

UNOnext indoor air quality monitor

User Guide (BACnet MS/TP version)

VER 0.5



uno[®]
next

 **DELTA**
Smarter. Greener. Together.

【Revision】

Date	Version	Description
2021/05/06	0.1	Initial Version
2021/07/28	0.2	Change the temperature calibration limitation
2021/08/30	0.3	<ol style="list-style-type: none">1. Correct the device Modbus table2. Correct the temperature calibration range3. Add OLED Celsius format instruction4. Add sensor criteria mark table5. Modify the Modbus sensor status text
2021/12/07	0.4	<ol style="list-style-type: none">1. Add description of sensor "out_of_service"2. Add AV objects to control IAQ indicator and OLED panel (FW: 0.1.7)3. Add IAQ index value in AI object (FW: 0.1.7)
2023/10/20	0.5	<ol style="list-style-type: none">1. Add more description for device object identifier.

【Overview】

UNOnext is an indoor air quality monitor to measure the space temperature / humidity / CO₂ / PM_{2.5} / PM₁₀ / TVOC / HCHO / O₃ / CO and expose the measurements directly onto a BACnet MS/TP and MODBUS RTU network.

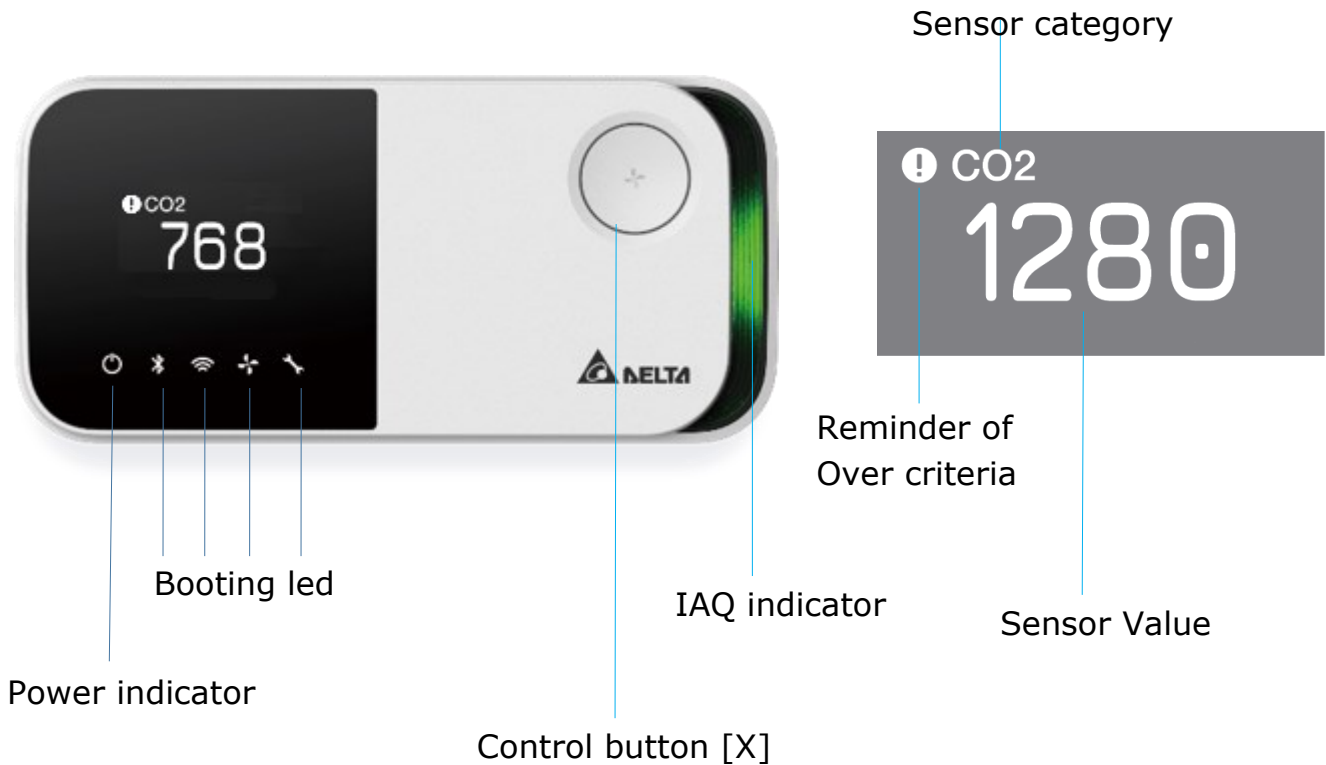
UNOnext is suitable for many different types of environments, including residential buildings, Commercial buildings, medical institutions, and places sensitive to air quality, such as nursing homes and day care centers.

