uno® slim

Modbus/BACnet User Guide

VER 0.3

DELTA

【Revision】

Date	Version	Description
2024/ 11 / 01	0.1	Initial Version
2025/ 01 / 10	0.2	Modify the unit of PM calibration Read CO2 ASC mode
2025/ 02 / 11	0.3	Update thermistor state

【Content】

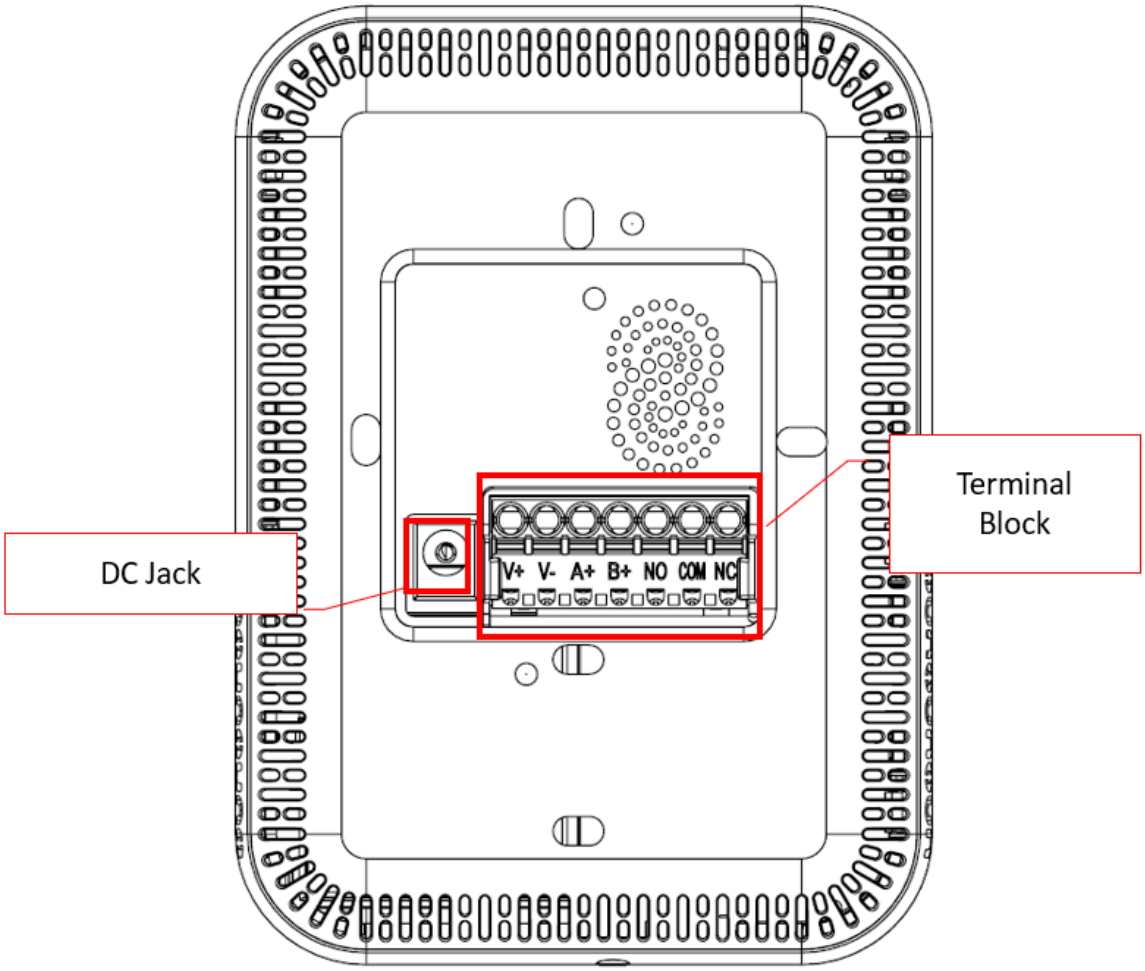
【Overview】

UNOslim is an indoor air quality monitor to measure the space temperature / humidity / CO2 / PM2.5 / PM10 / PM1 / TVOC and expose the measurements directly onto a BACnet MS/TP or Modbus RTU network. Moreover, the measurements are also accessible with UNO apps through BLE. Please refer to UNOslim official website for more product information.

https://isdweb.deltaww.com/resources/#unoslim

This document is primarily concerned how to communicates UNOslim using Modbus/RTU or BACnet MS/TP protocol.

