User Manual

tSENSE VAV Disp

CO_2-, temperature- and relative humidity transmitter

General

tSENSE VAV for wall mounting measures indoor air carbon dioxide concentration, temperature and relative humidity in rooms. *tSENSE VAV* is available with colour touch display (LCD).
The unit connects to Direct Digital Control (DDC).
Linear outputs are pre-programmed as CO_2-, temperature- and relative humidity transmitter.

Measuring ranges can be modified via touch display, from PC (Windows) software UIP (version 5 or higher) and USB communication cable, alternative via Modbus or BACnet.

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Opening of housing

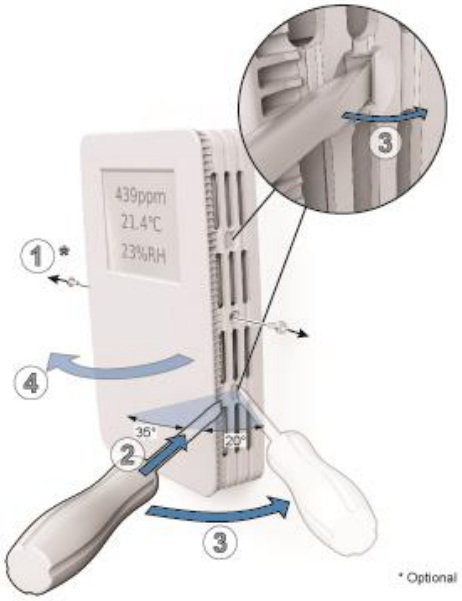


Figure 1

Download of software UIP5

senseair.se/products/software/uip-5/

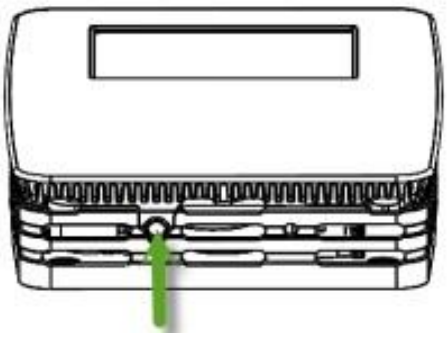


Figure 2: Connection to PC via phone jack
Connect Interface cable USB – 3.5mm,
Art. No.: 00-0-0070

Enter PIN code

	0 Power ON byt bild
PIN1 Access to display settings. Delivered product: **Code Off** PIN2 Access to meter settings. Delivered product: **2001** *See page 24 PIN codes*	SenseAir

1

CO_2	429ppm
Temperature	23.1°C
Humidity	21%RH
SenseAir	

2 NOTE!
PIN1 code **OFF**

CO_2	Screen
Temperature	Settings
Humidity	
	«

3 PIN2 code

Enter PIN		2001
	2	3
	5	6
/	8	9
Del	0	«

4

Meter
Measurements
Outputs
Misc «

2 NOTE!
PIN1 code **ON**

Enter PIN		0000
1	2	3
4	5	6
7	8	9
Del		«

3

CO_2	Screen
Temperature	Settings
Humidity	
	«

Output configurations

Terminal	Default output	Default output range	Outputs of this sensor	Output ranges of this sensor
OUT(1) CO_2: Temperature: Relative Huminity:	0 ─ 10VDC	 600 ─ 900ppm 22 ─ 23°C 75 ─ 85%	See label	See label
OUT(2) CO_2:	0 ─ 10VDC	0 ─ 2000ppm	See label	See label
OUT(3) Temp:	0 ─ 10VDC	0 ─ 50°C	See label	See label
Relay CO_2:	0 ─ 10VDC	900 ─ 1000ppm	See label	See label

Table 1. Default output configurations of tSENSE VAV

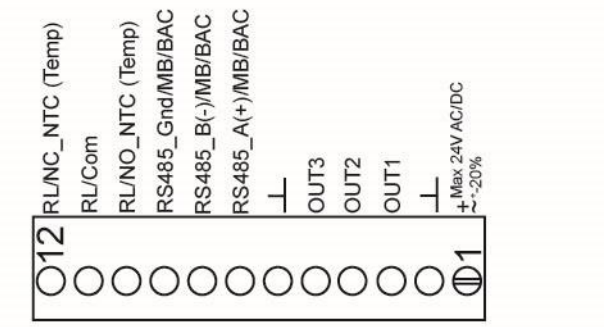
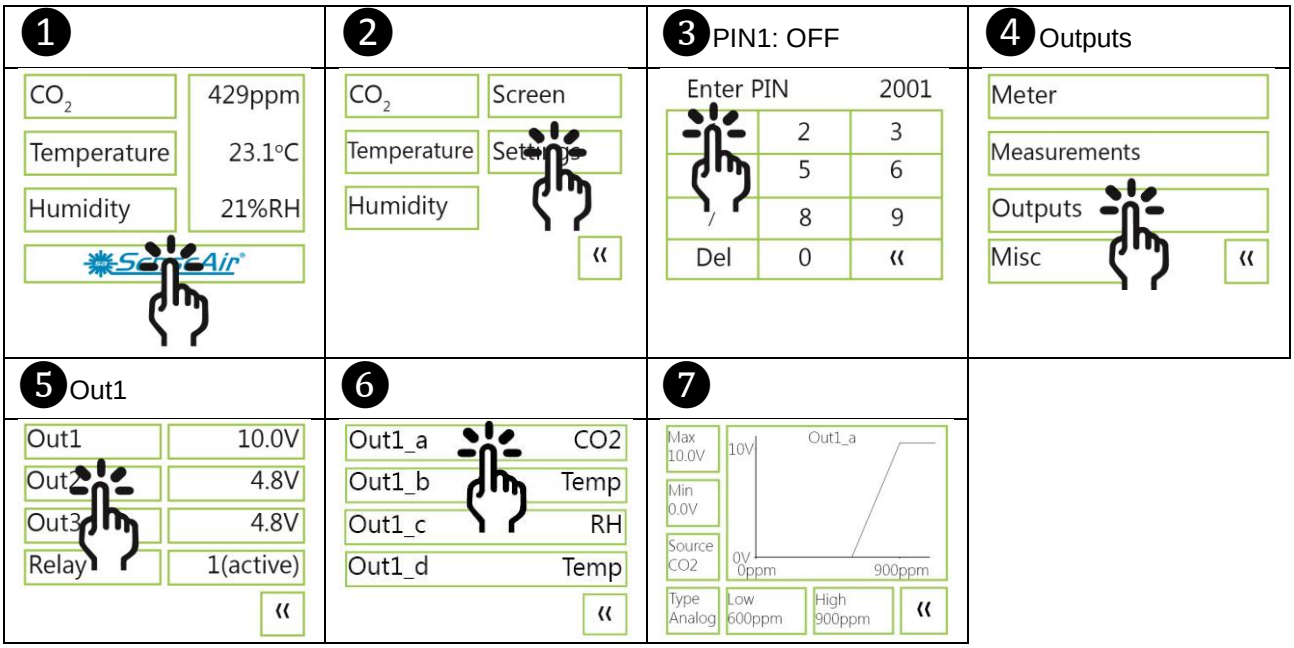


Figure 3: Screw Terminal

The sensor is supplied with 0 ─ 10VDC linear analogue outputs for Out(1), Out(2) and Out(3) (see Table 1). Alternative output ranges can be configured via touch display and/or PC software UIP (version 5 or later). See information at senseair.com.

Outputs

Out1/Out2/Out3

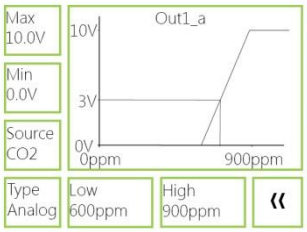
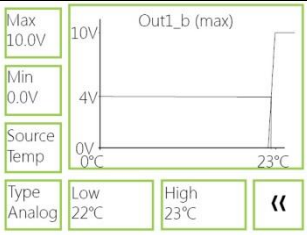
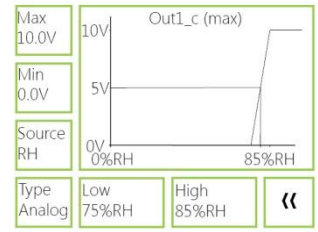
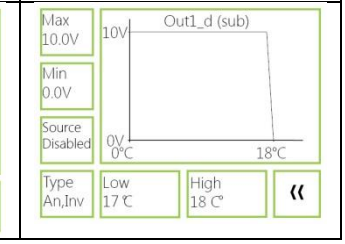


e.g.

The voltage level of OUT1 is the result of the *largest* demand from Proportional-bands.
Out1_a/Out1_b/Out1_c => OUT1
The voltage level of the one of Out1_a, Out1_b **or** Out1_c which has the highest voltage level provides the voltage level of OUT1.

The values below are defalt values.

Out1Standard	
Out1_a CO2 Out1_b Temp Out1_c RH Out1_d Disabled «	**Out1_a:** CO_2 has a Proportional-band of 600─900ppm **Out1_b:** Temp has a Proportional-band of 22─23°C **Out1_c:** RH has a Proportional-band of 75─85%RH **Out1_d:** Disabled **NOTE!** Possibility to set measurement range (“Low” and “High”) higher (out of range) than what is possible to measure.

Out1_a CO_2 = 714ppm =>3V	Out1_b Temp = 22.4°C =>4V	Out1_c Humidity = 80%RH=>5V	Out1_d Disabled
			

5V (Out1_c) – 0V (Out1_d Disabled) = 5V **=>** OUT1
The (e.g.) VAV valve opens from minimum set-point position, with full opened state at the maximum set-point position.

The values below are defalt values.

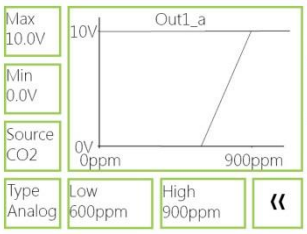
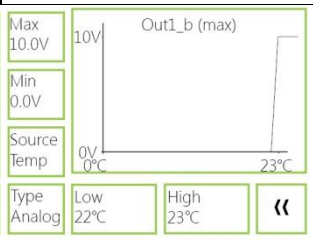
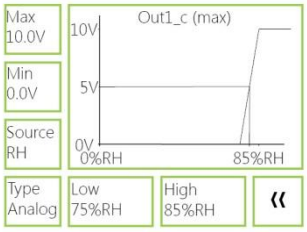
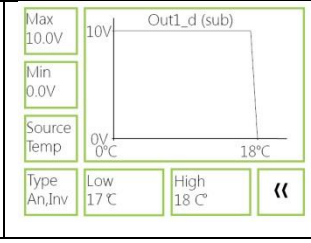
Voltage on OUT1 = 0V if measured values are:	Voltage on OUT1 will increase if measured values are:	Voltage on OUT1 = 10V if measured values are:
CO_2 ≤ 600ppm *and* Temp ≤ 22°C *and* RH ≤ 75%RH (Out1_d = Disabled)	600ppm ≤ CO_2 < 900ppm *or* 22°C ≤ Temp < 23°C *or* 75%RH ≤ RH < 85%RH (Out1_d = Disabled)	CO_2 > 900ppm *or* Temp > 23°C *or* RH > 85% (Out1_d = Disabled)

Voltage on OUT1 = 0V if: the measured CO_2-value is less than, or equal with, 600ppm **and** the measured temperature value is less than, or equal with, 22°C **and** the relative humidity value less than, or equal with, 75%.

Voltage on OUT1 will increase if: the measured CO_2-value is between 600ppm and 900ppm **or** the measured temperature value is between 22°C and 23°C **or** the measured relative humidity value is between 75% and 85%.

Voltage on OUT1 = 10V if: the measured CO_2-value is higher than 900ppm **or** the measured temperature value is higher than 23°C **or** the measured relative humidity value is higher than 85%.

