NS313 Advanced Lighting Multi

Digital Occupancy, Ambient Light and Environmental Sensor

- Passive Infrared Motion Sensor
- Light Sensor
- Total VOC Measurement
- Stereo Microphones
- Temperature, Humidity
- RS485 Digital Output
- Wi-Fi HTTPS/MQTT
- 5-60V DC Supply 3W
- 4 Wire Screw Terminals

Overview

The NS313 Advanced Lighting Multi sensor is an advanced low voltage multi sensor digital occupancy sensor. It features PIR motion, light sensing, temperature, humidity, multi-gas detection, sound monitoring and language processing. It can easily integrate into an existing building control system. Connect the sensor output signal to an RS485 transceiver of a controller, gateway, or data acquisition unit. Or provision for an existing Wi-Fi network for wireless connectivity.

Operation

The NS313 continuously gathers data from its environment, processes it, and transmits it via wired or wireless communication channels. This multifaceted functionality enables a wide range of applications in building automation, environmental monitoring, and occupancy management.

Occupancy Detection:

- The core function relies on a passive infrared sensor. This sensor captures heat signatures within its field of view, enabling it to detect the movement of people.
- Occupancy can also be detected using microphone sound level detection.

Environmental Monitoring:

- **Total Volatile Organic Compound (TVOC) Measurement:**
    - A Total Volatile Organic Compound (TVOC) sensor monitors the concentration of various gases, indicating overall air quality.

- **Temperature and Humidity:** Integrated sensors continuously measure ambient temperature and relative humidity, providing data for environmental control.
- **Light Sensing:** A light sensor measures ambient light levels, enabling applications such as automated lighting control.

Sound Monitoring and Language Processing:

- Stereo microphones capture audio within the sensor's range.
- The device processes audio data, potentially for sound level monitoring, or advanced language processing for voice commands, or anomaly detection.

Data Communication and Control:

- **RS485 Digital Output:** The sensor transmits data via an RS485 interface, allowing for wired integration with building management systems (BMS), controllers, gateways, or data acquisition units.
- **Wi-Fi Connectivity:** The sensor supports Wi-Fi connectivity, enabling wireless data transmission via HTTPS or MQTT protocols. This allows for remote monitoring and control over a network.

Power Supply:

- The sensor operates on a 5-60V DC power supply, providing flexibility for various installation environments.
- 4 wire screw terminals provide the electrical connections.

PIR Motion

The PIR sensor can detect the movement of warm objects such as humans occupying a space. The field of view is 106 x 97 degrees which is suitable for ceiling or wall mount application. The detection range is up to 5m. The typical detection distance such as the install ceiling height is 3m. Place the sensor in a suitable location with line of sight to areas where motion should be detected.

Key Features:

- **High Sensitivity:** Detect temperature differences greater than 4C for object speed 1m/s with size 700 x 250mm crossing 2 detections zones out of a total 64 zones.
- **Field of View:** The sensor's field of view 106 degrees by 97 degrees is designed to cover a substantial area, ensuring comprehensive monitoring of the target space at a sufficient resolution. This is roughly 8.0m by 6.8m viewable at 3m distance.

Operational Principle:

The passive infrared sensor measures the infrared radiation emitted by objects within its field of view. This radiation is measured differentially across 4 quadrant thermopiles. A non-homogenous lens amplifies the difference as moving objects cross internal boundaries.

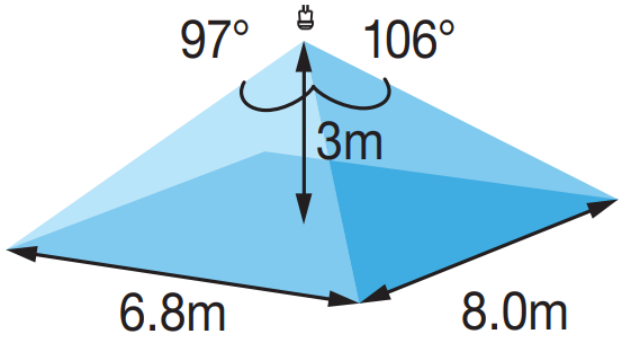


Figure 1 Detection area coverage

Total VOC Detection

Volatile organic compounds (VOCs) are up to five times more concentrated indoors than outdoor airspaces. These compounds are caused by human occupant's respiration, transpiration, and other metabolic processes. Additionally, common building materials such as furniture, flooring, wall coverings can out-gas VOCs. Most commonly these compounds include ethanol, toluene, acetone among other solvents. These compounds can cause eye irritation, headache, drowsiness, dizziness, and other irregularities. Continuous monitoring and ventilation are recommended.

Total volatile organic compound (TVOC) is the summation of various gas species. The metal-oxide detector has different sensitivities to various species. For example, it is significantly more sensitive to smaller molecules like CO and H2 than larger molecules like ethanol. Be advised that TVOC is an index of all pollutants and not a selective sensor for a particular gas species. If it is known that a particular gas species dominates an airspace, then selectivity might be significant. Use this sensor to detect the level of concern. But additional detection with more selective sensors might be necessary to find root cause.

