

## 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	
<b>Power</b>	15-24V +/- 10%, AC or DC,3VA@24VAC
<b>Display Resolution</b>	130x80 dot matrix, backlit
<b>Temperature Limt</b>	-20~+50°C, 0~95% RH(Non condensing)
<b>Plastic Housing</b>	Flammability rating UL 94 file E56070
<b>Particulate Matter Sensor Life time</b>	8 years continuous, adjustable to decades intermittent
<b>Communications</b>	ModBus TCP/IP & BACnet IP protocol over WIFI ModBus RTU & BACnet MSTP protocol over RS485,RS485 Baudrate:9600,19200,38400,57600,115200,76800

Range			
Range	Mass concentration range	0 to 100 ug/m <sup>3</sup>	
	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 <sup>3</sup>	
	Relative Humidity	0~100% non condensing	
Temperature	-30~70°C (-22~158 ° F)		
CO2	3000PPM		
Accuracy	PM0.5 PM1 PM2.5 PM4 PM10	0 to 100 ug/m <sup>3</sup> 100 to 1000 ug/m <sup>3</sup>	
	Relative Humidity	5%RH (25°C,20-80%,RH)	

<b>Accuracy</b>	Temperature	<±0.5°C@25°C
	CO2	±70PPM OR ±5% of reading
<b>Response-Time</b>	Relative Humidity	<10s(25°C,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 <sup>3</sup> )	PM10 24hr avg(ug/m <sup>3</sup> )
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 <sup>3</sup> )	PM10 24hr avg(ug/m <sup>3</sup> )
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 compounds (VOC1). The sum of VOC concentrations, or simply TVOC2, is used as an indication for VOC contamination. VOC contamination is an established concept in regulatory and scientific literature. Note that the specific TVOC composition varies between different ambient indoor environments and indoor air is always composed of different volatile organic substances<sup>3</sup>. 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 325m<sup>2</sup> and at least one per floor. The RESET standard suggests one air particle sensor every 500m<sup>2</sup> of building space**

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

Level	Hygienic Rating	Recommendation	TVOC (mg/m <sup>3</sup> )	TVOC (ppb ) <sup>8</sup>
5 Unhealthy	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 <sup>3</sup> )	TVOC (ppb ) <sup>8</sup>
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

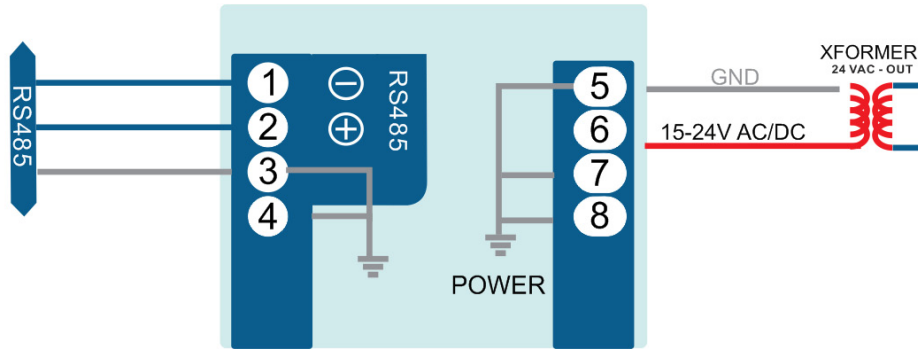
**IAQ Performance Targets for ambient Tvoc Conertration Expressed in mass concentration (ug/m<sup>3</sup>)**

