FIGURE 1 structure of wireless sensor network

General description

The wireless Ouman sensor system enables a quick and easy reading of precise room temperature data in a building without the laborious laying of cables and drilling of walls. The sensor system comprises a base station, sensors that act as routers and are connected to the mains, and battery-operated wireless sensors. A predefined register list makes it easy to connect the wireless sensors to a SCADA system. In the event of failure, a damaged sensor can be replaced without changing the register list. This makes the installation of the replacement sensor quicker and easier.

The mesh structure of the wireless network improves network reliability. The signal has multiple routes, from which the system automatically selects the strongest. The larger the number of routers in the coverage area, the more routing options the signal has. One wireless base station can monitor data from up to 100 sensors.

Base station connections:
– Direct connection to base station with browser. (over the Internet/locally)
– Ounet connection directly from the base station. (over the Internet)
– local Modbus RTU connection.
(Connections can be utilised simultaneously)

Initial engineering in network construction:

- Building structures are crucial in network engineering. Metal structures weaken the signal, which is also the case for lift wells, electrical power centres, fire doors, etc.
- Old concrete buildings are easier in regard to networks than buildings constructed in the 2010s, where the amount of steel in the structures is higher.
- From the base station, the network should be built by first finding a suitable "backbone" for the network and applying the operating voltage to the sensors, so that they will act as routing elements in the network. See FIGURE 1.
- Once the network is operational in this regard, battery-operated sensors are placed as part of the network.
- The positioning of room sensors must take into account that the sensor should never be exposed to direct sunlight. It must also be ensured that no other external sources of heat affect the sensor, such as refrigerators, television sets, ventilation windows, water radiators, etc.
- It is often the easiest way to place the base station to the same space with the automation substation (heat distribution room, AHU room), but due to the weak 3G signal the optimal location can also be in the other parts of the building. Centrally selected location for the base station can improve the functionality of the sensor network, because more sensors can be directly connected to the base station without routers.
- It is able to select external antenna to the base station which improves reception of the sensor network when needed to achieve better signal levels.
- The base station requires a separate housing, e.g. K118 which also includes the needed power supply. (must be applied when certain IP protection class is needed)

Base station

The base station is mounted to a wall or to the centre with a DIN bar. In the centre installation, the base station requires an external antenna. The base station must be installed indoors (0°C...+50°C).

The base station can be connected to Ounet, or independently to the Internet, in which case, measurement data can be inspected from outside the property through a remote connection. If the property already has an Internet connection, you can use it. If there is no Internet connection ready, we recommend you use the 3G connection provided by Ouman.

The base station can also be directly connected to the computer in the local internal network, and as part of the rest of the automation system through the modbus RTU route.

Temperature sensor / routing temperature sensor:
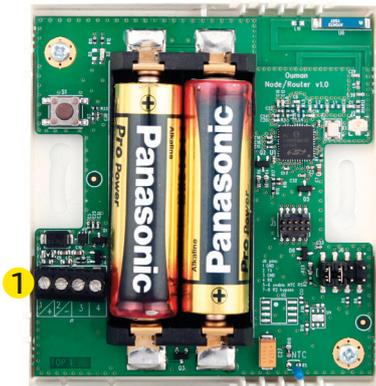
Rooms sensors can be mounted to the wall with screws or adhesive tape. Please note that the sensor is installed so that the black terminal strips are in the bottom left corner **1**.

Place the room sensor at a height of about 150 cm in a location where it measures the average temperature of the room. Do not install the room sensor in a location where direct sunlight or another source of heat may distort the measurement result.

The room sensor must be installed indoors (0°C ... +50°C). External temperature measuring, digital input or transmitter measurement (see page 5) can be connected to the sensor by using the room sensor's AUX connection

PLEASE NOTE: When connected to an external power source (5 VDC), the room sensor is a routing room sensor, but when equipped with AA batteries, it acts as a room sensor. The room sensor will automatically recognise the power source.

Commissioning the wireless network through the Internet connection

Base station

1. First install the base station.

2. Connect the antenna (or the extra antenna with an extension cord) to the antenna connection of the base station. **Do not detach or attach the antenna when the base station is live!**

3. Connect the Ethernet cable between the base station's RJ45 connector and the Internet connection (router/3G modem).

4. Switch on the operating voltage. The voltage is connected to the terminal strip ∽ and ground to the adjacent ⊥ connector.