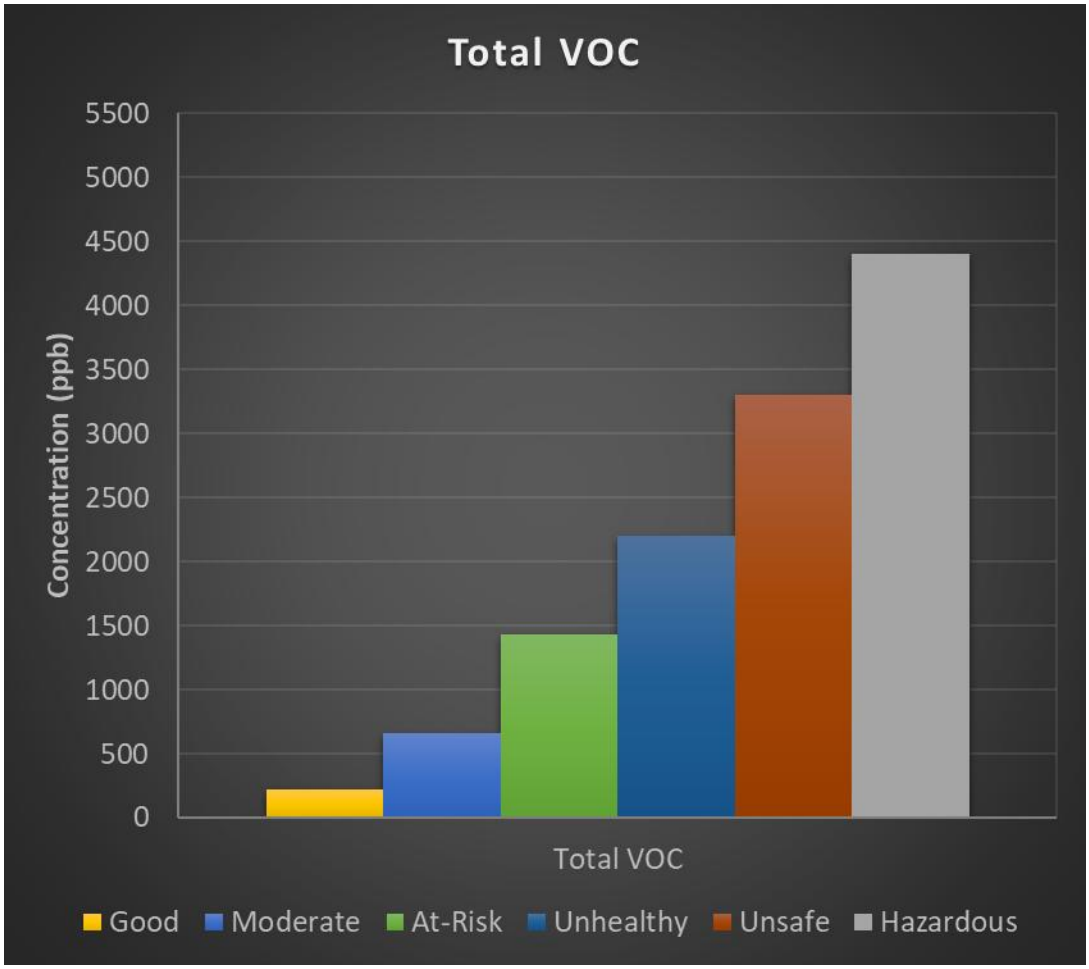
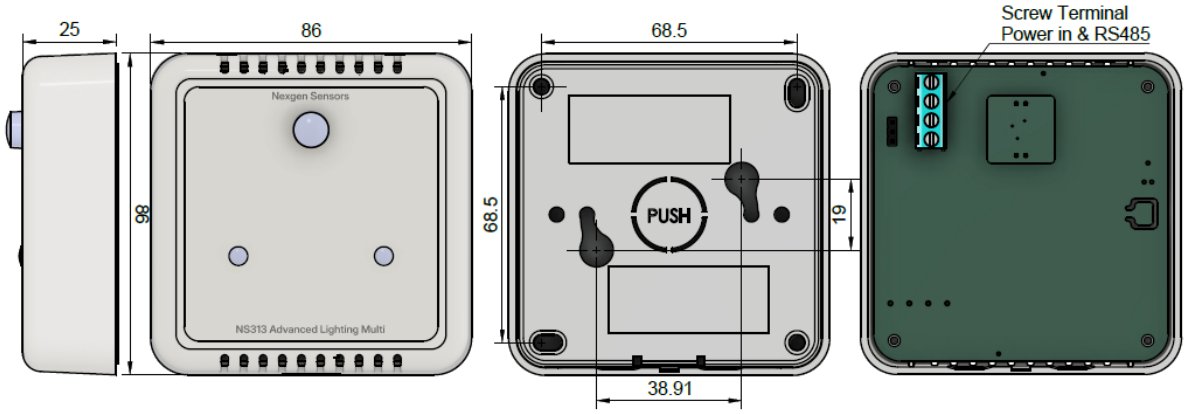


Figure 2 Total VOC Concentration Air Quality Levels

Product Features and Installation

The product is a small plastic enclosure that can be wall or ceiling mounted. The back mounting plate is removable. Separate the front housing from the back mounting plate. Then use screws or adhesive to secure the plate to the ceiling or wall surface. Reattach the front housing to the back mounting plate. The two pieces snap together without extra screws.