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

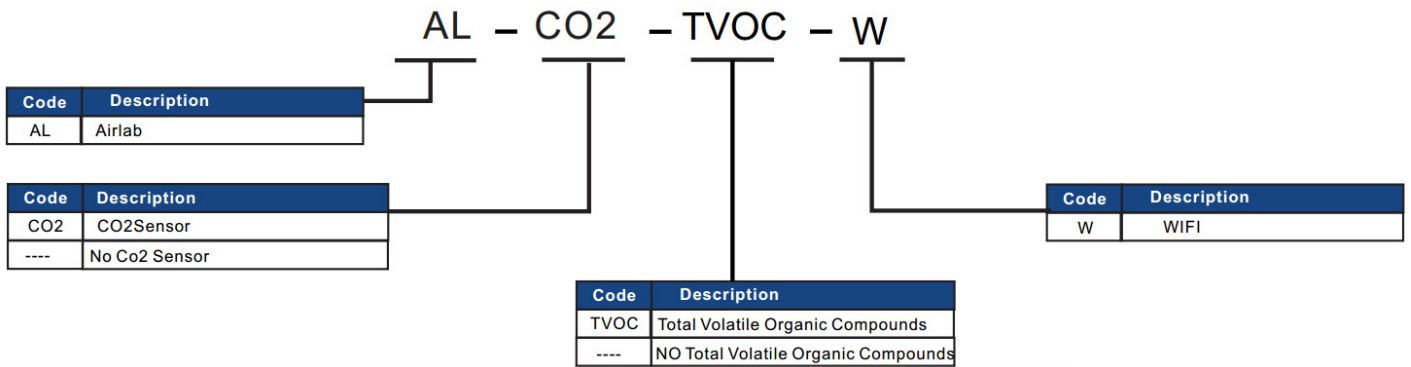
**Maximum Average TVOC Concentration according to LEED Standard for Green Buildings**

