SMART VENTILATION

PARTICULATE DEFENSE

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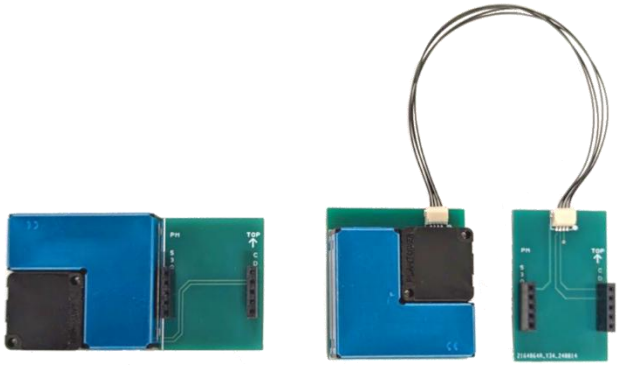


CERV2 Particulate Defense Kit

The Particulate Defense Kit for the CERV2 is designed to actively monitor and respond to airborne particulate levels in both indoor and outdoor environments. By utilizing high-precision sensors, the system continuously measures particulate concentrations in the airstreams, allowing it to intelligently adapt its ventilation and filtration operation to maintain optimal indoor air quality. This proactive approach ensures that contaminants such as cooking pollutants, smoke, dust, pollen, and other airborne pollutants are managed effectively, providing a healthier indoor environment.

Sensor Features:

- Calibration-free
- Low Power
- Particulate Mass (PM) and Particulate Count (PC) measurement
- High sensitivity

Sensor Specifications:

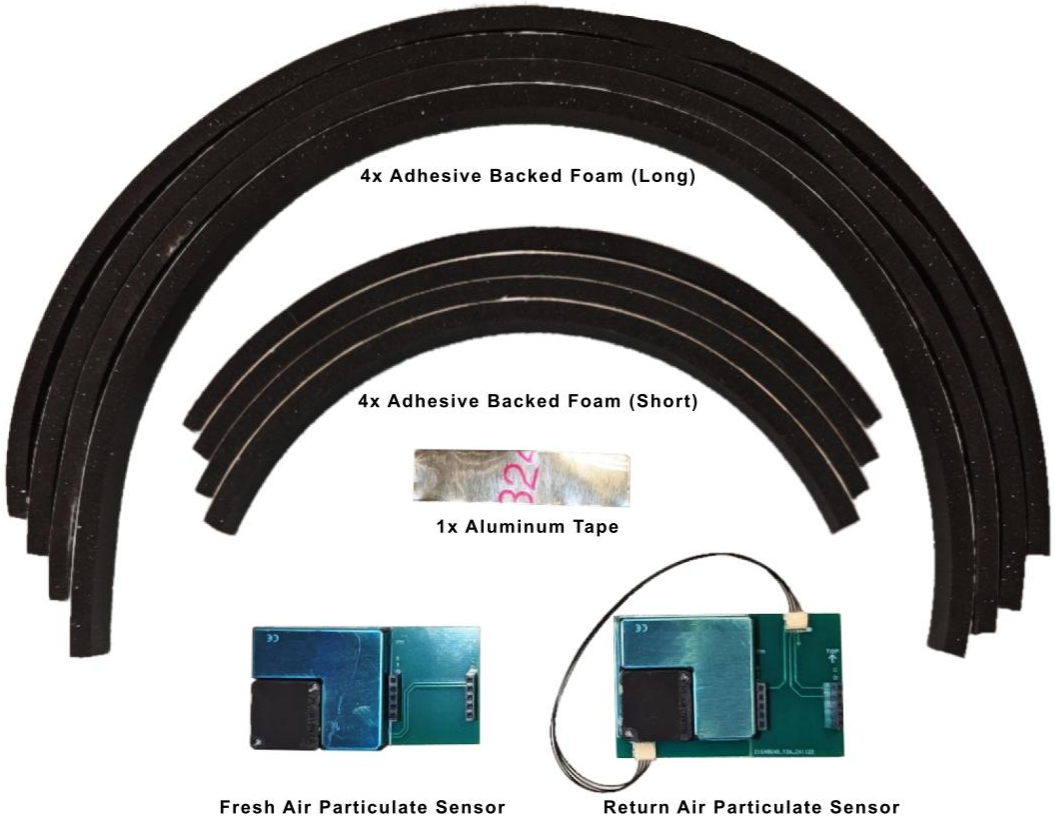
Technology	Laser Scattering
Particle Measurement Bins	PM [µg/m^3]: 1.0, 2.5, 5.0, 10.0 PC [#/L]: 0.3, 0.5, 1.0, 2.5, 5.0, 10.0
Particle Counting Efficiency	98% @ >= 0.5µm
Particle Resolution	1 µg/m^3
Particle Maximum Consistency Error (PM2.5 Standard)	± 10% @ 100~500 µ g/m ^{3} ±10 µ g/m ^{3} @0~100 µ g/m ^{3}
Warranty	1 Year

Table of Contents

Particulate Defense Kit Contents

Each CERV2 Particulate Defense Kit contains:

- 1x Return Air Particulate Sensor Module (two boards connected by cable)
- 1x Fresh Air Particulate Sensor Module (single board)
- 1x Aluminum Tape Strip
- 2x Alcohol Cleaning Pads
- 4x Adhesive Backed Foam (9.75” long ea)
- 4x Adhesive Backed Foam (18.5” long ea)
- 1x MicroSD Card
- 1x “Particulate Defense” Sticker



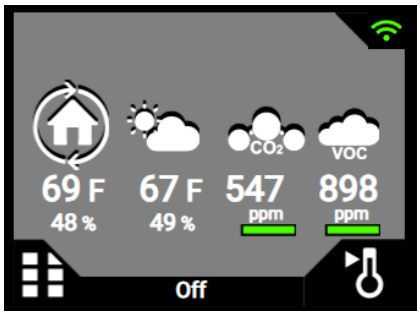
1x Particulate Defense Sticker

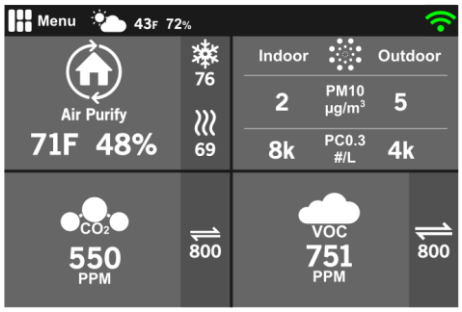
1x Touchscreen Update MicroSD

2x Alcohol Cleaning Pads

CERV2 Screen Update

To ensure accurate particulate readings on the CERV2's physical touchscreen, an update to the screen may be necessary. Compare your CERV2's home screen configuration to the images below; if it matches the image on the left, an update is necessary. If it matches the image on the right, your touchscreen is up to date. Please check your screen now to determine if the update is needed.





- If a touchscreen update is not needed, please proceed to the next section: **Particulate Sensor Module Installation – Return Air**. The MicroSD card included with this kit will not be used.
- If an update is required, the MicroSD card on the touchscreen must be replaced. Find the MicroSD card included with this kit and proceed with the update.