3 Product Dimensions and Features

Sensitivity, Output Mode and Type

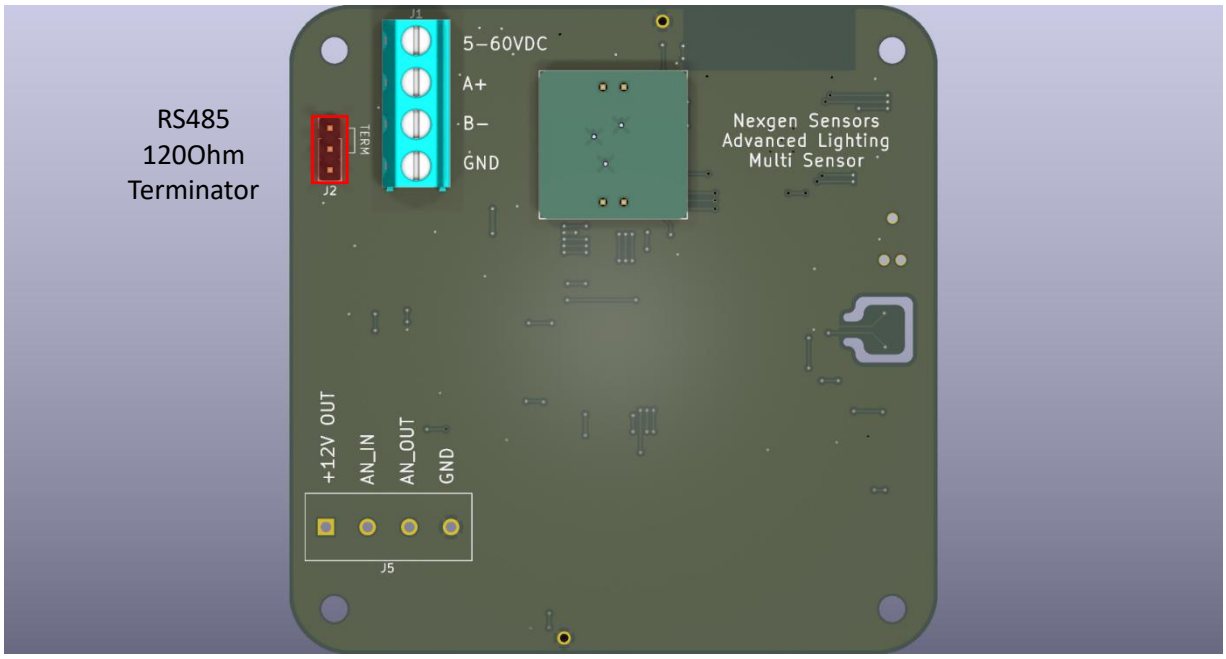
The sensitivity for each type is described in previous sections:

- ppb for Total VOC (TVOC)
- C for temperature (T)
- % for relative humidity (RH)
- Light Sensing: Measurement of ambient light intensity, providing relative lux values.
- Sound Monitoring: Stereo microphones capture audio, capable of detecting sound levels and potentially processing audio for language detection or anomaly detection.

The output mode is digital

- RS485 115200 Baud
- Jumper 120Ohm terminator if required
- 10 second message period
- ASCII message, sensor, serial number, key-value pairs comma separated, carriage return line feed:

```
sensor NS313,hostname ns-72a0b0,message_id 1,voc 43 ppb,temperature 29.1 C,humidity
26.0 %,light 76 lux,sound 36 dBA,keyword_detected none,occupied true \r\n
```



4 Sensitivity and Output Mode Adjustment and Measurement Type

Logical Parameters:

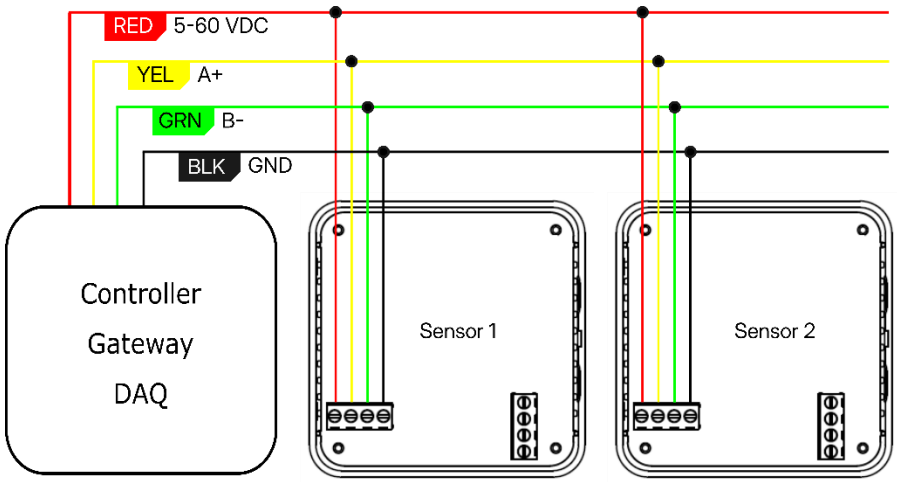
- **occupied (boolean):** Indicates whether the sensor detects occupancy in the space. (true/false).
- **keyword_detected (string):** a semicolon separated list of detected keywords

Usage and Wiring

Connect the sensor to an existing controller, gateway, or data acquisition unit (DAQ). Provide a DC supply of 5-60V with at least 3W. Use appropriate wires or cabling. Conductors can be solid or stranded 14-26 AWG. Secure the conductors to the 4 pins of the screw terminals.

