AQSync
Air Quality Monitoring Station

OPERATION MANUAL

Model AQSync

Technical Support:
https://2btech.io/support/
techsupport@2btech.io
+1(303)273-0559

Contents

IDENTIFICATION RECORDS

Record the following information for future reference:

Unit serial number: _____

Warranty start date: _____
(date of receipt)

PRINTING HISTORY

This manual covers the AQSync Air Quality Monitoring Station used for measurement of gases and particulate matter in air. The suite of measurement choices is customizable and includes modules for ozone (O_3), nitrogen dioxide (NO_2), nitric oxide (NO), particulate matter (PM_1, $PM_{2.5}$, PM_{10}), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), and total VOCs. New editions of this manual are complete revisions that reflect updates to the instrument itself, as well as clarifications, additions and other modifications of the text.

Revision A-1 ..... December 2021

Revision A-2 ..... February 2022

Added information to Section D.1 about the Data Portal on the 2B Tech website.

Revision A-3 ..... May 2023

Corrected Appendix referred to in Sections E.1.2 and G.3. Update photo on cover, Section A.1, and Fig. I.2.

Revision B-1 ..... September 2023

Many changes due to hardware and software updates. New Data Portal.

Revision B-2 ..... December 2023

Updated hyperlinks.

Revision C-1 ..... March 2024

Added Appendices 2 through 5. Several updates of touchscreen screenshots to reflect the most recent software version. Modify Sections C.7, E.7.10 and E.7.12 regarding Modbus and date/time. Add Section D.3 about Wi-Fi access.

Revision D-1 ..... December 2024

Revised photos and text to reflect new CH_4 measurement option. Added Appendix 6 regarding the field kits. Revised wording in several places to reflect change to internally generated Wi-Fi. Updated several screenshots for new terminology and menu structure. Updated AQSync overview photo and NOx module photos. Updated sampling inlet installation instructions (Section B.1.1). Updated Calibration and Maintenance Schedule (Appendix 5 and Section H). Added VPN Status page. Updated Table H.4, error codes for NOx module. Other minor updates.

Revision D-2 ..... June 2025

Updated Sections C.2.4 and E.4 to reflect that there is one CO sensor in the current version of the AQSync, not two. Deleted Section H.2.6 on comparing the (formerly) two CO sensor readings for diagnostic purposes.

TRADEMARKS & PATENTS

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CONFIDENTIALITY

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WARRANTY STATEMENT

2B Technologies warrants its products against defects in materials and workmanship. 2B Technologies will, at its option, repair or replace products that prove to be defective. The warranty set forth is exclusive and no other warranty, whether written or oral, is expressed or implied. 2B Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Warranty Period

The warranty period is one (1) year from date of receipt by the purchaser, but in no event more than thirteen (13) months from original invoice date from 2B Technologies.

Warranty Service

Warranty Service is provided to customers via web ticket, email, and phone support, Monday - Friday, from 9:00 a.m. to 5:00 p.m., Mountain Time USA. The preferred method of contacting us is through our web ticketing software at:

https://2btech.io/support/

This way all technical staff at 2B Tech will be alerted of your problem and be able to respond. When you receive an email reply, please click on the Ticket link provided to continue to communicate with us directly over the internet. The web ticket approach to customer service allows us to better track your problem and be certain that you get a timely response. We at 2B Tech pride ourselves on the excellent customer service we provide.

You may also contact us by email at techsupport@2btech.io or by phone at +1(303)273-0559. In either case, a web ticket will be created, and future communications with you will be through that ticket.

Initial support involves trouble-shooting and determination of parts to be shipped from 2B Technologies to the customer in order to return the product to operation within stated specifications. If such support is not efficient and effective, the product may be returned to 2B Technologies for repair or replacement. Prior to returning the product, a Repair Authorization Number (RA) must be obtained from the 2B Technologies Service Department. We will provide you with a simple Repair Authorization Form to fill out to return with the instrument.

Shipping

2B Technologies will pay freight charges for replacement or repaired products shipped to the customer site. Customers shall pay freight charges for all products returning to 2B Technologies.

Conditions

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance, adjustment, calibration or operation by the customer. Maintenance, adjustment, calibration or operation must be performed in accordance with instructions stated in this manual. Usage of maintenance materials purchased from suppliers other than 2B Technologies will void this warranty.

Limitation of Remedies and Liability

The remedies provided herein are the Customer's sole and exclusive remedies. In no event shall 2B Technologies be liable for direct, indirect, special, incidental or consequential damages (including loss of profits) whether based on contract, tort or any other legal theory. The AQSync Air Quality Monitoring Station manual is believed to be accurate at the time of publication and no responsibility is taken for any errors that may be present. In no event shall 2B Technologies be liable for incidental or consequential damages in connection with or arising from the use of the AQSync Air Quality Monitoring Station manual and its accompanying related materials. Warranty is valid only for the country designated on the 2B Technologies quote or invoice.

WARNINGS

ENGLISH

***WARNING*:**
Any operation requiring access to the inside of the equipment, could result in injury. To avoid potentially dangerous shock, disconnect from power supply before opening the equipment.

WARNING:
This symbol,  on the instrument indicates that the user should refer to the manual for operating instructions.

WARNING:
If this instrument is used in a manner not specified by 2B Technologies, USA, the protection provided by the instrument may be impaired.

ESPAÑOL

ATENCION:
Cualquier operación que requiera acceso al interior del equipo, puede causar una lesión. Para evitar peligros potenciales, desconectarlo de la alimentación a red antes de abrir el equipo.

***ATENCION*:**
Este símbolo,  en el instrumento indica que el usuario debería referirse al manual para instrucciones de funcionamiento.

ATENCION:
Si este instrumento se usa de una forma no especificada por 2B Technologies, USA, puede desactivarse la protección suministrada por el instrumento.

FRANÇAIS

ATTENTION:
Chaque opération à l'intérieur de l'appareil, peut causer du préjudice. Afin d'éviter un shock qui pourrait être dangereux, disconnectez l'appareil du réseau avant de l'ouvrir.

ATTENTION:
Le symbol,  indique que l'utilisateur doit consulter le manuel d'instructions.

ATTENTION:
Si l'instrument n'est pas utilisé suivant les instructions de 2B Technologies, USA, les dispositions de sécurité de l'appareil ne sont plus valables.

DEUTSCH

WARNHINWEIS:
Vor dem Öffnen des Gerätes Netzstecker ziehen!

WARNHINWEIS:
Dieses,  auf dem Gerät weist darauf hin, dab der Anwender zuerst das entsprechende Kapitel in der Bedienungsanleitung lesen sollte.

WARNHINWEIS:
Wenn das Gerät nicht wie durch die Firma 2B Technologies, USA, vorgeschrieben und im Handbuch beschrieben betrieben wird, können die im Gerät eingebauten Schutzvorrichtungen beeinträchtigt werden.

ITALIANO

ATTENZIONE:
Qualsiasi intervento debba essere effettuato sullo strumento può essere potenzialmente pericoloso a causa della corrente elettrica.
Il cavo di alimentazione deve essere staccato dallo strumento prima della sua apertura.

ATTENZIONE:
Il simbolo,  sullo strumento avverte l'utilizzatore di consultare il Manuale di Istruzioni alla sezione specifica.

ATTENZIONE:
Se questo strumento viene utilizzato in maniera non conforme alle specifiche di 2B Technologies, USA, le protezioni di cui esso è dotato potrebbero essere alterate.

DUTCH

OPGELET:
Iedere handeling binnenin het toestel kan beschadiging veroorzaken. Om iedere mogelijk gevaarlijke shock te vermijden moet de aansluiting met het net verbroken worden, vóór het openen van het toestel.

OPGELET:
Het symbool,  geeft aan dat de gebruiker de instructies in de handleiding moet raadplegen.

OPGELET:
Indien het toestel niet gebruikt wordt volgens de richtlijnen van 2B Technologies, USA gelden de veiligheidsvoorzieningen niet meer.

CHINESE

警告：
任何需要接触设备内部的操作均可能造成人身伤害。为避免可能的触电危险，请在打开设备前切断电源。

警告：
这个符号  在仪器上表示用户应参考说明书上的操作指南。

警告：
如果仪器没有按照美国 2B 科技公司指定方式操作，仪器的保护性能会减弱。

JAPANESE

警告：
機器の内部で操作する時、怪我できます。**危険な衝撃を回避するために、機器を開ける前に、電源を切断してください。**

警告：
機器でこの記号  を見れば、マニュアルを読んでください。

警告：
この機器は 2B テクノロジー会社、USA の指定でしなければ、機器の保護が損なえます。

UNPACKING

Please read all the following information before attempting to install the AQSync Air Quality Monitoring Station. For assistance, please call 2B Technologies at (303)273-0559.

NOTE:

Save the shipping carton and packing materials that came with the AQSync Air Quality Monitoring Station. If the AQSync Air Quality Monitoring Station must be returned to the factory, pack it in the original carton. Any repairs as a result of damage incurred during shipping will be charged.

Shipping Box Contents

Open the shipping box and verify that it contains all of the items on the shipping list. If anything is missing or obviously damaged, contact 2B Technologies immediately by email at techsupport@2btech.io or by phone at +1(303)273-0559.

Trailer Disclaimer

If a Wanco trailer has been purchased with an AQSync unit, the AQSync must not be transported installed on the trailer. Doing so may result in critical damage to instrumentation. The AQSync must be deinstalled and placed in the original packaging or carrying case when transporting the unit. Refer to this guide for installation instructions.

A. Overview

A.1 The AQSync Air Quality Monitoring Station

The AQSync Air Quality Monitoring Station is a comprehensive air monitoring package that combines Environmental Protection Agency (EPA)-Federal Equivalent Method (FEM) instruments for measuring ozone (O_3) and nitrogen dioxide (NO_2), with a weather transmitter and other devices for high-quality yet affordable measurements of several other air pollutants. The suite of measurement choices is customizable and includes modules for ozone, nitrogen dioxide, nitric oxide (NO), particulate matter (PM_1, $PM_{2.5}$, PM_{10}), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), and total VOCs.

The AQSync can be installed at any location where line power is accessible—for example, on a light post or building, or at field sites.

The AQSync integrates sensors such as those used in the 2B Technologies Personal Air Monitor (PAM) with the FEM-quality ozone measurements of the 2B Technologies Model 108-L Ozone Monitor, the FEM-quality NO_2 measurements of the 2B Technologies Model 405 nm NO_2/NO/NO_x Monitor, instruments for CO_2 and particulate matter, and a weather transmitter in a rugged, weatherproof enclosure.

We recommend reading this brief overview in Section A before proceeding to use your AQSync.

Customizable Choices for the AQSync:

108-L Ozone Monitor

405 nm NO_2/NO/NO_x Monitor

CO, VOCs, CH_4, CO_2 and PM devices

T, P, RH sensors

Weather transmitter

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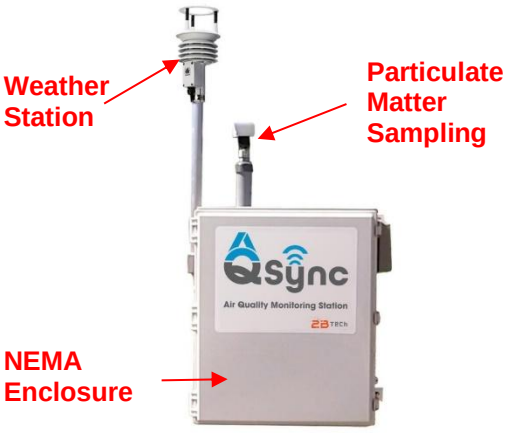
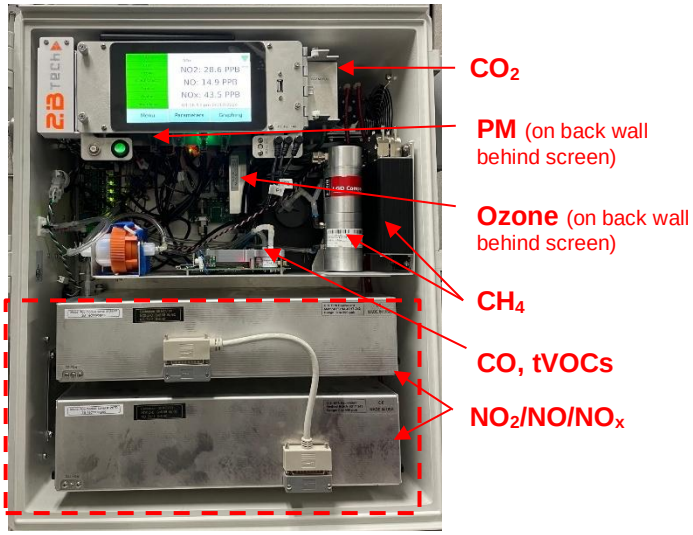
Rugged enclosure

Data transmission via AQSync's local Wi-Fi + external cellular





A.1.1 Summary of the AQSync Measurement Suite

For each measured quantity*, click on the left column to link to its website or user manual. See Appendix 1 for more information.

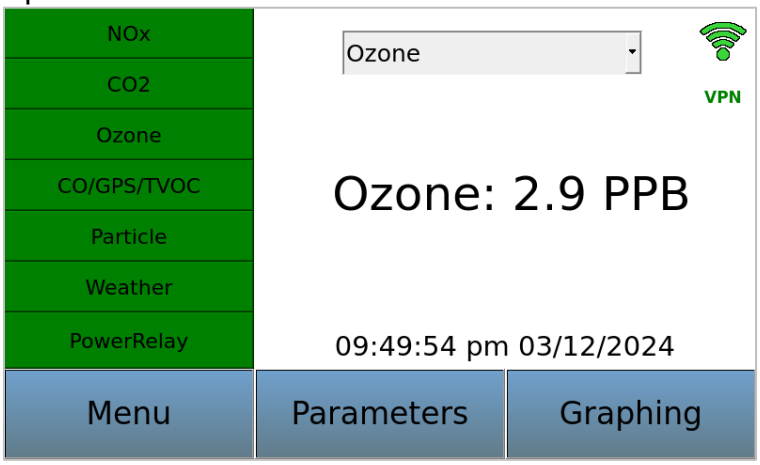
	Method	Device	Range	Accuracy
O_3	UV absoption, 254 nm	2B Tech 108-L (FEM)	0−100,000 ppb	1.5 ppb/2%
NO_2	Direct absorbance, 405 nm	2B Tech 405 nm (FEM)	0−10,000 ppb	2 ppb / 10%
NO	Oxidation to NO_2 with O_3 followed by absorbance of NO_2 at 405 nm	2B Tech 405 nm	0−2,000 ppb	2 ppb / 2%
CO_2	Non Dispersive Infrared (NDIR) absorbance, absolute absorptiometer	PP Systems CO_2 Gas Analyzer, Model SBA-5	0−1000 ppm	5 ppm
PM (1, 2.5, 10 µm)	Right angle light scatter particle detection using a laser diode	Met One 83214 AQ Mass Profiler	0−320,000 particles/L	±10%
CO	Amperometry	Alphasense CO-A4	0−50 ppm	0.1 ppm
VOCs	Photoionization Detection	ION Science MiniPID2-HS	0−3 ppm	0.5 ppb det. lim.
CH_4	Tunable-Diode Laser	Axetris LGD Compact-A CH4	0-100ppm	<0.8 ppm
T	(contact Gill Instruments Ltd.)	Gill Instruments MaxiMet GMX500 Weather Station	-40 to +70 °C	±0.3 °C @ 20 °C
P	(contact Gill Instruments Ltd.)	Gill Instruments MaxiMet GMX500 Weather Station	300 – 1100 hPa	±0.5 hPa @ 25 °C
RH	(contact Gill Instruments Ltd.)	Gill Instruments MaxiMet GMX500 Weather Station	0−100 %RH	±2 %RH (10 to 90 %RH)
Wind speed	2-D Sonic anemometry	Gill Instruments MaxiMet GMX500 Weather Station	0.01−60 m/s (134 MPH)	0–40 m/s ±3% 40–60 m/s ±5%
Wind direction	2-D Sonic anemometry	Gill Instruments MaxiMet GMX500 Weather Station	0-360 degrees azimuth	±3° to 40 m/s ±5° 40 to 60 m/s

* Some choices of the measurement suite are customizable and are specified at time of order.

A.1.2 Viewing and Acquiring Data with the AQSync

A.1.2.1 Viewing AQSync Data via the Touchscreen

Real-time data can be viewed using the touchscreen of the AQSync. Individual screens show the data for each of the AQSync measured quantities (ozone, NO_2, etc.). In addition, a graphing function allows viewing of the continuous data stream for any of the measured species.



Note: Choices on the left side of the screen will vary, based on the measurement options purchased for your AQSync.

The screen functions are intuitive but are more fully explained later in this manual.

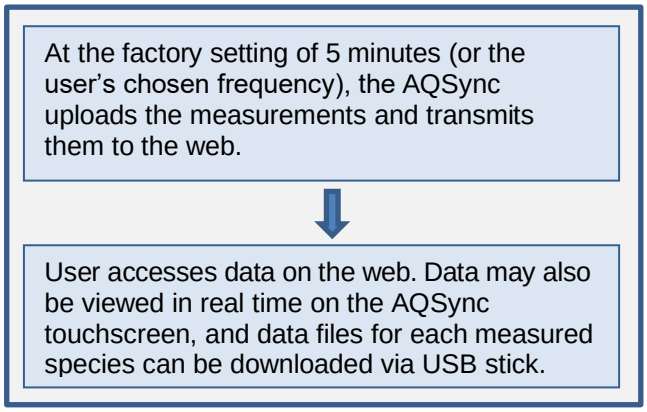
A.1.2.2 Accessing AQSync Data via the Cloud and via USB

As shipped from the factory, the AQSync is configured so that data from its instruments and sensors are integrated and then transmitted via Wi-Fi to the web every 5 minutes if the data communication package has been purchased. *This integrated web-based data stream is the primary data acquisition mode for use of the AQSync.* The AQSync creates its own dedicated Wi-Fi network, which is dependent on the availability of cellular service.

The upload frequency of the measurements is set at a default value of 5 minutes at the factory. However, if desired this setting can be changed by the user in the instrument's touchscreen menu. Shorter times are not generally recommended because of prohibitive cellular costs.

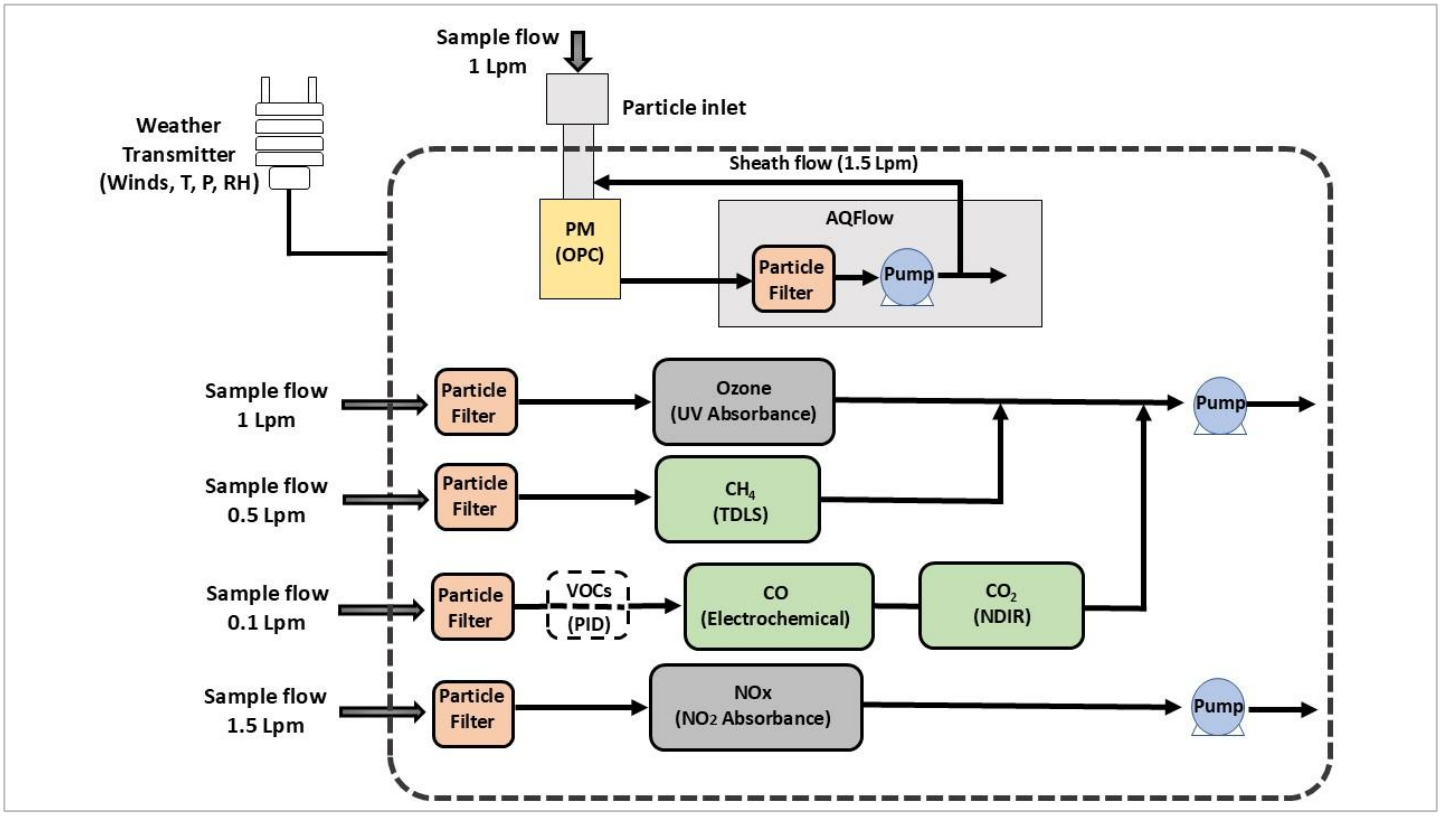
Each data line contains chemistry measurements (e.g., ozone, NO, NO_2, NO_x, CO, CO_2, CH_4, PM_1, $PM_{2.5}$, PM_{10}), meteorological measurements made by the AQSync's weather station (temperature, pressure, relative humidity, wind), location, and time. The data can be exported to a computer for subsequent analysis.

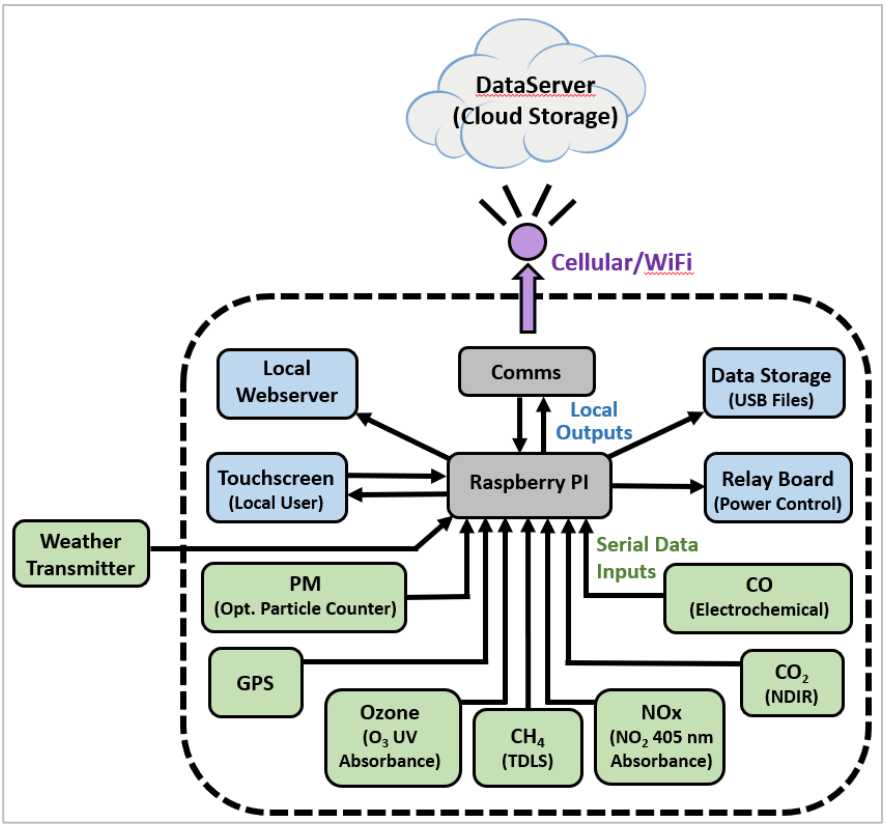
Data files for each measured species are also stored internally for USB access.



Schematic summary of the process

A.1.2.3 Schematics of the AQSync's Sample Flow and Data Flow





A.2 This User Manual

After gaining an overview of the AQSync through the description given in Section A.1 above, the user can find more detail in this manual's 7 major sections:

B. Assembly and Installation of the AQSync
C. Quick Start: Initiating Measurements with the AQSync
D. Data Access and Control
E. Menu (settings)
F. Parameters and Graphing Screens
G. Calibration and Zero Checks
H. Maintenance and Troubleshooting

Sections I through L of the manual contain labeled instrument photos, a list of spare parts, and a service log for your recordkeeping.

The Appendices give more detail about the individual components of the AQSync, calibration in the field, remote operations, and more:

Appendix 1: Instruments and Sensors of the AQSync
Appendix 2: Field Calibrations
Appendix 3: Remote Operation and Data Access (via Modbus)
Appendix 4: Downloading Data Files via Wi-Fi
Appendix 5: Recommended Maintenance and Calibration Schedule
Appendix 6: AQSync Field Kits Overview

B. Assembly and Installation of the AQSync

B.1 Assembly

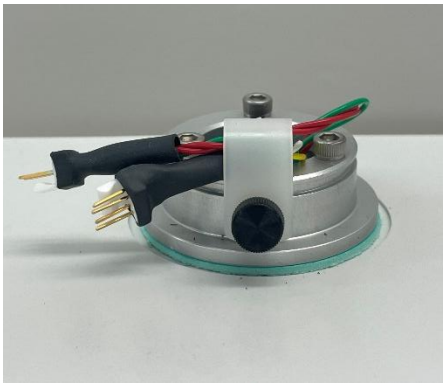
The weather station and particulate matter (PM) sampling inlet are detached from the AQSync for shipping to protect them from damage. Carefully unpack them and install them as shown here.

B.1.1 Install PM Sampling Inlet

Obtain the pieces of the Particulate Matter Sampling Inlet as shown below. After following these steps, the PM Inlet will be installed as shown in the picture at the right.

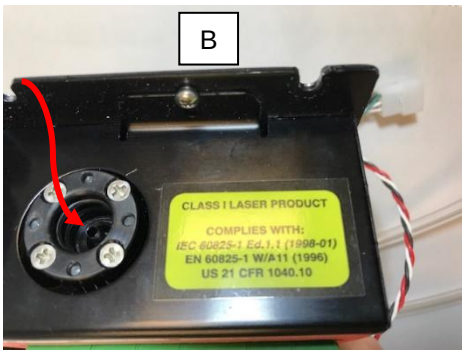
Final Install

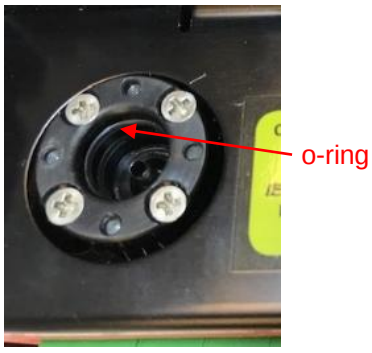
The AQSync has an aluminum flange on the top, with connecting wires secured, as shown at right. The PM Inlet is installed into this flange as described below.



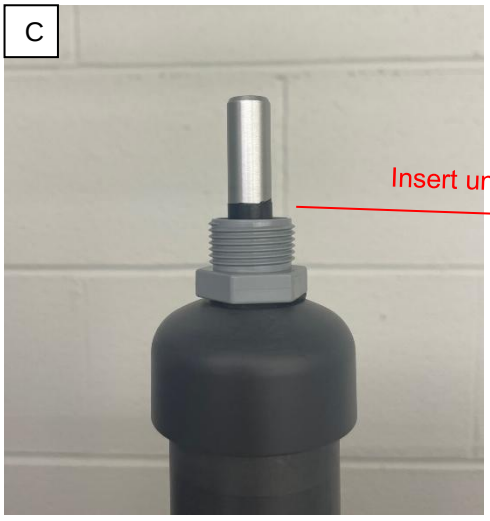
A. Remove the plastic p-clamp that is securing the wires on the flange, taking care not to let the wires fall inside the AQSync. Plug in the wires on the core to these wire connections. Push the connected wires through the flange and into the AQSync now.

