Severn WLD

User Manual for Severn WLD (2nd generation)

January 2024

Contents

Product and Regulatory Information

Disclaimer and Warnings

Read this user manual before attempting to install the device. Failure to observe the recommendations included in this manual may be dangerous or cause a violation of the law. LAIIER will not be held responsible for any loss or damage resulting from not following the instructions of this user manual.

The device must not be dismantled or modified unless specified by LAIIER. The safety of this product is only guaranteed when it is used in accordance with its purpose.

The device must not be installed near a heat source or in damp conditions.

When the device is open, do not carry out any operations other than the ones set out in this document.

There is a risk of explosion if the battery is replaced by an incorrect type. The battery should be removed from the device if it is not to be used for an extended period. Otherwise, the battery might leak and damage the device. Never leave a discharged battery in the battery compartment.

Maintenance should only be carried out by qualified personnel.

 LAIIER makes no warranties based on the accuracy or completeness of the contents of this user manual and reserves the right to make changes to specifications and product descriptions at any time without notice.

The Severn Board produces non-ionising radiation, please keep your distance if this might cause you harm.

There is a risk of explosion if the battery is replaced by an incorrect type. Contact LAIIER for more information about the battery needed.

Disposal

The device, including board and sensors, must not be disposed of with household or industrial waste. Please contact LAIIER to replace the device if you have a LAIIER Cloud subscription. If you haven’t, please take it to a collection point designated for the recycling of electrical and electronic appliances. The device contains a battery, which must be disposed of separately.

FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by LAIIER could void the user's authority to operate the equipment.

ISED Compliance Statement

This device complies with ISED Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'ISDE Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Introduction

Severn WLD is LAIIER's water leak detection device. The Severn WLD hardware connects to a printed sensor that is split into 12 sections or electrodes. Upon powering up with a single AA Li-SOCl2 cell battery, the device connects to the LoRaWAN® network via OTAA. After running through a self-test, the device enters its run mode.

Within the run mode, the device checks for water on each electrode every minute. It sends a regular or "heartbeat" uplink message by default every 4 hours via LoRaWAN. In its default mode, when it detects the presence of water on 4 or more electrodes, the device sends an emergency uplink message via LoRaWAN.

The threshold, the number of electrode segments that have to be wet to trigger an emergency message, and the regular message time interval can be changed via a LoRaWAN downlink message. The device also reports on its battery status and when its sensor becomes disconnected.

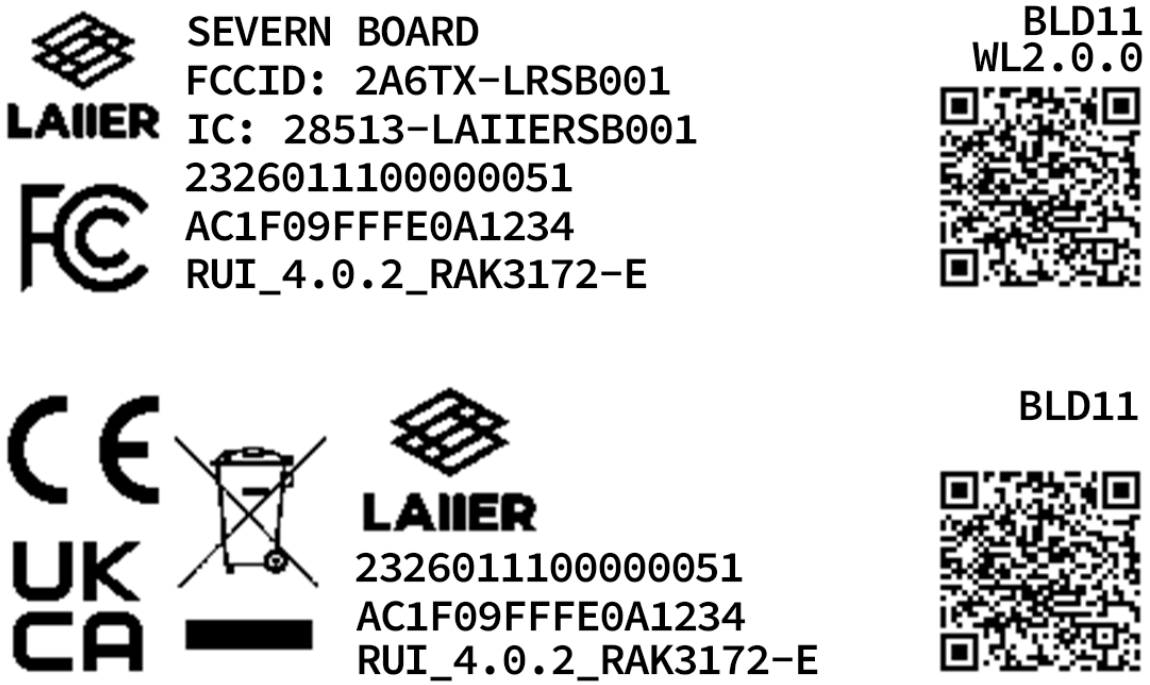
The Severn WLD device also contains a temperature sensor, to report the ambient temperature; and an accelerometer, to report whether the device has been moved.

