

BlueSky™ Air Quality Monitor



Model 8145

Operation and Maintenance Manual

P/N 6016553 Rev. C
March 2023



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Part Number

6016553 / Revision C / March 2023

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Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at (800) 680-1220 (USA) or (001 651) 490-2860 (International) or visit www.tsi.com.

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Go to <https://tsi.com/terms/> and click on **TERMS OF USE & PRIVACY POLICY** link.

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Safety Information

Description of Caution/Warning Symbols

Appropriate caution/warning statements are used throughout the manual and on the instrument that require you to take cautionary measures when working with the instrument.

Caution



CAUTION

Failure to follow the procedures prescribed in this manual might result in irreparable equipment damage. Important information about the operation and maintenance of this instrument is included in this manual.

Warning



WARNING

Warning means that unsafe use of the instrument could result in serious injury to you or cause damage to the instrument. Follow the procedures prescribed.

Caution and Warning Symbols

The following symbols may accompany cautions and warnings to indicate the nature and consequences of hazards:

	Warns that the instrument contains a laser and that important information about its safe operation and maintenance is included in the manual.
	Warns that the instrument is susceptible to electrostatic discharge (ESD) and ESD protection should be followed to avoid damage.
	Indicates the connector is connected to earth ground and cabinet ground.



WARNINGS

- Use of components other than those specified by TSI® Incorporated (TSI®) may impair the safety features provided by the equipment.
- When mains power adapters are used, the equipment should be positioned so the mains plug will remain accessible for emergency disconnect.
- When using outdoors, the BlueSky™ monitors power adapter should be connected to a weatherproof “in use” resistant/IP 68 rated outdoor receptacle enclosure.



CAUTIONS

- The BlueSky™ monitors enclosure is designed to be water resistant to rain or spray. It is not designed to be waterproof when immersed. Setting it in a pool of water will result in flooding the inner compartment with water. This will severely damage your BlueSky™ monitor. **DO NOT** install the BlueSky monitor less than 1.2 meters or 4 feet from the ground (TSI® recommends 3 meters or 10 feet)! Positioning the bottom of the BlueSky monitor too close to a surface will result in water splashing back in to the inlet and may result in damage to the PM sensor.
- **DO NOT** mount the BlueSky Monitor upside down. To increase sampling efficiency, the PM sensor is covered by a porous screen but is not splash proof or water proof. The BlueSky monitor has an ingress protection rating of IP 44. Direct injection of water in to the BlueSky is likely to damage it.
- Power adapter provided with the BlueSky monitor is rated for outdoor use (IP 68). **DO NOT** use any other power supply with the BlueSky monitor.

1. The input A/C voltage to the power supply should be between 100 to 240 V with a frequency between 50 to 60 Hz.
2. The power required to run the BlueSky monitor is 5W (5.0 VDC and 1 Amp). The BlueSky monitor is powered through the mini-USB connector and there are no outputs available from the BlueSky monitor.

3. The power supply adapter provided is rated for outdoor use with an ingress protection rating of IP 68. It can be used outdoors or indoors under wet conditions in rain or snow.
4. The power supply is rated to operate between – 30°C to 80°C (–22°F to 176°F) with humidity ranging from 0% to 95% non-condensing but the BlueSky™ monitor is rated to operate between –10°C to 60°C (14°F to 140°F). TSI® recommends running the BlueSky™ monitor within these temperature limits.
5. The BlueSky™ monitor can be used at altitudes up to 3000 meters (10,000 feet).
6. The BlueSky monitor is designed to be used outdoors in highly polluted areas where particulate concentrations can be as high 1000 µg/m³.

NOTICE

Installation videos can be found on our website www.tsi.com.

NOTICE

The safety of any system incorporating the BlueSky monitor is the responsibility of the assembler of the system.

LASER SAFETY

- | | |
|--|---|
| <ul style="list-style-type: none"> Model 8145 BlueSky monitors are Class 1 laser-based instruments. During normal operation, you will not be exposed to laser radiation. DO NOT open the BlueSky monitor when it is powered ON. | <ul style="list-style-type: none"> You will not be exposed to the laser radiation when the BlueSky monitor is disassembled. The PM sensor has a laser inside it. DO NOT open the PM sensor inside BlueSky monitor when the BlueSky monitor is powered. |
|--|---|

Take these precautions:

- DO NOT** remove any parts from the BlueSky monitor unless you are specifically told to do so in this manual.



WARNING

The use of controls, adjustments, or procedures other than those specified in this manual may result in exposure to hazardous optical radiation.





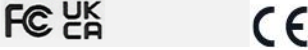


WARNING

If the BlueSky™ monitor is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

When operated according to the manufacturer’s instruction, this device is a Class 1 laser product as defined by U.S. Department of Health and Human Services standards under the Radiation Control for Health and Safety Act of 1968. A certification and identification label like the one shown below is affixed to each instrument.

Labels

Advisory labels and identification labels are attached to the instrument.

<p>1. Serial Number Label (Bottom)</p>	<p>BlueSky Model 8145 SN: 81452008007 MAC: A0:51:0B:6A:46:55 MFD: January 2022 TSI Incorporated, 500 Cardigan Road, Shoreview, MN 55126 Made in USA</p> 
<p>2. Laser Radiation Label (internal, on the PM sensor)</p>	
<p>3. Safety Details</p>	<p>Contains FCC ID: 2AC7Z – ESPWROVERE / IC ID: 21098 – ESPWROVERE</p> 
<p>4. European symbol for non-disposable item. Item must be recycled.</p>	
<p>5. Wi-Fi® Setup Label</p>	

Reusing and Recycling



As part of TSI® Incorporated's effort to have a minimal negative impact on the communities in which its products are manufactured and used:

- ♻️ If instrument becomes obsolete, return to TSI® for disassembly and recycling.

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Chapter 1

Product Overview

TSI® Incorporated's BlueSky™ 8145 Air Quality Monitor is a real-time outdoor air quality sensor that is designed to provide accurate mass concentration measurements of PM2.5, CO₂, CO, NO₂, SO₂, O₃ as well as barometric pressure, temperature and relative humidity. The monitor is designed to be deployed in less than ten minutes and can be used in both indoor and outdoor applications.

Data from the sensor is available at www.tsilink.com. All you need is an internet connection and web browser. The BlueSky™ monitor connects to the internet using wireless technology (Wi-Fi®). There is no need to install an app on your smartphone. Logged data is also available on the internal microSD card.

The BlueSky™ monitor also comes with factory calibrations, whose standards adhere to the same standards that are applied to other high-quality monitors like the DustTrak™ and AM520 models. The BlueSky monitors also come with self-diagnostics to enable you to run the monitor with greater than 95% up-time and empowers you to be proactive so that the data obtained is very high quality.