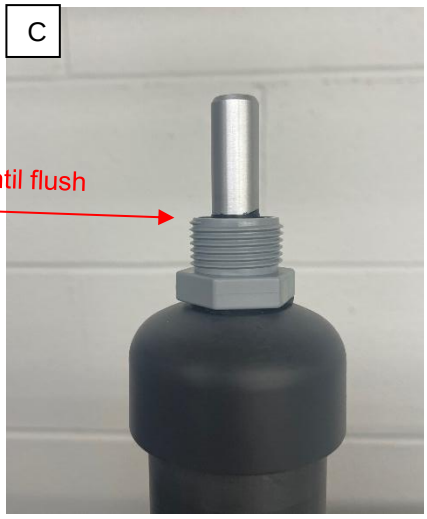
B. Insert the bottom of the Core into the receptacle of the PM instrument mounted inside the AQSync. Be sure not to pinch the wires as you do this. Twist and push the Core through the o-ring that is inside the receptacle, until it seats against the bottom of the receptacle. *The PM measurements will only be valid if the Core is sealed with the o-ring and seated properly! See Section G.2.3 for how to check for leaks after installation.*





C. Slide the Shield Assembly over the Core and down over the o-ring on the flange. Rest it on the aluminum flange. Check that the core (installed in step B) is inserted by looking at the electrical tape on the core. If fully inserted the electrical tape will be close to flush with the shield assembly See pictures for details

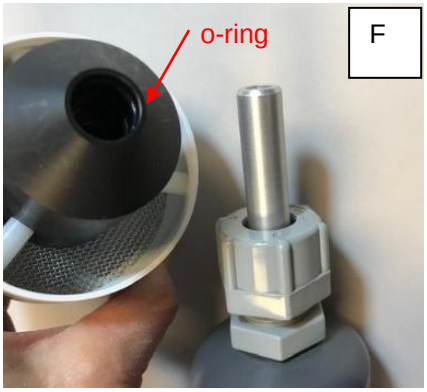




D. Line up the holes in the Shield and the flange. Attach the Shield with the three thumbscrews provided.

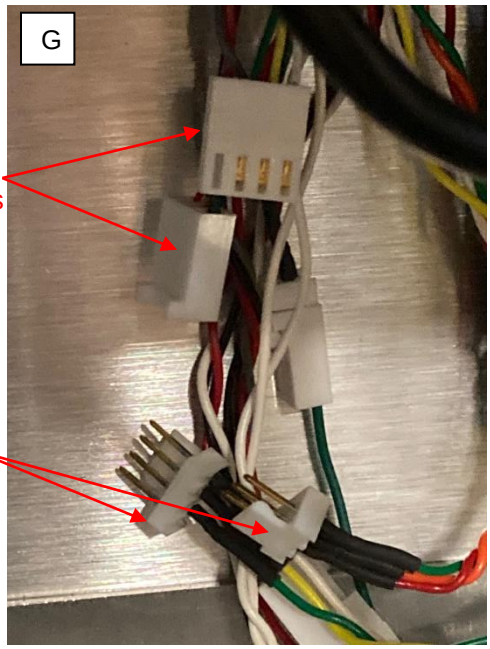
E. Slide the rubber gasket, white plastic washer, and nut onto the Core. The narrow end of the black rubber gasket should point downward. Secure the nut to the Shield Assembly.

F. Slide the Inlet Cover onto the top of the Core. This requires a hard push and twisting to get the Core through the internal o-ring that is inside the Inlet Cover.

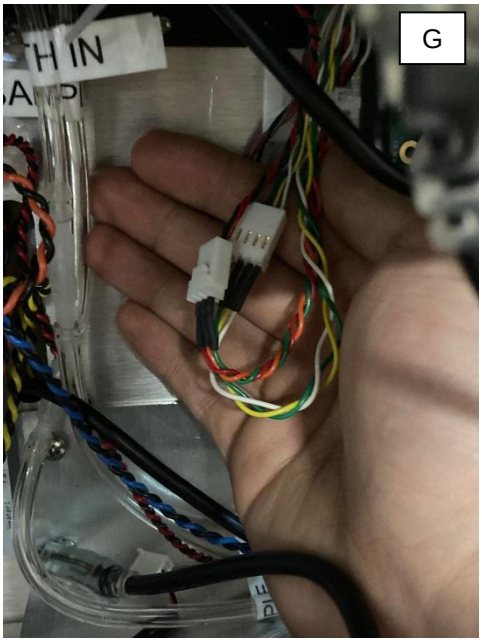


G. The assembly is now complete except for arranging the PM wires inside the AQSync. Check that the wires are still connected. Use a zip tie or other means to tidy.

Disconnected wires



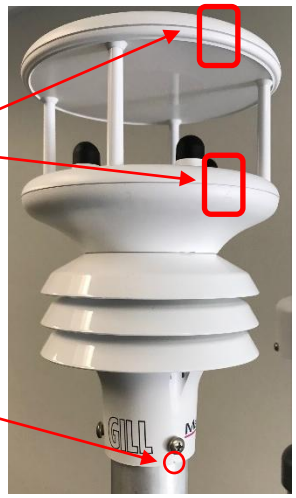
Connected wires

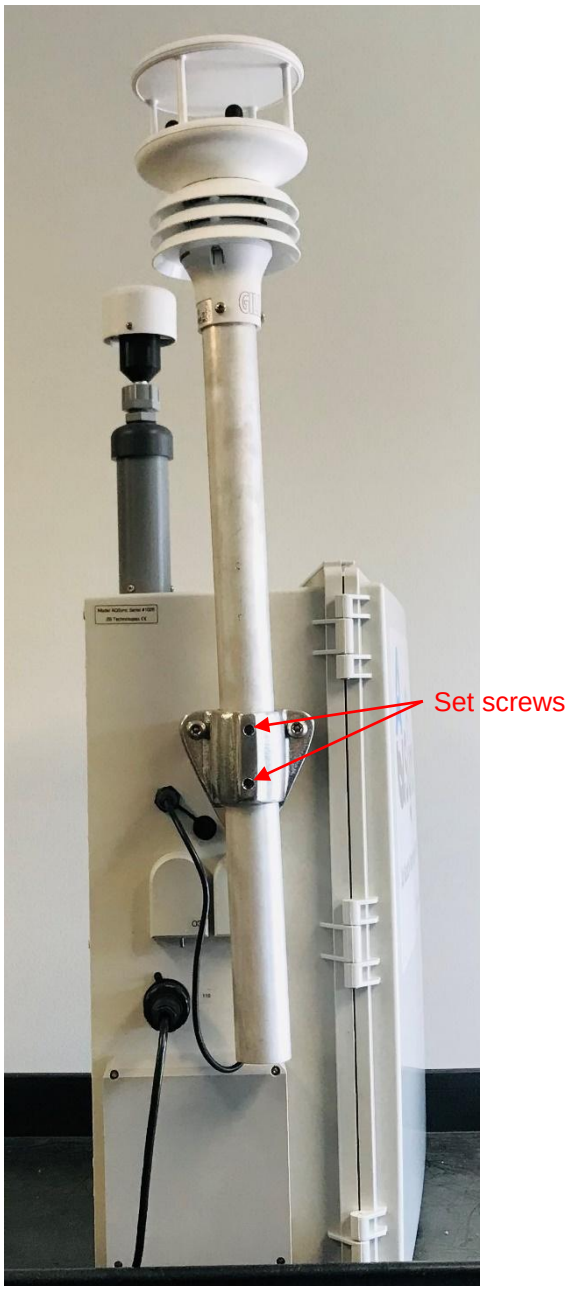


After installation, it is advisable to check for leaks. Use instructions in Section G.2.3.

B.1.2 Install Weather Station

- Slide into metal fitting.
- Use a hex wrench to secure it with the 2 set screws.
- Plug in as shown.
- Note that when the AQSync is installed in its measurement location, the **weather station's marker must be oriented to North.** Use your smartphone to access GPS information.





The weather station is a MaxiMet GMX500 Weather Station made by Gill Instruments Ltd. For more information about the installation of the wind sensor, please consult the manufacturer's manual.

B.2 Physical Installation

The AQSync Air Quality Monitoring Station is designed for outdoor environments and meets NEMA 3 specifications for environmental protection. The polyester enclosure is sealed to withstand rain and snow, and the enclosure is fitted with a weatherproof cable gland for all cable connections.

B.2.1 Placement

Monitoring objectives will influence the choice of the location of the AQSync. In addition to the air chemistry considerations, proper siting of the weather transmitter of the AQSync must be considered. Locate the instrument away from obstructions, because eddies from buildings, trees, or other structures influence the measurement. As a general recommendation: If the height of the nearest obstruction is H, locate the instrument at a distance of [10 × H] away from the obstruction, and at a height of [1.5 × H]. The weather transmitter user manual may be consulted for more information.

B.2.2 Secure the AQSync

We recommend that the monitor be mounted on a post or specially built stand. The back of the enclosure has three holes along each of the vertical sides that can be used for mounting. The holes are 1/4” in diameter and should be used with stainless steel bolts and washers. The dimensional drawings are shown in Section B.3.

When the AQSync is shipped from the factory, two Unistrut mounting pieces and associated hardware are included for possible use in mounting the AQSync.

B.2.3 Orient the Wind Sensor

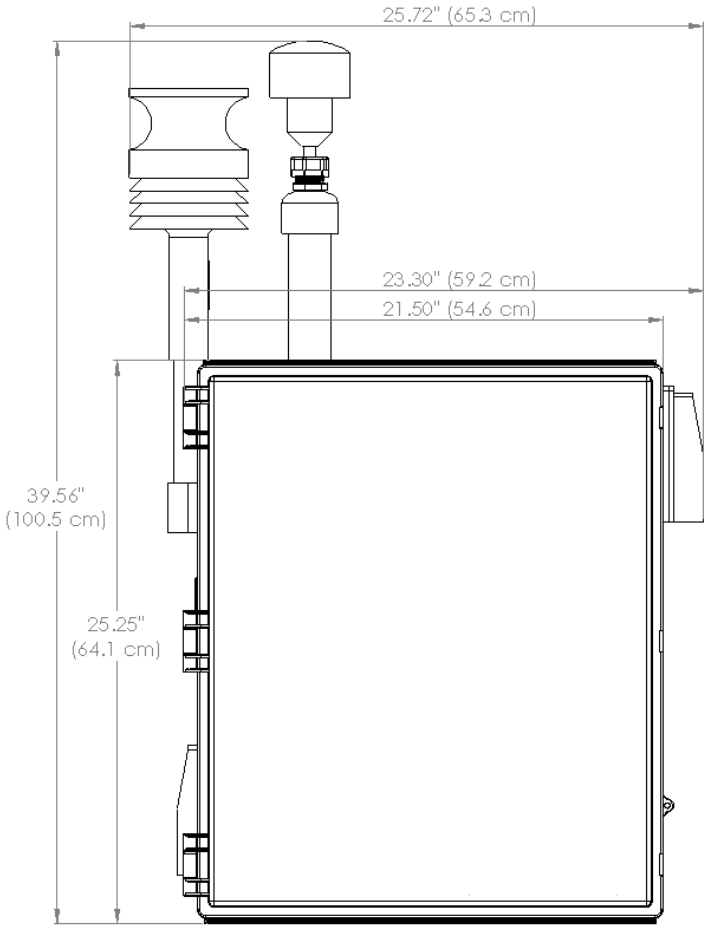
The wind sensor must be oriented to North:

- Use a hex wrench to loosen the set screws.
- Using your phone GPS to locate North, rotate the weather station as needed (see previous page for alignment marker location).
- Retighten the set screws.

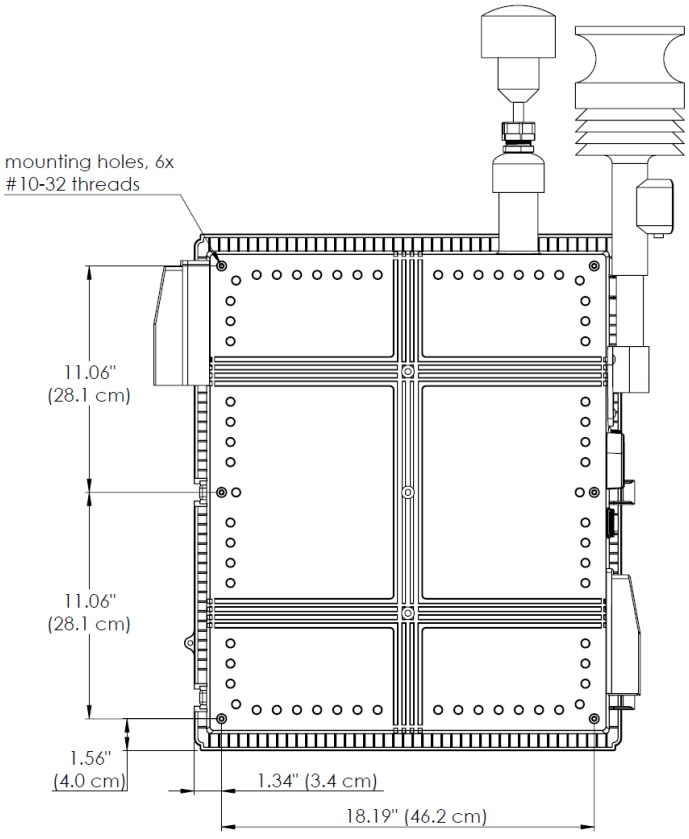
The Gill MaxiMet GMX500 weather station has a built-in compass that can be used to complete this step if a smartphone is not available. Please consult the user manual for more information on using the compass.

In the AQSync as shipped from the factory, the compass is turned off. Contact us if you wish to enable the compass.

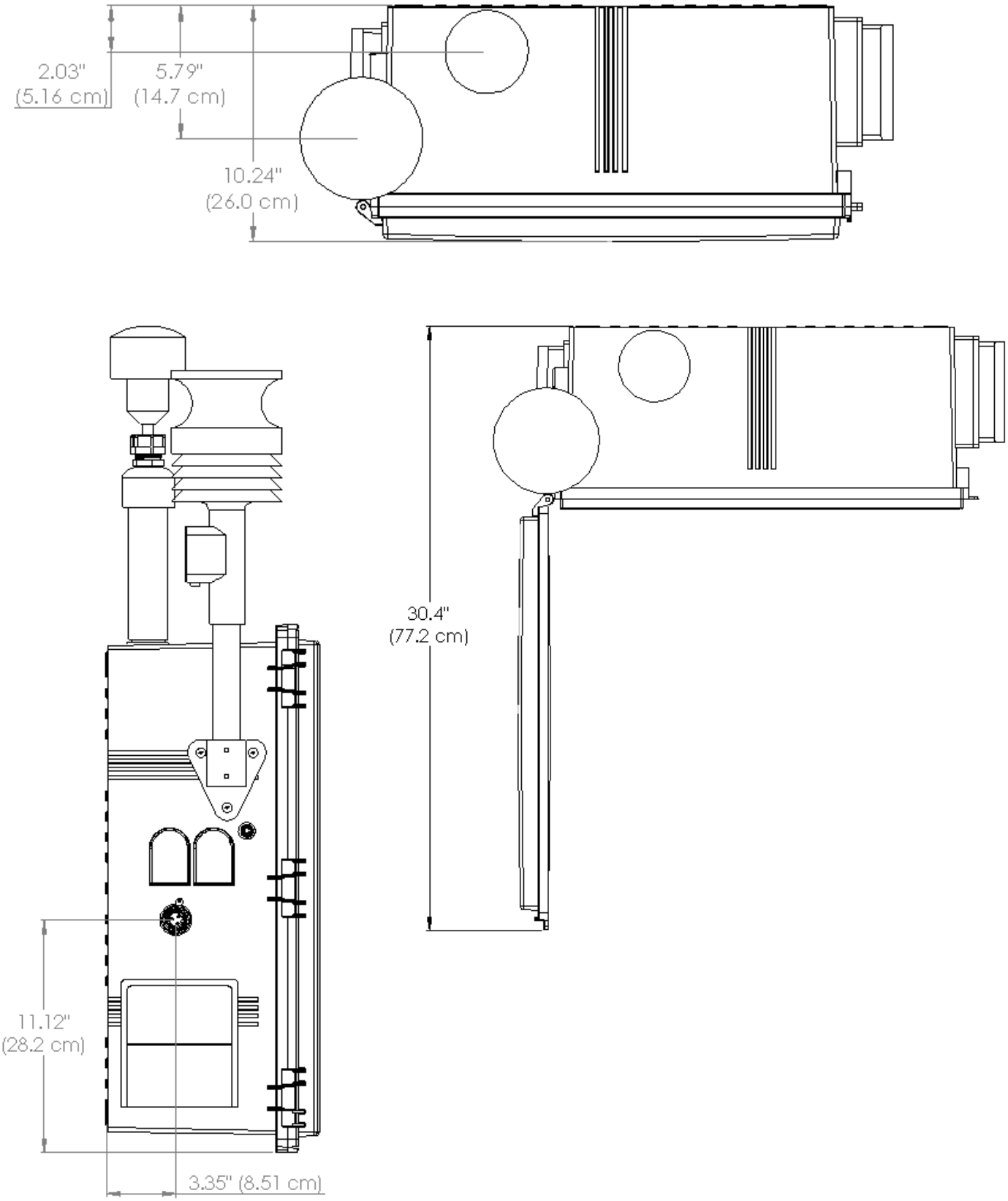
B.3 Dimensional Drawings



Front View



Back View



Side and Top Views

C. Quick Start: Initiating Measurements with the AQSync

This section of the manual serves as a "quick start" and describes:

- Powering up
- Warmup and battery charging
- Viewing the data on the touchscreen
- Flow rate check
- Wi-Fi connection (cellular service must be available)
- Adjusting settings for your air sampling

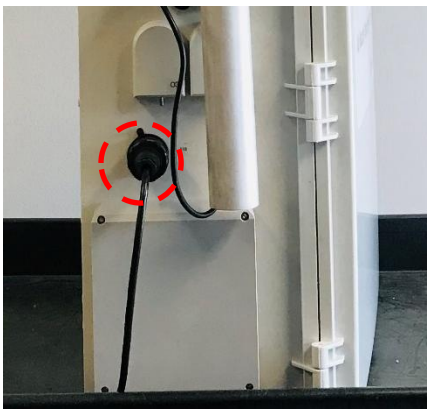
• Complete Section B steps before proceeding.
• Be sure the weather station is properly oriented (marker pointed North)
• Complete the steps in this Section C each time you power up the AQSync.

Below is a summary of the minimum steps for startup and use that are further described in this Section C. If the AQSync is deployed at a fixed installation site, step 6 will most likely not need to be repeated each time the AQSync is powered up.

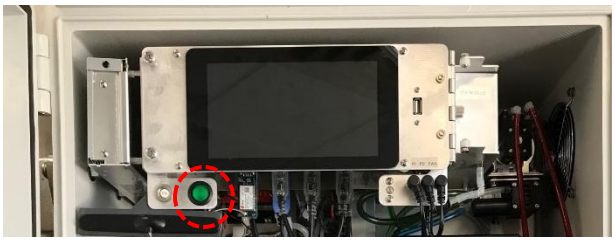
Startup Checklist	
1	Connect power cable and turn on the AQSync
2	Allow ~30 minutes for warmup and battery charging
3	Confirm measurements are functional by viewing on touchscreen
4	Check flow rates of NO_2/NO/NO_x instrument (restart if adjustment needed)
5	Check / set Wi-Fi access
6	Check upload frequency and instrument measurement intervals

C.1 Power Up

1. Connect the power cable and provide power to the AQSync.

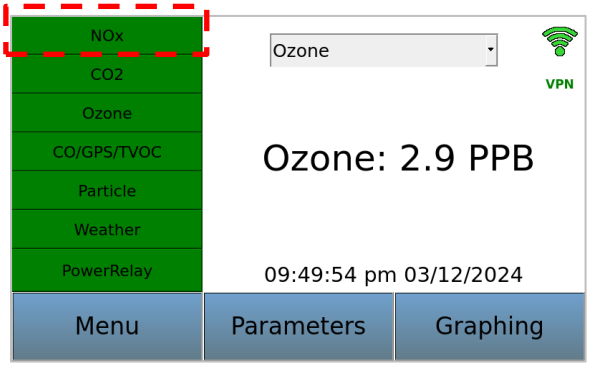


2. Power on using the green button located near the bottom left of the screen.



3. The instrument will initialize for a few moments before displaying the main screen shown below. Tap on any parameter on the left to see its current value.

Color code:
Green box = Connected (tap to see more)
Blue box = Warming up (for NOx, CO_2)
Gray box = Disconnected (tap to see more)
(*Parameters in green vary based on measurement options purchased for your AQSync.*)



← Wi-Fi status
← VPN status

NO_2, NO, and NOx values will be zero until the instrument is warmed up; see Section C.2.

4. Confirm that the AQSync's local Wi-Fi has been established, if purchased (green symbol will show in the upper right corner of the touchscreen). The VPN status is indicated below the Wi-Fi status (see Section E.8.7).

C.2 Warmup

Each module of the AQSync requires a period of time to warm up, described below. Note that the green color of the bars on the left indicates that the modules are connected, not that they are warmed up.

If a module is not connected, its bar on the left will be gray.

C.2.1 Ozone

Once the instrument has been powered on, the first dozen ozone readings (requiring about two minutes) will be spurious, with large positive and negative swings due to the rapid warmup of the lamp and electronics of the ozone monitor. Also, ozone readings may be noisier than expected during the initial 10-20 minutes required for the lamp, photodiode, and internal temperature of the absorption cell to stabilize.

C.2.2 NO_2/NO/NO_x

The instrument requires a warmup period of ~20-25 minutes. The screen will read zeroes for NO_2, NO, and NO_x during this period, and the NOx panel will be blue until warmup.

C.2.3 CO_2

The CO_2 instrument requires about 30 minutes of warmup to achieve thermal stability and to cycle through some automated zeroing checks. The CO_2 panel will be blue until warmup.

C.2.4 CO/GPS (and Optional VOCs)

In a typical configuration of the AQSync, there is a CO sensor. The CO sensor requires an equilibration period of about 15-20 minutes.

If the AQSync measurement suite includes Total VOCs, its readout is given here along with CO and GPS measurements.

C.2.5 Particulate Matter (PM)

The particulate matter instrument requires only ~5 minutes of warmup.

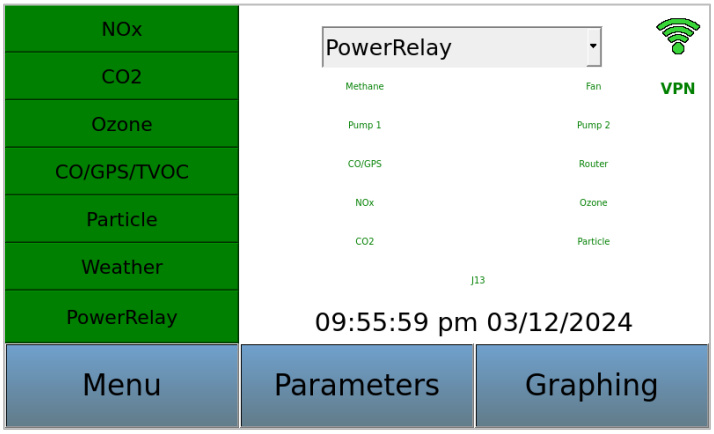
C.2.6 CH_4 (Methane)

The CH_4 instrument requires only ~5 minutes of warmup.

C.2.7 Power Relay Status

This screen gives the status of the power relays. (These can be turned on and off in the Menu/System screen; please see Section E.8.4.)

Pump 1 is the pump associated with the ozone/CO/VOCs/CO_2 modules, and Pump 2 is associated with the NOx module. Pump 3's use depends on the configuration.



Summary

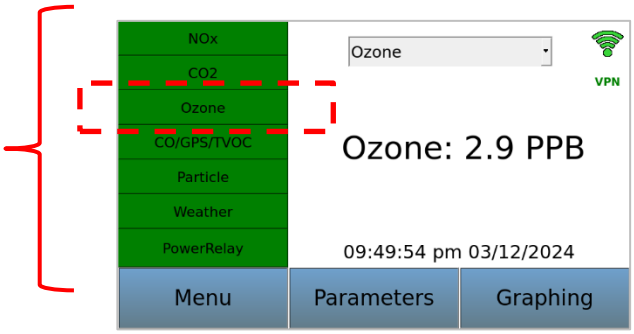
Allow ~30 minutes of warmup to ensure that the full measurement suite of the AQSync is valid. The data communication battery also charges during warmup.

C.3 Real-Time Data Viewing on the Touchscreen

C.3.1 Main Screen

Users can view the AQSync data on the Main screen of instrument's touchscreen. Each measured species in the chemistry suite can be viewed individually by selecting the species on the left-hand side of the Main screen:

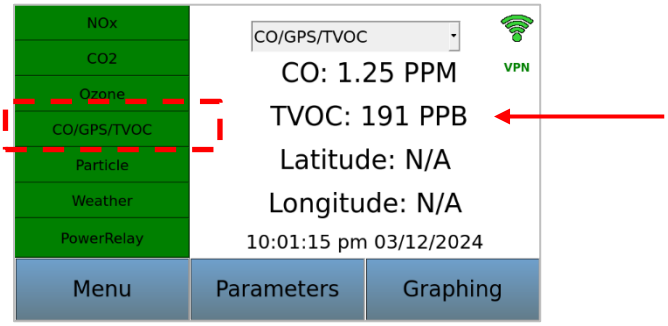
Note: Choices on the left side of the screen will vary, based on the measurement options purchased for your AQSync.



Tapping twice on a green measurement button brings up more information.

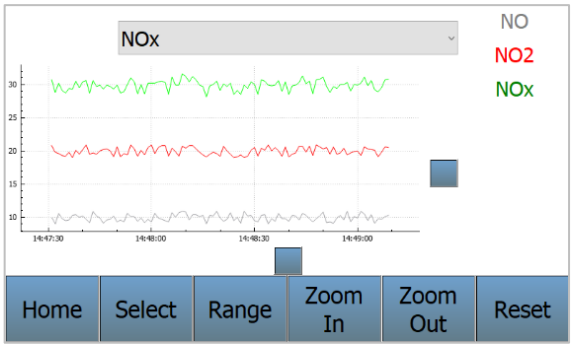
If your AQSync has the methane measurement option, it will appear as another choice in the list of green boxes on the left.

If your AQSync has the Total VOCs sensor option, its display is found in the CO/GPS submenu, as shown here:



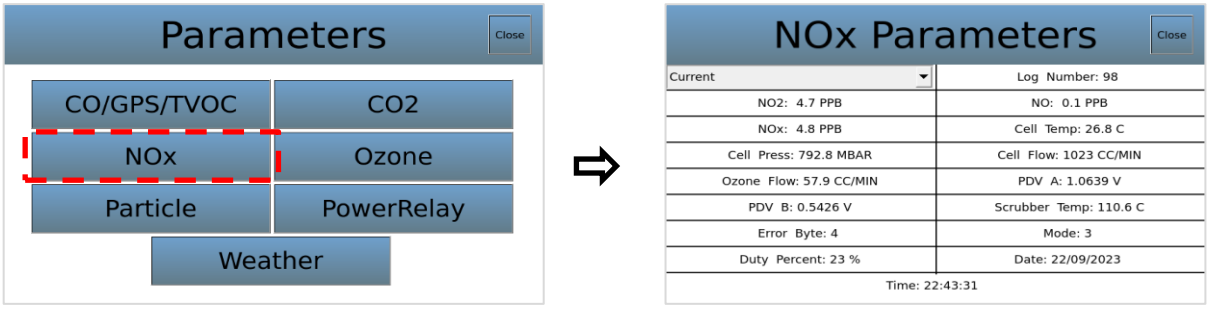
C.3.2 Graphing Screen

Select "Graphing" from the bottom right of the Main screen to view a plot of any of the measured variables of the AQSync. The Graphing screen has a pulldown menu for selecting the quantity plotted. The range of the graph can be specified. In addition, the "Select" menu enables the quantities plotted and color choices to be customized. Section F.2 describes how to use this feature of the AQSync.



C.3.3 Parameters Screen

Further detail can be seen for each instrument or sensor by selecting the Parameters tab and then selecting the parameter of interest. For example:



In the above example, values for the NO_2/NO/NO_x instrument include the cell temperature and pressure, flow rates, photodiode voltages, scrubber temperature, error byte, and mode. (The NOx instrument manual and Appendix 1 give more detail about the NOx instrument and the interpretation of this information.)

The information given in the Parameters screen varies for each measured species. This information can be useful for diagnosing any issues that might be occurring with the instrument. The Troubleshooting section of this manual (Section H.2) and Section F.1 describe the Parameters screens. Also refer to the user manuals linked in Appendix 1 of this manual.

C.3.4 Accessing Data via the Web, USB, and Wi-Fi USB (Overview)

As shipped from the factory and if the data communications package has been purchased, the AQSync is configured so that data from its instruments and sensors are integrated and then transmitted via Wi-Fi to the web every 5 minutes (as noted in Section C.6, this frequency can be changed by the user). The data can be accessed for analysis on the web. *This integrated web-based data stream is the primary data acquisition mode for use of the AQSync.* Data files for individual measured species are also accessible via USB and Wi-Fi connection to a computer.

Section D of this manual gives further information about how to access your data via the web, USB, and Wi-Fi connection to a computer.

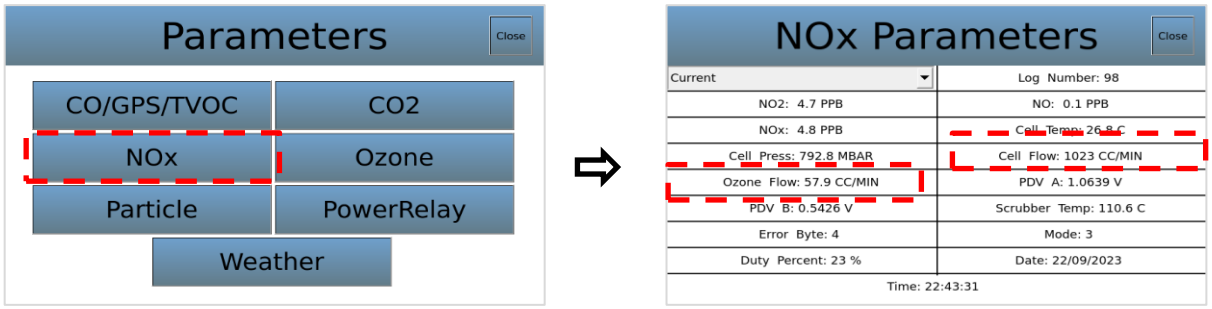
C.4 Flow Rate Check

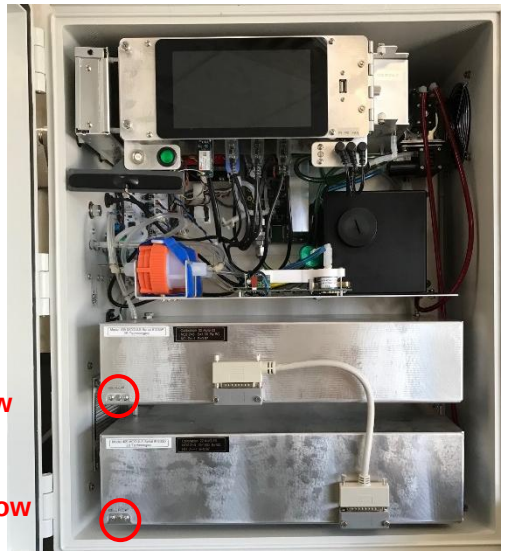
The AQSync's NO_2/NO/NO_x instrument has two independent flows that need to be verified (via the AQSync touchscreen) and adjusted before operating the instrument. The two volumetric flow rates that are independently adjusted are:

Cell Flow Rate (1400-1600 cm^3/min): The cell flow rate of sample gas and ozone/air through the reactor volume and optical cell.