5. Wait for the LINK light to remain green. This may take a couple of minutes.

6. When the LINK light remains green, the base station has successfully been connected to the Ouman ACCESS network.

7. If you have a QR reader, read the QR code of the base station label. In other case, enter the label's website address in your Web browser.

8. Perform base station login. The default password is indicated in the label on the side of the base station. Username = service

9. Upon your first login, the system proposes that the password be changed. We recommend that you do that. If you do not change the password, the default password will remain (each base station has a unique password).

In addition, you can specify a user password in the base station; the user password only entitles you to view measurement data. Username = user, password = Wireless

10. Switch on installation mode in the user interface. The RF status of the base station is green (see p. 6 Web UI Figure 2, Section 4.)

11. It takes about one minute for the installation mode to be activated. After that, the mode will remain active for 90 minutes, unless you interrupt it in the user interface (you can adjust the default time in the base station settings).

12. Go to "sensor commissioning" (p. 4).

Commissioning the wireless base station without the Web browser interface

1. Connect the antenna (or the extra antenna with an extension cord) to the antenna connection of the base station. **Do not detach or attach the antenna when the base station is live!**

2. Switch on the operating voltage. The voltage is connected to the terminal strip ∿ and ground to the adjacent ⊥ connector.

3. Press the base station's installation mode button.

4. Check that the RF-Status light of the base station is on. When the light is green, the commissioning mode is active.

5. Go to "sensor commissioning" (p. 4).

Base station signal light legend

| INIT / ERR	
● Red light is on	Upon start-up, the light will be red for about 30 seconds.
☀ Blinking green light	The light is green and blinking when the base station is active.
LINK	
● Yellow light on	The light is on when the connections are in order (both the Internet connection and the ACCESS connection are operational)
●●●●●●● The light is almost continuously on, but is off at times.	Internet connection is operational, but there is no ACCESS connection
●●●●●●● The light is off most of the time, but blinks at times.	LAN connection is operational, but there is no Internet and ACCESS connection.
No light	No LAN connection. If the LINK LED is not blinking or is not on at all, check that the LAN cable is properly connected to the base station and router. The signal lights of the base station's Ethernet connector are on if the network cable is physically in order and connected.
RF STATUS	
● Green light on	The base station is in installation mode
☀ Blinking green light	The base station is in normal mode

1. Commission the base station before commissioning the sensors (see pp. 2–3).

2. Open the room sensor's cover and install the batteries or switch on the operating voltage if you intend to make the sensor a routing sensor. **Do not put batteries in the sensor if you apply the operating voltage to the sensor!**

3. The LEDs indicate the network status when the batteries are connected or when the operating voltage is applied:

In commissioning mode:

Rapidly blinking green light = Connected to network
Red light blinking 2 times = Connection failure

When the button is pressed in normal mode:

Green light on (3 s.) = Connected to network
Red light blinking 2 times = Not connected to network

4. If neither LED is blinking rapidly, briefly press the sensor installation button.

5. If the network is not found, move closer to the base station or the already installed routing sensor.

6. You can remove the sensor from the network by keeping the installation button pressed down for five seconds. (You also need to separately remove the sensor from the user interface). (see p. 6)

Pay extra attention to the reception of the routing sensors, because they are the "backbone" of the network (see FIGURE 1, p. 1).

The RSSI figure indicates signal strength	
Good	... -85dBm
Medium:	-85 ... -95dBm
Poor:	-95dBm ...

Room sensor battery replacement

The Web UI shows the remaining battery life of each wireless sensor. If life is less than 10%, the figure is red, and there is a red exclamation mark in the right upper corner of the user interface.

Battery replacement does not require any special measures. You only need to replace batteries with fresh ones. The sensor is automatically connected to the network, and continues to operate as usual.

1. When the sensor has found the network, it will automatically appear last in the user interface list (or in place of a sensor removed from the list).