Figure 1: Front view



® Wi-Fi is a registered trademark of Wi-Fi Alliance.



Figure 2: Bottom view

Unpacking


Compare all the components you received with those listed in the table below.

Item	Part Number	Qty	Description
	8145	1	BlueSky™ Air Quality Monitor
	N/A	1	Mounting Bracket
	N/A	1	Screw
	N/A	1	IP68 Rated 5V Power Supply
	N/A	2	Zip Tie

BlueSky™ Monitor Replacement Parts

Listed below are replacement items for the BlueSky™ Air Quality Monitor. Contact [TSI®](#) for purchase information.

Item	Part Number	Description
	814306	Replacement Mounting Bracket
	814307	Maintenance kit—Screws, Screw Driver and PM Sensor screens
	814301	Replacement Power Supply—NA style plug
	814302	Replacement Power Supply—EU style plug
	814303	Replacement Power Supply—UK style plug
	814309	Replacement Power Supply—India style plug
	814310	Replacement Power Supply—AUS/China style plug
	814311	Replacement Power Supply—Korean style plug
	814308	Replacement microSD card

Item	Part Number	Description
	8145-SS	Replacement sensor shield

Replacement Sensors

Item	Part Number	Description
	814304	Single PM sensor replacement
	814305	5 pack PM sensors
	8145-SO ₂	SO ₂ (Sulfur Dioxide), EC (Electrochemical Sensor)
	8145-CO	CO (Carbon Monoxide), EC (Electrochemical Sensor)
	8145-NO ₂	NO ₂ (Nitrogen Dioxide), EC (Electrochemical Sensor)
	8145-O ₃	O ₃ (Ozone), EC (Electrochemical Sensor)
	814404	CO ₂ (Carbon Dioxide), Sensor
	8145-THP	Temperature, Relative Humidity & Pressure Sensor

Accessories

Item	Part Number	Description
	8145-CE	Cellular modem – NA version, FCC certified modem, w/indoor rated power supply
	8145-CEEU	Cellular modem – EU version, CE certified modem, w/indoor rated power supply
	8145-SO	Solar system, includes 1 12VDC (8) A-Hr battery, 1 charge controller, 1 panel, 1 outdoor enclosure and mounting hardware
	8145-CS	Solar system + Cellular modem – NA version, includes solar system plus FCC certified cellular modem
	8145-CSEU	Solar system + Cellular modem – EU version, includes solar system plus CE certified cellular modem
	8145-CEOD	Cellular modem + Outdoor enclosure – NA version, FCC certified modem
	8145-CEODEU	Cellular modem + Outdoor enclosure – EU version, CE certified modem

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Chapter 2

Setting Up

The BlueSky™ Outdoor Air Quality Monitor is delivered fully assembled and ready to be mounted on an outside wall or post. Start by unpacking the device and its contents from the shipping package. The monitor is intended to be connected to local 2.4 GHz Wi-Fi® to access all cloud features, but it can be used without Wi-Fi® if needed as all data is recorded to a pre-installed microSD memory card.

A quick start guide is shipped with each instrument. It provides the necessary steps to configure the Wi-Fi® settings for connecting the device to a local Wi-Fi® network and will also guide you through installation. A digital copy of the Quick Start Guide can also be found at <https://tsi.com/Products/Environmental-Air-Monitors/BlueSky-Air-Quality-Monitor-en>.



Figure 3: Front view of BlueSky™ monitor in package

NOTICES

- As long as a suitable microSD card is installed, the BlueSky™ monitor will store data on the card whether or not the unit is connected to Wi-Fi®. TSI® is not liable for corrupt data on the memory card.
- If connection to the internet is lost, the device will buffer and store data onto its internal memory for approximately 14 days (logged at 15 min. intervals), which will then be uploaded to the cloud once internet connection has been restored. Data older than that will be available only on the microSD card. Customers cannot manually upload microSD card data to the TSI® Cloud. You will be notified on the cloud data if the BlueSky™ monitor has trouble writing to the microSD card.
- The monitor does not have the capability to connect to public Wi-Fi® networks that require a second step of browser authentication, such as a free public hotel or airport network. A different network will need to be chosen.
- Some corporate networks require the device MAC address for security. This can be found on the serial number label of the monitor.



CAUTION

NEVER open the monitor when it is powered on or connected to the power adapter!

The monitor contains very sensitive sensors that are susceptible to electrostatic discharge (ESD) and ESD precautions should be followed to avoid damage.



If using the microSD card only, you can skip the steps below for connecting to Wi-Fi® and the cloud.

Activating a New Device(s)

1. Open the browser on your phone/computer and navigate to <https://www.tsilink.com/>.
2. Login using your TSI.com account credentials. If you do not have an TSI.com account, click on the “**Create Account**” button and create a new account.

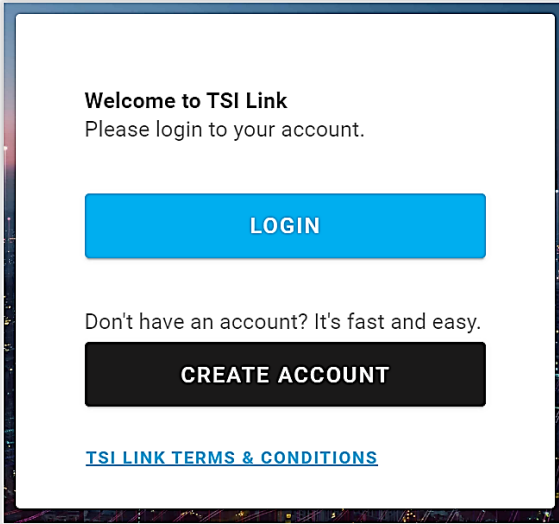


Figure 4: Activate new device

3. Once you are logged in, click on the plus icon in the lower right. Hovering over it will show “**Activate New Device**”.

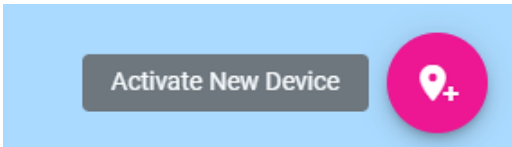


Figure 5: Activate New Device icon

4. Enter the required information into the fields. The serial number can be found on the underside of the device. You can also name the device, configure its location and whether or not you would like to make the data public.
5. Click “**Done**” when finished.
6. Repeat as necessary for remaining devices.

Connecting BlueSky™ to a Wi-Fi® Network

NOTICE

It is recommended that the process of configuring the wireless network settings and connecting the instrument to the internet be performed in an office or a lab environment before setting up in the final location.

1. Remove the power supply from its packaging and connect it to a nearby power outlet. Connect the other end of the power supply to micro USB port on the bottom of the monitor.






