Air Lab&PM2.5 Particle Sensor

Description

The air lab & PM2.5 particle sensors are specifically designed to monitor and air pollution in offices and other indoor spaces. The sensors complement applications for a healthy indoor climate. ModBus RTU&TCP/IP, BACnet MSTP&IP for direct digital reading on all models.

Highlights

- Accurate : Laser scatter method, particles are sized with a resolution of 0.3 μm.
- User defined sampling period prolongs sensor life.
- Fast Response : response time less than 10 seconds.
- Real-time display monitoring data on LCD .
- Supports ModBus TCP/IP & BACnet IP protocol over WIFI.
- Supports ModBus RTU & BACnet MSTP protocol over RS485.
- TVOC sensor can detect Glycerin (Vaping smoke).

Specifications

General	
Power	15-24V +/- 10%, AC or DC,3VA@24VAC
Display Resolution	130x80 dot matrix, backlit
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
Wifi	2.4G , 802.11 b/g/n
Communications	ModBus TCP/IP & BACnet IP protocol over WIFI ModBus RTU & BACnet MSTP protocol over RS485,RS485 Baudrate:9600,19200,38400,57600,115200,76800

Range	Mass concentration range	0 to 100 ug/m^3	
	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/cm^3	
	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/m^3 100 to 1000 ug/m^3	
	Relative Humidity	5%RH (25℃,20-80%,RH)	

Accuracy	Temperature	<±0.5℃@25℃
	CO2	±70PPM OR ±5% of reading
Response-Time	Relative Humidity	<10s(25℃,in slow air)
	Temperature	<10s
	CO2	20s
	PM0.5 PM1 PM2.5 PM4 PM10	<8s

AQI levels as defined by the China Ministry of Environmental Protection

Air Quality Index	Air Pollution Level	PM2.5 24hr avg(ug/m^3)	PM10 24hr avg(ug/m^3)
0~50	Good	0~35	0~50
50~100	Moderate	35~75	50~150
100~150	Unhealthy for Sensitive Groups	75~115	150~250
150~200	Unhealthy	115~150	250~350
200~300	Very Unhealthy	150~250	350~420
>300	Hazardous	>250	>420

AQI levels as defined by the US Environmental Protection Agency

Air Quality Index	Air Pollution Level	PM2.5 24hr avg(ug/m^3)	PM10 24hr avg(ug/m^3)
0~50	Good	0~12	0~54
51~100	Moderate	12.1~35.4	55~154
101~150	Unhealthy for Sensitive Groups	35.5~55.4	155~254
151~200	Unhealthy	65.5~150.4	255~354
201~300	Very Unhealthy	150.5~250.4	355~424
301~500	Hazardous	250.5~500.4	425~604

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

How many Airlabs do I need for your building? There are two main air quality standards in the industry known as WELL and RESET. The WELL standard suggests one air particle sensor per 325m2 and at least one per floor. The RESET standard suggests one air particle sensor every 500m2 of building space

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

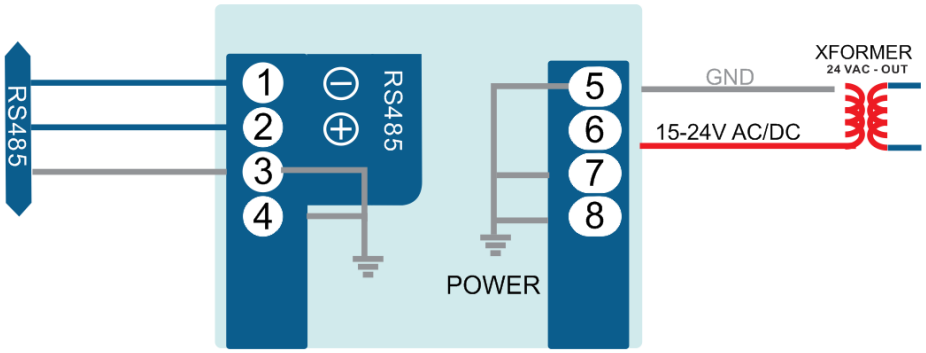
IAQ Performance Targets for ambient Tvoc Conerntration Expressed in mass concentration (ug/m^3)