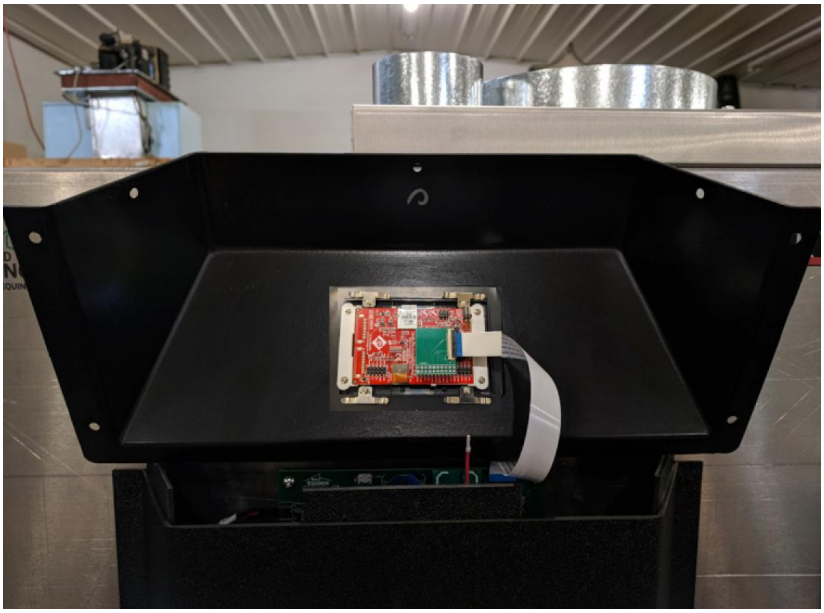
MicroSD Card

CERV2 Touchscreen SD Card Replacement

Step 1: Shut off power to the CERV with the main power switch.

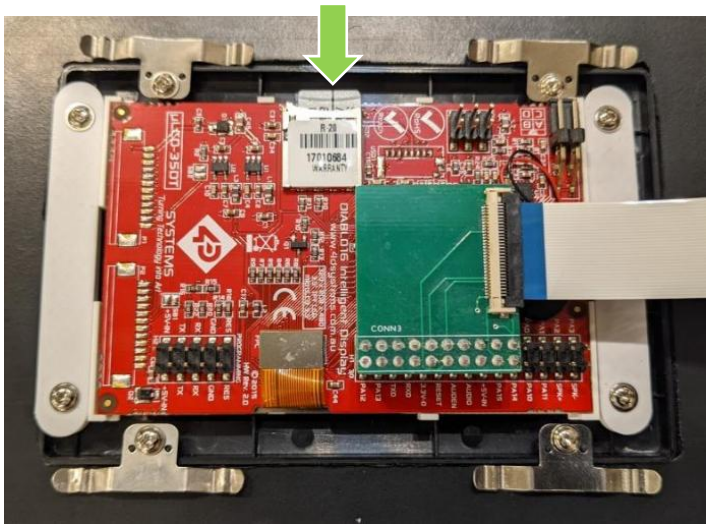
Step 2: Locate the 7 black Phillips head screws mounting the top touchscreen enclosure to the unit (shown below). Remove the screws. **NOTE: an electric screw driver may be used to remove the screws, but only use a hand operated Phillips screwdriver to put them back in. An electric screwdriver may strip the screw hole threads.**

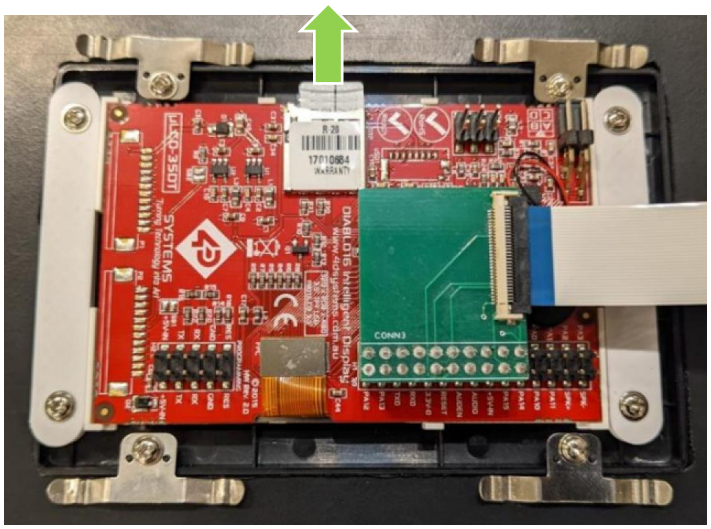
Step 3: Rotate the top enclosure to see the back of the touchscreen (rotate the bottom towards you, top away from you). A ribbon cable connects the touchscreen to the main control board, and should be left in place. Take care not to bend or dislodge the ribbon cable from its connectors. The top enclosure can be rested on the bottom enclosure as shown below. The SD card is located on the back of the screen and can now be removed.



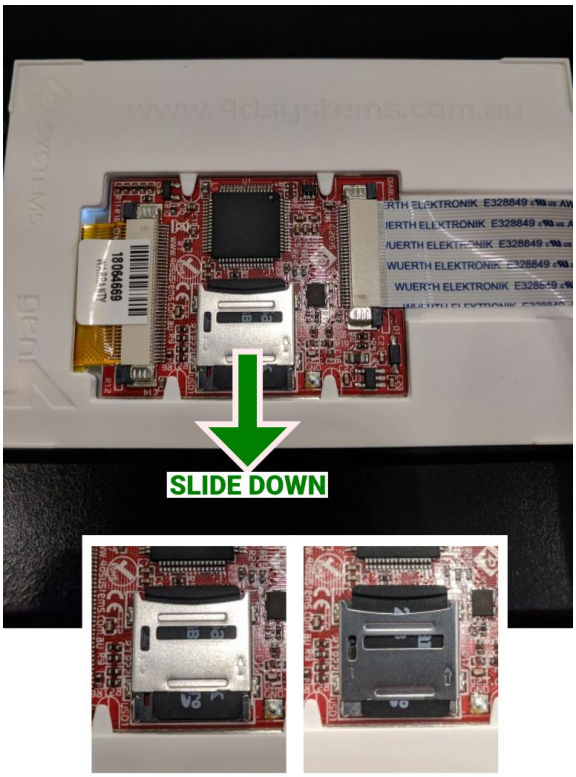
There are two screen styles, each with a different SD card retaining clip. Step 4a shows how to remove the SD card from a spring-loaded holder, while 4b shows removal from a flip down retainer clip. Identify the type of retaining clip and follow the instructions to remove and replace the SD card.

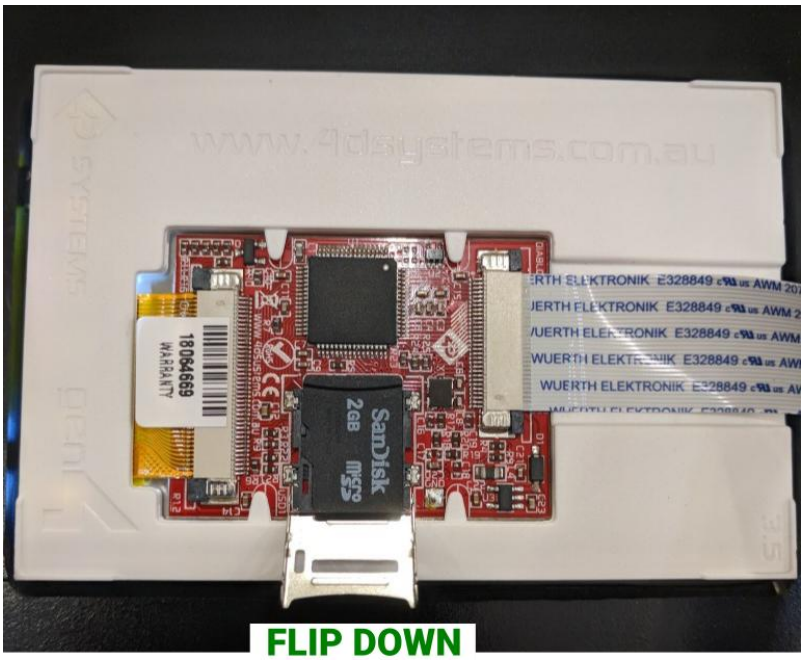
Step 4a: To remove the old MicroSD card from the spring-loaded connector, first press the card in lightly. The card will then release from the socket, and can be pulled outwards. Replace it with the new card and press it in to lock in place.





