UBIQ Weather Station

WS-100 Series

User Manual

Version 1.1

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Battery
The battery is NOT included with the product. The weather station 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. More details about battery consumption are described in the Technical details section.

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Contents

Introduction

UBIQ WS-100 is a LoRaWAN compliant weather station based on Davis Instruments Vantage Pro2 sensors array.

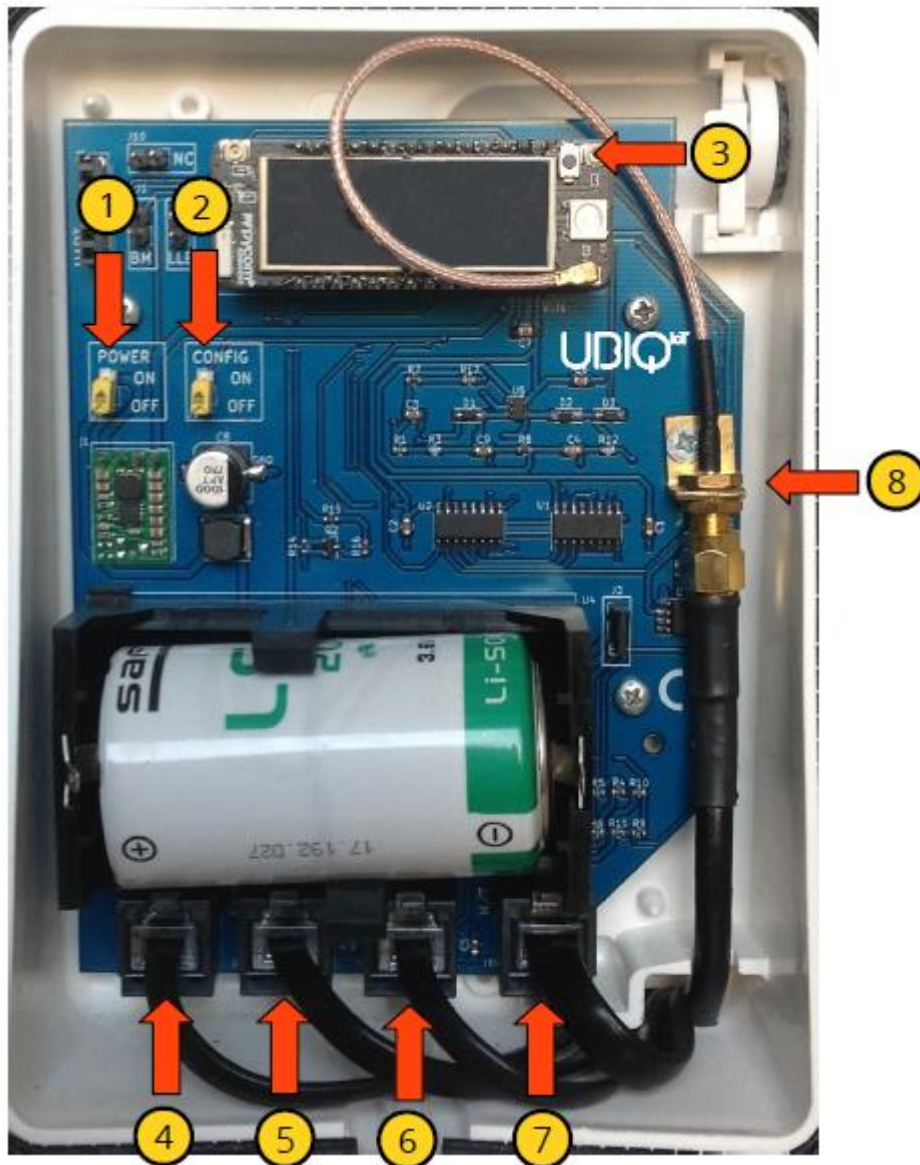*Figure 1 – Inside of the Weather Station*

1- Power switch
2- Configuration switch
3- Reset button

4- Solar radiation sensor connector (RJ11)

5- Rain gauge sensor connector (RJ11)

6- Wind speed and direction sensor connector (RJ11)

7- Air Humidity and Temperature sensor connector (RJ11)

8- Antenna connector

The weather station 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 weather station before its use (see Configuration Mode section). Read the documentation of your LoRaWAN gateway to find the correct configuration data.

