Device

WACS Series is a range of IoT devices intended to online asset management. They allow the remote control and remote supervision of equipment, cargos, vehicles and any other kind of asset, commercial and industrial system.

.WACS.

WS2-1xx devices were developed with focus on long battery life in indoor applications with existing wi-fi local network.

WACS can be configured to send messages in a periodic behavior (called log) or when a specific condition is detected (called event). In both log and event behaviors the available variables are:

- Temperature measurement - That can be sent as log or trigger events
- Relative humidity - That can be sent as log or trigger events
- Location estimation - Based on Wi-Fi access points location
- Motion detection - Using a 3-axis accelerometer, WACS is able to count motions, indicate when the motion was detected or even trigger location estimation when motion condition is detected, or end of motion condition is detected

Additionally, the IoT platform AYGA dots supports integrally all features of WACS and it is an extremely easy and powerful way for connecting WACS devices.

Main features of WS2-Wi-Fi:

- Compatibility with the Wi-fi local network
- Indoor geolocation
- Internal/external temperature and motion sensors
- Replaceable battery up to 10 years
- Remote parameterization with usage profiles
- Compatible with the AYGA dots platform
- Compact size
- IP67 class (according to the model)
- High level of flexibility intended for different applications
- Compact and robust mechanical structure

Profiles

General

The use of profiles that gather typical parameterizations for each application facilitates their quick configuration.

There are three profiles available in WS2-Wi-Fi devices: **Temperature and humidity, Cooler, and Cold chain.** Each one of them has a specific set of parametrization according to each specific use case:

Temperature and humidity

Specific profile for temperature and humidity monitoring. In this profile, WACS can measure **temperature** (periodic log, maximum, minimum, and average), **humidity** (periodic log, maximum, minimum, and average) and trigger events (alarms) if the device detects a value out of specified parameters. Some examples of applications are:

- **Low/High temperature events** for sensitive application
- **Low/High humidity events** for sensitive applications
- Temperature monitoring
- Humidity monitoring

The following features are available in this profile: **Remote parametrization request, Temperature/Humidity log, Temperature/Humidity event.**

Cooler

Specific profile for Freezers and Coolers. In this profile, WACS can measure **temperature** (periodic log, maximum, minimum, and average) and send location periodically. If installed in a Cooler's door it is also possible to count door openings (periodic log and absolute counter)

The set of features available in Cooler profile brings the following information for a cooler application:

- Equipment health and possibility of predictive maintenance
- **Low/High temperature events** for sensitives applications, such as Ice cream equipment
- **Location** for asset monitoring
- Usage profile analysis, being possible to detect peaks of usage, "best sellers" coolers and other advanced metrics

The following features are available in this profile: **Remote parametrization request, Motion count log, Temperature log, Temperature event and Location.**

Cold Chain

This profile allows a wide range of temperature and location features designed to register and send events in order to guarantee the quality in the supervision of medical fridges and storage of pharmaceutical products, some examples of applications are:

- Monitoring system for warehouses
- Monitoring system for pharmacies
- **Low/High temperature events** for sensitives applications, such as vaccines

The following features are available in this profile: **Remote parametrization request, Temperature log, Temperature event and Location.**

> NOTE– Check if the feature is available in your WACS version (According to the tag fixed in front of the device) through the Release note RN-WS2 available in en.ayga.com.br/suporte.

Compatible products

AYGA dots platform is fully compatible with WACS devices and is an extremely easy and powerful way to deploy WACS devices.

Product features

General features

Feature	WS2-Wi-Fi
IoT interface	Wi-fi 2.4 GHz
0Location	Yes, through the estimation of latitude and longitude made by dots or third-party platforms
Internal temperature sensor	Measurement range: -20 to 65°C Resolution: 0,1°C Precision: 0,5° C
External temperature sensor (WS2-11x and WS2-12x devices)	Measurement range: -40 to 100°C Resolution: 0,1°C Precision: 0,5° C
Humidity temperature sensor (WS2-13x devices)	Operating range: 0-100%RH Accuracy; +-2%RH
Motion sensor	Maximum acceleration: + 4 g Maximum update rate: 200 Hz
Battery monitoring	Yes, sent as diagnostic information
Real time clock	Yes, for precise log
Battery	Yes, Replaceable battery lasting up to 10 years
Diagnostic LED	Yes
Remote parameterization	Yes, via configurable **Remote parametrization request**
Sensor hall (WS2-10x/S devices)	Yes, available in devices
Operation temperature	-20 à 65°C
Material	ABS plastic (acrylonitrile butadiene styrene)
Mounting	Screw (WS2-110/S and WS2-100/S)
Dimensions	59 x 89 x 28 mm
Weight	100 g
IP level	WS2-100/S: IP67 Other models: IP64
AYGA dots compatible	Yes

Certifications

WACS products has Anatel certification and CE certification:

Product behaviour and operating modes

Connection with the local network

Allows fast and safe remote parameterization in your local Wi-fi network.