Figure 6: Micro USB port

- An LED next to the micro USB connector will pulse yellow to indicate that the monitor is in set up mode as a Wi-Fi® hotspot. **It will remain in this mode for 90 seconds.** If you need more time, simply unplug and plug the monitor back in again.



Figure 7: Set up mode – LED pulsing yellow (power cord not shown for clarity)

 LED	 Wi-Fi®	 Cloud
Pulse Yellow	Set up Mode	
Pulse White	Connecting	
Pulse Blue	Connected	Connecting
Solid Blue	Connected	Connected
Solid White	No connection	No connection

3. Locate the label on the bottom of the monitor, that contains the QR codes.



Figure 8: QR codes label

4. With your phone camera, scan the QR code on the left side of the label (Step 1) to connect to the monitor's Wi-Fi® hotspot. You may have to zoom in the camera on your phone to activate the QR code reader. You should be prompted to connect to a new Wi-Fi® network called "BlueSky OAQ 8145XXX..."

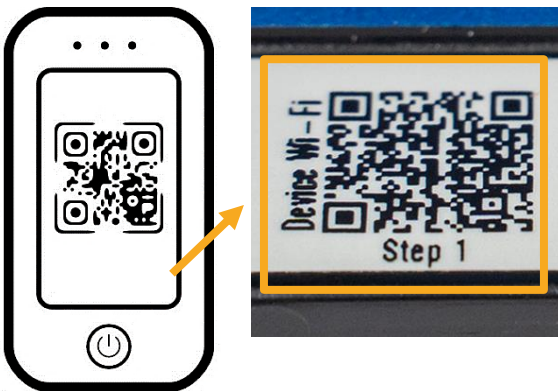


Figure 9: Scan QR code to connect to Wi-Fi®

5. If you are not connected automatically, you can still connect manually by searching for Wi-Fi® networks and connecting to the one listed as “BlueSky OAQ 8145XXX...”

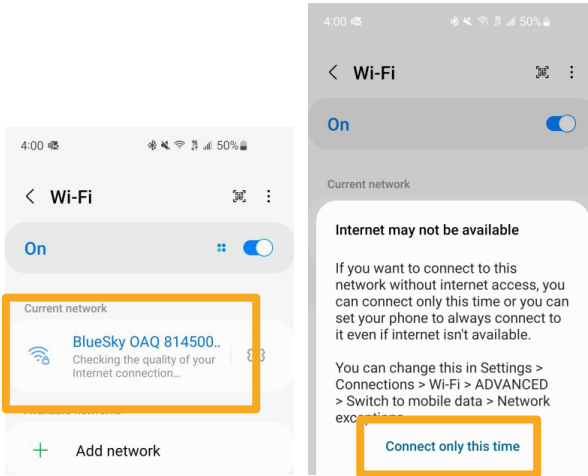


Figure 10: Manually connect to Wi-Fi®

6. Once connected to the BlueSky™ monitor Wi-Fi® network, use your phone camera again on the right-hand side of the label to scan the QR code marked (Step 2) to connect to the setup web page or open your phone browser and enter a URL of **192.168.4.1**.

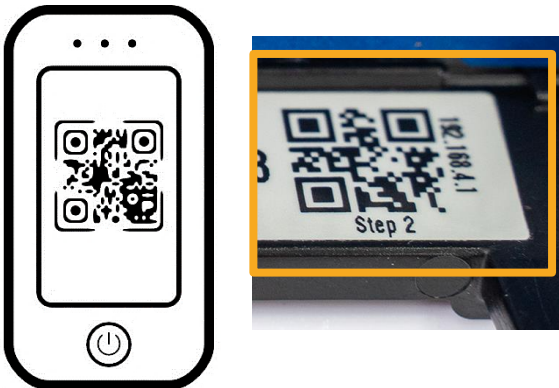


Figure 11: Connect to setup web page

7. You should see a web page like the one below. Select your home or office Wi-Fi® network from the list.



TSI BlueSky™ OAQ Setup

SN: 8145002208009 MAC: 34:86:5D:A5:0B:44

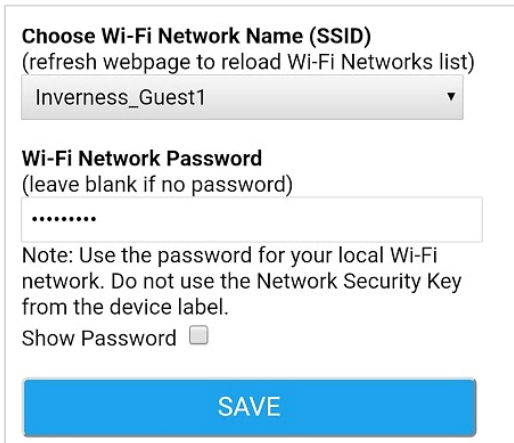
Connect BlueSky™ OAQ to a Nearby Wi-Fi Network

Choose Wi-Fi Network Name (SSID)
(refresh webpage to reload Wi-Fi Networks list)

(Select Wifi Network) ▾

Figure 12: Configure Wi-Fi® network

8. Enter the Wi-Fi® password and click **Save**.



Choose Wi-Fi Network Name (SSID)
(refresh webpage to reload Wi-Fi Networks list)

Inverness_Guest1 ▾

Wi-Fi Network Password
(leave blank if no password)

.....

Note: Use the password for your local Wi-Fi network. Do not use the Network Security Key from the device label.

Show Password

SAVE




Figure 13: Enter Wi-Fi® password

- The monitor should automatically power cycle and start again with a pulsing yellow LED next to the micro USB connector.



Figure 14: LED pulsing yellow
(power cord not shown for clarity)

- The process of connecting to your local internet will be reflected in the color sequence shown below. This may take several minutes.

 LED	 Wi-Fi®	 Cloud
Pulse Yellow	Set up Mode	
Pulse White	Connecting	
Pulse Blue	Connected	Connecting
Solid Blue	Connected	Connected
Solid White	No connection	No connection


11. If all connections are made, the LED will be solid blue. 
12. You should now be able to see measurement data from the device. Be patient, as it may take a few minutes for the device to start reporting its data to the cloud.






Figure 15: Connections made – LED solid blue

13. If the LED stops at solid white, review the steps above and repeat as needed.



Figure 16: No connection – LED solid white

 LED	 Wi-Fi®	 Cloud
Pulse Yellow	Set up Mode	
Pulse White	Connecting	
Pulse Blue	Connected	Connecting
Solid Blue	Connected	Connected
Solid White	No connection	No connection

Installing the BlueSky™ Outdoor Air Quality Monitor

1. The BlueSky™ monitor comes with the mounting bracket and zip ties to secure the instrument to a pole or a wall.
2. Start by attaching the mounting bracket to the bottom of the monitor.