Step 4b: To remove the old MicroSD card from the flip down retainer, while lightly pressing on the metal SD card housing, slide it down using a fingernail. This will release the clip and allow it to be flipped open. Remove the old card and set the new card in place. Close the metal clip and slide it back up to lock it in place.





Step 5: Follow all previous steps to reassemble the top touchscreen enclosure. This completes the touchscreen update. The CERV can remain powered off to proceed to the next section: **Particulate Sensor Module Installation – Return Air.**

Particulate Sensor Module Installation – Return Air

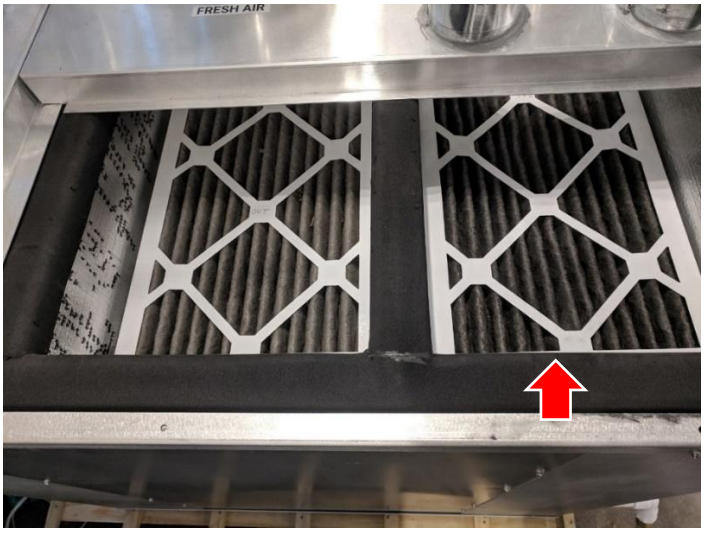
Materials needed:

- 1x Return Air Particulate Sensor Module (two boards connected by cable)
- 1x Aluminum Tape Strip
- 2x Adhesive Backed Foam (9.75” long ea)
- 2x Adhesive Backed Foam (18.5” long ea)
- 1x Alcohol Swab

The Return Air Particulate Sensor installs above the filter to allow the indoor return air’s particulate content to be measured unaffected by the return air filter. This section will demonstrate how to install the sensor circuit boards and the adhesive backed foam filter gasket.

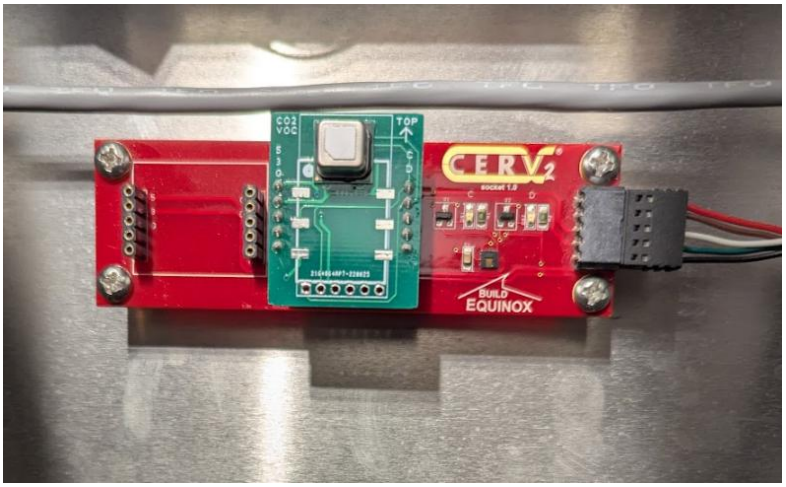
Procedure – Install Return Air Particulate Sensor Module

1) Turn off power to the CERV2 using the main power switch on the bottom right front of the unit.
2) Open the filter access cover and remove the return air filter.

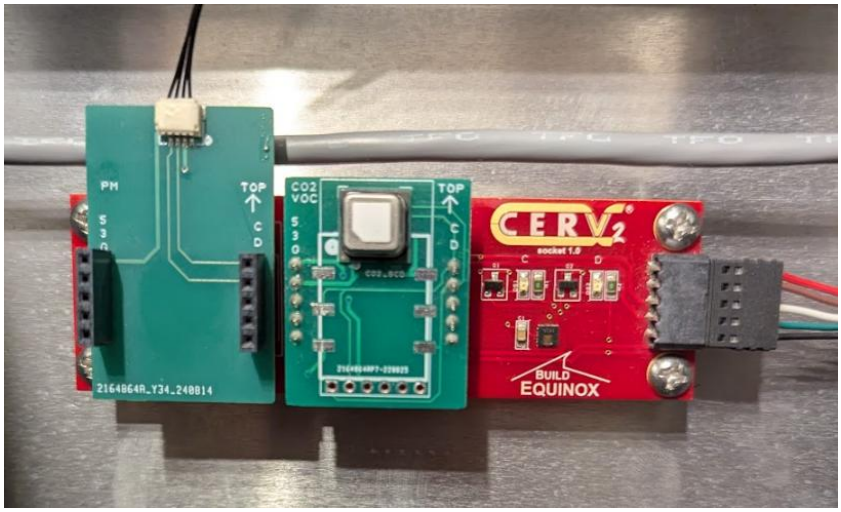


3) The return air sensor board is now visible. There is a main board with two small modules plugged in (these are the CO2 and VOC sensors). Unplug the module on the left by pulling directly outwards. Be very careful not to drop the module and set it aside.

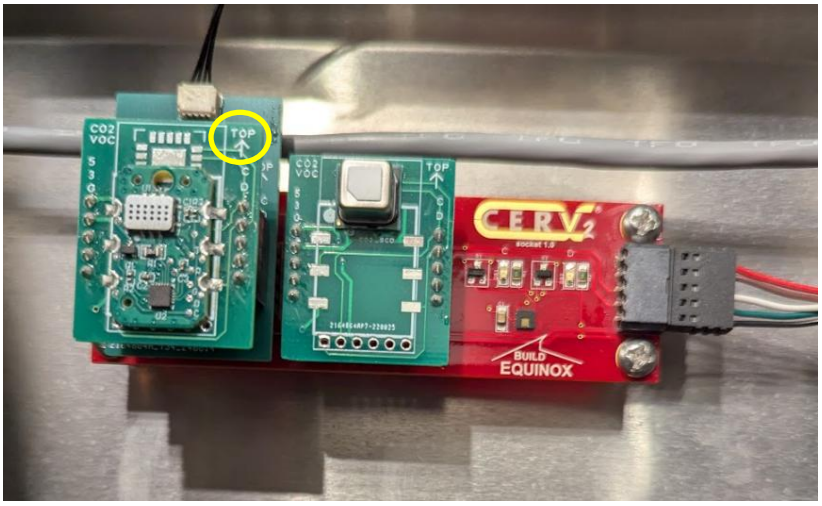
4) There should now only be one module plugged into the board.