Button

Press the button for 15 seconds, when the blue LED turns on, there are 2 minutes to connect the device with your local wi-fi network.

Connection with the local network

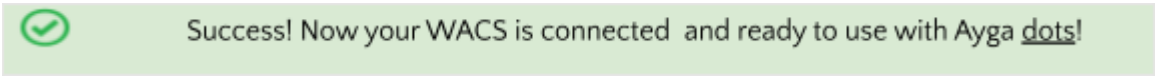
Connect your mobile phone to the Wi-fi network generated by the device (the name of the network is the device id).

Configuration page

After connecting to the Wi-Fi network generated by the device, access the url address “http://192.168.4.1/” or scan the QR code:

With the configuration page opened, select your local network and insert the network password. As soon the device connects to the local network, it will be indicated on the same page.

After the described process, the device will start a commissioning process, connecting to Ayga dots network and requesting the last configured parameters.



Parametrization request

Allows fast and safe remote parametrization and there are two ways to use it based on AYGA dots setup:

1. Starting new commissioning process
2. Periodically with custom period

Parametrization request with the button

With a short press of the button:

1. WACS is turned on and starts a new commissioning process

2. If the device is already on, only a new commissioning process is started. Check your Ayga dots to monitor the progress of the process

With a long press of the button:

1. WACS is turned **OFF**

Commissioning process

With a **SHORT** press of the button:

1. WACS enters in commissioning state and fast blinks for 30 seconds to indicate the process started.
2. Sends 3 sequential and specific messages to Ayga dots (or third-party platform) to check the signal quality.
3. Sends a **Parametrization request** 1 minute after the signal checking.
4. If all steps are successful, LED will turn on during 30 seconds to indicate it.
5. If not, WACS will repeat step 4 two more times.

Logs and events

There are two types of Wi-Fi messages sent by WACS to dots:

1. **Log message:** Sends periodic messages of read data. Examples:
   - **Temperature log**
   - **Location**
2. **Event message:** Sends event messages when detected a value out of specified parameters or changes the device state of motion. Examples:
   - If the detected temperature is higher than **high temperature threshold** sends a event message
   - If the device state changes to **on motion** sends an event

Once the period of the Log message is configurable by the user, the number of messages sent per day it is predictable.

Events have an opposite behaviour, the number of messages sent per day is directly proportional to the number of event conditions and the duration of these conditions. WACS has two different features to have better prediction of sent messages even in case of event messages:

- **Minimum period between event messages:** When enabled one event, it is defined as the minimum period between consecutive event messages. It means that even in continuous event condition, the device will limit the number of messages respecting the configured minimum period between event messages.
- **Automatic disabling (and enabling) of temperature events:** For temperature events, it is possible to specify the maximum time with continuous event condition, after this interval, temperature event will be disabled until the temperature condition returns to the expected value for a specific period.

Logs

Periodic logs

Period between reading and register variables before sending through Wi-Fi messages. The following periodic logs are available on WACS devices:

- **Sample** of temperature per period
- **Minimum value** of temperature per period
- **Maximum value** of temperature per period
- **Out of range** temperature per period
- **Motion count** per period
- **Motion occurrence** per period
- **Location** estimation per period

All periodic logs can be enabled/disabled or configured independently.

Temperature log

I. Temperature measurement is executed and stored internally after the end of the specified period. After 10 periods, WACS sends all temperature logs in one Wi-Fi message.
II. To assure data delivery and enable data recovery, use **ADD** feature, if this feature is enabled WACS sends one Wi-Fi message every 6 readings instead of 10.

Out of range log

WACS stores if temperature remained or exceeded the **high or low threshold** set value during the specified period.

After 40 periods, WACS sends a Wi-Fi message indicating the following information for each period:

- if the temperature stayed inside the range (between temperature thresholds)
- or if it was detected out of temperature range for each of all the 40 periods

Motion count log

Counts how many times the device detected motion during the defined period, stores internally and sends it after 10 periods in one Wi-Fi message.

Motion occurrence log

Registers if the device detected at least one motion occurrence during the defined period, stores internally and sends it after 80 periods in one Wi-Fi message.

