Display Navigation Guide
TotalSense Series

Senva Sensors
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Beaverton, OR 97008

TotalSense™ Series

154-0042-0A

Rev.	Release Date	By	Description of Change	ECR
0A		NAK	Initial Release	---

Contents

See Also:

152-0401	TotalSense Installation Instructions

154-0043	TotalSense BACnet Protocol Guide

154-0044	TotalSense Modbus Protocol Guide

Display Navigation

Congratulations on installing your new Senva TotalSense Air Quality Sensor! This OLED Parameter Map assumes the first stage of installation is complete, with the TotalSense connected and powered.   The OLED display should show the home screen when any button is pressed. If you see a lock icon, hold the up and down arrows for 5 seconds to unlock.
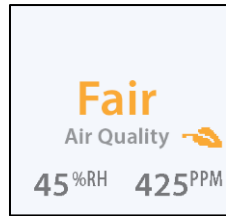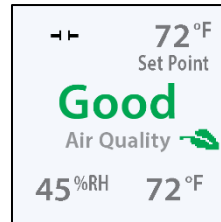

Figure 1: Default Home Display   *Figure 2: Sample Display*

If you see a lock icon, hold the up and down arrows for 5 seconds to unlock.
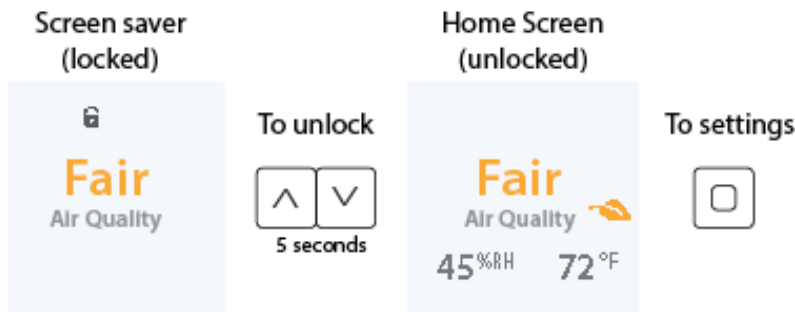
To change any setting, press enter to see setup menu and navigate to desired parameter and press enter again to choose. For example, to adjust display parameters, access the setup menu by pressing the 'enter' button once to access the setup and once more to access the "display" menu and then select "center display".
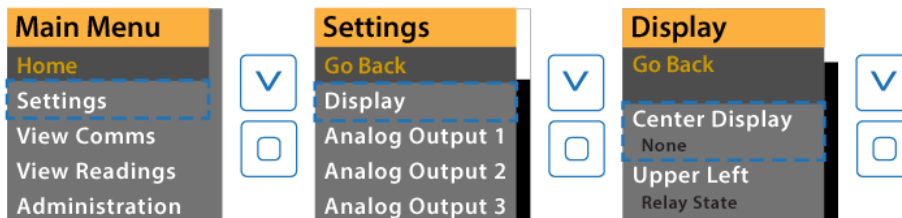
Select your value for center display and then select "go back" until you are back at the home screen.
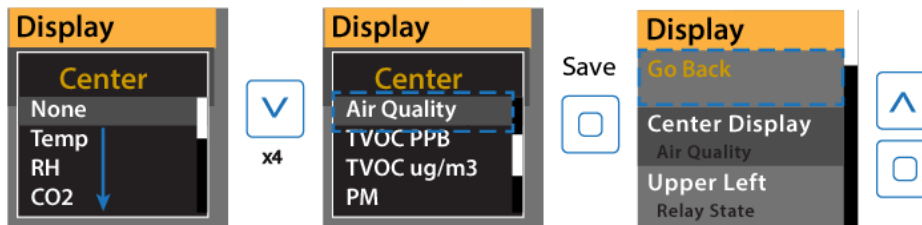
To adjust a numerical setting, set each digit individually and press enter to move cursor to the left. When all digits are set, the value will be saved when enter is pressed again.