The configuration of BACnet and MODBUS can be easily adjusted via device DIP switches.

Specification	
Operation range	0°C to 50°C , 10-90% RH, IP20
Storage temp.	-20°C to 70°C
Power requirements	source 1: 9-24VDC+/-10% source 2: power adapter 12V/1A
Power consumption	Max 500mA@12VDC
Dimension	14.2cm(L) x 6.8cm(W) x 4.2cm(D) 5.6in(L) x 2.68in(W) x 1.65in(D)
Weight	208 g
Display	1.3" OLED
Location	1.5m from floor level
Accessory	Wall Mount, Power Adapter (Optional)
Connectivity	Mobus RTU (9600, 38400, 57600, 115200) BACnet MS/TP (9600, 19200, 38400, 76800)

Sensors		
Sensing item	Range	Accuracy
Temperature	0-50°C	±1°C at 25°C and 50% rH
Humidity	0-100% rH	±5% at 25°C and 50% rH
CO ₂	350-10000 ppm	± 30 ppm ± 3%
PM _{2.5}	0-1000 ug/m ³	0-100 ug/m ³ ± 10 ug/m ³ , 100-1000 ug/m ³ ± 10%
PM ₁₀	0-1000 ug/m ³	Relative accuracy
HCHO	0-5000 ppb	±15% at 20~50°C
CO	0-500 ppm	±20ppm or ±5%
O ₃	0.5-10 ppm	Relative accuracy
TVOC	0-60000 ppb	±15% in lab test (Ethanol)
Luminance	0-10000 lux	Relative accuracy
Ext. temp.	NTC10k Thermistor	±0.3°C at 25°C and 50% rH

【UNOnext Front】



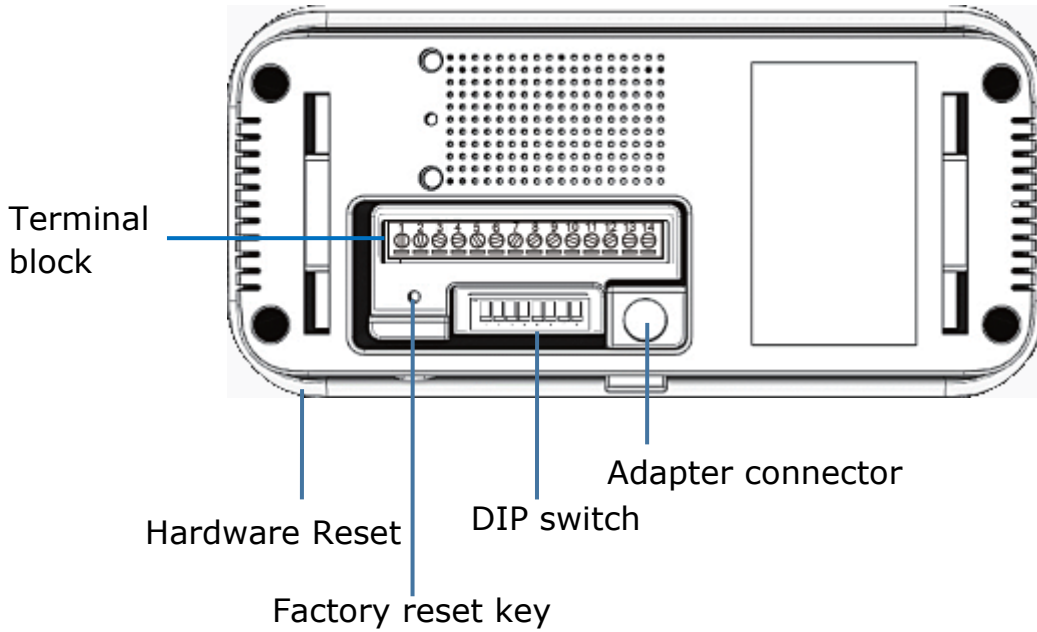
Item	Description
Power indicator	Show the power status
Booting led	Show the booting progress and will be off state after boot done
Control button	Reserved
IAQ indicator	Refer to the IAQ Indicator table
Reminder	Exclamation mark means the sensor value over criteria

