



UBIQ Sensor Node SN-100 Series

User Manual



Version 1.0



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Battery

The battery is NOT included with the product. The sensor node has been tested and certified using one SAFT LSH20 3.6V lithium-thionyl chloride (Li-SOCl₂) battery (see Technical details section).

The battery life time in operation mode is **more than one year** (tested in operation mode, transmitting on the EU868 frequency band every 20 minutes with four soil moisture probes and one air humidity and temperature sensor attached).



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Introduction

UBIQ SN-100 is a LoRaWAN compliant sensor node capable to manage up to four METER 10HS soil moisture probes and one Davis Instruments DW-6830 air humidity and temperature sensor.



Figure 1- Inside of the Sensor node

- 1- Power switch
- 2- Configuration switch
- 3- Reset button
- 4- Soil moisture connectors (mini-jack 3.5 mm, numbered 0 – 3 from left to right)
- 5- Air Humidity and Temperature sensor connector (RJ11)
- 6- Antenna connector

The sensor node can be fully configured to communicate with any LoRaWAN compatible gateway transmitting on one of the following ISM Band channel frequencies:

- **AS923** (channel plan AS923)
- **AU915** (channel plan AU915-928)
- **EU868** (channel plan EU863-870)
- **US915** (channel plan US902-928)



Device operation

The LoRaWAN transmission parameters **MUST** be configured on the sensor node before its use (see Configuration Mode section). Read the documentation of your LoRaWAN gateway to find the correct configuration data.

WARNING!

Before any operation involving the antenna (attach/detach), the battery (insertion/removal) or any probe (insertion/removal) the sensor node has to be turned off (Power switch in "OFF" position, see Figure 1- Inside of the Sensor node).

Battery insertion and first power on of the device

After all mounting operations are completed, insert the battery in its socket, set the Configuration switch to the "ON" position and turn on the sensor node setting the Power switch to the "ON" position. After a few seconds the Wi-Fi network of the device becomes available and it is possible to set-up the node (see the Configuration Mode section below).

Configuration Mode

To activate the Configuration Mode of the device the Configuration switch (see Figure 1- Inside of the Sensor node) has to be in the “ON” position. If the sensor node is already turned on, push the Reset button, otherwise turn it on using the Power switch.

Entering in the Configuration Mode, the device enables the internal Wi-Fi network, which could be accessed using the following credentials:

- SSID (network name) = UBIQ_SN100
- Password = configpw

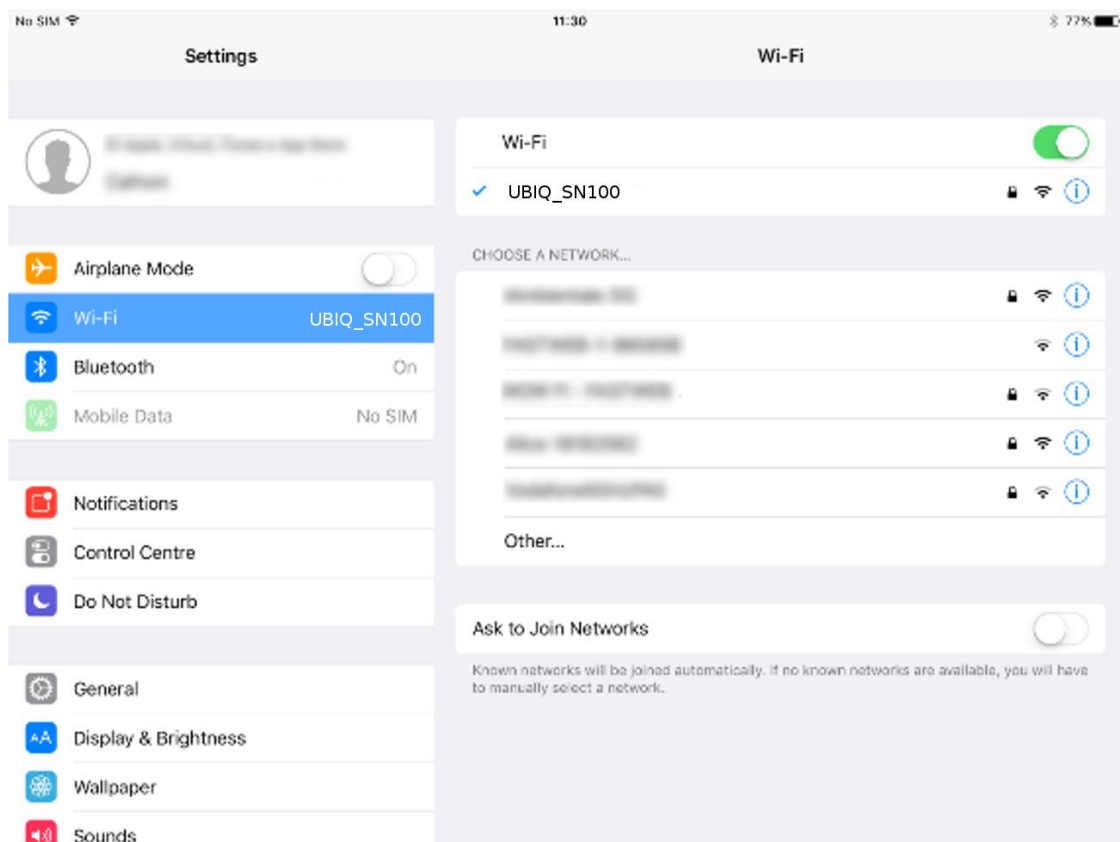


Figure 2 – Connection to the sensor node Wi-Fi network from an iPad device

When your device is connected to the WiFi network, open the Internet browser and open the following address:

<http://192.168.4.1/index>



The web page represented in the next picture will be loaded.