Figure 17: Mounting bracket

3. Next, mount the instrument to a pole or wall using the mounting bracket for stability. Additionally, connect the power cable to the USB port on the bottom of the monitor. Make sure the power cable has some strain relief as shown below in the pole mount example. This prevents the power cable from becoming disconnected during operation.

Mounting options are shown below.

- a. Pole mount.



Figure 18: Pole mount



WARNING

DO NOT install the BlueSky™ monitor too close to the ground! Minimum distance from ground should be 1.2 meters or 4 feet to prevent water from splashing from the ground to the bottom of the BlueSky™ monitor. TSI® recommends 3 meters or 10 feet.

NOTICE

Use 1/4" screws or #10 screws to mount the bracket to a surface like a wall. The type of screw used depends on the type of the material the surface is made up of.

- b. Wall mount.



Figure 19: Wall mount

- c. Tripod mount (The bracket needs to be removed to use the Tripod). The thread on the bottom of the device should fit most camera tripods.

4. Plug the other end of the power supply into a weatherproof “in use” resistant/IP 68 rated outdoor receptacle enclosure, an example is shown below.



Figure 20: Water resistant /waterproof outdoor receptacle enclosure



WARNING

Improper outdoor installation could result in equipment damage and/or electrical shock. Installation must follow local electrical codes.



WARNING

DO NOT install the BlueSky™ monitor upside down. The bottom of the device is designed to allow for aerosol to enter the PM sensor. The bottom of the instrument is not water proof. However, if installed upright, it can withstand rain and snow due to the protection from the drip edge.

- When power is now applied, the start-up sequence will start again with a pulsing yellow LED next to the micro USB connector.






Figure 21: Start-up sequence starts again - LED pulsing yellow (*power cord not shown for clarity*)




- The process of connecting to your local internet will be reflected in the color sequence shown below. This may take several minutes. The LED light bar should be solid blue.



Figure 22: Connect to internet – LED solid blue (*power cord not shown for clarity*)

 LED	 Wi-Fi®	 Cloud
Pulse Yellow	Set up Mode	
Pulse White	Connecting	
Pulse Blue	Connected	Connecting
Solid Blue	Connected	Connected
Solid White	No connection	No connection

7. If the LED stops at solid white, then review the steps above and repeat as needed or see the [troubleshooting section](#) in Chapter 5.

 LED	 Wi-Fi®	 Cloud
Pulse Yellow	Set up Mode	
Pulse White	Connecting	
Pulse Blue	Connected	Connecting
Solid Blue	Connected	Connected
Solid White	No connection	No connection

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Chapter 3


Operation

Overview

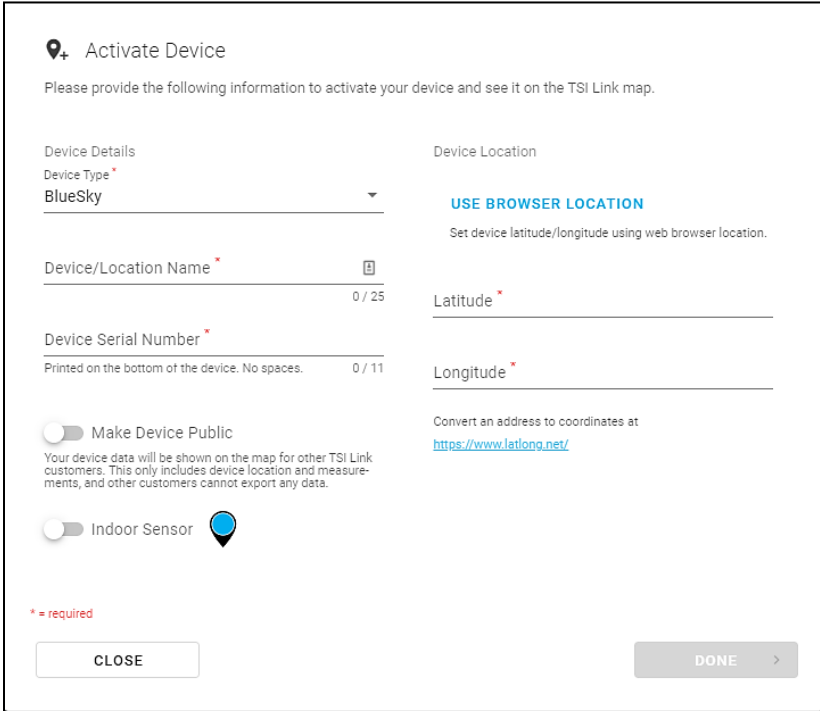
The BlueSky™ Air Quality Monitor's primary use is in outdoor applications. It is designed to operate 24/7 when powered by a standard outdoor power outlet. Once you have setup your monitor(s) and connected them to a local wireless (Wi-Fi®) network, you can log into the TSI® cloud platform, www.tsilink.com, and see the air quality around your monitors in real time. It will give you insights into how the air quality varies over time and from monitor to monitor. It allows you to start seeing trends, which can lead to making more informed decisions, benefiting the entire project/community and share more air quality information with your community.

How to Register your BlueSky™ Outdoor Air Quality Monitor(s) and Account Onboarding

1. After the unit is powered on, check to make sure the LED on the bottom is a steady blue color after 2 minutes. If not, go to the [troubleshooting](#) chapter to fix connectivity issues.
2. From any location, open your web browser and enter the BlueSky™ Outdoor Air Quality monitor landing page (www.tsilink.com). If you have an existing tsi.com account skip to step 5. If not, go to the next step.
3. If you do not have a tsilink.com click on the **CREATE ACCOUNT** button.
4. Select type of account that you want to create (business/ personal) and follow the instructions. Please note if you are creating a business account you will need to wait to get an approval (Approximately 24 hours) before you can use your account login credential.
5. Once your account is successfully created go to tsilink.com and login.

6. Register your device by entering in the required information and click **DONE**. If you do not see the Device Registration screen, click the “Plus” icon  on the bottom right of the map.

- Note that you can enter Latitude and Longitude using the browser location or the tool by going to <https://www.latlong.net/>.



Activate Device

Please provide the following information to activate your device and see it on the TSI Link map.


Device Details

Device Type *
BlueSky

Device/Location Name * 0 / 25

Device Serial Number * 0 / 11
Printed on the bottom of the device. No spaces.

Make Device Public
Your device data will be shown on the map for other TSI Link customers. This only includes device location and measurements, and other customers cannot export any data.

Indoor Sensor 

* = required

Device Location

[USE BROWSER LOCATION](#)
Set device latitude/longitude using web browser location.