2. You can edit the default name (SensorX) of the added sensor to match the location. Example: Room 101 (see p. 6 Web UI, Figure 2)

3. In the sensor route table, you can see how the added sensor is connected to the network (see p. 7 Web UI, Figure 3). Please note: The sensor will automatically find its route by the best reception. **You cannot change the route manually.**

4. Set the failed response alert limit and updating interval for the base station on a sensor-specific basis. (see p. 5 Web UI, Figure 1)

Instructions: You can define joint maximum and minimum limits for all base station sensors. (Default 21°C and 24°C) Example: if the calculation interval is 10 h and temperature is 2h of the timeline over the maximum limit or under the minimum limit → The permanence value is 80% for the calculated time.

5. Likewise, the calculation interval of the permanence value. (see p. 5 Web UI, Figure 1)

AUX connection of wireless room sensor
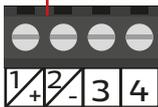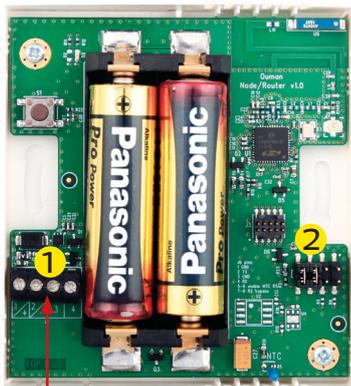
In the wireless sensor or routing sensor, it is possible to connect an external temperature measurement, digital input, status data or 0–10 VDC transmitter measurement by using the AUX connection.

AUX connection in temperature measurement	1. Connect temperature measurement in terminal strips 3 and 4 ①
AUX connection as digital input	1. Connect the digital input in terminal strips 3 and 4 ①
AUX connection as transmitter measurement	1. First remove the jumper on the battery side from the sensor's circuit board ② 2. Connect the transmitter measurement to terminal strips 2 and 3 (power source's ground ⏚) ①

AUX connection settings from WEB UI:

Web UI, Figure 1

Reception alert will be indicated with a red exclamation mark in the right upper corner of the Web UI.

1. Select the type of AUX input in the drop-down menu.

Setting the stability interval for the sensor's permanence value (see p. 5).

2. You can name the input as you like. The name will appear in the AUX connection tooltip in the Web UI.

Usually, you do not need to adjust other settings.

Wireless sensors

English ▾

Gateway

Any sensor low signal	Any sensor battery low	Over 50% of batteries under 30%	Temperature avg	Lowest temperature	Highest temperature
false	**false**	**false**	24.6	13.5	26.4

Devices (9 connected)

Location name	Type	MAC	Temp (°C)	Aux	Signal (dBm)	B
Sensor1	End device	000D6F000A64B13A	13.5	-	Good -84	
Sensor2	End device	000D6F000A64EC08	25.6	25	Good -29	81 OK 18 s ago
Sensor3	End device	000D6F000A64B0A3	26.1	-	Good -61	38 OK 10 m 41 s ago
Sensor4	End device	000D6F000A64B0B2	26	-	Good -28	82 OK 56 s ago

4. You can also enter the installation mode through the Web UI by clicking this icon. To exit the installation mode, click the icon. Or, if you do not do that, an automatic exit will take place after 90 minutes.

1. Click the icon with three dots, and the function menu will open.

Location name	Type	MAC	Temp (°C)	Aux	Signal (dBm)	Battery (%)	Status
Sensor1	End device	000D6F000A64B13A	13.5	-	Medium	35	OK
Sensor2	End device	000D6F000A64EC08	25.6	25			K
Sensor3	End device	000D6F000A64B0A3	26.4	-	-63		
Sensor4	End device	000D6F000A64B0B2	26	-	Good -30	82	OK
Sensor5	End	000D6F000A64B03A	26.4		Good	100	OK	28 s

Settings

Copy values

Edit location

Change position

Delete

2. Select "Edit location" to rename the sensor location.

Sensor1	End device	000D6F000A64B13A	13.5		Medium -90		OK	2 s ago
Sensor2		64EC08	25.6	25	Good	80	OK	48 s ago
Sensor3		64				38	OK	2 m 11 s ago
Sensor4	End device	000D6F000A64				82	OK	26 s ago
Sensor5	End device	000D6F000A64B03A	26.4	-	Good -39	100	OK	1 m 48 s ago