Specifications

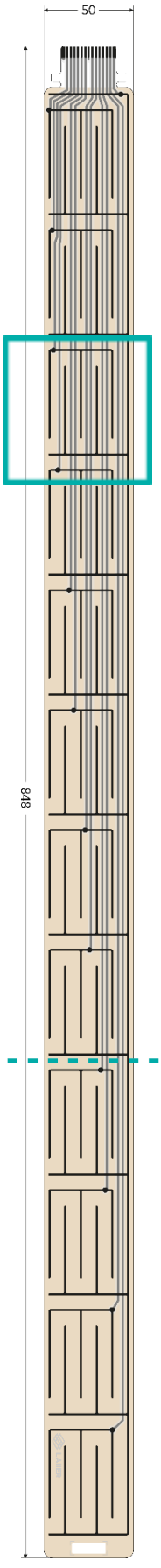
Hardware Dimensions	25 x 59 x 110 mm
Hardware Weight	90g
Operating Temperature Range	-20°C to 60°C
Operating Humidity Range	<90%RH (non-condensing)
Battery Type	AA Li-SOCl2 cell*
Operating Voltage	3.6V
Peak Current Drawn	105mA
Active Battery Lifetime	6 years**
Enclosure	IP65
Mounting	Self-adhesive
Sensor Dimensions	883 x 50mm
Sensitivity	Maximum resolution of 0.1ml of water
Wireless Communication Protocol	LoRaWAN 1.0.3 OTAA
LoRaWAN Frequency Plans	EU868 and US915
Read Range	Up to 2km***
Radio Compliance	Canada, EU, UK, USA

* **Using incorrect batteries can damage the device!** If you are unsure, please contact us at support@laiier.io.
** The device has a 6-year battery life when operating at room temperature, a good distance from a LoRaWAN gateway, and when sending a regular message every 4 hours.
*** The surroundings of the device can influence the read range.

Label Example



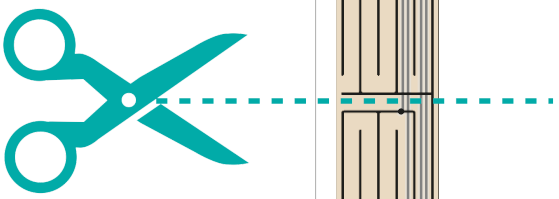
Sensor Dimension and Electrode Definition



Each one of these sections is called an “electrode”. There are 12 electrodes on the sensor.

All dimensions are in mm.

You can trim the sensor by cutting the sensor just behind one of the electrodes. An example cutting line is indicated here.



Please note that the device will not register that the sensor has been cut.

Attaching the Sensor

For a video on how to attach a sensor to the device, please see:
laiier.io/severn-wld-attach-sensor

1. First, open the enclosure by twisting the dial on the enclosure counter-clockwise towards the unlock symbol and opening the hinged lid.

2. Open the connector, the beige part in the front of the device, by lifting the black lever of the connector upwards and insert the sensor with the print facing upwards. Insert the sensor fully, ensuring that both tabs either side of the sensor come into contact with outside of the device enclosure.

3. Close the connector by pushing down the black lever. Check that the sensor is properly connected by tugging it gently.