Ozone Flow Rate (60-80 cm^3/min): The flow rate of ozone/air mixed into the sample flow stream.

These flow rates are adjusted to be in the ranges specified above at the factory. However, due to possible differences in altitude and thus pressure at the user location, the two flow rates need to be verified and adjusted by the user if necessary to be within the specified ranges. To do this, follow the flow rates on the touchscreen by selecting "Parameters" and then "NOx".





- The Cell Flow should be in the range 1400-1600 cm^3/min. Use a small flathead screwdriver to adjust the flow using the needle valve located on the left lower corner of the NOx instrument's bottom panel.
- The Ozone Flow should be in the range 60-80 cm^3/min. Use a small flathead screwdriver to adjust the flow using the needle valve located on the left lower corner of the NOx instrument's top panel.

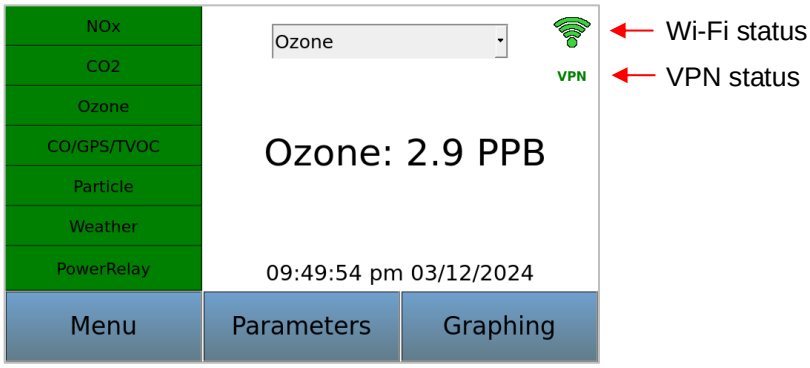
If any adjustments are made to the flow(s), the AQSync instrument power should be cycled on and off before proceeding.

Once these flows have been verified and adjusted, they should not need to be re-adjusted unless the instrument's location changes in altitude. However, it is best practice to check the flow rates upon each instrument startup to verify that associated pumps and flow meters are functioning properly.

C.5 Communication Check (Wi-Fi)

C.5.1 Check Status of Wi-Fi

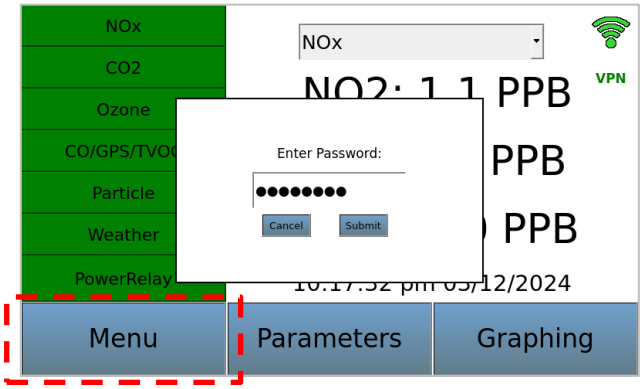
The AQSync communicates its data to the Cloud using its own locally created Wi-Fi (which is dependent on the availability of cellular service). If connected via Wi-Fi, an icon appears in the upper right corner of the main screen. Just below is an icon showing the VPN status (green when connected, as shown here; see Section E.8.7 about the VPN).



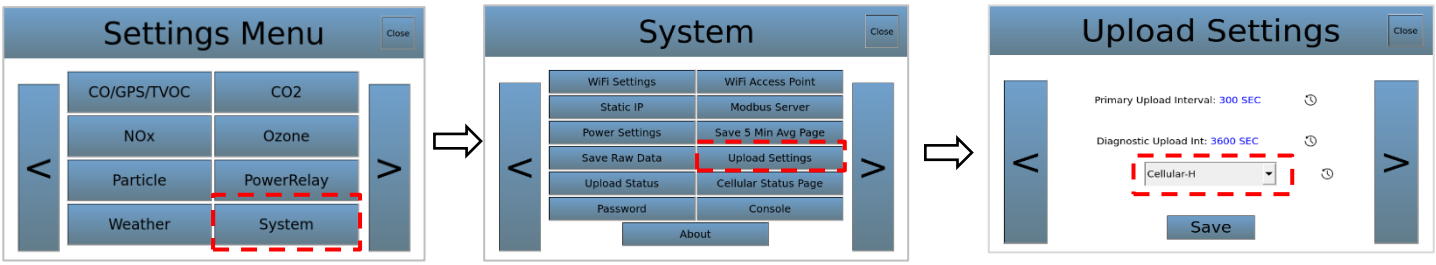
C.5.2 Choose Preferred Communication Method

Use the Menu/System/Upload Settings screen to select your preferred method of data communication.

NOTE: The password for accessing the Menu is “password”. (This can be reset; see Section E.8.6 of this manual.

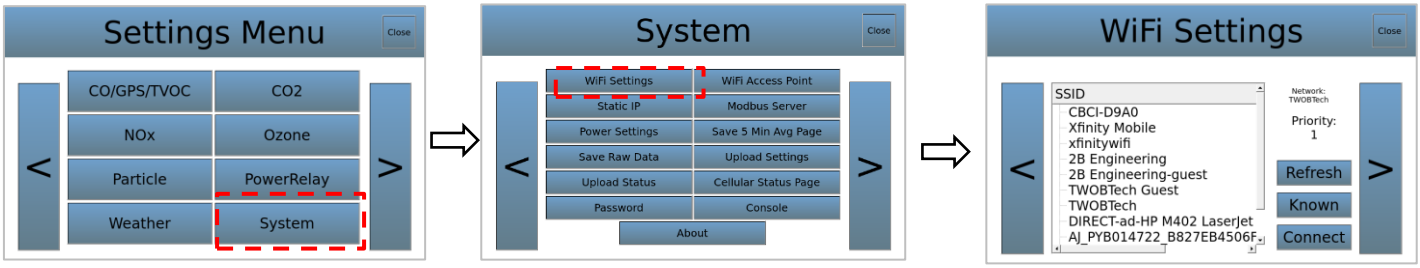


A dropdown menu in the Upload Settings screen enables you to choose between Wi-Fi or “no uploads”. Be sure to tap “Save” after you’ve made your selection. *Note, older AQSyncs will also have “cellular” options as shown in the screen on the right, below.*



C.5.3 Choose Alternative Wi-Fi Network

If you wish to use a Wi-Fi network other than the AQSync's own internally generated Wi-Fi, the alternative Wi-Fi network is specified through the Menu/System/WiFi Settings screen. Select the network from the list of desired choices and tap "Connect." You will likely be prompted to enter a password for the network. *The AQSync's internal ethernet cable must be disconnected in order to use an alternative Wi-Fi network. Contact us for information about this.*



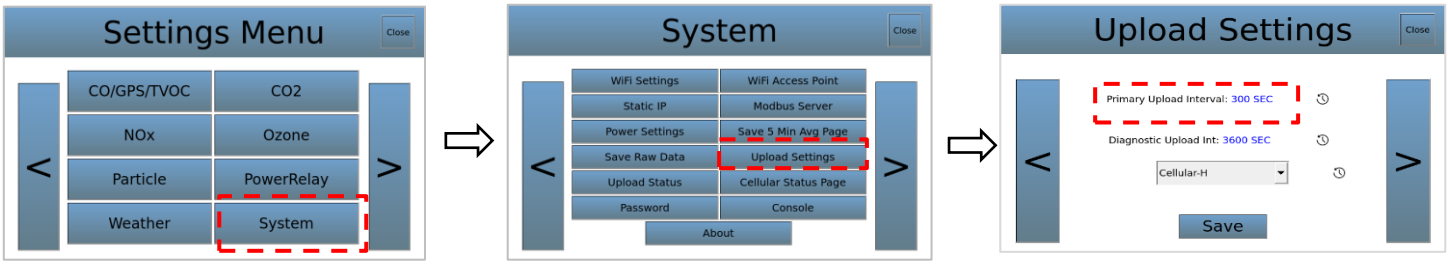
C.6 Set Upload Frequency and Instrument/Sensor Measurement Intervals

C.6.1 Upload Frequency

The AQSync comes from the factory with default settings for the upload frequency (5 minutes). ***For each sensor or instrument, the AQSync computes averages of all data acquired since the last upload, and then transmits those averages.***

We recommend that the upload frequency should be set at 5 minutes or longer. Settings shorter than 5 minutes would have prohibitive cellular costs (the AQSync's internally generated Wi-Fi is dependent upon cellular communications for transmitting to the Cloud).

The upload frequency can be changed by the user by accessing Menu/System/Upload Settings on the touchscreen:



NOTE: The password for accessing the System menu is "password". See Section E.8.6 of this manual if you wish to change the password.

The frequency of the uploads can be specified by tapping on the Primary Upload Interval in the above right-hand screen. This brings up a keyboard for entering the desired frequency (in seconds). Enter the desired frequency using the popup keyboard and press "Save". The Diagnostic upload frequency should be left at its default setting, and is only changed when working with 2B Tech to troubleshoot.

C.6.2 Instrument and Sensor Outputs

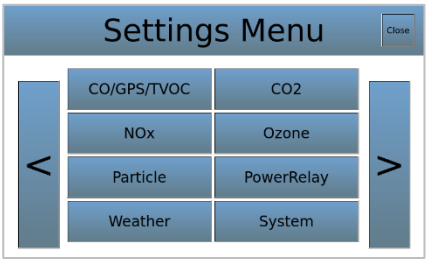
Some of the AQSync's instruments and sensors have options for choosing their data output intervals.

The AQSync's upload frequency set in the previous section (Section C.6.1) will influence the user's choices of instrument and sensor outputs. At the factory default value of 5 minutes for the upload frequency, in most cases it would make sense to use instrument and sensor settings that are faster than 5 minutes. ***Because the AQSync averages all the values it receives from an instrument/sensor since the last upload, it likely makes the most sense to set the instrument/sensor output to one of its faster settings. When shipped from the factory, the output of the instruments/sensors are set in this way.***

The table below summarizes the instrument/sensor output options, factory settings, and user options.

Parameter	Measurement Frequency	AQSync Output: Factory Setting	Output (averaging) Options for User
O_3 and VOCs	2 sec	10 sec	(none)
NO_2/NO/NO_x	5 sec	5 sec	(none)
CO	~3-7 sec	~3-7 sec	(none)
T/P/RH	1 sec	5 sec	(none)
CO_2	1 sec	1 sec	1 to 36000 sec
PM	1 sec	10 sec	1 to 3600 sec
CH_4	2 Hz	2 Hz	(none)

Use the Menu>Settings Menu if you wish to use different settings for the measurements.



C.7 AQSync Time and Date

The AQSync acquires its time and date stamp from the web. The UTC time/date stamp is shown on the Home screen of the touchscreen. It is also incorporated into the data streams that are accessible via the web or via USB (data access is described in Section D of this manual).

The format of the date of the AQSync is DDMMYYYY (European format). Time is UTC.

If Wi-Fi or cellular service are not available, the date and time are maintained by an on-board real-time clock. Note that if Wi-Fi/cellular service is restored, the date/time are automatically updated to UTC.

D. Data Access

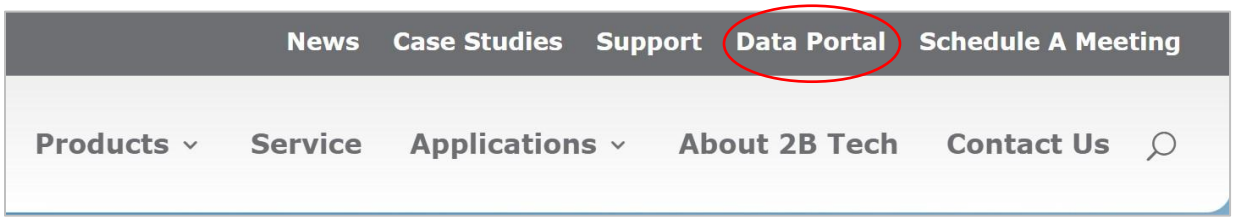
As shipped from the factory and if the data communications package has been purchased, the AQSync is configured so that data from the instruments and sensors are integrated and then transmitted via Wi-Fi to the web every 5 minutes (as noted in Section C.6.1, this upload interval can be increased by the user). The data can be accessed for analysis on the web. *This integrated web-based data stream is the primary data acquisition mode for use of the AQSync.*

The raw data files from the individual modules of the AQSync are also stored locally on the AQSync's Raspberry Pi computer. These individual files can be downloaded using the USB connection to the right of the touchscreen. Wi-Fi access is also an option.

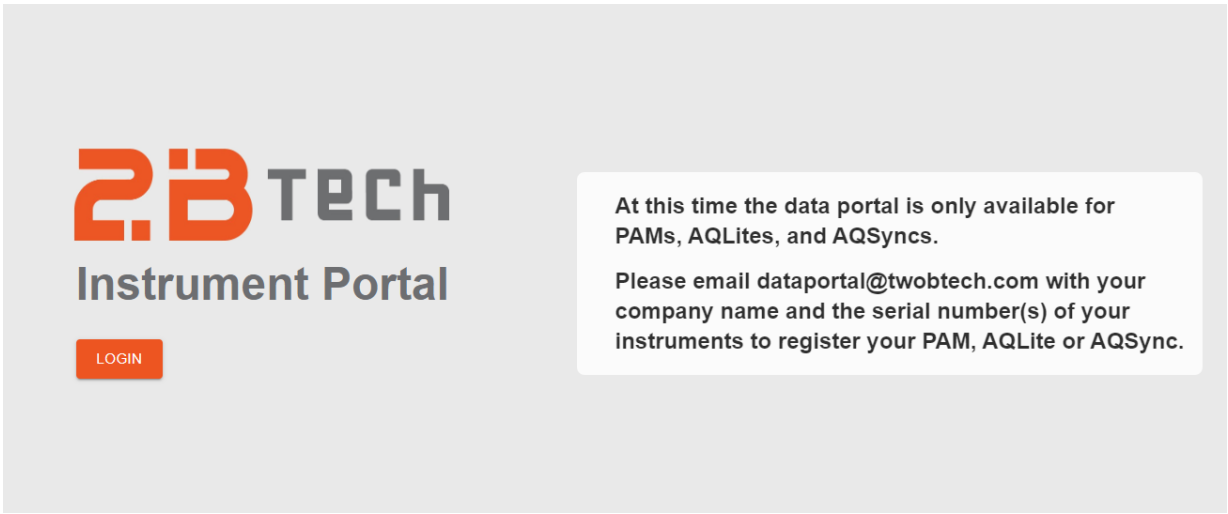
D.1 Web Access

D.1.1 Data Portal Login

Web access is via a Data Portal on the 2B Tech website, https://2btech.io ("Data Portal" tab along the top menu bar). **Contact** dataportal@2btech.io **to set up an account for the Data Portal.** The Data Portal is used with three 2B Tech instruments: the AQSync, AQLite-Standard, and Personal Air Monitor (PAM).

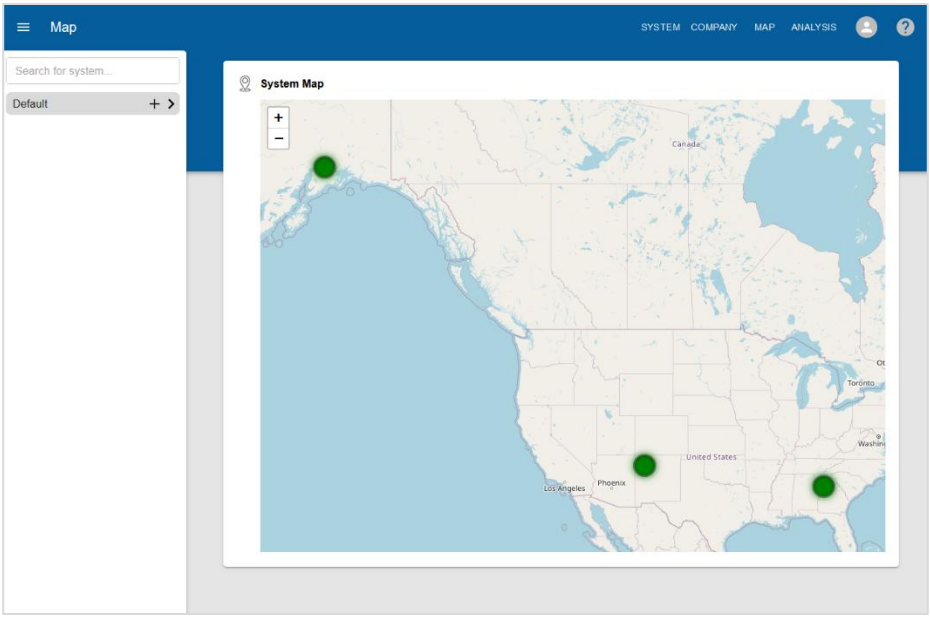


Click on the "Login" button and use your login credentials to login:

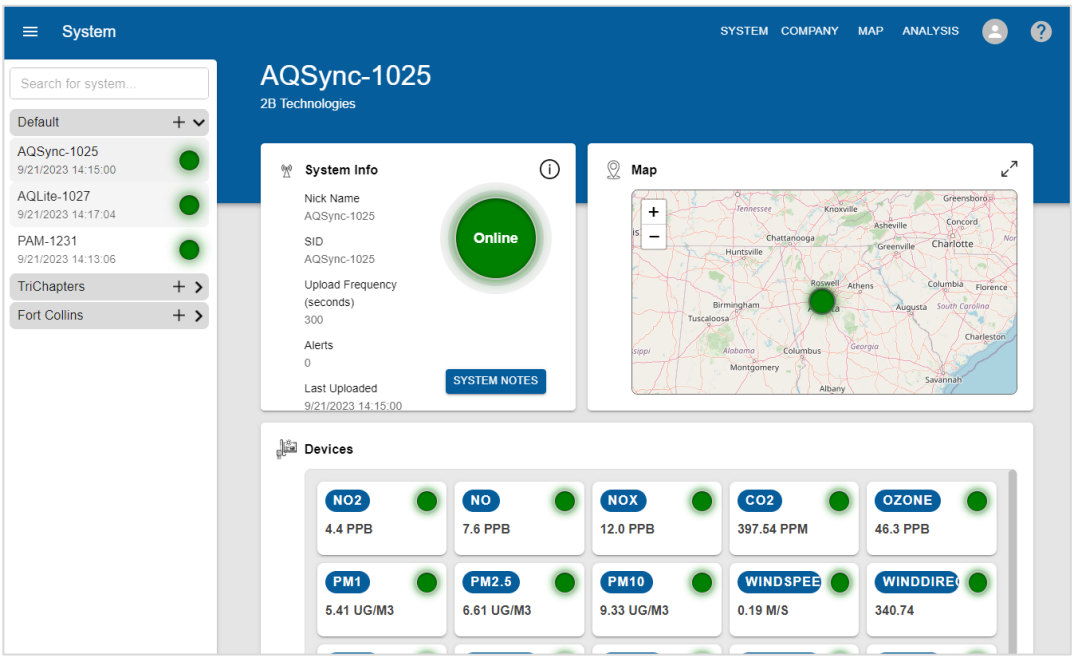


D.1.2 Viewing the Data

A few minutes after logging in, you will see the dashboard. On the left side is a default folder containing a list of all your instruments, identified by their serial numbers (use the pulldown arrow to view them). To the right they are displayed on a map.



Display your instruments using the pulldown on the Default tab. Click on the AQSync name/serial number to see an instrument. If the instrument is online, it is shown as a green circle in the list at the left and in the System Info box next to the map. The various measurements of that instrument are shown as a grid of boxes in the Devices section, with their status shown in a circle that is either green (functioning) or yellow. Yellow indicates there is an issue with that AQSync measurement (click on the circle to get information).

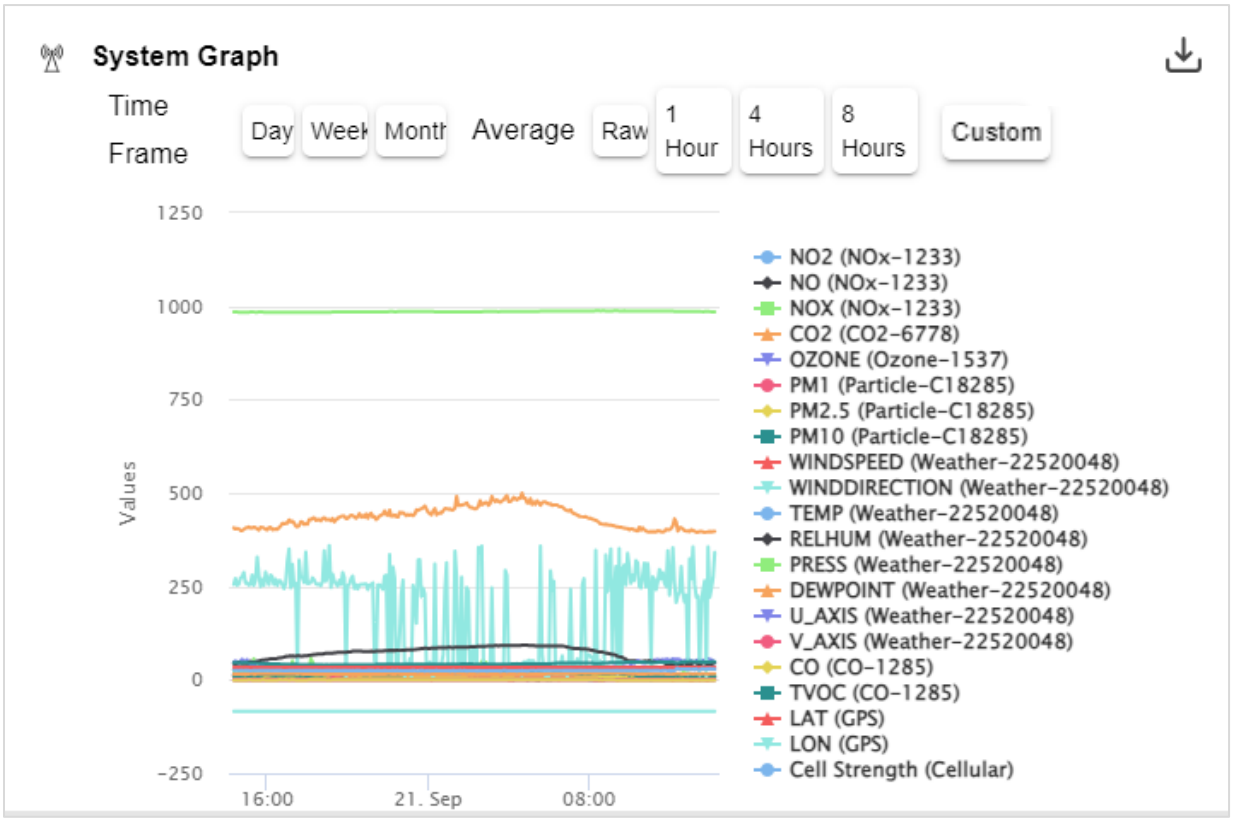


Click on the box for any of the measurements with “green” status to see a graph of its data, as in this example for ozone:

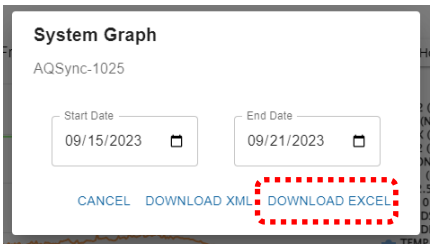
Hover over any point with the cursor to see its data value. The time frame for the data, as well as the averaging time, can be specified from the menu along the top of the graph.

Note that the “Settings” tab is currently under development. It will display instrument parameters in the future.

A graph of all the measured parameters appears at the bottom of the main screen. Use the menu buttons to choose the Time Frame and Averaging period or enter custom values for those quantities:



Click on any of the parameters to display only its data (autoscaled). Multiple measurements can be displayed by clicking on them as shown below. Click again on the displayed item in the legend to return to displaying all measured parameters.



Click the icon in the upper right corner to download the displayed data. You can choose the date range for the file that will be created. The file is named "AQSync- xxxx.csv," where xxxx is the serial number of your AQSync.

The file column headings in the csv data file are largely self-explanatory. The headings contain the serial number of the particular module used in measuring the parameter.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Averaged Start Date (UTC)	Averaged End Date (UTC)	NOx-1233:NO2 (PPB)	NOx-1233:NO (PPB)	NOx-1233:NOX (PPB)	CO2-6778:CO2 (PPM)	Ozone-1537:OZONE (PPB)	Particle-C18285:PM1 (UG/M3)	Particle-C18285:PM2.5 (UG/M3)	Particle-C18285:PM10 (UG/M3)	Weather-22520048:WINDSPEED (M/S)	Weather-22520048:WINDDIRECTION (OTHER)	Weather-22520048:TEMP (CELSIUS)	Weather-22520048:RELHUM (PERCENTAGE)	Weather-22520048:PRESS (MBAR)	Weather-22520048:DEWPOINT (CELSIUS)	Weather-22520048:U_AXIS (OTHER)	Weather-22520048:V_AXIS (OTHER)	CO-1285:CO (PPM)	CO-1285:TVOC (PPB)	GPS:LAT (OTHER)	GPS:LON (OTHER)	Cellular: Cell Strength (OTHER)
9/15/2023 6:00	9/15/2023 6:00	24	-7	17	456.01	19.3	8.7	11.27	69.37	0.27	140.83	21.4	98	986.5	21.2	-0.16	0.2	-0.16	56	33.68796	-84.2902	N/A
9/15/2023 6:01	9/15/2023 6:01	23.8	-7	16.8	468.2	12.8	8.6	11.58	63.67	0.41	154.2	21.4	98	986.5	21.2	-0.18	0.37	-0.16	56	33.68797	-84.2902	N/A

Note that the "Download XML" choice is used for our mobile devices (the PAM Personal Air Monitor) and is not useful for the AQSync.

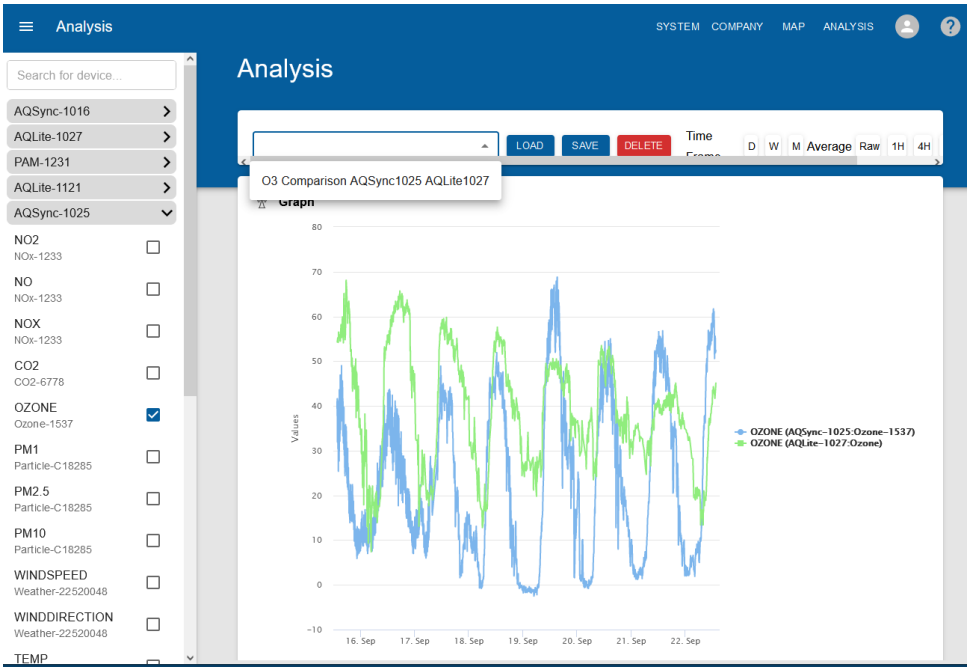
D.1.3 Organizing Your Instruments

All of your instruments are shown in the "Default" folder upon first login. Users with Admin status can create project folders (done in the "Company" tab). Click on the "+" sign of a project folder to move an instrument from the Default folder into that project folder.

