

BlueSky™ Air Quality Monitor

Model 8143



Operation and Maintenance Manual

P/N 6013929 Rev. J
January 2023



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Thank you for your TSI® instrument purchase. Occasionally, TSI® releases information on software updates, product enhancements and new products. By registering your instrument, TSI® will be able to send this important information to you.

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As part of the registration process, you will be asked for your comments on TSI products and services. TSI's customer feedback program gives customers like you a way to tell us how we are doing.

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Part Number

6013929 / Revision J / January 2023

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- b. Pumps are warranted for hours of operation as set forth in product or operator's manuals;
- c. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment;
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Buyer further agrees that purchase of TSI's BlueSky™ Monitors Buyer agrees to the Terms and Conditions of Use and the Privacy Policy located at <https://tsi.com/terms/>.

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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Cloud Software End User Licensing Agreement and Privacy Policy

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

Contents

Contents	iii
Safety Information	v
Description of Caution/Warning Symbols	v
Caution	v
Warning	v
Caution and Warning Symbols	v
Labels	viii
Reusing and Recycling	ix
Chapter 1 Product Overview	1
Unpacking	2
BlueSky™ Monitor Replacement Parts	3
Accessories	4
Chapter 2 Setting Up	7
Connecting the BlueSky™ Monitor to a Wi-Fi® Network	9
Installing the BlueSky™ Air Quality Monitor	14
Chapter 3 Operation	19
Overview	19
Registering your BlueSky™ Monitor(s) and Account Onboarding	19
Viewing Data from one or more BlueSky™ Monitors	23
Downloading Data from one or more BlueSky™ Monitors	23
Downloading Data from the microSD Card in the BlueSky™ Monitor ...	24
Interpreting the Data Downloaded from the SD Card	26
Interpreting the Data Downloaded from the Cloud	27
Chapter 4 Maintenance	29
Bi-Annual Maintenance Checks	29
Annual Maintenance Checks	30
Chapter 5 Troubleshooting the BlueSky™ Monitor	31
Appendix A Specifications*	35
Appendix B Status Flags and Error Codes	37
Examples:	39

Figures

1: Front View of BlueSky™ Air Quality Monitor	1
2: Bottom view of BlueSky™ monitor	2
3: Front view of BlueSky™ monitor in package	7
4: Bottom view of BlueSky™ monitor in package	8
5: Slide switch toward settings gear	9

6: PC wireless configuration10
7: Enter the PWD found on the device label.....11
8: Security Key (PWD) location12
9: Entering IP address12
10: Entering Wi-Fi network SSID and password.....12
11: BlueSky™ Monitor Setup Wi-Fi® network saved13
12: Move Wi-Fi® switch back into operate position.....13
13: Mounting bracket.....14
14: Pole mount15
15: Wall mount16
16: Water resistant / waterproof outdoor receptacle enclosure17
17: Device registration screen20
18: Adjust device pin location21
19: Map view21
20: API menu.....22
21: Access additional TSI Link™ features22
22: Verify device pin is displaying PM2.523
23: Access microSD card24
24: Location of microSD card holder25
25: SD card data26
26: Downloaded CSV file from Cloud27
27: Replacing PM sensor30

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)! Setting the bottom of 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 [tsi.com](https://www.tsi.com). Using the search function on the main page, type the model number 8143 into the search field and navigate to the product page.

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 8143 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.

1. Serial Number Label (Bottom)	
2. Laser Radiation Label (internal, on the PM sensor)	
3. Safety Details	<p>Contains FCC ID: 2AC7Z – ESPWROVERE / IC ID: 21098 – ESPWROVERE</p> <p style="text-align: center;"> </p>
4. European symbol for non-disposable item. Item must be recycled.	

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™ Air Quality Monitor is a real-time Particulate Matter (PM) sensor that is designed to provide accurate mass concentration measurements of PM1, PM2.5, PM4, PM10 as well as temperature and 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 stored on the internal microSD card.

The BlueSky™ monitor also comes with factory calibration, 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 of BlueSky™ Air Quality Monitor

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





Figure 2: Bottom view of BlueSky™ monitor



Unpacking

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

NOTICE





If any parts are missing, contact [TSI® Incorporated](http://www.tsi.com).



Item	Part Number	Qty	Description
	8143	1	BlueSky™ Air Quality Monitor
	N/A	1	Mounting Bracket
	N/A	1	Screw

Item	Part Number	Qty	Description
	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
	814304*	Single PM sensor* replacement
	814305	5 pack PM sensors
	814306*	Replacement Mounting Bracket*
	814307	Maintenance kit—Screws, Screw Driver and PM Sensor screens

Item	Part Number	Description
	814301*	Replacement Power Supply— NA Plug Type A (NEMA 1-15)
	814302*	Replacement Power Supply—EU Plug Type C (CEE 7/16)
	814303*	Replacement Power Supply—UK Plug Type G (BS 1363)
	814309*	Replacement Power Supply – India Plug Type D (IS 1293:2005)
	814310*	Replacement Power Supply – AUS/China Plug Type I (2 prong AS 3112)
	814311*	Replacement Power Supply – South Korea Plug Type C (KS C 8305)
	814308*	Replacement microSD card*

*Indicates pre-installed factory item or ships with initial purchase, but is also available as a spare or if replacement is needed.