When your sensor is connected, you can remove the battery safety tab. The LED of your device should then be flashing cyan, which means it is powering up.

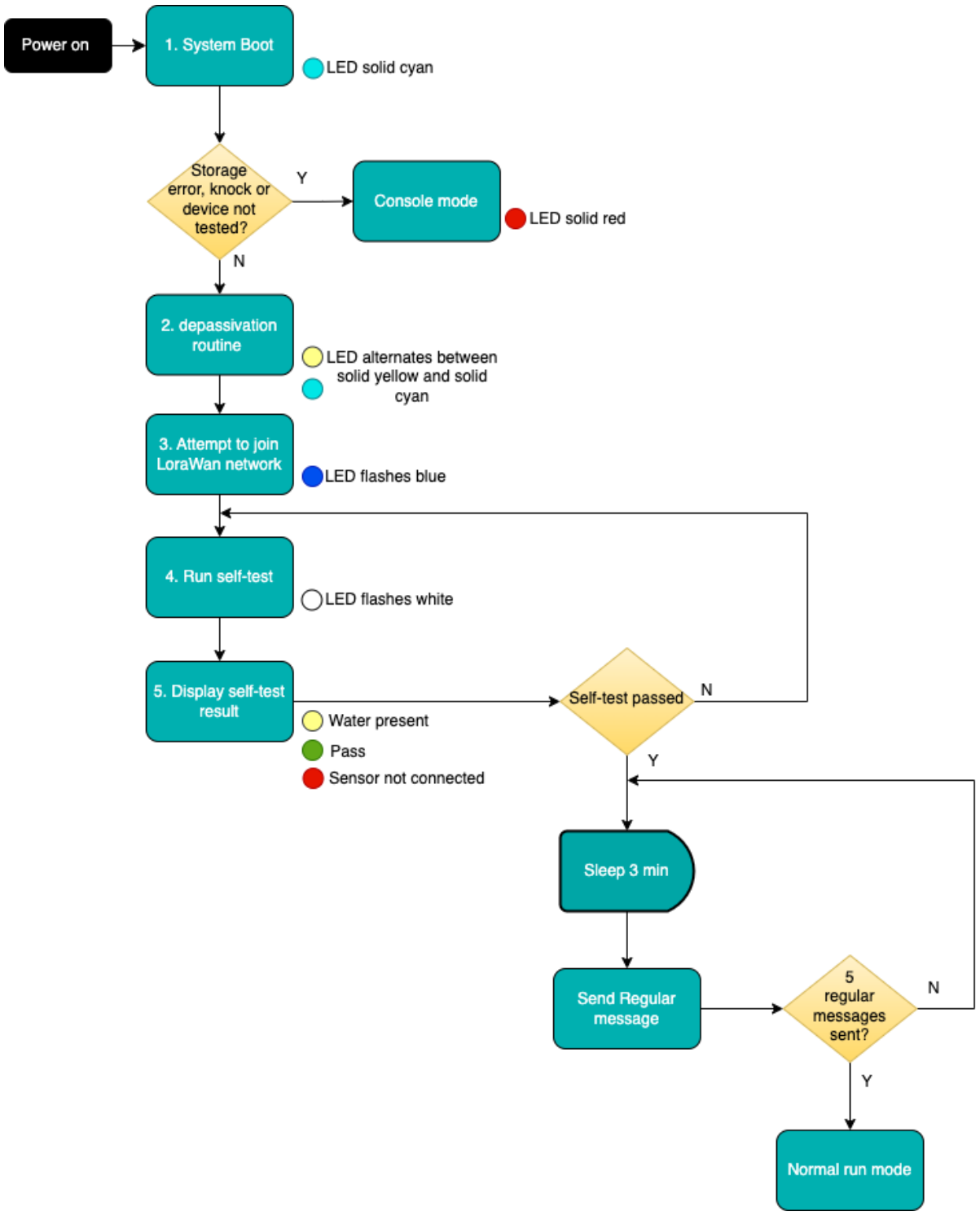
Now close the enclosure lid and lock the device by twisting the dial clockwise so that the arrow points to the lock symbol and set up your device on your software platform.