IAQ Indicator table			
Status	PM 2.5 (ug/m ³)	PM10 (ug/m ³)	CO2 (ppm)
Green (Good)	0 - 28	0 - 60	400 - 800
Yellow (Moderate)	29 - 35	61 - 75	801 - 1000
Red (Bad)	36 - 140	76 - 300	1001 - 4000
Purple (Polluted)	> 140	> 300	> 4000

【UNOnext Front】

Over Criteria Mark Table						
PM 2.5 (ug/m ³)	PM10 (ug/m ³)	CO2 (ppm)	TVOC (ppm)	HCHO (ppm)	CO (ppm)	O3 (ppm)
> 35	>75	>1000	>0.56	>0.08	>9	>0.06

【UNOnext Back】



Item	Description
Factory reset	After booting, press this key three times duration one second to execute factory reset. After factory reset, the BACnet configuration will be cleaned

Terminal Block		
Pin	Name	Definition
1	GND	Ground
2	AI1	NTC
3	AI2	Reserved
4	NO4	Reserved
5	NO3	Reserved
6	NO2	Reserved
7	NO1	Reserved
8	B2	Modbus slave B
9	A2	Modbus slave A
10	B1	BACnet MS/TP B
11	A1	BACnet MS/TP A
12	GND	Ground
13	Vin	9-24 V DC input
14	Vout	9-24 V DC output

Dip Switch			
Num	Definition	ON	OFF
1	RS485 terminator resistor		■
2	Modbus/BACnet slave position[3]		■
3	Modbus/BACnet slave position[2]		■
4	Modbus/BACnet slave position[1]		■
5	Modbus/BACnet slave position[0]		■
6	BACnet baudrate [1]		■
7	BACnet baudrate [0]		■
8	Night mode		■

- The above are the default states of the DIP switches
- Modbus and BACnet use the same dips to set the address. Refer to the address table for more information
- Set Dip [1] ON will enable the 120 ohm on RS485
- The dips must be adjusted to properly position in power off state
- Night mode 'ON' will turn off the IAQ indicator and OLED sensor panel**

Address Table					
Dip				Modbus Slave address	BACnet MAC address
2	3	4	5		
↓	↓	↓	↓	0xD0 (208)	0x00
↓	↓	↓	↑	0xD1 (209)	0x01
↓	↓	↑	↓	0xD2 (210)	0x02
↓	↓	↑	↑	0xD3 (211)	0x03
↓	↑	↓	↓	0xD4 (212)	0x04
↓	↑	↓	↑	0xD5 (213)	0x05
↓	↑	↑	↓	0xD6 (214)	0x06
↓	↑	↑	↑	0xD7 (215)	0x07
↑	↓	↓	↓	0xD8 (216)	0x08
↑	↓	↓	↑	0xD9 (217)	0x09
↑	↓	↑	↓	0xDA (218)	0x0A
↑	↓	↑	↑	0xDB (219)	0x0B
↑	↑	↓	↓	0xDC (220)	0x0C
↑	↑	↓	↑	0xDD (221)	0x0D
↑	↑	↑	↓	0xDE (222)	0x0E
↑	↑	↑	↑	0xDF (223)	0x0F

BACnet Baudrate		
Dip		Baudrate
6	7	
↓	↓	76800
↑	↓	9600
↓	↑	19200
↑	↑	38400

NOTE

1. The dips must be adjusted to properly position in power off state
2. The BACnet MAC address also can be configured by BACnet object. If the BACnet have been set by object, the dips setting for BACnet MAC address will be abandoned. See BACnet section for more information.
3. Only BACnet baudrate can be adjusted by dips. The Modbus baudrate is default set to 9600 and can be changed by Modbus register