Latitude *

Longitude *

Convert an address to coordinates at <https://www.latlong.net/>

CLOSE **DONE >**

Figure 23: Device registration screen

7. Adjust the device pin location if needed and/or click **Done**.

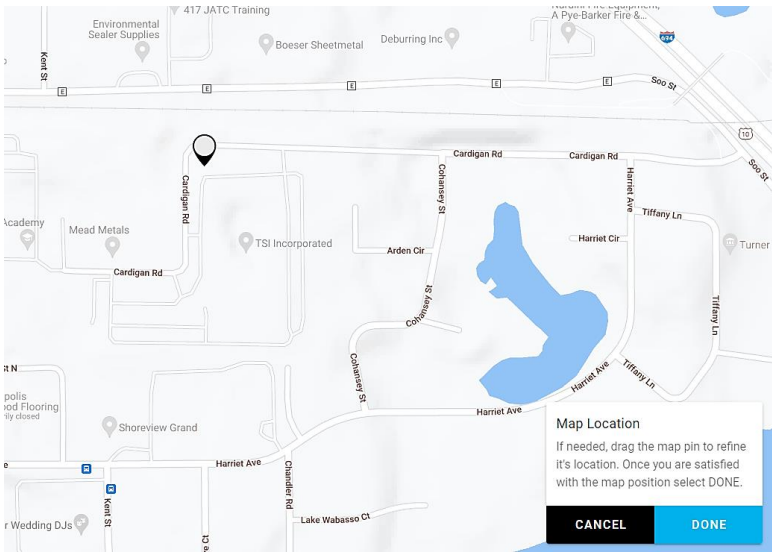


Figure 24: Adjust device pin location

8. Verify your device pin is displaying PM2.5 and other measurements to confirm you successfully signed up for an online account and registered your device.



Figure 25: Map view

9. If you have both TSI Link™ Software and Data Services subscriptions or TSI Link™ Data Services subscription go to the API menu. Enter device or devices that you want to register to this TSI Link™ Account. Click **SUBMIT**.

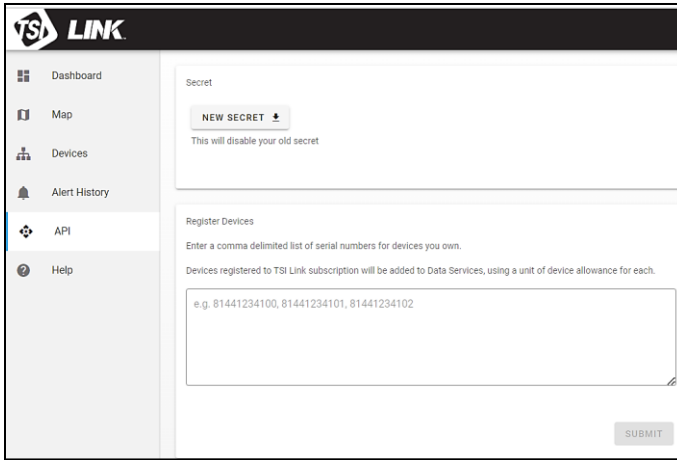


Figure 26: API menu

10. Check box if you are registering device for both TSI Link Software and TSI Link Data Service subscriptions. If you are only registering the device for TSI Link Data Service subscription keep the box unchecked. Click **DONE** when completed.

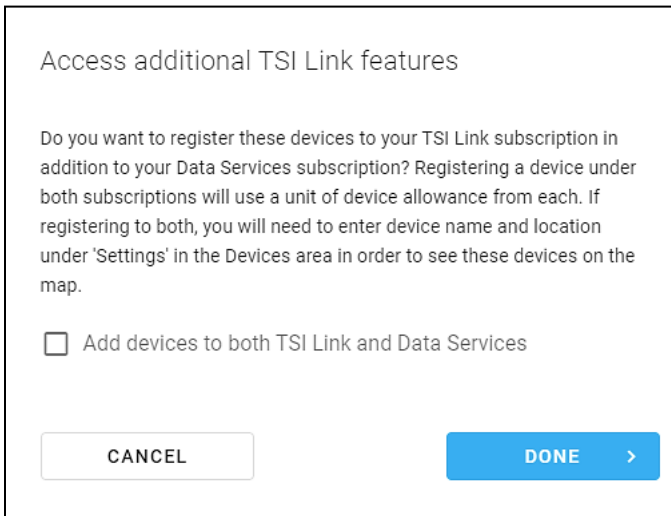


Figure 27: Access additional TSI Link™ features

11. If you run into issues or need additional information please go to <https://tsi.com/resources/tsi-link-monitoring-and-research-faqs/tsi-link-solutions-faqs-installation-and-setup/>
12. Verify your device pin is displaying PM2.5 and other measurements to confirm you successfully signed up for an online account and registered your device.

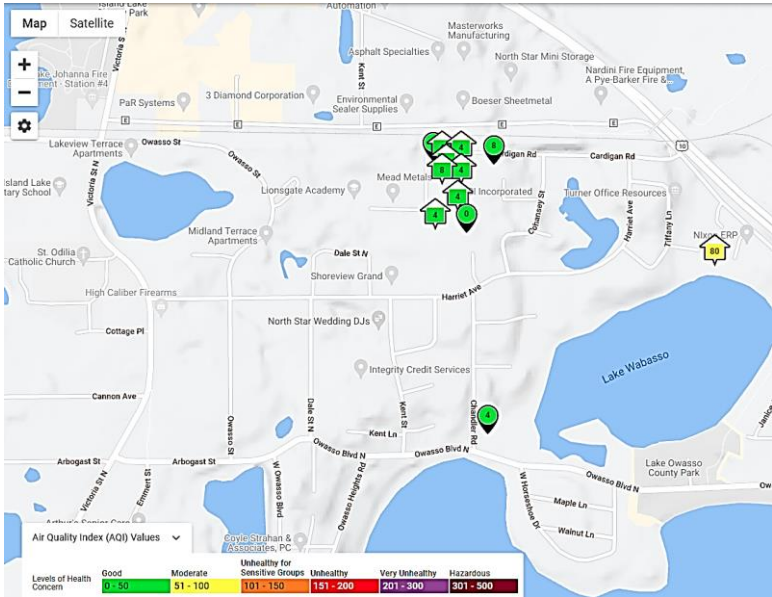


Figure 28: Verify device pin is displaying PM2.5

How to View Data from one or more BlueSky™ Outdoor Air Quality Monitors

1. Go to www.tsi.com/tsilink and log in.
2. Click on the map and zoom in to the area where your BlueSky™ Outdoor Air Quality device pin is located.
3. Click on the device pin to view the current values.
4. Or click on the devices tab to view high-level readings of multiple devices side by side.