Best Practices for Installing the Sensor

The Severn WLD can be installed in various locations for detecting water leaks. But in order to ensure it is installed securely and most effectively, we recommend a couple of best practices:

- Install the sensor where a leak is most likely to occur: In order for the device to catch a leak as early as possible, it needs to be installed as close as possible to the source of a potential leak, for example, underneath pipes or appliances.
- Make sure the surface area is as clean as possible: For the sensor and the device to adhere to the surface, the surface mustn't be covered in debris or dust, we recommend going over the surface with a brush and a cloth.
- Avoid installing the sensor in areas with heavy footfall: While the sensor and device are long-lasting, any footfall risk either removing the sensor and device or damaging the sensor. Therefore we recommend installing the sensor where it sees very little to no footfall.
- Avoid installing the sensor on fragile surfaces: While the adhesive on the sensor is designed to be repositionable, the adhesive on the device is fairly strong. We therefore recommend not to install the device on fragile surfaces, such as tiles, that could get damaged once the device is being removed.

Board Behaviour at Start-up and Self-test



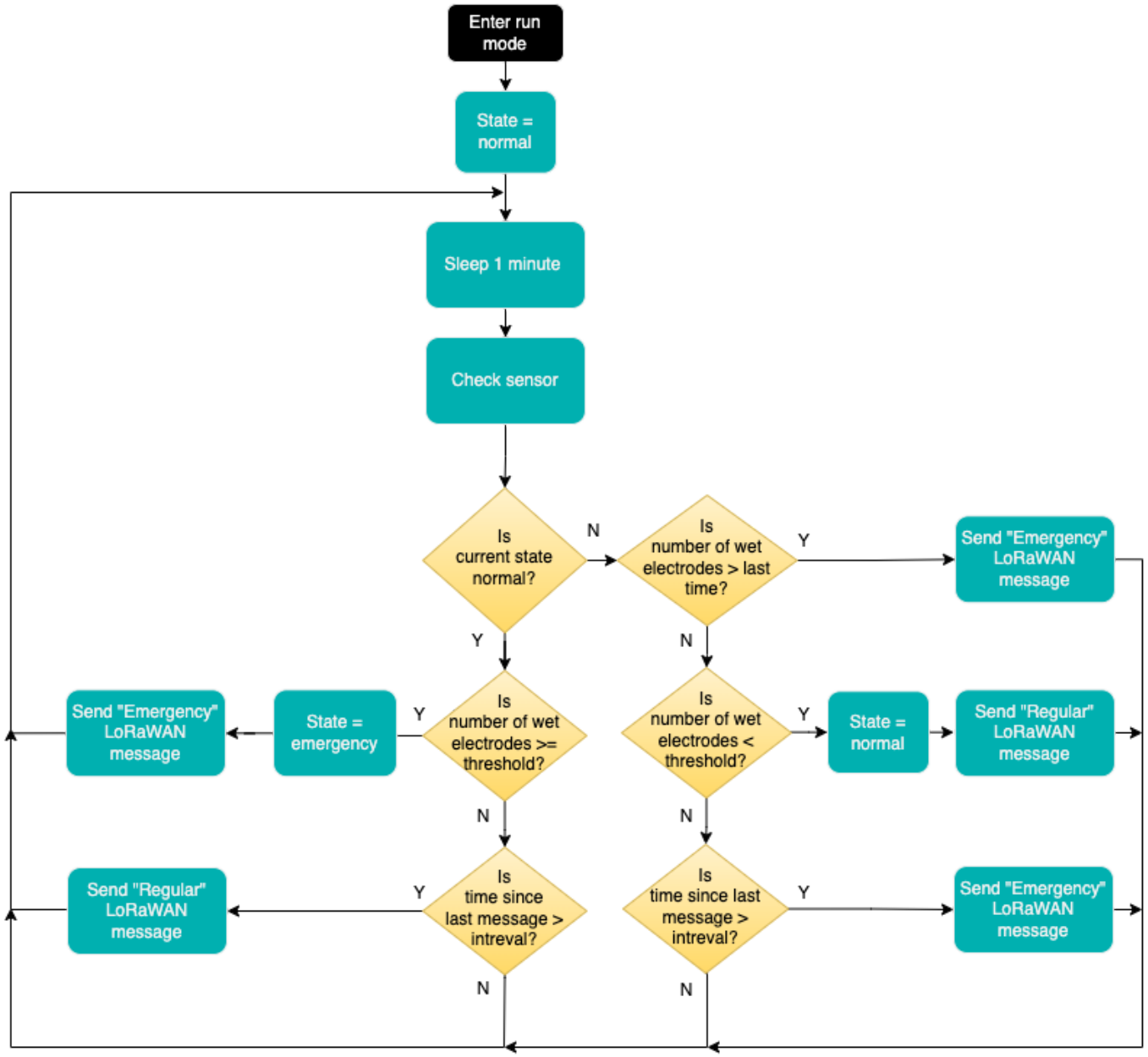
1. When powering the device up, the LED flashes cyan once.
2. A solid red LED indicates if there is a problem with the device, otherwise it continues its powering up procedure, where it will flash alternately between yellow and cyan.
3. The device will then attempt to connect to the LoRaWAN network, indicated by the LED flashing blue repeatedly.
4. Once the board has successfully joined the LoRaWAN network, the device runs a self-test, checking whether the sensor is critically wet. During the self-test, the LED flashes white.
5. Upon completion of the self-test, the results are displayed via the LED: yellow if the sensor is critically wet; green if the sensor isn't critically wet; red if the sensor isn't connected.