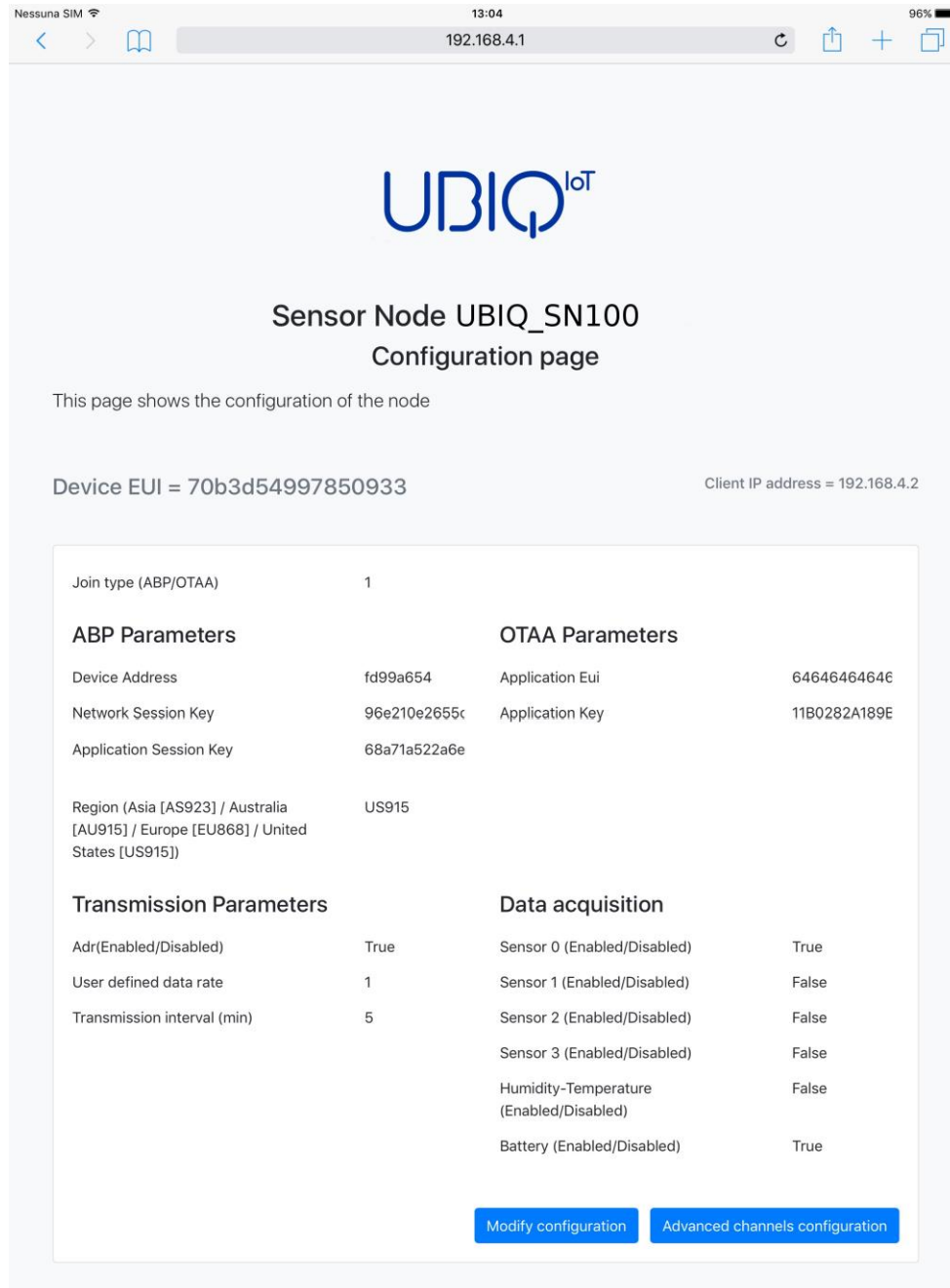


Figure 3 - Configuration page

The configuration page shows the device unique identifier (Device EUI) in bold and, on the right, the IP address of the client device connected to the Wi-Fi network of the sensor node.



The “Data acquisition” section lists which probes are enabled. The sensor node will read and transmit only the data acquired from the enabled probes; the “Battery” probe is embedded on the board and reads the voltage level of the battery.

The “Transmission interval” represents the interval (in minutes) between two probe readings and transmissions of the data. It can be set between 1 and 120 minutes.

All the other data presented are used to configure the sensor node transmission parameters needed to communicate with the LoRaWAN gateway. These data have to be obtained from the organization that manages the network infrastructure:

- Join type: ABP (Activation By Personalization)
OTAA (Over The Air Activation)
- ABP join type specific parameters
- OTAA join type specific parameters
- Transmission frequency band: AS923
AU915
EU868
US915
- ADR (Adaptive Data Rate)
- User specified data rate (DR) [used only if ADR is not enabled]

WARNING!

Due to limits on the maximum amount of data for a single transmission specified by the LoRaWAN Regional Parameters, the DR0 data rate cannot be used for the US915 transmission band (see the Technical Details section and the LoRaWAN 1.1 Regional Parameters documentation available on the LoRa Alliance web site <https://lora-alliance.org>).

Configuration data

The sensor node configuration can be modified clicking on the “Modify configuration” button at the bottom of the page (Figure 3). The browser will open a new page where each parameter can be modified.

Nessuna SIM 13:05 192.168.4.1 96%

Network Session Key Application Key

Application Session Key

Region Asia [AS923] Australia [AU915] Europe [EU868]
 United States [US915]

Transmission Parameters

Adaptive Data Rate (ADR)

User defined data rate (*)

Transmission time (min) [1..120]

Data acquisition

Sensor 0 (Enabled/Disabled)

Sensor 1 (Enabled/Disabled)

Sensor 2 (Enabled/Disabled)

Sensor 3 (Enabled/Disabled)

Humidity-Temperature (Enabled/Disabled)

Battery (Enabled/Disabled)

(*) See regional LoRaWAN specifications. For US915 DR=0 is not supported.

Figure 4 - Configuration editing page



To save the configuration data, click the “Save configuration” button at the bottom of the page. The browser will present the following page to confirm that the device has been correctly configured.

