Outdoor Air Lab Sensor

Descriptions

Duct Mount Airlab Air particle Sensor with humidity,temperature,CO2,TVOC,PM2.5,WIFI and light level sensors helps with free cooling strategies and other energy saving routines. The sensor communicates over both Ethernet and RS485, using BOTH Bacnet and Modbus protocols so there are many ways to integrate into the system.The modbus interface is documented and integrator friendly. They also have transducer outputs for connecting as analog inputs to all popular control systems.

Highlights

- sensor has a long life fan rated for > 10 years maintenance free.
- Fast Response : response time less than 10 seconds.
- Supports ModBus TCP/IP & BACnet IP protocol over WIFI.
- Supports ModBus RTU & BACnet MSTP protocol over RS485
- TVOC sensor can detect Glycerin (Vape smoke).
- The SPS30 dust sensor in the AirLab is MCERTS certified to DIN EN 15267 air quality standard.
- Advanced Measurement Principle: Utilizes laser scattering and innovativeconfamination-resistance technology for precise and reliable measurements
- Long-Term Stability: Designed to provide accurate readings throughout its lifetime ofmore than ten years
- Wide Particle Size Range: Capable of measuring PM1.0, PM2.5, PM4, and PM10particles, making it versatile for various applications
- High-Quality Components: Built with high-quality and long-lasting components toensure consistent performance

Specifications

General	
Power	15-24V +/- 10%, AC or DC,3VA@24VAC
Temperature Limt	-20~+50°C, 0~95% RH(Non condensing)
Plastic Housing	Flammability rating UL 94 file E56070
Particulate Matter Sensor Life time	8 years continuous, adjustable to decades intermittent
Communications	ModBus TCP/IP & BACnet IP protocol over WIFI ModBus RTU & BACnet MSTP protocol over RS485
TVOC Low power consumption	48 mA at 1.8V
Accuracy	
Relative Humidity	5%RH (25℃,20-80%,RH)
Temperature	<±0.5℃@25℃
CO2	±70PPM OR ±5% of reading
PM2.5	0 to 100 ug/m3 100 to 1000 ug/m3
Respouse-Time	
Relative Humidity	<10s(25℃,in slow air)
Temperature	<10s
CO2	20s
PM2.5	<8s

Range	Mass concentration range	0 to 100 ug/m³	
	Mass concentration size range	PM1.0	0.3 to1.0um
		PM2.5	0.3 to2.5um
		PM4	0.3 to4.0um
		PM10	0.3 to10.0um
	Number concentration size range	PM0.5	0.3 to 0.5um
		PM1.0	0.3 to 1.0um
		PM2.5	0.3 to 2.5um
		PM4	0.3 to 4.0um
		PM10	0.3 to10.0um
	Number concentration range	0 to 3000 1/cm³	
	Relative Humidity	0~100% non condensing	
	Temperature	-30~70℃ (-22~158 ° F)	
	CO2	0-40000PPM	
Accuracy	PM0.5 PM1 PM2.5 PM4 PM10	0 to 100 ug/m³ 100 to 1000 ug/m³	
	Relative Humidity	5%RH (25℃,20-80%,RH)	

Specifications of air quality signals are shown

Parameter	Signal	Values		Comments
Output range	TVOC signal	0 ppb to 60000 ppb		Maximum possible output range. The gas sensing performance is specified for the measurement range as defined in **Table 1**
	CO_2eq signal	400 ppm to 60000 ppm		
		Range	Resolution	
	TVOC signal	0 ppb - 2008 ppb	1 ppb	
		2008 ppb – 11110 ppb	6 ppb	
		11110 ppb – 60000 ppb	32 ppb	
	CO_2eq signal	400 ppm – 1479 ppm	1 ppm	
		1479 ppm – 5144 ppm	3 ppm	
		5144 ppm – 17597 ppm	9 ppm	
		17597 ppm – 60000 ppm	31 ppm	
Sampling rate	TVOC signal	1 Hz		The on-chip baseline compensation algorithm has been optimized for this sampling rate. The sensor shows best performance when used with this sampling rate.
	CO_2eq signal	1 Hz		