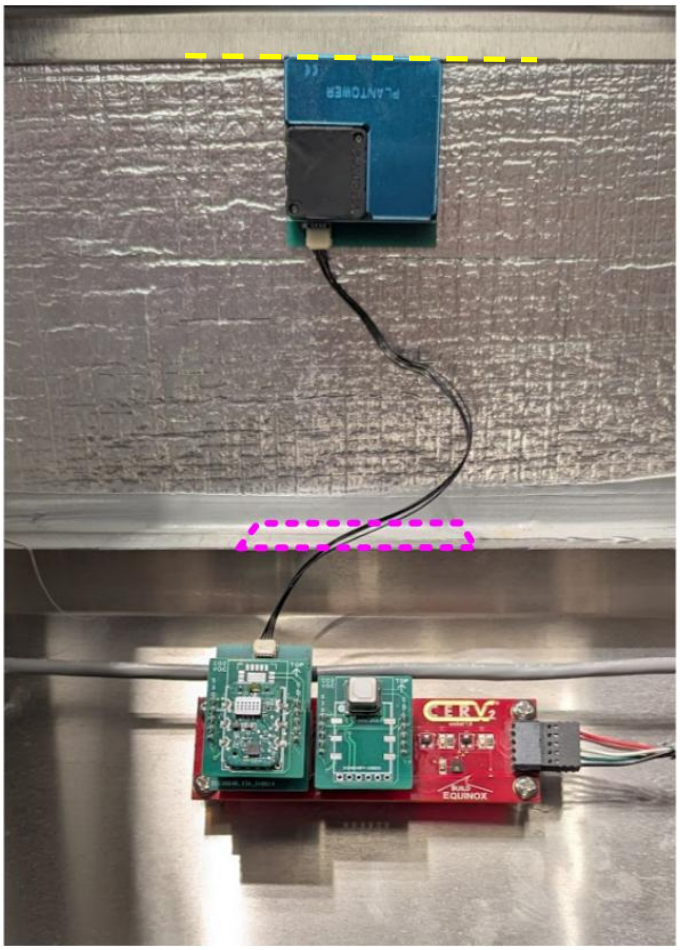
5) Plug in the Particulate Sensor circuit board, with the wire connector at the top. Ensure that the pins of the board plug correctly into the pins of the socket below (i.e. not offset). The plastic bracket on the back of the sensor board helps align the pins.

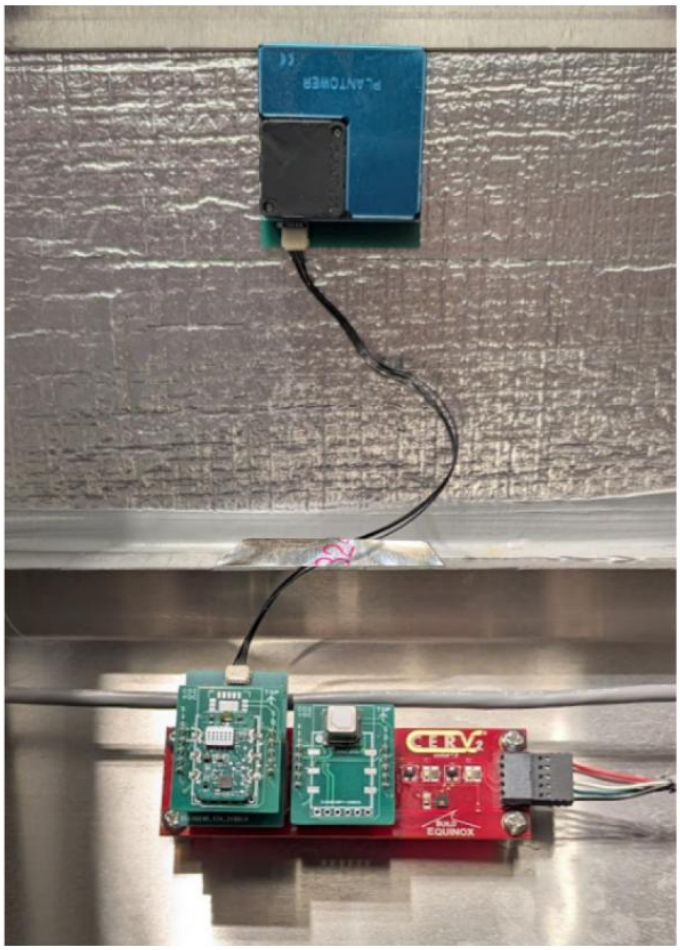


6) Plug the removed sensor module into the particulate sensor connector board. Ensure that the pins of the board plug correctly into the pins of the socket below (i.e. not offset), and the module is oriented properly with the arrow pointing up.



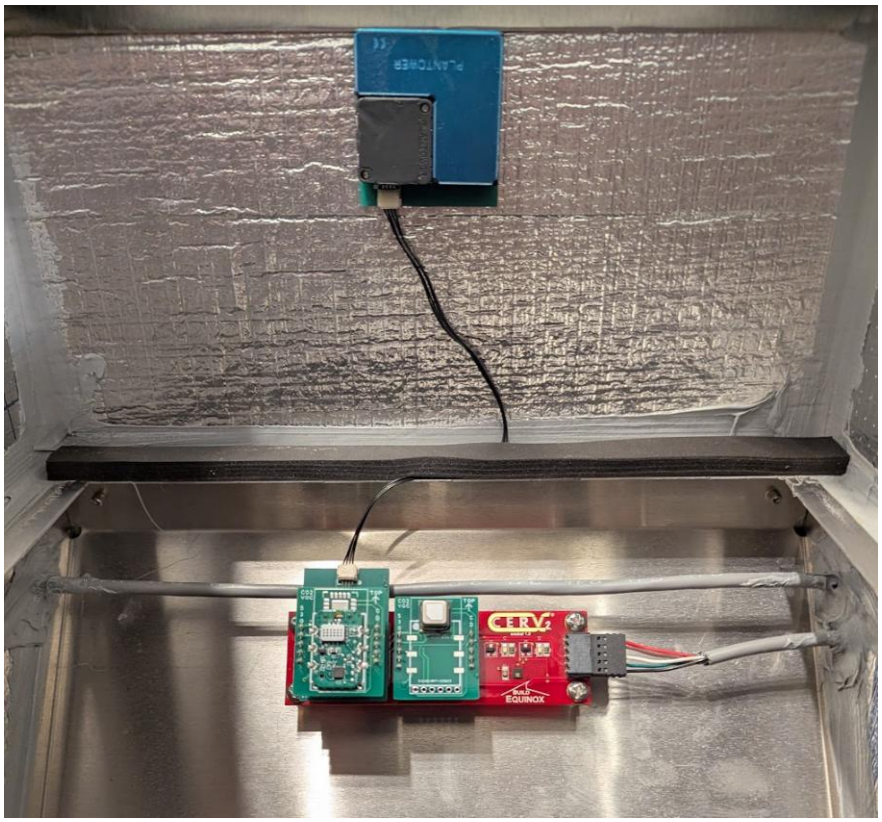
7) Remove the film from the double-stick tape on the back of the blue sensor module. Stick the sensor module to the wall directly below the return air duct aligning the top of the sensor with the bottom edge of the aluminum angle. The sensor module should be oriented as shown below with the wire connector facing downwards. If this surface appears dirty clean it with a damper paper towel and allow to dry before affixing sensor module.
8) Using the small piece of aluminum tape, cover the wire on the metal filter platform so it is flat on the surface. Make sure the wire is not too tight on either side of the tape. If this surface is dirty clean it before applying tape.