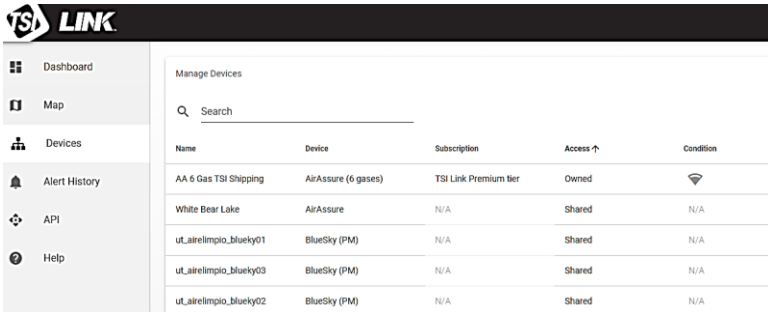


Figure 29: View data from multiple devices

5. Please note to view data on the cloud right after you installed the BlueSky™ Outdoor Air Quality monitor, powered it **ON** and connected it to the TSI Link™ Solutions, please wait at least 15 minutes before you see a data point in the cloud.

How to Download Data from one or more BlueSky™ Monitors

1. Go to www.tsilink.com and log in.
2. Click on the map and zoom in to the area where your BlueSky™ device pin is located.
3. Click on the device pin.
4. Click on the history button.
5. Click on the three dots in the top left corner and select **Export CSV**.

How to Download Data from the microSD Card in the BlueSky™ Monitor

1. Disconnect the power to the unit by disconnecting the USB cable from the power adapter.
2. The microSD card is located inside the monitor, which for security reasons, needs to be opened to access the SD card. To do this, separate the white top from the black bottom.



CAUTION

NEVER open the unit when the unit is powered on or connected to the power adapter!

The instrument is susceptible to electrostatic discharge (ESD) and ESD protection should be followed to avoid damage.



3. Remove the two screws that attach the top and bottom halves of the BlueSky™ monitor together.



Figure 30: Access microSD card

4. The microSD card holder is located on the top left corner as shown below.

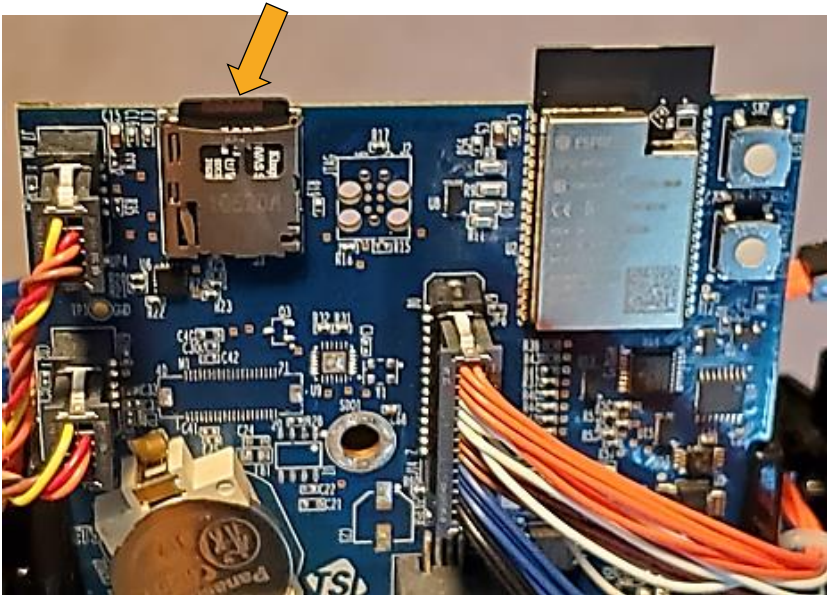


Figure 31: Location of microSD card holder

5. Remove the card and download the data. You have the options to put the card back in, insert a new card, or choose to not install an SD card. At 15-minute logging intervals, the memory consumed is about 500 kb/week. If the BlueSky™ monitor has any issues writing to the card, an error flag will be activated on the cloud that action needs to be taken.

Interpreting the Data Downloaded from the microSD Card or from the Cloud

Data downloaded from the BlueSky™ Outdoor Air Quality Monitor from the microSD card or cloud is stored as an ASCII format file with the serial number and date as the filename and .csv as the extension (e.g. 8145002208009-202210.csv). This format is easily imported into spreadsheet and database programs.

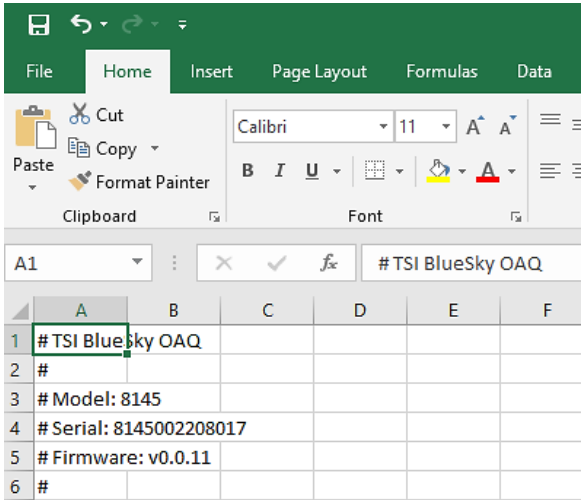


Figure 32: ASCII file format

The top line of the output in the file has header information such as model, serial number, firmware version, etc. Farther down there are descriptions of the data in each column along with the data. The actual output of the file will depend on the number and configurations of sensors installed in your particular device.

	A	B	C	D	E	F
58	Timestamp	System St	Temperat	Humidity	Temperat	Ba
59	UTC		C	%		int
60	4/29/2021 21:16	1	24.2	27	0	
61	4/29/2021 21:31	0	24	27	0	

Figure 33: File headers

Most of them are self-explanatory but a few such as sensor status bits require further explanation that can be found in Frequently Asked Questions (FAQs) at www.tsi.com/tsilink.

Logging Interval Options and How to Change the Settings

By default, the BlueSky™ Outdoor Air Quality Monitor will log a sample (data point) every 15 minutes. Depending on your software license, logging intervals include 1, 5, 10, 15, 30 and 60 minutes. The logging interval can be changed by logging into TSILINK.com and accessing the device settings. Some logging interval options may not be accessible, depending on your TSILINK.com subscription level.

Sampling frequency varies from sensor to sensor for the BlueSky™ Outdoor Air Quality Monitor. For example, the PM (particulate matter) sensor samples at a rate of 1 Hz. The logged data that is reported on TSI Link™ and microSD card, is an average of the 1 second data points. Therefore, if the logging interval is set to every 1 minute, then the logged data is an average of the last 60 data samples. Second by second data is not stored on the microSD card and cannot be obtained or downloaded from the device.

Chapter 4

Maintenance

Replacement sensors can be ordered from TSI® Incorporated. Although sensor life times vary depending on the conditions they are exposed to, conservative recommended replacement intervals are listed below for each sensor.

Bi-Annual Maintenance Checks

NOTICE

For extreme conditions it is recommended that more frequent maintenance be performed.