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



Part Number Scheme

AL – CO2 – TVOC

Code	Description
AL	Airlab

Code	Description
CO2	CO2Sensor
----	No Co2 Sensor

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

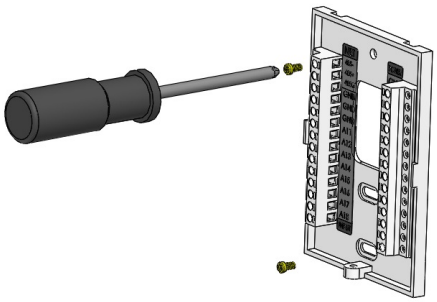
Dimensions

Mounting Installation

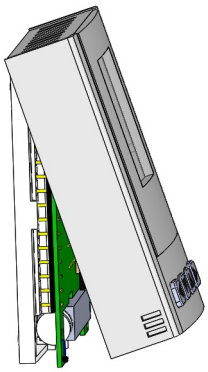
1.Slotted Screwdriver

2.Unfasten screw at cover

3.Install screws as shown

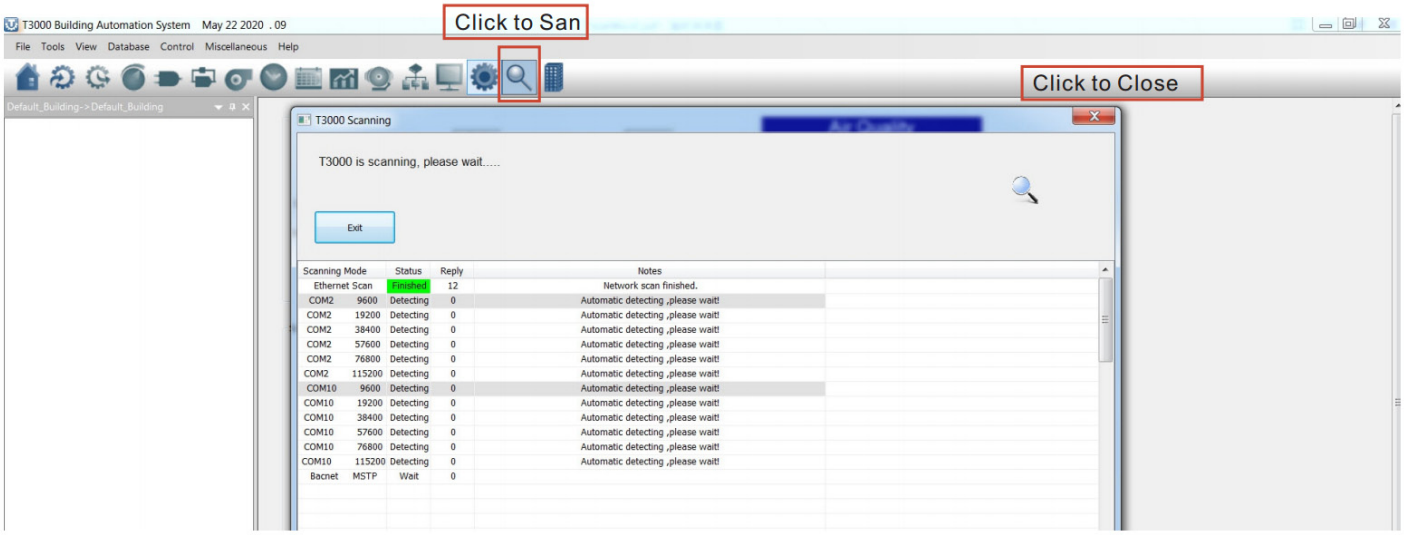


4.Installing the rear panel

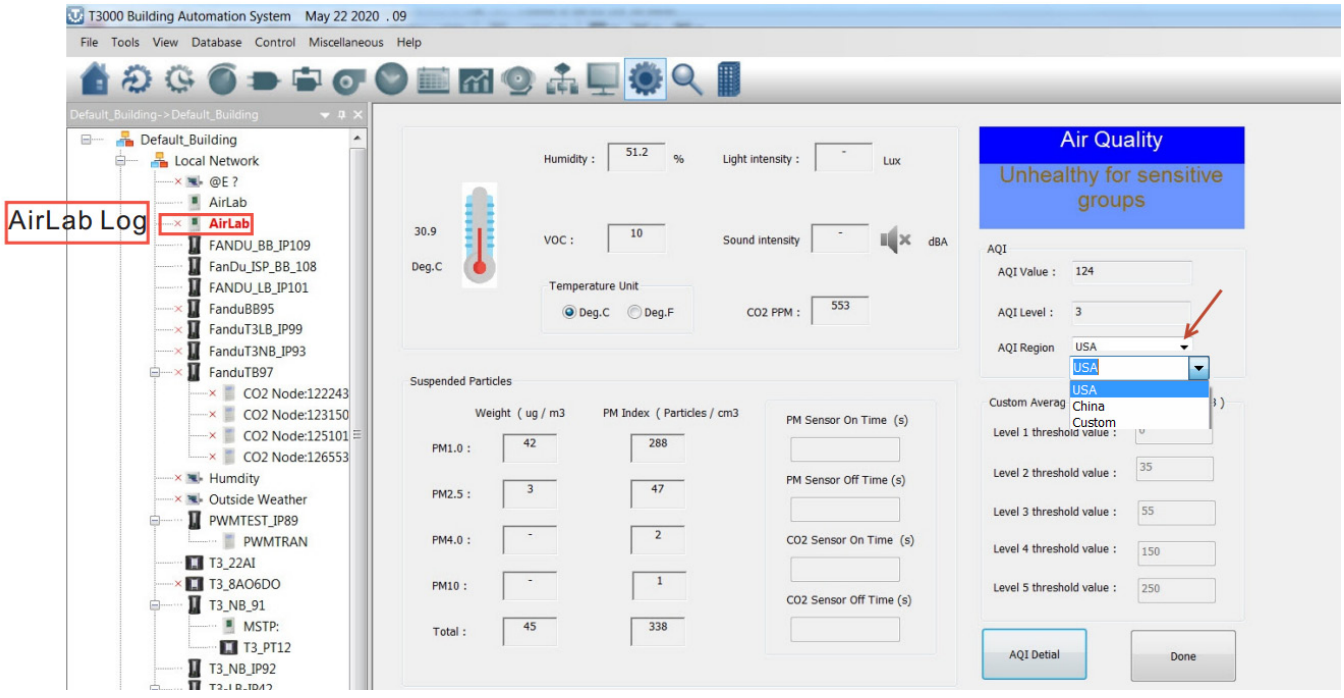


T3000 Building System

1.Connect AirLab to PC by RS485, start T3000 software



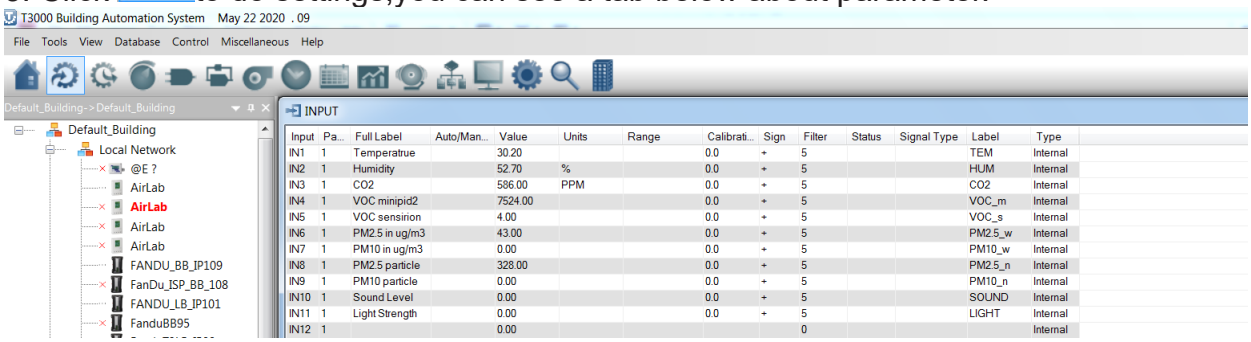
2. Click AirLab log,then you can see a tab below about AQI Region and AQI detial.