【Hardware Interface】

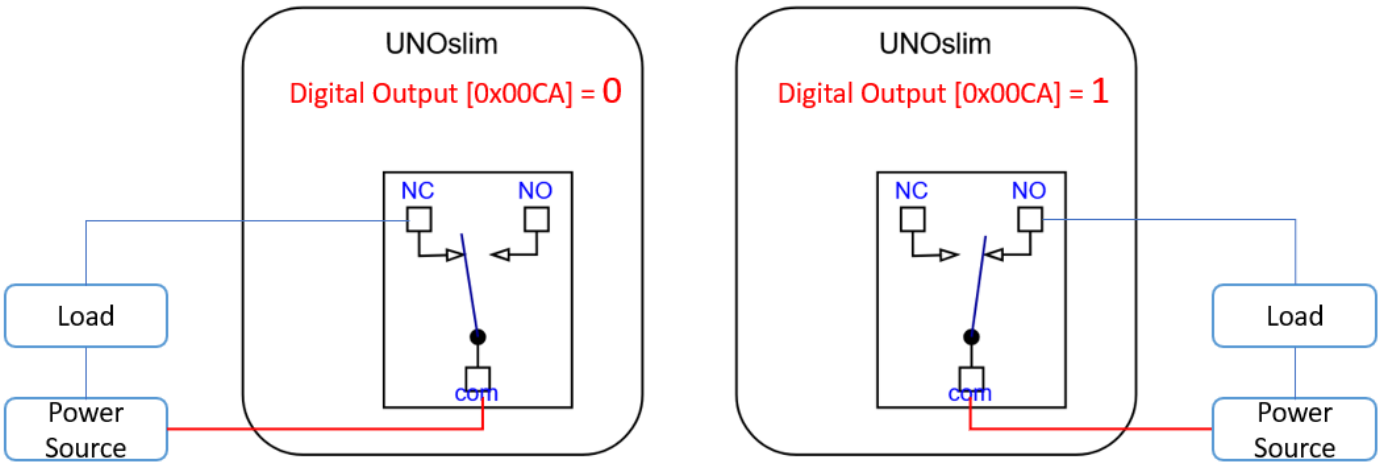


Terminal block

Terminal	Description
V+	Power input. For more information, please refer to production specification.
V-	Power input. For more information, please refer to production specification.
A+	RS485(+) data pin. For Modbus/BACnet network.
B-	RS485(-) data pin. For Modbus/BACnet network.
NO	Normally open pin. The contact to the common pin is normally open and closes during operation.
COM	Common pin.
NC	Normally closed pin. The contact to the common pin is normally close and open during operation.

***NOTE1**: Safety Precautions! NO, NC and COM are all relay pins. Please refer to the specifications provided in the datasheet for proper usage. Do not connect circuits that exceed the specified current or voltage ratings, as this may damage the device and pose safety risks.*

***NOTE2:** The relay pins could be controller by Modbus, BACnet or by condition. Here is an application example demonstrating how to control relay via Modbus (Relay reference Output 0×00CA).*



When the circuit connects NC and COM, the load will activate (turn on) when the 0×00CA register is set to 0.

When the circuit connects NO and COM, the load will activate (turn on) when the 0×00CA register is set to 1.