1. Check the metal screen at the bottom of the BlueSky™ monitor. If it is dirty, remove the screen and clean it with compressed air, soap and water.
2. Make sure the splash guard covering the gas sensors is in place and secure.
3. Make sure there are no cracks on the top cover. Cracks can cause water to leak into the device, which may damage the electronics inside.
4. Make sure the mounting bracket is rigidly mounted to the mounting pole, wall or tripod. Tighten screws if necessary.
5. Check to make sure zip ties are tight and replace them if necessary, as they can degrade when exposed to direct sunlight or exposed to the elements over a prolonged period of time.
6. Inspect the power supply and the cable to make sure they have not degraded due to exposure to the elements. Replace if you find any cracks in the power supply or the cable as it might cause shorting.

Annual Maintenance Checks

NOTICE

For extreme conditions it is recommended that more frequent maintenance be performed.

1. Any maintenance should be performed only after powering the unit down by disconnecting the USB cable from the power adapter.
2. TSI® recommends replacing the PM sensor once a year.
3. TSI® recommends replacing the electrochemical gas sensors (SO₂, CO, NO₂, O₃) once a year or if they become contaminated.
4. TSI® recommends replacing the CO₂ sensor every 3 years.
5. TSI recommends replacing the T/RH/BP module every 5 years.
6. Replacement of any of the sensors requires that you disconnect power and remove the two screws that attach the top and bottom halves of the BlueSky™ monitor together.



Figure 34: Remove cover screws

Replacing the PM Sensor Module

1. The PM sensor is easy to replace. It is mounted on a carrier board that can be removed from the base of the unit.
2. First disconnect the cable by unplugging the top connector at the PCB. Pinch the top and bottom of the connector to release the clips and pull the connector away from the PCB.

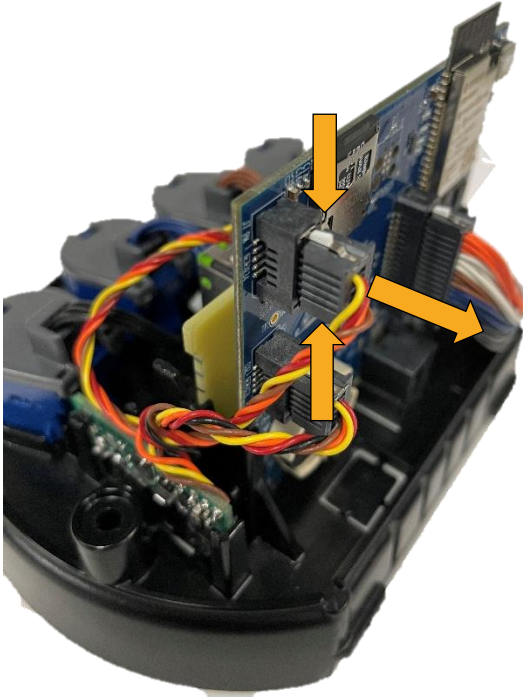


Figure 35: Disconnect cable from main board

3. Push the plastic release to the right and pull up on one side of the carrier board until it is free from the base. Remove the sensor, carrier board and cable assembly.



Figure 36: Remove sensor

4. Insert the new module by aligning the sides of the carrier board and pushing down evenly on both sides until the board bottoms out and snaps in place. Insert the black connector into the PCB.



Figure 37: Install new sensor

Replacing the Electrochemical Sensors

1. The electrochemical sensors are easy to replace. They are supplied as a smart module that contains a calibration for plug-and-play installation.



Figure 38: Replace electrochemical sensors

2. If replacing multiple sensors, replace one at a time. To replace a sensor, remove the snap on top cover holding the connectors in place and lift the connector and cable straight up.



Figure 39: Disconnect sensor cable

3. Next remove the sensor body by pulling it straight up.



Figure 40: Remove sensor body

4. Note the type of sensor (in this case O_3) and replace it with a new sensor of the same type. The new sensor should sit at the same depth as the other sensors. Replace the connector and cap. Note that the housing cover holds the sensor in place so they do not need to snap in place.
5. Repeat the steps above for any other electrochemical sensor replacements.

Replacing the CO_2 Sensor Module

1. The CO_2 sensor is easy to replace. It is supplied as a wired module that can be removed from the base of the unit.
2. First disconnect the cable by unplugging the top connector at the PCB. Pinch the top and bottom of the connector to release the clips and pull the connector away from the PCB.



Figure 41: Disconnect sensor cable

3. Grip the CO₂ board in the middle and lift up to remove it



Figure 42: Lift sensor board to remove it

4. Replace with a new module by aligning the PCB in the slots and pushing down. Note that the housing cover holds the sensor in place so it does not need to snap in place. Insert the connector.

Replacing the T/RH/BP Sensor Module

1. The T/RH/BP sensor is easy to replace. It is supplied as a wired module that can be removed from the base of the unit.
2. First disconnect the cable by unplugging the connector. Push down on the locking tab and pull the connector away from the PCB.



Figure 43: Disconnect sensor cable

3. Pull the cable out of the way and pull up from the base on the PCB.



Figure 44: Remove sensor

4. Insert the new module in the slots and reconnect the cable connector.






Figure 45: Reconnect cable connector

Chapter 5

Troubleshooting the BlueSky™ Monitor

Detailed troubleshooting and frequently asked questions can be found on TSI® website.

The table below lists the symptoms, possible causes and recommended solutions for common problems encountered with the BlueSky™ Air Quality Monitor.

Possible Cause	Corrective Action		
The BlueSky™ monitor does not turn on			
Bad Power Connection	Check all power connections from the outside of the Enclosure to the Monitor.		
The BlueSky™ monitor has no data on the TSI® Cloud			
Check the LED status bar	If the device is not connecting (solid blue after 2 minutes), check your local 2.4 GHz Wi-Fi® connection strength with another device like a phone. If there is a good signal, follow the directions in the Setting Up section to check the connection.		
	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>LED</p> </div> <div style="text-align: center;">  <p>Wi-Fi®</p> </div> <div style="text-align: center;">  <p>Cloud</p> </div> </div>		
	Pulse Yellow	Set up Mode	
	Pulse White	Connecting	
	Pulse Blue	Connected	Connecting
	Solid Blue	Connected	Connected
	Solid White	No connection	No connection