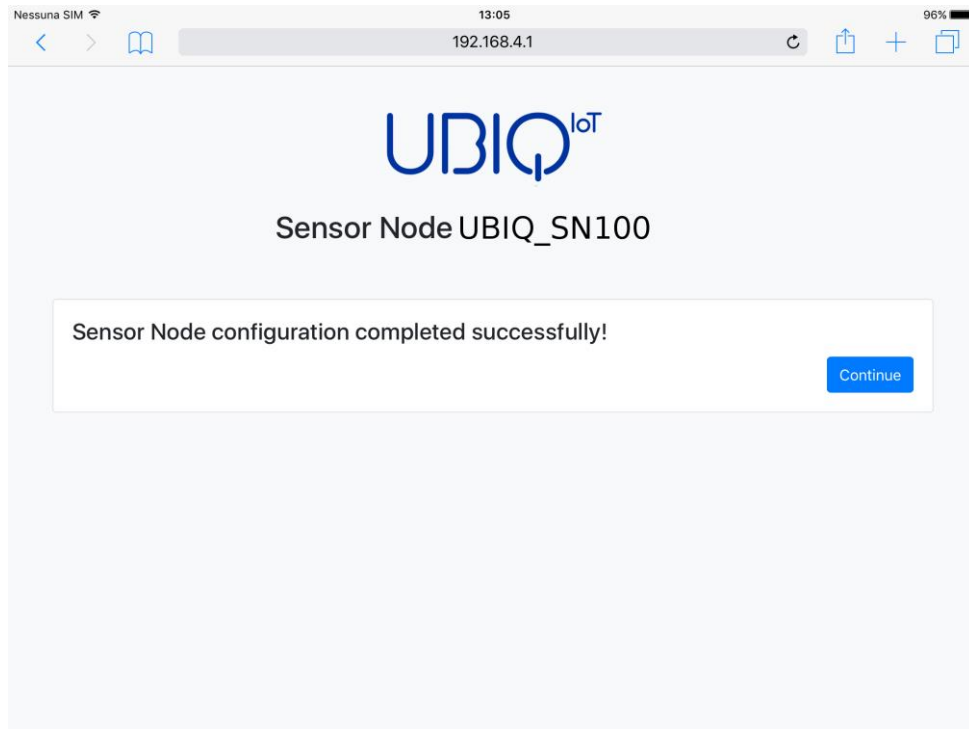


Figure 5 - Configuration modified successfully



Channels configuration

For the AU915 and US915 transmission bands the specific channels can be activated using the “Advanced channels configuration” button (see Figure 3) which enables the selection of the specific channels used by the LoRaWAN gateway.