The mounting guide for the installation of the weather station can be found at the following address:
https://www.davisinstruments.com/product_documents/weather/manuals/07395-298_IM_07717.pdf

WARNING!
Before any operation involving the antenna (attach/detach), the battery (insertion/removal) or any probe (insertion/removal) the weather station has to be turned off (Power switch in "OFF" position, see Figure 1).

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 weather station 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 station (see the Configuration Mode section below).

Configuration Mode

To activate the Configuration Mode of the device the Configuration switch (see Figure 1) has to be in the "ON" position. If the weather station 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_WS100
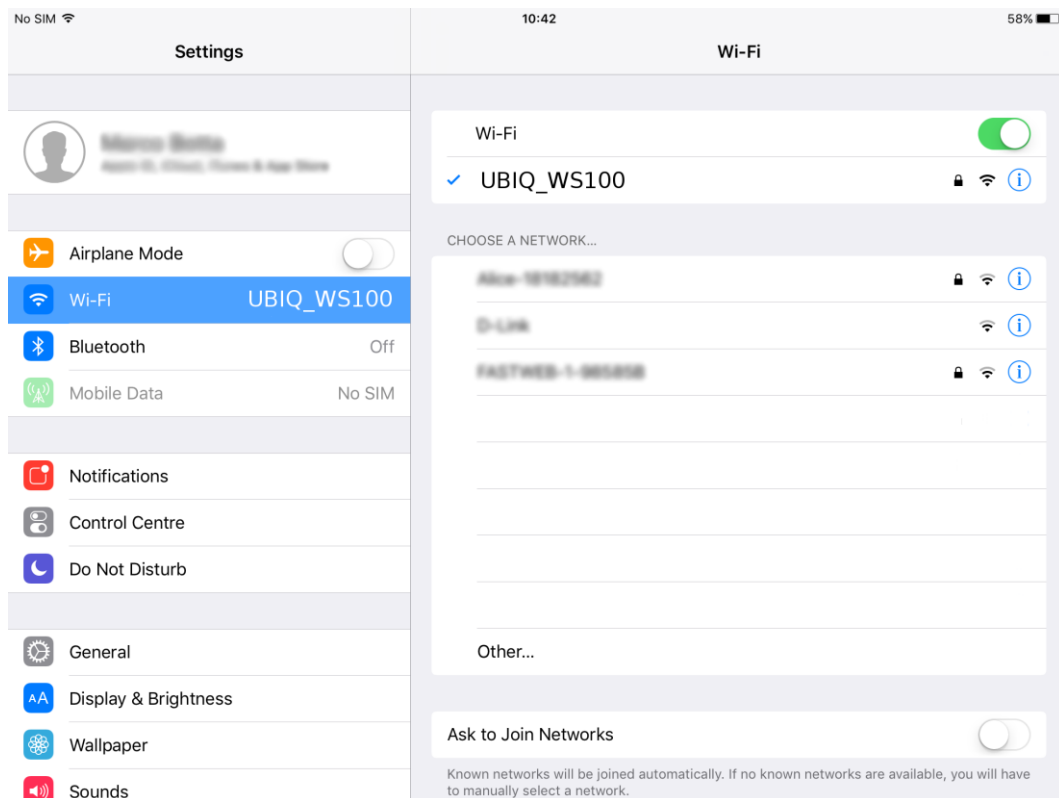- Password =   configpw

Figure 2 – Connection to the weather station 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