This option is indicated when it is required to know the **OCCURRENCE** of motion instead of **QUANTITY.**

Events

If there is some value out of specified parameters or changes the device state of motion, send an event message. The following events are available on WACS devices:

- **High temperature event**
- **Low temperature event**
- **On motion event**
- **No motion event**

Events detection can be also enabled/disabled independently.

Temperature Events

If the measured Temperature remains higher than **High temperature threshold** or lower than **Low temperature threshold** for a configurable period, a new event is sent for a pre-set period (determined in **Time to disable temperature event)**, after that the temperature event is disabled.

Motion events

Sends an event message when the motion state changes.

Diagnostic message

WACS sends a diagnostic message with information of battery voltage, periodic counter and additional diagnostic variable when an event is detected or each 20 Wi-Fi Messages.

Temperature features

This feature has 4 important topics to be exposed, which will influence temperature log and events: **Low pass temperature filter, offset, high and low threshold.**

I. The **Low pass temperature filter**, decreases temperature spikes in abrupt temperature changes and also simulates a higher mass thermal inertia.

   The selected value corresponds to the time constant (RC constant), which means that after the end of 1 period of RC constant the temperature indicates 63,2 % of temperature step change, after two periods indicated 86,5%, and so on, as shown in the following example:

EXAMPLE: Low pass temperature filter: 2 minutes

Low pass period	RC constant	Transfer percentage
2 minutes	1 RC	63,2%
4 minutes	2 RC	86,5%
6 minutes	3 RC	95,0%
8 minutes	4 RC	98,2%
10 minutes	5RC	99,3%
12 minutes	6RC	99,8%
14 minutes	7RC	100%

II. Offset value is a temperature adjustment that can be necessary depending on the application site.

Ex.: Offset value: **-5°C**

Current temperature value: **30°C**

Resulting temperature value: **25°C** (this is the value that will be computed).

III. **High and Low temperature thresholds** are used as the limit values to generate **temperature events** and define **out of range** in **Temperature log type**.

Location

Location

WACS sends messages for location estimation every set period (Period 1, 2, 3, 4 or custom).

Location estimation

WACS scans and filters Wi-Fi access points and sends its respective MAC address through a Wi-Fi message to dots or a third-party platform that estimates location based on the received data.

To increase location precision there are two features available:

1. **Increased location precision with RSSI:** Additional message with respective RSSI data of MAC sent for location estimation, combined with dots or other platforms which use RSSI data, it is possible to reach better estimative precision
2. **Number of MACs:** Number of Access Points used to estimate the device's location. The greater the number of MACs the greater the accuracy of the latitude and longitude estimation, but the higher battery use.

Configurable parameters

Location

Parameter	Description	Impacted features
Number of MACs	Number of Access Points used to estimate the device's location (The greater the number of MACs the greater the accuracy of the latitude and longitude estimation, but the higher battery use)	**Location**
Increased location precision with RSSI	Additional message with respective RSSI data of MAC sent for location estimation. When using dots or other platforms which use RSSI data, it is possible to reach better estimative precision.	**Location**