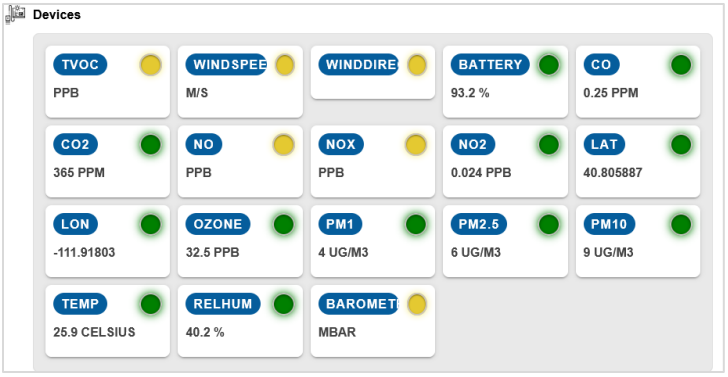
D.1.4 Viewing/Comparing Data from Different Instruments

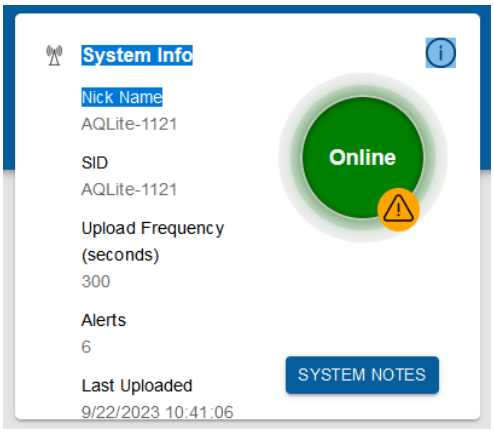
The "Analysis" tab in the upper right corner of the main screen enables you to compare data across multiple instruments.

Use the Device pulldown menus to select the items you wish to compare on the graph. Adjust the time frame and averaging as desired. If you want to frequently check the same comparison, you can "Save" it and name it. To compare it again in the future, click "Load" and select its name. Delete any named comparisons that you no longer want. The example below shows a comparison of ozone data from 2 different devices.



D.1.5 Troubleshooting



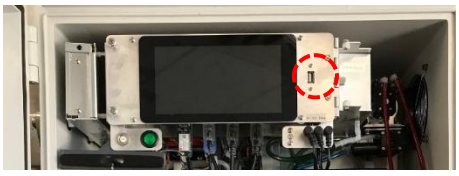


If one of your measurements has a problem, it will have a yellow circle next to it, and an orange warning triangle will appear on the system's green circle as shown above on the right. Click on the measurement box to get information about the problem.

Click on "System Notes" to see an overview of problems with your instrument.

D.2 USB Access

The USB port to the right of the touchscreen can be used to download the raw data files of the AQSync modules. These are the "fast" data that are used to make the 5-minute averages that are uploaded to the web. The fast data could be useful for more



detailed analysis of quickly changing air quality conditions. They are also useful for periods in which cellular service or Wi-Fi are not available. The 5-minute averaged data can also be downloaded to the USB.

A separate data file is made for each of the modules of the AQSync, and a new data file is created for each day that the AQSync is powered on. If the AQSync is powered off and on during a day, the data are added onto the previous file for that day when power is restored. An example filename is Ozone_2023_09_21.csv.

Please see Section E.8.5 for information on downloading these files through the Menu/System/Save Raw Data and Save 5 Min Avg Data menus.

An example of one of the raw data files for the ozone module is shown below. An average data file (see second example below) can also be downloaded, using the settings chosen in the AQSync menu. Please consult the manufacturers' documents linked in Appendix 1 for more information about the fields in these data files.

	A	B	C	D	E	F	G	H
1	AQSyncSerial Number	ModuleSerial Number	Ozone(PPB)	Cell Temp(C)	Cell Press(MBAR)	Voltage(V)	Date(UTC)	Time(UTC)
2	1028	1543	14.3	33.3	817.7	1.3003	21/09/2023	0:06:17
3	1028	1543	14.6	33.3	820.6	1.3002	21/09/2023	0:06:28
4	1028	1543	16.6	33.3	818.6	1.3001	21/09/2023	0:06:38
5	1028	1543	17.9	33.3	821.7	1.3002	21/09/2023	0:06:49
6	1028	1543	16.7	33.3	817.9	1.3000	21/09/2023	0:06:59
7	1028	1543	15.6	33.2	817.6	1.2994	21/09/2023	0:09:26
8	1028	1543	16.5	33.2	821.5	1.2995	21/09/2023	0:09:37
9	1028	1543	15.2	33.2	818.0	1.2994	21/09/2023	0:09:48
10	1028	1543	16.2	33.2	822.0	1.2995	21/09/2023	0:09:58
11	1028	1543	15.2	33.2	818.7	1.2995	21/09/2023	0:10:09
12	1028	1543	13.0	33.1	821.8	1.2995	21/09/2023	0:10:19
13	1028	1543	13.3	33.2	817.5	1.2994	21/09/2023	0:10:30
14	1028	1543	13.8	33.2	821.3	1.2995	21/09/2023	0:10:40

	A	B	C	D	E	F	G	H
1	AQSyncSerial Number	SerialNumber	Ozone(PPB)	Cell Temp(C)	Cell Press(MBAR)	Voltage(V)	AvgStartDate	AvgEndDate
2	1028	1543	14.6	33.2	820.2	1.2990	21/09/2023 01:04:14	21/09/2023 01:09:14
3	1028	1543	13.0	33.2	820.0	1.2992	21/09/2023 01:09:14	21/09/2023 01:14:14
4	1028	1543	14.0	33.4	819.9	1.3005	21/09/2023 01:14:14	21/09/2023 01:19:14
5	1028	1543	14.3	33.3	820.2	1.3007	21/09/2023 01:19:14	21/09/2023 01:24:14
6	1028	1543	13.6	33.2	820.3	1.2993	21/09/2023 01:24:14	21/09/2023 01:29:14
7	1028	1543	13.2	33.2	820.2	1.2981	21/09/2023 01:29:14	21/09/2023 01:34:14
8	1028	1543	14.5	33.2	820.3	1.2978	21/09/2023 01:34:14	21/09/2023 01:39:14
9	1028	1543	13.5	33.2	820.4	1.2970	21/09/2023 01:39:14	21/09/2023 01:44:14
10	1028	1543	13.2	33.1	820.4	1.2954	21/09/2023 01:44:14	21/09/2023 01:49:14
11	1028	1543	13.8	33.1	820.3	1.2947	21/09/2023 01:49:14	21/09/2023 01:54:14
12	1028	1543	12.9	33	820.4	1.2949	21/09/2023 01:54:14	21/09/2023 01:59:14
13	1028	1543	14.5	33	820.3	1.2944	21/09/2023 01:59:14	21/09/2023 02:04:14
14	1028	1543	13.3	32.9	820.3	1.2929	21/09/2023 02:04:14	21/09/2023 02:09:14

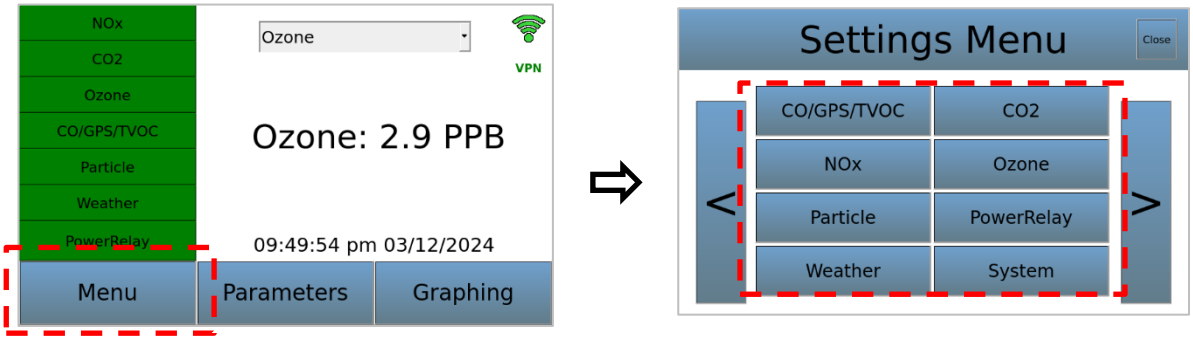
Folders for all the modules (e.g., ozone, NOx, CO, weather, PM, etc.) can also be downloaded all at once. See Section E.8.5.

D.3 Wi-Fi Access

The AQSync's data files can also be accessed via Wi-Fi using your computer. Please see Appendix 4 for information on this topic.

E. Menu

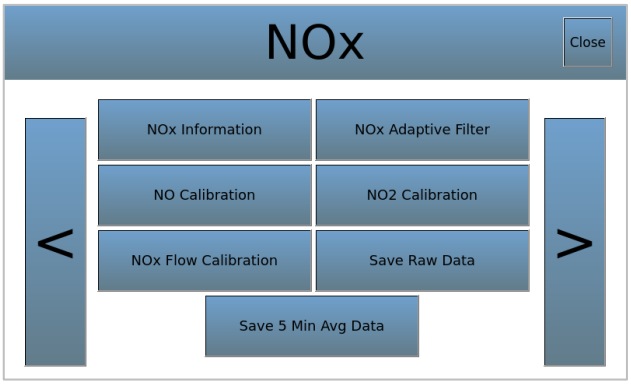
Settings for the AQSync's instruments and sensors as well as System settings may be further adjusted using the Menu/Settings Menu. These are explained below.



NOTE: The password for accessing the "System" menu is "password". This can be changed by the user; see Section E.8.6 of this manual.

E.1 NOx Module Settings

The $NO_2/NO/NO_x$ instrument in the AQSync is based on 2B Tech's Model 405 nm $NO_2/NO/NO_x$ Monitor and many of the features are the same. For more information about this measurement, please consult the website for the Model 405 nm. The Model 405 nm user manual is linked at the bottom of that webpage.



This instrument uses absorption principles and Beer's Law to measure NO_2, and measures NO by conversion to NO_2. The basics of the AQSync's settings for this instrument are given in this Section E.1. In the AQSync, the NOx instrument is set to 5-second measurements and the measurement mode gives all three measurements: NO_2, NO, and NOx. This measurement mode uses three 5-second cycles to measure I_o for NO_2, I for NO_2, which is also I_o for NO, and I for NO. After each 5-second cycle, a new measurement of nitrogen dioxide and nitric oxide is computed and output to the instrument, along with the sum ($NOx = NO + NO_2$).

E.1.1 Adaptive Filter

The $NO_2/NO/NO_x$ instrument's firmware processes sample concentration data through a built-in adaptive filter. During operation, the firmware may automatically switch

between two different filter lengths based on the conditions at hand. During the measurement of stable concentrations, the firmware, by default, computes an average of the last 36 raw (5-sec) measurements, or 3 minutes of measurements. This provides smooth and stable readings by averaging out a considerable amount of random noise to improve the precision. If the filter detects rapid changes in concentration, the filter reduces the averaging to only 4 samples or 20 seconds to allow the analyzer to respond more quickly. Two conditions must be simultaneously met to switch to the short filter. First, the instantaneous concentration must differ from the average in the long filter by at least 40 ppb. Second, the instantaneous concentration must differ from the average in the long filter by at least 10% of the average in the long filter. The values cited in this description are the factory default settings in place when the instrument is shipped: Change Difference = 40 ppb, Change Percent = 10%, Short Filter = 4 pts (20 s), Long Filter = 36 pts (3 min).

Via the touchscreen, the lengths of the long and short filter can be changed as well as the minimum difference and percent difference. Tap on each value and use the popup keyboard to enter the desired value. Tap “Apply” and then “Save” when all four desired values are entered. To disable the adaptive filter, set the short filter length to 1, the difference to 0, and the percent to 0.

E.1.2 NO Calibration and NO_2 Calibration Parameters

The NO_2/NO/NO_x instrument is calibrated at the factory, where slope and offset parameters for NO_2 and NO are entered into the instrument’s memory. These preset calibration parameters are given in the instrument’s Birth Certificate and recorded on the instrument’s calibration sticker. However, the calibration parameters may be changed by the user if zeroing or calibration of the instrument is carried out. See manuals linked in Appendix 1 for recommended procedures. Tap on each value and use the popup keyboard to enter the desired value (in ppb). Be sure to “Apply” and then “Save”.

E.1.3 Flow Calibration Parameters (Cell, Ozone Flows)

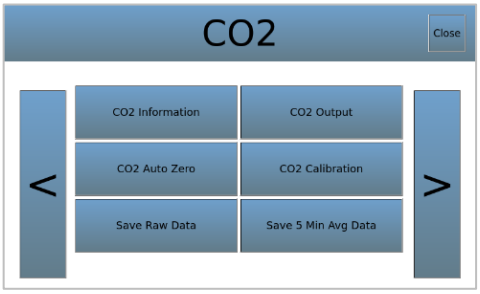
Two different flow measurements are critical to the performance of the instrument: one is the cell flow rate and the other is the ozone flow rate.

We recommend that you do NOT change the calibration settings for these flow meters without contacting 2B Technologies to discuss.

E.1.4 Data Save Options

The data may be saved as either 5-minute averages or raw data (5 seconds). Choose the desired date range when the screens appear.

E.2 CO_2 Module Settings

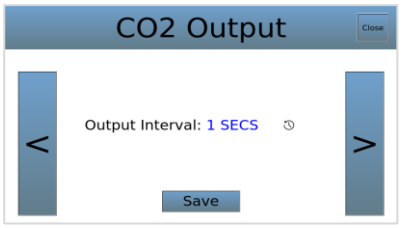


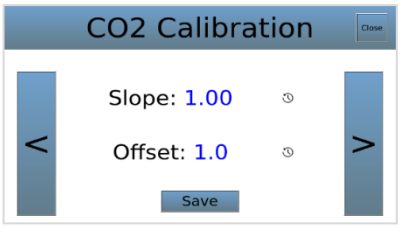
The CO_2 instrument in the AQSync is the PP Systems CO_2 Gas Analyzer, Model SBA-5. Its manual is available on the 2B Technologies website: https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/CO2_Instrument_PPSystems_SBA-5.pdf

Brief descriptions of the settings are given below.

E.2.1 Output and Calibration

The measurement output interval can be specified. Entries from 1 sec to 36000 sec are possible. The factory default setting for the AQSync is 1 sec. Clicking on this value brings up a keyboard that allows you to enter a different output interval, if desired.





Calibration values for slope and offset (in ppm) can be entered by clicking on the current setting to bring up a keyboard. A calibration for CO_2 is carried out at the factory of the CO_2 instrument manufacturer, and new values would only be needed if a new calibration is carried out by the user or during factory servicing.

E.2.2 Zeroing

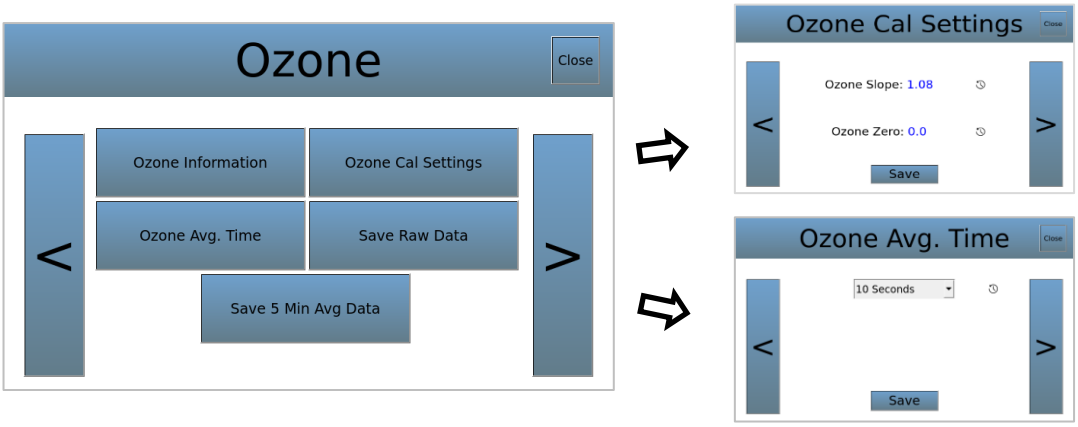
The CO_2 instrument's zeroing frequency and the duration of the zero are pre-set in the AQSync. The factory settings are to zero every 6 hours for a duration of 40 seconds. Shorter times between zeroing and/or longer durations of zeroing would exhaust the module's soda-lime scrubber too quickly. See the manufacturer's document linked here and in Appendix 1 for more information.

E.2.3 Data Save Options

The data may be saved as either 5-minute averages or raw data (user-selected; factory default is 1 second). Choose the desired date range when the screens appear.

E.3 Ozone Module Settings

The ozone instrument in the AQSync is based on 2B Tech's Model 108-L Ozone Monitor and many of the features are the same. For more information about this measurement, please consult the website for the Model 108-L. The Model 108-L user manual is linked on that webpage. Calibration values for slope and offset (in ppb) can be entered using this screen (clicking on a number brings up a keyboard). An ozone calibration is carried out at the factory for your AQSync, and new values would only be needed if a new calibration is carried out by the user or during factory servicing. Contact 2B Tech if you are considering changing the factory default for averaging time (10 s).



E.4 CO and TVOCs Module Settings

The CO calibration is carried out at the factory for your AQSync and no settings adjustments are available. The same is true for AQSync TVOCs modules.

E.5 Weather Station Settings

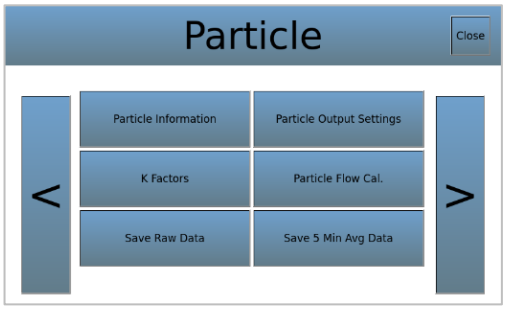
Settings for the Gill Instruments GMX500 Weather Station are pre-set at 2B Tech. The offsets for temperature, pressure, humidity, and wind direction are 0. Other settings are:

Output Interval		10 sec
Compass		Off
Wind speed	Units	meters/sec
	Output format	Cartesian
	Sample frequency	1 Hz
Temperature	Units	°C
	Offset	0
Pressure	Units	hPa
	Offset	0
Relative Humidity	Units	%
	Offset	0

Each wind measurement is calculated from the median of multiple wind samples. If high wind speeds (above 30 m/s) are expected, more than 1 Hz samples may be more suitable. Contact us if you wish to change the sample setting.

E.6 Particle Settings

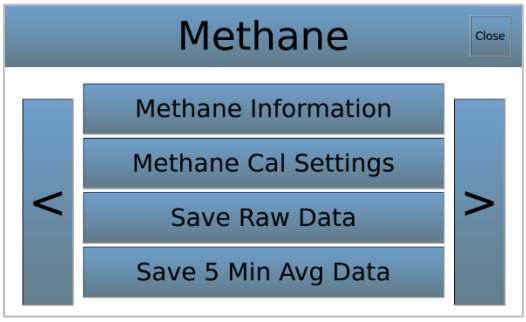
The sampling time in the range of 1 to 60 seconds can be specified on the Particle Output Settings screen. A value of 10 seconds is recommended and is the factory default setting for the AQSync.



K Factors for PM1, PM2.5, and PM10 are calibration factors and can be specified by the user. The K-Factors are only valid at the same site and for the same particulate type. If the local particulate source changes, the K-Factors may no longer be valid. As shipped, the AQSync has K Factors appropriate for the Denver, Colorado USA area. The user should determine the appropriate K Factors for their sampling location and adjust accordingly. See the manufacturer's document linked here and in Appendix 1 for more information.

E.7 Methane Settings

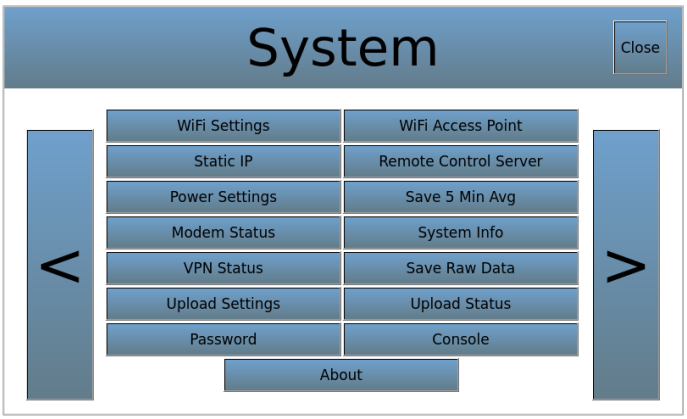
The methane instrument in the AQSync is the Axetris LGD Compact-A CH_4 laser gas detection OEM module. Its manual is available on the 2B Technologies website: https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/CH4_Axetris_LGD-Compact.pdf



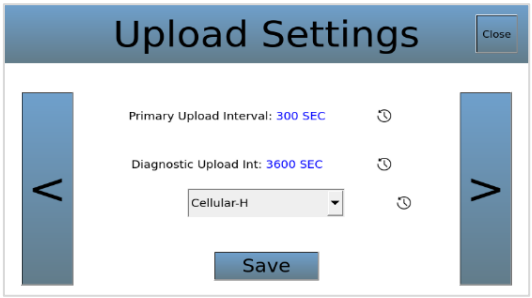
A calibration for CH_4 is carried out at the factory of the CO_2 instrument manufacturer, and new values would only be needed if a new calibration is carried out by the user or during factory servicing. The data may be saved as either 5-minute averages or raw data (0.5 seconds). Choose the desired date range when the screens appear.

E.8 System Settings

From the Home screen, choose “Menu” and then “System.” The password set at the factory is “password”. (See Section E.8.6 for a description of how to reset the password.)



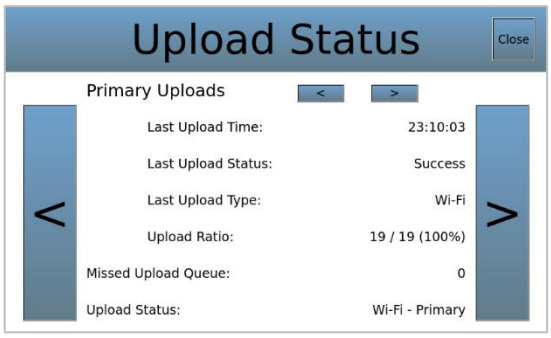
E.8.1 Upload Settings and Upload Status



As mentioned in Section C.6.1, the upload method and frequency are set using this screen. When “Wi-Fi” is chosen from the pulldown menu, it is recommended that the upload frequency be at 5 minutes or longer in order to save on cellular costs. The factory default setting for the AQSync is 5 minutes (300 sec). (As mentioned previously in this manual, the AQSync generates its own local Wi-Fi. However the communication with the Cloud is dependent on cellular.)

The frequency of the uploads can be specified by tapping on the blue digits in the Primary Upload Interval line in the above right-hand screen. This brings up a keyboard for entering the desired frequency (in seconds). Enter the frequency and select “Save”.

The Diagnostic upload frequency should be left at its default setting. It is only changed when working with 2B Tech to troubleshoot problems.

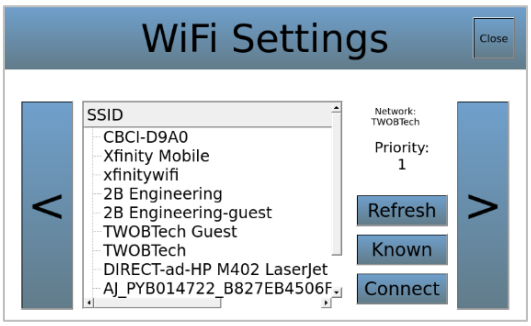


Either Wi-Fi (or cellular on older AQSyncs) can be chosen from the pulldown menu as the upload method. The most cost effective and (generally) the most stable choice for uploads is Wi-Fi. “No Upload” could be selected if neither Wi-Fi nor cellular are reliably available, in which case the internal data logged by the AQSync can be downloaded to a USB stick.

A second screen is available to check the status of uploads.

E.8.2 Alternative Wi-Fi Settings

The AQSync generates its own Wi-Fi network. However you can choose an alternative Wi-Fi network for your data uploads. This works in conjunction with the Uploads Settings screen, which enables you to select whether Wi-Fi is used. Adjustments should be made prior to beginning a measurement period.

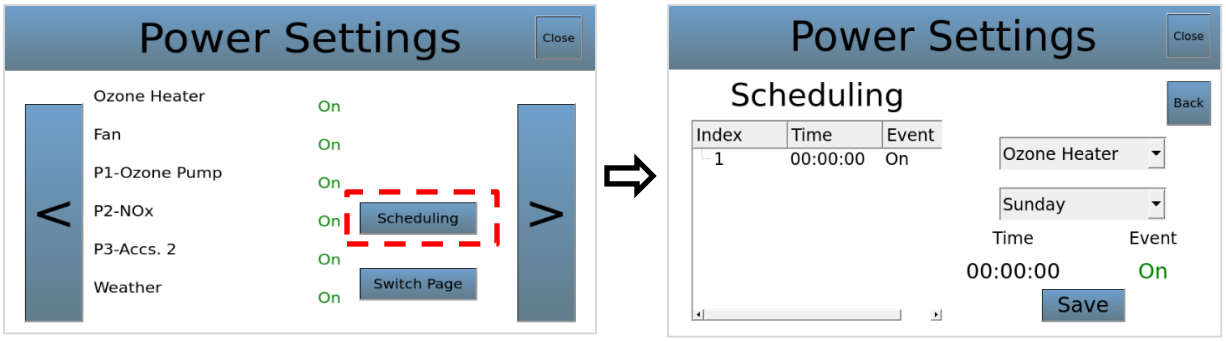


See Section C.5.3 for the description of this setting. As noted there, the use of an alternative Wi-Fi network requires you to unplug the ethernet cable inside the AQSync. Contact us for information on how to do this.

E.8.3 Wi-Fi Access Point

This feature is used in conjunction with the Modbus feature for remote data access and control. Please see Appendix 3.

E.8.4 Power Settings

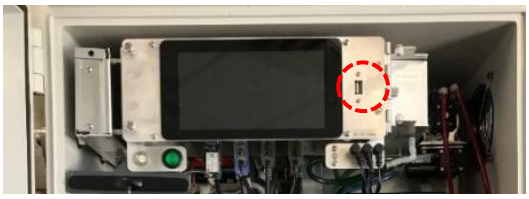


Here, the whole system, or individual components of the system, can be turned on or off by clicking on the current setting. In addition, specific operating hours can be made for each individual instrument. These capabilities are useful for example if there are situations when data are not needed, or in prioritizing measurements in order to conserve power consumption. The "Show Extra" button brings up the status of the pumps, fan, and heater in the AQSync. Pump 1 is the ozone/CO/VOCs/CH_4/CO_2 modules' pump; Pump 2 is the NOx module pump; Pump 3 is currently unassigned.

E.8.5 Save Raw Data and Save 5 Min Avg Data

A new file containing the raw data ("fast" ~10-sec data) for each AQSync module (ozone, CO_2, weather, etc.) is created for each day that the AQSync is powered on. If the AQSync is powered off and on during a day, the data are added onto the previous file for that day. These daily files accumulate in the AQSync until they are deleted by the user.

When a USB stick is inserted to the right of the touch screen, these screens enable the user to save raw data to a USB. Five-minute averaged data for each AQSync module can also be downloaded to the USB. The selected files can be "Saved" only if a USB stick is connected.



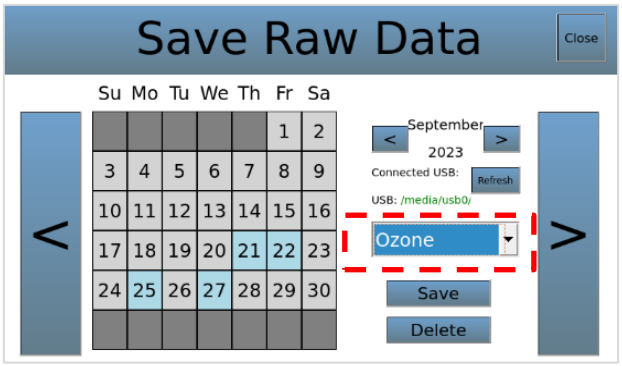
If no USB is connected, the red message appears stating "no USB connected." When a USB is inserted, hit "refresh." A green message then will appear saying the USB is connected. ***It is important to "refresh" after adding or removing a USB stick*.**

Also, the raw data files can be deleted from the AQSync using the Save Raw Data screen.

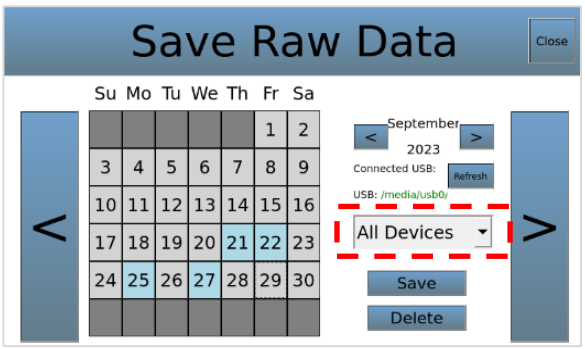
To save data:

1. Select the modules you wish to save.

To save a data folder containing just one module's data, such as ozone, choose it from the pulldown menu as shown at the right. The ozone file will contain the ozone measurement, as well as time, date, and other measured quantities specific to that module (such as cell temperature, photodiode voltage, etc.).

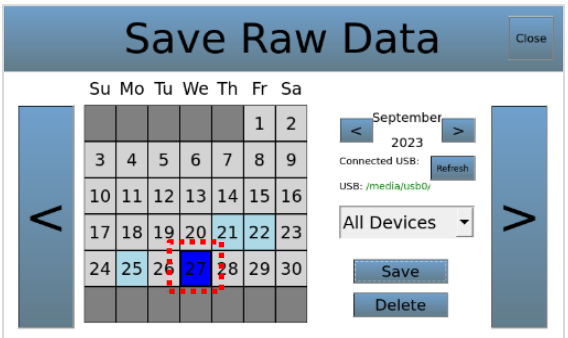


To save all the data folders containing the data for all the AQSync modules, choose "All Devices" from the pulldown as shown in the second screen at right.



***2. Select the dates you wish to save*.**

The light blue dates on the calendar indicate days for which data are available. Choose which dates you wish to download by pressing on them. They will turn a darker blue as shown at right.