3. Enter a new, unique name for the sensor location.

Location

Room 101

CANCEL   CHANGE LOCATION
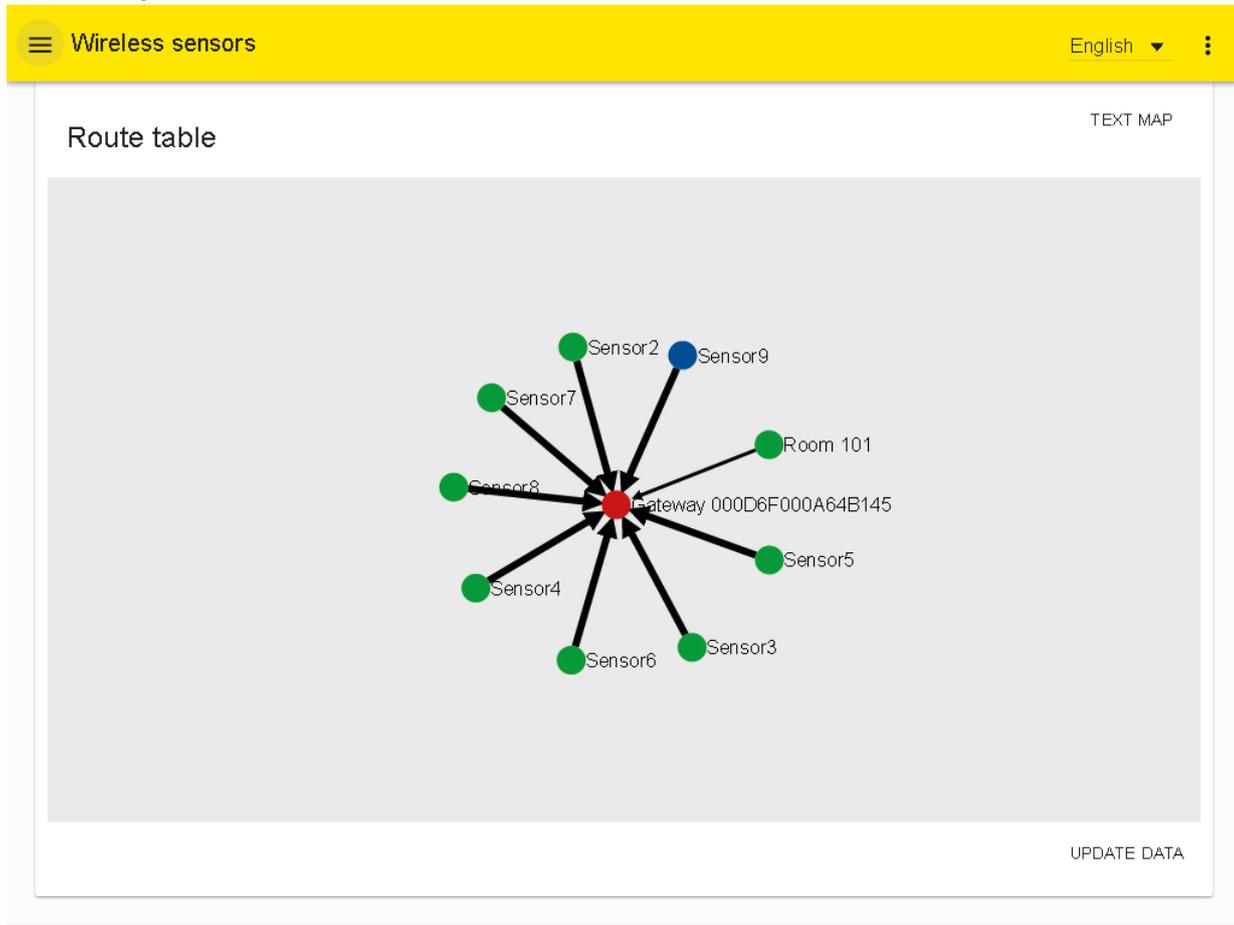
Base station configuration
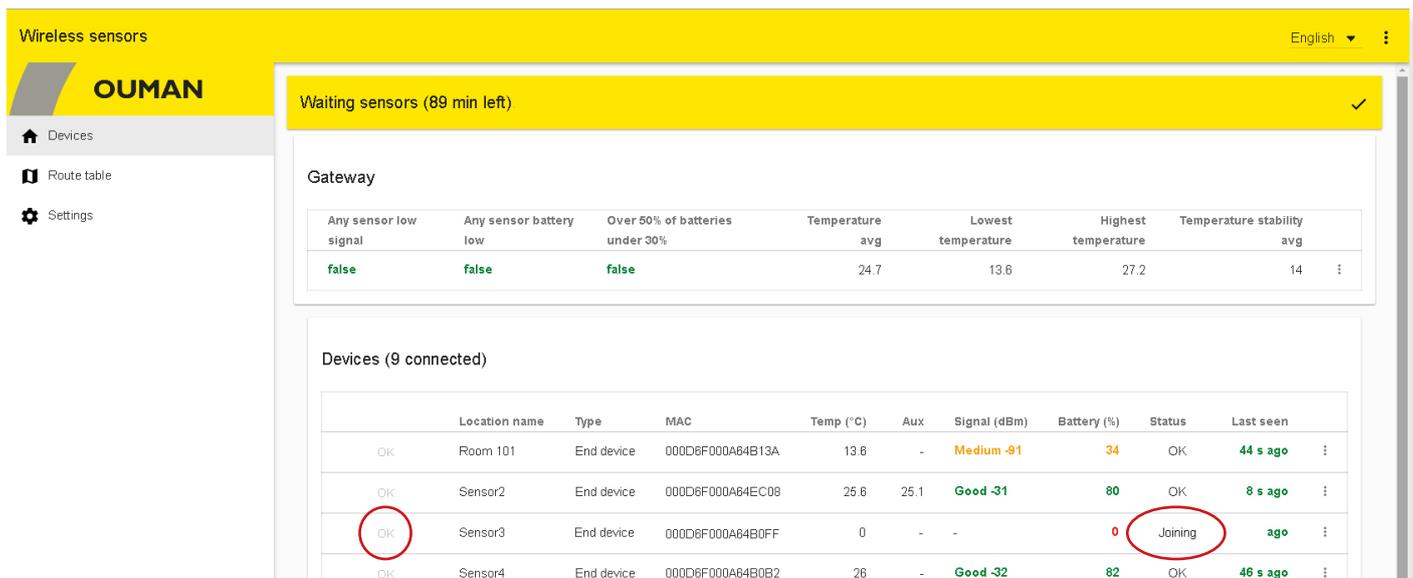
OK button – In the installation mode, the sensor sampling interval is 10 seconds by default. When there are 15 or more sensors in "join mode", the sampling interval will slow down the device. When you press "OK", the sensor's sampling interval will change to two minutes, which will accelerate the device.