Temp protection (Out1_d) Enabled

Out1_a	Out1_b	Out1_c	Out1_d
CO_2: 1205ppm (higher than set “High” 900ppm) => 10V	Temp: 16.4°C (lower than set “Low” 22°C) => 0V	Humidity: 80%RH => 5V	Temp: 16.4°C (lower than set “Low” 17°C) => 10V *See Note!*
			

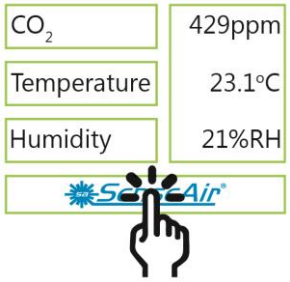
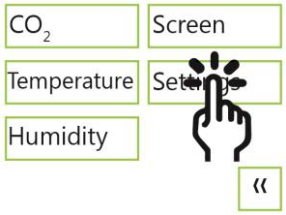
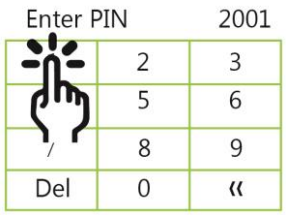
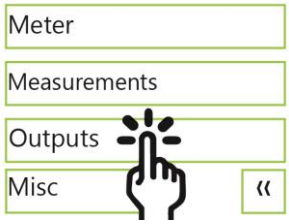
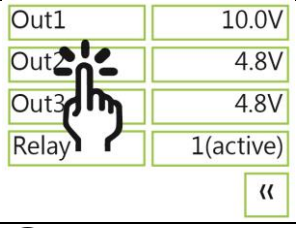
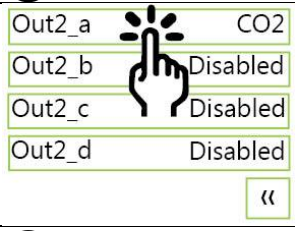
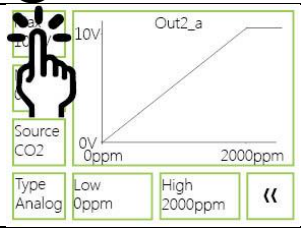
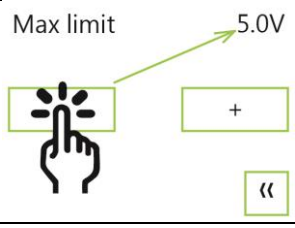
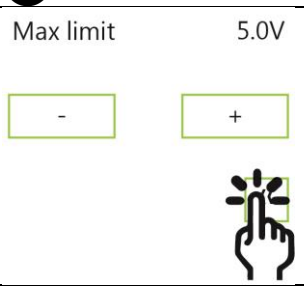
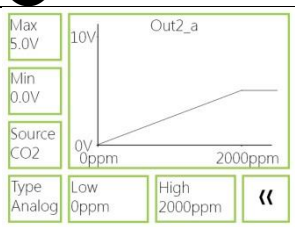
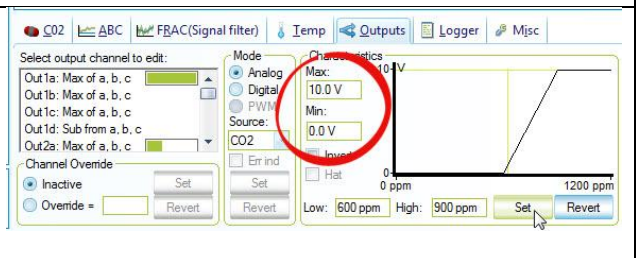
10V (Out1_a) **–** 10V (Out1_d) **=** 0V **(**OUT1).

The voltage level of the one of Out1_a, Out1_b **or** Out1_c which has the highest voltage level is in this case 10V (Out1_a), **minus** 10V (the voltage level of Out1_d) provides the voltage level of OUT1 which is 0V.

Despite high value of CO_2 (1205ppm), OUT1 is 0V (no signal to ventilation system to start), because of low value of Out_b (16.4°C) when temperature protection Out1_d is Enabled.

NOTE!
Out_d (sub) in display picture: (sub) = subtraction, (Temperature protection)

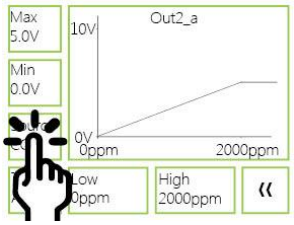
Voltage range
Max voltage limit can be changed, in steps of 0.1V, **from** set Min voltage limit *plus* 0.1V **to** 10.0V
Min voltage limit can be changed, in steps of 0.1V, **from** 0.0V **to** set Max voltage limit *minus* 0.1V

1	2	3	4
			
5 Out2	**6** Out2_a	**7** Max	**8** 10.0V, 9.9V..5.0V..
			
9	**10**	**UIP5**	
			

Select source

There are eight sources to choose among: CO_2 (Ch0), Temp. (Ch1), Relative Humidity (Ch2) and Ch3 to 7 (contains no data) plus the Disable-button.

7 Source



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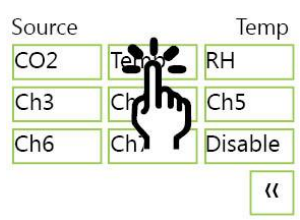

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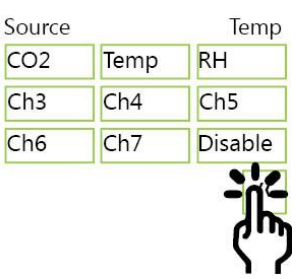

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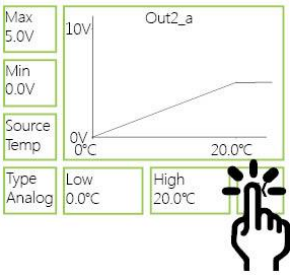
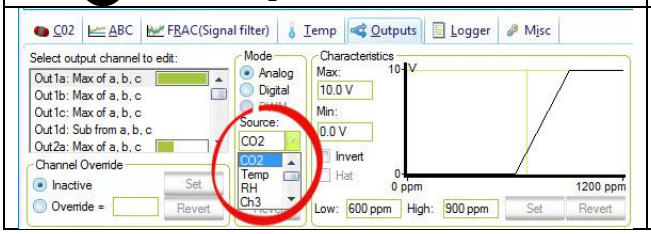
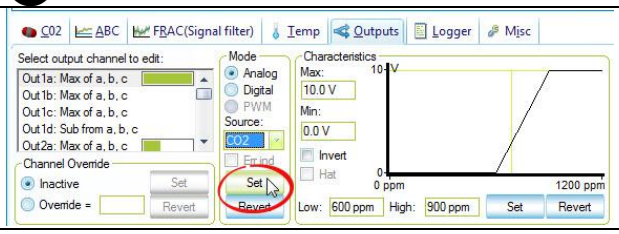


UIP5 **1** Source: CO_2 selected



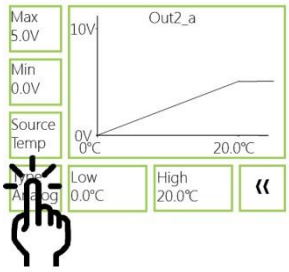
2 Save



Types

Analogue/Analogue Invert (Analogue Invert is usable e.g. temp. protection page 6)

7 Analogue



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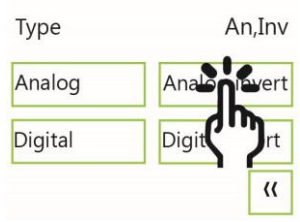

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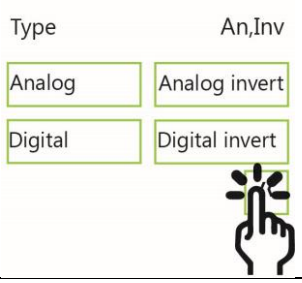
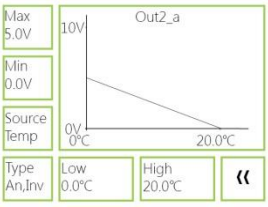
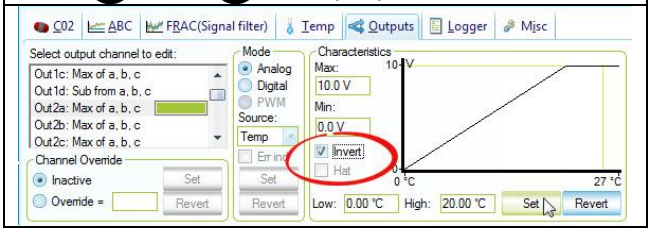


10 Analogue invert

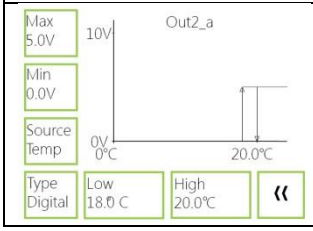


UIP5 **1** Invert **2** Save (Set)

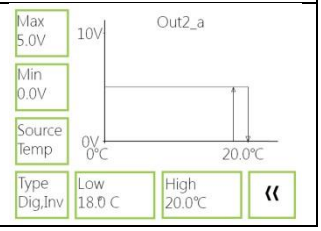


Digital/Digital Invert

10 Digital



10 Digital Invert



Measure range settings

CO_2:

Low value can be changed, in steps of 100ppm, **from** 0ppm **to** set High value *minus* 100ppm.
High value can be changed, in steps of 100ppm, **from** set Low value *plus* 100ppm.

(SenseAir guarantiees accuracy ±30ppm ±3% of reading, in the measurement range 0 ─ 2000ppm).

Temperature:

Low value can be changed, in steps of 1°C, **from** 0°C **to** set High value *minus* 1°C.
High value can be changed, in steps of 1°C, **from** set Low value *plus* 1°C.
(SenseAir guarantiees accuracy ±1.0°C of reading, at the operating temperature range: 0 ─ 50°C)