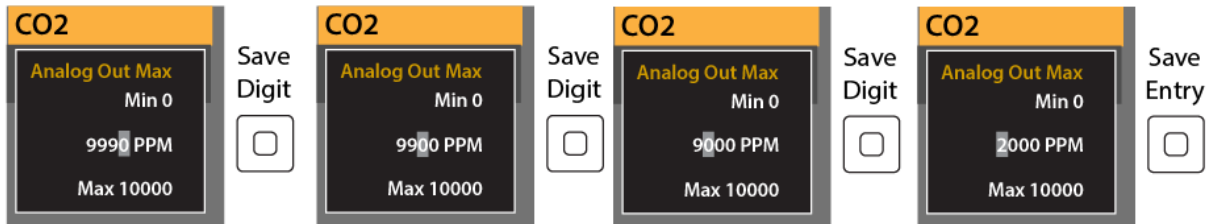| CO2	Save Digit	CO2	Save Digit	CO2	Save Digit	CO2	Save Entry
Analog Out Max Min 0 9990 PPM Max 10000	☐	Analog Out Max Min 0 9900 PPM Max 10000	☐	Analog Out Max Min 0 9000 PPM Max 10000	☐	Analog Out Max Min 0 2000 PPM Max 10000	☐
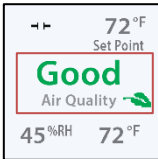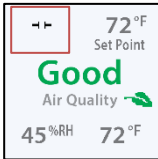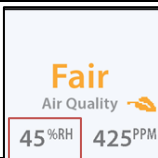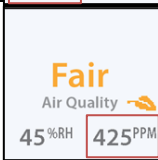
To view comms, navigate to "view comms" in the main menu.

Main Menu		View Comms	Scroll

Home
Settings
View Comms
View Readings
Administration
	☐	Go Back
		
		Protocol
		  Modbus RTU
		Baud
		  115200
			∨
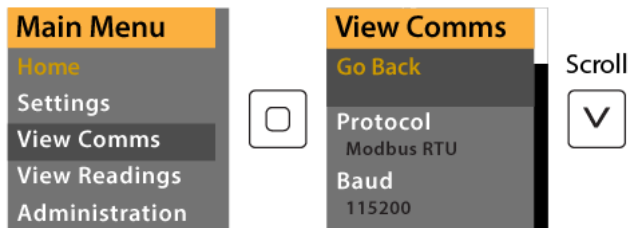
To view current readings without configuring display, navigate to "view readings" in the main menu.

Main Menu		View Readings	Scroll

Home
Settings
View Comms
View Readings
Administration
	☐	Go Back
		
		CO2
		  887 PPM
		Barometric Pressure
		  29.92 in/Hg
			∨

Display Settings

Parameter	Description	Selections	Functionality
Display Settings > **Center**	*Choose the value to show in the center of the display*	None	No value will be shown.
		Temp	Current temperature reading will be shown. Choose F or C in **Temp Settings.**
		RH	Current relative humidity reading value will be shown (%).
		CO2	Current CO2 reading will be shown (PPM).
		Air Quality (default)	Good air quality (green), Fair air quality (yellow), or poor (red) air quality will be displayed when inactive based on **Air Quality Thresholds.**
		TVOC PPB	Current TVOC reading will be displayed in center (PPB).
		TVOC µg/m^3	Current TVOC reading will be displayed in center (µg/m^3). Readings over 999 will be shown as mg/m^3.
		PM	PMx value will be displayed in center (µg/m^3). Choose particle size in **PM Settings**. Readings over 999 will be shown as mg/m^3.
		Slider Setpoint	Value corresponding to position of slider set point will be displayed in center. Slider range can be adjusted in Slider Settings. Choose F or C in **Temp Settings**
Display Settings > **Upper Left**		None (default)	Nothing will be shown in the upper left corner of display.
		Relay State Icon	Relay state will be shown either open (as pictured in Figure 2) or closed, depending on Relay Settings and current status.
Display Settings > **Upper Right**		None (default)	No value will be shown.
		See center	Options described in display settings > Center. Air Quality is not an option for this corner.
Display Settings > **Lower Left**		None	No value will be shown.
		See center (default: RH if present)	Options described in display settings > Center. Air Quality is not an option for this corner.
Display Settings > **Lower Right**		None	No value will be shown.
		See center (default: CO2 if present)	Options described in display settings > Center. Air Quality is not an option for this corner.
Display Settings >		Enable	Screen lock mode will initiate after 60s of inactivity. Screen saver will be shown until device is unlocked by holding the up and down buttons for 5s.