【RS485 Configuration】

UNOslim supports Modbus/RTU and BACnet MS/TP through pin A+/B-. All devices are configured with Modbus protocol as default, for any further modifications, please refer following steps to make changes using the mobile application:

1. Open the UNO NFC App that download from Google Play or Apple Store, you can find the QR-Code link in the user manual.
2. Bring the phone close to the device to read the current settings.
3. Modify the RS485 configurations and then execute the WRITE operation.
4. Bring the phone close to the device again and hold it there for a few seconds.

RS485 Termination resistor

The termination resistor is configurable on UNOslim. Add a jumper to the red rectangle below to add 120ohm termination resistor to RS485 network.

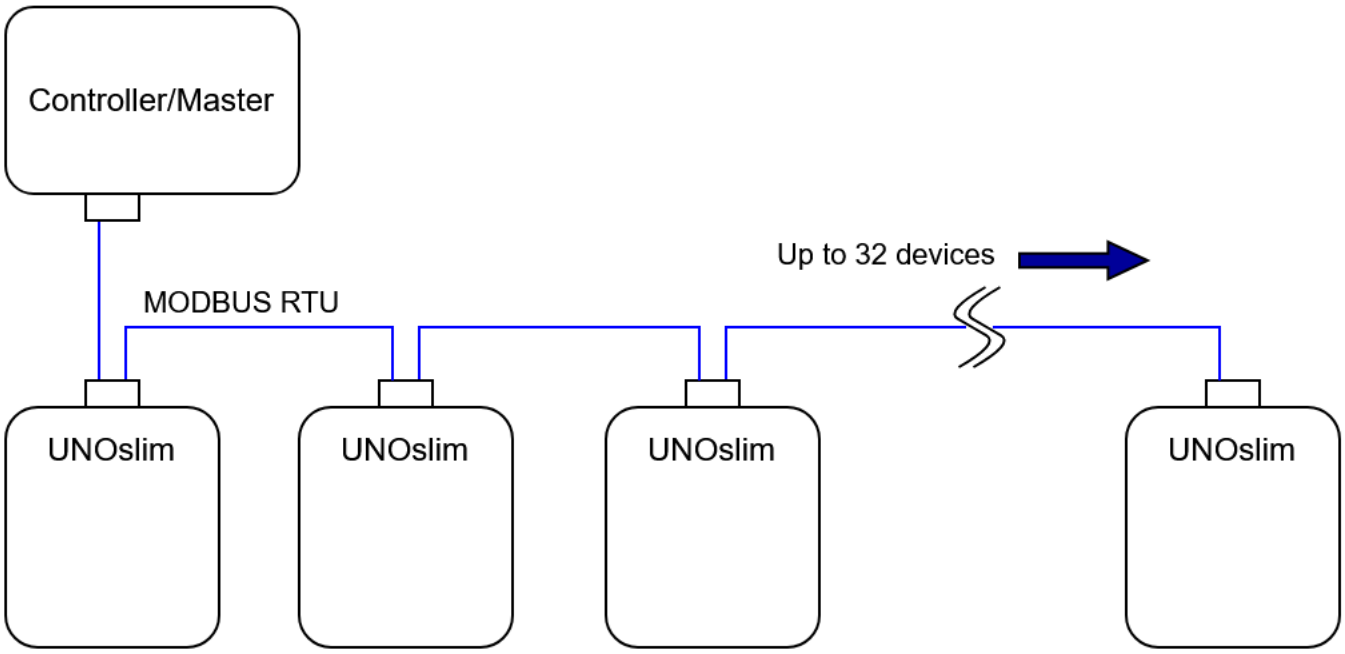
【Modbus Mode】

Modbus Slave Address

The Modbus slave address is available from 1~247 and default address is 208 (0xD0).

Serial Configuration

UNOslim can directly connect to a controller with RS485 interface, up to 32 devices can be joined to a Modbus serial bus. Suggestion to use **22AWG shielded twisted pair cable** to connect devices in sequence.