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

Item	Part Number	Description
	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™ Air Quality Monitor is very easy to set up. The monitor comes fully assembled except for the mounting bracket. 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-8143/>.



Figure 3: Front view of BlueSky™ monitor in package



Figure 4: Bottom view of BlueSky™ monitor in package

There are only two reasons why a BlueSky™ monitor would need to be dismantled:

1. To remove the SD card to download data.
2. To replace the PM sensor. The sensor comes pre-installed, in addition to the microSD card.

NOTICE

The BlueSky™ monitor will store data on the SD card under all conditions whether or not the unit is connected to Wi-Fi®. The BlueSky™ monitor does not need Wi-Fi® to function normally. When Wi-Fi® is not available, data can always be found on the SD card.

NOTICE

The BlueSky™ monitor cannot read data from the SD card and upload the data to the cloud when Wi-Fi® is available. However, an internal data buffer will store about a week's worth of data (logged at 15 min. intervals), which will then be uploaded to the cloud. Data older than a week will be available only on the SD card. Currently, customers cannot read the SD card data and upload it to the cloud.

NOTICE

The SD card is user-accessible by removing the two screws that hold the top and bottom halves of the monitor. Data is always logged to the SD card, regardless of whether or not the device is connected to the Wi-Fi®. TSI® is not liable for corrupt data on the SD card. There will be a warning on the cloud data if the BlueSky™ monitor has trouble writing to the SD card.

Connecting the BlueSky™ Monitor 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 USB port on the bottom of the monitor.
2. After the monitor has powered on, slide the switch on the bottom of the monitor, toward the settings gear. The green LED should blink once per second. The monitor is now like a Hotspot to which a Wi-Fi® device, such as your laptop or mobile device, can connect to. This will allow you to configure the devices Wi-Fi® settings.

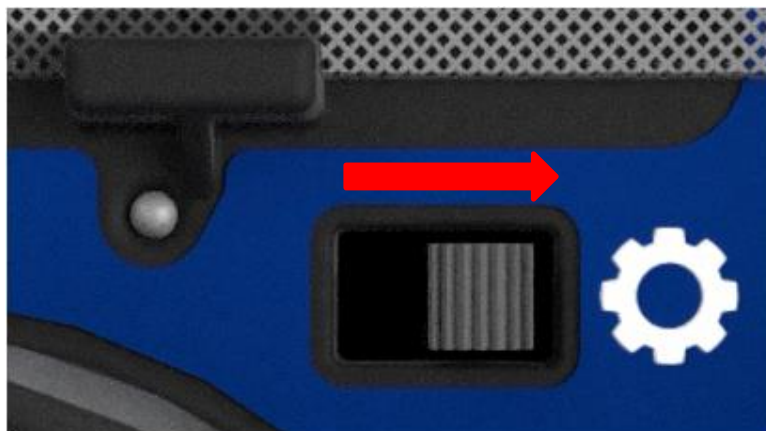


Figure 5: Slide switch toward settings gear

- Using a laptop, tablet or a smartphone, look for the BlueSky™ Wi-Fi® SSID (Service Set Identifier). The SSID is indicated as **TSI BlueSky 8143YYWWXXX Setup**, which includes the monitor's serial number.