Total volatile organic compounds (TVOC) and why this quantity is related to indoor air quality (IAQ) and the so called IAQ levels. Since Sensirion's SGP gas sensor is responsive to a broad range of volatile organic compounds (VOC) and other gases relevant for indoor air quality, the present gas sensing technology is well suited for monitoring TVOC concentrations and for translating those into IAQ levels. In order to meet Sensirion's high quality standards, each SGP sensor is production calibrated.

TVOC (= Total Volatile Organic Compounds) corresponds to the sum of volatile organic co pounds (VOC1). The sum of VOC concentrations, or simply TVOC2, is used as an indication for VOC contamintation. VOC contamination is an established concept in regulatory and scientific literature. Note that the specfic TVOC composition varies between different ambient indoor environments and indoor air is always composed of different volatile organic substances3. Therefore, it is helpful to consider TVOC concentrations as statistical reference values which help to indicate indoor air quality

Indoor air quality(IAQ)Levels and how they are related to Tvoc Concentration

Level	Hygienic Rating	Recommendation	TVOC (mg/m ^{3})	TVOC (ppb)^8
5 Unhealty	Situation not acceptable	Intense Ventilation necessary	10-25	2200-5500
4 Poor	Major objections	Intensified Ventilation/ airing necessary	3-10	660-5500
3 Moderate	Some objections	Intensified Ventilation recommended	1-3	220-660
2 Good	No relevant objections	Ventilation/airing recommended	>0.3-1	65-220
1 Excellent	No objections	Target Value	<0.3	0-65

Indoor air quality Levels for Europe according to WHO

Level	Recommendation	TVOC (mg/m ^{3})	TVOC (ppb)^8
Outside quality classes	Greatly increased (not acceptable)	>3.0	>610
4	Significantly increased Only temporary exposure	1.0-3.0	200-610
3	Slightly increased (harmless)	0.5-1.0	100-200
2	Average(harmless)	0.25-0.5	50-100
1	Target value	>0.25	0-50

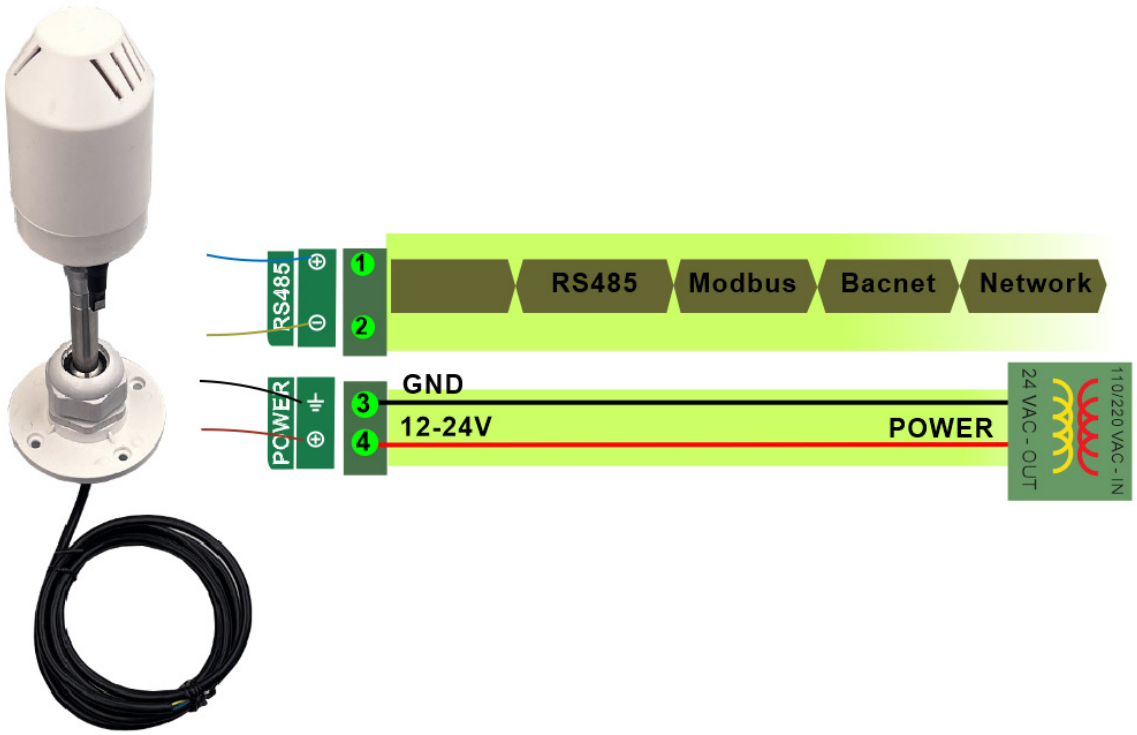
IAQ Performance Targets for ambient Tvoc Conerntration Expressed in mass concentration (ug/m³)