Default parameters:

- Baud: 9600
- Data-Bit: 8
- Parity: None
- Stop-Bit: 1

Available baud: 9600, 19200, 38400, 57600, 115200
Available Serial configuration: 8-N-1, 8-N-2, 8-E-1, 8-O-1

Relay settings for Modbus

The device is configured at the factory to allow relay control via Modbus/BACnet.

【Modbus Read Data】

UNOslim supports function code both 0×03 and 0×04 to read following registers.

0×03: read holding registers

0×04: read input registers

Modbus Application Data Unit (ADU)

Request				
Slave Address 1 byte	Function code 1 byte	Register 2 bytes	Length [N] 2 bytes	CRC16 2 bytes
Response				
Slave Address 1 byte	Function code 1 byte	Count [2*N] 1 byte	Data N * 2 bytes	CRC16 2 bytes

Register List

Sensor Measurement			
Register		Name	Description
30001	0x0000	RESET® air index	0-100(%): The index is calculated from the concentrations of multiple pollutants, including sensors like PM2.5, CO2, and TVOC. The categories of the values can be referenced from the list suggested by RESET: Green 90% or above Yellow 80-89% Orange 65-79% Red 50-64% Purple 49% or lower
30002	0x0001	Concentration of PM2.5	Unit: μg/m^3
30003	0x0002	Concentration of PM10	Unit: μg/m^3
30004	0x0003	Concentration of carbon dioxide (formula CO_2)	Unit: ppm
30005	0x0004	Concentration of total volatile organic compound (TVOC)	Unit: ppb
30006	0x0005	Concentration of total volatile organic compound (TVOC)	Unit: μg/m^3 (factor 1 ppb = 4.5 μg/m^3)

30007	0x0006	RESET® Viral index, RVI	0-99 (%): RVI calculates the potential for infection based on the indoor air quality metrics. The higher the value, the better the air quality.
30008	0x0007	RVI Label	RESET recommends the categories for the RVI: 0 Poor RVI 0-19% 1 Unsatisfactory RVI 20-39% 2 Needs Improvement RVI 40-54% 3 Fair RVI 55-69% 4 Good RVI 70-84% 5 Excellent RVI 85-99%
30009	0x0008	(Main) Relative humidity	The built-in T/H sensor provides the relative humidity. If a thermistor is connected to the device, the relative humidity will be compensated using the temperature provided by the thermistor. Unit: 0.01%
30010	0x0009	(Main) Dew Point temperature	If a thermistor is connected, the temperature will be related to the thermistor, not built-in sensor. Temperature = (Value -4500) * 0.01 Unit: °C
30011	0x000A	(Main) Celsius temperature	If a thermistor is connected, the temperature will be related to the thermistor, not built-in sensor. Temperature = (Value - 4500) * 0.01 Unit: °C
30018	0x0011	(Main) Fahrenheit temperature	If a thermistor is connected, the temperature will be related to the thermistor, not built-in sensor. Temperature = (Value - 4500) * 0.01 Unit: °F
30020	0x0013	Concentration of PM1	Unit: $\mu g/m^3$
30022	0x0015	(Built-in) Celsius temp.	Regardless of whether the thermistor is installed, it always returns temperature from built-in sensor. Temperature = (Value -4500) * 0.01 Unit: °C

30023	0x0016	(Built-in) Relative humidity	Regardless of whether the thermistor is installed, it always returns humidity from built-in sensor. Unit: 0.01%
30024	0x0017	(External) Celsius temp.	Only works if a thermistor is installed. Temperature = (Value -4500) * 0.01 Unit: °C
30025	0x0018	(External) Relative humidity	Only works if a thermistor is installed. Unit: 0.01%
30057	0x0038	CO2 Automatic self-calibration (ASC) mode	0: OFF 1: ON