AQI Detial

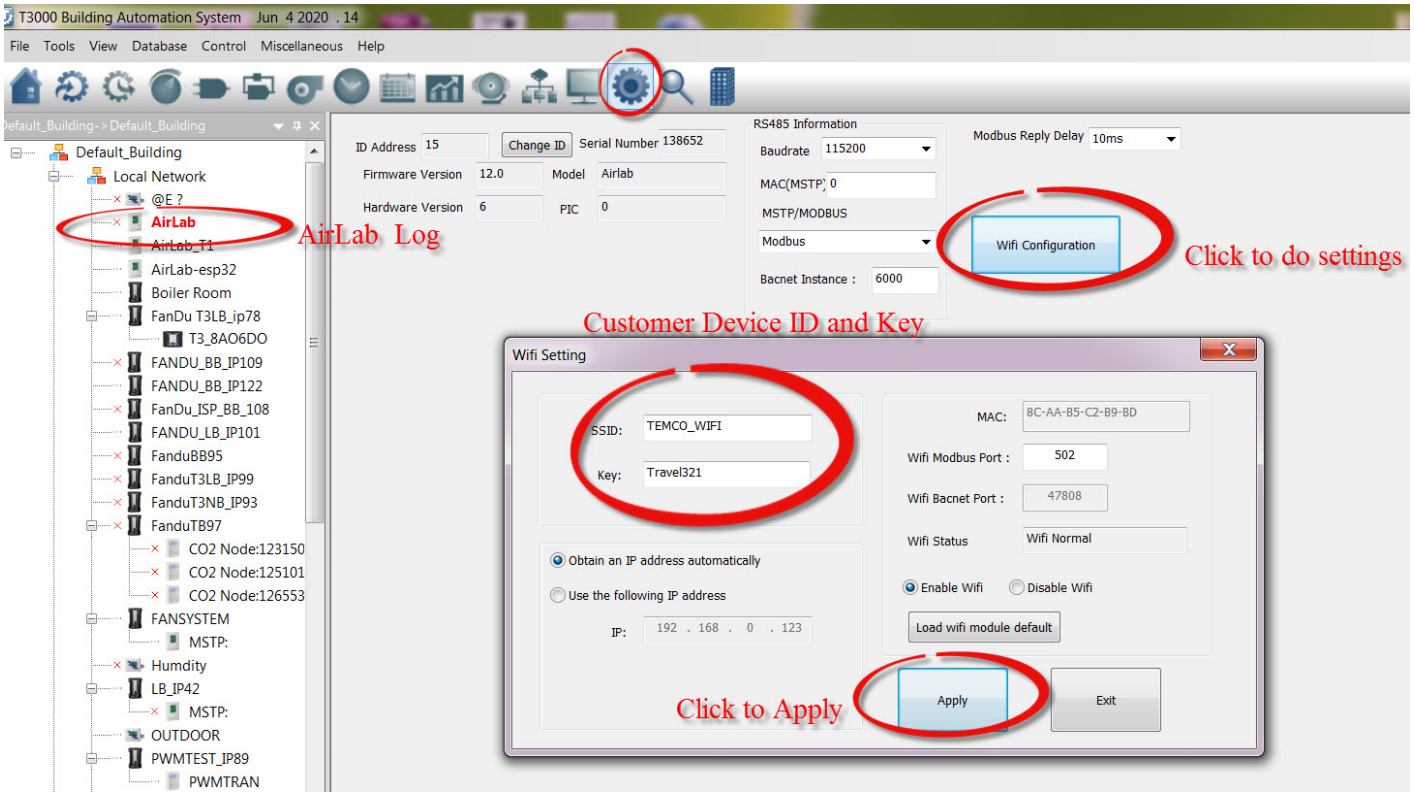
The PM2.5 index grade corresponding to the average daily concentration				
Average daily concentration(ug/m³)			Air quality rating	
Custom	China	USA	China	USA
0-0	0-35	0-12	Level 1	Good
0-35	35-75	12-35	Level 2	Medium
35-55	75-115	35-55	Level 3	Unhealthy for Sensitive groups
55-150	115-150	55-150	Level 4	Unhealthy
150-250	150-250	150-250	Level 5	Very Unhealthy
250-500	250-500	250-500	Level 6	Poisonous

3. Click to do settings,you can see a tab below about parameter.



Set Up Wifi via T3000

1.Visit https://temcocontrols.com/ftp/software/09T3000Software.zip, download T3000 software and install it;
2.Start T3000 software,click to scan