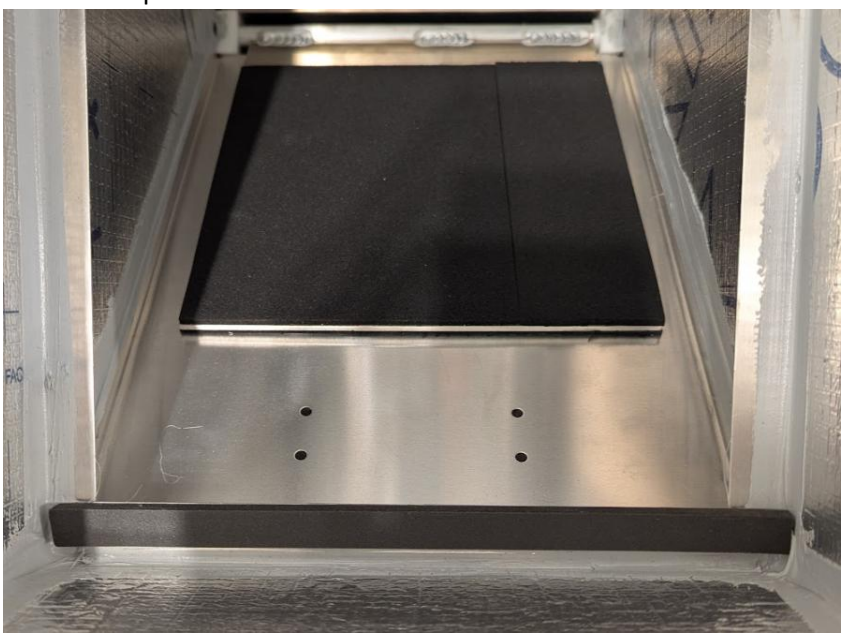


Procedure – Install Return Air Filter Gasket

1) Using a damp paper towel, wipe down all four sides of the metal filter platform to remove any dirt or debris.
2) Using one of the included alcohol wipes, wipe down the metal platform again. Let the surface air dry before proceeding to the next step.
3) Remove the film from the back of one of the short (9.75”) sections of adhesive backed foam strips and stick it on the edge of the metal filter platform (covering the wire). Align the edge of the foam strip with the edge of the metal platform as shown below.



4) Remove the film from the back of another short (9.75”) section of adhesive backed foam and stick it on the opposite edge of the metal filter platform.



5) Remove the film from the back of one of the long (18.5”) sections of adhesive backed foam and stick it on the left side of the metal filter platform. Make sure to butt it tight against the short foam strips so there are no gaps between the foam. Remove the film from the back of the other long (18.5”) section of adhesive backed foam and stick it on the right side of the metal filter platform. Butt it tight against the short foam strips.

6) Firmly press down on the top of the foam strips on all sides of the filter opening to ensure they are well adhered to the surface. This completes the installation of the Return Air Particulate Sensor. The return air filter may now be put back in place.

Particulate Sensor Module Installation – Fresh Air

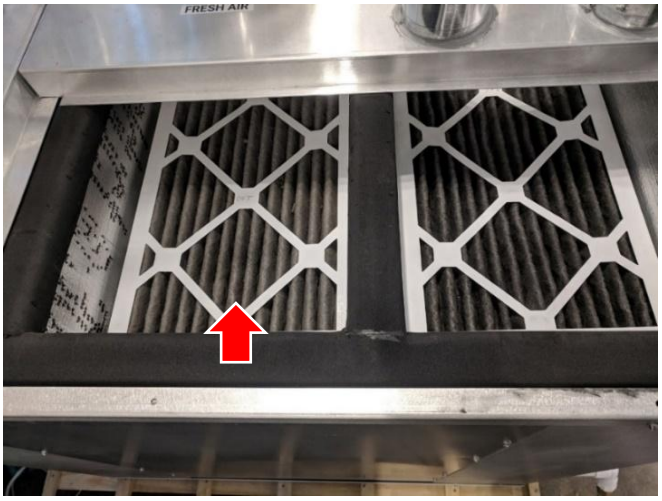
Materials needed:

- 1x Fresh Air Particulate Sensor Module (single board with sensor attached)
- 2x Adhesive Backed Foam (9.75” long ea)
- 2x Adhesive Backed Foam (18.5” long ea)
- 1x Alcohol Swab

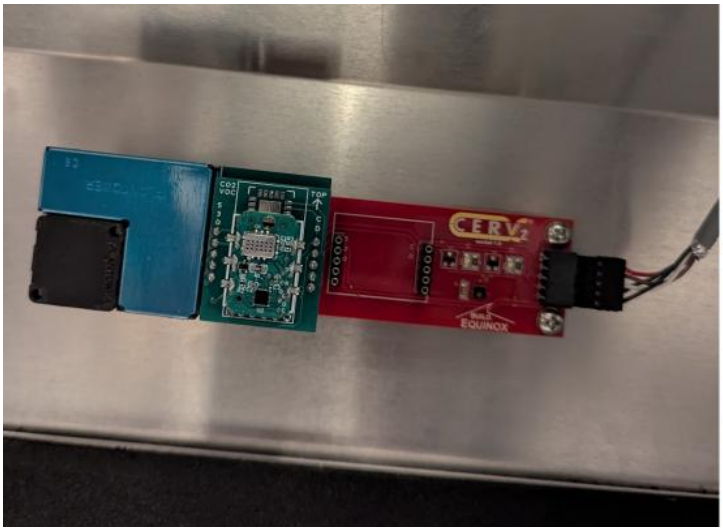
The Fresh Air Particulate Sensor installs below the fresh air filter to obtain a post filtered fresh air reading and to protect it from heavy outdoor dust and debris. This section will demonstrate how to install the sensor circuit board and the adhesive backed foam filter gasket.

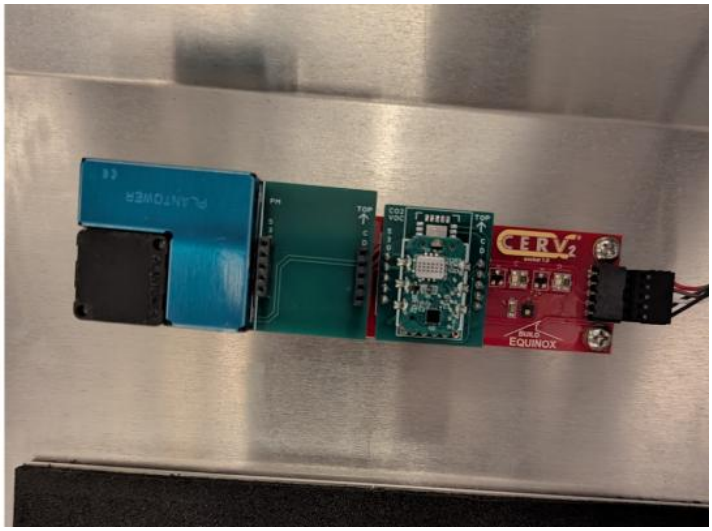
Procedure – Install Fresh Air Particulate Sensor Module

1) Power for the CERV2 should remain off and the filter access covered removed.
2) Remove the Fresh Air filter.



3) The fresh air circuit board is now visible. If an Outdoor VOC sensor option is installed, it is likely plugged into the right pin socket space. If no Outdoor VOC sensor is already installed, both sets of sockets will be open. Plug the blue Fresh Air Particulate Sensor Module into the left-most socket, as shown below. If the Particulate Defense Kit was purchased with the Outdoor VOC option included, it is pre-installed (left figure below).



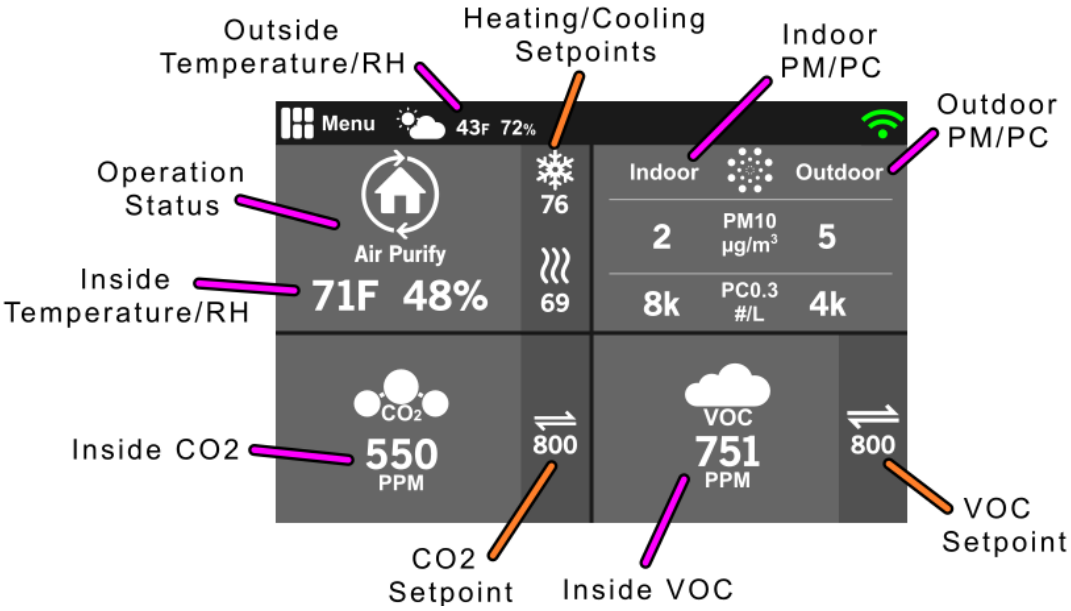


Procedure – Install Fresh Air Filter Gasket

Please follow the same steps for installing the adhesive backed foam strips from the Return Air Filter Gasket section. Replace the fresh air filter when finished.