TVOC concentration regarding RESET target	(ug/m ³)	(ppb)[8]
Acceptable	<500	<250
High Performance	<400	<200

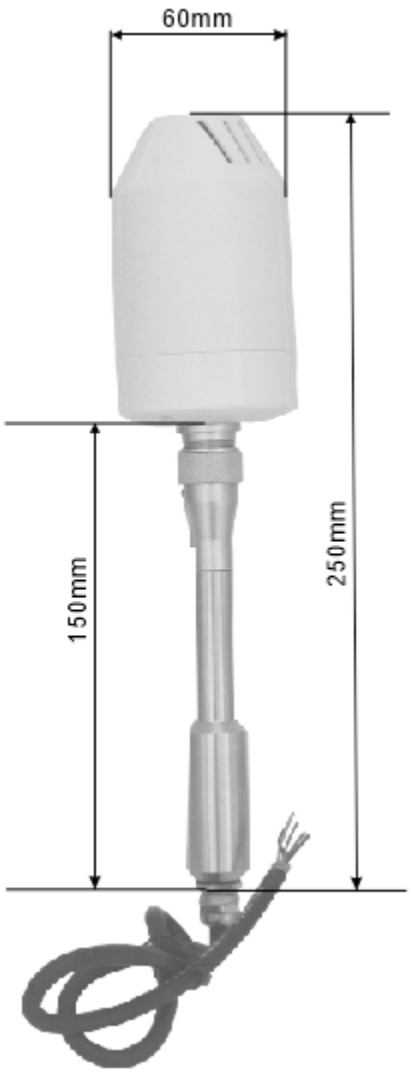
Maximum Average TVOC Concentration according to LEED Standard for Green Buildings

Green building standard LEED	(ug/m ³)	(ppb)[8]
TVOC limit	<500	<250

Wiring Diagram



Dimensions



Part Number Scheme

DUTAIR – CO2 – TVOC – W

Code	Description
DUCTAIR	Duct Mount Air Lab

Code	Description
CO2	CO2Sensor
----	No Co2 Sensor

Code	Description
W	RS485+Wifi
-	RS485

Code	Description
TVOC	Total Volatile Organic Compounds
----	NO Total Volatile Organic Compounds