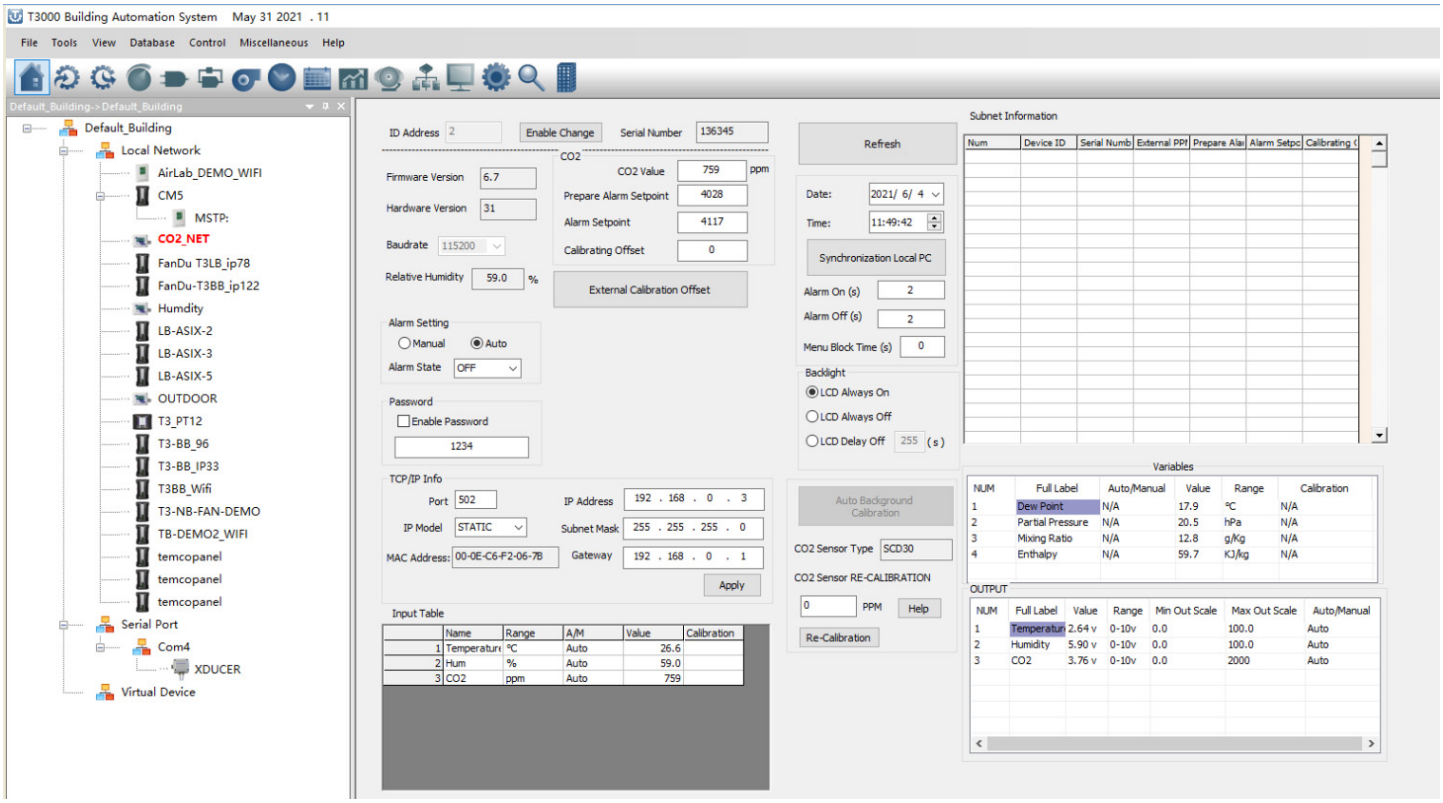


Sensirion CO2 Sensor Re-Calibration

Locate the device in an environment with air having a stable CO2 concentration in the range of 400 ppm to 2000 ppm.

1. Setting and controlling a known CO2 concentration in a sealed environment with the set CO2concentration acting as the reference value for FRC .

2.Fresh air from the outside can be used as a reference. Outside air typically has a CO2 concentration of 400 ppm . expose the device to outside air, e.g. by placing it close to an open window or outside. Direct sun light, extreme temperatures,and strong air flow have to be prevented,After 5 minutes, apply FRC with the reference value 400 ppm .



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