【UNOnext BACnet MS/TP】

BACnet Object Table

Object Type	Object Identifier	Object Name	Unit	Descriptions
Analog Input	AI-0	Temperature	°C	Range: 0.00 - 50.00
	AI-1	Humidity	%	Range: 0.00 - 100.00
	AI-2	PM2.5	µg/m ³	Range: 0 - 1000
	AI-3	PM10	µg/m ³	Range: 0 - 1000
	AI-4	CO2	ppm	Range: 350 - 10000
	AI-5	Light	Lux	Range: 0 - 10000
	AI-6	TVOC	ppm	Range : 0 - 60.000
	AI-7	HCHO	ppm	Range: 0 - 50.000
	AI-8	CO	ppm	Range: 0 - 500
	AI-9	O3	ppm	Range: 0 - 10.000
	AI-10	NTC	°C	Range: 0 - 50.00
	AI-11	Temperature_F	°F	Range: 32.00 - 122.00
	AI-12	NTC_F	°F	Range: 32.00 - 122.00
	AI-13	IAQ	-	IAQ index (Refer to indicator table)
Analog Value	AV-0	MAC Address	-	<p>Range: 0 - 127</p> <p>Set value on this object to configure the MAC address. The MAC address will be saved and overwritten the dip setting. The saved value will be cleaned after factory reset.</p> <p>Device will reboot after writing on this object</p>
	AV-1	Temperature_Cali	°C	<p>Range: based on reality temperature</p> <p>Write the reality temperature(°C) to calibrate UNOnext's temperature. The difference between reality temperature should less than 4°C.</p> <p>EX: UNOnext's temperature is 23°C, write 2200 to this object will calibrate UNOnext's temperature to 22°C</p>
	AV-2	CO2_Cali	ppm	<p>Range : 400 - 2000</p> <p>Writing the current CO2 value to calibrate UNOnext's CO2</p>

【UNOnext BACnet MS/TP】

Analog Value	AV-3	Set_OLED_Fahrenheit	-	Change the format of temperature degree on device. Set value to 1 to let OLED show temperature Fahrenheit format Set value to 0 to let OLED show temperature Celsius format
Analog Value	AV- 4	Panel_Ctl	-	The switch of OLED panel. Set value to 0 to disable OLED panel. Set value to 1 to enable OLED panel. (The value won't be saved when power loss)
Analog Value	AV- 5	IAQ_LED	-	The switch of IAQ indicator. Set value to 0 to disable the indicator Set value to 1 to enable the indicator. (The value won't be saved when power loss)

BACnet Device information	
Object Name	Descriptions
Model Name	"UNOnext"
Max Master	127
Application Version	The firmware version of UNOnext BACnet version
Object Identifier (R/W)	The identifier is composited of UNOnext serial number. EX: The SN of UNOnext is 2026N0FF0011. Then the BACnet object identifier should be 260011. The object identifier is also writeable and non-volatile. Running factory reset will set it to default value.
Vendor Name	Delta

NOTE

1. The property "Out Of Service" of sensor object preset the health of the sensor. If the value is "true", the sensor is unhealthy. Please power cycle UNOnext to recover that sensor.

【UNOnext Modbus RTU】

RS485 Configuration (default)

Baudrate : **9600** Data-bit : **8** Parity : **None** Stop-bit : **1**

Slave address : Use DIP switch behind the device to set address.
The range of address is from **208** to **223**

Function code used:

- 04h : Read input registers
- 06h : Read single holding register
- 10h: Write multiple holding registers

Register list [04h] (Read Only)

Request				
Address	Function Code	Register	Len [N]	CRC-16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response				
Address	Function Code	Count [2*N]	Data	CRC-16
1 byte	1 byte	2 bytes	N *2 bytes	2 bytes

Error				
Address	0x84	Exception Code :		CRC-16
1 byte		0x01, Illegal Function		2 bytes
		0x02, Illegal data address		
		0x03, illegal data value		
		0x04, slave device failure		

Register	Name	Descriptions
Sensor Measurement (sensor types vary by device model)		
30002	0x01	Concentration of PM2.5 Unit: $\mu\text{g}/\text{m}^3$
30003	0x02	Concentration of PM10 Unit: $\mu\text{g}/\text{m}^3$
30004	0x03	Concentration of carbon dioxide (formula CO2) Unit: ppm
30005	0x04	Concentration of total volatile organic compound (TVOC) Unit: ppb
30009	0x08	Humidity Unit: 0.01 %

Register list [04h] (Read Only)