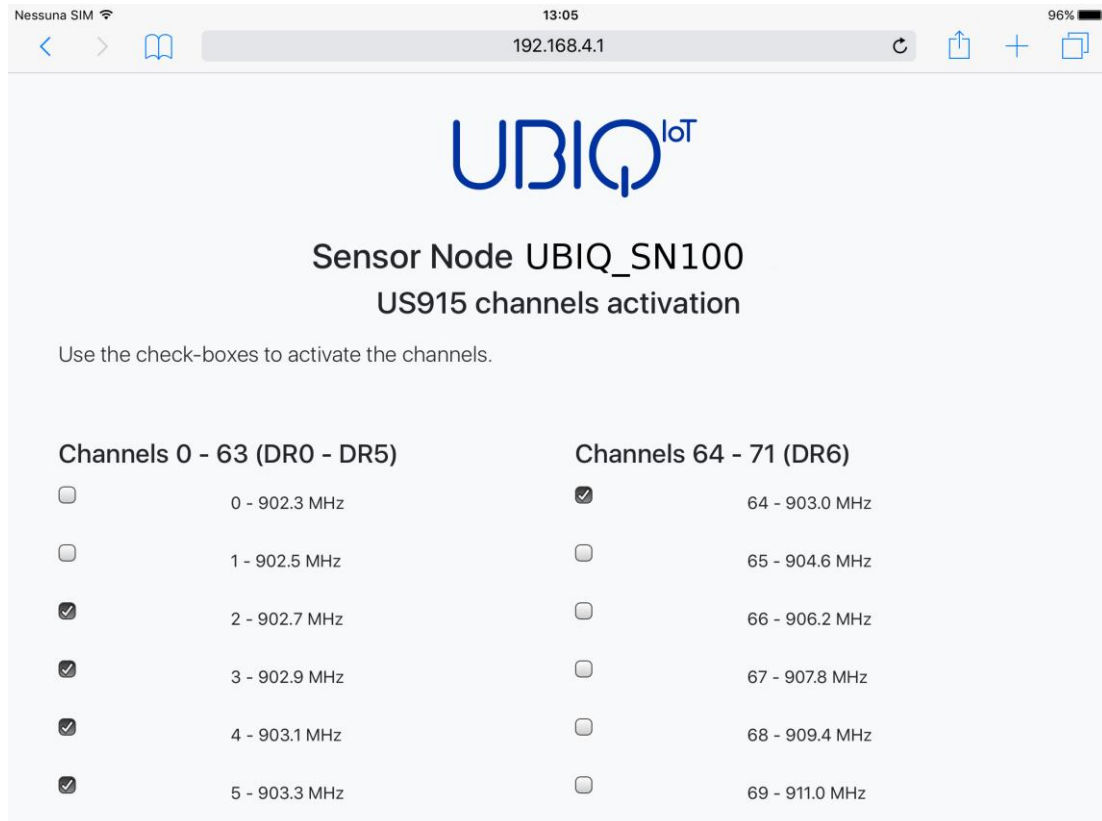


Figure 6 - Channels configuration page for AU915 and US915 bands



To save the configuration data, click the “Save configuration” button at the bottom of the page. The browser will present the following page to confirm that the device has been correctly configured.

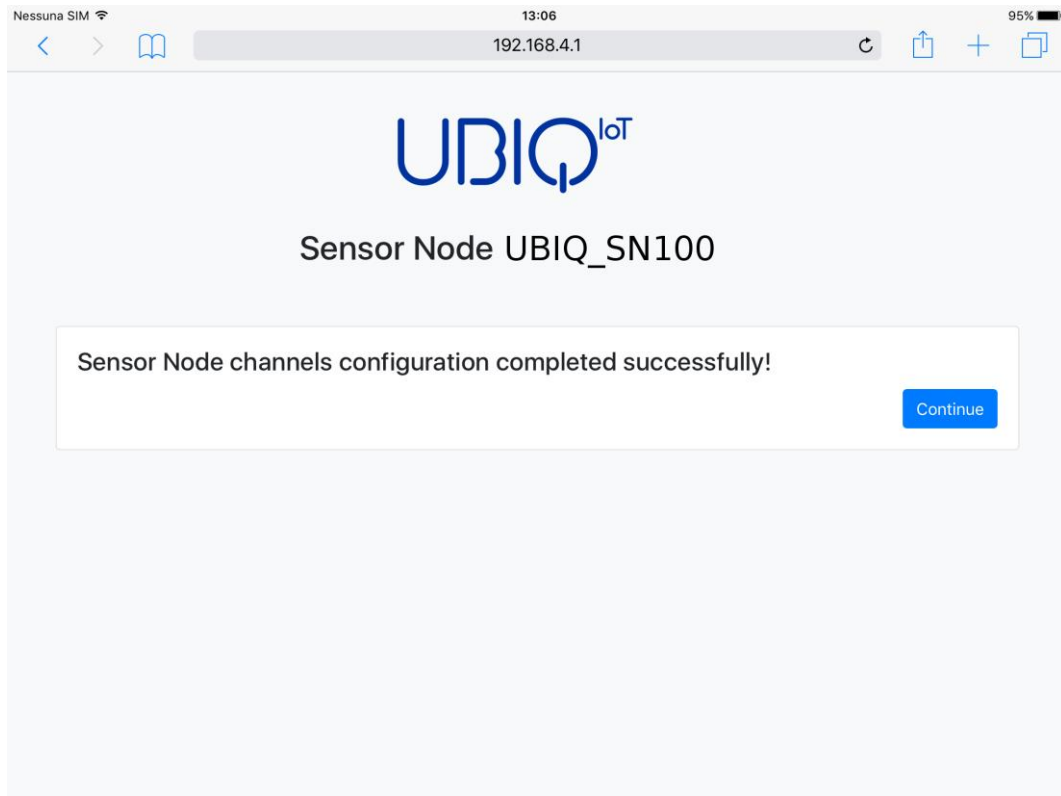


Figure 7 - Channel configuration completed



Exit the Configuration Mode

To exit the Configuration Mode, set the Configuration switch to the “OFF” position and push the Reset button (see Figure 1) to initiate the hand-shaking sequence.