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

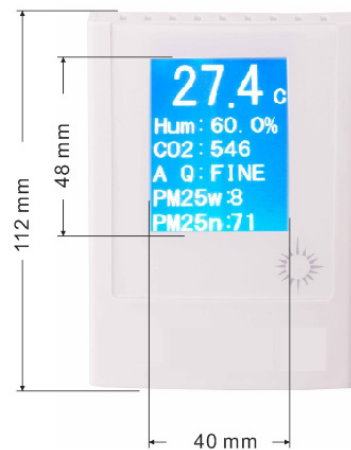
## Wiring Diagram



## Part Number Scheme



## Dimensions



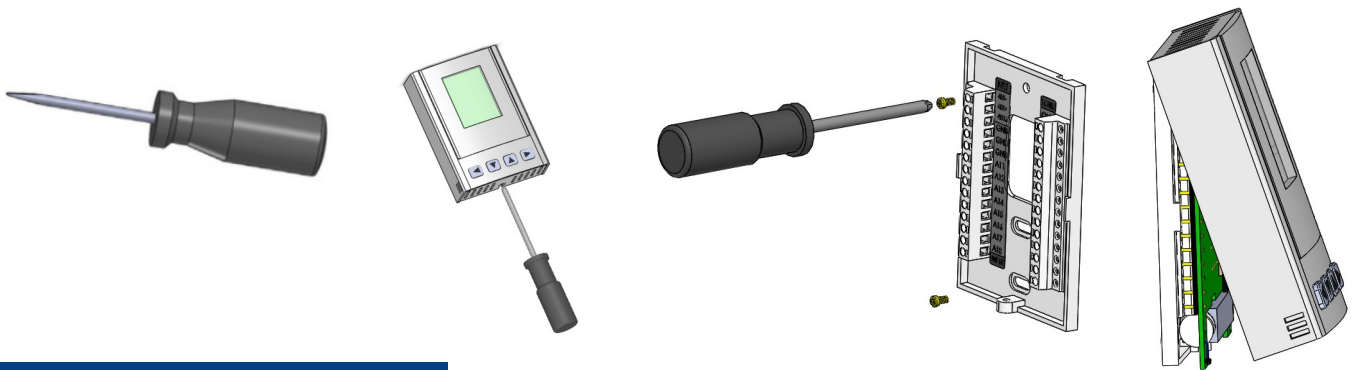
# Mounting Installation

1. Slotted Screwdriver

2. Unfasten screw at cover

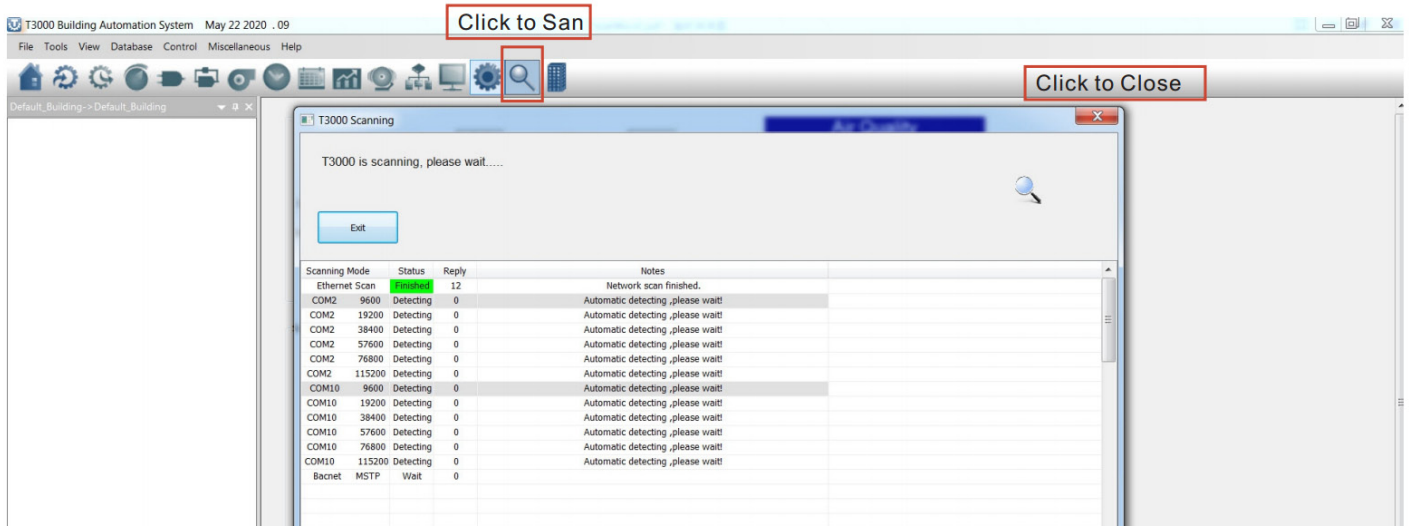
3. Install screws as shown

4. Installing the rear panel

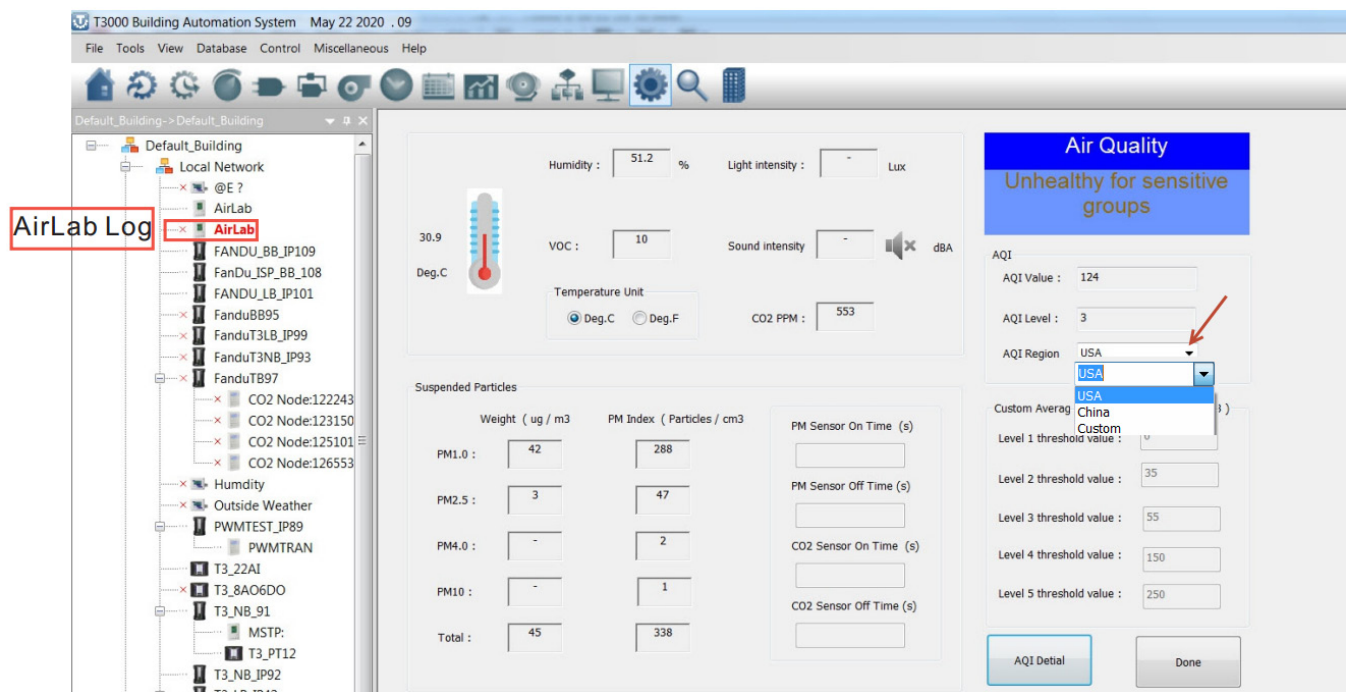


# T3000 Building System

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 detail.




AQI Detial



The PM2.5 index grade corresponding to the average daily concentration

Average daily concentration(ug/m <sup>3</sup> )			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.

T3000 Building Automation System May 22 2020 .09

File Tools View Database Control Miscellaneous Help

Default\_Building->Default\_Building

Default\_Building

- Local Network
  - @E ?
  - AirLab
  - AirLab
  - AirLab
  - FANDU\_BB\_IP109
  - FanDu\_JSP\_BB\_108
  - FANDU\_LB\_IP101
  - Fandu8895