***3. Press SAVE*.**

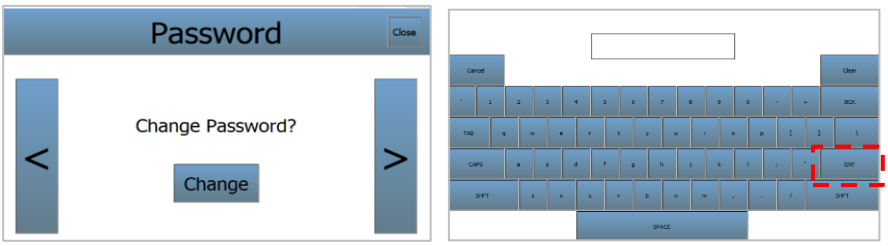
A data folder will be created on the USB stick for each selected date and module.

The 5-minute averaged data is downloaded analogously to the example shown here.

Examples of the data files created can be seen in Section D.2 of this manual.

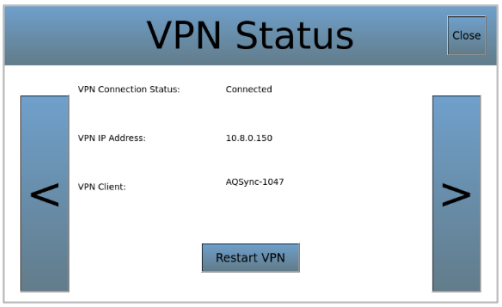
E.8.6 Password

This screen sets the password for entering the Menu>Settings Menu. By default, this password is set to “password” when the instrument is shipped from the factory. A new password is entered with the popup keypad followed by “ENT” to enter it.



E.8.7 VPN Status

This page gives more information about the VPN status of the instrument. It is used for checking the status of the VPN client. The VPN allows 2B Tech to remotely update and check the operating status of the AQSync (not accessible by the customer).



E.8.8 About Page

Basic system information is provided on this screen.

The import and export buttons are for machine updates and are only to be used in consultation with 2B Tech.

E.8.9 Static IP

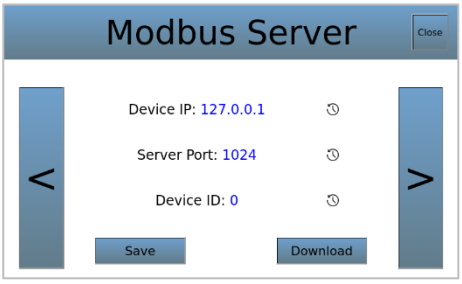
Remote operation can be accomplished via a Modbus interface. This feature is described in Appendix 3.

The “Static IP” screen allows you to choose a set/unchanging (static) IP address for your instrument, provided that you know the correct DNS and router for your network. Although most users don't need static IP addresses, they normally matter more when external devices or websites need to remember your IP address. Click on the address areas and enter your Static IP/Router/DNS values in the screens that pop up. Press “Apply” when ready in each case, and then “Save” when you return to the Static IP screen.

Warning: The static IP must be set to a valid IP address and not an IP address which is already assigned to another networked device, or it could cause errors/instrument failure. If you need assistance with this setting, consult your system administrator or contact 2B Technologies' Technical Support.

E.8.10 Remote Control Server for Remote Operation of the AQSync

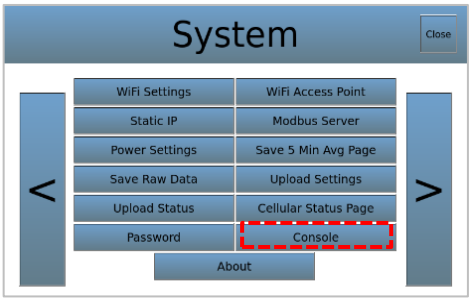
Remote operation of the AQSync makes it possible for the user to adjust the parameters of the AQSync during runtime without being co-located with the instrument.



The remote operation of the AQSync is accomplished via a Modbus TCP/IP interface through a Wi-Fi connection to your computer. Please see Appendix 3 for details.

E.8.11 Console

Note that the selection called "Console" in the System settings menu is not currently used.



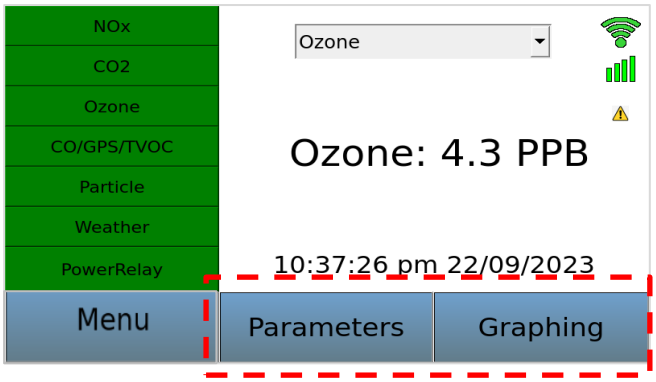
E.8.12 Date and Time

Date and time are automatically set in the AQSync. The AQSync acquires its time and date stamp from the web. The UTC time/date stamp is shown on the Home screen of the touchscreen. It is also incorporated into the data streams that are accessible via the web or via USB (data access is described in Section D of this manual).

The format of the date of the AQSync is DDMMYYYY (European format). Time is UTC.

If Wi-Fi or cellular service are not available, the date and time are acquired via an onboard real-time clock. Note that when Wi-Fi or cellular service is restored, the date/time are automatically updated to UTC.

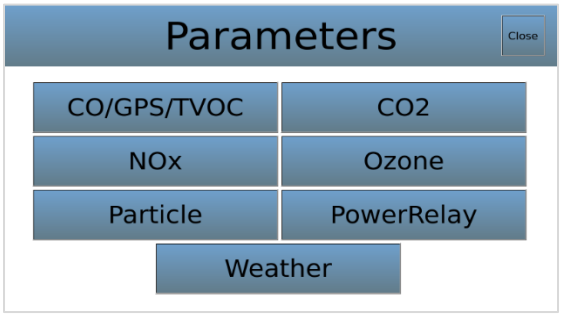
F. Parameters and Graphing Screens



Note: Measurement choices on the screens shown in this section will vary, based on the measurement options purchased for your AQSync.

F.1 Parameters

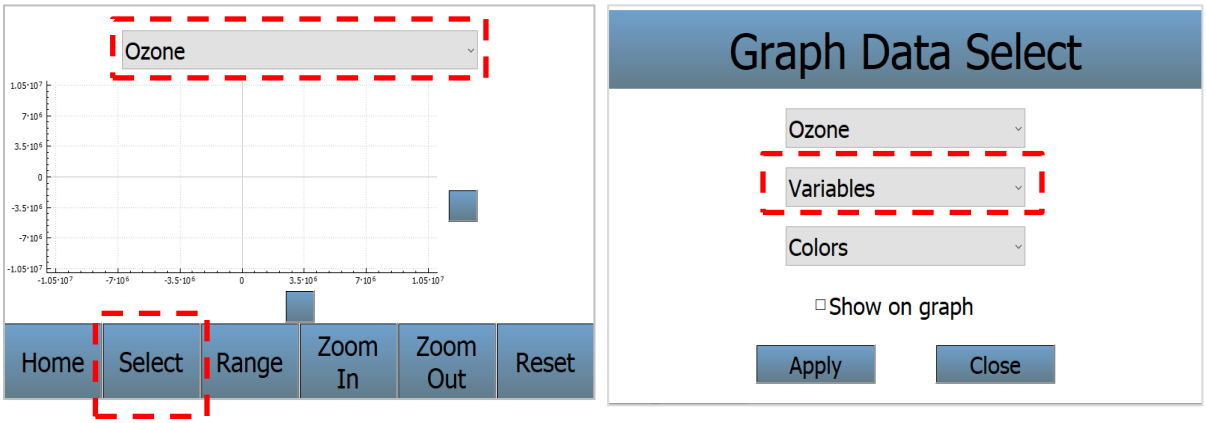
The Parameters screens give additional information for each of the instruments and sensors of the AQSync. This information is primarily used in diagnosing instrument performance issues. Please refer to the Troubleshooting section of this manual (Section H.2) or the individual instruments' manuals (linked in Appendix 1) for more information about the parameters shown for each instrument.



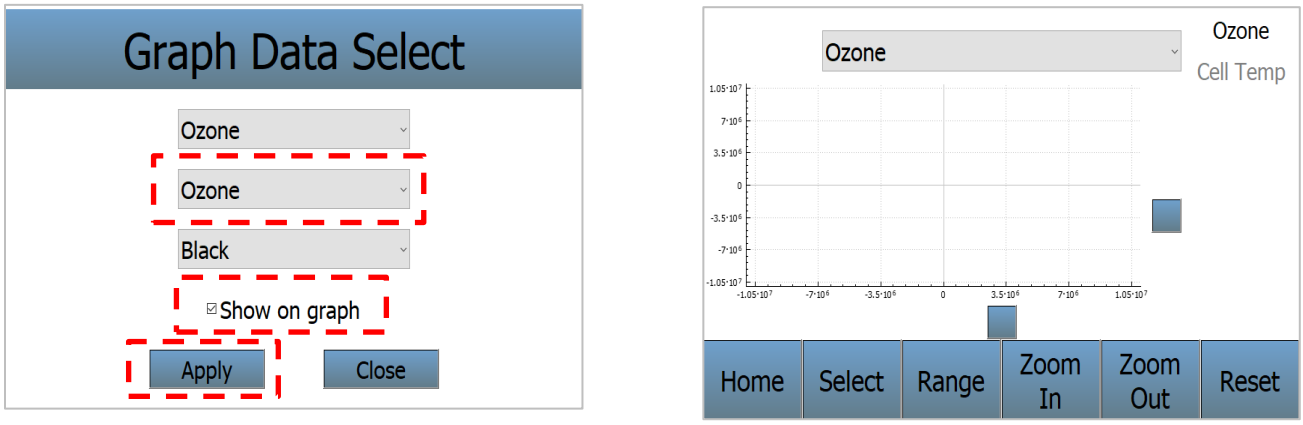
F.2 Graphing

Graphing screens are available for real-time viewing of the data associated with any of the measured species of the AQSync.

Select: From the graphing screen, use the gray pulldown to choose a measured species (left screen below). Then enter the "Select" screen and from the "Variables" pulldown, choose the quantity to be plotted (right screen below).



For each measured species, the measurement itself as well as other variables associated with that measurement can be plotted. For example, if "Ozone" is selected, Ozone, Cell Temperature, Cell Pressure, and/or Photodiode Voltage may be chosen. The default colors of the plotted data also can be changed. Be sure to check the box "Show on graph" and then select "Apply" for each variable you want to display (left screen below). When you "Close" and return to the main graphing screen, select "Ozone" from the dropdown menu to display what you have selected (right screen below). Multiple variables can be selected to appear on the graph simultaneously. In the example below, both Ozone and Cell Temperature have been selected.



De-select any of the variables by unchecking the "Show on graph" box.

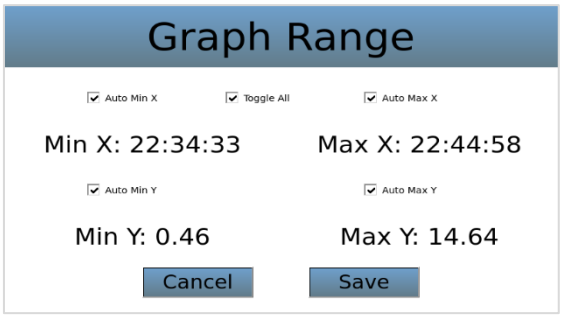
Note that if the total VOCs module is a part of the AQSync, its display is selectable from the CO screen.

You can set up any number of measured species to plot (NO_x, ozone, CO_2, CH_4, etc.) using their respective Select screens such as on the left screen above, and then switch between them from the display screen on the right using the gray pulldown menu.

Range: Specify the range of the *x* and *y* axes. Minimum and Maximum values for *x* and *y* can be specified, or auto-ranging can be chosen.

Zoom In/Zoom Out: Change the viewing level.

Reset: Return to default settings.



G. Calibration and Zero Checks

It is recommended that the user frequently examine the data from the AQSync to be sure that the readings make sense and the instruments are working properly. For example, on polluted days ozone readings should be higher, and other pollutants such as particulate matter might be higher (especially if fires are burning nearby, for example). Outside CO_2 readings should be around 400 ppm. If an EPA monitoring station is located nearby, the AQSync's readings could be compared to the station readings.

G.1 Calibration

In addition to the routine observations of the functioning of your AQSync Air Quality Monitoring Station mentioned above, periodic (typically annual) calibration is recommended. The various modules of the AQSync can be removed and exchanged for calibrated modules from the factory. Calibration recommendations are given in the table in Section H.1.7 and in Appendix 5.

If desired, the user can carry out calibrations for the various instruments in the AQSync. *A field calibration of the NOx and ozone modules is recommended at 6 months of operation*. Also, the flowmeter of the PM sensor can be checked/recalibrated in the field. Please see Appendix 2 of this manual, and also the manufacturers' manuals linked in Appendix 1.

G.2 Zero Checks

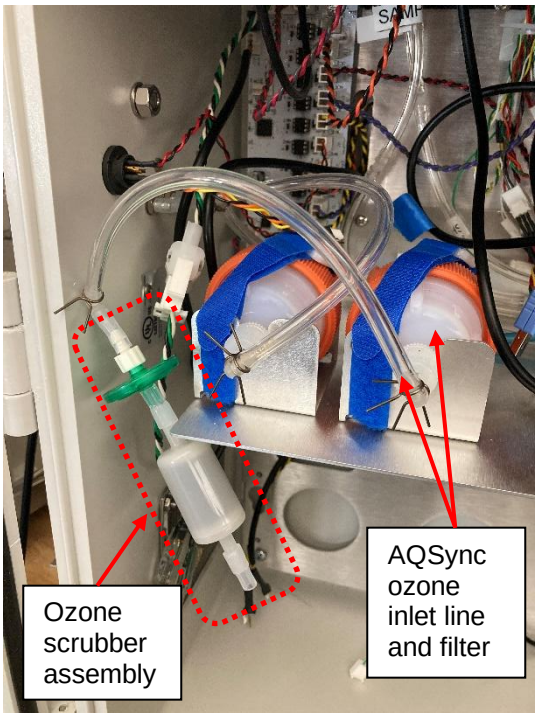
Zero checks can be carried out if convenient, either periodically or when instrument performance exhibits potential problems.

G.2.1 Ozone Monitor

The AQSync Ozone module is the 2B Technologies Model 108-L Ozone Monitor (link to user manual in Appendix 1). To zero the instrument, open the AQSync and disconnect the ozone inlet tubing from the bulkhead fitting (left side of the AQSync). Attach the ozone scrubber (provided with your AQSync) to the inlet tubing.

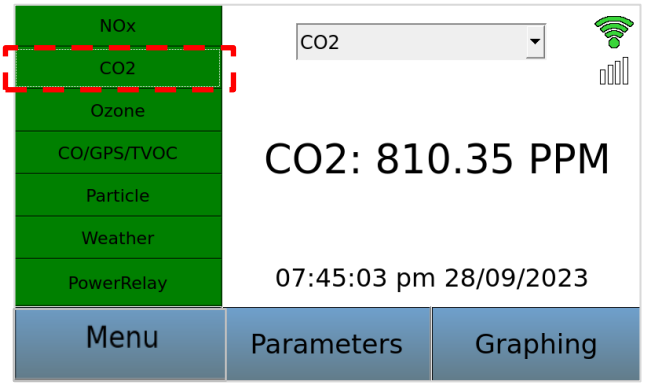
Note, the orange filters' orientation is now different from what is shown in the photo. Attach the scrubber to the inlet tubing similarly to what is shown here.

Once you have completed the setup, follow the steps below to zero the ozone instrument.



1. Power up the AQSync. For an accurate measurement, the ozone instrument must have been turned on long enough for the internal temperature to stabilize (normally ~20 minutes).
2. After the instrument is warmed up, make note of the time and collect data for at least 3 times the upload frequency (typically 5 min), so collect for 15-25 minutes.
3. Access the data for that time interval using the web interface and compute the average. Omit the first and last points, to ensure the filter was in place for the whole interval you're looking at.
4. The observed ozone offset, which can amount to ± a few ppb, can be corrected for by changing the offset calibration parameter from the Menu/Ozone Settings/Cal Settings touchscreen. The offset is applied in units of ppb (integer numbers only). Note the number currently displayed as the "Zero." Click on it to bring up the keyboard that will enable you to change it as needed. For example: If during your zero check the instrument reads an average of +3 ppb with the external scrubber in place, the instrument is reading too high by 3 ppb. Therefore, the value of the offset should be decreased by 3 from its present value.
5. Remove the ozone scrubber from the inlet tubing and restore the original plumbing connection to the sampling bulkhead on the AQSync.

G.2.2 CO_2 Instrument



The CO_2 instrument is the PPSystems SBA-5 CO_2 Gas Analyzer (link to user manual in Appendix 1). The CO_2 instrument has a built-in zeroing system and periodically carries out a zero, including at startup.

The frequency of the zeroing is set to 6 hours (360 mins) and the duration is 40 seconds. The zeroing occurs by passing the air sample through a soda-lime filter. With a zeroing frequency of 6 hours at a duration of 40 seconds, the soda lime will need replacement approximately every 6 months of continuous operation at typical ambient levels of CO_2. Please see Section H of this manual for maintenance procedures.

If the measurements of ambient CO_2 seem to be consistently going below 400 ppm, it suggests that the soda lime in the scrubber should be replaced, or the CO_2 flow rate is too high and the air doesn't get fully scrubbed. Consult with 2B Tech about adjustments.

G.2.3 Particle Instrument

The particle instrument is a Met One Model 83214 AQ Mass Profiler (link to user manual in Appendix 1). This instrument is zeroed and calibrated by Met One. It is recommended to field-check the zero every 6 months. To carry out a zero check,

disconnect the top from the PM inlet and attach a filter (provided with your AQSync) as shown.

Note that this is essentially a “leak test” for the PM instrument, and no calibration parameters will be adjusted. Rather, the expected values here are all zeroes for PM 1, 2.5, and 10. If the values are not zero, there is a leak somewhere. Most likely, the inlet tube is not properly inserted through the internal o-ring leading into the PM instrument. Adjust and re-seat the sampling inlet tube until the values show zero. If the leak persists, some other source of a leak, or a malfunction of the Met One instrument, is indicated.

G.2.4 CO Sensor

The CO sensor is an Alphasense Model CO-A4. For the highest data quality, quarterly zeroing is recommended. Zeroing requires a stream of air that is both CO-free and humidified.

G.2.5 NO_2/NO/NOx Module

The electronic zeros for NO_2 and NO are tested by introducing NO_x-free air to the analyzer. The NO_x-free air can be generated from either (1) passing ambient air through a NO_x scrubber or (2) using zero grade air from a compressed cylinder or zero air generator via a user-provided valve system and an overflow tee (it is important not to pressurize the instrument). Please see the NOx module user manual linked in Appendix 1 and the field calibration information in Appendix 2 for more information. As with the instructions above for ozone (Section G.2.1), gather data for an appropriate period of time as you do this.

G.2.6 Weather Transmitter

The weather transmitter is a Gill Instruments Ltd MaxiMet GMX500 Weather Station. Per the manufacturers’ information, the weather transmitter does not have a protocol for routine zeroing or calibration.

G.2.7 CH_4 Module

The CH_4 instrument is an Axetris LGD Compact-A CH_4 laser gas detection OEM module (link to user manual in Appendix 1). This instrument is zeroed and calibrated by the manufacturer. It is recommended to check the zero quarterly.

H. Maintenance and Troubleshooting

H.1 Maintenance

The AQSync has been designed to produce reliable data with minimal intervention. The recommendations below reflect procedures to meet the highest data quality objectives. Completing maintenance on the Ozone, NOx, and other modules may cause the zero to drift. Refer to Section G.2 of this manual for zero checks.

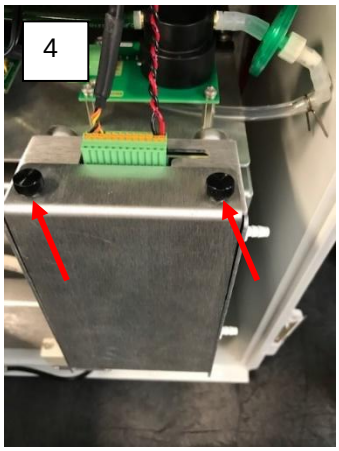
H.1.1 Replacement of CO_2 Scrubber

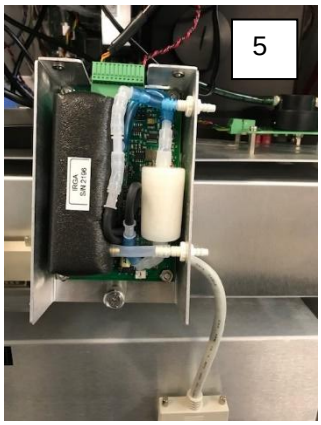
The CO_2 scrubber uses soda lime as the scrubbing material. The replacement frequency depends on the auto-zeroing frequency as well as the CO_2 concentration and the flow rate of the sample air. At the recommended zeroing frequency of 6 hours and duration of 40 seconds, and ambient CO_2 concentrations of ~400 ppm, replacement is recommended ~every 6 months. If ambient CO_2 levels start to consistently go below 400 ppm, replacement of the soda lime is indicated (or flow adjustments are needed; contact 2B Tech if that may be the case).

No tools are needed to access the CO_2 scrubber housing and replace the CO_2 scrubber:

1. Disconnect the inlet and outlet lines from the white barb fittings, shown by the red arrows. Make note of which line was to the front and which to the back. Unscrew the mounting thumbscrew shown by the red circle.
2. The back of the housing has screw and washer mounting assemblies that slide into the slotted holes in the AQSync bracket shown in picture #2.
3. Slide the housing toward the front of the AQSync so that the mounting assemblies can be removed from the bracket. The electrical connection on the back of the housing does not need to be removed.

4. Undo the two black thumbscrews on the back of the housing, shown by the 2 red arrows.
5. Remove the cover of the housing.
6. Remove the scrubber by pulling the tubing off the barbed fittings. Note that the smooth end of the scrubber is on the bottom as shown in the picture.
7. Install the new scrubber, being sure to orient the smooth end as shown in #6. Reverse the steps to reassemble and reinstall the housing in the AQSync.





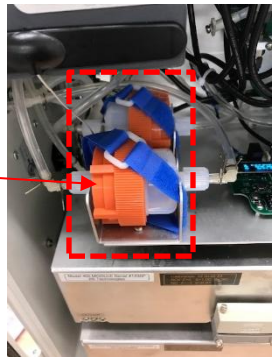
H.1.2 Replacement of Ozone Measurement Scrubber

It is recommended that the ozone instrument's internal measurement scrubber/filter assembly be replaced periodically, preferably every 6 months but at least annually. A replacement scrubber/filter assembly is available for purchase from 2B Technologies. In Section I of this manual, see Figure I.4 for its location on the ozone module. Contact 2B Technologies for information on accessing this scrubber/filter assembly. The zero must be checked and adjusted if needed after replacing the scrubber.

H.1.3 Replacement of NOx and Ozone Inlet Filters

The inlet filters of the NOx and ozone modules should be replaced if the flow rate is declining or if visible contamination is present. Frequency will depend on conditions of use (general recommendation: every 3 months).

The NOx and ozone instrument flow rates can be used as a check on the filter performance, in that reduced flow rates (below ~1 L/min) would indicate a need to replace the filter(s).



NOx filter check: The flow rate for the NOx instrument can be viewed on the NOx Parameters screen (cell flow).

Ozone filter check: The pump for the CO_2 module and CO sensor is used also for the ozone module. There is no flowmeter in this path. The ozone module's cell pressure can be used as a diagnostic. With a properly functioning

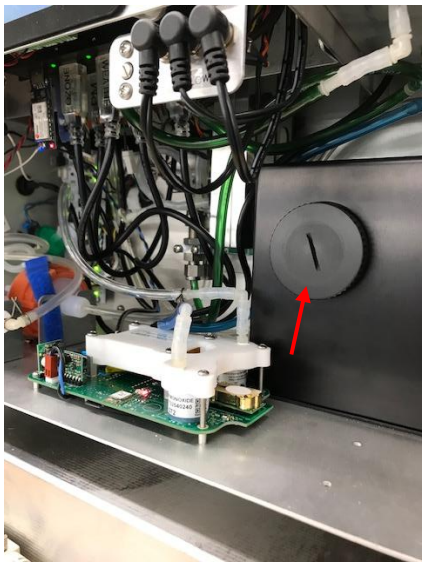
pump and filter, the cell pressure should be at least 10 mbar lower than the ambient pressure (readout from the AQSync weather transmitter).

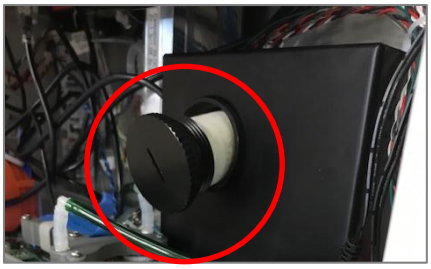
Note, the filters are labeled on the left side of the brackets holding them.

To replace a filter, disconnect its inlet tubing from the inlet barb on the left wall of the AQSync. Twist to open the filter housing and replace the 47mm filter. Reassemble the filter housing and reconnect the inlet line to the barb fitting on the left wall of the AQSync. **Caution: Leaks can occur here! These filters must be securely tightened. The instrument zeros must be checked and adjusted if needed after this maintenance.**

H.1.4 Replacement of PM Pump Filter

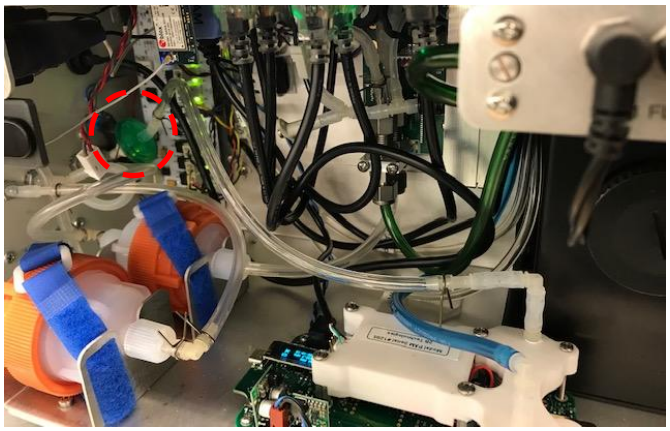
It is recommended that the filter of the PM instrument pump be rotated quarterly so it pulls through a different (clean) part of the filter. Twist open the filter housing, which is easily accessible from the front of the AQSync. Use a wide flathead screwdriver to loosen it, if necessary. Rotate the round cylindrical filter so it is sampling through a new spot, and then reassemble. Replace the filter entirely when needed.



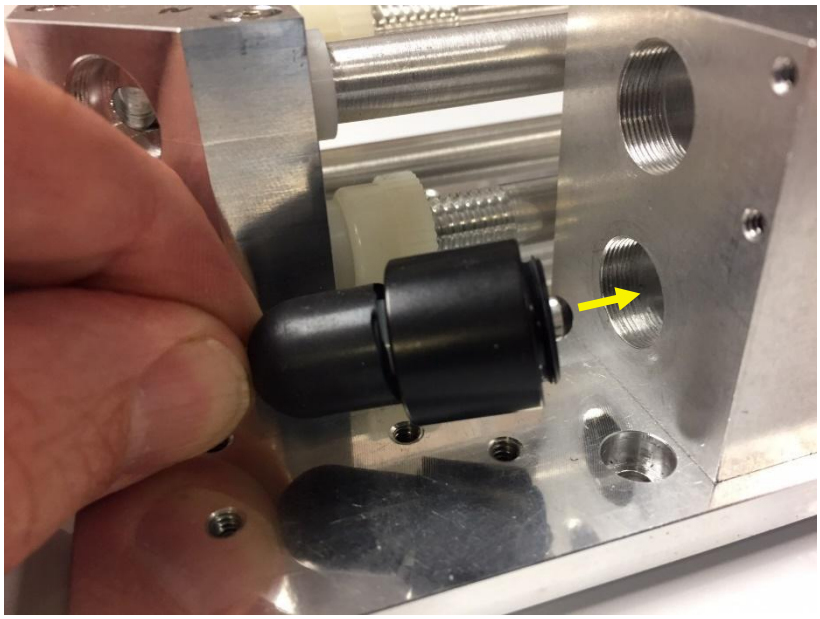


H.1.5 Replacement of the CO/CO_2 Inlet Filter

The green inlet filter for the CO and CO_2 instruments should be replaced quarterly. Remove it from the plumbing fittings and replace with a new one. The picture shows it as located near the back corner, at the inlet (see red circle).



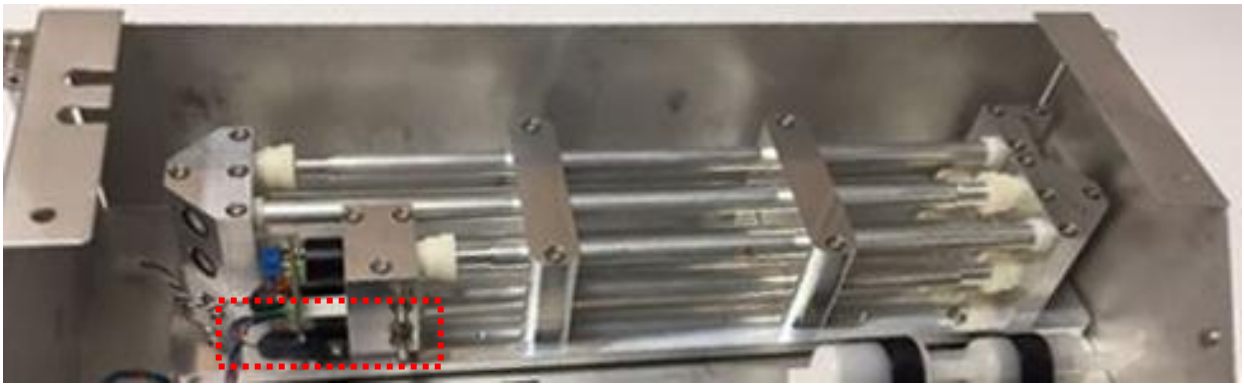
H.1.6 Replacement of NOx Instrument LED



Remove the black light cover for the LED (two screws on the back of the cover). The LED for the NOx instrument is threaded into a hole of the stacked endcap of the instrument's cell. Remove and replace into the same hole on the cell.