5-60VDC	Positive Supply, connect to 5-60V 3W
A+	RS485 A data signal
B-	RS485 B data signal
GND	Negative Supply and signal return, connect to ground or common

Multiple sensors can be wired in parallel. Identify each sensor by serial number. Associate the serial number to the installation location of the sensor. This is useful for extending the sensing range or observing a larger area.



5 Sensor Wiring Diagram

Alternatively, the sensors can operate independently rather than connected to an external controller or gateway. And Wi-Fi connectivity can be used instead of a wired RS485 network. In this example the sensors connect to a local Wi-Fi access point for communication. They are powered by a simple external power supply. Additionally, external analog sensors or switches can be wired to the analog input terminal. And external alarms, indicators, or relays can be driven from the analog output terminal. A 12V DC supply is also provided at a screw terminal for powering the external devices with up to 100mA.

12VDC	Positive Output Supply, 12V/100mA for external devices
AN_IN	0-10V Analog Input, tolerant to 60V over-voltage
AN_OUT	0-10V Analog Output, drive up to 25mA
GND	Negative Supply and signal return, connect to ground or common

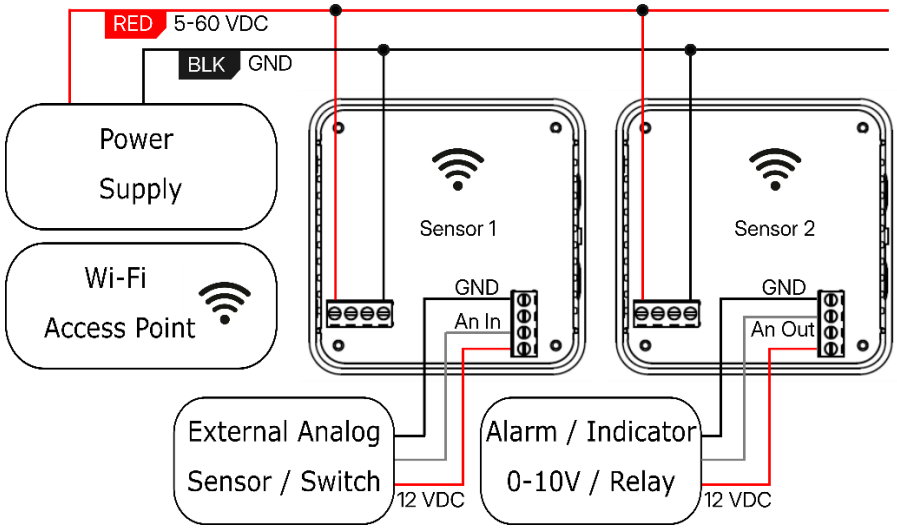


Figure 6 Wireless Network and Programable Analog I/O Usage

WiFi Setup

Provision the WiFi credentials for wireless usage. Use the Web UI hosted by the device. Start by connecting to the device's access point (AP). The SSID is the device hostname. For example "ns-72a0b0". You can use the QR codes on the device for quick access.

Figure 7 Device QR Codes

1. Follow the WiFi code to connect to the access point (AP).
2. Then follow the Setup Code or otherwise browse to 192.168.4.1/setup.html.
3. Enter your local WiFi SSID and password.
4. Click Connect