If you do not change the sampling interval in the install mode, it will automatically change to 15 minutes when you exit the install mode. The minimum sampling interval is one minute.

Base station sensor settings

Wireless sensors
English ▼ ⋮

Gateway

Any sensor low signal	Any sensor battery low	Over 50% of batteries under 30%	Temperature avg	Lowest temperature	Highest temperature	
false	**false**	**false**	24.8	13.6	27.2	

Settings **1**

Edit average settings

Wireless sensors
English ▼ ⋮

Gateway

Any sens low s						
false						⋮

Devices

Gateway settings

Temperature stability limits	Low limit 20	High limit 24

Battery low limit	Low limit 10	

CANCEL   UPDATE VALUES **2**

Locati name								
Room 101	End device	000D6F000A64B13A	14	-	**Good -84**	35	OK	**11 s ago**	⋮
Sensor2	End device	000D6F000A64EC08	25.8	25.2	**Good -27**	80	OK	**42 s ago**	⋮
Sensor3	End device	000D6F000A64B0A3	26.5	-	**Good -58**	39	OK	**7 m 2 s ago**	⋮
Sensor4	End device	000D6F000A64B0B2	26	-	**Good -27**	82	OK	**17 s ago**	⋮
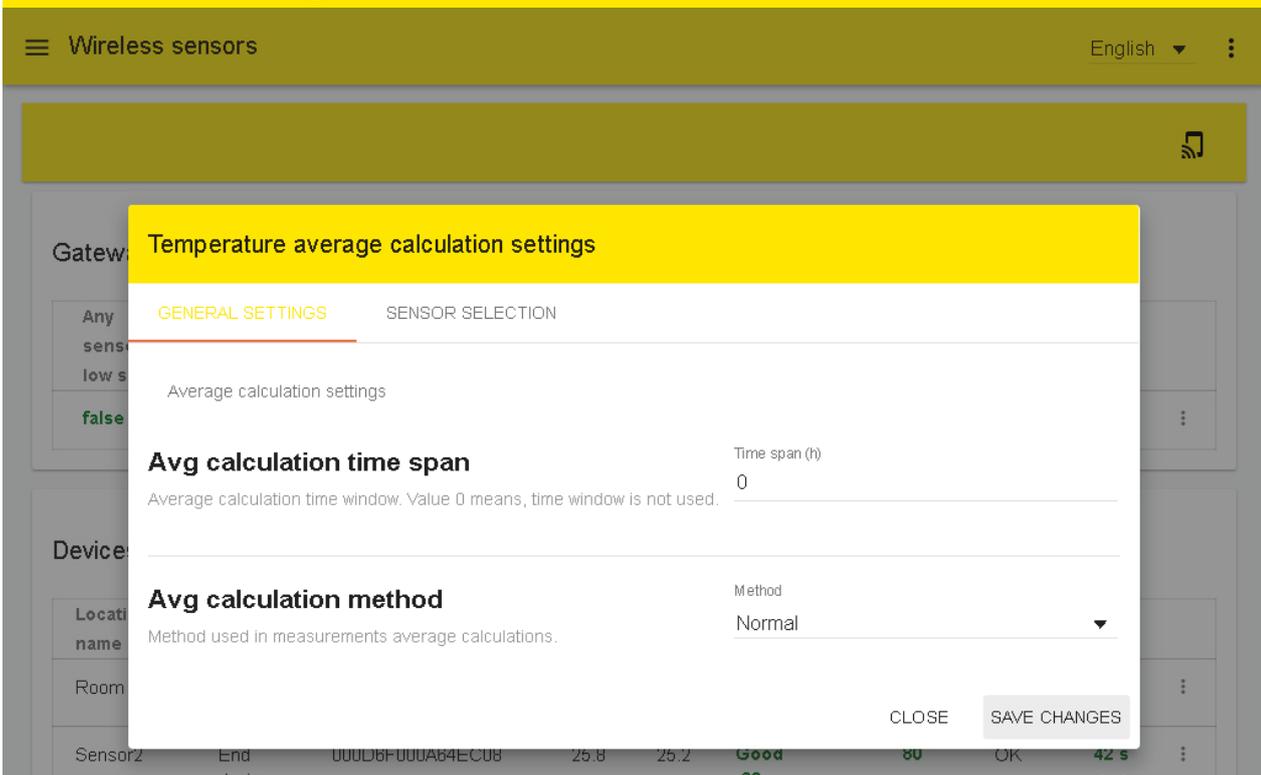
Go to the "Sensor selection" tab or the sensor-specific settings to select the measurements to be included in the calculation.

Avg calculation time span: The calculation can be performed as sliding for a specific period. If the value is 0, the value is an "online" value.

Normal: Will calculate the average of all sensors included in the calculation

Min – max limited: In the calculation, this function removes measurements not in the minimum and maximum range

Pick out mode: This function removes the selected number of measurements from the calculation. Example: The two lowest temperatures and the highest temperature.