Register		Name	Descriptions
Sensor Measurement (sensor types vary by device model)			
30011	0x0A	Temperature in Celsius	Unit: 0.01 °C Real Temperature = (Value - 4500)
30013	0x0C	Formaldehyde (formula HCHO) concentration	Unit: ppb
30015	0x0E	Ozone (formula O3) concentration	Unit: ppb
30016	0x0F	Concentration of carbon monoxide (formula CO)	Unit: ppm
30018	0x11	Temperature in Fahrenheit	Unit: 0.01 °F Real Temperature = (Value - 4500)
30019	0x12	Ambient light intensity	Unit: lux
30026	0x19	Temperature from negative temperature coefficient (NTC) thermistor [Fahrenheit]	Unit: 0.01 °F Real Temperature = (Value - 4500) (0 if thermistor is not installed)
30029	0x1C	Temperature from negative temperature coefficient (NTC) thermistor [Celsius]	Unit: 0.01 °C Real Temperature = (Value - 4500) (0 if thermistor is not installed)
Sensor State			
30033	0x20	PM2.5 sensor	0x01 Ready 0x02 WarmingUp Others: sensor does not exist or error
30034	0x21	PM10 sensor	
30035	0x22	CO ₂ sensor	
30036	0x23	TVOC sensor	
30037	0x24	Humidity sensor	
30038	0x25	Temperature sensor	
30039	0x26	HCHO sensor	
30040	0x27	O ₃ sensor	
30041	0x28	CO sensor	
30043	0x2A	Light Sensor	

Register list [04h] (Read Only)

Register	Name	Descriptions				
UNOnext Information						
30045	0x2C	OLED display status <table border="1"> <thead> <tr> <th>High Byte</th> <th>Low Byte</th> </tr> </thead> <tbody> <tr> <td>Temperature unit</td> <td>-</td> </tr> </tbody> </table> Unit: 0x01 Celsius 0x02 Fahrenheit	High Byte	Low Byte	Temperature unit	-
High Byte	Low Byte					
Temperature unit	-					
30145 - 30160	0x90 - 0x9F	Model and Serial Number An ASCII string consists model name and serial number, separated by a comma. For example: "UNO-S00FC07X011-A,2039N01F0001"				

Modbus RTU read example

Read all sensor measurement from slave address 208

Request	D0 04 00 01 00 1F F2 43
Response	D0 04 3E 00 08 00 08 02 95 00 4C 01 90 39 23 52 F5 1B C6 3C BC 1B 7C 01 68 00 00 00 00 00 00 00 00 00 00 00 00 00 2F E8 00 60 00 00 00 00 00 00 00 00 00 00 00 00 00 00 A4 27 99 0D 00 00 00 87 00 00 00 00 EF 0F

PM2.5 : 8
(00 08 is hex)

CO2 : 661
(02 95 is hex)

T : 25.36 °C
(1B 7C is hex)
(7036 - 4500) / 100 = 25.36

Register list [06h] (Write Only)

Request				
Address	Fn Code	Register	Data	CRC-16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Response				
Address	Fn Code	Register	Data	CRC-16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Error			
Address 1 byte	0x86	Exception Code : 0x01, Illegal Function 0x02, Illegal data address 0x03, illegal data value 0x04, slave device failure	CRC-16 2 bytes

Register	Name	Descriptions
Write only		
40014 0x0D	Set display temperature unit	0x01 Celsius 0x02 Fahrenheit

Modbus RTU examples

Set OLED to display Temperature Fahrenheit to slave address 208	
Request	D0 06 00 0D 00 02 8B 89
Response	D0 06 00 0D 00 02 8B 89

Register list [10h] (Write Only)

Request						
Address	Fn Code	Register	Len [N]	Count [2*N]	Data	CRC-16
1 byte	1 byte	2 bytes	2 bytes	1 byte	N*2 bytes	2 bytes

Response				
Address	Fn Code	Register	Len [N]	CRC-16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Error			
Address 1 byte	0x90	Exception Code : 0x01, Illegal Function 0x02, Illegal data address 0x03, illegal data value 0x04, slave device failure	CRC-16 2 bytes

Register	Name	Descriptions																								
40097	0x60 - RS485 slave parameters 0x62	<p>Format:</p> <table border="1"> <tr> <td>1st word</td> <td>2nd word</td> <td colspan="2">3rd word</td> </tr> <tr> <td colspan="2">A</td> <td colspan="2"></td> </tr> </table> <table border="1"> <tr> <td colspan="4">3rd word</td> </tr> <tr> <td colspan="2">Hi byte</td> <td colspan="2">Lo byte</td> </tr> <tr> <td>Bit7-4</td> <td>Bit3-0</td> <td>Bit7-4</td> <td>Bit3-0</td> </tr> <tr> <td>B</td> <td>C</td> <td>D</td> <td></td> </tr> </table> <p>A (baud): 32 bits for baud rate, default 9600, user can set 38400, 57600, or 115200 bps</p> <p>B (char length): 0x8</p> <p>C (parity bit): 0x00 Even 0x01 Odd 0x04 None (default)</p> <p>D (stop bit): 0x00 1 bit (default) 0x02 2 bits</p>	1 st word	2 nd word	3 rd word		A				3 rd word				Hi byte		Lo byte		Bit7-4	Bit3-0	Bit7-4	Bit3-0	B	C	D	
1 st word	2 nd word	3 rd word																								
A																										
3 rd word																										
Hi byte		Lo byte																								
Bit7-4	Bit3-0	Bit7-4	Bit3-0																							
B	C	D																								
		Need to power cycle UNOnext after RS485 configuration																								