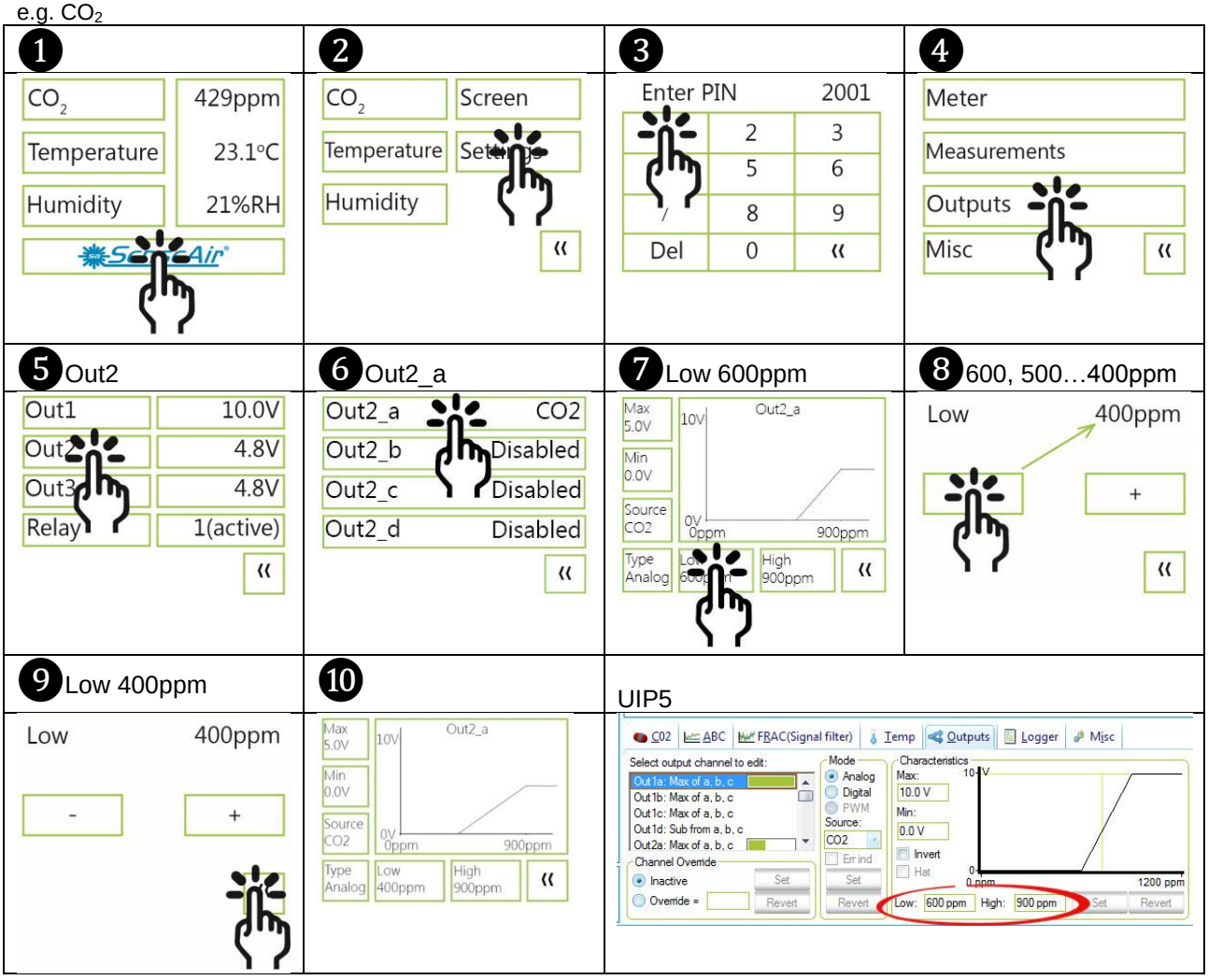
Relative Humidity:

Low value can be changed, in steps of 1%, **from** 0% **to** set High value *minus* 1%.
High value can be changed, in steps of 1%, **from** set Low value *plus* 1%.
(SenseAir guarantiees accuracy ±5RH of reading at 20 ─ 80%RH. Operating humidity range: 0 ─ 95%)

NOTE!

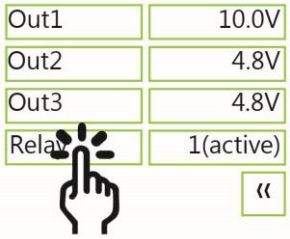
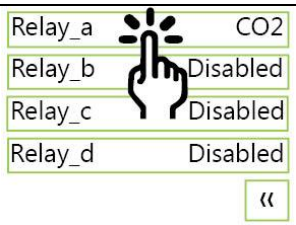
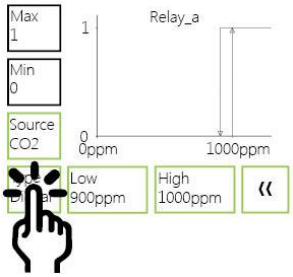
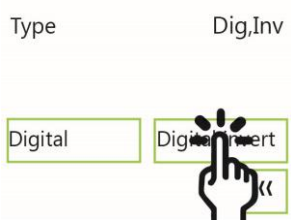
Possibility to, in software, set measurement range higher (out of range) than what is possible to measure.

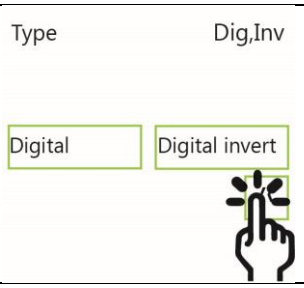
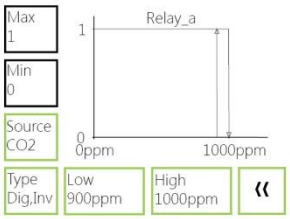
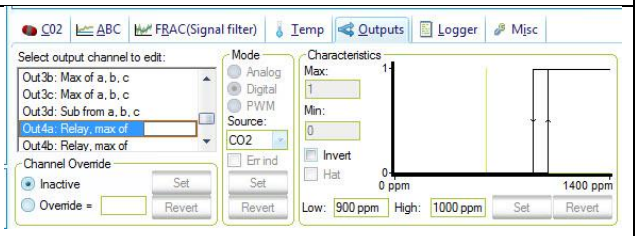
e.g. CO_2



Outputs

Relay

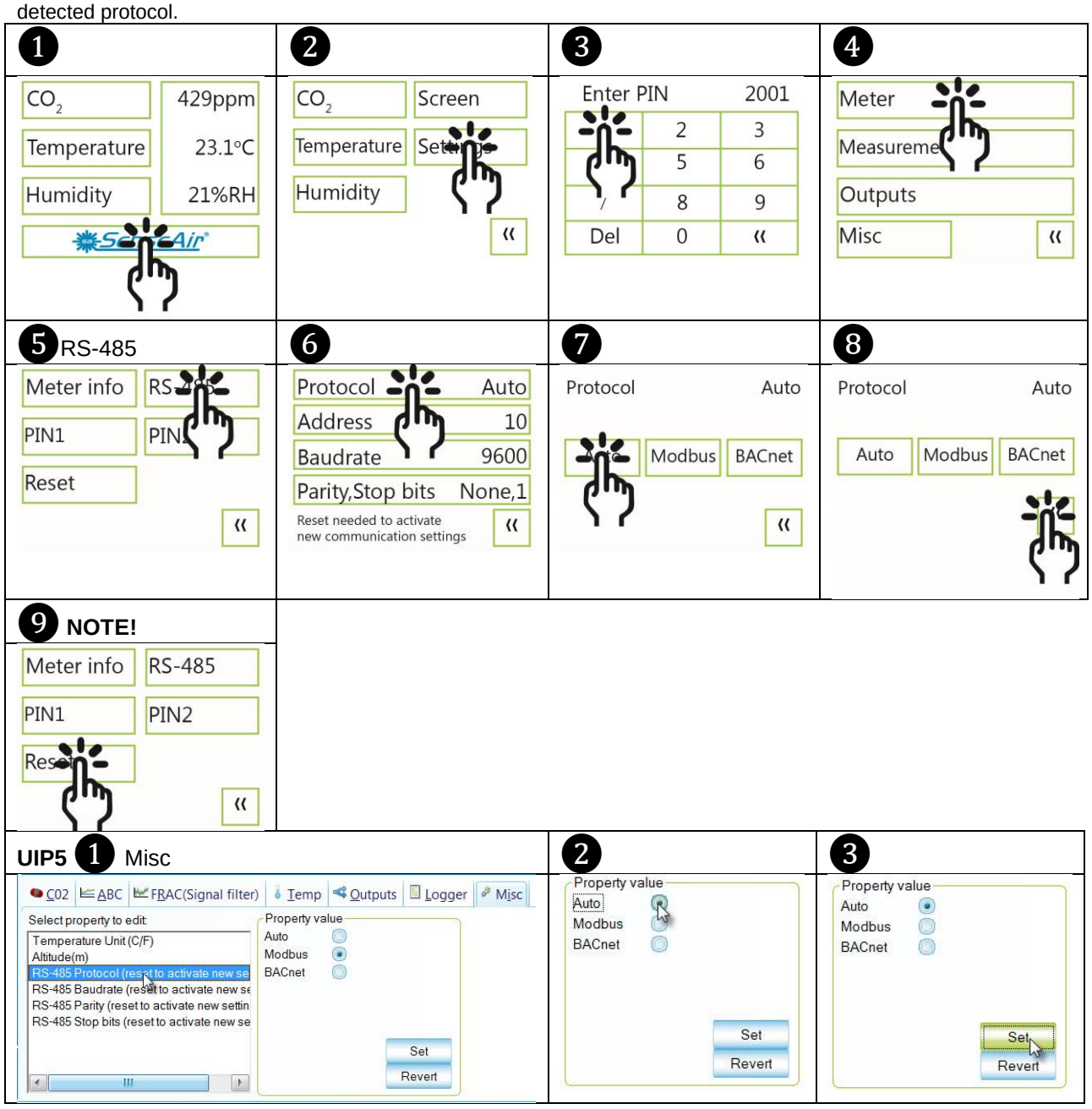
5 Relay	6	7 Type Digital	8
			

9	10	UIP5
		

Communication settings

Protocol

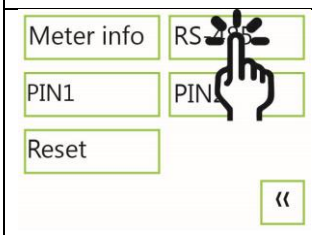
When the sensors RS-485 Protocol parameter is set to “Auto”, the sensor selects protocol depending on the protocol used on the network it is connected to. After power on, the sensor then listens to the traffic on the RS-485 network. If the sensor detects valid BACnet, or Modbus messages, the sensor will start to use the detected protocol.



Address/Baudrate

Address can be changed **from** 1 **to** 253
Baudrate can be choosen as either 9600, 19200, 38400, 57600, 76800 or 115200

5 RS-485



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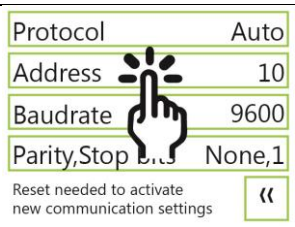

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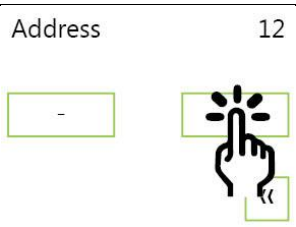

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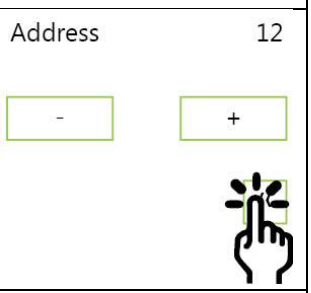
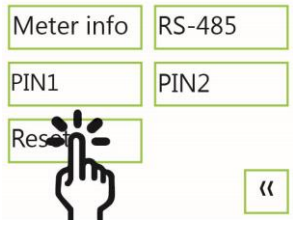
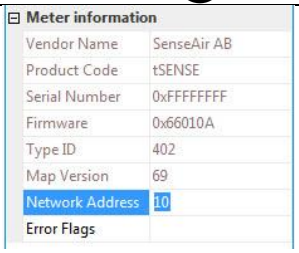


9 **NOTE!**



UIP5 Address **1**



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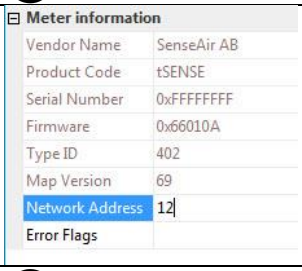
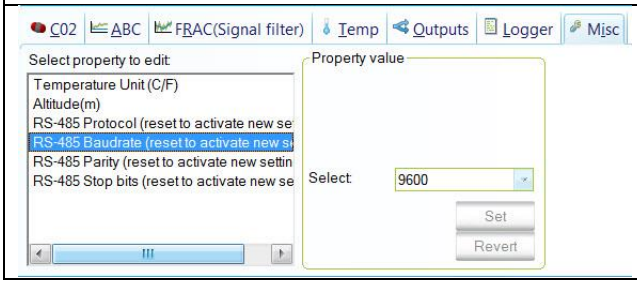
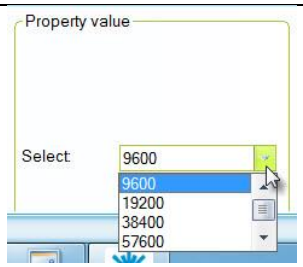


3

UIP Baudrate **1** Misc



2



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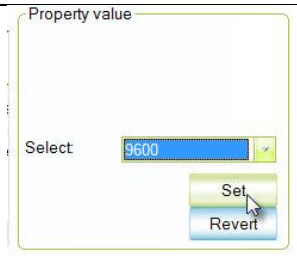
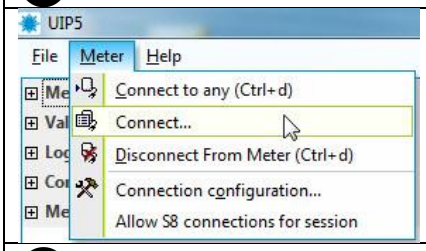


NOTE!
UIP baudrate ≠ RS-485 baudrate if *tSENSE VAV* is connected *via phone jack* (see fig. 2).
UIP baudrate = RS-485 baudrate if *tSENSE VAV* is connected *via screw terminal* (see fig. 3).