Modbus Object List

Sensor	Description
0	Serial Number-4 byte value,Read-only
4	Software version-2 byte value,Read-only
6	Address,Modbus device address
7	Product Model.This is a read-only register that is used by the microcontroller to determine the product
8	[INVALID_DATA]
9	PIC firmware version
10	PIC version of humidity module
11	[INVALID_DATA]
15	
16	Firmware update register ,used to show the status of firmware updates.Writing 143 sets the config back to out of the box except for modbus ID and baud rate. Write 159 to fix the current config as the user defaults,this is done automatically by T3000 any.
20	Hardware options register,starting with LSB: Bit 0=Clock present or not ,Bit1=humidity present or not,Bit2=CO2 Sensor,Bit3=COsensor,Bit4=Motion Sensor.
104	DEGC_OR_F,engineering units,Deg C=0,Deg F=1
121	Temperature reading in Deg C or F from the sensor used in the control loop PI 1which is configured in register 111.This can be internal sensor,external,or an avergae of the two. writing a temperature value to this register will calibrate the curren.
139	CO2 ppm
140	humidity %
142	Temperature sensor filter,Fil,weighted average of stored value to new raw value
151	CO2 filer
152	hum filer
382	Sensor to be used for the PID calculations, 1=external sensor analog input 1,2=internal thermistor,3=average the internal thermistor and analog input 1
612	CO2 sensor calibration data
628	value of light sensor,unit lux
629	PIR sensor select 1=PIR sensor enable 0=PIR sensor disable
630	PIR sensor real value
631	PIR sensor ZERO value
640	Sound sensor real value,unit dbm
760	PM1.0 real value,unit ug/m3
761	PM2.5 real value,unit ug/m3
762	PM4.0 real value,unit ug/m3
763	PM10 real value,unit ug/m3
764	PM0.5 real value,unit number
765	PM1.0 real value,unit number

766	PM2.5 real value,unit number
767	PM4.0 real value,unit number
768	PM10 real value,unit number
769	Humidity sensor calibration data
805	Tvoc sensor real value,unit ppb
988	Tvoc sensor real value,unit ppb

Bacnet Object List

AI	Description
AI1	TEM： Temperature value collected by the sensor [℃/℉]
AI2	HUM： Humidity value collected by the sensor
AI3	CO2： CO2 value collected by the sensor [ppm]
AI4	TVOC： Tvoc (Total Volatile Organic Compounds) value collected by the sensor [ppb]
AI5	PM1.0DEN： Mass Concentration PM1.0 [μg/m³]
AI6	PM2.5DEN： Mass Concentration PM2.5 [μg/m³]
AI7	PM4.0DEN： Mass Concentration PM4.0 [μg/m³]
AI8	PM10DEN： Mass Concentration PM10 [μg/m³]
AI9	PM0.5C： Number Concentration PM0.5 [#/cm³]
AI10	PM1.0C： Number Concentration PM1.0 [#/cm³]
AI11	PM2.5C： Number Concentration PM2.5 [#/cm³]
AI12	PM4.0C： Number Concentration PM4.0 [#/cm³]
AI13	PM10C： Number Concentration PM10 [#/cm³]
AI14	P_size： Typical Particle Size [μm]
AI15	SOUND： Volume of sound [dB]
AI16	LIGHT： Light intensity [lm]
AI17	OCC： Occupancy
AI18	WBGT： Wet Bulb Globe Temperature

AV	Description
1	Baudrate： baud rate
2	StnNumer： station number
3	Protocol： Serial communication protocol, modbus or bacnet
4	Instance： Instance Number
5	Unit： Temperature unit 0:C 1: F
6	Trgger_S： Volume alarm trigger threshold
7	Timer_S ： Volume Alarm Timer
8	Trgger_L： Light alarm trigger threshold
9	Timer_L： Light Alarm Timer
10	Trgger_O： Occupancy alarm trigger threshold
11	Timer_O： Occupancy Alarm Timer
12	Trgger_C： CO2 alarm trigger threshold
13	Timer_C： CO2 Alarm Timer
14	TemOffset： Temperature calibration offset
15	HumOffset： Humidity calibration offset
16	CO2Offset： CO2 calibration offset
17	VOCOffset： TVOC calibration offset
18	PM1_0_D_O： Mass Concentration PM1.0 calibration offset
19	PM4_0_D_O： Mass Concentration PM2.5 calibration offset
20	PM4_0_D_O： Mass Concentration PM4.0 calibration offset
21	PM10_D_O： Mass Concentration PM10 calibration offset
22	PM0_5_C_O： Number Concentration PM0.5 calibration offset
23	PM1_0_C_O： Number Concentration PM1.0 calibration offset
24	PM2_5_C_O： Number Concentration PM2.5 calibration offset
25	PM4_0_C_O： Number Concentration PM4.0 calibration offset
26	PM10_C_O： Number Concentration PM10 calibration offset
27	TPSOffset ： Typical Particle Size calibration offset
28	SoundOffs ： Volume of sound calibration offset
29	LightOffs ： Light intensity calibration offset