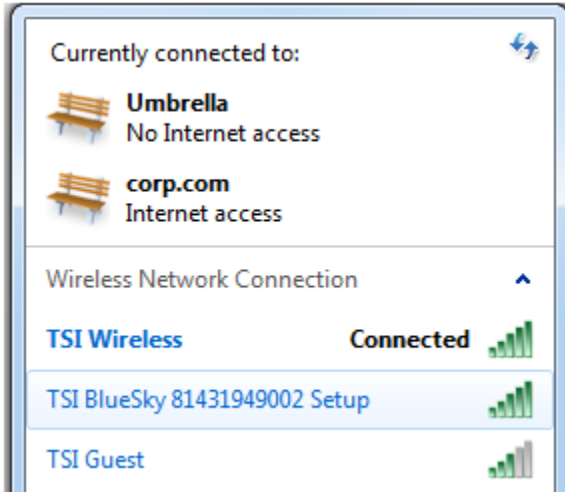


Figure 6: PC wireless configuration

4. Click on the monitor's network and click **Connect**. You will be prompted to enter a password/network security key.

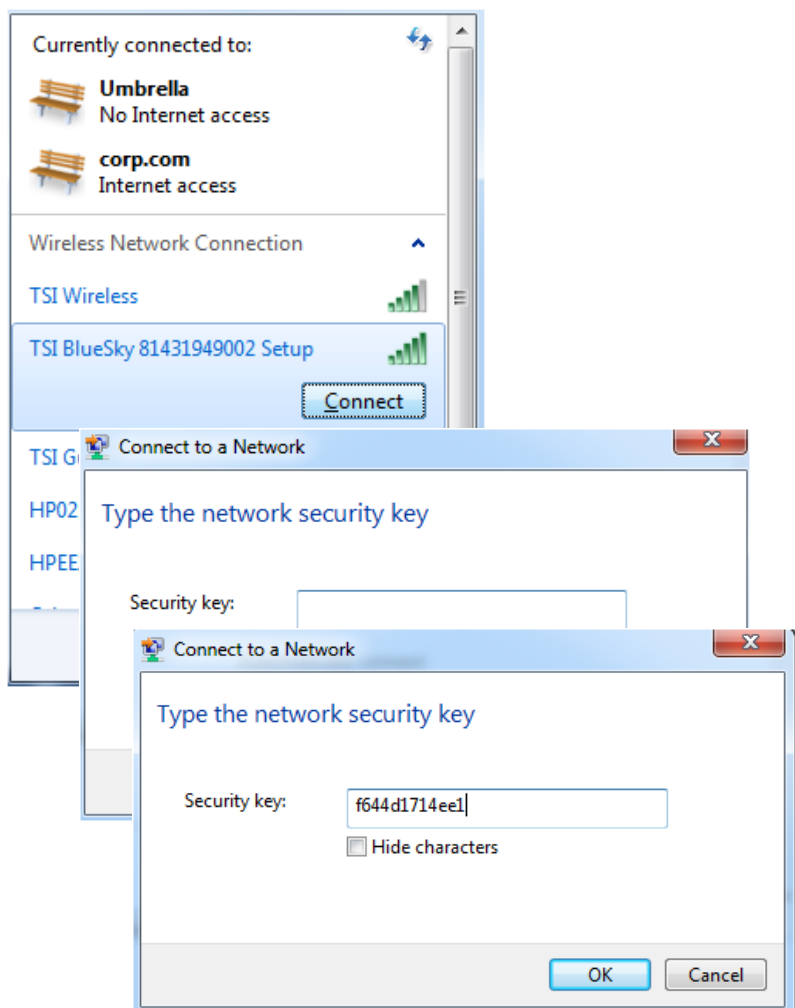


Figure 7: Enter the PWD found on the device label

NOTICE

Your computer or phone may indicate that there is no internet connection present. This is common, because the BlueSky™ monitor is not connected to the internet.

- The security key (PWD) can be found on the serial number label on the bottom of the monitor or on the label that was placed on the quick start guide.



Figure 8: Security Key (PWD) location

- Enter the password and click **OK**.
- After you are connected to the monitor's network, open a web browser on your laptop, tablet or a smartphone and enter the following IP address **192.168.4.1** as shown. Click **Enter** on the keyboard.

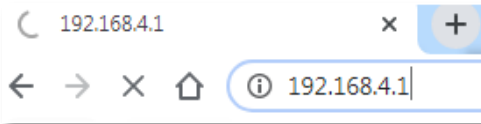


Figure 9: Entering IP address

- The browser will prompt you to enter the SSID (network name) and password of the network you want the BlueSky™ monitor to connect to. This network should be connected to the internet, which will be used by the BlueSky™ monitor to connect to the cloud.

NOTICE
The BlueSky™ monitor can only connect to 2.4 GHz Wi-Fi® signals. Most Wi-Fi® routers provide several frequency channels. Make sure you are connecting to the 2.4 GHz channel.

- Click **SAVE** after entering the information.

TSI BlueSky™ Monitor Setup

Connect BlueSky™ Monitor SN: 81432053002 to a Nearby Wi-Fi Network

Your Wi-Fi Network Name (SSID):

Your Wi-Fi Network 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 10: Entering Wi-Fi network SSID and password

- The browser should let you know that the Wi-Fi® SSID (network name) and password were saved successfully onto the monitors shown below.

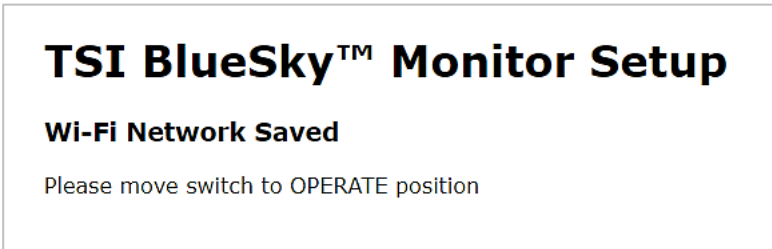


Figure 11: BlueSky™ Monitor Setup Wi-Fi® network saved

The device is now ready to communicate to the Wi-Fi® network. It is recommended that you configure the monitor with the network credentials, which will be present at the final installation location. Then when you plug the monitor in after installation, it will connect to that network and start transmitting data to the cloud.

- Finally, move the Wi-Fi® switch back into the operate position so it can connect to the local Wi-Fi® network.