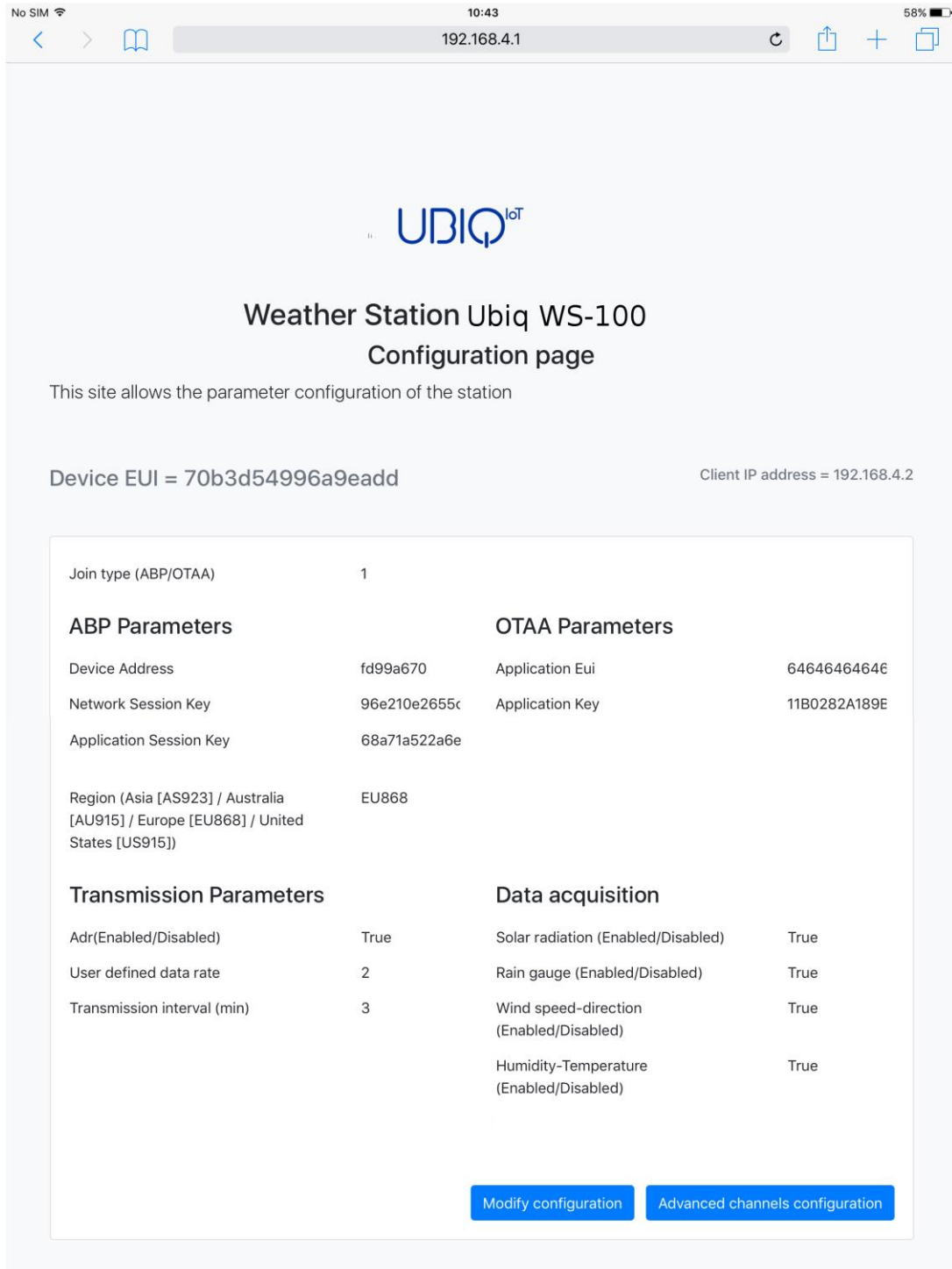The web page represented in the next picture will be loaded.

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 weather station.

The "Data acquisition" section lists which probes are enabled. The weather station will read and transmit only the data acquired from the enabled probes.

The "Transmission interval" represents the interval (in minutes) between two probe readings and transmissions of the data. It can be set between 10 and 120 minutes.

All the other data presented are used to configure the weather station 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]

Configuration data

The weather station 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.

Weather Station UBIQ_WS100
Modify the configuration

This site allows the parameter configuration of the station

Device EUI = 70b3d54996a9eadd

Client IP address = 192.168.4.2

Join type   ● ABP ○ OTAA

ABP Parameters

Device Address	fd99a670
Network Session Key	96e210e2655
Application Session Key	68a71a522a6

OTAA Parameters

Application Eui	6464646464
Application Key	11B0282A189E

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

Transmission Parameters

Adaptive Data Rate (ADR)	☑
User defined data rate	2
Transmission time (min) [5..120]	10

Data acquisition

Solar radiation (Enabled/Disabled)	☑
Rain gauge (Enabled/Disabled)	☐
Wind speed/direction (Enabled/Disabled)	☑
Humidity-Temperature (Enabled/Disabled)	☑