AirLab Calibration Sheet

NO	Calibration items	Reference Instrument	Reference value	Calibration Method	Before Calibration	After Calibration
NO.1	Temperature	TESTO 435-2	33.7	Single Point Calibration	33.2	33.8
NO.2					33.5	33.9
NO.3					34	33.8
NO.4					32.6	33.9
NO.5					33.3	33.9
NO.6					32.4	33.7
NO.7					36.9	33.9
NO.8					34.4	33.9
NO.9					37.0	33.9
NO.10					37.9	33.9
NO.1	Humidity	TESTO 435-2	57.7	Single Point Calibration	61.3	57.3
NO.2					58.6	57.5
NO.3					58.2	57.4
NO.4					62.8	57.3
NO.5					60.4	57.4
NO.6					59.2	57.7
NO.7					49.1	57.1
NO.8					55.9	57.3
NO.9					48.7	57.2
NO.10					46.3	57.1
NO.1	CO2	TESTO 435-2	400	Sensirion field Calibration	400	411
NO.2					394	400
NO.3					421	394
NO.4					395	414
NO.5					436	421
NO.6					400	407
NO.7					482	415
NO.8					405	407
NO.9					475	408
NO.10					238	415
NO.1	Light	TESTO 435-2	30	Single Point Calibration	30	30
NO.2					26	29
NO.3					43	32
NO.4					23	28
NO.5					37	33
NO.6					30	30
NO.7					36	31
NO.8					24	30

NO	Calibration items	Reference Instrument	Reference value	Calibration Method	Before Calibration	After Calibration
NO.9	Light	TESTO 435-2	30	Single Point Calibration	24	29
NO.10					25	32
NO.1	Sound	CENTER321	61	Single Point Calibration	61	60
NO.2					61	61
NO.3					61	61
NO.4					60	60
NO.5					61	61
NO.6					61	60
NO.7					60	60
NO.8					60	61
NO.9					61	60
NO.10					60	60
NO.1	PM2.5	The average value of 10 sensirion particulate matter sensor	4	Single Point Calibration	4	5
NO.2					5	4
NO.3					5	4
NO.4					4	5
NO.5					4	5
NO.6					5	4
NO.7					5	5
NO.8					5	4
NO.9					4	4
NO.10					5	4
NO.1	PM10	The average value of 10 sensirion particulate matter sensor	33	Single Point Calibration	31	32
NO.2					36	35
NO.3					33	33
NO.4					31	32
NO.5					31	34
NO.6					34	33
NO.7					37	34
NO.8					32	32
NO.9					30	33
NO.10					34	33
NO.1	TVOC	The average value of 10 sensirion TVOC sensor	25	Single Point Calibration	22	25
NO.2					6	22
NO.3					42	28
NO.4					12	20
NO.5					7	22
NO.6					42	28
NO.7					7	22
NO.8					23	25

NO	Calibration items	Reference Instrument	Reference value	Calibration Method	Before Calibration	After Calibration
NO.9	TVOC	The average value of 10 sensirion TVOC sensor	25	Single Point Calibration	41	28
NO.10					21	24