To change settings via UIP requires Reset (Power OFF – Power ON) to execute them.

Connect meter

1



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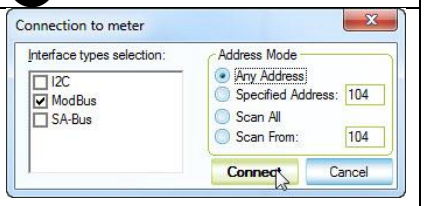
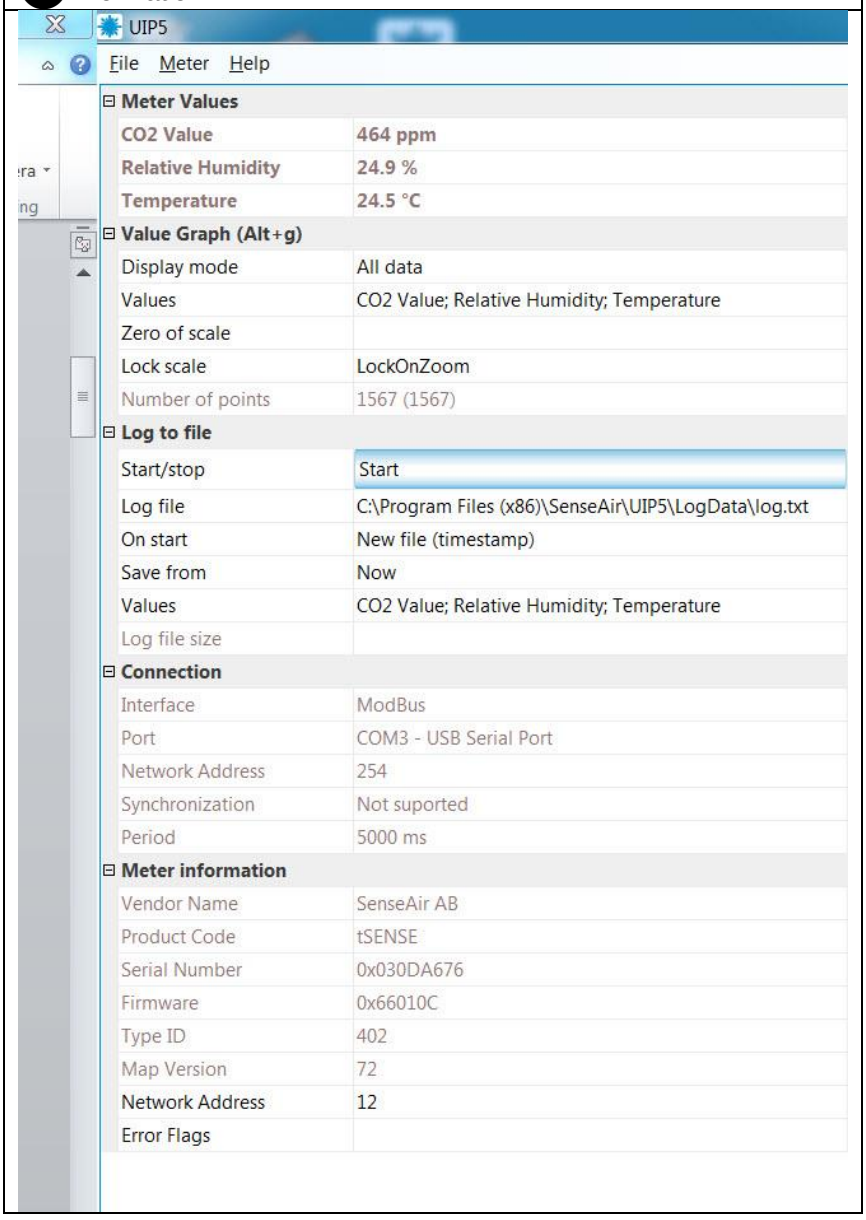
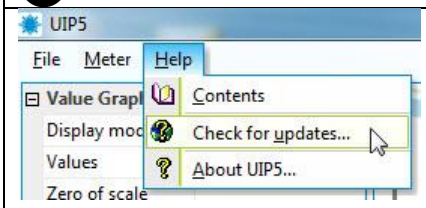


3 Information



Check for updates

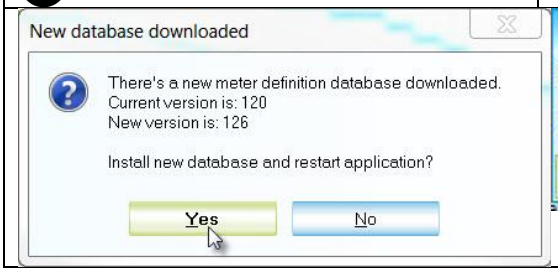
1



2 New version available

2 No new version

2 New database downloaded



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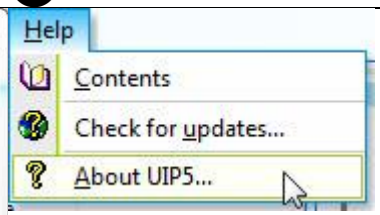

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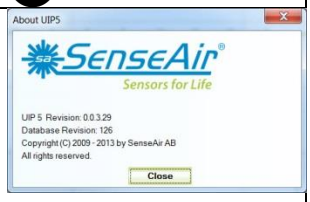
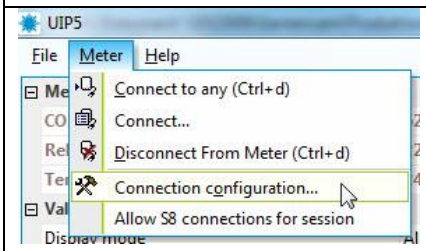
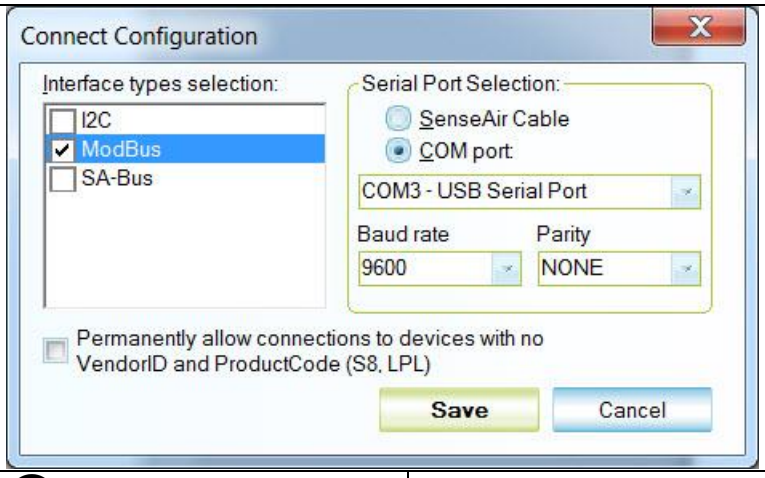


Connection configurations

1



2 ModBus 3 COM13-USB Serial Port 4 Save



5 Lower right corner of screen

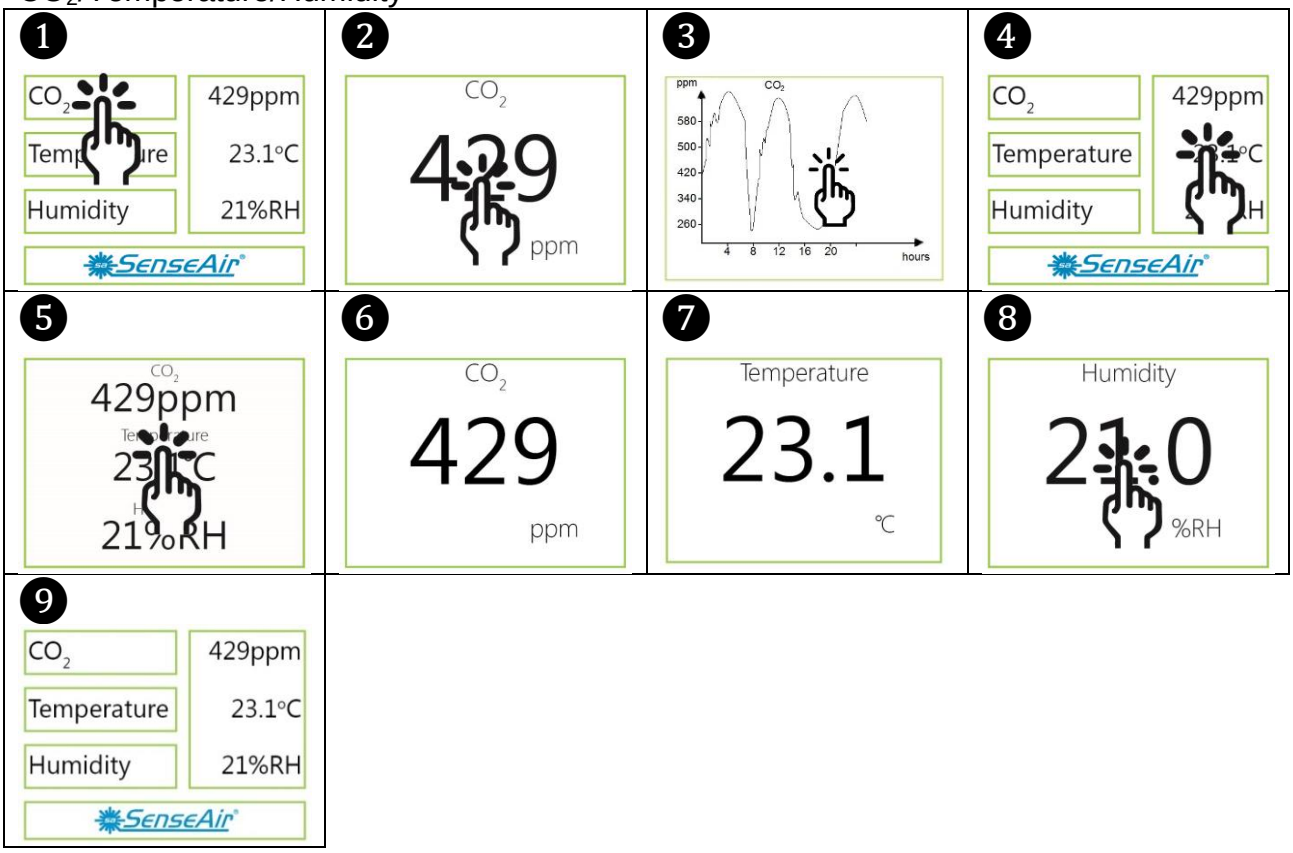
6

NOTE!
UIP baudrate ≠ RS-485 baudrate if *tSENSE VAV* is connected *via phone jack* (see fig. 2).
UIP baudrate = RS-485 baudrate if *tSENSE VAV* is connected *via screw terminal* (see fig. 3).