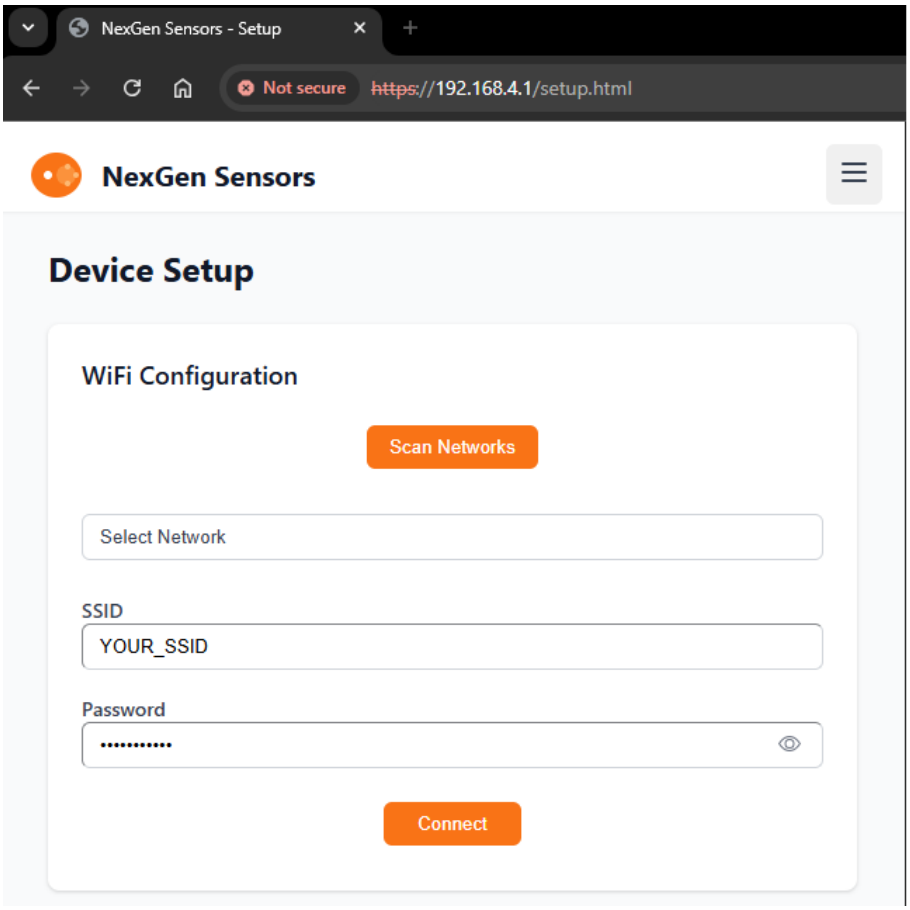


Figure 8 Web UI WiFi Setup

View the device status to verify your local WiFi is connected. Also verify the device internet is connected. Internet connectivity is necessary to access the data remotely. For local access internet is not required.

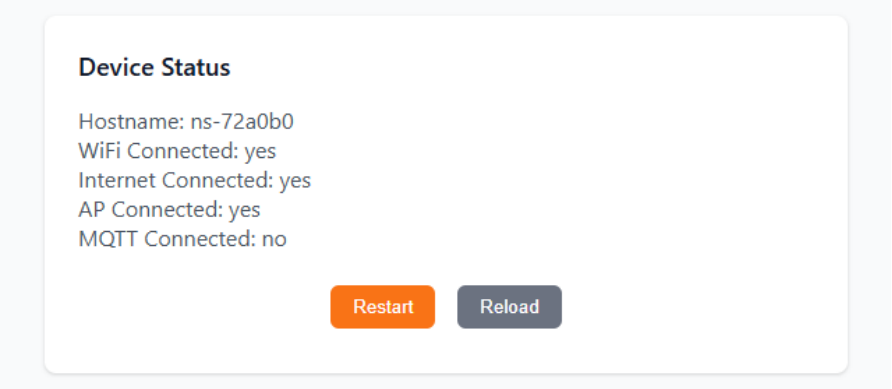


Figure 9 Device Status WiFi and Internet Connected

For normal operation do not connect to the device's access point. This is indicated in the status "AP Connected: yes". Click the Restart button to disconnect from the device's access point.

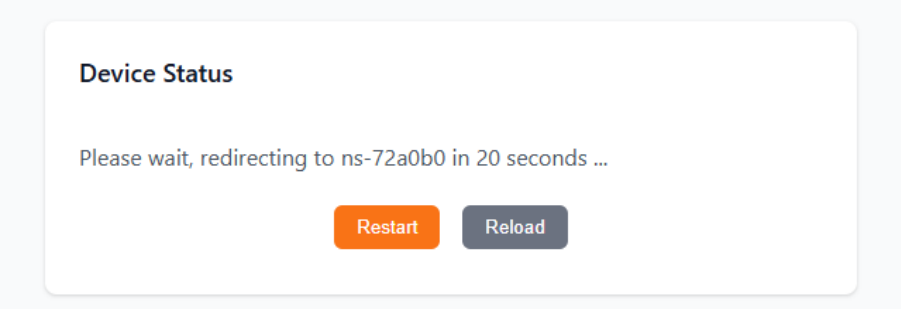


Figure 10 Device status restarting.

After the device restarts, the page will redirect to hostname.local for example “https://ns-72a0b0.local/”.