Parameter	Description	Selections	Functionality
Screen Lock	*Lock out access to home screen and settings*	Disable (default)	Display will show home screen when any button is pressed.
Display Settings > **Screen Saver**	*Choose what to display when inactive*	Off	Display will turn off after 60s if inactivity. No screen saver will be displayed. Screen will remain blank until any button is pushed.
		Leaf Icon	The AQ leaf icon will be displayed when inactive in either green, yellow, or red depending on **Air Quality Thresholds.**
		Air Quality (default)	Good air quality (green), Fair air quality (yellow), or poor (red) air quality will be displayed when inactive based on **Air Quality Thresholds.**
		CO2 reading	Current CO2 reading will be displayed in PPM.
		Temp reading	Current Temp reading will be displayed in either °F or °C. See **Temp Settings.**
		RH reading	Current RH reading will be displayed in %.
		All Display Selections	Display will cycle through all present sensor readings that are chosen to be displayed on the main screen. See parameters: Center, Upper right, Lower Left, and Lower Right.
		All Readings	Display will cycle through all present sensor readings from this list: temp, RH, CO2, TVOC, PM, and Air Quality.
Display Settings > **Backlight**	*Adjust brightness of screen*	10-90% (default 90%)	Adjust value to increase or decrease brightness of display.

Analog Parameters

Parameter	Description	Selections	Functionality
Analog Out 1 > **Source**	*Analog out 1 reading (terminals O1 or O2)* *Default will be set to first available sensor in this order: CO2, TVOC, RH, Temp, slider*	None	No signal will be generated
		CO2	CO2 reading will be output by analog output 1. Adjust output scale in PPM in **CO2 Settings**.
		RH	Relative humidity reading will be output by analog output 1. Adjust output scale in % in **RH Settings.**
		Temp	Temp reading will be output by analog output 1. Adjust output scale in PPM in **Temp Settings**.
		TVOC	TVOC reading will be output by analog output 1. Adjust output scale in PPM in **TVOC Settings**.
		Temp Slider	Slider reading will be output by analog output 1. Adjust output scale in PPM in **Slider Settings**. Please note this reading is in addition to a resistive reading that can be read on "slider" terminals.
Analog Out 1 > **Min V**	*Min voltage output for O1*	0-10V (default 0V)	This value corresponds to the lowest point on an analog scale. For a 0-10V signal, set to 0V. For a 2-10V signal, set to 2V. This will override any analog dip switch settings.
Analog Out 1 > **Max V**	*Max voltage output for O1*	0-10V (default 10V)	This value corresponds to the highest point on an analog scale. For a 0-10V signal, set to 10V. For a 0-5V signal, set to 5V. This will override any analog dip switch settings.
Analog Out 1 > **Min A**	*Min current output for O2*	0-20mA (default 4mA)	This value corresponds to the lowest point on an analog scale. For a 4-20mA signal, set to 4mA. For a 0-20mA signal, set to 0mA.
Analog Out 1 > **Max A**	*Max current output for O2*	0-20mA (default 20mA)	This value corresponds to the highest point on an analog scale. For a 0-20mA or 4-20mA signal, set to 20mA.

Settings for Analog Out 2 (four outputs O3 and O4) and Analog Out 3 (for outputs O5 and O6) will have the same options as shown above.

- *Default source setting for analog out 2 (if at least 2 of 'source' sensors are present) is first available sensor in this order: TVOC, RH, Temp, slider.*
- *Default source setting for analog out 3 (if at least 3 of 'source' sensors are present) is first available sensor in this order: RH, Temp, slider.*