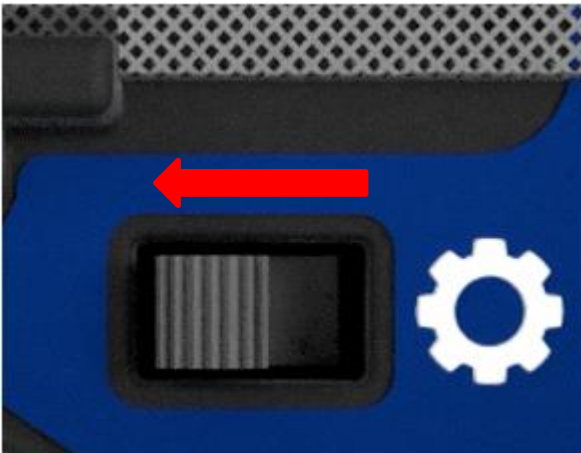


Figure 12: Move Wi-Fi® switch back into operate position

The BlueSky™ monitor will start uploading data to the cloud once it connects to the Wi-Fi® network. After successful communication with the local Wi-Fi® network and the cloud has been established, the green LED should flash once every two seconds.

If the LED is flashing twice every second, with a 1 second pause in-between, the monitor is trying to connect to the Wi-Fi® network, but cannot. Try repeating the process for entering the Wi-Fi® network information to fix the problem.

If the LED is blinking three times every second, with a 1 second pause in-between, it has established connection to the Wi-Fi® network successfully, but it cannot connect the cloud. This is most likely due to no internet being present on the Wi-Fi® network. Try connecting to a separate Wi-Fi® network, with a known working internet connection.

NOTICE

The monitor does not have the capability to connect to public Wi-Fi® networks that requires a second step of browser authentication, such as a free public hotel or airport network. A different network will need to be chosen.

Refer to the [troubleshooting](#) section to debug any problems.

Installing the BlueSky™ 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.

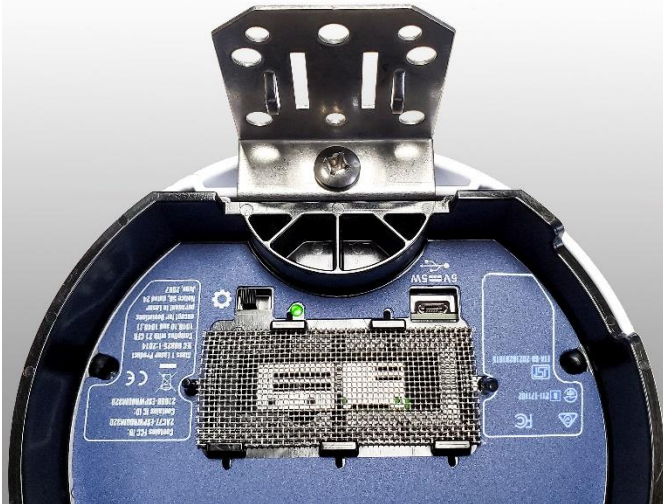


Figure 13: Mounting bracket

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 14: 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 15: 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 16: 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.

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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 off 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 new TSI® 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.

Registering your BlueSky™ Monitor(s) and Account Onboarding

1. After the unit is powered on, check to make sure the green LED at the bottom is flashing once every 2 seconds. If not, go to the [troubleshooting](#) section 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 account, click on the **CREATE ACCOUNT** button. You will be redirected to <https://tsi.com/register>.


NOTICE

If you already have a TSI.com account, the same credentials can be used to log into tsilink.com.

4. Select type of account that you want to create (business/personal) and follow the instructions.
5. You will receive an email from TSI® to verify your email address. Once you receive this email click on the **Verify Link**. An additional e-mail will be sent letting you know the account has been verified.

NOTICE

Verification for business accounts may take up to 24 hours. You will not be able to login, until the process is complete.


6. Once your account is successfully created go to tsilink.com and login.
7. Now you can register your device(s). Register your device by entering in the required information and click **DONE**. If you do not see the Device Registration screen, click the “**Activate New Device**” icon  on bottom right corner of the map.
 - Click on Use Browser Location, to auto generate Latitude and Longitude coordinates or click on the <https://www.latlong.net/> link and then manually entering the coordinates.

Activate Device

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

Device Details	Device Location
Device Type * BlueSky	USE BROWSER LOCATION Set device latitude/longitude using web browser location.
Device/Location Name * 0 / 25	Latitude *
Device Serial Number * Printed on the bottom of the device. No spaces. 0 / 11	Longitude *