Sensor State			
Register		Name	Description
30033	0x0020	PM2.5 sensor	State of sensor hardware module 0x0000: Power off or does not exist 0x0001: Sensor ready 0x0002: Warming up 0x0003: Busy 0x00FE: CSERROR 0x00FF: FAIL
30034	0x0021	PM10 sensor	
30035	0x0022	CO_2 sensor	
30036	0x0023	TVOC sensor	
30037	0x0024	Humidity sensor	
30038	0x0025	Temperature sensor	
30042	0x0029	PM1 sensor	
30044	0x002B	Thermistor state	0x0000: Not installed 0x0001: Ready 0x00FA: Not installed

Device Information		
Register	Name	Description

30145-30160	0x0090-0x009F	Model and Product Serial Number	An ASCII string consists of model name and serial number, separated by a comma. For example: "UNO-M,2450M0179999"
30203	0×00CA	Relay control reference state	0x0000: OFF. COM and NC pins are connected. 0x0001: ON. COM and NO pins are connected.
30209	0x00D0	Main firmware version	Number 1 to 65535 0x0000: device is initializing
30216	0x00D7	Software configuration	Data format Hi byte | Lo byte | SW build **SW build** 0x4 build for UNOslim
30257-30259	0x0100-0x0102	BT MAC address	6 groups of two hexadecimal digits, e.g. F2:11:8F:36:F6:93

【Modbus Write Command】

UNOslim supports function code 0×06 and 0×10 to write request.

0×06: write single register

0×10: write multiple registers

Modbus Application Data Unit (ADU) for fn. 0×06

Request				
Address 1 byte	Function code (6) 1 byte	Register 2 bytes	Data 2 bytes	CRC16 2 bytes
Response				
Address 1 byte	Function code 1 byte	Register 2 bytes	Data 2 bytes	CRC16 2 bytes

Modbus Application Data Unit (ADU) for fn. 0×10

Request						
Address 1 byte	Fn. Code (16) 1 byte	Register 2 bytes	Length[N] 2 bytes	Count[2*N] 1 byte	Data N * 2 bytes	CRC16 2 bytes
Response						
Address 1 byte		Function code 1 byte	Register 2 bytes	Length [N] 2 bytes		CRC16 2 bytes

Register List

Calibration			
Notes before performing calibration: ● It's recommended to operate in an environment with good air quality and ensure the sensor reading is stable. ● For temperature, it's recommended to allow device to reach thermal equilibrium after power-on one hour. (typically, 1~3 minutes for other sensors) ● Approximately 20~60 seconds for changes to take effect after calibration. ● The device will compute new internal parameters and apply them. However, the parameters have reasonable limits. If the new readings still significantly differ from the given value, consider checking these parameters on the mobile phone application.			
Register		Name	Description
40012	0x000B	Temperature calibration	0~5000: give a reference value in units of 0.01 degrees Celsius. 9999: reset to default Return Error Code (ILLEGAL DATA ADDRESS): Data is out of range, or the sys uptime (since power on) is not long enough.
40013	0x000C	Humidity calibration	1000-9000: give a reference value in units of 0.01%RH. 9999: reset to default Return Error Code (ILLEGAL DATA ADDRESS): Data is out of range, or the sys uptime (since power on) is not long enough. **Temperature can impact the measured values of relative humidity, it's better to perform temperature calibration first.**
40050	0x0031	Automatic self-calibration (ASC) mode of carbon dioxide sensor	0: disable ASC 1: enable ASC (default) Typically, the sensor drift per year, ASC helps generate a reference value by analyzing CO_2 levels to keep accuracy every period
40052	0x0033	TVOC calibration	1-500: give a reference value of TVOC levels in **µg/m³**. The written value is constrained within a range of 1% to 200% of the raw data. If the written value exceeds this range, it will cap at 200% of the raw data, thus preventing the TVOC number from increasing further. 9999: reset to default *Note: 1 ppb = 4.5 µg/m³*