Temperature

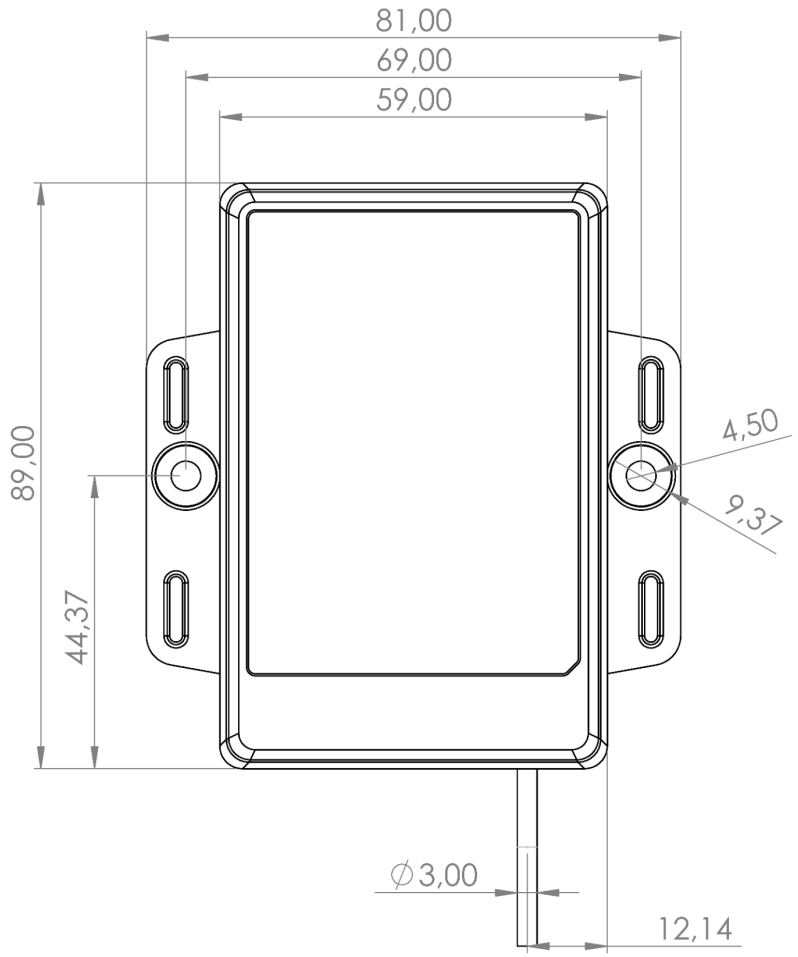
Parameter	Description	Impacted features
Temperature thresholds	Temperature value used to generate high or low temperature event when measured temperature is out of specified values.	**Temperature event, High temperature threshold, Low temperature threshold**
Temperature event delay	Determines the delay required to send the temperature event message. **EXAMPLE**: If a delay of 5 minutes is set, the event must occur during the whole time to send the Wi-Fi event message.	**Temperature event**
Time to enable temperature event	Period without temperature events required to enable/ re-enable temperature event feature.	**Temperature event**
Temperature filter	Low-pass filter used to decrease temperature spikes.	**Temperature log type, Temperature events**

Motion

Parameter	Description	Impacted features
Wakeup threshold	Set the accelerometer sensibility to identify a motion condition to enter in	**On motion event, No motion event, Motion count log, Motion occurrence log**

	on motion state. The higher the number of “g”, the lower the sensibility is and vice versa.	
Accelerometer sampling rate	Accelerometer sampling rate. Higher values detect shorter acceleration peaks but results in higher battery consumption. It is recommended 50 Hz as a good relation between sampling rate and battery consumption.	**On motion event, No motion event, Motion count log, Motion occurrence log**
Time for no motion condition	Time required, after the last motion detection, with no additional motion detection to enter in ***NO motion state.***	**No motion event, On motion event, Motion occurrence log.**

Dimensions



WACS installation

General care

I. Avoid wrapping the device in metallic structures
II. Position as far from the ground as possible.
III. Give preference to the product being in an upright position.

Proper WACS installation with tape:

I. Clean the installation surface with a cloth and make sure it is dry before installing your device.
II. Press WACS against the surface to guarantee a good adhesion of the tape.

Proper WACS installation with screw:

I. Fasten WACS with screw

Safety instructions

SAFETY INSTRUCTIONS: Non-compliance with these safety instructions can result in fire, electric shock, injury, or damage to WACS or other property. Read all the safety information below before using WACS.

- WACS can only be opened and operated by qualified people.
- The appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.
- WACS can not have direct contact with food.
- It is not safe to operate WACS out of specified temperature values.
- Forbid to put flammable and explosive objects and any other fire or heat source around WACS. Also is not allowed to use the device in an environment full of flammable gas and powder.
- Incorrect repair or replacement can damage WACS internal battery, causing overheat and result in serious injury.
- Please turn off and unplug WACS battery before cleaning or maintenance.
- Do not attempt to replace the WACS power source with a non-authorized battery.
- WACS contains radios that emit electromagnetic fields which may interfere with pacemakers, defibrillators, or other medical devices. Do not maintain WACS within close proximity this kind of device.
- Do not keep WACS within close proximity to your body.
- WACS devices are not resistant to hard impacts, such as falls and high vibration.

Legislation instructions

LEGISLATION INSTRUCTIONS:

- Ayga does not assume responsibility for any law violation. Before using the device, check if it is allowed according to the legislation in your country
- WACS internal battery disposal should follow each country legislation. Ayga does not assume responsibility for incorrect battery disposal.

Related application notes

The following application notes are useful to explain common doubts and operating processes related to WACS Wi-fi product

They are all available in: **https://en.ayga.com.br/suporte**

Code	Name	Language
AN-0001	WACS getting started	ENGLISH
AN-0002	Battery Consumption Estimation	ENGLISH