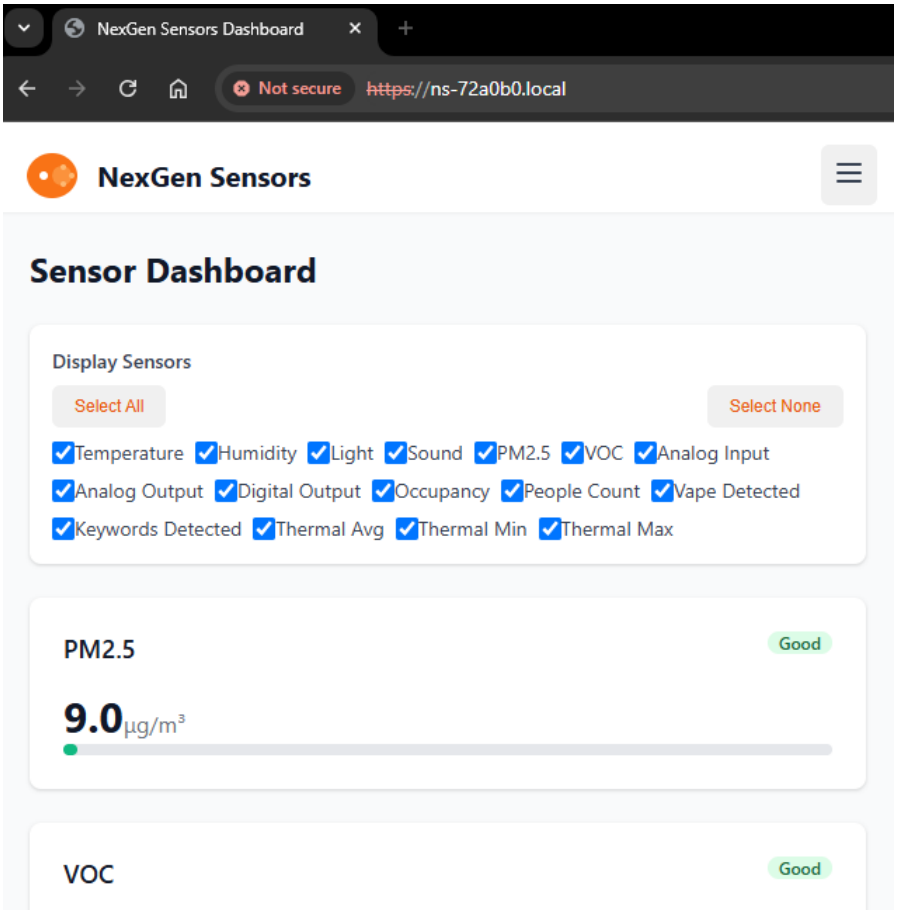


Figure 11 Web UI Dashboard at hostname.local

RS485 Configuration

The device default data communication is via RS485. The baud rate is fixed at 115200. The default data period is 10 seconds. This can be adjusted by changing the period in the Web UI Setup. The RS485 data can also be disabled in not needed. Click Save button after making changes.

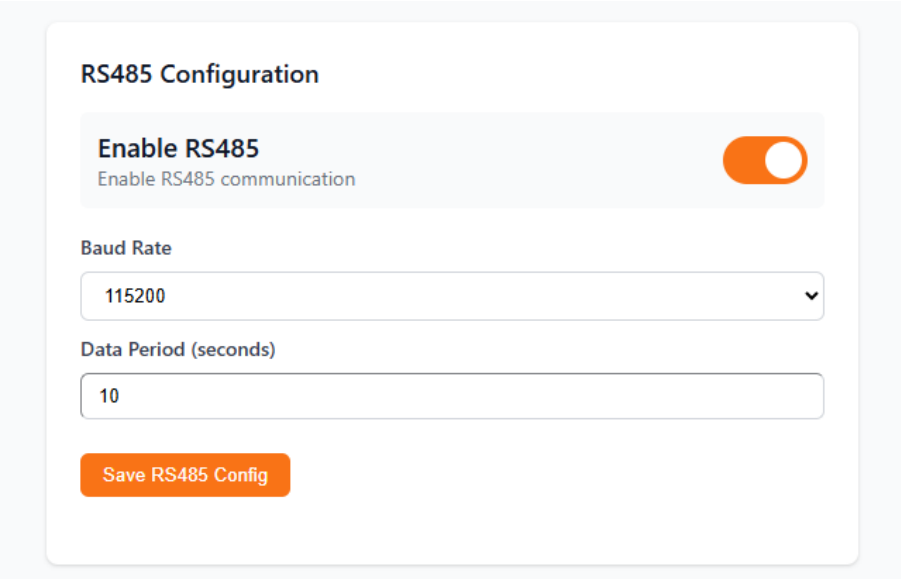


Figure 12 Web UI Setup RS485 Configuration

HTTP Client Configuration

The HTTP Client can be enabled to send data to a server using either PUT or POST methods. Use the Web UI Setup to set the Server URL. This should be the endpoint at which the data can be received. Specify the method either PUT or POST. And set the data period. This is a synchronous feature for data logging. Click save after making changes.