Min - max and pick out combination" A combined selection of the above. The program will first perform the selection and then the limiting process.
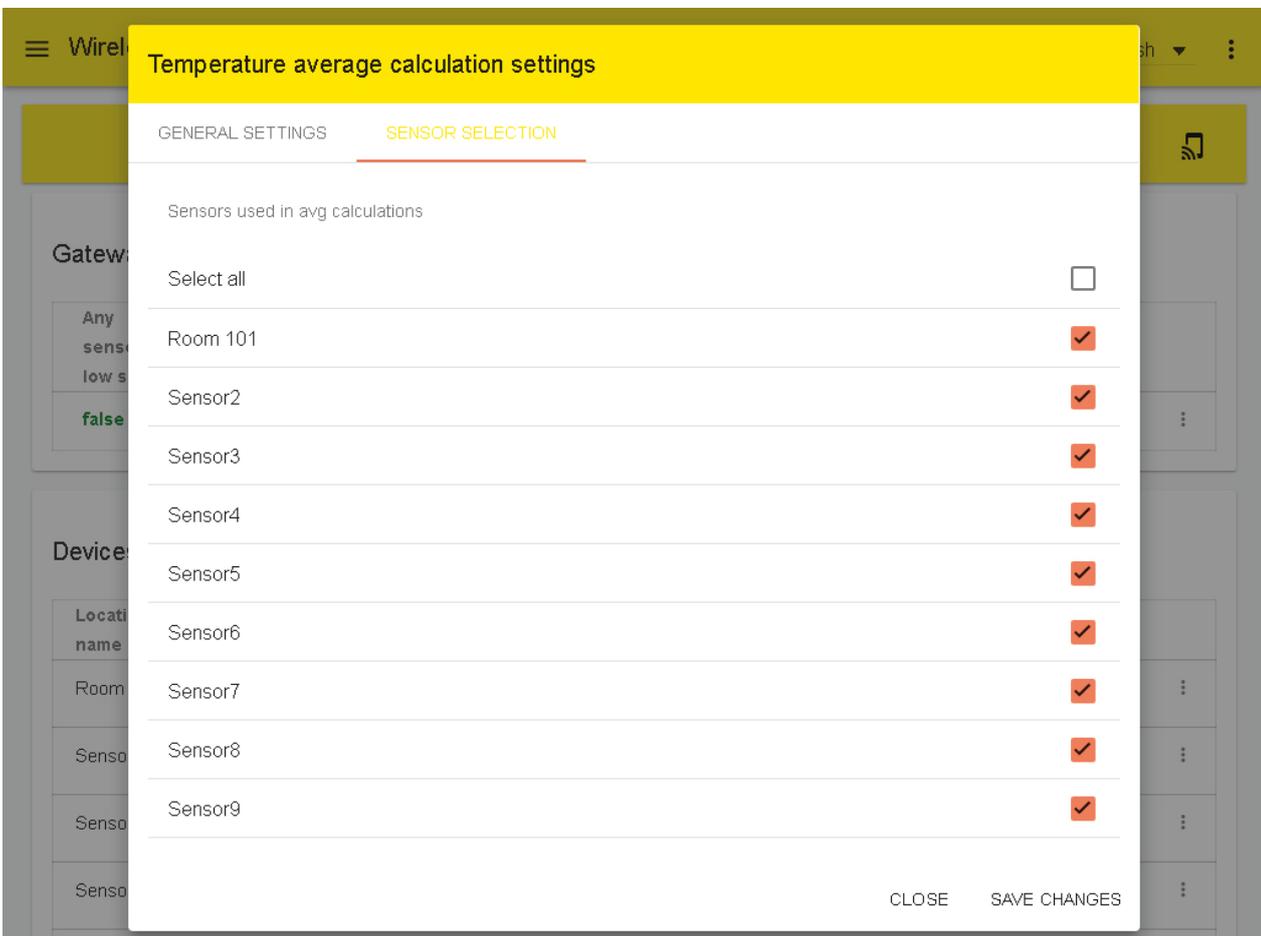
Base station configuration

↻

Common settings

Version
Device's software version

1.0

WL-Base name
Show this name in the title bar of the web site.

Name
Wireless sensors

Get backup
Download backup file. You can restore setting values using this file.

DOWNLOAD

Restore backup
Restore backup from file. ()

SELECT FILE.

RESTORE

SAVE CHANGES

Gateway settings

Channel
Gateway selects channel automatically in set up. Channel can be 16, 17 or 18.

18

Clear sensor network
Removes all the installed sensors from network

CLEAR

Restore default values
Restores factory default values to sensors. Installed sensors are also removed.

RESTORE

Reboot
Reboot gateway

REBOOT

The base station will automatically retrieve the network settings once the device is connected to the network and the power is switched on.