To change settings via UIP requires Reset (Power OFF – Power ON) to execute them.

Measured values

CO_2/Temperature/Humidity



Display settings

Limits

CO_2/(Temperature)/(Humidity)
CO_2 Yellow/Red limit (Temp./Humidity same method as for CO_2 limit settings)
CO_2
Yellow limit can be changed, in steps of 100ppm, **from** 0ppm **to** set Red limit *minus* 100ppm.
Red limit can be changed, in steps of 100ppm, **from** set Yellow limit *plus* 100ppm.

Temperature:
Yellow limit can be changed, in steps of 1°C (1.8°F), **from** -99°C (-146.2°F) **to** set Red limit *minus* 1°C (1.8°F)
Red limit can be changed, in steps of 1°C (1.8°F), **from** set Yellow limit *plus* 1°C (1.8°F).

Relative Humidity:
Yellow limit can be changed, in steps of 1%, **from** 0% **to** set Red limit *minus* 1%,
Red limit can be changed, in steps of 1%, **from** set Yellow limit *plus* 1%.

NOTE!
Possibility to, in software, set display limits higher (out of range) than what is possible to measure.

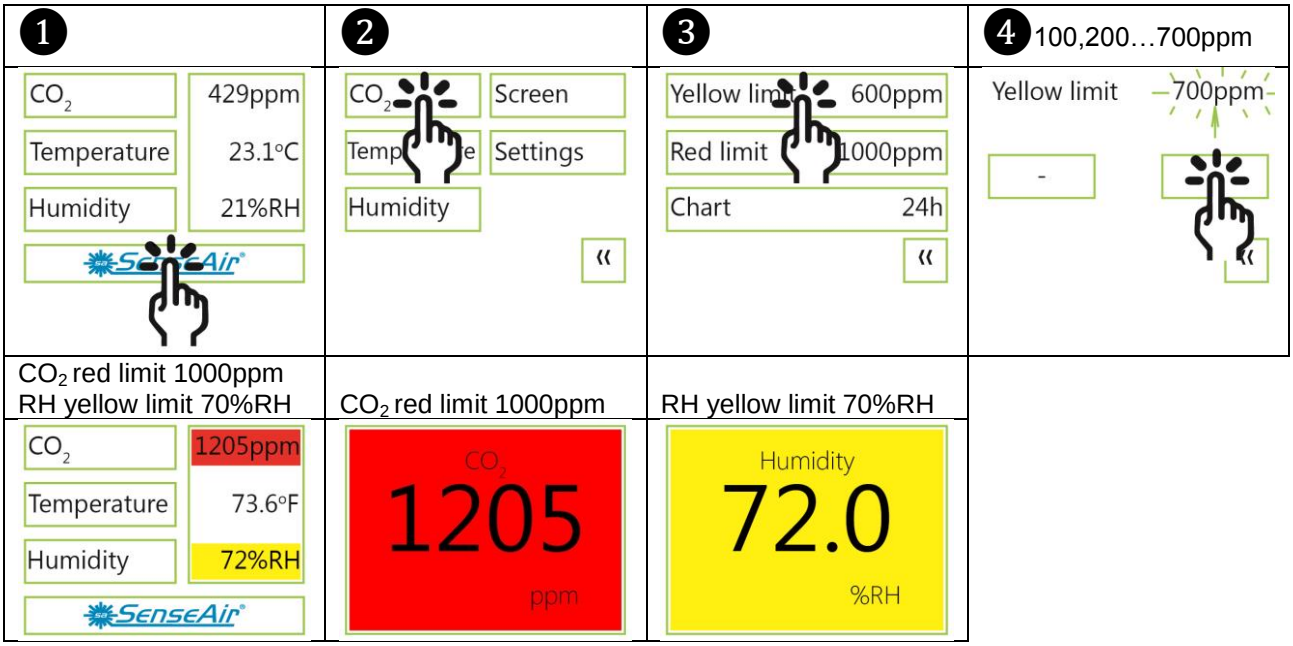
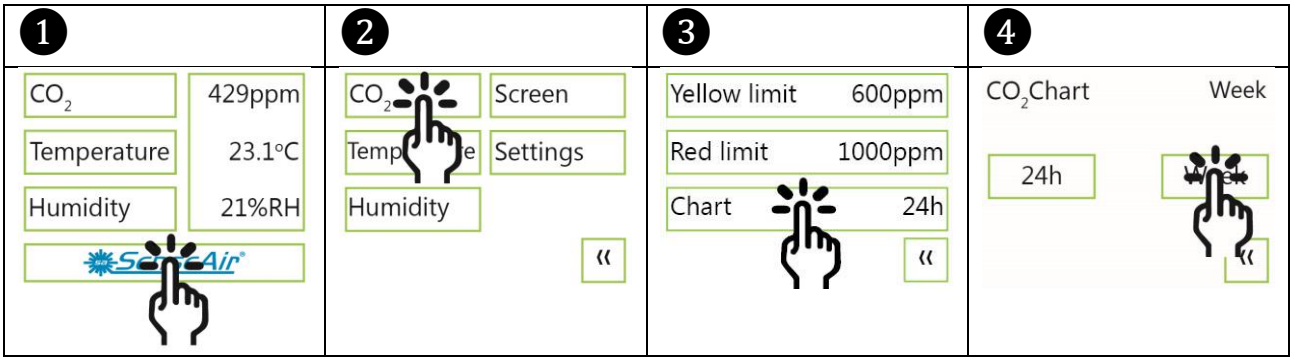
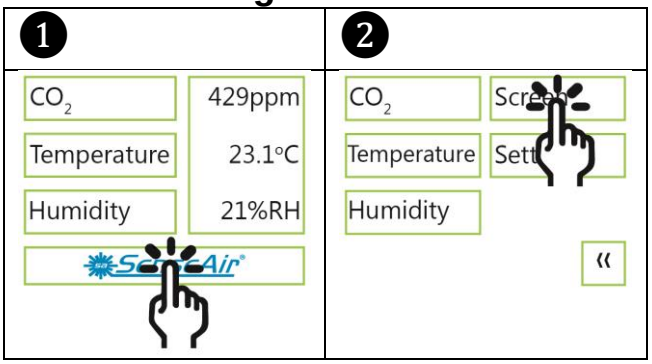


Chart 24h/Week

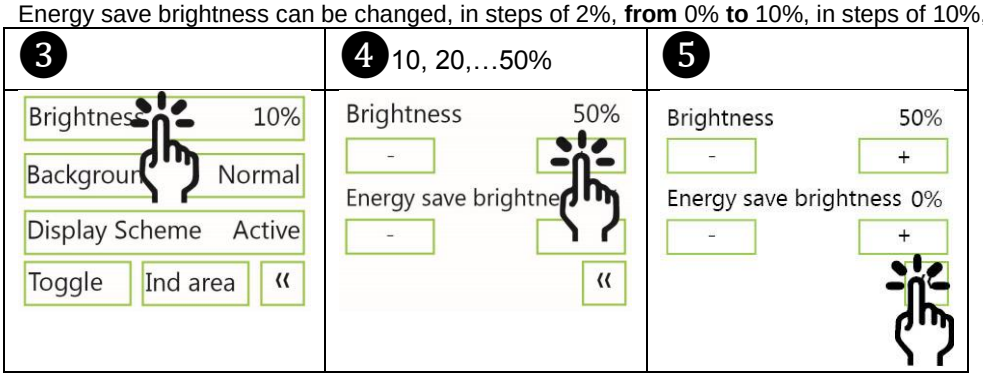


Screen settings

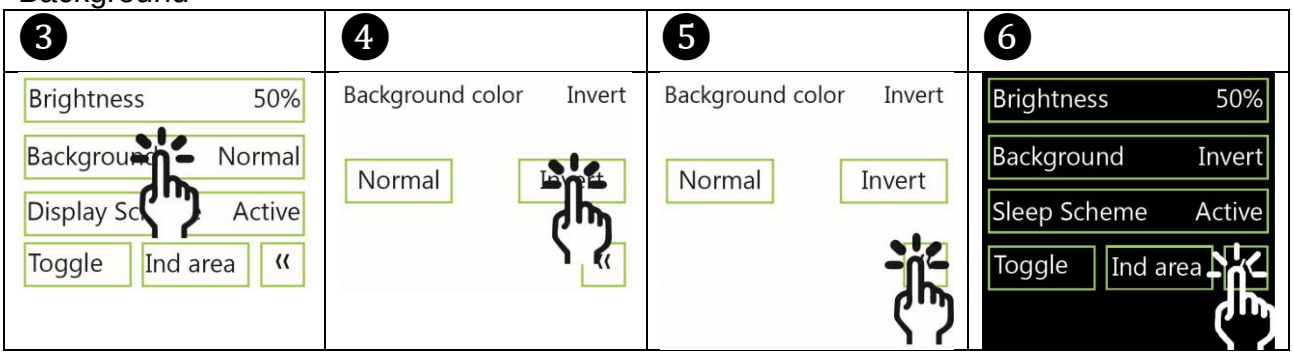


Brightness

Brightness can be changed, in steps of 2%, **from** 0% **to** 10%, in steps of 10%, **from** 10% **to** 100%
Energy save brightness can be changed, in steps of 2%, **from** 0% **to** 10%, in steps of 10%, **from** 10% **to** 40%