Source Parameters

CO2 Settings

Parameter	Description	Selections	Functionality
CO2 Settings > **Cal Offset**	*Adjust CO2 reading*	-250 to 250 PPM (default 0 PPM)	Offset CO2 reading by ±250 PPM.
CO2 Settings > **Range L**	*Min PPM scale for CO2 analog*	0-10,000 PPM (default 0 PPM)	This value corresponds to the lowest point on an analog scale for a CO2 reading. This will correspond to any analog output that has CO2 selected as a source in **Analog Parameters**.
CO2 Settings > **Range H**	*Max PPM scale for CO2 analog*	0-10,000 PPM (default 2,000 PPM)	This value corresponds to the highest point on an analog scale for a CO2 reading. This will correspond to any analog output that has CO2 selected as a source in **Analog Parameters**.
CO2 Settings > **Auto-Calibration Disable**	*Enable ABC*	Enable (default), Disable (default if dual channel CO2 is selected)	Enable or disable ABC function for CO2 sensor calibration. It is not recommended to disable this unless you are using a dual channel CO2 element.
CO2 Settings > **Auto-Calibration**	*Baseline value for ABC*	300-1000 PPM (default 400 PPM)	This sets the baseline value for the automatic baseline calibration. This should correspond to expected "unoccupied" levels of CO2.
CO2 Settings > **Auto-Calibration Period**	*Period ABC uses to calibrate*	1-15 days (14 default)	This sets the period for which ABC will calculate its unoccupied level and calibrate.

PM Settings

Parameter	Description	Selections	Functionality
PM Settings > **PM Size**	*Choose particle size for analog and display*	1.0, 2.5 (default), 4.0, 10.0	Each selection will display particle count for all measurable particles less than selected size (minimum size is 0.3µm). For example, PM2.5 will show particle count for particles sized 0.3-2.5µm.

RH Settings

Parameter	Description	Selections	Functionality
RH Settings > **Cal Offset**	*RH offset*	-5 to 5% (default: 0)	Adjust RH reading by up to 5%.
RH Settings > **Analog Out Min**	*Min scale for RH analog*	0-100% (default: 0%)	This value corresponds to the lowest point on an analog scale for a RH reading. This will correspond to any analog output that has RH selected as a source in **Analog Parameters**.
RH Settings > **Analog Out Max**	*Max scale for RH analog*	0-100% (default: 100%)	This value corresponds to the highest point on an analog scale for a RH reading. This will correspond to any analog output that has RH selected as a source in **Analog Parameters**.

Temp Settings

Parameter	Description	Selections	Functionality
T Settings > **Unit**	*T units*	°F (default), °C	Select whether display shows degrees Fahrenheit or Celsius
T Settings > **Cal Offset**	*T offset*	-5 to 5°C (default: 0)	Adjust T reading by up to 5°C (or 9°F).
T Settings > **Analog Out Min**	*Min scale for T analog*	-40 to 122°F (default: 50°F)	This value corresponds to the lowest point on an analog scale for a temp reading. This will correspond to any analog output that has temp selected as a source in **Analog Parameters**.
T Settings > **Analog Out Max**	*Max scale for T analog*	-40 to 122°F (default: 95°F)	This value corresponds to the highest point on an analog scale for a temp reading. This will correspond to any analog output that has temp selected as a source in **Analog Parameters**.

TVOC Settings

Parameter	Description	Selections	Functionality
TVOC Settings > **Analog Out Min**	*Min scale for TVOC analog*	0-5000 $\mu g/m^3$ (default: 0 $\mu g/m^3$)	This value corresponds to the lowest point on an analog scale for a TVOC reading. This will correspond to any analog output that has TVOC selected as a source **Analog Parameters**.
TVOC Settings > **Analog Out Max**	*Max scale for TVOC analog*	0-5000 $\mu g/m^3$ (default: 2000 $\mu g/m^3$)	This value corresponds to the highest point on an analog scale for a TVOC reading. This will correspond to any analog output that has TVOC selected as a source in **Analog Parameters**.

Parameter	Description	Selections	Functionality
TVOC Settings > **TVOC Scale**	*Scale factor for TVOC reading*	0.000 to 10.000 (default: 1.000)	This value can be used to adjust the TVOC reading. The standard readings are based on an Ethanol equivalent. See "TVOC Molecular Weights" section for more information.

Slider Settings

Parameter	Description	Selections	Functionality
Slider Settings > **Analog Out Min**	*Min scale for slider analog and display*	-40 to 122°F (default: 50°F)	This value corresponds to the lowest position of the slider and, if using slider as analog output, the minimum analog point. This will correspond to any analog output that has temp slider selected as a source in **Analog Parameters**. This will not affect the slider resistive output.
Slider Settings > **Analog Out Max**	*Max scale for slider analog and display*	-40 to 122°F (default: 95°F)	This value corresponds to the highest position of the slider and, if using slider as analog output, the maximum analog point. This will correspond to any analog output that has temp slider selected as a source in **Analog Parameters**. This will not affect the slider resistive output.