Cancel   Save configuration

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.
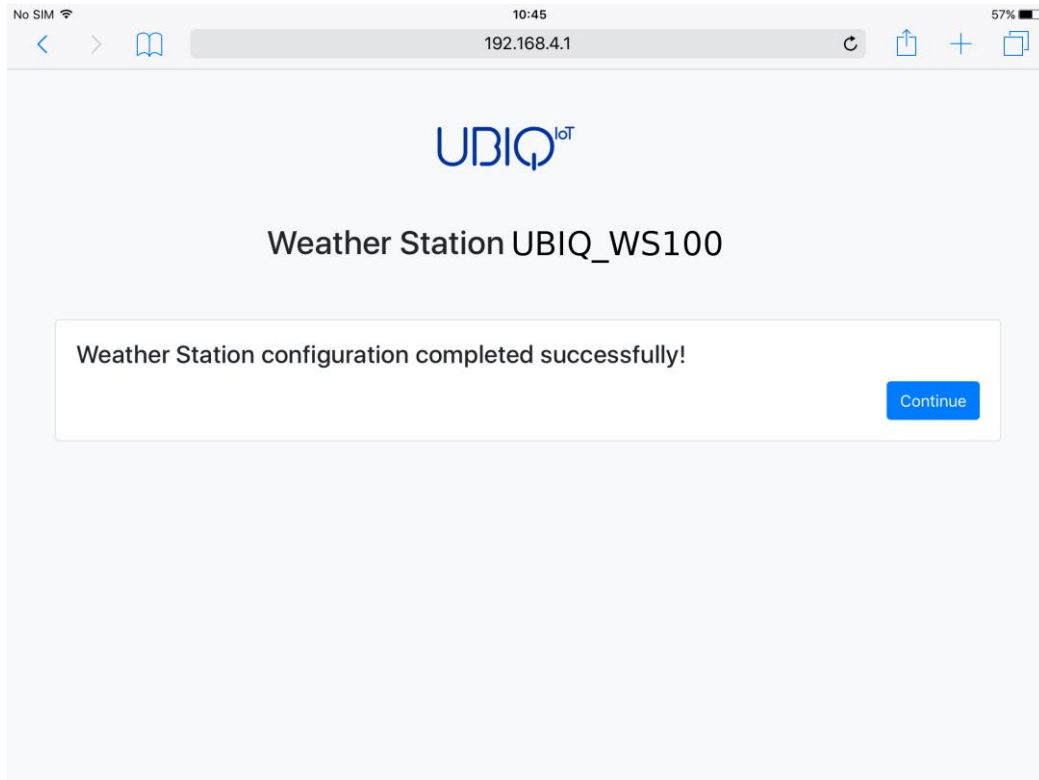

Figure 5 - Configuration modified successfully

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.
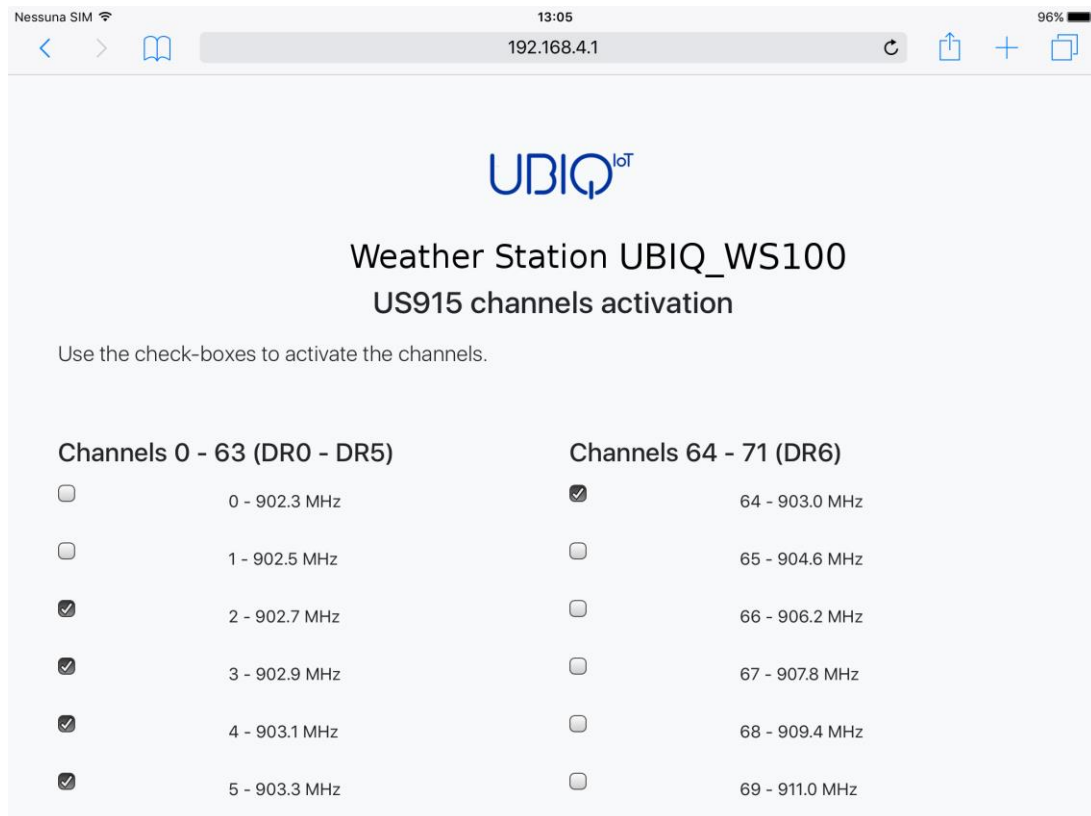