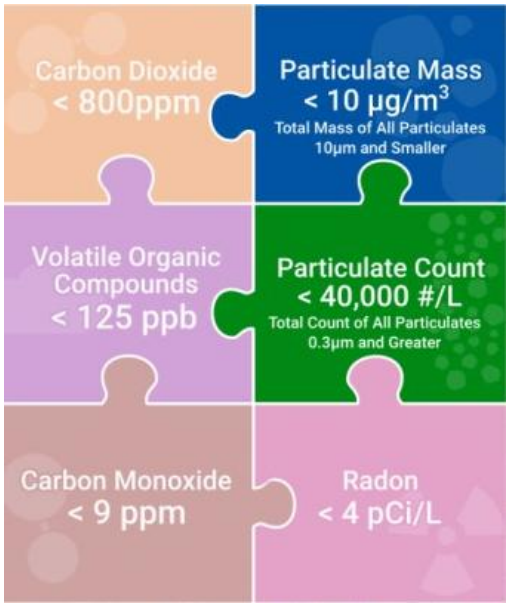
Finishing Installation

1) After completing the installation of the two particulate sensors and the filter gaskets, make sure to install both filters and secure the filter access cover back in place. Power to the CERV2 can be turned back on.
2) When the CERV2 boots into the home screen, it will begin to display both particulate mass and particulate count in the top right quadrant, as shown in the graphic below. If either of the sensors are not working properly, it will display dashes (---) instead of numbers. If dashes are shown for either indoor or outdoor sensors, turn off power to the CERV and check to ensure that sensor is properly installed.

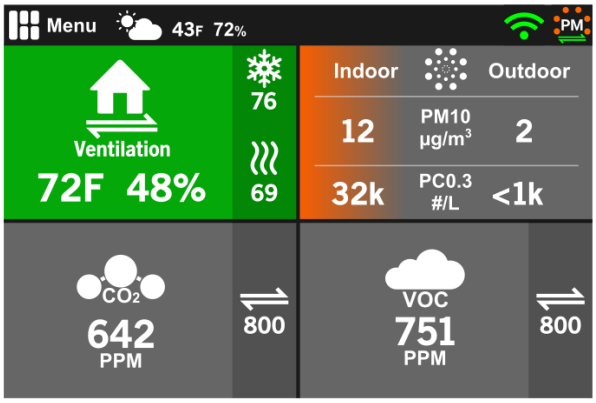


3) Once the PM sensors are working properly, affix the “Particulate Defense” sticker to the upper right front face of your CERV2 to indicate it is now equipped to mitigate and defend against elevated levels of indoor and outdoor particulate matter. Proceed to the user guide section to learn how to use this new functionality.

Indoor Particulate Reduction

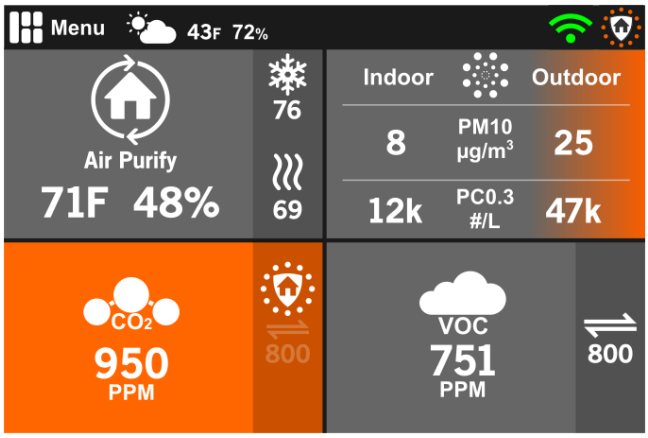


The CERV2 Particulate Defense kit integrates seamlessly with Build Equinox's IAQ Standards to ensure that your home's particulate levels are properly managed. Indoor and outdoor particulate mass (PM10) and count (PC0.3) are displayed in the upper right quadrant of the controller Home Screen.



When indoor particulate levels exceed **10 µg/m³ in mass (PM10) or 40,000 particles per liter in count (PC0.3)** - thresholds identified as poor indoor air quality (IAQ) by Build Equinox's Standards - the CERV2 activates ventilation mode. The following status icons will appear in the status bar at the top right corner of the Home Screen to indicate ventilation due to elevated inside PM or PC. The left side of the particulate data quadrant will also turn orange during this time.