Possible Cause	Corrective Action
<p>Cannot connect to Wi-Fi® or the internet.</p>	<p>Note that BlueSky™ IAQ monitor can only connect to 2.4 GHz Wi-Fi® signals. Most Wi-Fi® routers provide several frequency channels. Please make sure you are connecting to the 2.4 GHz channel.</p> <p>The monitor does not have the capability to connect to public networks that require a second step of browser authentication, such as a free public hotel or airport network. A different network will need to be chosen.</p> <p>Some corporate networks require the device MAC address for security. This can be found on the serial number label of each monitor.</p> <p>The monitor does not support IEEE 802.1X connections.</p> <p>Additionally, the following firewall ports need to be available:</p> <ul style="list-style-type: none"> • DNS: 53 (UDP) • SNTP: 123 (UDP) • HTTPS: 443 (TCP) • MQTT: 8883 (TCP)
Readings are unusually low	
<p>Plugged screen.</p>	<p>Remove screen from the BlueSky™ monitor and blow out debris with compressed air. Rinse with clean air, if needed.</p>
<p>Replace sensor</p>	<p>Sensor may be past its recommended replacement cycle (see maintenance section for recommended replacement cycle times).</p>
<p>The BlueSky™ monitor is located near an object that obstructs the flow.</p>	<p>Move the BlueSky™ monitor into a more open area.</p>
Sensor Readings are not correct	
<p>Custom calibration factor is incorrect</p>	<p>Check the custom calibration factor. Is the value correct? Was it changed by mistake?</p>
<p>No custom calibration factor</p>	<p>Values can be corrected by using a custom calibration factor. The custom calibration factor can be changed in the cloud.</p>
Data Flags/Error Codes	
<p>Flags in data</p>	<p>See Appendix B for detailed information on Data Flags/Error Codes.</p>

Appendix A

Specifications*

PM Sensor	
Sensor Type	Light scattering single particle counting
Aerosol Concentration Range.....	0 to 1000 $\mu\text{g}/\text{m}^3$
Measurements	PM1.0, PM2.5 PM4.0, and PM10 on SD Card and PM2.5, PM10 on Cloud
Resolution	1 $\mu\text{g}/\text{m}^3$
Counting Efficiency	50% at 0.3 μm and 98% at 0.5 μm
Accuracy	$\pm 10\%$ @ 100 – 1000 $\mu\text{g}/\text{m}^3$ when compared to a DustTrak™ DRX monitor
Zero Stability	$\pm 1\ \mu\text{g}/\text{m}^3$
Sample Flow Rate	~ 0.3 L/min
Response Time	1 second (sensor sampling frequency, not an indicator of reporting interval)
Start-up Time	< 8 seconds
Optimal Temperature Range ⁽¹⁾	-10 to 60°C
Optimal Humidity Range ⁽²⁾	0 to 95% non-condensing
Storage Temperature .	-40 to 70°C
Acoustic Emissions Level.....	25 dBA @ 0.2 m
Carbon Dioxide (CO ₂) Sensor	
Sensor Type	NDIR (Non-dispersive Infrared)
Range.....	0 – 10,000 ppm
Accuracy	$\pm (30\ \text{ppm} + 3\% \text{ of reading})$ (typical)
Resolution	1 ppm
Temperature Range ...	0 to 50°C
Humidity Range.....	0 to 95% non-condensing

Ozone (O ₃) Sensor	
Sensor Type	Electrochemical
Range	0 – 5,000 ppb
Accuracy	± 30 ppb (typical)
Resolution.....	1 ppb
Limit of Detection ⁽³⁾	2 ppb
Temperature Range....	-20 to 40°C
Humidity Range	15 to 90% non-condensing
Carbon Monoxide (CO) Sensor	
Sensor Type	Electrochemical
Range	0 – 20 ppm
Accuracy	± 0.150 ppm (typical)
Resolution.....	0.001 ppm
Limit of Detection ⁽³⁾	0.010 ppm
Temperature Range....	-20 to 50°C
Humidity Range	15 to 90% non-condensing
Nitrogen Dioxide (NO ₂) Sensor	
Sensor Type	Electrochemical
Range	0 – 5,000 ppb
Accuracy	± 30 ppb (typical)
Resolution.....	1 ppb
Limit of Detection ⁽³⁾	2 ppb
Temperature Range....	-20 to 50°C
Humidity Range	15 to 90% non-condensing
Sulfur Dioxide (SO ₂) Sensor	
Sensor Type	Electrochemical
Range	0 – 5,000 ppb
Accuracy	± 50 ppb (typical)
Resolution.....	1 ppb
Limit of Detection ⁽³⁾	5 ppb
Temperature Range....	-20 to 50°C
Humidity Range	15 to 90% non-condensing
Temperature Sensor	
Range	-40 to 50°C
Accuracy	±0.5°C

Humidity Sensor	
Range.....	0 to 100% RH
Accuracy	±3 % RH
Barometric Pressure Sensor	
Range.....	8 to 35 inHg (270 to 1185 hPa)
Accuracy	± 0.12 inHg (± 4 hPa)
AC and DC Power Requirements	
AC Power	100 to 240 VAC, 50/60 Hz
Power Consumption ...	< 5 W
Environmental/Installation Requirements	
Maximum Altitude.....	3000 meters (10,000 feet)
Pollution Degree.....	3
Installation Category ..	III

**Specifications are subject to change without notice.*

- (1) Optimal Temperature Range – Range of temperature that the sensors work at optimal performance
- (2) Optimal Humidity Range – Range of humidity that the sensors work at optimal performance
- (3) Limit of detection: Measured quantity value giving the probability of falsely claiming the absence or presence of a component at 15 minute logging interval

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Appendix B

Status Flags and Error Codes

Type	Value	Definition
General Sensor Status	1	Sensor is not factory calibrated
	2	Sensor specific fault. See specific sensor status for more details
	4	Sensor communication error
	8	Sensor data corrupt
	16	Data not available
	32	Sensor measurement over detectable limit
	64	Sensor measurement under detectable limit
Gas Sensor Status	256	Measurement not compensated
PM Sensor Status	256	Fan RPM error
	512	Laser error
	1024	Fan blocked
	2048	Completed cleaning cycle
System Status	1	Device rebooted
	2	Data was not written to the SDCARD (SD card not present or write failed)
	4	Cloud is disconnected
	8	Real-time Clock Battery low
	16	Device internal time has not been synced to the cloud in the last 24 hours
	32	Device internal time value is invalid due to low battery, unpowered device and lack of cloud connection
	64	Sensor board EEPROM failure. Some sensors may be disabled

NOTICE

There can be more than one error in the same or different categories.

Examples:

PM status =	$1027 = 1024 + 2 + 1 =$ "Fan blocked" + "Sensor specific fault " + "Sensor is not factory calibrated"
Gas Sensor status =	$258 = 256 + 2 =$ "Measurement not compensated" + "Sensor specific fault"
CO ₂ status =	$12 = 8 + 4 =$ "Sensor data corrupt" + "Sensor Communication Error"
System status =	$14 = 8 + 4 + 2 =$ "Sensor Board battery low" + "Cloud is disconnected" + "Data not written to SD card"



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P/N 6016553 Rev. C

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Printed in U.S.A.