It is recommended that this LED be replaced annually.

When the LED is replaced, recalibration of the NOx instrument is recommended.



H.1.7 Summary of Maintenance Recommendations

The next page gives a recommended schedule of maintenance and calibration for the AQSync.

Note that it is best practice to check zeros, and in some cases recalibrate, after maintenance on instruments. Refer to Section G.2 of this manual for information on zero checks and calibration.

Table H.1. Maintenance/Calibration Schedule.

Air Quality Monitoring Station

Recommended Maintenance and Calibration Schedule

This schedule represents frequencies we recommend to meet the highest data quality objectives. However, the AQSync was designed to produce reliable data with minimal intervention. Please contact us to discuss your specific situation and the minimum required maintenance for the AQSync in your monitoring location.

Task	3 Mo	6 Mo	9 Mo	12 Mo
GENERAL				
Change inlet filter membranes (every 3 months or up to every month if *very* dirty air)	•	•	•	•
OZONE				
Change internal scrubber and scrubber filter (minimum every 12 mo, preferably every 6 mo)		•		•
Check calibration in field with Model 714 Calibrator		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•
NOx				
Change LED				•
Check calibration in field with Model 714 Calibrator		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•
PM				
Rotate pump filter membrane (every 3 months for dirty air)	•	•	•	•
Field check zero and flow rate		•		•
Adjust calibration factor based on comparison with co-located or nearby FEM monitor		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•
CO/TVOC/CH_4				
Change CO sensor (if significant sensitivity drift has occurred)		•		•
Field check zero for CO and CH_4 (Requires tank of zero air)	•	•	•	•
CO_2				
Replace green inlet filter		•		•
Change soda lime zeroing scrubber		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•

[AQSync_Maintenance_Cal_Schedule_rev10E]

H.2 Troubleshooting

H.2.1 Overall System Checks

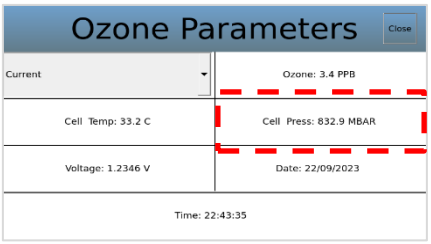
- Power is being supplied correctly (check power connections)
- Weather station is plugged in securely
- All lights on the Relay Board are “green”.
- If touchscreen won’t go through startup routine, contact 2B Tech.

The Parameters screens for the individual instruments give information that is useful for diagnosing and troubleshooting. Refer to the Parameters screens, in conjunction with the instrument manufacturer information in Appendix 1 and the information below.

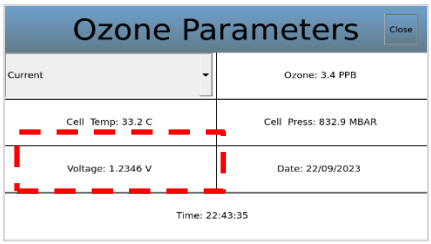
H.2.2 Ozone Module Troubleshooting

The following are indications of various instrument malfunctions for the Ozone module in the AQSync.

Air Pump Failure: The ozone instrument’s flow is drawn by a pump via the connector labeled P1 in the AQSync (front panel near the touchscreen). The ozone cell pressure is a useful diagnostic of pump failure. Normally, the ozone pressure reading will be below ambient by ~10 mbar or more. However if the pump is failing, the pressure will be about the same as ambient. Therefore, compare the ozone cell pressure readout (Ozone Parameters screen) to the readout of ambient pressure given by the weather transmitter (access from the Home screen).



Lamp Failure: The ozone measurements will be erratic and the photodiode voltage will be less than 0.6 V (Ozone Parameters screen, see figure at right). Note that in cold conditions, a normal working lamp could read less than 0.6 V.



Solenoid Valve Failure: The ozone readings will be low and will average to close to zero if the solenoid valve is not switching. Partial switching of the solenoid valve will cause the instrument to read low but not zero.

Contaminated Flow Path: The instrument will typically have a large positive or negative offset and the ozone readings will be low once corrected for the measured offset.

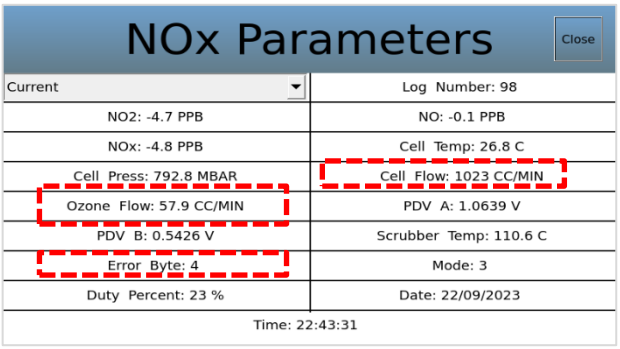
Contaminated Ozone Scrubber: Large calibration parameters (offset and/or slope) indicate that replacement of the ozone measurement scrubber (Fig. I.4) may be needed.

Help with troubleshooting the ozone module is provided in the following table.

Table H.2. ***Troubleshooting the Ozone Module for performance problems.***

Problem/Symptom	Likely Cause	Corrective Action
Readings are noisy with standard deviations greater than 2.5 ppb. *(Note, noisier readings are expected when ambient temperatures are very low, e.g., lower than -5°C.)*	Lamp output is weak, below 0.6 V on the Ozone Parameters screen.	Power off, open AQSync to check lamp connection to circuit board. Lamp may need replacement. If so, return ozone module to 2B Tech for exchange.
	Flow path is contaminated.	Contact 2B Tech.
Required calibration parameters are large (>±9 ppb offset and/or >±9% slope) when calibrated using a standard ozone source or reliable ozone instrument.	Ozone measurement scrubber is contaminated.	Replace the ozone inlet filter, and return the ozone module to 2B Tech for exchange.
	Flow path is contaminated.	Contact 2B Tech.
	Solenoid valve is contaminated and not opening and closing properly.	Power off, open AQSync and unplug pumps P1 and P2. Turn instrument on and listen for clicking of solenoid valve every 2 seconds. If solenoid valve is not clicking, return the ozone module to 2B Tech for exchange.
	Air pump for CO_2/O_3/CO is not drawing sufficient flow (ozone cell pressure is not ~10-20 mbar lower than ambient pressure).	Check for leaks in the sampling plumbing. If none found, the pump may be failing. Return CO_2 module to 2B Tech for exchange.
Ozone readings are unexpectedly low or zero	Lamp voltage has fallen below 0.6 V (Ozone Parameters screen).	Power off, open AQSync and check lamp connection to circuit board. If photodiode voltage is noisy and is less than 0.6 V, the lamp needs to be replaced. Return ozone module to 2B Tech for exchange.

H.2.3 NOx Module Troubleshooting



Use the troubleshooting tips below along with the error byte shown in the Parameters table to diagnose issues. Also refer to the manufacturer information linked in Appendix 1. The error byte codes are shown after the Troubleshooting table.

Pump 2 is the connection for the NOx module's pump. When adjusted and functioning properly, the Cell Flow Rate will be 1400-1600 cm^3/min) and the Ozone Flow Rate should be 60-80 cm^3/min.

Table H.3. Troubleshooting the NO_2/NO/NO_x Module for performance problems.

Problem/Symptom	Likely Cause	Corrective Action
Cell flow and ozone air flow are zero.	Burned out air pump.	Replace air pump P2.
Cell temperature reads low by several 10's of degrees.	Absent or loose connection of temperature probe cable to circuit board.	Remove module cover and reattach connector to circuit board.
Readings are noisy with standard deviations much greater than 3 ppb using 5-second averaging.	LED output is weak.	Remove top cover and check LED connection to circuit board. If photodiode voltage is less than 0.5 V, replace LED.
	Excessive vibration.	Provide additional vibration insulation for the instrument such as a foam pad.
	Flow path is contaminated.	Contact 2B Technologies for instructions if contamination is suspected.
Required calibration parameters are outside the adjustable range when calibrated using a known calibration gas.	Flow path is contaminated.	Contact 2B Technologies for instructions if contamination is suspected.
	Solenoid valve is contaminated and not opening & closing properly.	Remove solenoid valve, rinse with methanol, dry with zero air, and replace.
	Air pump is not drawing sufficient flow.	Air flow should be greater than 1.4 L/min. If flow is lower, check for leaks. If there are no leaks, replace air pump.

Instrument has a large offset	Internal heated NO_2 scrubber is exhausted or contaminated.	Contact 2B Technologies about replacement of the internal heated NO_2 scrubber.
Instrument always reads close to zero for NO_2 concentrations.	Solenoid valve cable is not properly connected to circuit board. Internal heated NO_2 scrubber is exhausted or contaminated.	Reattach solenoid valve cable to circuit board. Contact 2B Technologies about replacement of the internal heated NO_2 scrubber.

Table H.4. Error Codes of the NO_2/NO/NO_x Module

The following tables list the hexadecimal codes and their corresponding error definitions. The first table lists the errors if there is only one error, while the second table lists all possible error combinations with their definitions.

Single Errors		
Error byte	**Decimal Value**	**Definition**
00	0	No errors
08	8	Scrubber temp out of range. Temp is either > 113 degrees or < 110.
80	128	Pressure control out of range by > 1 mbar
04	4	Cell flow out of range (< 1200 or >1600)
40	64	Ozone flow out of range (<30 or >110)
02	2	Cell voltage out of range (<0.1V or >2.4V)
20	32	Ozone Generator voltage out of range (< 0.01V or >2.4V)

Combination Errors		
Error Byte	**Decimal Value**	**Definition**
0A	10	Scrubber Temp and Cell Voltage
0C	12	Scrubber Temp and Cell Flow
0E	14	Scrubber Temp, Cell Flow, and Cell Voltage
22	34	Cell Voltage, and Ozone Generator Voltage
26	38	Cell Flow, Cell Voltage, and Ozone Generator Voltage
28	40	Scrubber Temp and Cell Voltage
24	36	Cell Flow and Cell Voltage
2A	42	Scrubber Temp, Cell Voltage, and Ozone Generator Voltage
2C	44	Scrubber Temp, Cell Flow, and Ozone Generator Voltage
2E	46	Scrubber Temp, Cell Flow, Cell Voltage, and Ozone Generator Voltage
42	66	Ozone Flow and Cell Voltage
46	70	Cell Flow, Ozone Flow, and Cell Voltage
48	72	Scrubber Temp and Ozone Flow

44	68	Cell Flow and Ozone Flow
4A	74	Scrubber Temp, Ozone Flow, and Cell Voltage
4C	76	Scrubber Temp, Cell Flow, and Ozone Flow
4E	78	Scrubber Temp, Cell Flow, Ozone Flow, and Cell Voltage
62	98	Ozone Flow, Ozone Generator Voltage, and Cell Voltage
64	100	Ozone Flow, Ozone Generator Voltage, and Cell Flow
66	102	Ozone Flow, Ozone Generator Voltage, Cell Flow, and Cell Voltage
68	104	Ozone Flow, Ozone Generator Voltage, Scrubber Temp
6A	106	Ozone Flow, Ozone Generator Voltage, Scrubber Temp, and Cell Voltage
6C	108	Ozone Flow, Ozone Generator Voltage, Scrubber Temp, and Cell Flow
6E	110	Ozone Flow, Ozone Generator Voltage, Scrubber Temp, Cell Voltage, and Cell Flow
82	130	Pressure Control and Cell Voltage
84	132	Pressure Control and Cell Flow
86	134	Pressure Control, Cell Flow, and Cell Voltage
88	136	Scrubber Temp and Pressure Control
8A	138	Scrubber Temp, Pressure Control, and Cell Voltage
8C	140	Scrubber Temp, Pressure Control, and Cell Flow
8E	142	Scrubber Temp, Pressure Control, Cell Flow, and Cell Voltage
A0	160	Pressure Control and Ozone Generator Voltage
A2	162	Pressure Control, Cell Voltage, and Ozone Generator Voltage
A4	164	Pressure Control, Ozone Flow, and Ozone Generator Voltage
A6	166	Pressure Control, Ozone Flow, Cell Voltage, and Ozone Generator Voltage
A8	168	Scrubber Temp, Pressure Control, and Ozone Generator Voltage
AA	170	Scrubber Temp, Pressure Control, Cell Voltage, and Ozone Generator Voltage
AC	172	Scrubber Temp, Pressure Control, Cell Flow, and Ozone Generator Voltage
AE	174	Pressure Control, Ozone Generator Voltage, Scrubber Temp, Cell Flow, and Cell Voltage
C0	192	Pressure Control and Ozone Flow
C2	194	Pressure Control, Ozone Flow, and Cell Voltage
C4	196	Pressure Control, Cell Flow, and Ozone Flow
C6	198	Pressure Control, Cell Flow, Ozone Flow, and Cell Voltage
C8	200	Scrubber Temp, Pressure Control, and Ozone Flow
CA	202	Scrubber Temp, Pressure Control, Ozone Flow, and Cell Voltage
CC	204	Scrubber Temp, Pressure Control, Cell Flow, and Ozone Flow
CE	206	Scrubber Temp, Pressure Control, Cell Flow, Ozone Flow, and Cell Voltage
E0	224	Pressure Control, Ozone Flow, and Ozone Generator Voltage
E2	226	Pressure Control, Ozone Flow, Cell Voltage, and Ozone Generator Voltage
E4	228	Pressure Control, Cell Flow, Ozone Flow, Ozone Generator Voltage

E6	230	Pressure Control, Cell Flow, Ozone Flow, Cell Voltage, and Ozone Generator Voltage
E8	232	Scrubber Temp, Pressure Control, Ozone Flow, and Ozone Generator Voltage
EA	234	Scrubber Temp, Pressure Control, Ozone Flow, Cell Voltage, and Ozone Generator Voltage
EC	236	Scrubber Temp, Pressure Control, Cell Flow, Ozone Flow, and Ozone Generator Voltage
EE	238	Scrubber Temp, Pressure Control, Cell Flow, Ozone Flow, Cell Voltage and Ozone Generator Voltage

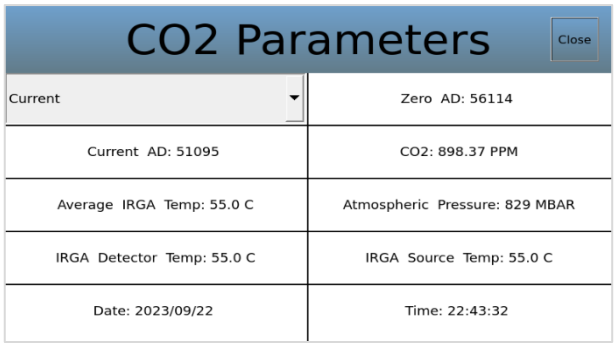
H.2.4 CO_2 Module Troubleshooting

When sampling ambient air, CO_2 readings of less than 400 ppm indicate a problem with the autozero operation, such as the zero gas not being connected, the CO_2 absorber being exhausted, or the flow rate is too high. Contact 2B Tech if flow adjustments are needed.

The pump for the AQSync's ozone module is used to provide the air sample to the CO_2 module (as well as the CO module and optional VOCs module). The flow rate through the CO_2/CO/VOCs modules is ~100 cc/min. If the ozone module's pump were to fail, the measurements for the CO_2/CO/VOCs modules will be affected. See the discussion in Section H.2.2 regarding diagnosis of pump failure in the ozone module.

The CO2 Parameters screen should have values of approximately:

- 55°C for the temperatures of the IRGA thermostats.
- Pressure close to ambient pressure
- Current AD values ~55,000
- Zero AD values greater than current AD values (say, 60,000)



The AD values are diagnostic of the lamp and detector status. Declining or zero values would indicate an aging detector and/or lamp. The manufacturer states that the infrared source should last for at least 2 years depending on use.

Erratic values could indicate a dirty inlet filter. Replace the green inlet filter quarterly, or more often if sampling very dirty air.

H.2.5 PM Module Troubleshooting

A filter placed before the pump keeps contaminates from damaging the pump, and filters the air supplied for the air sheath. The flow rate shown on the Particle Parameters screen should read 1.0 ± 0.1 liters per minute. For highest data quality, it is advisable to regularly monitor the flow rate.

If the flow rate drops below 1.0 ± 0.2 liters per minute, it is possible that the filter has become dirty and needs to be replaced. As noted in the Maintenance section of this manual, it is best practice to rotate the filter at least quarterly and replace when needed. Deviations in the flow rate could also indicate malfunction of the module's pump or the flow meter.

H.2.6 Service through 2B Technologies

2B Technologies offers reasonably priced customer service for instrument repairs. The calibration service for the ozone monitor includes cleaning of the entire flow path with methanol, testing of all components for proper function, installation of a new internal ozone measurement scrubber and calibration against a NIST-traceable standard. 2B Technologies also offers calibration and service for the sensors. The best way to contact us for service is to log a customer service ticket at https://2btech.io/support/. Normally, you will hear back from us by email within a few hours. Or, call us at +1(303)273-0559.

A great deal of technical information about our instruments is posted as technical notes on the 2B Tech website. Manuals, brochures, software, cleaning procedures and scientific papers may be downloaded at https://2btech.io/downloads/. Replacement parts may be purchased by calling us at +1(303) 273-0559 or by emailing us at sales@2btech.io.

I. Instrument Schematics and Photos

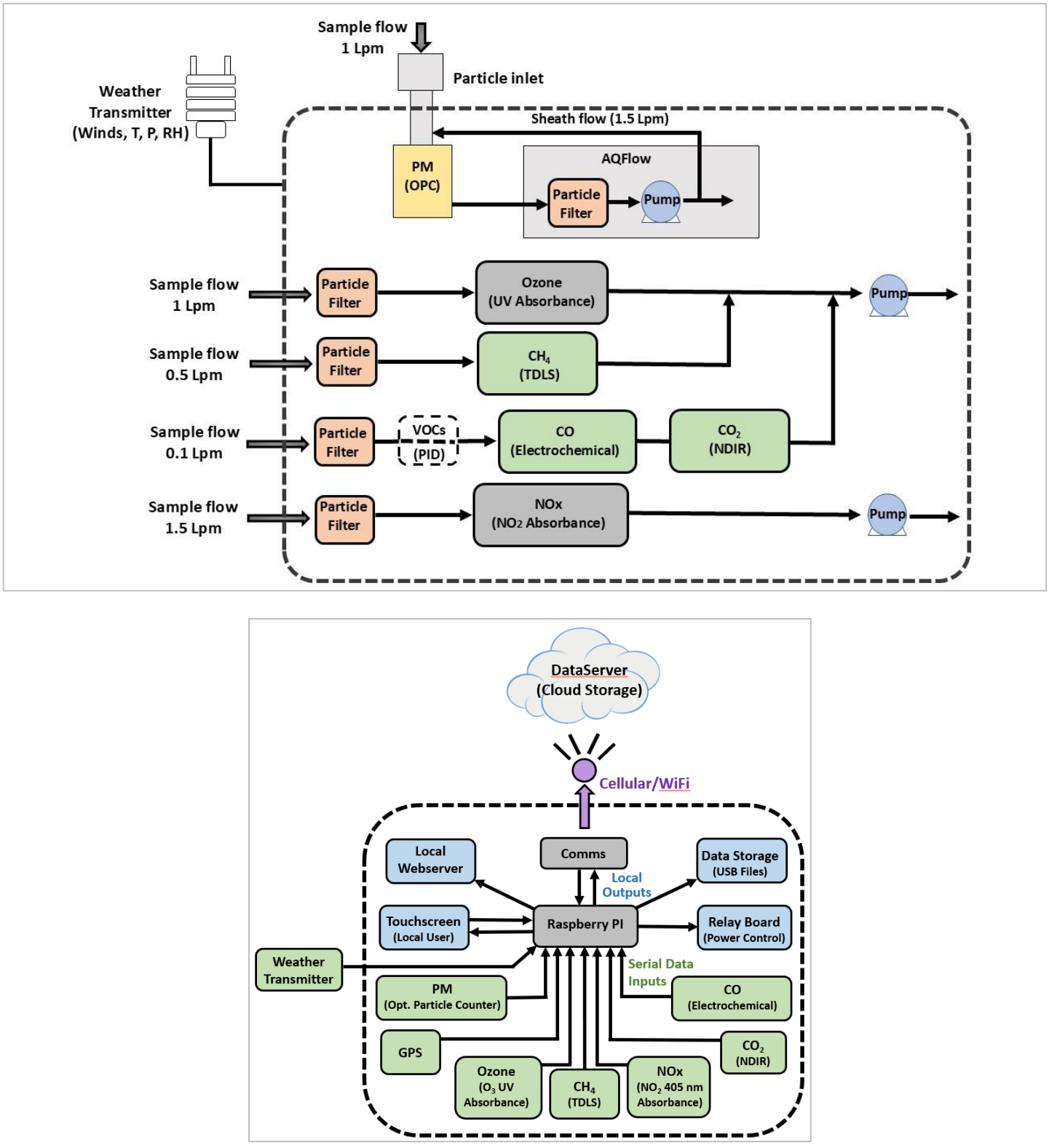


Figure I.1. Schematics of the AQSync's Sample Flow (top) and Data Flow.

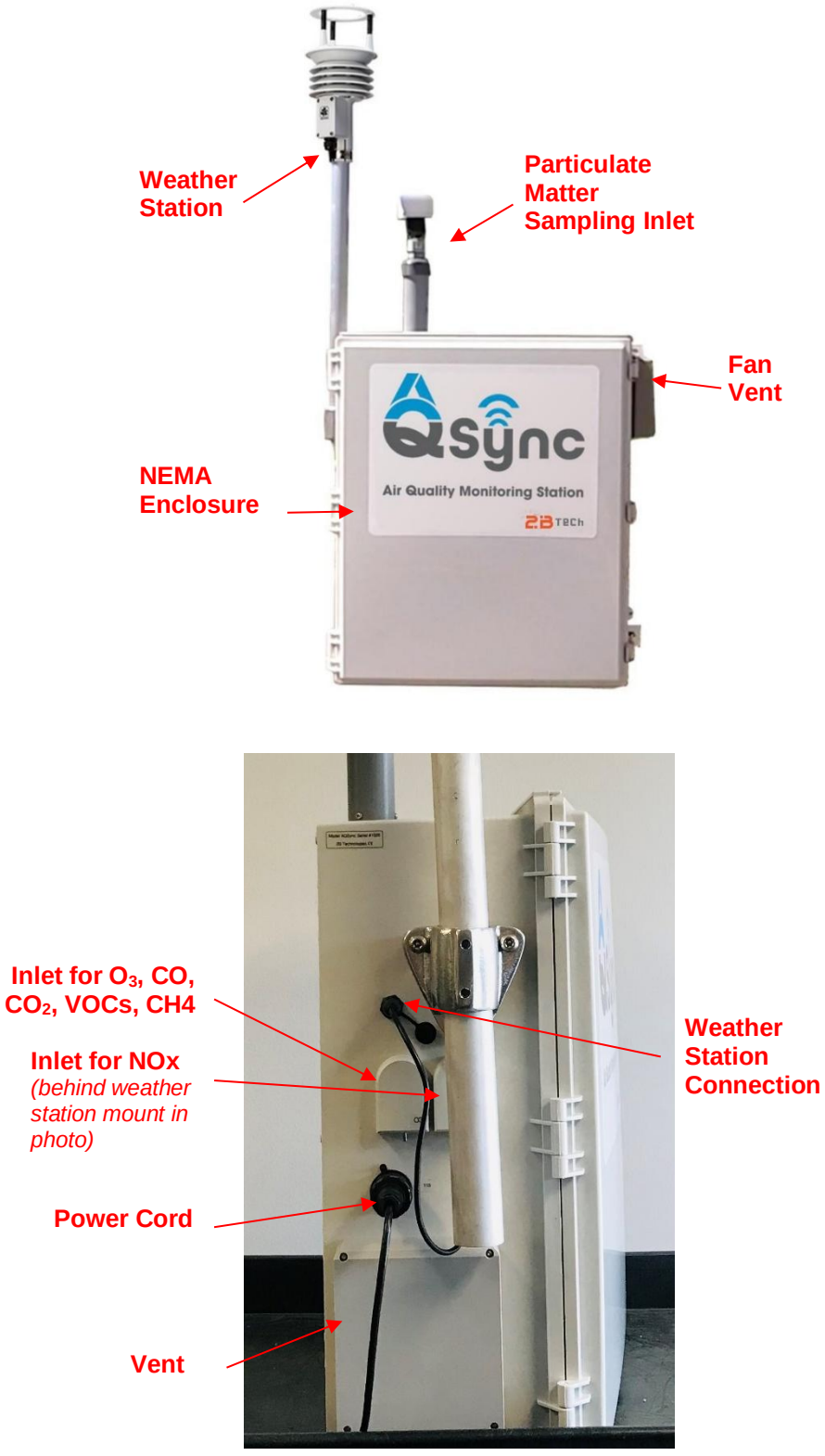


Figure I.2. Overview of the AQSync Air Quality Monitoring Station
(outside views)

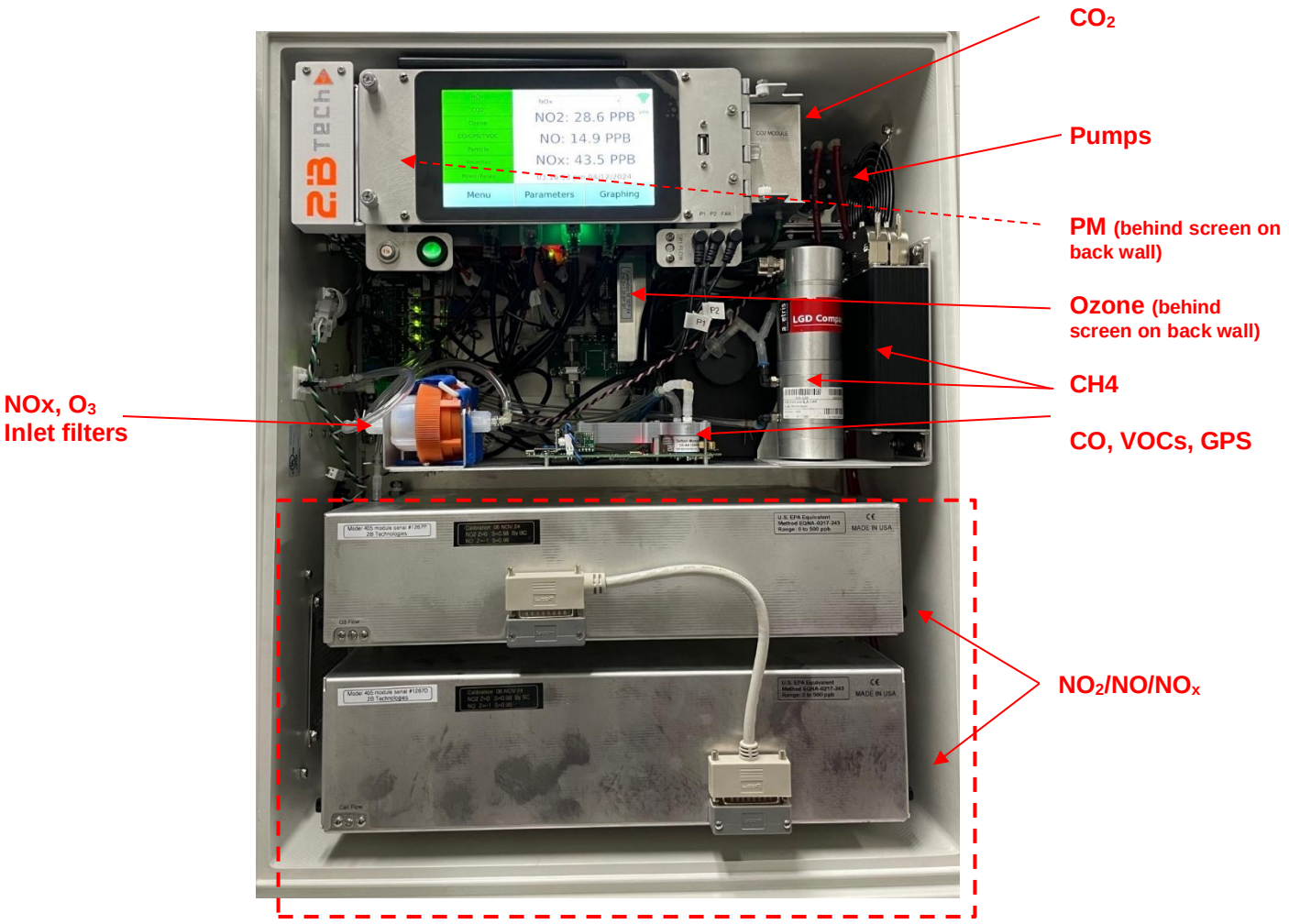


Figure I.3. Overview of the AQSync Air Quality Monitoring Station
(inside view)

