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 was developed with focus in long battery life and flexibility to be used in different scenarios ranging from industrial packaging and tracking to cold chain monitoring. It can be used indoor or outdoor geolocation.

WS2 can be configured to send Sigfox 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
- Location estimation - Based on Wi-Fi access points location
- Motion detection - Using a 3-axis accelerometer, WS2 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 WS2 and it is an extremely easy and powerful way for connecting WS2 devices.

Main features of WS2:

- Compatibility with the LPWAN Sigfox network
- Relative humidity - Which can be sent as log or trigger events.
- Indoor and outdoor 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
- Outdoor and indoor usage
- Models compatible with RC1, RC2, RC4, RC6, and RC7 Sigfox zones

Profiles

General

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

There are four profiles available in WS2 devices: **Tracking and motion, Cooler, and Cold chain and Temperature and Humidity.** Each one of them has a specific set of parametrization according to each specific use case:

Tracking and motion

Used for locating and monitoring mobile or fixed assets, this profile brings a wide range of applications, such as:

- Mobile equipment location
- Vehicle location
- Containers and trailers location
- Returnable Industrial Package (RIPS) location
- Medical and hospital equipment location

It can also be configured to identify motion, with **Motion count log, Motion occurrence log, On motion event, and No motion event,** this options allows a series of application possibilities and combined with tracking can be used to:

- Sends an event message when the device **stops** motion
- Sends an event message when the device **starts** motion
- Counts how many times the device was in motion
- The device identify when a container, RIP or other load is in motion

The following features are available in this profile: **Remote parametrization request, Hall sensor function, Motion count log, Motion occurrence log, On motion event, No motion event, Location and Location on motion.**

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 moving packages with thermal sensitive goods.
- 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.**

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 applications
- **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.**

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 WS2 devices and is an extremely easy and powerful way to deploy WS2 devices.

Product features

General features

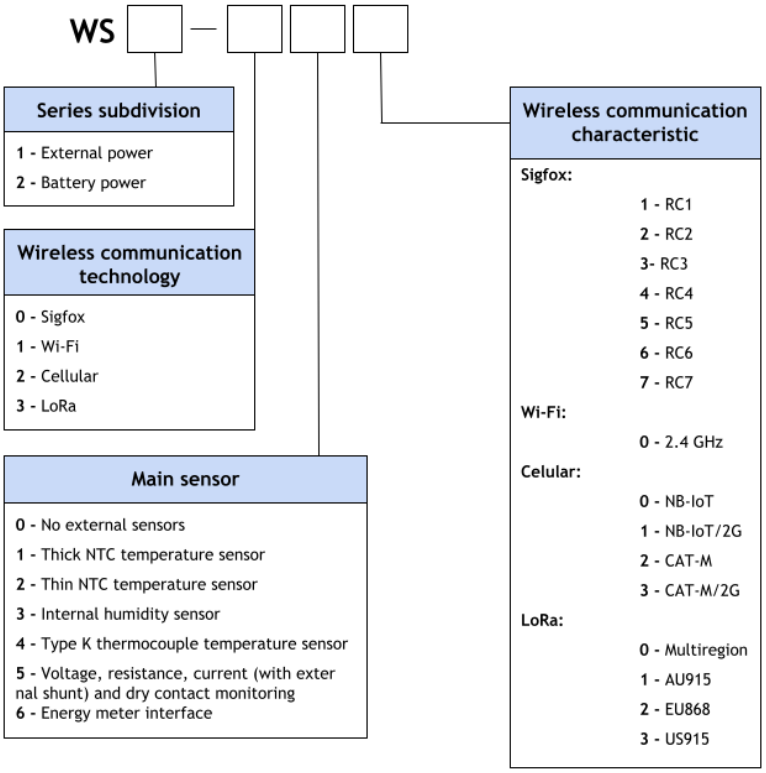
Feature	WS2
IoT interface	Sigfox
Sigfox product class	Class 0
Location	Yes, through the estimation of latitude and longitude made by dots or third-party platforms.
Humidity sensor	Operating range: 0-100%RH Accuracy; +-2%RH
Internal temperature sensor	Measurement range: -20 to 60°C Resolution: 0,1°C Precision: 0,5° C
External temperature sensor	Measurement range: -40 to 100°C Resolution: 0,1°C Precision: 0,5° C
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.**
Commissioning process[1]	Yes, started by the button.
Sensor hall	Yes, available in devices
Operation temperature	-20 à 65°C
Material	ABS plastic (acrylonitrile butadiene styrene)
Mounting	Double sided tape (WS2-0xx/T) or screw (WS2-0xx/S).
Dimensions	59 x 89 x 28 mm
Weight	100 g
IP level	Tape and screw mount models with external sensor: IP64 Screw mount models without external sensor: IP67
AYGA dots compatible	Yes