40054	0x0035	Particulate matter calibration	1-500: give a reference value of PM2.5 levels in **µg/m³**. The calibration also applies to PM1 and PM10 measurement. 9999: reset to default Return Error Code (ILLEGAL DATA ADDRESS): Data is out of range, or the sys uptime (since power on) is not long enough.
40081	0x0050	Carbon dioxide calibration	400~1500: give a reference value of CO_2 levels in ppm to calibrate sensor. *NOTE: The sensor cannot do reset*

Device Information			
Register		Name	Description
40014	0x000D	Temperature unit on display	0x0: Celsius 0x1: Fahrenheit
40203	0x00CA	Relay control reference	0x0: COM and NC will be connected. COM and NO will be disconnected. 0x1: COM and NO will be connected. COM and NC will be disconnected.
40215	0x00D6	UNOslim operations	0xA200: enable sensor low power mode. 0xB200: disable sensor low power mode. 0xA400: Display is always off. 0xB400: Display is always on. The option may affect the built-in T/H sensor. 0xC400: Auto display off according to the ToF detection.

【Modbus Examples】

1. Read all sensor status from device 208 (0xD0)

Request	D0 03 00 20 00 0B 17 86
Response	D0 03 16 00 01 00 01 00 01 00 01 00 01 00 FE 00 FE 00 FF 00 00 00 01 60 8F

2. Read firmware version from device 208 (0xD0)

Request	D0 03 00 D0 00 01 97 B2
Response	D0 03 02 00 04 45 95

3. Set relay control reference to 1

Request	D0 06 00 CA 00 01 7A 75
Response	D0 06 00 CA 00 01 7A 75

4. Close Display

Request	D0 06 00 D6 A4 00 00 B3
Response	D0 06 00 D6 A4 00 00 B3

【Modbus Exception Response】

If device receives a request message without a communication error but cannot handle the query. It will reply with requested function code plus 0x80. Example, function code 0x3 becomes 0x83.

Response format

Address 1 byte	Function code 1 byte	Code 1 byte	CRC16 2 bytes

Code List

Code	Name
0x01	ILLEGAL FUNCTION
0x02	ILLEGAL DATA ADDRESS
0x03	ILLEGAL DATA VALUE
0x04	SERVER DEVICE FAILURE
0x05	ACKNOWLEDGE
0x06	SERVER DEVICE BUSY
0x08	MEMORY PARITY ERROR
0x0A	GATEWAY PATH UNAVAILABLE
0x0B	GATEWAY TARGET DEVICE FAILED TO RESPOND

Note: Please refer to "Modbus_Application_Protocol_V1_1b3" from www.modbus.org

【BACnet Mode】

BACnet MS/TP Configuration

Baud Rates: Auto(0), 76800, 9600, 19200, 38400

MAC Address: 0... 127

Number of Nodes: Max. 32

Device Instance ID: The default identifier number is composed of serial number. EX: The SN of UNOslim is 2512M0170040. Then the BACnet object identifier number will be 120040. The object identifier is also writeable and non-volatile. Running factory reset will set it to default value.

BACnet Interoperability Building Bocks Supported (BIBBs)

Data sharing — ReadProperty-B (DS-RP-B)
Data sharing — ReadPropertyMultiple-B (DS-RPM-B)
Data sharing — WriteProperty-B (DS-WP-B)
Device management — DynamicDeviceBinding-B (DM-DDB-B)
Device management — DynamicObjectBinding-B (DM-DOB-B)
Device management — DeviceCommunicationControl-B (DM-DCC-B)
Device management — DeviceCommunicationControl-B (DM-DCC-B)
Device Management — ReinitializeDevice-B (DM-RD-B)