Relay Settings

Parameter	Description	Selections	Functionality
Relay Settings > **Source**	*Which measurement will activate setpoint relay*	None	Relay will never change from "normal" state.
		CO2 (default)	Relay will change state when CO2 reading exceeds Turn-On value, set as a %.
		RH	Relay will change state when RH reading exceeds Turn-On value, set as a %.
		Temp	Relay will change state when Temp reading exceeds Turn-On value, set as a %.
		TVOC	Relay will change state when TVOC reading exceeds Turn-On value, set as a %.
		PIR	Relay will change state when PIR senses motion.
		Air Quality	Relay will change state when any sensor reading exceeds "fair" thresholds described in Error! Reference source not found..
Relay Settings > **Turn On**	*Threshold for relay activation*	0-100.00% (default: depends on source selection)	Based on full scale range of the selected sensor, set the value above which the relay will activate. For example, if CO_2 is selected, its full available range is 0-10,000 PPM, so a setpoint of 800 PPM would correspond to an 8.00% threshold setting. For temperature, the full range is -40 to 122°F, so a setpoint of 70°F would correspond to a threshold value of 68%. Use this equation to determine threshold setting for temp in °F: (T+40)/162*100. This setting is ignored for PIR and G/F source selections. Display will show the calculated value as you adjust this setting. The below shows the values that are set by default when each source is selected as well as the calculated value for each.

Source Selection	Range	Default Turn-on Threshold	Calculated Turn-on value	Default Turn-off Threshold	Calculated Turn-off value
CO2	0-10,000 PPM	8.0%	800 PPM	7.0%	700 PPM
RH	0-100% RH	60%	60% RH	55%	55% RH
Temp*	-40 - 122 °F	74%	80°F	73%	78°F
TVOC	0-10000 µg/m^3	4.0%	400 µg/m^3	3.5%	350 µg/m^3

Parameter	Description	Selections	Functionality
Relay Settings > **Turn Off**	*Threshold for relay deactivation*	0-100.00% (default: depends on source selection)	Based on full scale range of the selected sensor, set the value below which the relay will de-activate. For example, to deactivate relay when CO_2 setting reaches 790, set this threshold value to 7.90%.
Relay Settings > **Polarity**	*N.O./N.C. selection*	N.O. (default), N.C.	A N.O. (normally open) relay will be in the open state until it is activated, i.e., turn-on threshold is met, at which time it will close. A N.C. (normally closed) relay will be in the closed state until it is activated, at which time it will open.
Relay Settings > **Min On**	*Min on time*	1-240s (default: 3s)	When relay activates, it will not deactivate until this time has lapsed, regardless of the turn-off setting. The relay will deactivate only when this time has expired AND the turn-off threshold is met.
Relay Settings > **Min Off**	*Min off time*	1-240s (default: 3s)	When relay de-activates, it will not activate again until this time has lapsed, regardless of the turn-on setting. The relay will re-activate only when this time has expired AND the turn-on threshold is met.

PIR Settings

Parameter	Description	Selections	Functionality
PIR Settings > **Sensitivity**	*Adjust sensitivity of PIR motion sensor*	0-100 (default: 80)	Sensor sensitivity can be adjusted from 0-100. The default of 80 achieves the specified distance and degree. If nuisance triggers occur or a further sensing distance is required, this value can be decreased and increased accordingly. See Figure 3 for a visual representation of this sensitivity value.
PIR Settings > **Occupied Delay**	*Time PIR stays active after event*	1-120 min (default: 10 min)	This is the number of minutes the occupancy state will remain active after each motion event is detected. This applies to the "occupancy" BACnet and Modbus point as well as the output relay state, if set to PIR in Relay Settings.
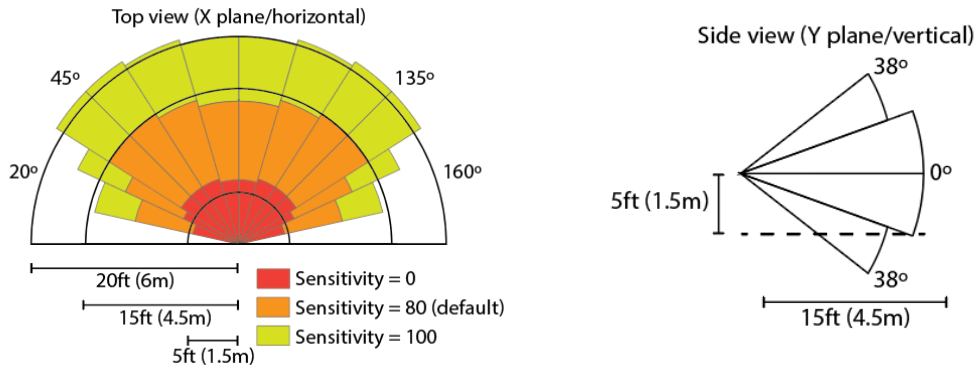
Figure 3: PIR Sensitivity