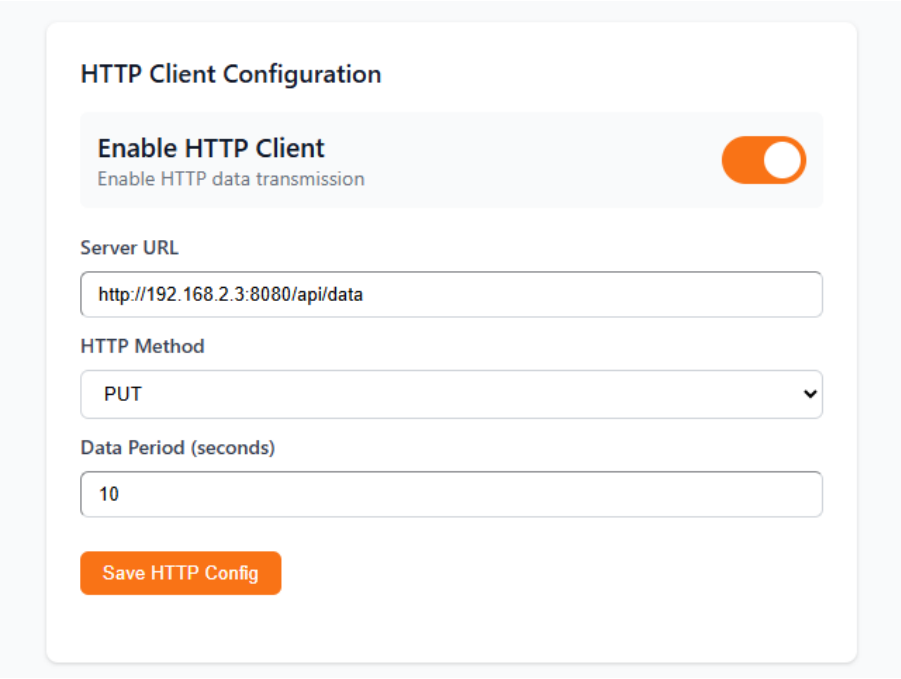


Figure 13 Web UI Setup HTTP Client Configuration

MQTT Client Configuration

The MQTT Client can be enabled to send data to a MQTT broker. Use the Web UI Setup to set the Broker URI and the topic at which the data is published. Username and Password credentials are optional. Leave blank if no authorization is necessary. Finally, set the data period and click Save.

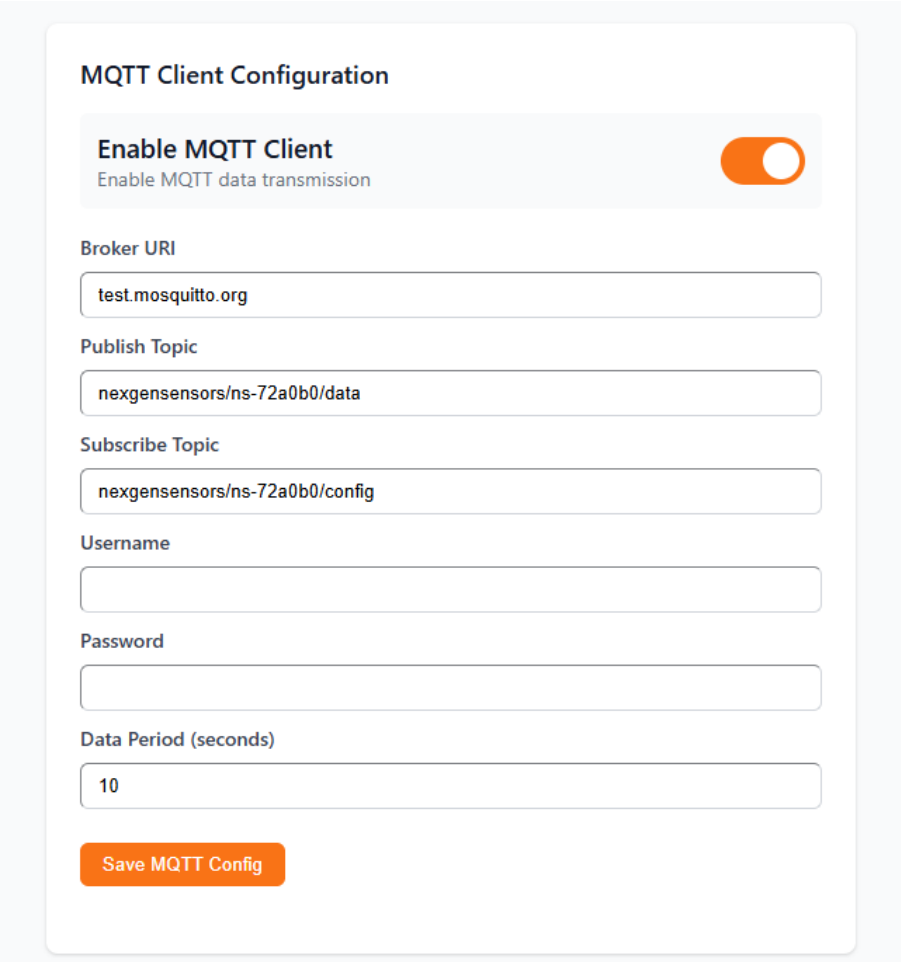


Figure 14 Web UI Setup MQTT Client Configuration

Device Settings

Occupancy is determined by both sound and people count. The occupancy state goes to occupied (output high) when either sufficient sound or people are observed. The state goes vacant (output low) after a timeout. Adjust these setting in the Web UI as needed.