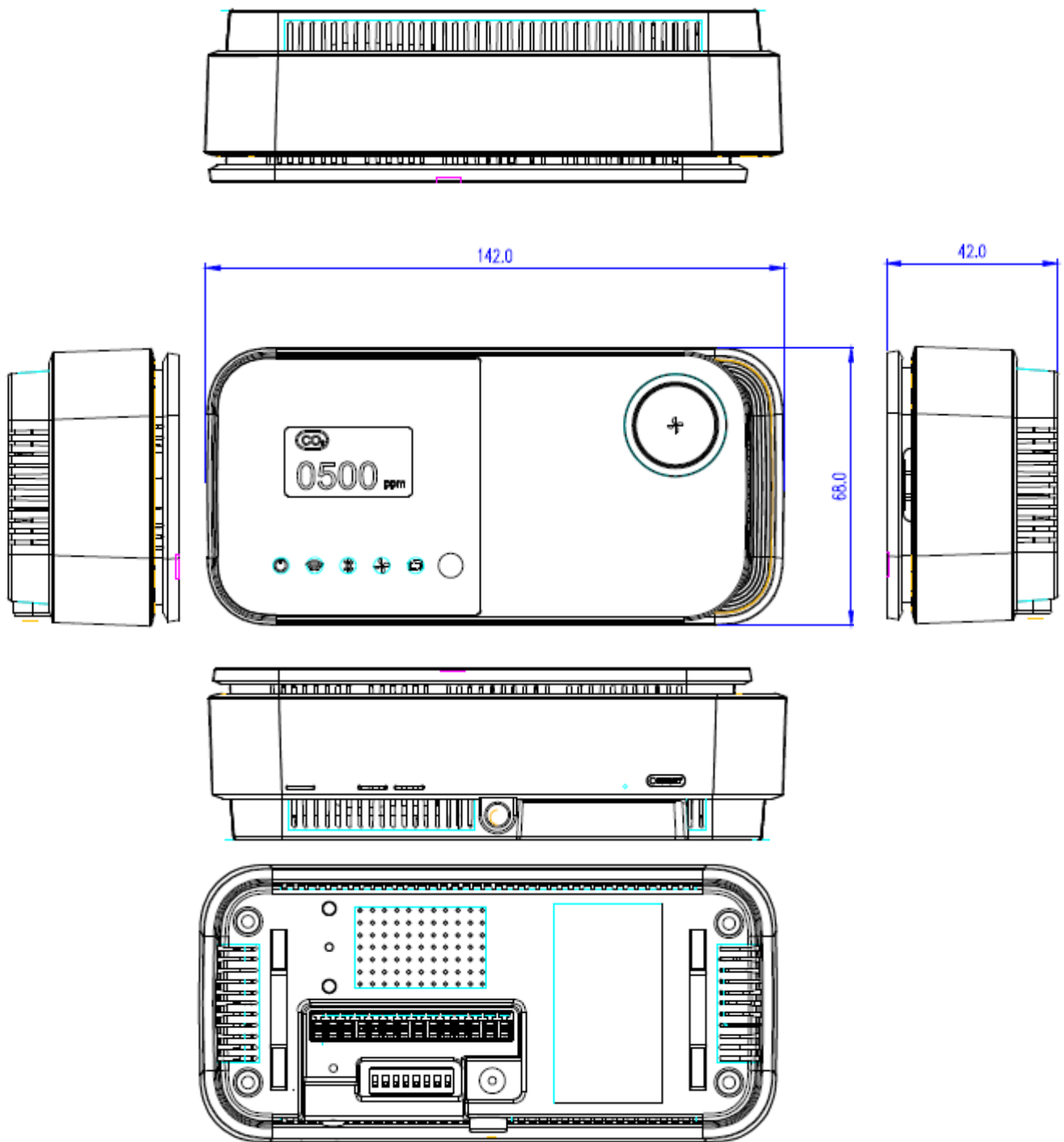
Modbus RTU examples

Set RS485 to 115200-8-N-1 to slave address 208

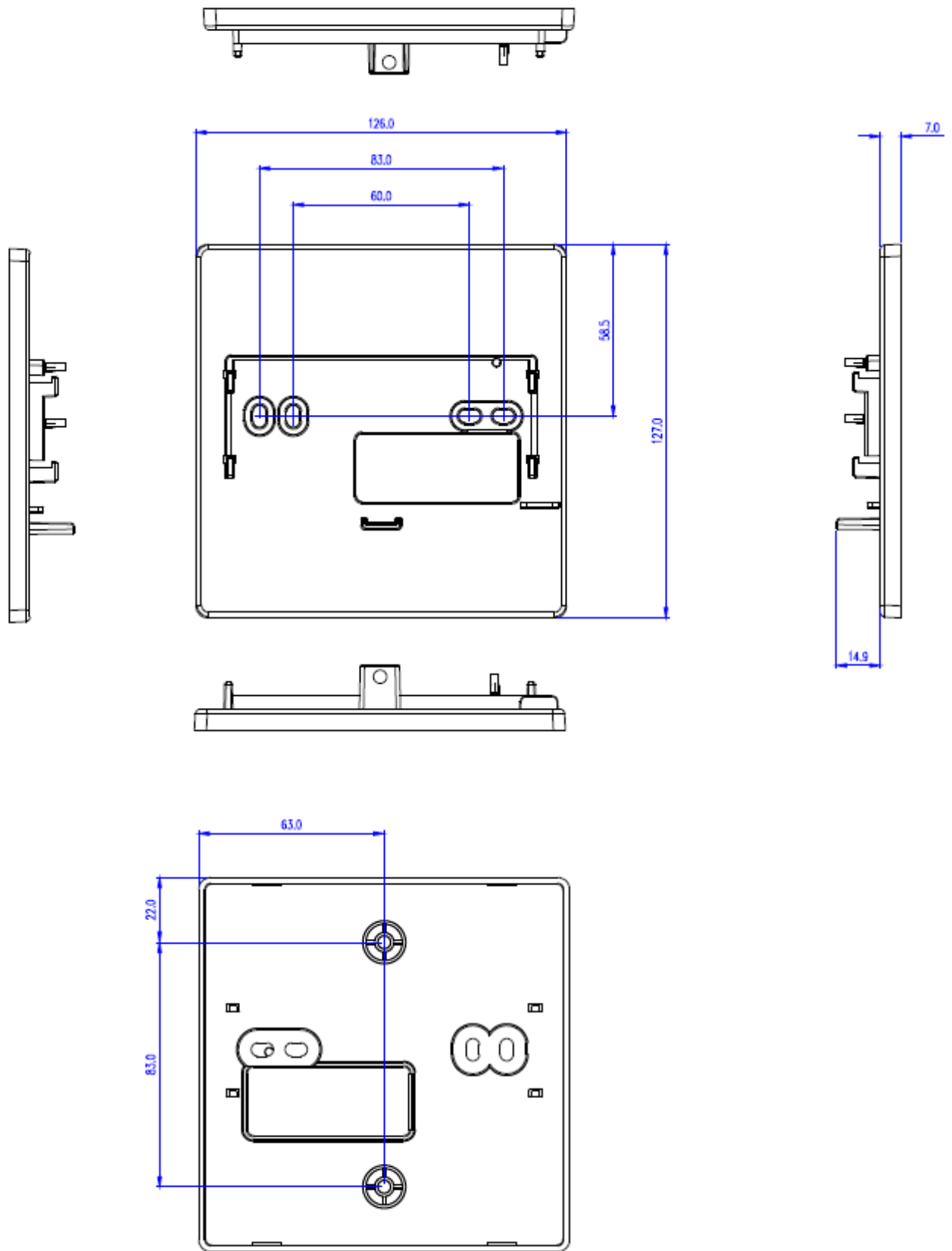
(115200 -> 00 01 C2 00 in hex)

Request	D0 10 00 60 00 03 06 00 01 C2 00 84 00 BB 56
Response	D0 10 00 60 00 03 92 57