Figure 6 - Channels configuration page for AU915 and US915 bands

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.
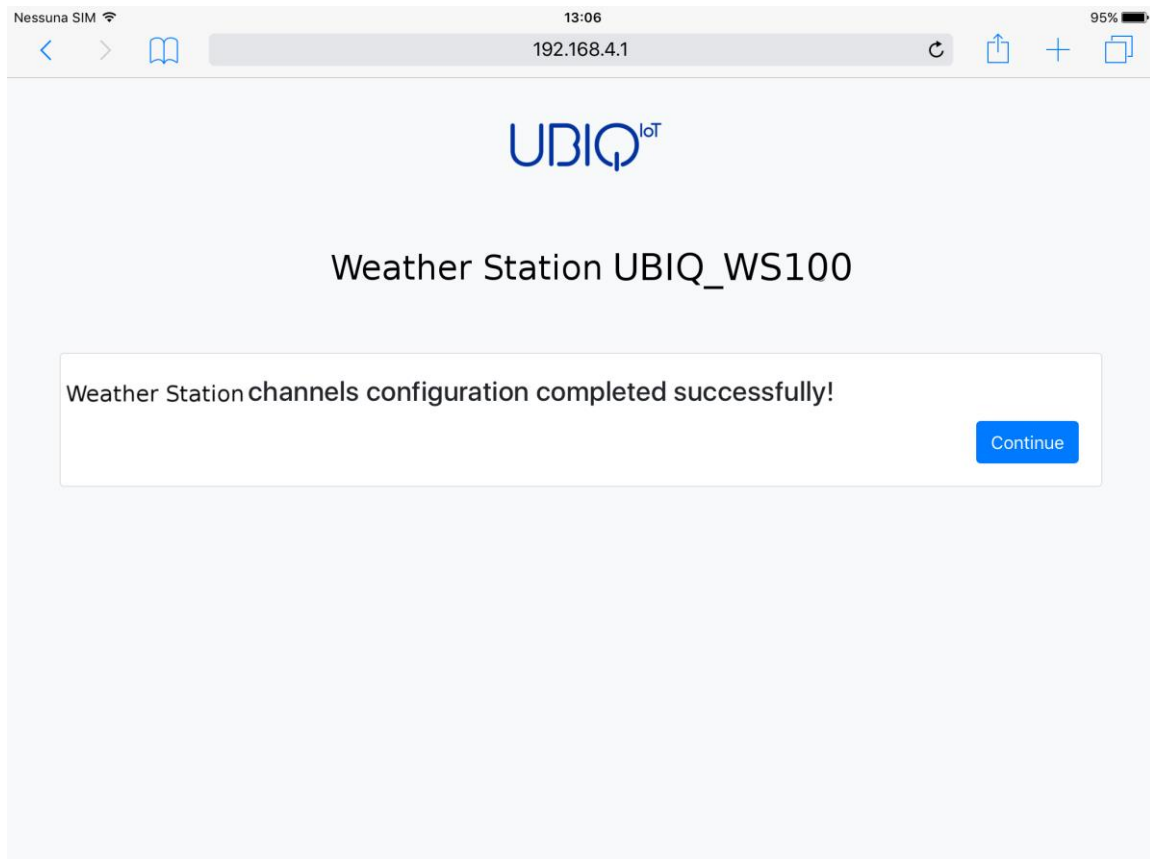

Figure 7 - Channel configuration completed

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 weather station will start the hand-shaking sequence sending a series of three messages which have a fixed payload of 1 byte separated by 10 seconds each. These messages use the Data Rate set by the weather station 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 weather station works in Operation Mode when the Configuration switch is set in "OFF" position. When turned on setting Power switch in "ON" position, the weather station 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 weather station 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

Weather station dimensions:

75cm x 55cm x 25cm (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

Solar Radiation

Range:

SR = 0 – 1800 Wm^2

Reference data sheet available at:

https://www.davisinstruments.com/product_documents/weather/spec_sheets/6450_SS.pdf

Rain

Range:

R = 0 – 10000

Conversion formula:

mm = (R / 100)

Range mm = from 0 mm to 100 mm

Reference data sheet available at:

https://www.davisinstruments.com/product_documents/weather/spec_sheets/6463_6465_SS.pdf

Wind Speed and Direction

Range:

WS = 0 – 322 Km/h

WD = 0° – 360°

Reference data sheet available at:

https://www.davisinstruments.com/product_documents/weather/spec_sheets/7911_SS.pdf

Temperature

Range:

T = 3300 – 13800

Range °C = from -40.15 °C to +64.85 °C

Conversion formula:

°C = [(T + 20000) / 100] – 273.15

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

Energy consumption

Using a data rate of zero (DR 0), with the recommended battery model (SAFT LSH20), the life of a battery should be:

- at least 30 months with a transmission interval of one hour (1h)
- at least 16 months with a transmission interval of thirty minutes (30 min)

WARNING!

In Configuration Mode the unit requires a battery capable to provide a current of at least 1 A; in Operation Mode this requirement is lowered to at least 400 mA. Please, pay particular attention to these values for batteries different than the model specified in this manual.

Even if not recommended, it is possible to use a battery for the Operation Mode and use instead a power adapter to supply the device in Configuration Mode; the power adapter must be capable to provide a voltage between 3.5 V and 5.5 V. In any case **DO NOT** exceed 5.5 V or the device will be **permanently damaged**.

Payload specification

Operation mode payload format

Solar radiation: 11 bits
Rain: 14 bits
Wind speed: 9 bits
Wind direction: 9 bits
Temperature: 14 bits
Relative humidity: 7 bits

The bits are arranged into the 8 bytes long payload as shown in the following map:
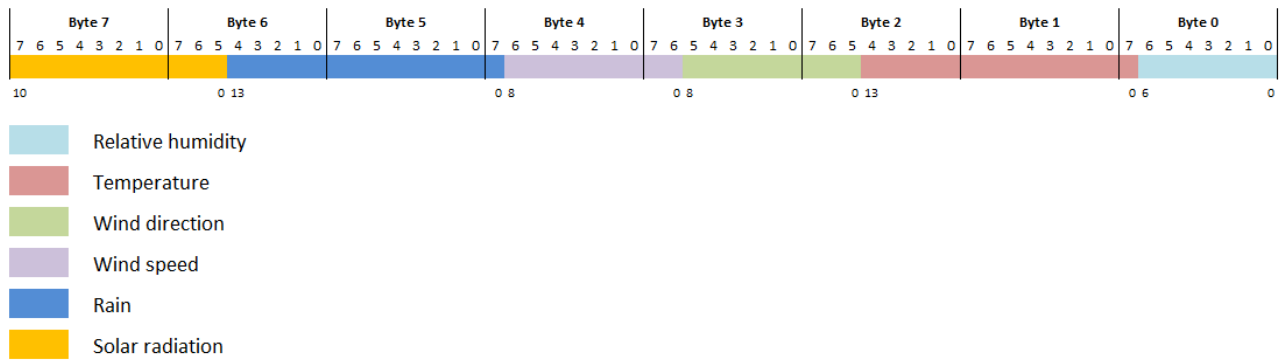
Hand-shaking payload format

Byte 00 :   Hand-shaking packet number

Troubleshooting

The Wi-Fi network in Configuration Mode is not available

Power off the unit and:

- make sure that the battery is firmly inserted into its socket
- make sure that the Configuration switch is in "ON" position
- the battery conforms to the specification

Switch on the device.

The Wi-Fi network in Configuration Mode could not be accessed

- make sure to insert the correct credentials
- make sure to access the specified address
- if your computer has installed a firewall, make sure that there are no rules blocking the configuration page address

The device messages are not received by the gateway/network server

Check the configuration parameters match those one specified by the service provider. If still no transmissions are received power off the unit and:

- make sure that the battery is firmly inserted into its socket
- the battery conforms to the specification
- make sure that the Configuration switch is in "OFF" position

Switch on the device.

The device stops to transmit

Push the Reset button and check if the handshake or normal operation messages start to be received again.

If still no transmission could be received, power off the unit, switch to Configuration Mode and check if the device configuration data are correct. Power off the unit, switch to Operation Mode and power on again the device.