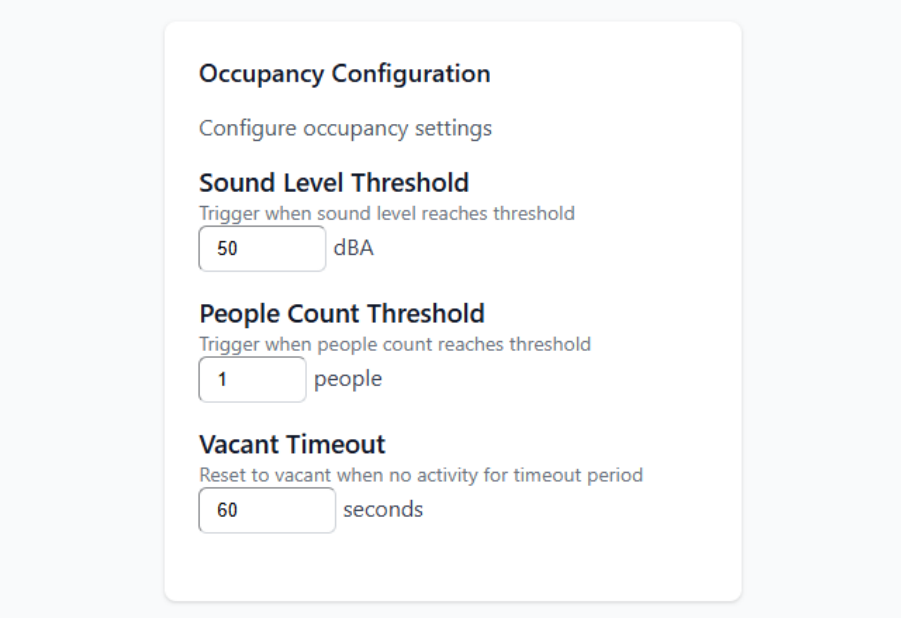


Figure 15 Web UI Device Settings Occupancy Configuration

The keyword detection identifies keywords spoken. Up to 10 keywords can be detected. Adjust the list of keywords using the Web UI Device Settings Keyword Configuration. Add or remove keywords. Then finally click Save Settings to finish the changes.

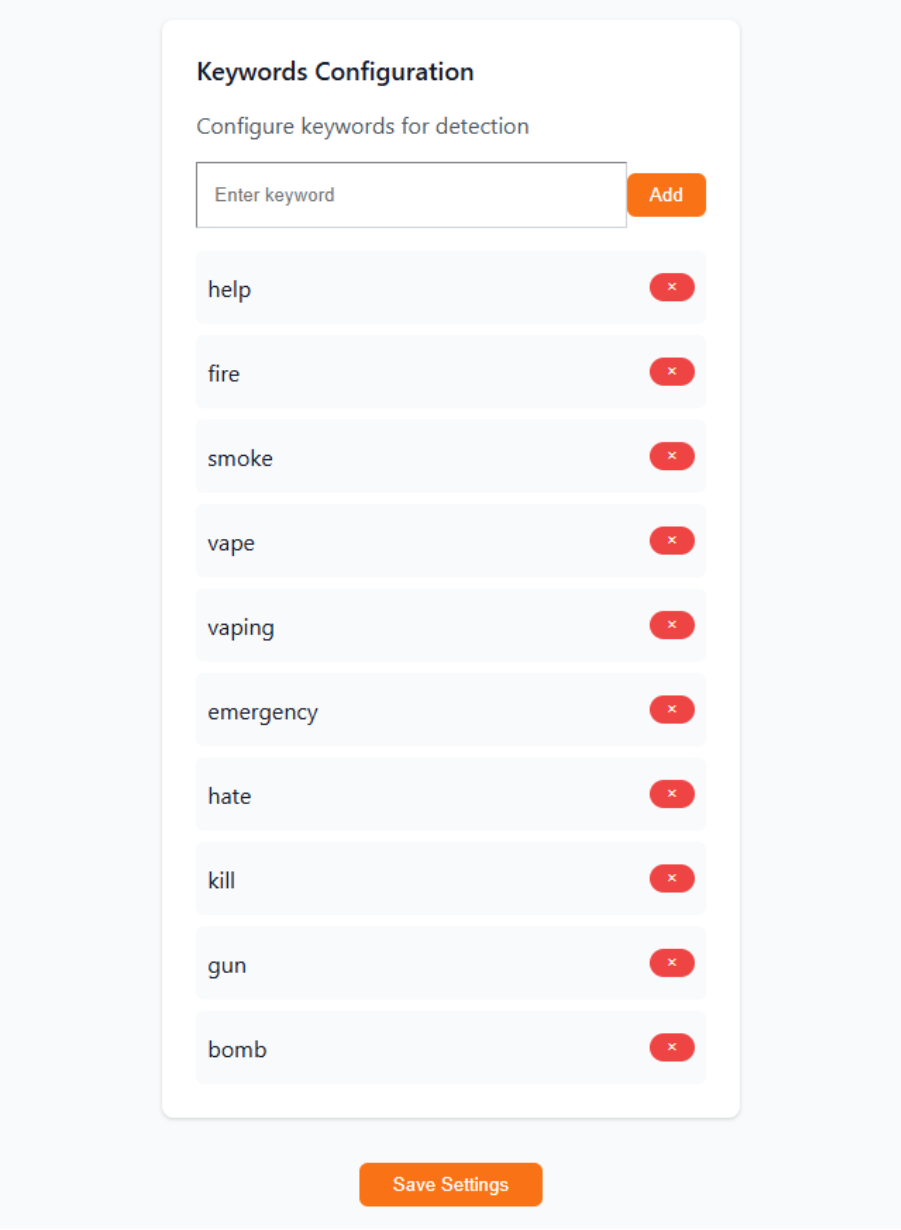


Figure 16 Web UI Device Settings Keyword Configuration