Hand-shaking sequence

The sensor node will start the hand-shaking sequence sending two series of messages which have a fixed payload of 11 bytes.

In the first series the sensor node sends four messages to the gateway with the Data Rate set to 1; these messages have an interval of 10 seconds. In the second series the sensor node sends another four messages to the network server separated by 10 seconds each. These messages use the Data Rate set by the sensor node configuration.

After the hand-shaking sequence is over, the device enters the Operation Mode and will start to transmit the sensor readings according to the specified configuration.

Operation Mode

The sensor node works in Operation Mode when the Configuration switch is set in “OFF” position. When turned on setting Power switch in “ON” position, the sensor node will immediately start to transmit according to the saved configuration. No actions are required by the user.

If case the device stops to send data push the Reset button (see Figure 1). The sensor node should begin immediately to transmit again. Depending what was the cause of the problem, the device could restart from the hand-shaking sequence.

Technical details

Sensor node dimensions:

20cm x 16cm x 7cm (L x H x P)

Operating temperature range:

-30 °C / +50 °C

Battery

Reference data sheet available at:

<https://www.saftbatteries.com/products-solutions/products/ls-lsh>

Soil Volumetric Water Content

Range: mV = 350 – 1250 mV

Conversion formula: $VWC (m^3/m^3) = 2.97 * 10^{-9} * mV^3 - 7.37 * 10^{-6} * mV^2 + 6.69 * 10^{-3} * mV - 1.92$

Range m^3/m^3 = from 21.5% to 81.5%

Reference data sheet available at:

<https://www.metergroup.com/environment/products/ech20-10hs-soil-moisture-sensor/>

Temperature

Range: T = 23300 – 33800 K*10²

Conversion formula:

$^{\circ}C = (T / 100) - 273.15$

Range $^{\circ}C$ = from -40.15 $^{\circ}C$ to +64.85 $^{\circ}C$

Reference data sheet available at:

https://www.davisinstruments.com/product_documents/weather/spec_sheets/6830_6832_SS.pdf

Relative Humidity

Range: H = 0 – 100 RH%

Reference data sheet available at:

https://www.davisinstruments.com/product_documents/weather/spec_sheets/6830_6832_SS.pdf

Payload specification

MSB = Most Significant Byte

LSB = Less Significant Byte

FE = Future Expansion

Operation mode payload format

Byte 00 :	Error code
Byte 01 :	Sensor node type
Byte 02 :	Sensor node map
Byte 03 :	Soil moisture sensor 0 (MSB)
Byte 04 :	Soil moisture sensor 0 (LSB)
Byte 05 :	Soil moisture sensor 1 (MSB)
Byte 06 :	Soil moisture sensor 1 (LSB)
Byte 07 :	Soil moisture sensor 2 (MSB)
Byte 08 :	Soil moisture sensor 2 (LSB)
Byte 09 :	Soil moisture sensor 3 (MSB)
Byte 10 :	Soil moisture sensor 3 (LSB)
Byte 11 :	Air temperature value (MSB)
Byte 12 :	Air temperature value (LSB)
Byte 13 :	Air relative humidity value
Byte 14 :	Battery voltage level (MSB)
Byte 15 :	Battery voltage level (LSB)

Hand-shaking payload format

Byte 00 :	Generic error code
Byte 01 :	Transmission error code
Byte 02 :	FE
Byte 03 :	FE
Byte 04 :	FE
Byte 05 :	FE
Byte 06 :	FE
Byte 07 :	FE
Byte 08 :	FE
Byte 09 :	FE
Byte 10 :	Hand-shaking packet number