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

Figure 17: Device registration screen

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

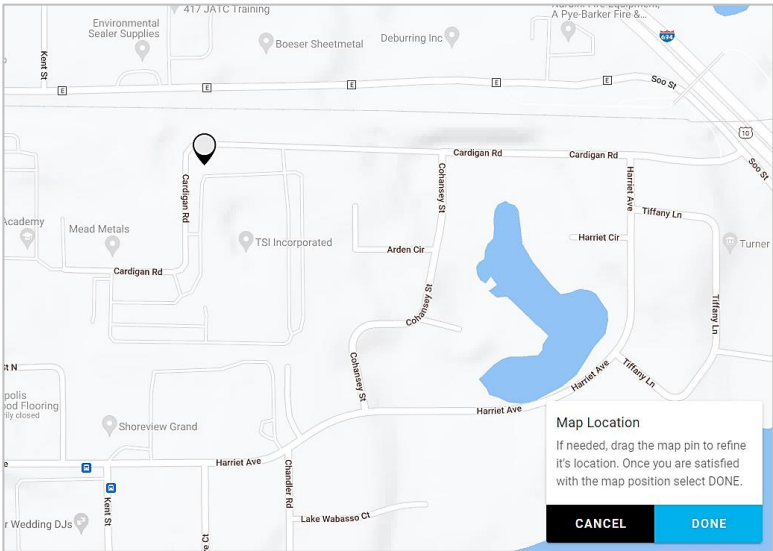


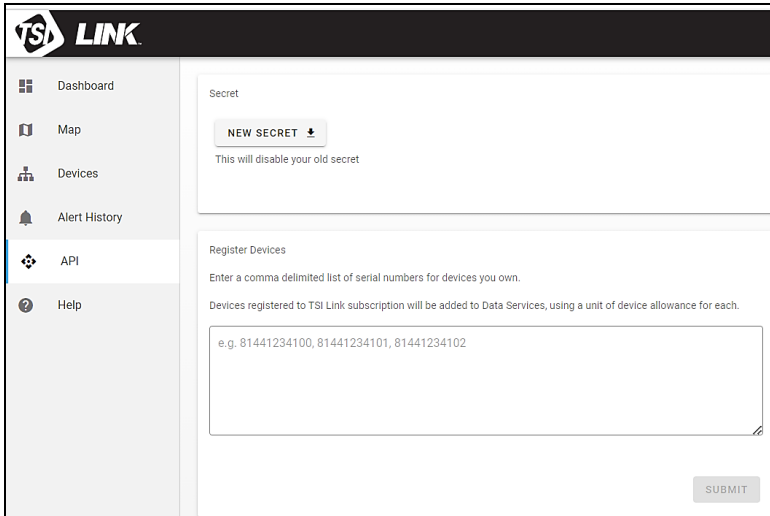
Figure 18: Adjust device pin location

- 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 19: Map view

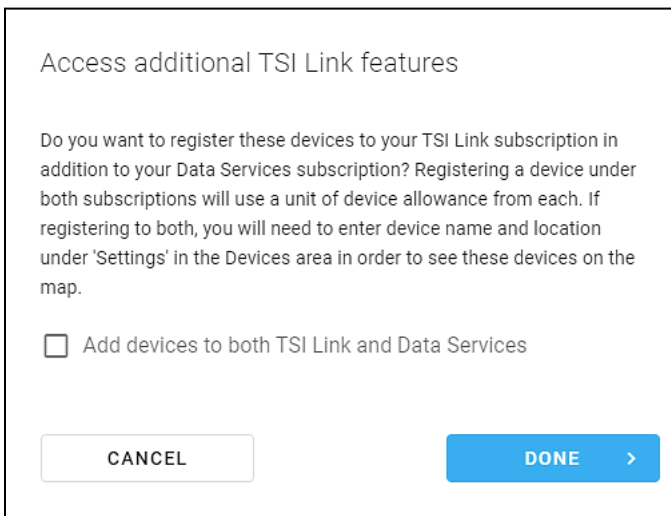
10. If you would like to use the Data Services and API functionality of tsilink.com, click on **API**. Enter the device(s) that you want to register to this TSI Link™ Account. Click **SUBMIT**.



The screenshot shows the TSI LINK user interface. On the left is a navigation menu with options: Dashboard, Map, Devices, Alert History, API (highlighted), and Help. The main content area is divided into two sections. The top section is titled 'Secret' and contains a 'NEW SECRET' button with a dropdown arrow and a note: 'This will disable your old secret'. The bottom section is titled 'Register Devices' and contains instructions: 'Enter a comma delimited list of serial numbers for devices you own.' and 'Devices registered to TSI Link subscription will be added to Data Services, using a unit of device allowance for each.' Below the instructions is a text input field containing the example serial numbers: 'e.g. 81441234100, 81441234101, 81441234102'. A 'SUBMIT' button is located at the bottom right of the form.

Figure 20: API menu

11. 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.



The modal dialog has a title 'Access additional TSI Link features'. The main text asks: 'Do you want to register these devices to your TSI Link subscription in addition to your Data Services subscription? Registering a device under both subscriptions will use a unit of device allowance from each. If registering to both, you will need to enter device name and location under 'Settings' in the Devices area in order to see these devices on the map.' Below the text is a checkbox labeled 'Add devices to both TSI Link and Data Services'. At the bottom, there are two buttons: 'CANCEL' on the left and 'DONE >' on the right.

Figure 21: Access additional TSI Link™ features

- If you have trouble creating an account or need additional information please go to <https://tsi.com/resources/tsi-link-monitoring-and-research-faqs/tsi-link-solutions-faqs-installation-and-setup/>.
- 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 22: Verify device pin is displaying PM2.5

Viewing Data from one or more BlueSky™ Monitors

- Go to <http://www.tsi.com/tsilink> and log in.
- Click on the map and zoom in to the area where your BlueSky™ Outdoor Air Quality device pin is located.
- Click on the device pin to view the current values. It may take roughly 15 minutes before any data can be seen, after the device has been initially powered on and connected to the cloud.

Downloading Data from one or more BlueSky™ Monitors

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

Downloading 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 electro-static 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.