【BACnet Points】

Analog Input Points			
Point Name	**R/W**	**Unit**	**Descriptions**
Temperature	R	°C	Thermistor or Built-in sensor. If a thermistor is connected, the temperature will be related to the thermistor.
Temperature_F	R	°F	
Humidity	R	%	The built-in T/H sensor provides the relative humidity. If a thermistor is connected to the device, the relative humidity will be compensated using the temperature provided by the thermistor.
CO_2	R	ppm	Concentration of carbon dioxide
VOC	R	$\mu g/m^3$	Concentration of total volatile organic compound
$PM_{2.5}$	R	$\mu g/m^3$	Concentration of PM (Particulate Matter) sensor
PM_{10}	R	$\mu g/m^3$	
PM_1	R	$\mu g/m^3$	
RVI	R	%	0-100(%): The index is calculated from the concentrations of multiple pollutants, including sensors like PM2.5, CO2, and TVOC. The categories of the values can be referenced from the list suggested by RESET: Green 90% or above Yellow 80-89% Orange 65-79% Red 50-64% Purple 49% or lower
RVI_Label	R	No Unit	RESET recommends the categories for the RVI: 0 Poor RVI 0-19% 1 Unsatisfactory RVI 20-39% 2 Needs Improvement RVI 40-54% 3 Fair RVI 55-69% 4 Good RVI 70-84% 5 Excellent RVI 85-99%
Int_Temperature	R	°C	Regardless of whether the thermistor is installed, it always returns temperature from built-in sensor.
Int_Temperature_F	R	°F	
Ext_Temperature	R	°C	Only works if a thermistor is installed
Ext_Temeprature_F	R	°F	

Int_Humidity	R	%	Regardless of whether the thermistor is installed, it always returns humidity from built-in sensor.
Ext_Humidity	R	%	Only works if a thermistor is installed.
Dew_Temeprature	R	°C	If a thermistor is connected, the temperature will be related to the thermistor, not built-in sensor.

Note1: Input objects writable only when "Out of Service" is set to true

Note2: Use "Status flags" or "Reliability" to monitor sensor status

Analog Value Points			
Point Name	**R/W**	**Unit**	**Descriptions**
Temperature_Cali	W	°C	0~50.00: give a reference value in units of 0.01 degrees Celsius. 9999: reset to default
Humidity_Cali	W	%	10 ~ 90: give a reference value in units of %RH. 9999: reset to default
CO_2_Cali	W	%	400~1500: give a reference value of CO_2 levels in ppm to calibrate sensor. *NOTE: The sensor cannot do reset*
PM_Cali	W	µg/m³	1-500: give a reference value of PM2.5 levels in **µg/m³**. The calibration also applies to PM1 and PM10 measurement. 9999: reset to default
VOC_Cali	W	µg/m³	1-500: give a reference value of TVOC levels in **µg/m³**. The written value is constrained within a range of 1% to 200% of the raw data. If the written value exceeds this range, it will cap at 200% of the raw data, thus preventing the TVOC number from increasing further. 9999: reset to default *Note: 1 ppb = 4.5 µg/m³*
MAC_Address	R/W	No unit	0 – 127. Set value on this object to configure the MAC address. The saved value will be cleaned by factory reset or write 255 to this object. Device will reboot after writing on this object
CO_2_ASC	R/W		Automatic self-calibration (ASC) mode 0: disable ASC 1: enable ASC (default)

			Typically, the sensor drift per year, ASC helps generate a reference value by analyzing CO_2 levels to keep accuracy every period
Temp_Unit	R/W		Temperature unit on display 0x0: Celsius 0x1: Fahrenheit
Low_Power_Mode	R/W		0x0: Disable sensor low power mode 0x1: Enable sensor low power mode
Disp_mode	R/W	No unit	0: Auto display off according to the ToF detection. 1: Display is always on. The option may affect the built-in T/H sensor. 2: Display is always off.
Relay_out_ref	W		0x0: COM and NC will be connected. COM and NO will be disconnected. 0x1: COM and NO will be connected. COM and NC will be disconnected.
Relay_val	R		0x0: COM and NC are connected. 0x1: COM and NO are connected.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