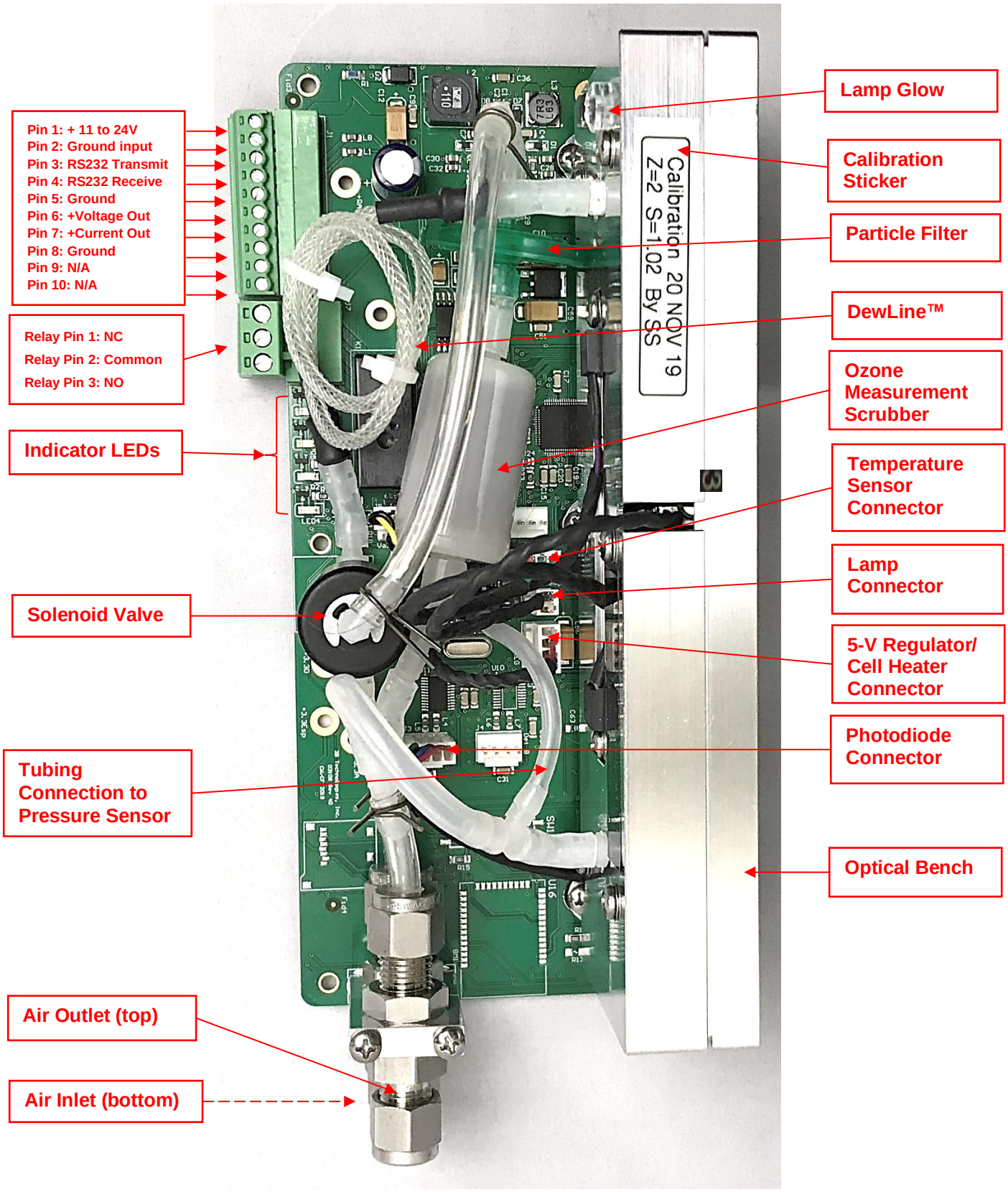


Figure I.4. The 2B Tech Model 108-L Ozone Monitor, the basis of the AQSync's ozone instrument

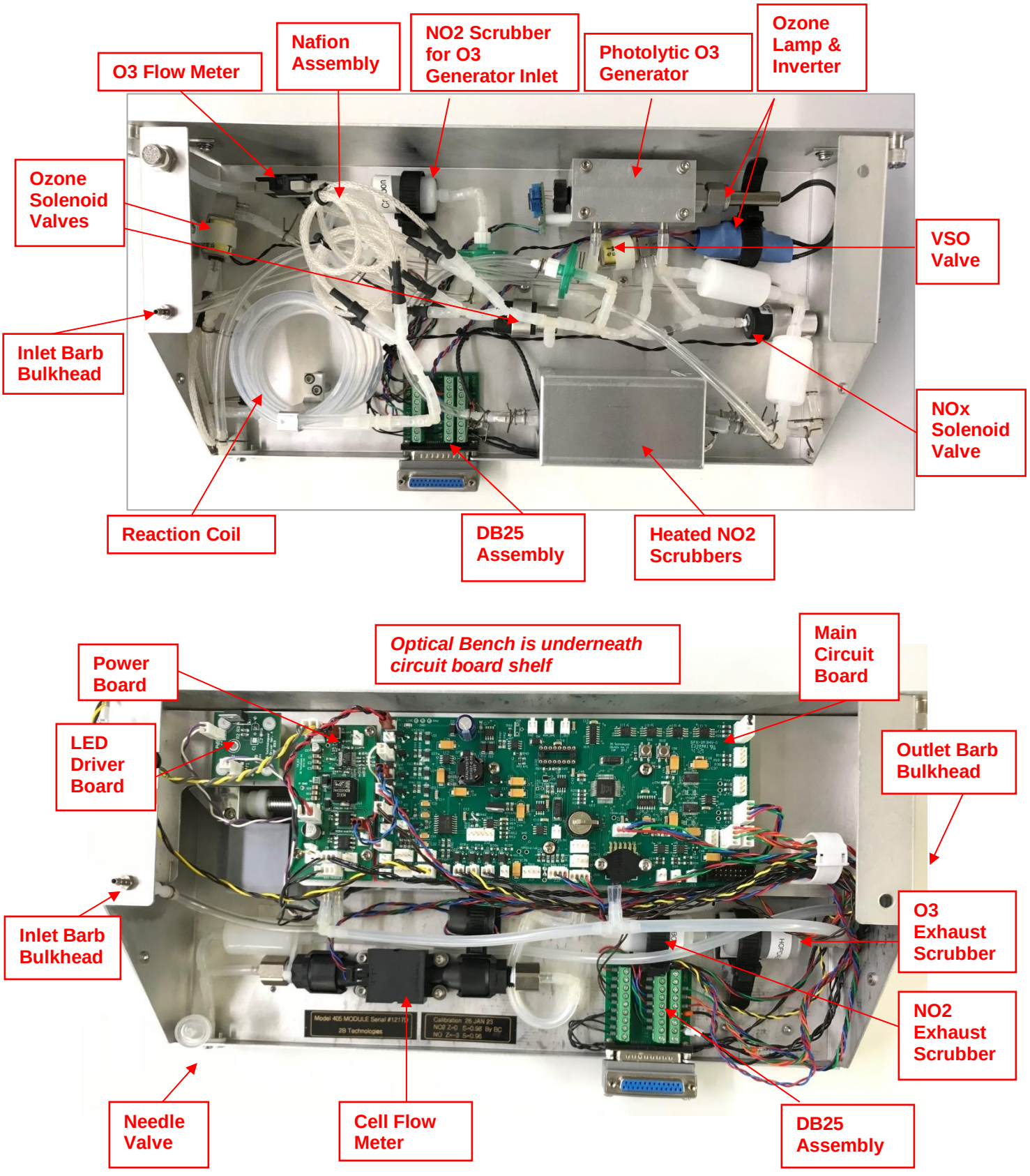
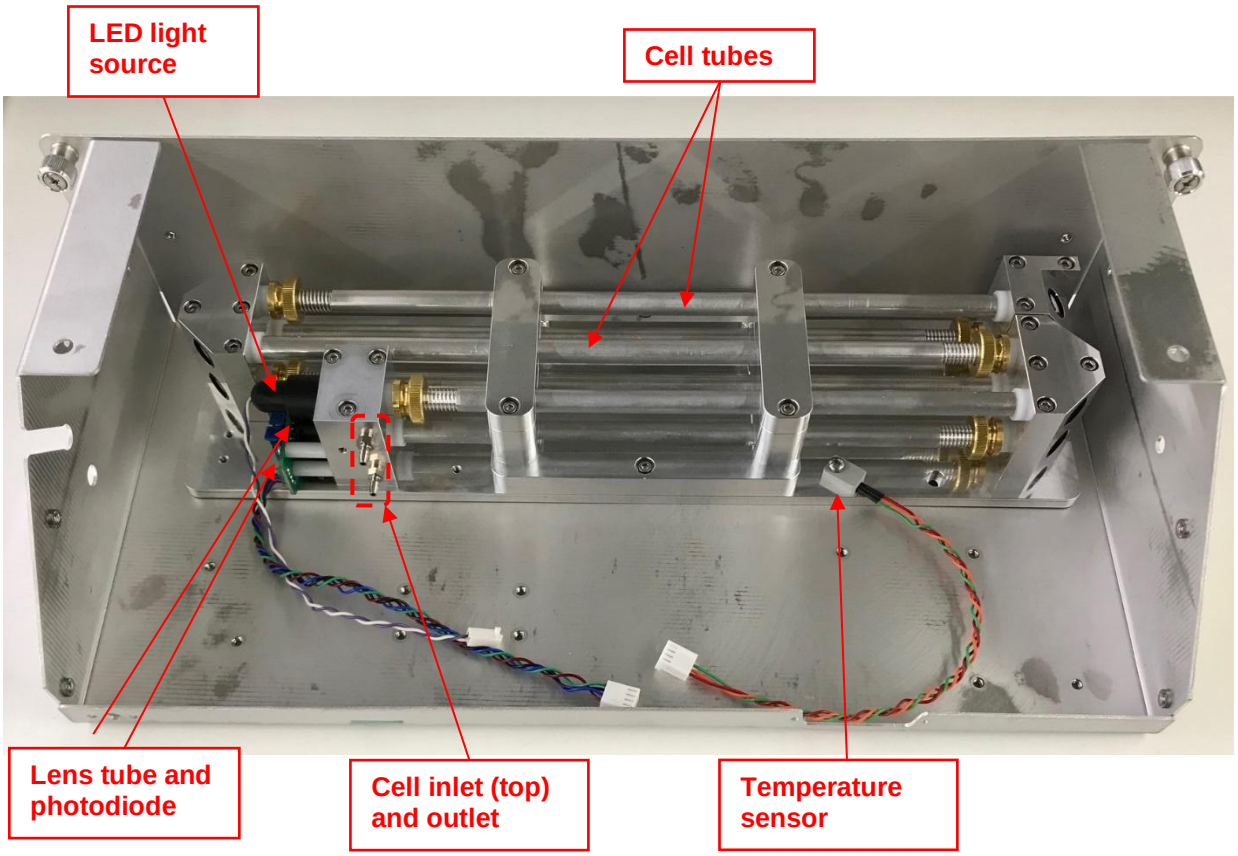


Figure I.5. The NOx Instrument in the AQSync



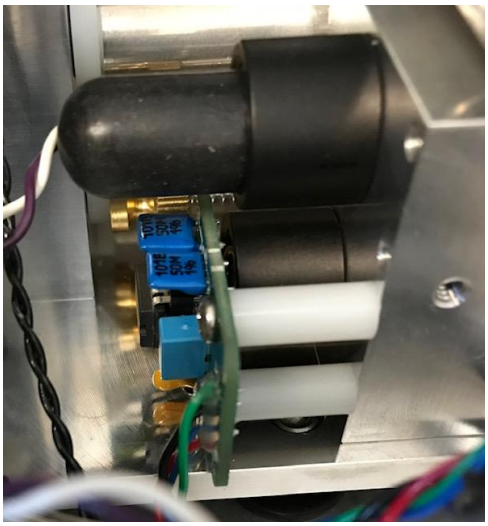


Figure I.6. Optical Bench of the NOx Instrument in the AQSync.

(Shown during assembly without light hood and all final installations.)

J. Replacement Parts

Please contact us to discuss your needs for replacement modules and spare parts for the AQSync:

- Our online ticketing system is accessible at: https://2btech.io/support/
- Via email, please contact us at sales@2btech.io
- Via phone, please contact us at +1(303) 273-0559.

K. Service Log

2B Tech Model: __AQSync Air Quality Monitoring Station *AQSync Serial #_____*

Purchase Date: _____

Date	Module Serviced or Exchanged	**Description of Service** (note old and new serial numbers, if applicable)	Notes

Date	Module Serviced or Exchanged	**Description of Service** (note old and new serial numbers, if applicable)	Notes

APPENDIX 1: Instruments and Sensors of the AQSync

The Summary table presented earlier in this manual (Section A.1.1) is reproduced here for convenience. Click on the left column to link to the manufacturer's user manual.

Species*	Method	Device	Range	Accuracy
O_3	UV absoption, 254 nm	2B Tech 108-L (FEM)	0−100,000 ppb	1.5 ppb/2%
NO_2	Direct absorbance, 405 nm	2B Tech 405 nm (FEM)	0−10,000 ppb	2 ppb / 10%
NO	Oxidation to NO_2 with O_3 followed by absorbance of NO_2 at 405 nm	2B Tech 405 nm	0−2,000 ppb	2 ppb / 2%
CO_2	Non Dispersive Infrared (NDIR) absorbance, absolute absorptiometer	PP Systems CO_2 Gas Analyzer, Model SBA-5	0−1000 ppm	5 ppm
PM (1, 2.5, 10 µm)	Right angle light scatter particle detection using a laser diode	Met One 83214 AQ Mass Profiler	0−320,000 particles/L	±10%
CO	Amperometry	Alphasense CO-A4	0−50 ppm	0.1 ppm
VOCs	Photoionization Detection	ION Science MiniPID2-HS	0−3 ppm	0.5 ppb det. lim.
CH_4	Tunable-Diode Laser	Axetris LGD Compact-A CH4	0-100ppm	<0.8ppm
T	(contact Gill Instruments Ltd.)	Gill Instruments MaxiMet GMX500 Weather Station	-40 to +70 °C	±0.3 °C @ 20 °C
P	(contact Gill Instruments Ltd.)	Gill Instruments MaxiMet GMX500 Weather Station	300 – 1100 hPa	±0.5 hPa @ 25 °C
RH	(contact Gill Instruments Ltd.)	Gill Instruments MaxiMet GMX500 Weather Station	0−100 %RH	±2 %RH (10 to 90 %RH)
Wind speed	2-D Sonic anemometry	Gill Instruments MaxiMet GMX500 Weather Station	0.01−60 m/s (134 MPH)	0–40 m/s ±3% 40–60 m/s ±5%
Wind direction	2-D Sonic anemometry	Gill Instruments MaxiMet GMX500 Weather Station	0-360 degrees azimuth	±3° to 40 m/s ±5° 40 to 60 m/s

* Some choices of the measurement suite are customizable and are specified at the time of order.

Summary of Links to Manufacturer User Manuals

Please consult these resources for more information about each instrument. They are helpful in understanding the operating principles of the instruments, as well as the information presented in the Parameters screens of the AQSync.

Ozone:
https://2btech.io/items/industrial-ozone-monitors/model-108-l-ozone-monitor/

NO_2/NO/NOx:
https://2btech.io/items/other-monitors/model-405-nm-no2-no-nox-monitor/

CO_2:
https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/CO2_Instrument_PPSystems_SBA-5.pdf

CO:
https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/CO_Alphasense_CO-A4.pdf

VOCs:
https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/VOCs_IONScience_MiniPID2-HS.pdf

Particulate Matter:
https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/AQ-Mass-Profiler_MetOne_83214.pdf

Weather Transmitter:
https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/WeatherTransmitter_Gill_MaxiMet.pdf

CH_4:
https://2btech.io/wp-content/uploads/pdf/AQSyncInstruments/CH4_Axetris_LGD-Compact.pdf

APPENDIX 2: Field Calibration Guide

Ozone and NOx Field Calibration Procedure

Note: It is advisable to check the recommended maintenance and calibration schedule (see Appendix 5) before doing any field calibrations. Procedures for most maintenance items can be found in this AQSync User Manual.

A. Tools

- 2B Tech Model 714 NO_2/NO/O_3 Calibration Source (CAUTION: If using an alternative calibration source for O_3, NO_2, or NO, an overflow tee must be present to avoid over-pressurizing the AQSync)
- Access to power/battery bank for Model 714
- Calibration gas line: Ozone/NOx Compatible Tubing (Teflon or Teflon-lined, length needed is dependent on AQSync access and location; ¼" o.d. tubing is recommended).
- Tubing Connections: Tubing connection to the Model 714 is a ¼" Swagelok compression fitting. Connection to the AQSync module inlets lines is most easily made with a 1/8" barb fitting (shown in step (a) of the Ozone Calibration section).
- Laptop (optional)

B. Procedure

1. Prepare Calibration Source (2B Technologies Model 714) and AQSync

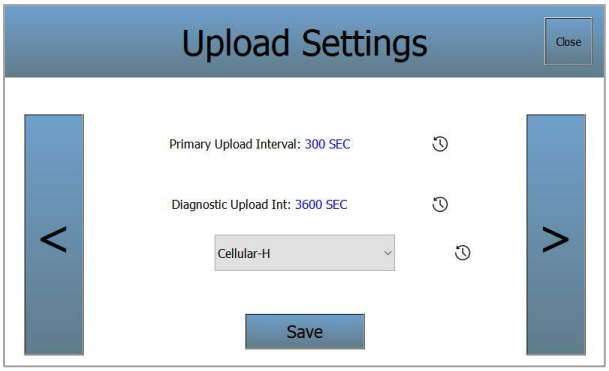
a) If the field, where calibration may be occurring in a high NO-environment (e.g., along highway), it is advisable to replace the main scrubber in the Model 714 with a fresh scrubber before using the Model 714 in the calibration. Ozone and NO_2 will be removed quantitatively regardless; however, a fraction of the NO may not be removed by an older scrubber. This can affect measurement of the NO offset on the instrument to be calibrated.

b) Take note of the current values of the calibration offset (Z) and slope (S) on both the ozone and NOx (NO and NO_2) modules, using the Touchscreen Menu>Settings Menu page. These initial values need to be taken into account if the field calibration indicates that changes are needed in the calibration parameters.

c) Note that there is no need to adjust the AQSync's O_3 or NO_x adaptive filter settings for the calibration. Maintain the settings you normally use during sampling.

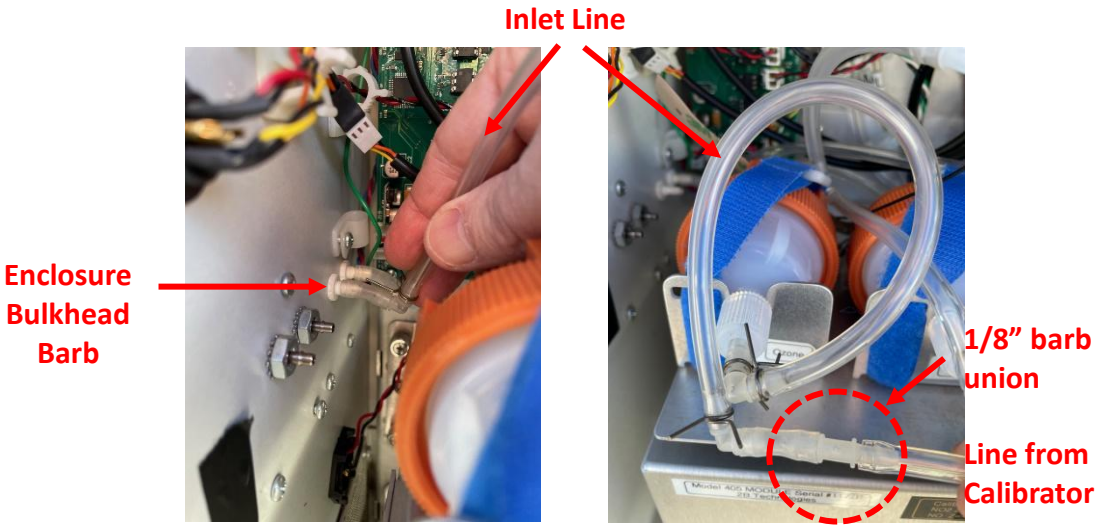
d) Plug in the Model 714 to either available AC power or to battery. Turn on the 714 and allow it to fully warm up. While warming up, the 714 outputs zero air (O_3 and NOx-free), so that the calibration line from the 714 can be connected to the instrument module to be calibrated (O_3 or NOx) during warmup. This can serve as an initial offset measurement.

e) It is advisable to also change the uploading frequency to 1 minute while doing the calibrations (Menu > System > Upload Settings). This will allow you to watch the data update more rapidly during the calibration. One can also use Modbus and Wi-Fi access point to watch the real-time data from a nearby laptop (see Appendices 3 and 4 for details).

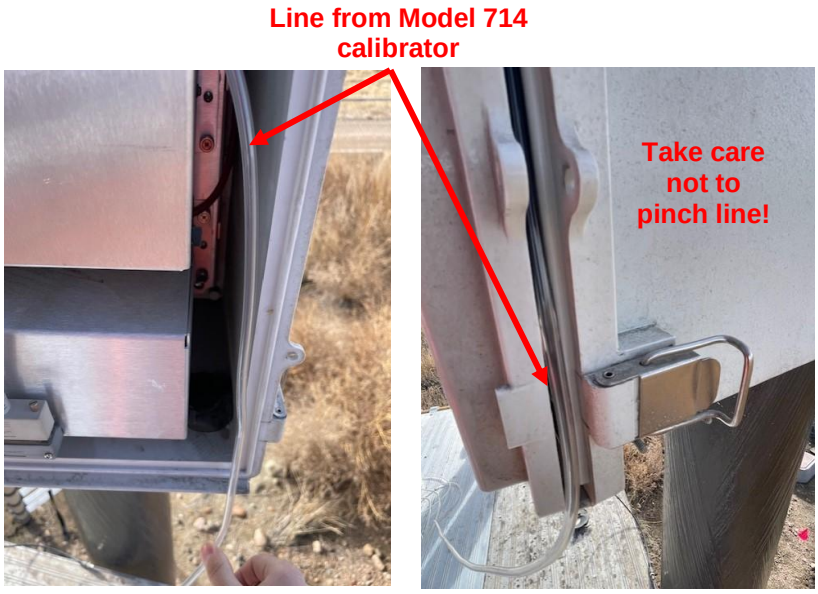


2. Calibrate the Ozone Module

a) Open the door of the AQSync and disconnect the ozone inlet line (coming from the orange filter holder) from the barbed bulkhead in the wall of the enclosure. Attach the calibration line from the 714 to the ozone inlet line. Make sure to remove the overflow cap from the 714 and attach a NO_2 and O_3 scrubber to the overflow port.



b) Run the calibration line out of the AQSync at the bottom right-hand corner of the enclosure. Then close the enclosure door and connect the top latch (top right side of enclosure) to hold the door in place. The middle latch can also be connected, but not clipped tight. This should leave enough room for the calibration line to exit the AQSync from the bottom right corner without being pinched, yet the door is held securely in a closed position.



c) Once the Model 714 is fully warmed up and in the "Ready" state, use the Model 714 to introduce ozone calibration gas to the AQSync ozone module at different concentrations (see Model 714 manual for calibration options).

d) Remain at each concentration for ~ 8-10 minutes to insure complete stability in the concentration. It is recommended to at least measure a single high concentration (100 ppb or greater) and a zero concentration.

e) Observe the data either via the dashboard or live (via Wi-Fi) to make sure that the ozone concentration is stable.

f) When finished – open the enclosure door, disconnect the calibration line, and re-attach the ozone inlet to the enclosure wall bulkhead. If you changed the uploading frequency, remember to change it back to its original setting if desired.

g) At this point you can update calibration factors if needed. It is typical that the offset (Z) may need to be updated; however, it is advisable to **be cautious** when changing slope (S) coefficients. Typically, field calibrations have greater uncertainties compared to the original lab calibrations.

3. Calibrate the NOx Module

a) Open the door of the AQSync and disconnect the NOx inlet line (Refer to pictures in the Ozone calibration section above) from the barbed bulkhead in the wall of the enclosure. Attach the calibration line from the 714 to the NOx inlet.

b) Run the calibration line out of the AQSync at the bottom right-hand corner of the enclosure. Then close the enclosure door and connect the top latch (top right side of enclosure) to hold the door in place. The middle latch can also be connected, but not clipped tight. This should leave enough room for the calibration line to exit the AQSync from the bottom right corner without being pinched, yet the door is held securely in a closed position.

c) Once the Model 714 is fully warmed up and in the "Ready" state, use the Model 714 to introduce NO and/or NO_2 calibration gas to the AQSync NOx module at different concentrations (see Model 714 manual for calibration options).

d) Remain at each concentration for ~ 10 minutes to insure complete stability in the concentration. It is recommended to make at least 3 measurement settings: (a) NO = NO_2 = 0 (for offset check), (b) High concentration of NO with NO_2 = 0, and (c) Same NO concentration as (b), but a high NO_2 concentration (~ 100 ppb or more).

e) Observe the data either via the dashboard or live (via Wi-Fi) to make sure that the NO and NO_2 concentrations are stable.

f) When finished – open the enclosure door, disconnect the calibration line and re-attach the NOx inlet to the enclosure wall bulkhead. If you changed the uploading frequency, remember to change it back to its original setting if desired.

g) At this point you can update calibration factors if needed. It is typical that the offset (Z) for NO and NO_2 may need to be updated; however, it is advisable to **be cautious** when changing slope (S) coefficients for either NO or NO_2. Typically, field calibrations have greater uncertainties compared to the original lab calibrations.

PM Zero and Flow Calibration Check

A. Tools

- Particle filter assembly (provided by 2B Tech)
- NIST-traceable calibrated Flow meter. Be sure that the flow meter outputs volumetric flow (not standardized flow). We recommend using the MetOne Swift 6.0 for the flow calibration procedure (this meter will be shown in the following description).
- USB extension cord (optional)
- Laptop
- Tera Term (or equivalent terminal emulator program)

B. Procedure

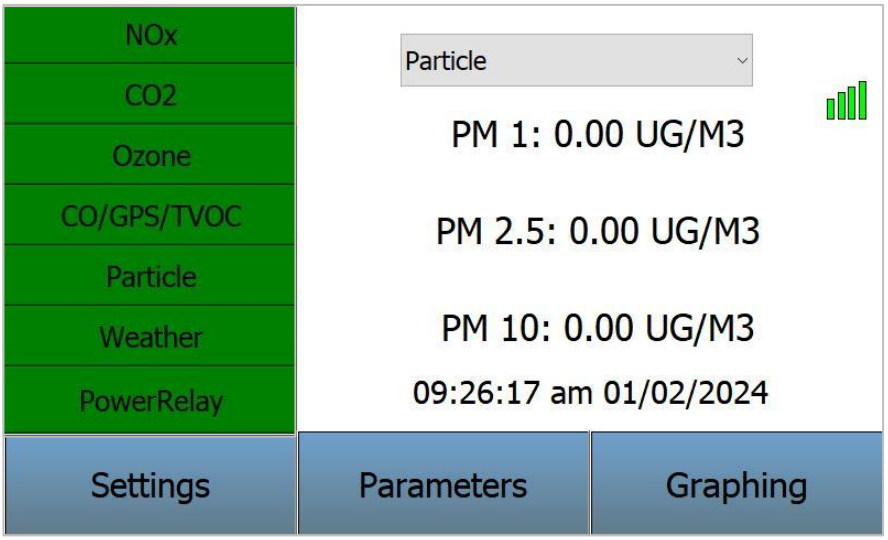
1. Install terminal emulator program

Before visiting the AQSync, install both Tera Term (or any other equivalent terminal emulator program) and the correct USB-serial driver on the laptop to be used. Tera Term can be installed following the link at https://2btech.io/downloads/?filter=true&docs_category=docs_software.
The USB-serial drivers can be found at https://ftdichip.com/drivers/d2xx-drivers/. Select the laptop operating system and follow the download and installation instructions.

2. PM Zero

a) Remove the aerosol inlet cover from the top of AQSync by gently pushing and twisting the Inlet cover upwards and off of the steel inlet tube.

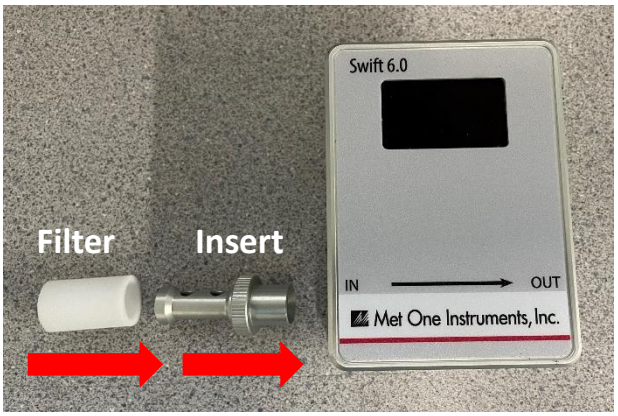
b) Attach the 2B-provided particle filter assembly to top as shown below. Check "Particles" on the touchscreen home screen or dashboard data – data should read 0.00 for all species after a few readings. If there is a non-zero number(s) there is likely a leak somewhere in the plumbing. Contact 2B for advice on leak determination.



3. PM Flow Check

a) Attach calibrated flow meter to the aerosol inlet tube. The MetOne SWIFT 6.0 flow meter fits directly onto the aerosol inlet tube. If using a different flow meter, one will need to connect either to the ½" o.d. aerosol inlet tube or to the inlet of the particle filter assembly shown above.

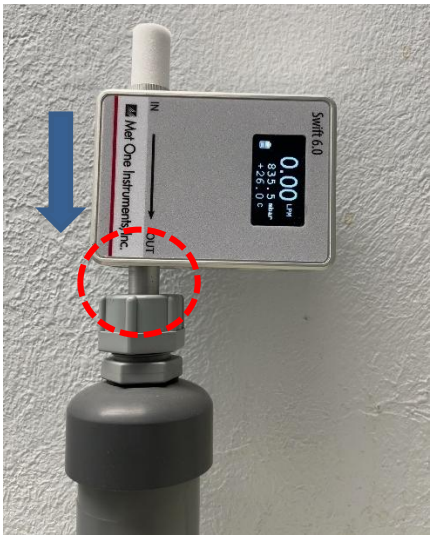
b) **Make sure the flow meter is reading in Volumetric Flow**.