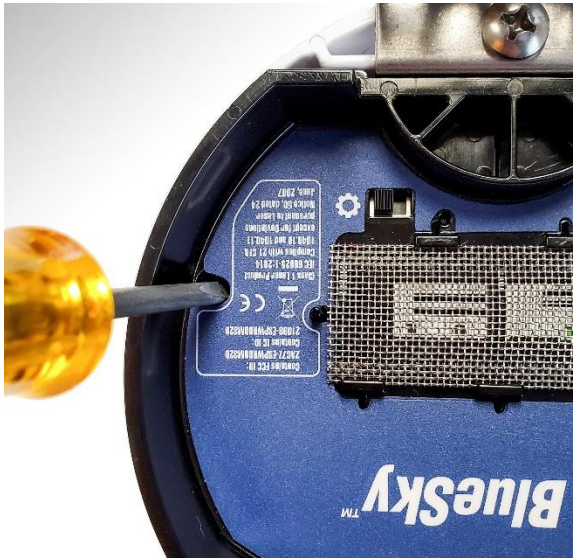


Figure 23: Access microSD card

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

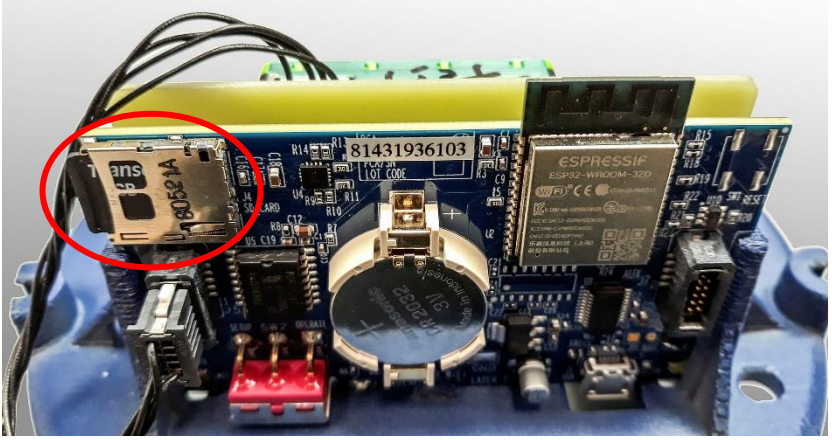


Figure 24: Location of microSD card holder

5. Remove the card and insert the card into a PC to download the data.
6. Once you have downloaded the data, reinsert the card into the BlueSky™ monitor. If the BlueSky™ monitor has any issues writing to the card, an error flag will be activated on the cloud, notifying you that action needs to be taken.

Interpreting the Data Downloaded from the SD Card

Data downloaded from the BlueSky™ Air Quality Monitor will be in the following format:

See [Appendix B](#): for PM Sensor and Device Status definitions.

	A	B	C	D	E	F	G	H	I
	# TSI BlueSky								
	# Model: 8143	Serial: 81432008061							
	# FW: v1.1.0								
	# PM sensor								
	# Model: SPS30	Serial: D8524B470814A84C							
	Timestamp	PM1	PM2.5	PM4	PM10	PM Sensor	Temperature	Relative Humidity	Device Status
	UTC	µg/m ³	µg/m ³	µg/m ³	µg/m ³		° Celsius	%	
1	11/29/2021 0:00	1	1	1	1	0	25	12	0
2	11/29/2021 0:01	1	1	1	1	0	25	12	0
3	11/29/2021 0:02	1	1	1	1	0	25	12	0
4	11/29/2021 0:03	1	1	1	1	0	25	12	0
5	11/29/2021 0:04	1	1	1	1	0	25	12	0
6	11/29/2021 0:05	1	1	1	1	0	25	12	0
7	11/29/2021 0:06	1	1	1	1	0	25	12	0
8	11/29/2021 0:07	1	1	1	1	0	25	12	0
9	11/29/2021 0:08	1	1	1	1	0	25	12	0
10	11/29/2021 0:09	1	1	1	1	0	25	12	0

Figure 25: SD card data

Column A	Date in Universal Time Coordinated (GMT)
Column B	PM1.0 Mass concentration data in µg/m ³
Column C	PM2.5 Mass concentration data in µg/m ³
Column D	PM4 Mass concentration data in µg/m ³
Column E	PM10 Mass concentration data in µg/m ³
Column F	PM Sensor Status
Column G	Temperature data in °C or °F
Column H	Relative Humidity data in %
Column I	Device Status

Interpreting the Data Downloaded from the Cloud

Data downloaded from the BlueSky™ Cloud will include the following:

See Appendix B: for PM Sensor and Device Status definitions.