Certifications

WS2 product has Anatel certification (RC2 models), CE certification (RC1 models), and Sigfox Ready for all models:

Product codification



Sigfox ready certificate

Product code	End product certificate code
WS2-001	P_01AD_88A8_01
WS2-002	P_01AD_5FE6_01
WS2-004	P_01AD_1668_01

NOTE– To check Sigfox Ready Certificates of other products contact our commercial team in ayga@ayga.com.br

Product behavior and operating modes

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

Button behavior

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. WS2 enters in commissioning state and fast blinks for 30 seconds to indicate the process started.
2. During steps 3 and 4, binks according to the respective RC zone, (RC1: 1 blink, RC2: 2 blinks, RC4: 4 blinks, RC6: 6 blinks, RC7: 7 blinks)
3. Sends 3 sequential and specific messages to Ayga dots (or third-party platform) to check the signal quality.
4. Sends a **Parametrization request** 1 minute after the signal checking.
5. If all steps are successful, LED will turn on during 30 seconds to indicate it.
6. If not, WACS will repeat step 4 two more times.

Motion states

There are two motions states available in WACS that can influence logs and events:

On motion state

When the accelerometer detects motions.

No motion state

When the accelerometer does not detect motion.

Logs and events

There are two types of sigfox 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 behavior, 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 sigfox messages. The following periodic logs are available on WS2 devices:

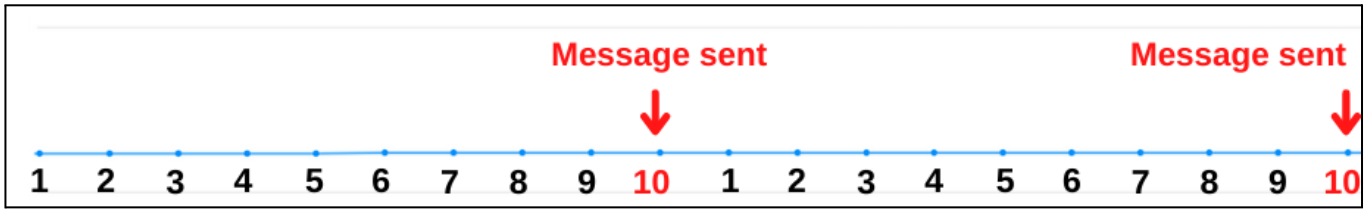
- **Sample** of temperature per period;
- **Minimum value** of temperature per period;
- **Maximum value** of temperature per period;
- **Out of range** temperature per period;
- **Motion count** per period;
- **Motion occurrence** per period;
- **Location** estimation per period
- **Location on motion**