Input	Pa...	Full Label	Auto/Man...	Value	Units	Range	Calibrati...	Sign	Filter	Status	Signal Type	Label	Type
IN1	1	Temperature		30.20			0.0	-	5			TEM	Internal
IN2	1	Humidity		52.70	%		0.0	-	5			HUM	Internal
IN3	1	CO2		586.00	PPM		0.0	-	5			CO2	Internal
IN4	1	VOC minipid2		7524.00			0.0	-	5			VOC_m	Internal
IN5	1	VOC sensinon		4.00			0.0	-	5			VOC_s	Internal
IN6	1	PM2.5 in ug/m3		43.00			0.0	-	5			PM2.5_w	Internal
IN7	1	PM10 in ug/m3		0.00			0.0	-	5			PM10_w	Internal
IN8	1	PM2.5 particle		328.00			0.0	-	5			PM2.5_n	Internal
IN9	1	PM10 particle		0.00			0.0	-	5			PM10_n	Internal
INT0	1	Sound Level		0.00			0.0	-	5			SOUND	Internal
INT1	1	Light Strength		0.00			0.0	-	5			LIGHT	Internal
INT2	1			0.00					0				Internal

## Wifi Set Up

Visit <https://temcocontrols.com/ftp/software/24esptouch.zip>, download Androidwifisetup software and install it;

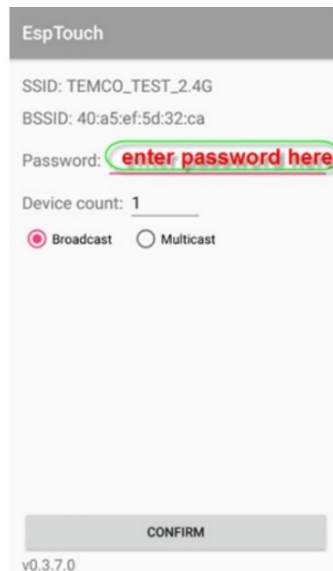
First install this application on any Android phone, it is only used during setup of the Wifi credentials after which you will be able to manage the device from a PC running the T3000.exe software.