A	B	C	D	E	F	G	H	I	J	K
Timestamp	PM2.5	Applied PM2.5 Custom Calibration Setting	PM10	Applied PM10 Custom Calibration Setting	PM Sensor Status	Temperature	Applied Temperature Custom Calibration Setting	Relative Humidity	Applied Relative Humidity Custom Calibration Setting	Device Status
UTC	ug/m3		ug/m3			Fahrenheit		%		
8/3/2022 18:17	1		1		0	76.6		47		1
8/3/2022 18:21	1		1		0	77.4		46		0
8/3/2022 18:22	1		1		0	77.5		46		0
8/3/2022 18:23	1		1		0	77.5		45		0
8/3/2022 18:24	1		1		0	77.7		45		0
8/3/2022 18:25	1		1		0	77.9		45		0
8/3/2022 18:26	1		1		0	78.1		45		0

Figure 26: Downloaded CSV file from Cloud

Column A	Timestamp in Coordinated Universal Time (UTC)
Column B	PM2.5 Mass concentration data in $\mu\text{g}/\text{m}^3$
Column C	Applied PM2.5 Custom Calibration Setting - Multiplication Factor
Column D	PM10 Mass concentration data in $\mu\text{g}/\text{m}^3$
Column E	Applied PM10 Custom Calibration Setting - Multiplication Factor
Column F	PM Sensor Status
Column G	Temperature data in °C or °F
Column H	Applied Temperature Custom Calibration Setting - Offset
Column I	Relative Humidity data in %
Column J	Applied Relative Humidity Custom Calibration Setting - Offset
Column K	Device Status

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Chapter 4

Maintenance

Bi-Annual Maintenance Checks

NOTICE

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

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 there are no cracks on the top cover. Cracks can cause water to leak into the device, which may damage the electronics inside.
3. Make sure the mounting bracket is rigidly mounted to the mounting pole, wall or tripod. Tighten screws if necessary.
4. 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.
5. 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 every month.

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. To replace the PM sensor, disconnect the cable between the sensor and the PC board, from the PC board.



Figure 27: Replacing PM sensor

4. To remove the sensor from the base, push on the black plastic release to the right of the carrier board and pull up on one side of the carrier board until it is free from the base.
5. The replacement sensor will come with a new cable assembly. Insert the new sensor by aligning the sides of the carrier board and pushing down evenly on both sides until the board bottoms out and snaps in place. Connect the new cable to the main board.
6. Replacement sensor kit can be purchased from TSI®. See the [replacement parts](#) section at the beginning of the manual.

Chapter 5

Troubleshooting the BlueSky™ Monitor

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

The LED on the bottom can be used to help troubleshoot device issues. Use the blink pattern to identify the error and possible cause.

The LED blinks in the following manner over a 2 second period.

* = LED On
_ = LED Off

All LED blink patterns are over a 2 second interval (depicted below):

0	1	2 sec	
* _ *	_____		WIFI connection in progress
* _ * _ *	_____		TSI Link (Cloud) connection in progress, Wifi connected
* _ _ _	_____		TSI Link (Cloud) connected, Normal operation
* _ _ _ *	_____		Error detected in PM and/or Temp/Humidity Sensor
***** _ *****	_____		WIFI Setup Mode active

Possible Cause	Corrective Action
Monitor does not turn on	
Bad Power Connection or Failed Power Supply	<p>Check all power connections, including the power port on the bottom of the device and where the power supply is plugged into an outlet to confirm proper connections have been made.</p> <p>If the power connections have been confirmed and the device still will not power on, try confirming the power supply is working by plugging it into a different monitor. If found that the power supply is defective, a replacement can be purchased.</p> <p>If power supply seems to be working the main board may have failed and the entire device will need to be replaced.</p>

Possible Cause	Corrective Action
Monitor is not reporting data to tsilink.com cloud	
<p>2 blinks every second, followed by a 1 second pause – Not able to connect to network</p>	<p>Initially indicates the device is attempting to connect to Wi-Fi® network. If this status continues, the device is unable to connect to the network.</p> <p>To resolve, repeat the setup process and re-enter the SSID and password. If the problem persists, check the following:</p> <ul style="list-style-type: none"> • The monitor CAN ONLY CONNECT TO 2.4 GHZ Wi-Fi® signals. Most Wi-Fi® routers provide several frequency channels. Make sure you are connecting to the 2.4 GHz channel. • 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. • Some corporate networks require the device MAC address for security. This can be found on the serial number label of each monitor. • Additionally, the following firewall ports need to be available: <ul style="list-style-type: none"> a. DNS: 53 (UDP) b. SNTP: 123 (UDP) c. HTTPS: 443 (TCP) d. MQTT: 8883 (TCP)
<p>3 blinks every second, followed by a 1 second pause – No internet available, cannot connect to cloud</p>	<p>Device is connected to the Wi-Fi® network but it is unable to establish connection with tsilink.com cloud. This can happen if the configured network does not have an internet connection. Check to make sure the Wi-Fi® network actually has an internet connection. Confirm by connecting to the same network with your phone or PC and make sure you can browse the internet.</p>
<p>1 short blink, followed by 3 rapid blinks every second, followed by a 1 second pause – PM Sensor error</p>	<p>An error has occurred in the PM sensor or the Temp/RH sensor. Only the PM sensor can be serviced. Disconnect power and remove the white cover. Check the PM sensor connection and inspect the cable. Disconnect the cable from the PM sensor and the main board. Reconnect the cable, install the cover and power the device on. If the problem persists, replace the PM sensor.</p>

Possible Cause	Corrective Action
PM Readings seem too low	
Plugged screen.	Remove the mesh screen on the bottom of the monitor and blow out any debris with compressed air. Wash with soap and water, dry with compressed and reinstall the screen.
PM sensor has failed and needs to be replaced.	PM sensor may have failed and needs to be replaced. Purchase a replacement sensor from TSI® and install the new into the monitor.
The monitor is located near an object that obstructs the flow.	Move the BlueSky™ monitor into a more open area and ensure the bottom of the device is open to free air.
Readings are not correct	
Custom calibration factor is incorrect	Check the custom calibration factor. Is the value correct? Was it changed by mistake?
No custom calibration factor	Values can be corrected by using a custom calibration factor. The custom calibration factor can be changed in the cloud.