Air Quality Settings

Parameter	Description	Selections	Functionality
Air Quality Settings > **Good-Fair**	*Adjust good-to-fair threshold for air quality on display*	0-100 (default: 70)	When using the Air Quality setting in **Display Settings**, this value may be adjusted to change the threshold below which the display will show a "Fair" rating.
Air Quality Settings > **Fair-Poor**	*Adjust fair-to-poor threshold for air quality on display*	0-100 (default: 40)	When using the Air Quality setting in **Display Settings**, this value may be adjusted to change the threshold below which the display will show a "Poor" rating.

Advanced Settings & Diagnostics

Advanced Settings

Parameter	Description	Selections	Functionality
Advanced Settings > **Reset**	*Reset factory defaults*	No (default), Yes	Set to "yes" to restore all factory default settings.

Diagnostics

Parameter	Description	Status	Action
Advanced Settings > Diagnostics **> System Status**	*This will display several possible statuses in binary. All zeros indicate no errors or warnings are present.*	00000001 = EEPROM hardware fault	Consult factory.
		00000010 = EEPROM data corruption	Consult factory.
		00000100 = EEPROM write error	Consult factory.
		00001000 = Device is currently using factory defaults	Reset to factory defaults. Consult factory.
		00010000 = Sensor alert	See individual sensor statuses for more information. **Bolded** statuses will trigger this alert.
Advanced Settings > Diagnostics **> CO2 Status**	*This will display several possible statuses in binary. All zeros indicate no errors or warnings are present.*	**00000001 = Sensor hardware fault**	Consult factory.
		00000010 = Sensor data error	Consult factory.
		00000100 = Sensor not Ready	Consult factory.
		00001000 = Pressure Compensation not applied	No action necessary. Default value (101kPA) is used for pressure compensation.

Parameter	Description	Status	Action
Advanced Settings > Diagnostics > **RH Status**	*This will display several possible statuses in binary. All zeros indicate no errors or warnings are present.*	**00000001 = Sensor hardware fault**	Consult factory.
		00000010 = Sensor data error	Consult factory.
Advanced Settings > Diagnostics > **Temp Status**	*This will display several possible statuses in binary. All zeros indicate no errors or warnings are present.*	**00000001 = Sensor hardware fault**	Consult factory.
		00000010 = Sensor data error	Consult factory.
Advanced Settings > Diagnostics > **TVOC Status**	*This will display several possible statuses in binary. All zeros indicate no errors or warnings are present.*	**00000001 = Sensor hardware (I2C) fault**	Consult factory.
		00000010 = Sensor error (bad initialization range)	Consult factory.
		00000100 = Sensor error (Gas timeout)	Consult factory.
		00001000 = Sensor error (other) error	Consult factory.
		00010000 = Training cycle not complete	No action necessary. Sensor is in "training mode". This may take up to 7 days. See Installation Manual for explanation.
		00100000 = Sensor not ready (4-minute warmup)	No action necessary. Please wait for the 4-minute warm up period to expire.
		01000000 = Temperature compensation not applied	No action necessary. Default value (25C) is used for temperature compensation.
		10000000 = Pressure compensation not applied	No action necessary. Default value (101kPA) is used for pressure compensation.
Advanced Settings > Diagnostics	*This will display several possible*	**00000001 = Sensor communication error**	Consult factory.