First use your phone to log into your local Wi-Fi network, select your usual SSID that you would like the AirLab to also connect. Once your phone is connected to your local Wi-Fi lan, run the ESP-Touch utility and you will see this dialog below.

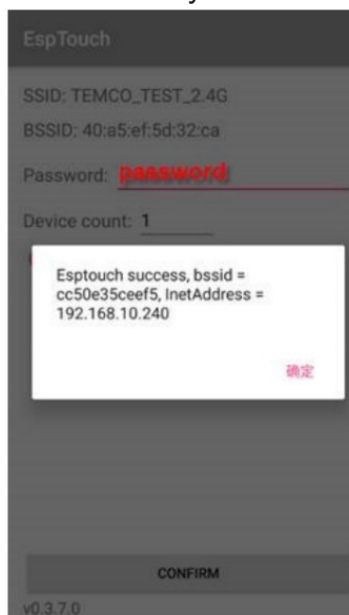
Enter the Wi-Fi password here and it will be sent to the Airlab device from your phone, the Airlab sensor can now log into your Wi-Fi network directly without assistance from your phone.

Note: If you plan to change the Wi-Fi password you can log into the device with the T3000 software and update the Airlab password before making the network change.

If you forget to keep the Airlab password up to date you can always redo the ESPTouch procedure from the beginning.




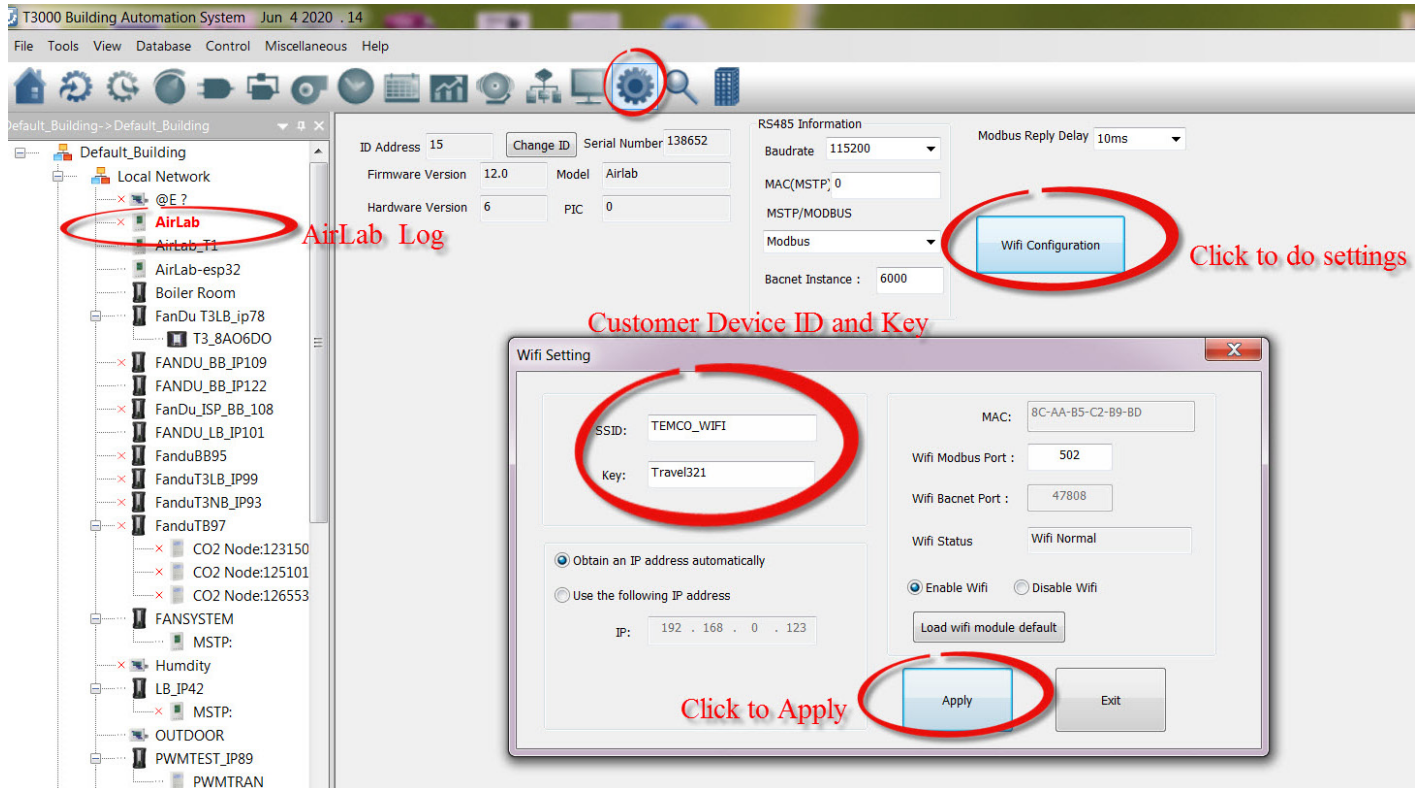
When the connection is made and password is successfully passed to the Airlab device you will see a message like this with the IP address obtained from your Wifi Lan, assuming there is a DHCP server active to assign IP addresses.