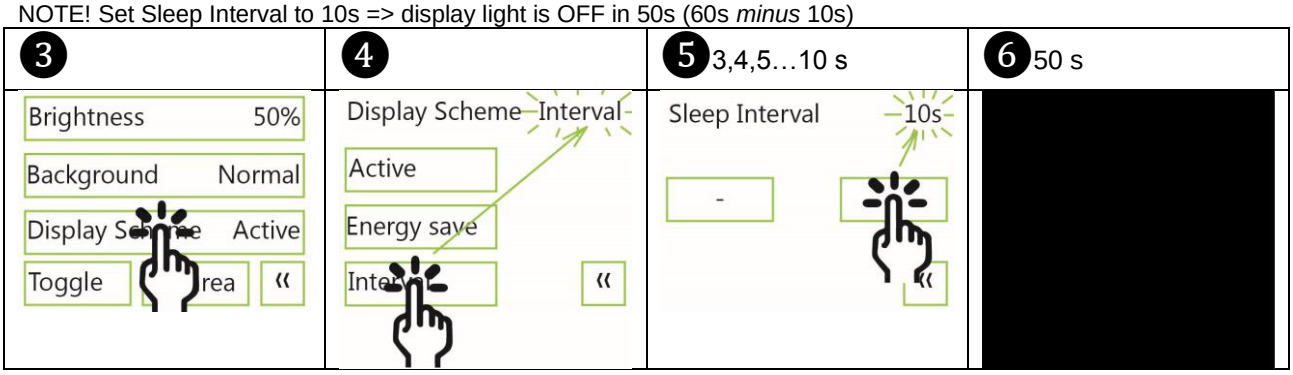


Background



Screensaver, Time setting

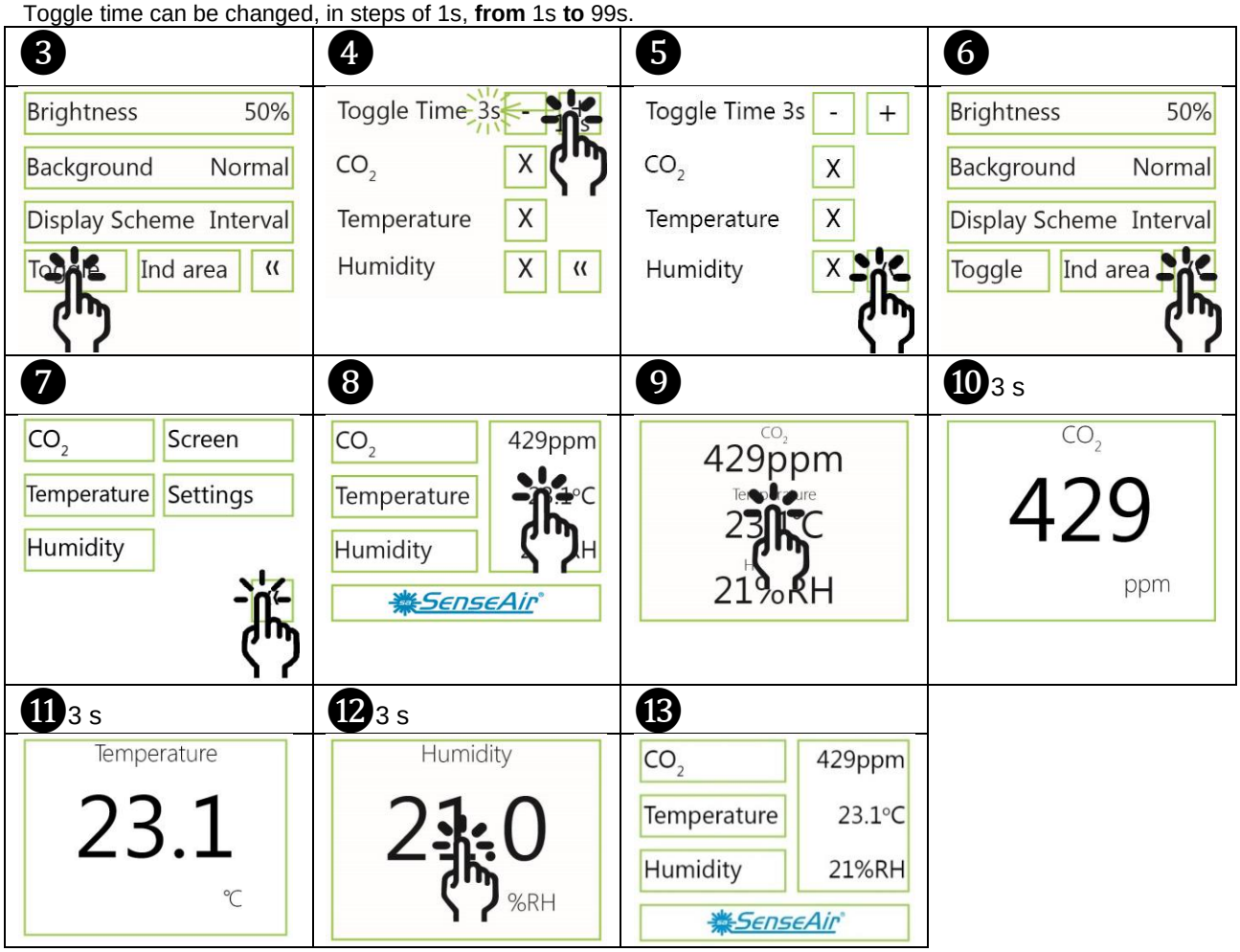
Display Scheme Interval can be changed, in steps of 1s, **from** 3s **to** 10s.
NOTE! Set Sleep Interval to 10s => display light is OFF in 50s (60s *minus* 10s)



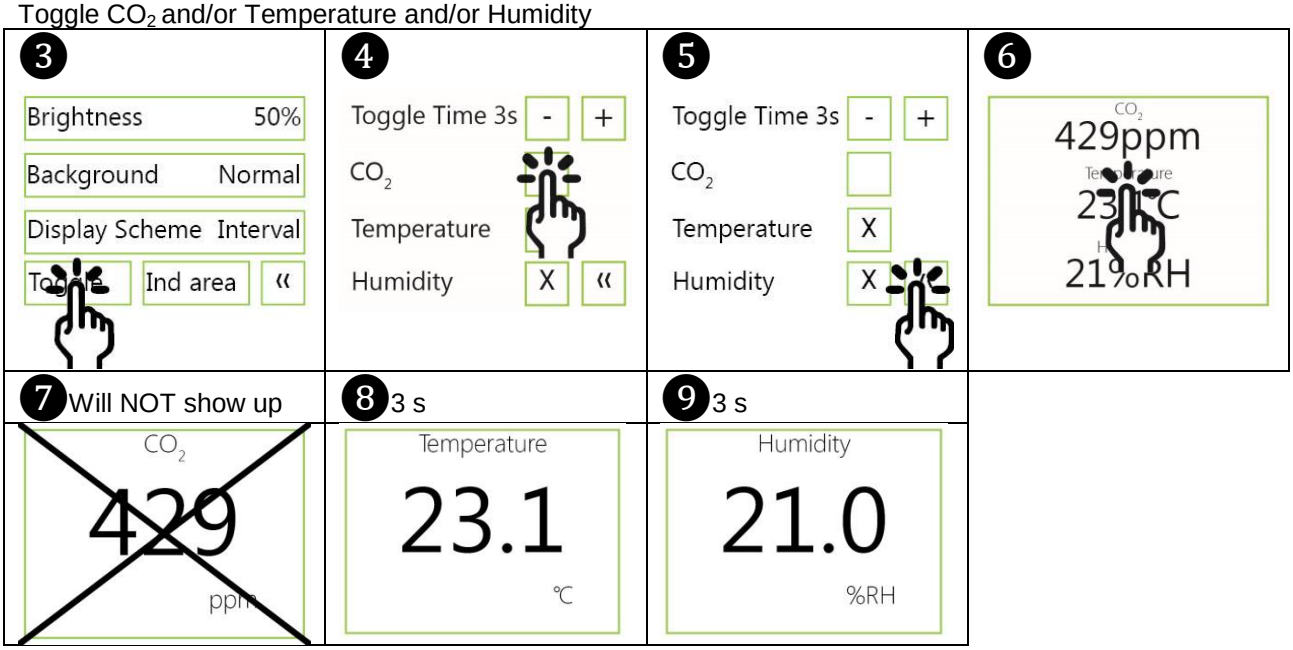
Toggle (Time and CO_2 and/or Temperature and/or Humidity

Toggle time

Toggle time can be changed, in steps of 1s, **from** 1s **to** 99s.

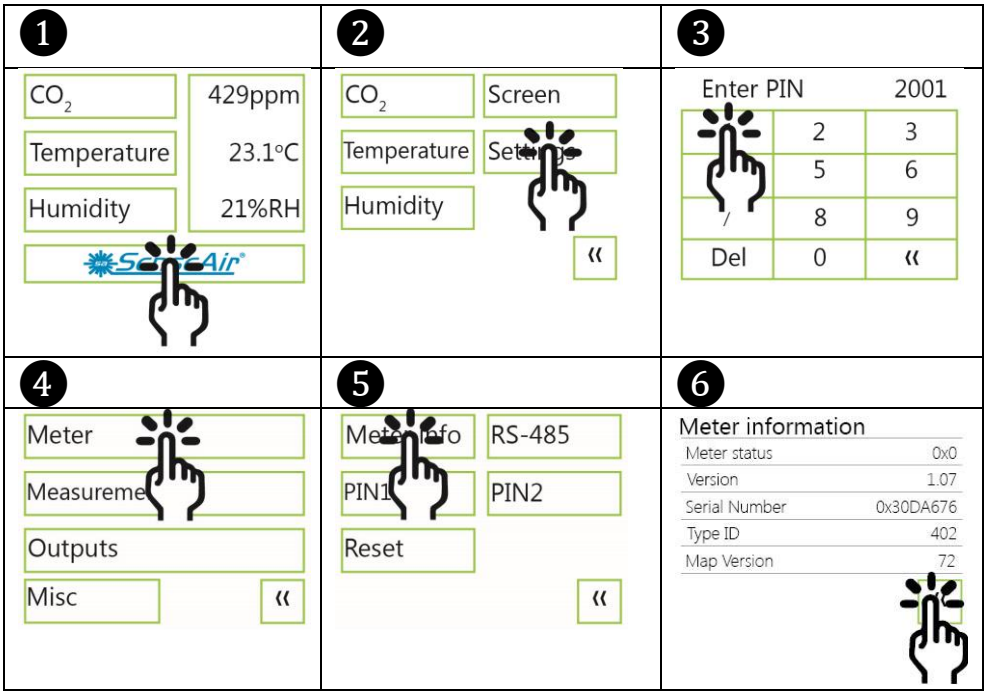


Toggle CO_2 and/or Temperature and/or Humidity

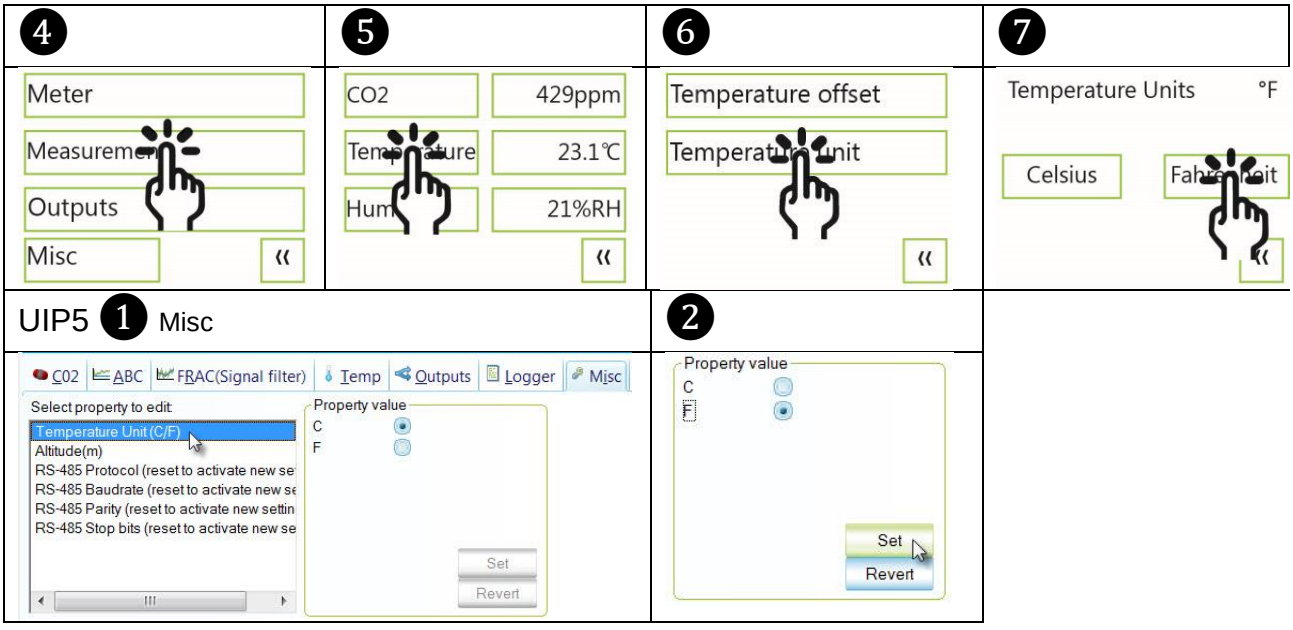


Meter settings

Meter information



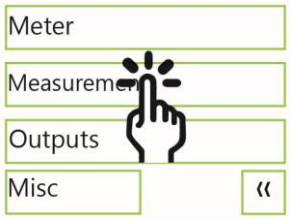
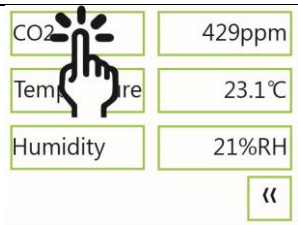
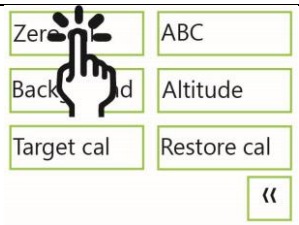
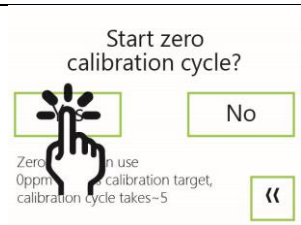
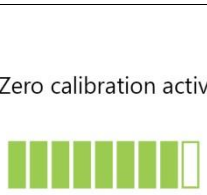
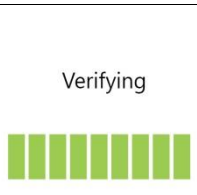
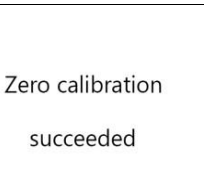
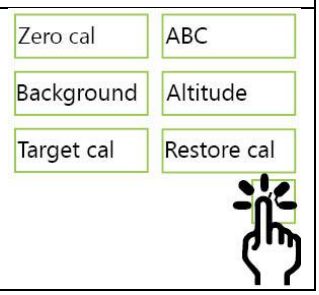
Temperature unit (°C/°F)