≡ Wireless sensors   English ▼   ⋮

Network settings

DHCP
DHCP ON/OFF   DHCP
                                               On   ▼

Access
Access ON/OFF   State
                                               On   ▼

Access address
Access IP address   xx.xx.xx.xx

IP address
Local IP address   Address
                                               xx.xx.xx.xx

Gateway address
Gateway address   Gateway
                                               xx.xx.xx.xx

Subnet mask
Subnet mask   Mask
                                               xx.xx.xx.xx

Name server address
Name server address   Address
                                               xx.xx.xx.xx

                                                        SAVE CHANGES

≡ Wireless sensors   English ▼   ⋮

Modbus RTU settings

Baud rate
Baud rate   Value
                                               9600   ▼

Data bits
Data bits   Data bits
                                               8

Parity
Parity   Parity
                                               None

Stop bits
Stop bits   Stop bits
                                               1

Slave address
Slave address   Address
                                               1

≡ Wireless sensors   English ▼   ⋮

Modbus TCP/IP settings

Enabled
Modbus TCP/IP enabled   Enabled
                                               On   ▼

Modbus TCP/IP port
Modbus TCP/IP port   Port
                                               502

Sockets
Maximum sockets count   20

                                                        SAVE CHANGES

SNMP settings

Enabled
SNMP enabled   Enabled
                                               Off   ▼

IP address
SNMP IP address   Address
                                               10.1.1.23

                                                        SAVE CHANGES

You can open the function menu by clicking the three dot icon in the upper right corner of the Web UI. You can download a modbus CSV file, Ounet template and a Modbus RTU template onto your computer. The menu also includes the Web UI version information, password change, and logout.

≡ Wireless sensors   Download modbus CSV file

                                                        Download Ounet template

                                                        Download Modbus RTU template

Gateway   Version info

Any sensor low signal	Any sensor battery low	Over 50% of batteries under 30%	Temperature avg	Lowest temperature	High temperatu	Change password
false	false	false	25.1	14.8	26.9	Logout
					14	⋮

Technical details

Base station	
Case	ABS plastic
Operating temperature	0°C...+50°C
Protection class	IP20
Measurement interval in installation mode	10 seconds
Measurement interval in normal mode	can be adjusted (1–240 min).
Dimensions	80 x 85 x 30 mm
Installation	Mounted to DIN bar
Operating voltage	24 VAC / 5.5 VA or 10...30 VDC / 3W
Power consumption in use	12 VDC 160mA 24VDC 85mA 24 VAC 210mA
Network size	up to 100 sensors

Base station

– Access feature
– Built-in Web server to facilitate installation
– Short measurement interval in installation mode
– Ethernet, Modbus TCP/IP
– RS-485, Modbus RTU slave

NOTE! Base station should not be connected to the public internet without firewall! That is, for example, a fixed IP address that is visible from outside network. Typically 3G-modem, adsl/wdsl/cable modem operates firewall functionality, wherein the separate accessory is not required.

Temperature sensor / routing temperature sensor	
Case	ABS plastic
Operating temperature	0°C...+50°C
Protection class	IP20
Measurement accuracy	+- 0.2°C
NTC-10 thermistor	10kΩ / 25°C
AUX temperature measurement Operating temperature Measurement accuracy	-30°C...+50°C +/- 0.3°C
AUX 0-10VDC measurement accuracy	0.5% / 50mV
Power source when used as temperature sensor	2 x AA batteries
Battery life (not included in delivery): Energizer L91 Ultimate Lithium 3100 mAh: 15 min measurement interval 60 min measurement interval Energizer EN91 2800 mAh 15 min measurement interval 60 min measurement interval	9.5 years 11 years 6 years 7.5 years
Key factors affecting battery life: – Sampling interval – Ambient temperature – Sensor placed in a weak field (Occasionally dropped out from the network)	
External power source (operated as routing temperature sensor)	5 VDC
Dimensions	80 x 85 x 30 mm
Installation	Surface installation

Temperature sensor:

• Built-in antenna
• Sensor coverage is not impaired when the battery is low.
• 868 MHz ZigBee technology
• Connector for outdoor temperature sensor (with a fixed cable connection to outside)
• Option to connect second temperature measurement, 0–10 V transmitter measurement or contact terminal information.

OUMAN