# 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



The screenshot displays the T3000 Building Automation System interface. On the left, a tree view shows the 'Default\_Building' structure with various devices, including 'AirLab' and 'AirLab\_T1', which are circled in red. A red circle highlights the magnifying glass icon in the top toolbar. The main panel shows device details for 'AirLab' (ID Address 15, Serial Number 138652) and RS485 information (Baudrate 115200, Modbus Reply Delay 10ms). A 'Wifi Configuration' button is circled in red with the text 'Click to do settings'. A 'Wifi Setting' dialog box is open, showing fields for SSID (TEMCO\_WIFI), Key (Travel321), and MAC (8C-AA-B5-C2-B9-BD). The 'Obtain an IP address automatically' option is selected. The 'Apply' button in the dialog is circled in red with the text 'Click to Apply'.

# 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 CO2 concentration 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 .

The screenshot displays the T3000 Building Automation System interface. On the left, a tree view shows the network structure under 'Default\_Building', including a 'Local Network' with various devices like 'AirLab\_DEMO\_WIFI', 'CM5', and 'CO2\_NET'. The main panel is divided into several sections:

- General Information:** ID Address (2), Serial Number (136345), Firmware Version (6.7), Hardware Version (31), Baudrate (115200), and Relative Humidity (59.0%).
- CO2 Settings:** CO2 Value (759 ppm), Prepare Alarm Setpoint (4028), Alarm Setpoint (4117), and Calibrating Offset (0).
- Alarm Setting:** Manual/ Auto radio buttons, Alarm State (OFF), and Password (1234).
- TCP/IP Info:** Port (502), IP Address (192.168.0.3), IP Model (STATIC), Subnet Mask (255.255.255.0), MAC Address (00-0E-C6-F2-06-78), and Gateway (192.168.0.1).
- Subnet Information:** A table with columns for Num, Device ID, Serial Num, External PPI, Prepare Ala, Alarm Setpc, and Calibrating.
- Variables:** A table listing variables like Dew Point, Partial Pressure, Mixing Ratio, and Enthalpy.
- OUTPUT:** A table listing output variables like Temperature, Humidity, and CO2.
- CO2 Sensor RE-CALIBRATION:** A section with a 'Re-Calibration' button and a 'CO2 Sensor Type' dropdown set to 'SCD30'.

## 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 1 which is configured in register 111.This can be internal sensor,external,or an average 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
AI2	HUM
AI3	CO2
AI4	VOC_m
AI5	VOC_s
AI6	PM2.5 ug/m3
AI7	PM10 ug/m3
AI8	PM2.5 number
AI9	PM10 number
AI10	Sound level
AI11	Light strength

AV	Description
1	baud rate
2	station number
3	protocol select 0:MODBUS 1:BACKED
4	Instance
5	Temperature unit 0:C 1: F

## 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