Slide Filter element over the metal insert. Then slide insert fully into the "IN" side of The Swift 6.0 flow meter.

Make sure the flow meter is reading in volumetric flow.

Push the "OUT" side of the Swift flow meter onto the exposed inlet tube.



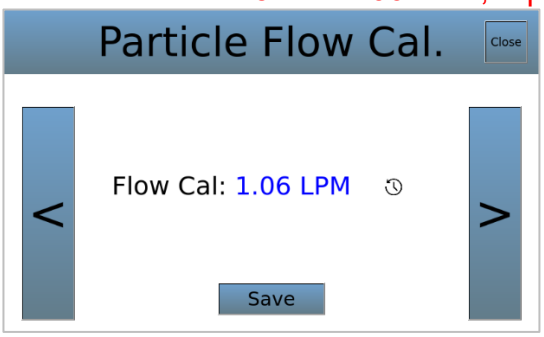
c) Flow should be reading between 0.95 and 1.05 LPM (not 0.00 as in picture).

d) If the flow is not reading within the proper range – proceed to step 4 (next page).

e) If the flow is reading in the proper range, the Flow Check is done. Remove the flow meter from the aerosol inlet tube and replace the aerosol inlet cover.

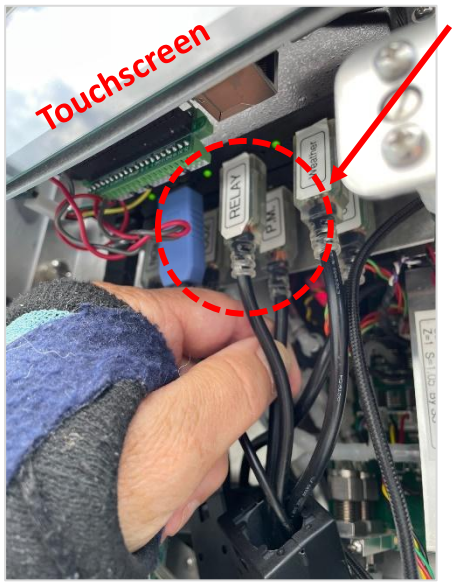
4. ***PM Flow meter calibration*** If flow is reading outside the bounds of 0.95 to 1.05 LPM, the flow meter in the Met One PM monitor needs to be calibrated.

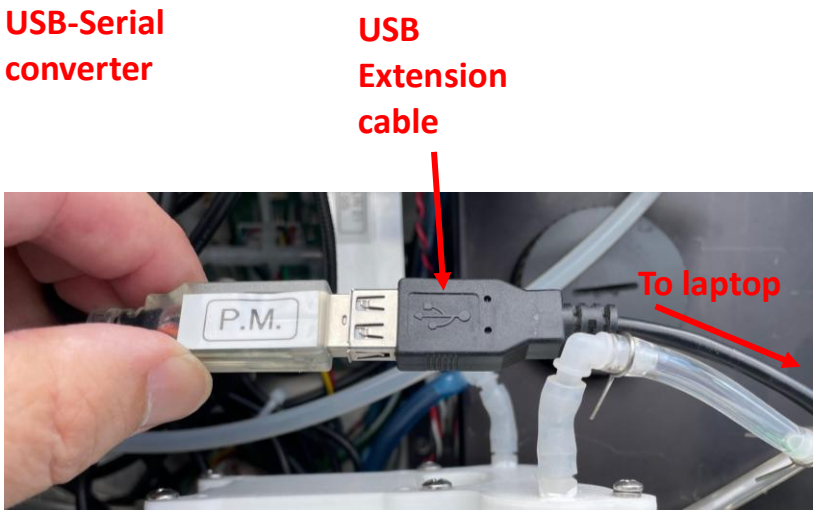
   NOTE: If software is version 3.0.0 or newer the calibration factor can be entered through the touchscreen. Enter the flow rate measured by the flow meter in the Particle Flow Cal. Pg. Home > Menu > Particle Flow Cal. Press "Save". If the flow rate is not within 5% of 1.00 LPM, repeat this step.



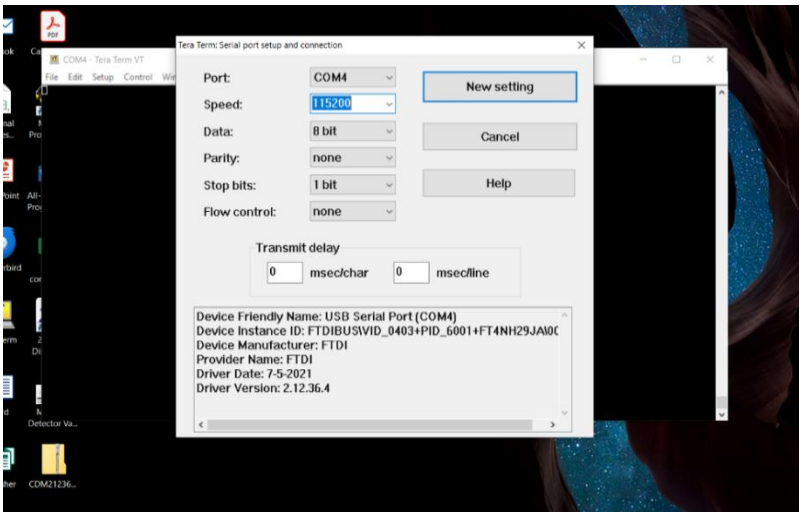
   Otherwise, follow procedure below.

   a) Leave the flow meter attached on the aerosol inlet tube. Turn on laptop. Unplug USB cord labeled P.M. from USB hubs (located beneath the touchscreen of the AQSync) and connect to the laptop. A USB extension cord is helpful to aid in connecting the MetOne USB-serial converter to the laptop.





b) Open Tera Term and find the proper COM port (new COM port added once connected). Set the baud rate to 115200 under the Setup/Serial Port and hit Open (or connect). Lines of data should begin to appear every 10 seconds.



c) Read value of the Swift flow meter on the aerosol inlet
(Example: say it reads 0.50 LPM)

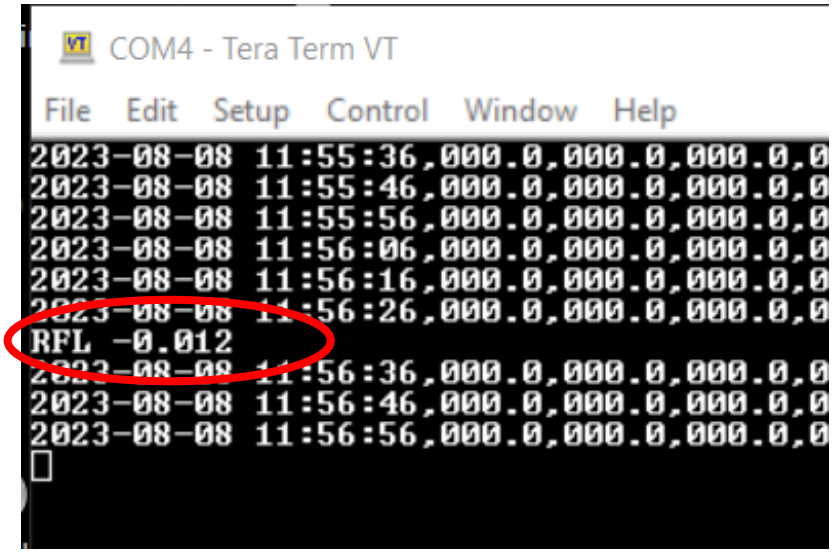
d) Select (click on) the Teraterm window and type the command:

<ESC>RF #.##<CR>

<ESC> is Escape key, <CR> is Carriage return or Enter, #.## is the reading of the Swift flow meter. (Example: <ESC>RF 0.50<CR> if the Swift meter was reading 0.50). Note there is a space in between the RF and #.##.

e) If entered properly the Tera Term window should respond with a line:

RFL -0.025 (or some other number dependent on adjustment).
See picture below, 7th line down.



f) Repeat RF command until Swift calibration flow meter reads between 0.95 and 1.05 LPM – then the PM monitor flow meter has been successfully re-calibrated.

g) Plug the USB-serial converter back into the USB hubs on AQSync when finished.

h) Remove the flow meter from the inlet tube and replace the aerosol inlet cover.

APPENDIX 3: Remote Operation of the AQSync

Remote operation of the AQSync makes it possible for the user to adjust the parameters of the AQSync during runtime without being co-located with the instrument.

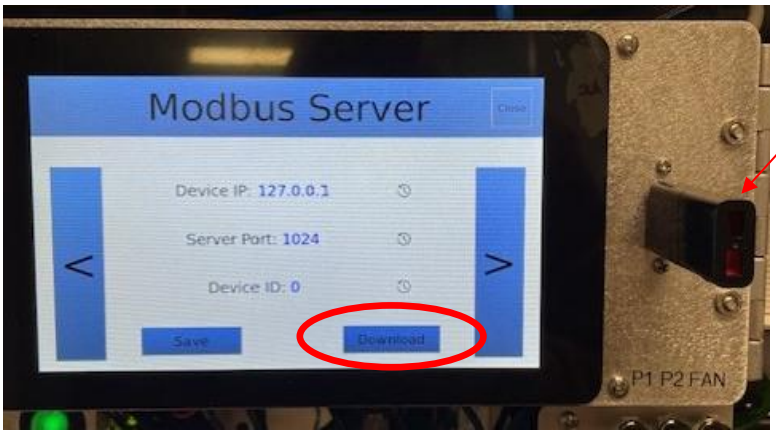
The remote operation of the AQSync is accomplished via a Modbus TCP/IP interface through a Wi-Fi connection to your computer. Important: The AQSync's software version must be 159C or newer. Please contact 2BTech if attempting to use Modbus with older software versions.

Tools

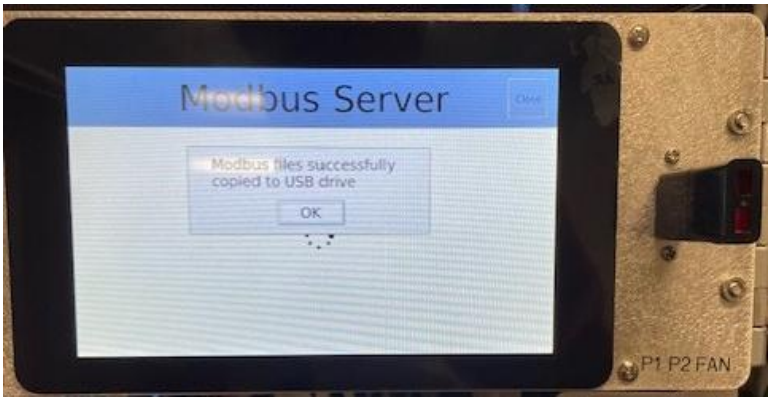
- Laptop computer with Windows version 10 or 11.
- AQSync with software 159C or newer
- USB thumb drive (with at least 1GB of available storage)

Procedure

(1) Open the door to the AQSync and plug in the USB thumb drive. Navigate to the Modbus server page [Menu > System > Modbus Server]. Note: the password to access the settings will be autofilled.

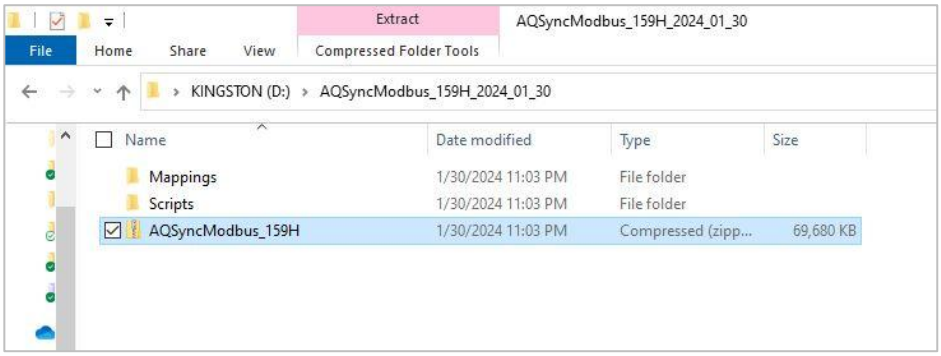


Press "download." The download will take approximately 1-2 min to complete. Press "OK" when download complete. Remove USB thumb drive from AQSync.

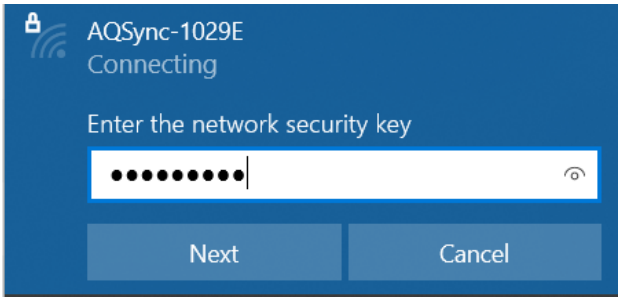


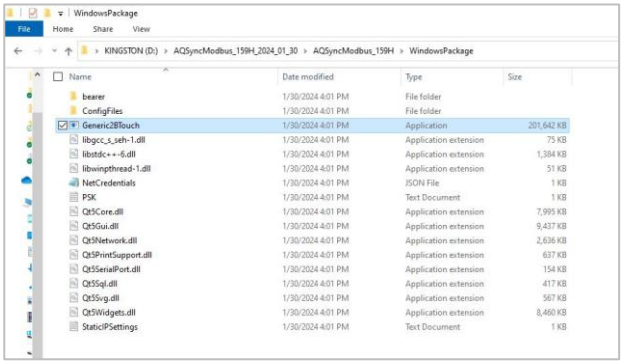
(2) Navigate to the Wi-Fi access point [Menu > System > Wi-Fi Access Point]. Write down (or take a picture) of the password on this page, as this will be needed in the next step. Click "Enable" if not enabled. If the access point is already enabled the blue icon will say "Disable" (in that case, do not disable the Wi-Fi Access Point; go to the next step). Enabling the Wi-Fi Access Point will cause the AQSync computer to restart; this is normal operation.

(3) Plug a USB thumb drive into laptop. Find the folder called "AQSyncModbus_VER_YYYY_MM_DD". Inside that folder there is a zipped file called "AQSyncModbus_VER". Download to your computer and then unzip this folder.

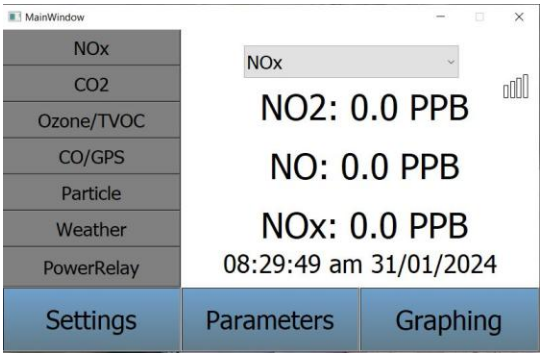


(4) After unzipping the folder, open "Windows Package". In this folder there will be an application called "Generic2BTouch". Before launching the application, connect to the Wi-Fi network that the AQSync is on. The password is the one displayed on the Wi-Fi Access Point page on the device.

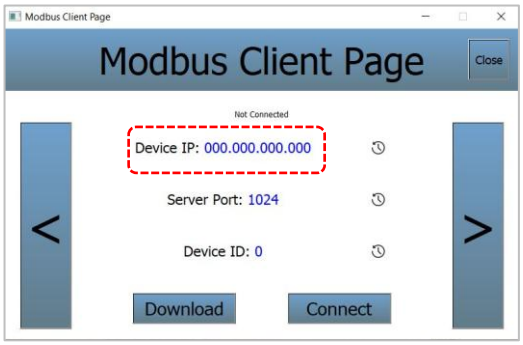


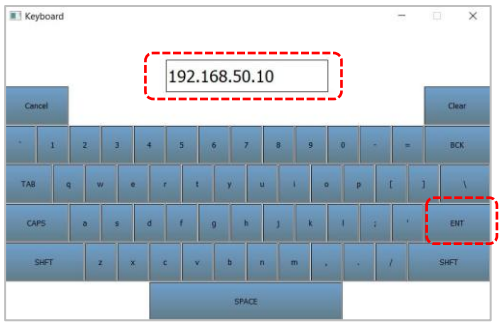


(5) Launch “Generic2BTouch”. A Windows version of the software will open. At this point, the software still needs to connect to the AQSync and the devices (NOx, CO_2, …) are shown in gray. The next steps will establish the AQSync’s connection to your computer.

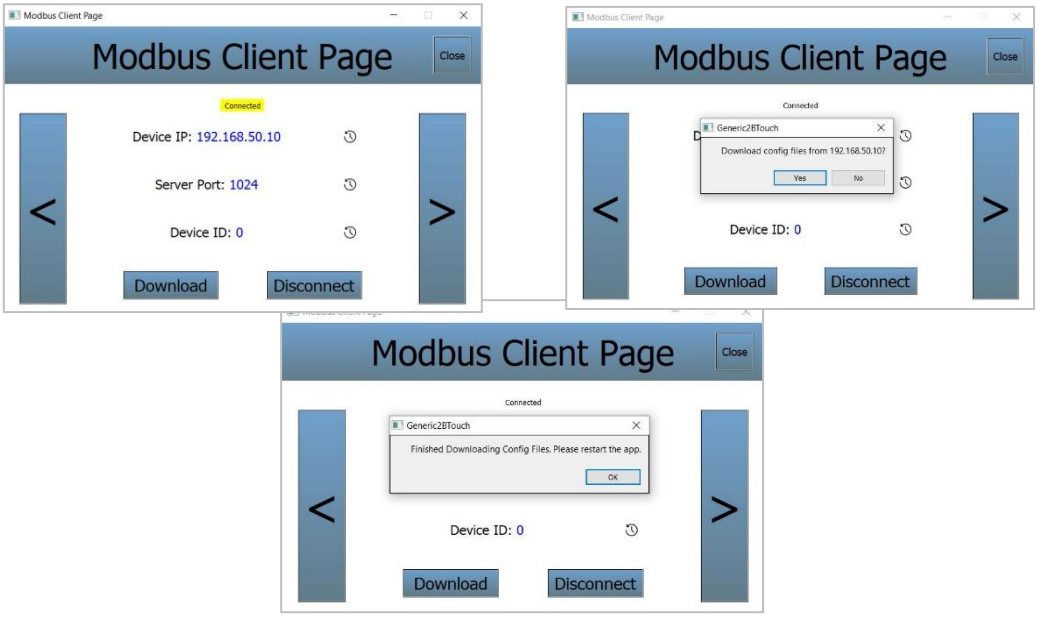


(6) Navigate to the Modbus Client page on the laptop version. Click on the device IP and change it to 192.168.50.10, or device name and serial number (Example “AQSync-xxxx”) then hit “ENT” to enter.

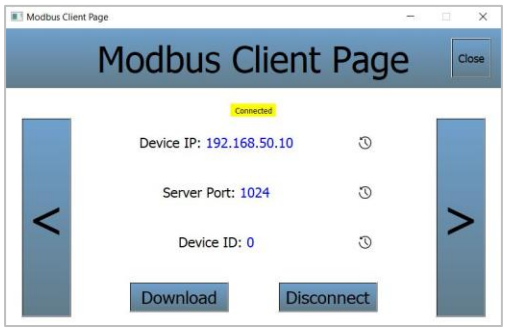


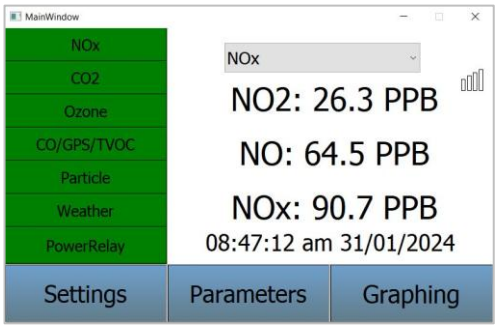


(7) Click on “Connect”, then click on “Download” and then confirm “Yes”. After the configuration files are downloaded, close and reopen the application.



(8) After reopening the application, navigate back to the Modbus Client page and click “Connect”. Once connected, navigating back to the Home screen will display the current data in real-time and the devices will change from gray to green.





(9) Your laptop is now connected to the AQSync. Remote data access and instrument control are now activated.

(10) Note that touchscreen entries can still be made when a computer is remotely connected. The page entries made on the touchscreen will be displayed on the remote computer, and vice versa. Note that selections made within a single page are not replicated between the touchscreen and the computer.

(11) Click Disconnect when you wish to exit the computer’s control of the AQSync.

APPENDIX 4: Downloading Data Files over Wi-Fi

The AQSync can establish its own “hotspot” Wi-Fi network, or can connect to an external, independent Wi-Fi network. Below are procedures for each configuration.

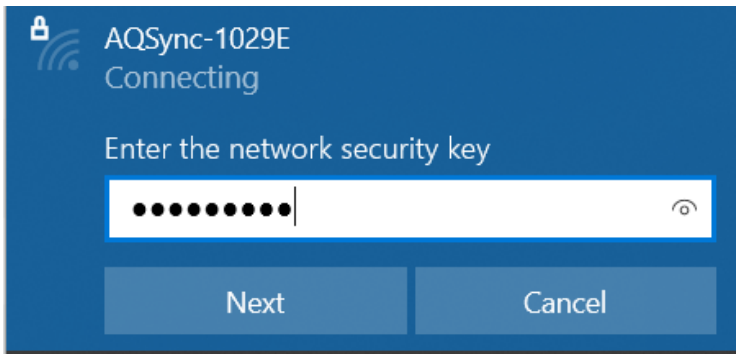
Tools

- Phone or laptop
- Optional: Wi-Fi network

Procedure 1: Using the AQSync’s Hotspot Wi-Fi Network

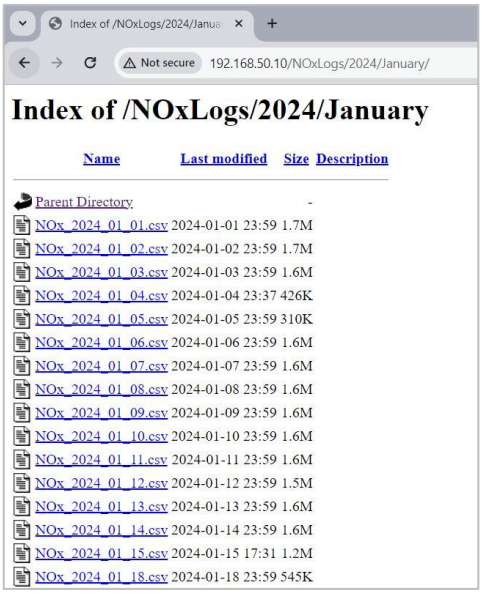
(1) Enable the Wi-Fi access point. Navigate to the Wi-Fi access point (Menu > System > WiFi Access Point). Write down (or take a picture) of the password on this page. This will be needed in the next step. Click “Enable” if not enabled. If the access point is already enabled the blue icon will say “Disabled” (do not disable). Enabling the Wi-Fi access point will cause the AQSync computer to restart; this is normal operation.

Connect to AQSync’s Wi-Fi network using laptop or phone. The password is the one displayed on the WiFi Access Point page on the device.



(2) Open web browser and enter the IP address 192.168.50.10. This will open a file index.

(3) Navigate to desired files. Clicking on the hyperlink will download a .csv file.



Procedure 2: AQSync connected to external/independent Wi-Fi network

(1) Connect phone/laptop to the same Wi-Fi network as AQSync.

(2) Follow steps 2 and 3 in Procedure 1 but use the IP Address listed in the “About” page (Menu > System > About).

APPENDIX 5: Recommended Maintenance and Calibration Schedule

Air Quality Monitoring Station

Recommended Maintenance and Calibration Schedule

This schedule represents frequencies we recommend to meet the highest data quality objectives. However, the AQSync was designed to produce reliable data with minimal intervention. Please contact us to discuss your specific situation and the minimum required maintenance for the AQSync in your monitoring location.

Task	3 Mo	6 Mo	9 Mo	12 Mo
GENERAL				
Change inlet filter membranes (every 3 months or up to every month if *very* dirty air)	•	•	•	•
OZONE				
Change internal scrubber and scrubber filter (minimum every 12 mo, preferably every 6 mo)		•		•
Check calibration in field with Model 714 Calibrator		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•
NOx				
Change LED				•
Check calibration in field with Model 714 Calibrator		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•
PM				
Rotate pump filter membrane (every 3 months for dirty air)	•	•	•	•
Field check zero and flow rate		•		•
Adjust calibration factor based on comparison with co-located or nearby FEM monitor		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•
CO/TVOC/CH_4				
Change CO sensor (if significant sensitivity drift has occurred)		•		•
Field check zero for CO and CH_4 (Requires tank of zero air)	•	•	•	•
CO_2				
Replace green inlet filter		•		•
Change soda lime zeroing scrubber		•		•
Return module to 2B Tech/authorized distributor for calibration or replace with calibrated unit				•

[AQSync_Maintenance_Cal_Schedule_rev10E]

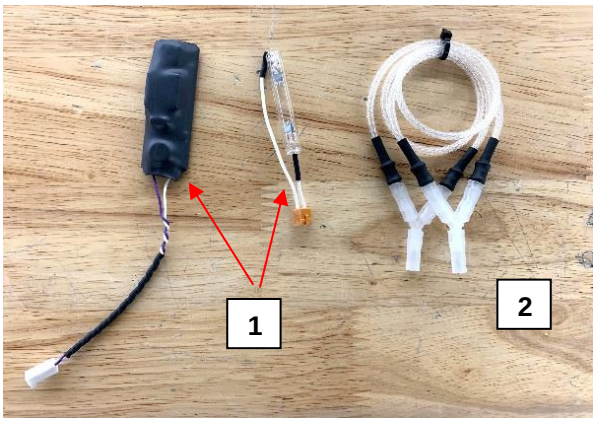
APPENDIX 6: AQSync Field Kits Overview

Field Kit AQS Base (11-741)

1. Green Particle filter
2. Filter membranes

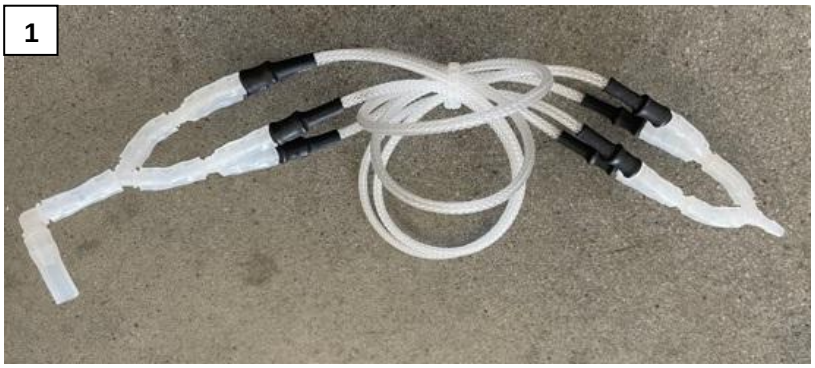
Field Kit AQS O_3 Monitor (11-743)

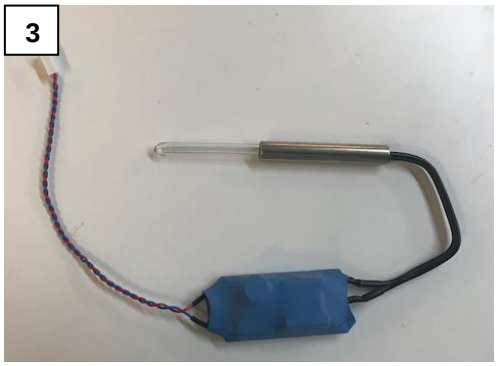
1. UV lamp assembly
2. DewLine assembly
3. Valve assembly
4. Internal ozone scrubber assembly

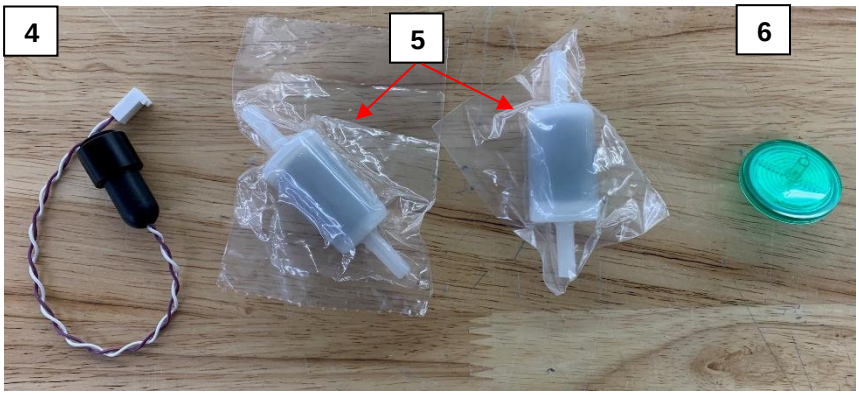


Field Kit, AQS NOx Monitor [11-744]

1. DewLine assembly
2. Pump assembly
3. UV lamp assembly
4. LED assembly
5. Internal Ozone and NOx exhaust scrubbers
6. Green disk filter







Field Kit AQS Aux Pump Assm (11-742)

1. Auxiliary pump assembly

Field Kit AQSync PM Monitor (11-745)

1. External filter assembly

AQS CO Sensor Kit (11-746)

1. CO sensor

AQS CO_2 Monitor Field Kit (11-747)

1. Mixed base scrubber assembly

AQS tVOC PID Sensor Field Kit (11-748)

1. tVOC PID