Parameter	Description	Status	Action
> PM Status	*statuses in binary. All zeros indicate no errors or warnings are present.*	**00000010 = Sensor Data Error**	Consult factory.
		00000100 = Sensor not ready	Consult factory.
		00001000 = Sensor fan speed warning	Warning only. No action necessary.
		00010000 = Sensor fan failure	Consult factory.
		00100000 = Sensor laser failure	Consult factory.
Advanced Settings > Diagnostics **> Pressure Status**	*This will display several possible statuses in binary. All zeros indicate no errors or warnings are present.*	**00000001 = Sensor hardware fault**	Consult factory.
		00000010 = Sensor data error	Consult factory.
		00000100 = Sensor not ready	Consult factory.

Air Quality Thresholds

If Air Quality is selected in Display Settings, the device will monitor each CO2, TVOC, PM, RH, and Temp sensor present and will display accordingly. The device will calculate an average air quality based on up to 5 sensors and display good, fair, or poor accordingly.

Sensor	Good	Fair	Poor
PM2.5	<35 µg/m^3	35-55 µg/m^3	>55 µg/m^3
TVOC	<1000 µg/m^3	1000-3000 µg/m^3	>3000 µg/m^3
CO2	<1200 PPM	1200-2000 PPM	>2000 PPM
Temp	64-79F	<64, >79F	
RH	30-60%	<30%, >60%	<10%, >90%

The average air quality is calculated as follows:

1. Each reading is rated according to the above thresholds and given an air quality rating. For each sensor, a good rating is given 90%, fair is given 60% and poor is given 0% air quality.

2. The average of all sensors' air quality is calculated.

3. The average air quality is assigned based on the following thresholds. These thresholds can be adjusted in AV28 Good-fair and AV29 fair-poor.

    a. Good ≥ 75

    b. 55 < Fair < 75

    c. Poor ≤ 55

TVOC Molecular Weights

Senva's TVOC sensor uses an Ethanol reading to determine a raw TVOC value. Additionally, conversion from µg/m^3 uses the molecular weight of Ethanol. To scale based on a different gas baseline, choose the appropriate gas from the list below and enter the scale factor in **TVOC Settings.**

Please note that the sensor is measuring TOTAL VOCs, so adjusting the scale factor will not necessarily result in a gas-specific reading unless, in special cases, that is the only expected VOC present in the area. It is recommended to use the 1.0 scale factor in most cases. The RESET standard suggests calculating TVOC based on the molecular weight of Isobutelyne (scale factor: 1.218).

Data Source: http://aqt-vru.com/emissions/complete-list-of-vocs/

Contamination	Name	Molecular Weight	Scale factor
ACETYLENE	ACETYLEN	26.04	0.565
FORMALDEHYDE	FORMALD	30.03	0.652
METHANOL	MEOH	32.04	0.695
PROPANE	PROPANE	44.1	0.957
ETHANOL	ETOH	46.07	1.000
DIMETHYL ETHER	ME-O-ME	46.07	1.000
METHYL CHLORIDE	CH3-CL	50.49	1.096
1,3-BUTADIENE	13-BUTDE	54.09	1.174
ISOBUTENE	ISOBUTEN	56.11	1.218
N-BUTANE	N-C4	58.12	1.262
ISOBUTANE	2-ME-C3	58.12	1.262
ACETIC ACID	ACETACID	60.05	1.303
ISOPROPYL ALCOHOL	I-C3-OH	60.1	1.305
ETHYLENE GLYCOL	ET-GLYCL	62.07	1.347
ISOPRENE	ISOPRENE	68.12	1.479
BUTANAL	1C4RCHO	72.11	1.565
N-PENTANE	N-C5	72.15	1.566
ISOPENTANE	2-ME-C4	72.15	1.566
HYDROXY ACETONE	HOACET	74.08	1.608
ISOBUTYL ALCOHOL	I-C4-OH	74.12	1.609
BENZENE	BENZENE	78.11	1.695
TOLUENE	TOLUENE	92.14	2.000
M-XYLENE	M-XYLENE	106.17	2.305
O-XYLENE	O-XYLENE	106.17	2.305
P-XYLENE	P-XYLENE	106.17	2.305
TERPENE	TERPENE	136.24	2.957