Outdoor Particulate Defense

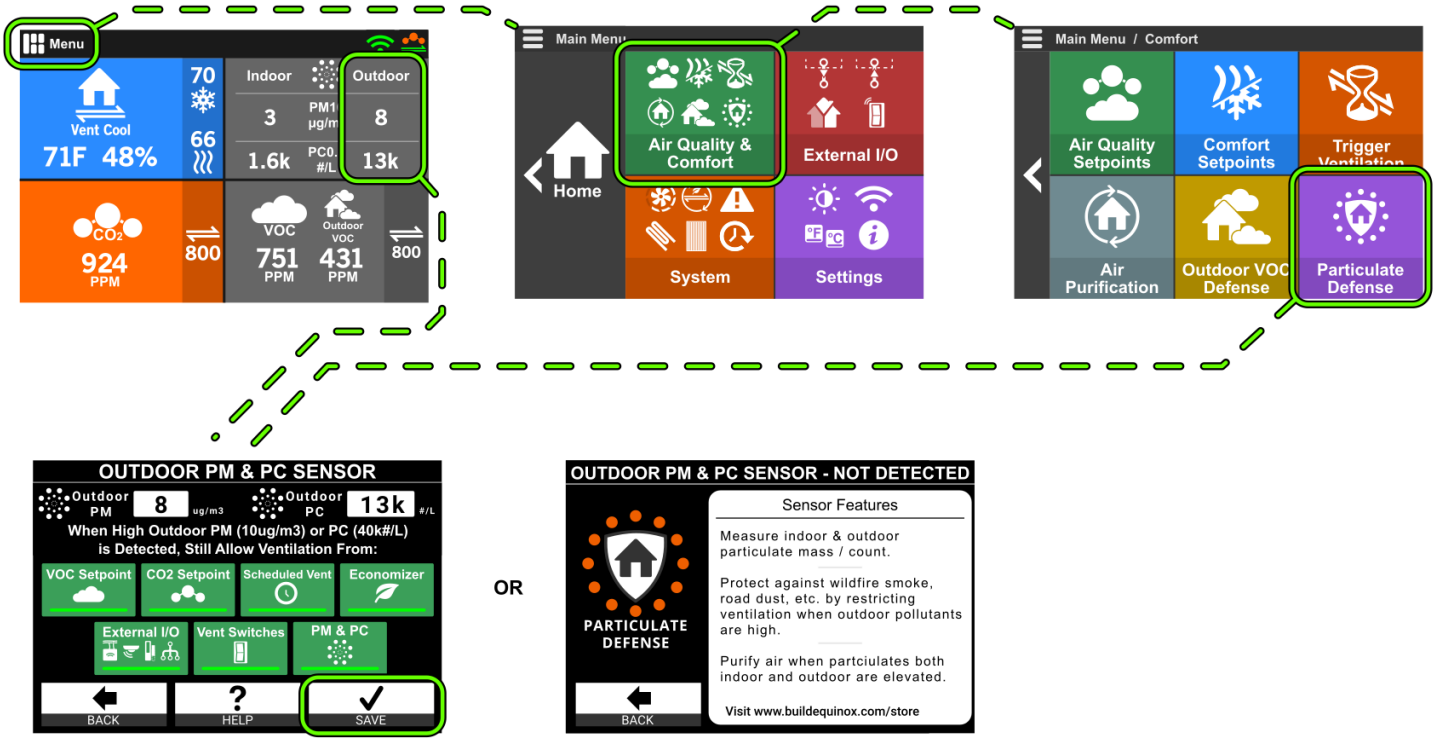


If outdoor particulate levels elevate above these same **10 µg/m³** and **40,000 #/L** limits, the CERV will enter Particular Defense Mode, and use Air Purify Mode to recirculate indoor air over its high-efficiency filters to remove the particulates. When this is active, the Status & Alerts bar will show the Particulate Defense icon, shown below.

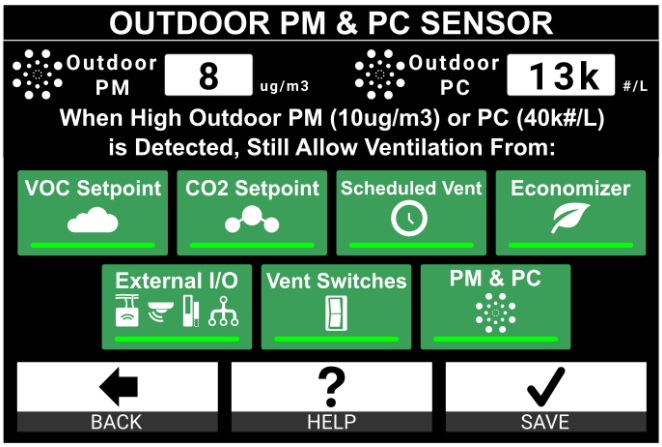
If ventilation is restricted due to the high outdoor particulates (in the case above, CO2 Setpoint is disabled during high outdoor particulate events), the icon will show above the disabled setpoint.

Configuration

Outdoor Particulate Defense can be configured to restrict certain types of ventilation when outdoor PM or PC are elevated. To access the Outdoor Particulate Defense Configuration Screen, follow the diagram shown below. It can be accessed either by the shortcut on the home screen, or through the main menu.



The control screen shown below will be displayed showing the current outdoor PM and PC levels and toggle buttons for the CERV2's various ventilation trigger modes. When outdoor particulates are high, the CERV will only allow ventilation due to the sources that are enabled (green) and prevent ventilation due to disabled sources (gray). Below the control screen is a full list and description of the ventilation mode controls.

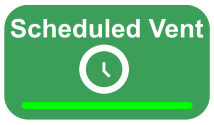


VOC Setpoint Allowed - If outdoor particulates are high:
CERV still ventilates to keep indoor VOCs below setpoint. Remote VOC sensors can still trigger ventilation.

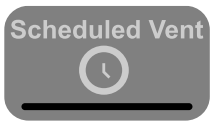
VOC Setpoint Restricted - If outdoor particulates are high:
The CERV will not ventilate due to high indoor VOC levels. Remote VOC sensors do not trigger ventilation.

CO2 Setpoint Allowed - If outdoor particulates are high:
CERV still ventilates to keep indoor CO2 below setpoint. Remote CO2 sensors can still trigger ventilation.

CO2 Setpoint Restricted - If outdoor particulates are high:
The CERV will not ventilate due to high indoor CO2 levels. Remote CO2 sensors do not trigger ventilation.



Scheduled Ventilation Allowed - If outdoor particulates are high:
A ventilation schedule (ex. Vent 10 min every hour) still allows the CERV to vent periodically.



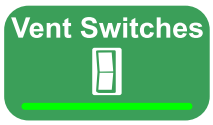
Scheduled Ventilation Restricted - If outdoor particulates are high:
The CERV will not ventilate due to scheduled ventilation.

Economizer Allowed - If outdoor particulates are high:
If outdoor temperature and relative humidity are beneficial, the CERV may ventilate to help heat or cool.

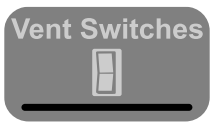
Economizer Restricted - If outdoor particulates are high:
The CERV will not ventilate to help boost heating or cooling.

External I/O Allowed - If outdoor particulates are high:
Status Monitors (ACT, motion detectors, etc), auxiliary inputs, and remote RH sensors may trigger ventilation.

External I/O Restricted - If outdoor particulates are high:
Status Monitors (ACT, motion detectors, etc), auxiliary inputs, and remote RH sensors will not trigger ventilation.

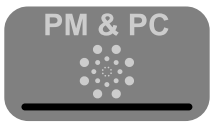


Vent Switches Allowed - If outdoor particulates are high:
Triggering a wireless ventilation switch will cause the CERV to ventilate for the configured amount of time.



Vent Switches Restricted - If outdoor particulates are high:
Wireless ventilation switches will not trigger the CERV to ventilate.

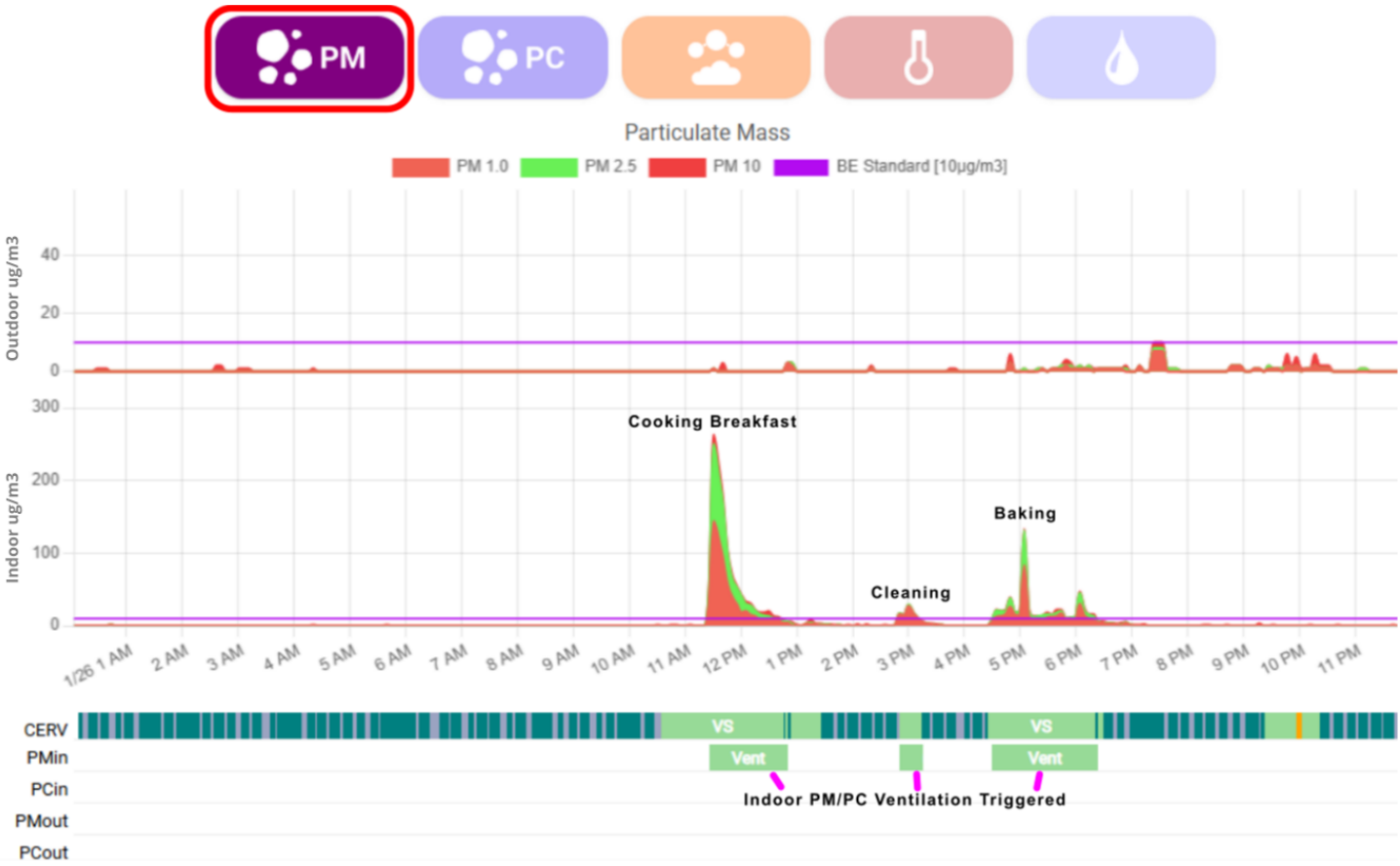
Indoor PM / PC Sensor Allowed - If outdoor particulates are high:
Indoor particulate sensor will trigger ventilation when the indoor PM or PC is high (PM10 > 10 µg/m³ or PC0.3 > 40,000 #/L).