Additional detailed troubleshooting and frequently asked questions can be found on TSI® website by visiting:

<https://tsi.com/resources/bluesky-faqs/>.

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Appendix A

Specifications*

PM Sensor	
Sensor Type	Light scattering single particle counting
Aerosol Concentration Range.....	0 to 1000 µg/m ³
Measurements	PM1.0, PM2.5 PM4.0, and PM10 on SD Card and PM2.5, PM10 on Cloud
Measurement Resolution	1 µg/m ³
Counting Efficiency	50% at 0.3 µm and 98% at 0.5 µm
Accuracy	±10 % @ 100 – 1000 µg/m ³ when compared to a DustTrak™ DRX monitor
Zero Stability	±1 µg/m ³
Sample Flow Rate	~ 0.3 L/min
Response Time	1 second
Start-up Time	< 8 seconds
Operating Temperature Range ...	-10 to 60°C
Operating Humidity Range.....	0 to 95% non-condensing
Storage Temperature .	-40 to 70°C
Acoustic Emissions Level.....	25 dBA @ 0.2 m
Temperature Sensor	
Range.....	-40 to 125°C
Accuracy	±1°C
Response Time	5 to 30 seconds
Humidity Sensor	
Range.....	0 to 100% RH
Accuracy	±2 % RH
Response Time	8 seconds

Maintenance Requirements	
PM Sensor	Replace PM sensor every year (recommended)
AC and DC Power Requirements	
AC/DC Power Supply .	100 to 240 VAC, 50/60 Hz – INPUT 5 VDC - OUTPUT
Device Input Power	5 VDC
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.*

Appendix B

Status Flags and Error Codes

Below is a table of error codes that may be listed in the sensor status columns of the downloaded CSV file from the cloud and/or SD card. Any error codes, other than zero, indicate one of the below errors occurred during that logging interval.

The BlueSky™ firmware is taking readings from the sensors usually at a frequency greater than one time per second. What that means is that if an error code is reported, it may have only occurred once during logging interval. For example, a PM sensor error of 16, during a 5 min logging interval, may have only occurred 1 time during the 300 times the firmware was attempting to take a reading from the sensor. Therefore, use best judgement to determine if there is an actual sensor failure. If the device seems to be reporting data accurately, when compared to other BlueSky™ devices and/or a reference device, you may not have to take any action. If needed call TSI® Technical Support and they can help provide direction.

Type	Value	Definition	Actions/Resolutions
Device Status	0	No Errors	N/A
	1	Device was rebooted	No action required
	2	Data was not written to the SD card (SD card not present or write failed)	Confirm SD present and installed properly
	4	Cloud communication error	No action required
	8	Temperature / Relative Humidity sensor error	If error persists may have to replace entire BlueSky™ monitor, it is not possible to replace Temp/RH sensor as it is on the main board
	16	PM Sensor error. See specific sensor status for more details	See PM sensor statuses

Type	Value	Definition	Actions/Resolutions
Device Status <i>(cont.)</i>	32	Device Real-Time Clock Battery is low	Replace small coin cell battery on main board. Ensure to use the correct battery part number.
	64	Device internal time has not been synced to the cloud in the last 24 hours	May need to replace coin battery. See 32.
	128	Device internal time value is invalid due to low battery, unpowered device and lack of cloud connection	No action required.
PM Sensor Status	0	No Errors	N/A
	1	Sensor not factory calibrated	Replace PM sensor. All PM sensors from TSI® should be factory calibrated.
	2	Sensor cleaning occurred during interval	No action required
	4	Sensor could not be initialized	No action required
	8	Sensor internal error	Replace PM sensor if problem persists and data does not seem accurate.
	16	Sensor communication timeout	Check sensor cable and ensure the PM sensor is properly connected to main board. Check both ends of the cable. If problem persists after visual inspection of hardware, consider replacing the PM sensor.

Type	Value	Definition	Actions/Resolutions
PM Sensor Status <i>(cont.)</i>	32	Sensor communication error	See 16 actions/resolutions
	64	Sensor check sum error	No action required
	128	Sensor limit exceeded	No action required, max concentration exceeded sensor limit.
	256	Sensor fan error	No action required. If problem persists consider replacing PM sensor.

NOTICE

It is also possible that more than one error may occur during the logging interval. If this occurs, the codes are added together to produce the final code. Use math to determine what the individual codes are.

Examples:

Device status =	<u>Reported Code = 3</u> $3 = 1 + 2 = \text{"Device was rebooted"} + \text{"Data not written to SD card"}$ <u>Reported Code = 17</u> $17 = 1 + 16 = \text{"Device was rebooted"} + \text{"PM sensor error"}$
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Knowledge Beyond Measure.

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