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

Temperature log

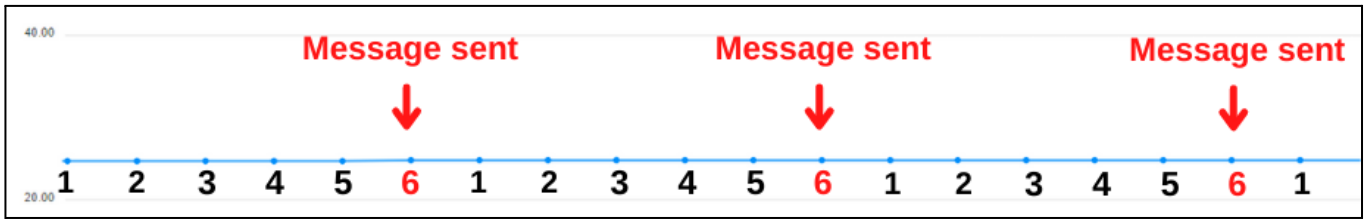
Temperature measurement is executed and stored internally after the end of the specified period. After 10 periods, WS2 sends all temperature logs in one Sigfox message.

For example:



Temperature log with ADD

ADD is the feature that enables data recovery when there is no Sigfox Signal. Basically it stores data and when enabled sends messages every 6 periods instead of 10.



Out of range log

WS2 stores if temperature remained or exceeded the **high or low threshold** set and sends it to the user after 40 periods.

Motion count log

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

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

Location on motion

Changes the Location log when the device is **On motion.**

Events

Works as an alarm that can be sent by email or cell phone, and informs the user if there is a value out of the specified parameters. The following events are available on WS2 devices:

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

Events detection can be also enabled/disabled independently.

Temperature Events

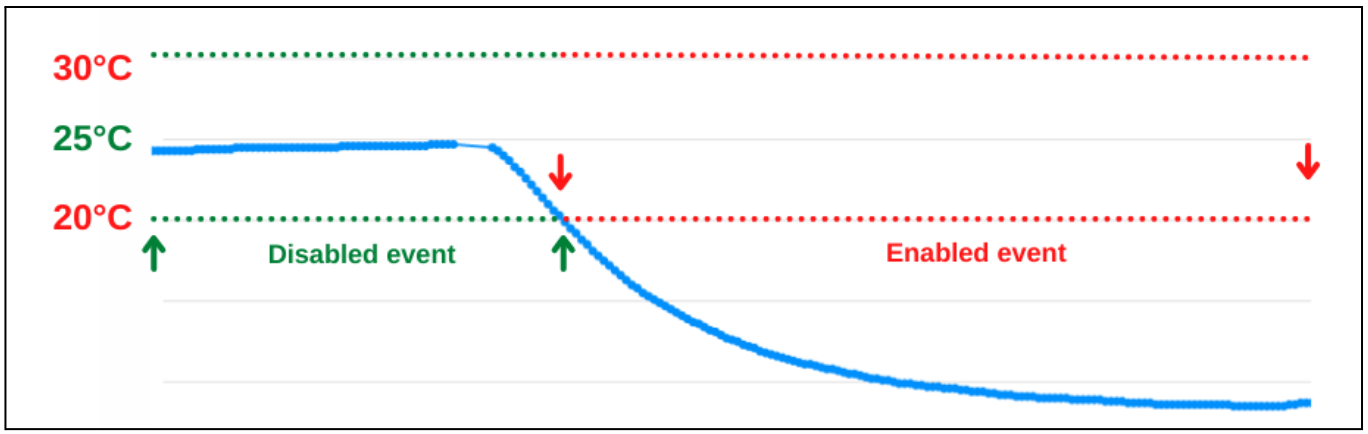
Sends an event instantly if the temperature is out of the configured threshold.

For example:

An event is configured with:

High temperature threshold	Low temperature threshold
30	20

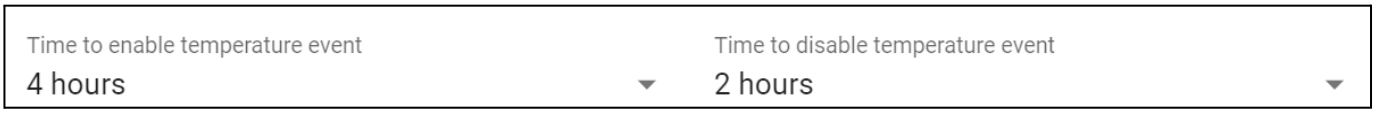
It means that if the device crosses these thresholds, it will send events periodically, as shown in the following image:

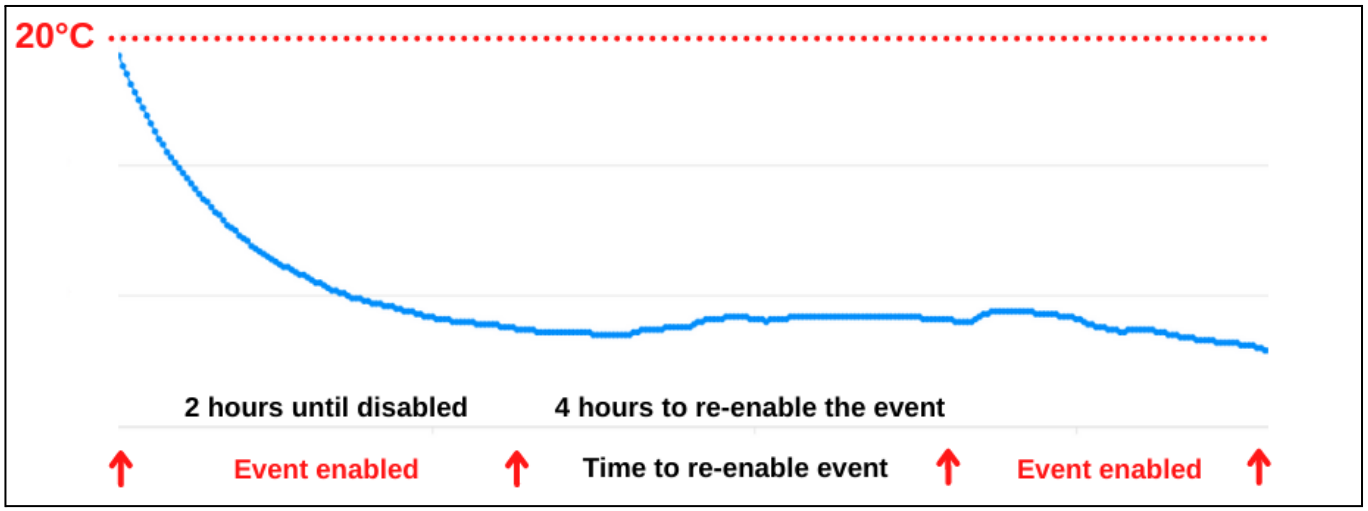


The frequency of messages sent when the temperature is out of the threshold (When the event is enabled) is configured by the user, so, if it is chosen a 5 minutes period, the device will send new event messages every 5 minutes.

But to improve battery life, the device can also be configured to disable the event after some period of time and re-enabled if configured to.

For example:





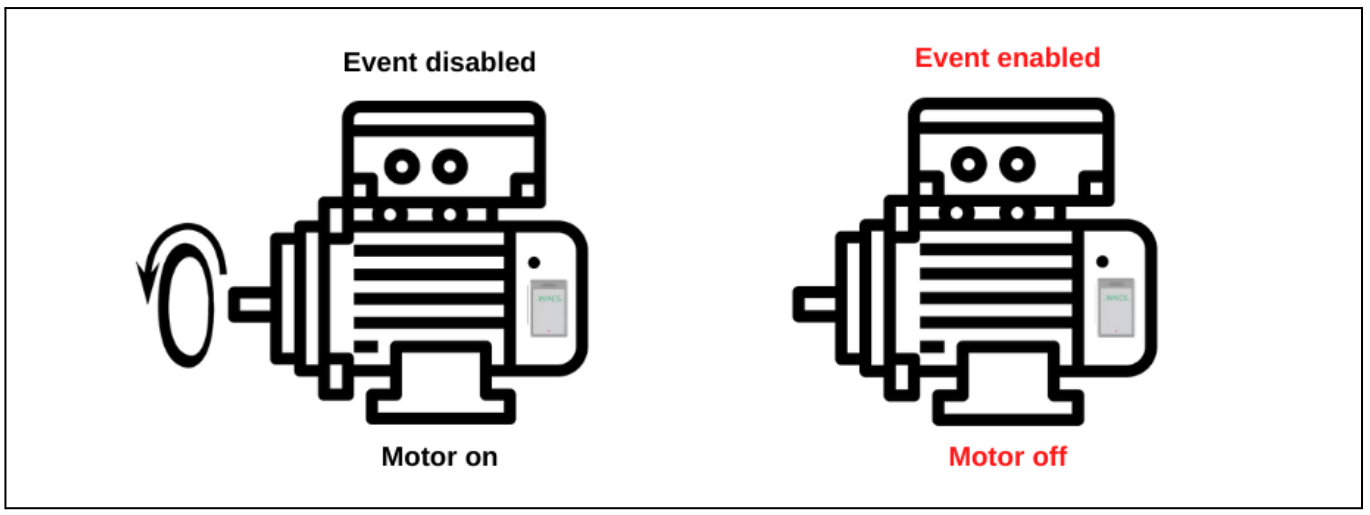
Motion events

Sends an event message when the motion state changes.

No Motion event

Sends an event message when the device doesn’t detect motion through its accelerometer.

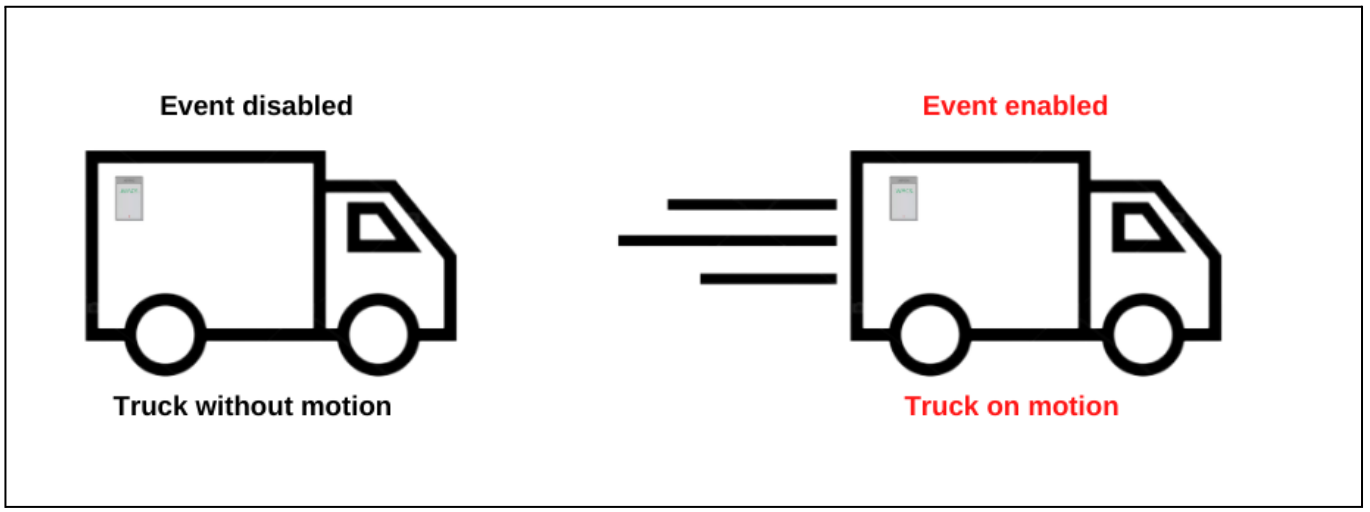
For example:



On Motion event

Sends an event message when the device detects motion through its accelerometer.

For example:



Diagnostic message

WS2 sends a diagnostic message with information of battery voltage, periodic counter and additional diagnostic variable when an event is detected or each 20 Sigfox 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**, serves as a thermal buffer, similar to a glycerol filter, that decreases temperature spikes in abrupt temperature changes and also simulates a higher mass thermal inertia.