【UNOnext Dimension】

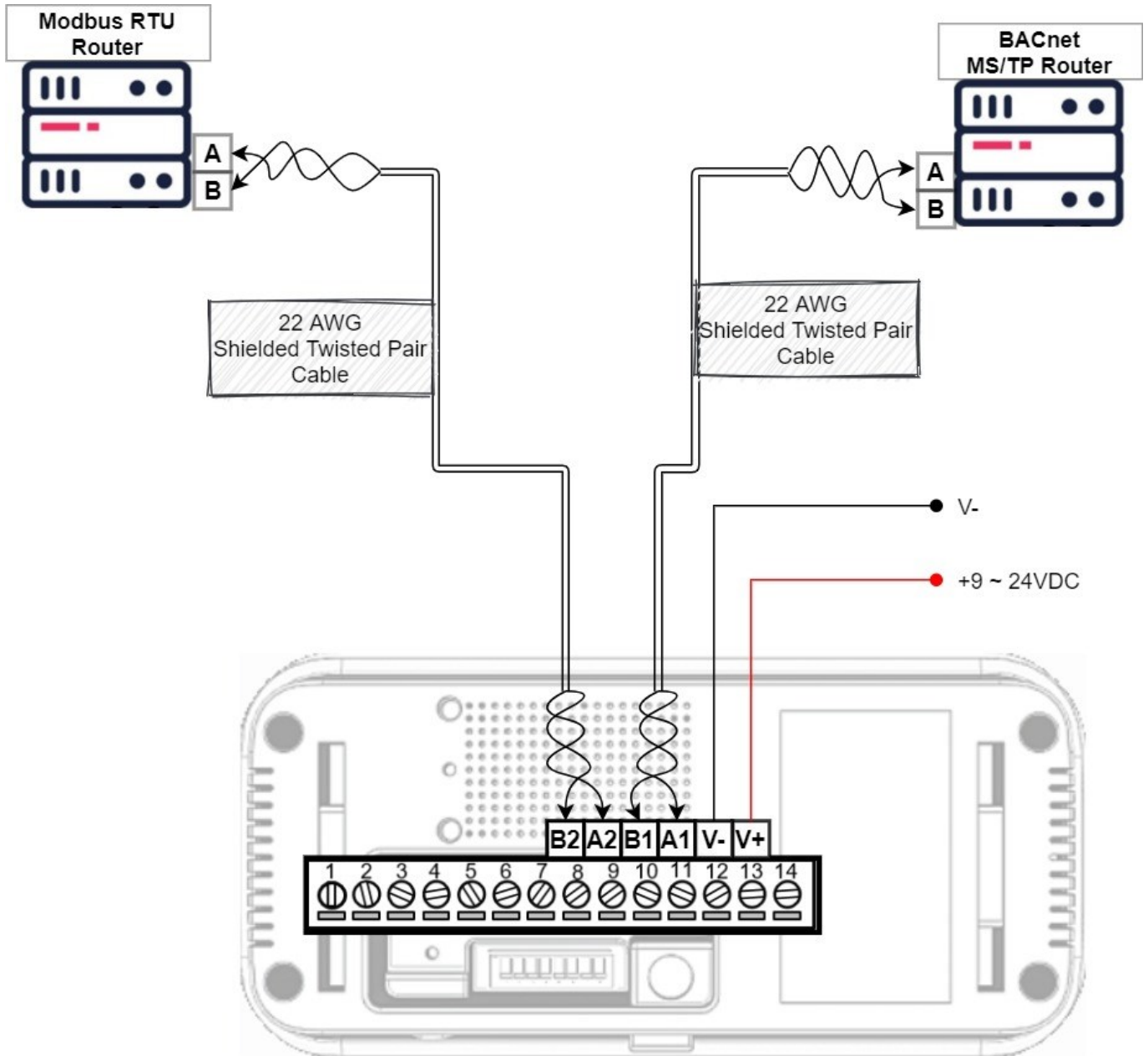


【UNOnext Wall-mount Dimension】



【UNOnext Wiring Example】

Use Case : 1 Modbus router + 1 Bacnet MS/TP Router +
1 UNOnext for Modbus + 1 UNOnext for MS/TP



【UNOnext Wiring Example】

Use Case : 1 Modbus router + 1 Bacnet MS/TP Router +
1 UNOnext for Modbus + 2 UNOnext for MS/TP