Indoor PM / PC Sensor Restricted - If outdoor particulates are high:
If outdoor particulates are higher than indoor particulates, the CERV will not ventilate. If indoor particulates are higher than outdoor particulates, the CERV will still ventilate to reduce indoor particulates.

CERV-ICE Historical Data

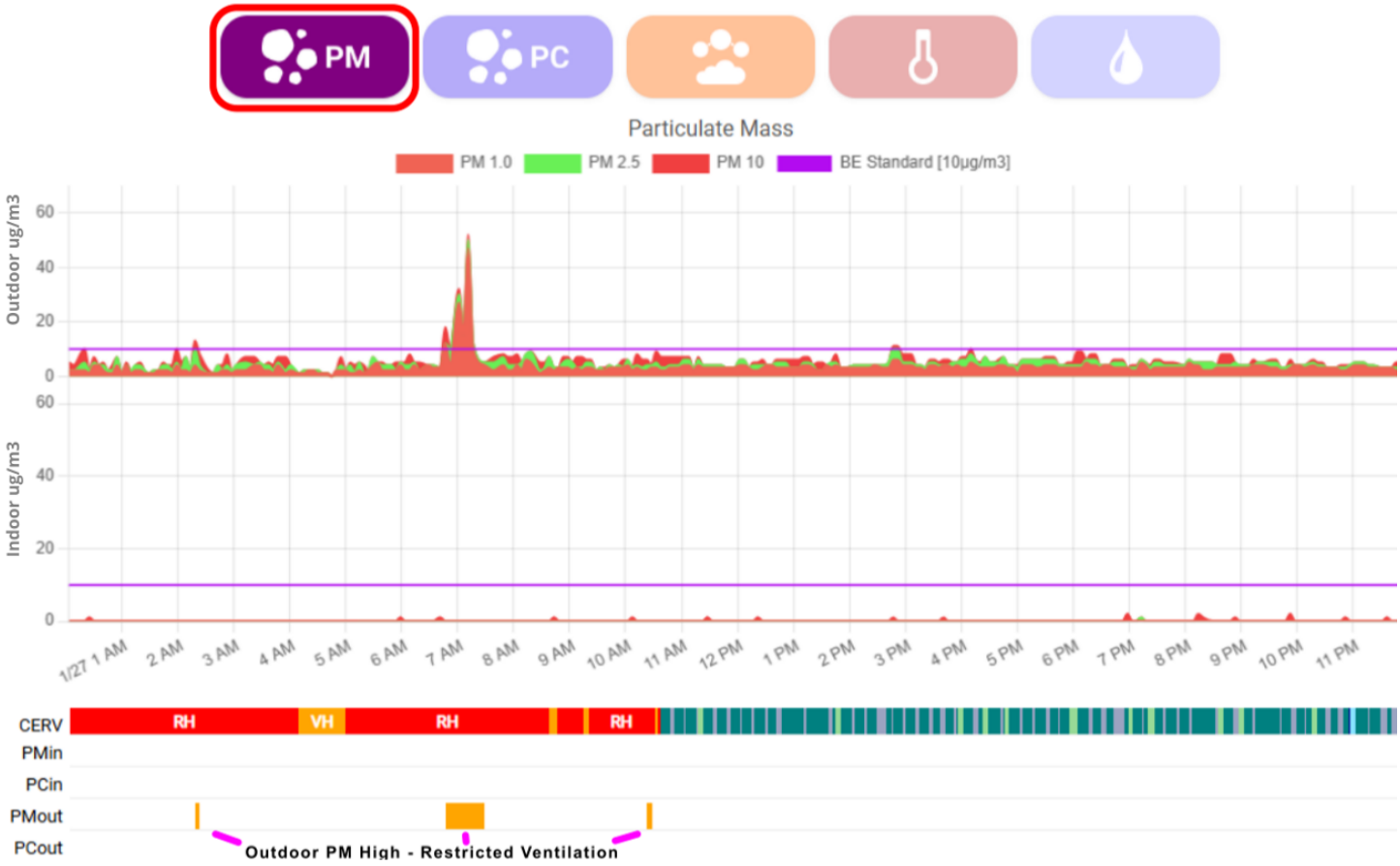
With the CERV2 Particulate Defense kit installed, historical particulate sensor data can be viewed on CERV-ICE. In CERV-ICE's Historical Data section is an option to view plots for PM (particulate matter) or PC (Particulate Count). These charts not only show the total PM and PC levels, but also break down the particulate composition into size groups. For Particulate Mass, the bins are: 1.0, 2.5, and 10 microns. For Particulate Count, the bins are: 0.3, 0.5, 1.0, 2.5, 5.0, and 10.0 microns. Example plots are shown below.



The top half of the chart above shows particulate data for the outdoor sensor, and the bottom half shows particulate data for the indoor sensor. Both charts additionally show a purple horizontal line, which indicates the Build Equinox IAQ maximum recommended level for PM and PC (PM10: 10 µg/m³ or PC0.3: 40,000 #/L).

Under the chart are CERV and PM / PC Activity Bars – composed of PMin, PCin, PMout, and PCout. When these horizontal bars show activity, that indicates the sensors were triggered. For the case of indoor particulate mass and count, PMin and PCin, activity would mean that the CERV is ventilating to reduce indoor particulates as described earlier in the **Indoor Particulate Reduction** section. These events often align with activity in the home such as cooking, cleaning, burning a candle, etc. In the above chart the green periods in the PMin activity bar show that indoor particulate levels triggered the CERV to ventilate.

For the case of outdoor particulate mass and count, PMout and PCout, activity indicates that outdoor particulates are high and the CERV could be in a restricted ventilation mode (as defined by the user settings in the previous **Outdoor Particulate Defense** section). In the case below, the orange bars show times when outdoor PM was above the limit to restrict venting.



For more examples of both indoor and outdoor particulate defense, see our article: [Unveiling CERV2 Particulate Defense: See How It Shields your Home Against Dangerous Indoor & Outdoor Particulates]