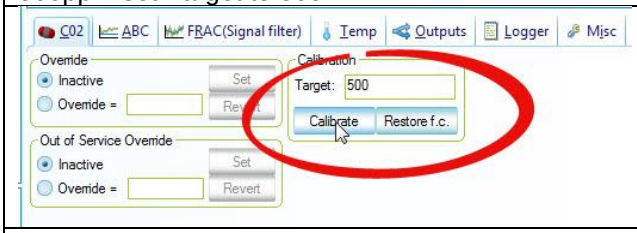
Calibration options CO_2

Zero cal/Background/Target cal

(Same display procedure for the three options. *See Note!*)

4	5	6	7
			
8	**9**	**10**	**11**
			

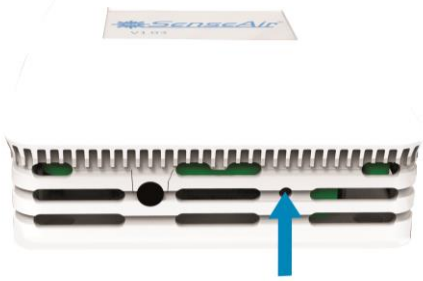
UIP: If reference meter shows e.g. CO_2-value 500ppm set Target to 500



Background calibration button

1 Press 15s, until…

2 Green LED blinks twice



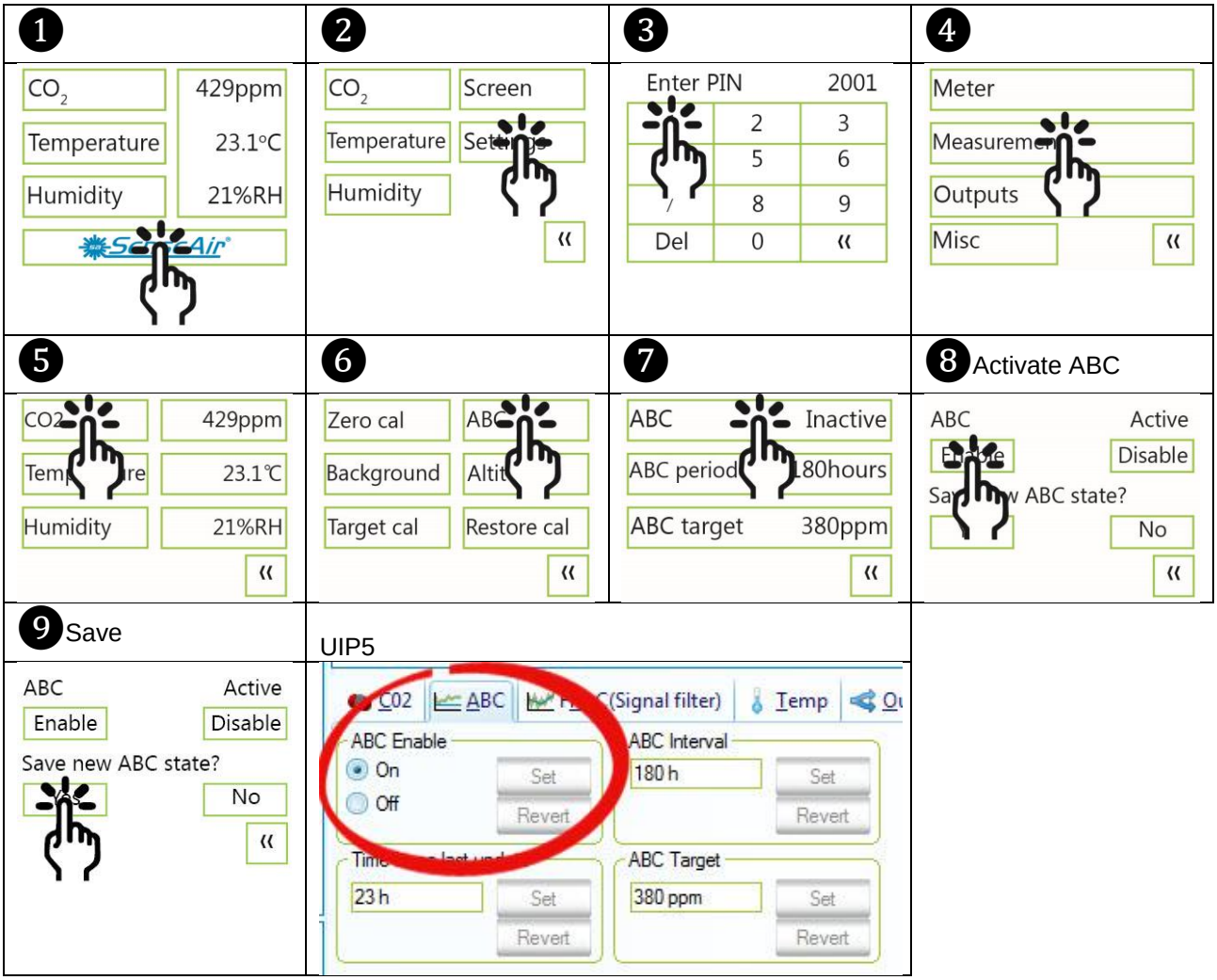
NOTE!

Zero Calibration: procedure requires calibration gas with CO_2 value 0ppm
Zero Calibration Kit is used to zero calibrate CO_2 sensors. The unit produces CO_2 free air from ambient air.

Background Calibration: uses ABC (Automatic Baseline Correction) target, default value is 380ppm, as calibration target. (Background Calibration button as option.)

Target Calibration (Background CO_2 level): default value is 400ppm.
e.g. The ABC requires that the sensor is exposed to fresh air (at background level of CO_2 at least once per ABC period). If sensor is operated in environments that never reaches the background level, it might still be possible to benefit from ABC function by adjusting target level.

ABC
Enable/Disable



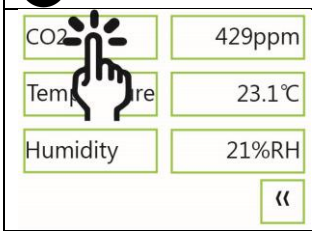
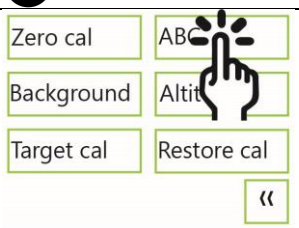
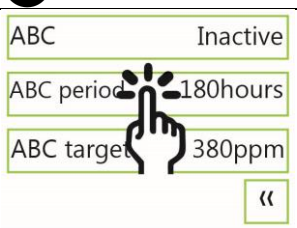
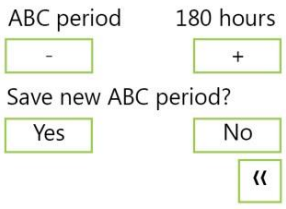
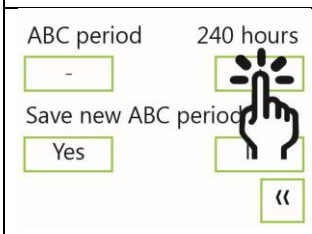
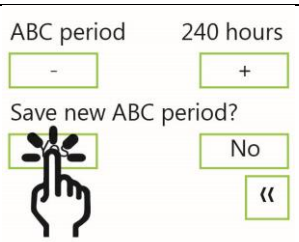
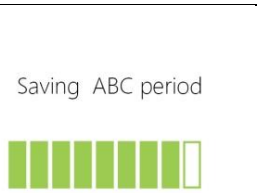
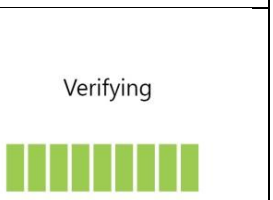
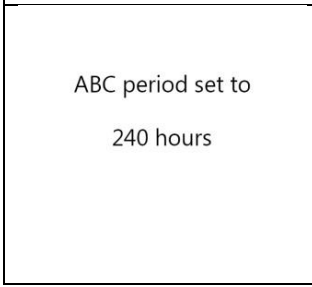
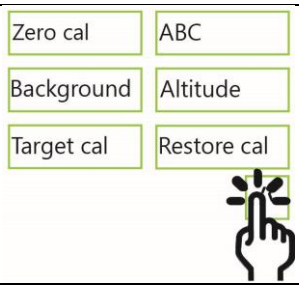
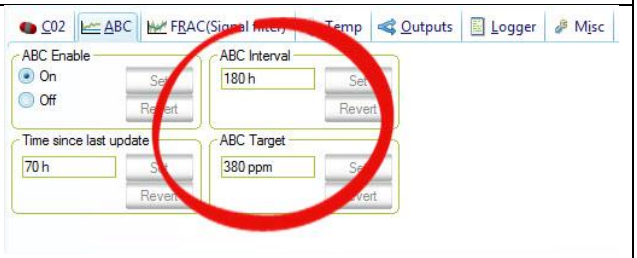
ABC: the function makes the sensor automatically adjust for any drifts in sensor reading due to e.g.:

- calibration misalignment due to vibration/shock from transportation and/or installation
- component aging
- dust accumulation
- degradation of reflective surfaces in the optical system

The ABC makes use of the fundamental fact that there is a background level of CO_2 in the atmosphere that is fairly constant, currently close to 400ppm_{vol}, and that for many applications the CO_2 level will reach the background level at some points in time.

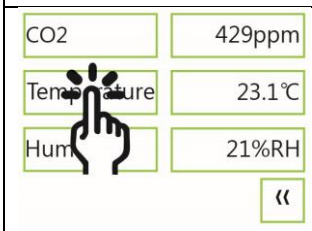
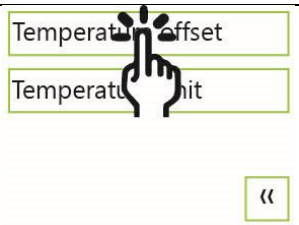
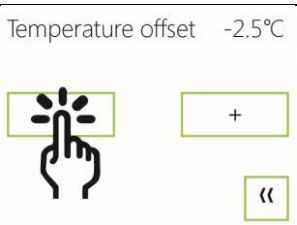
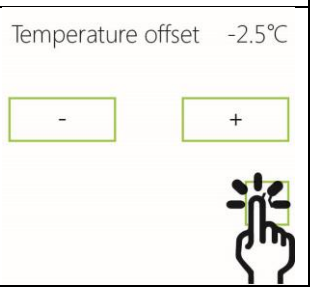
NOTE!
For the ABC time counter to work properly, the electrical power supply to the sensor needs to be continuously ON for at least four (4) hours.