Ayga recommends using 30 minutes of filter to 24 ml of glycerol as a reference. To learn more about this feature please check our Application Notes section

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

WS2 sends messages for location estimation every set period (Period 1, 2, 3, 4 or custom).

Location estimation

WS2 scans and filters Wi-Fi access points and sends its respective MAC address through a Sigfox 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:

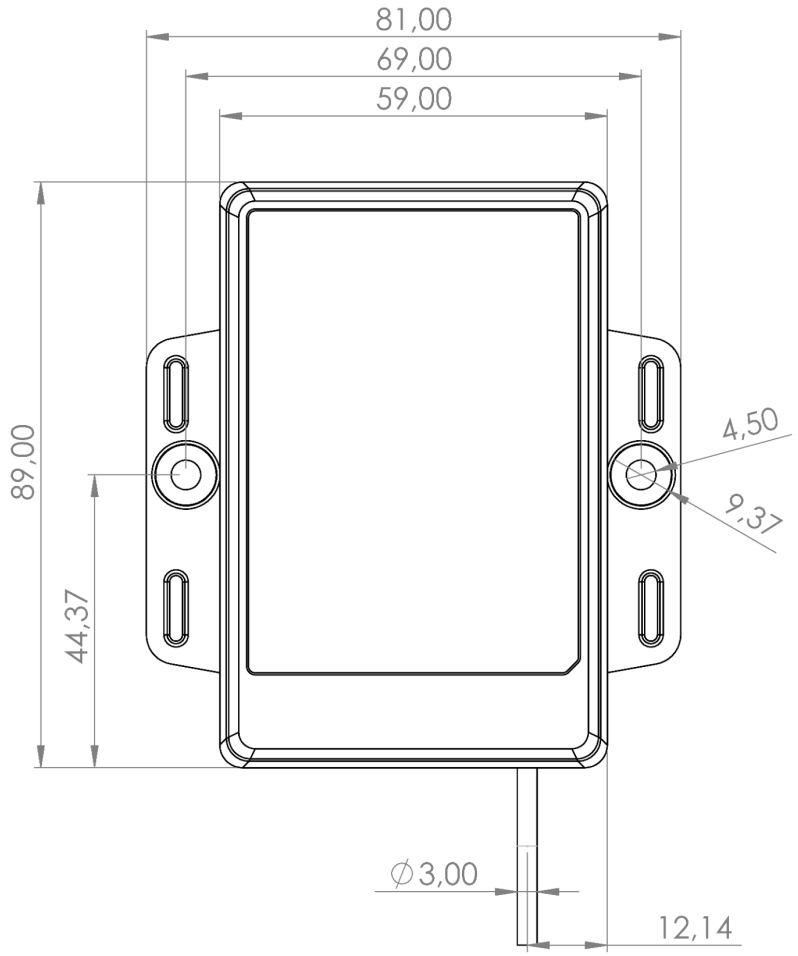
1. **Increased location precision with RSSI:** Additional message with respective RSSI data of MAC sent for location estimation, combined with dots or other platforms which use RSSI data, it is possible to reach better estimative precision
2. **Number of MACs:** Number of Access Points used to estimate 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.

Location on motion

WACS sends messages for location estimation (using dots or third party platforms) when in **On motion state** with a different set period than Location. (Period 1, 2, or 3).

This feature is useful to gain resolution when the asset is **on motion state** and to save battery when it is in **no motion state**

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 and will void the device's warranty. Read all the safety information below before using WACS.

- WACS can only be opened and operated by qualified people.
- The device 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.
- 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.
- Damages in the device's enclosure or electronics will result in loss of warranty.
- The device's tape located on the backside can't be taken off.
- In case of device opening, the screws have to be tight and can't have any damages.

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 WS2 product

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

Code	Name	Language
AN-0001-EN-R01	WS2 Commissioning process PROCESS	ENGLISH
AN-0002-EN-R01	Battery Consumption Estimation	ENGLISH