ABC period (ABC target / Altitude / Restore cal)
(Same display procedure for the four options *See Note!)*

5	6	7 See NOTE!	8
			
9	**10** 180, 181, 240hours	**11** Save	**12**
			
13	**14**	UIP5	
			

NOTE!
The ABC period is default set to 180 hours, which means that the sensor will make an adjustment once a week.

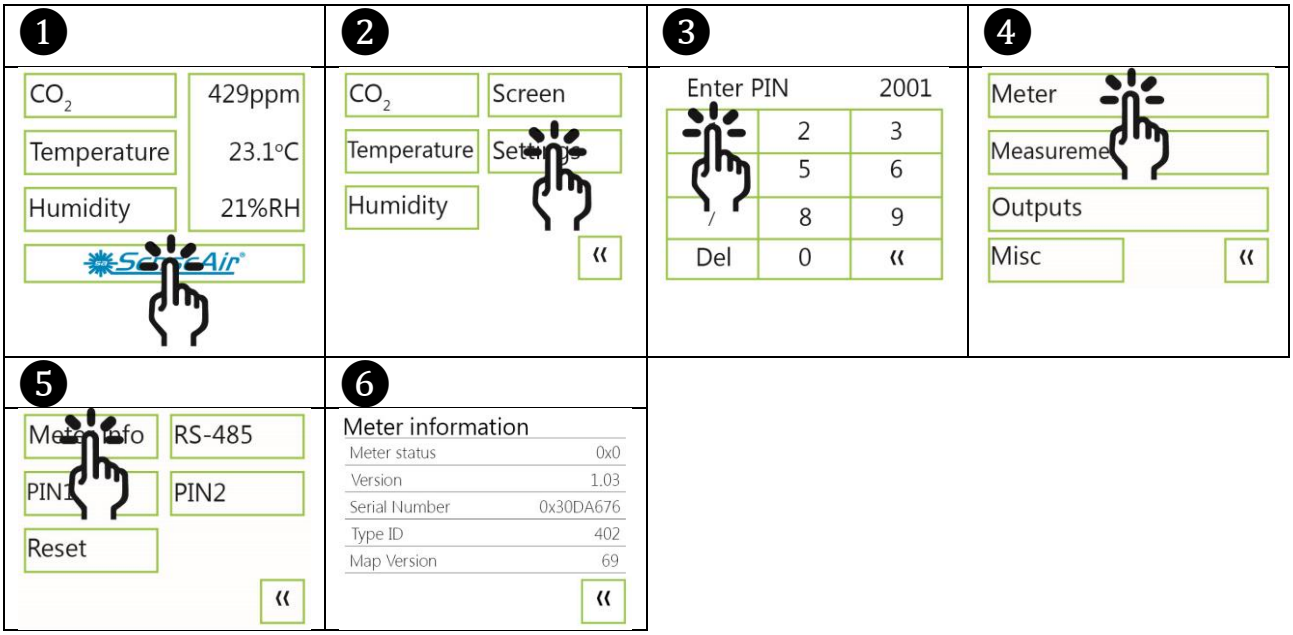
Temperature/Humidity Offset

5	6	7 0.0..-0.1…-2.5°C	
			

Automatic system test

A full system test is executed automatically at every power-up. Sensor probes are checked constantly during operation against failure by checking valid dynamic measurement ranges.

System checks returns error bytes to RAM. Error codes are available by connecting the sensors to a PC with a special USB cable (art.No. 00-0-0070) connected (see fig. 2). Error codes are shown in software UIP (version 5 or higher) and in the display at “Meter status”



Error codes and action plans

Error symbol (a wrench appears when one or several error codes are active)

Bit #	Error code	Error description	Suggested action
0	CO_2 sensor Com. error	No ability to communicate with CO2 sensor module.	Try to restart sensor by power OFF/ON. Contact local distributor.
1	CO_2 sensor CO_2 measure error	CO_2 measurement error.	Try Background calibration (see fig. 4 and 5). Contact local distributor. *See Note 1!*
2	T sensor T measure error	Temp measurement error.	Try to restart sensor by power OFF/ON. Contact local distributor.
3	RH/T sensor com error	No ability to communicate with RH/T sensor module.	
4	RH/T sensor RH measure error	RH measurement error.	
5	RH/T sensor T measure error	Temp measurement error, sensor will use CO_2 sensor temperature if RH/T Temperature is unavailable. S_Temp will be set to NTC_Temp.	
6			
7			
8	Output config. error	Error in output configuration. Output is still updated, i.e. can be 0 ─ 10V	Check connections and loads of outputs. Check detailed settings and configuration with UIP software version 5 or later. Contact local distributor. *See Note 2!*

Table 2: Error codes and action plans.

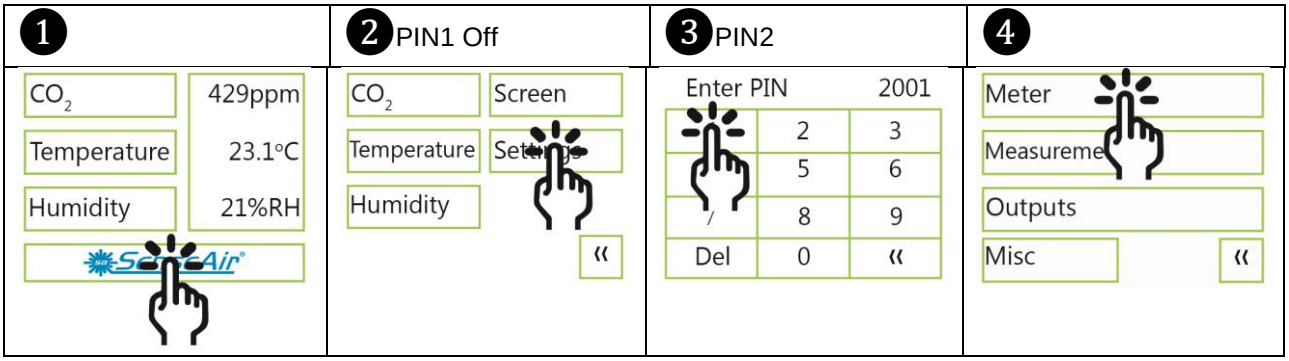
NOTE!

1: Occurs if probe is out of range, at very high CO_2 values. Error code resets automatically when measured values returns to normal. May also indicate need of zero point calibration. If CO_2 values are normal and error code remains, the sensor can be defect or the connections to it are broken.

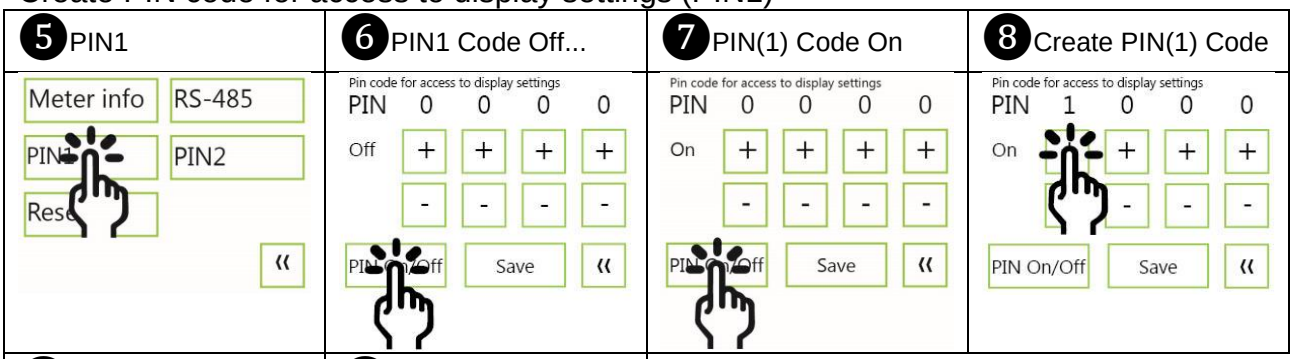
2: Even if there is an error in the configuration parameters for the output, and this error code is present in the status of the tSENSE VAV, the actual voltage on the output may be somewhere in the range 0-10V. There is no error control that for example sets the output to some pre-defined level (like 0V) in case of parameter error, rather the output will be undefined but in the range 0 ─ 10V.

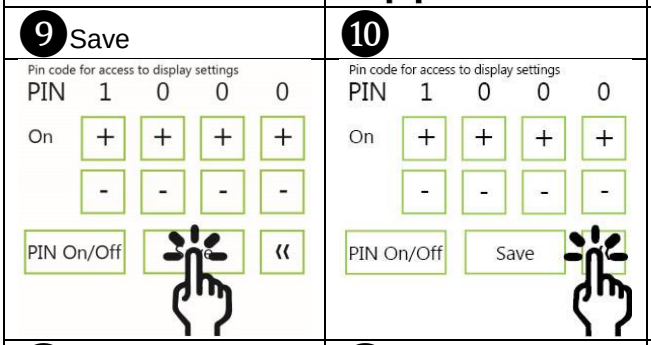
If several errors are detected at the same time, different error code numbers will be added together into one single error code!
Sensor accuracy is defined at continuous operation (at least three (3) weeks after installation).

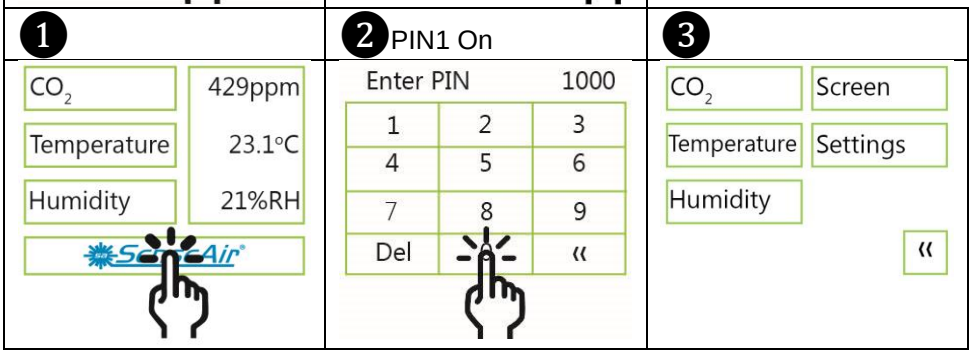
PIN codes



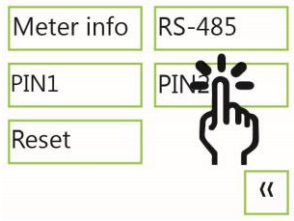
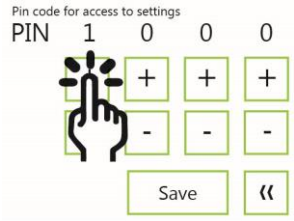
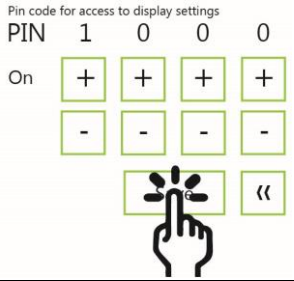
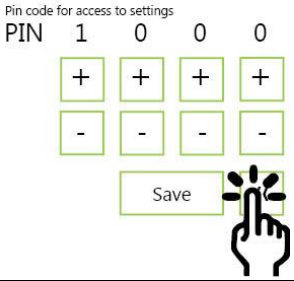
Create PIN code for access to display settings (PIN1)







Create PIN code for access to meter settings (PIN2)

5 PIN2	6 Create PIN2 Code	7 Save	8
			

Maintenance

tSENSE VAV is maintenance free. Internal self-adjusting calibration function takes care of normal long term drift. To secure highest accuracy, a time interval of five years is recommended between CO_2 calibrations, unless some special situations have occurred.

Software can be downloaded free at senseair.com.
USB-cable and zero calibration kit can be ordered from SenseAir.

Check can be done on site without interfering with ventilation system.

CE

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