   Note that the default threshold for critical wetness is 4, which is the number of electrode segments that have to be wet to trigger an emergency message (check Sensor Dimension and Electrode Definition to see what an electrode is). The self-test will re-run until it has been passed, which means less than the threshold of the electrodes are wet.
6. Once the device has passed the self-test, the device will send 5 regular messages via LoRaWAN every 3 minutes, in order to indicate its signal strength.
7. When 5 messages have been sent, the device enters its run mode.

You can run a self-test at any time by swiping a magnet across the device.

For a video on how to swipe the magnet across the device, please see: laiier.io/severn-wld-swipe-magnet.

Board Behavior in Run Mode



When the device enters its run mode, its state is set to normal, and it checks for the presence of water on each electrode every minute (check Sensor Dimension and Electrode Definition to see what an electrode is). By default, 4 electrodes need to be wet for the device to sense a leak.

1. If the device detects that 4 or more electrodes are wet, it will send an immediate emergency message via LoRaWAN. Otherwise, it sends a regular message via LoRaWAN every 4 hours.
2. After sending the emergency message and waiting for an additional minute, the device checks the sensor again. If more electrodes are now wet than at the previous check, the device will send another immediate LoRaWAN emergency message.
3. If the number of wet electrodes has decreased to below the threshold (in this case, below 4), then the device will exit its emergency state. It will send an immediate regular message via LoRaWAN and return to its normal state.
4. If the number of wet electrodes remains the same, the device will go back to sleep and repeat this procedure until 4 hours have passed. After 4 hours it will send an emergency message again as an update.

Payload Encoding

The Severn WLD's payload has two profiles: 0 for the Severn WLD (1st generation) and 1 for the Severn WLD (2nd generation).

Uplinks

Startup message: port 100

Bytes	Bits	Value
0..7	0..7	Unit serial number as an unsigned 64-bit integer, big-endian
8	0..7	Firmware major revision as an unsigned 8-bit integer
9	0..7	Firmware minor revision as an unsigned 8-bit integer
10	0..7	Firmware patch revision as an unsigned 8-bit integer

Profile 0

Regular message: port 1
Emergency message: port 99
Self-test message: port 102

Bytes	Bits	Value
0	0..3	Sensor wetness status for electrodes 8..11 0 = dry, 1 = wet
	6	Self-test failed flag: 0 = pass, 1 = fail
	7	Critically wet flag: 0 = general operation, 1 = sensor wetness exceeds critically wet threshold
1	0..7	Sensor wetness status for electrodes 0..7: 0 = dry, 1 = wet
2	0..7	Accelerometer reading in x dimension (across narrow width of the device) as a signed 8-bit integer, 1 LSB = 1/63 g
3	0..7	Accelerometer reading in y dimension (along length of the device) as a signed 8-bit integer, 1 LSB = 1/63 g
4	0..7	Accelerometer reading in z dimension (along the height of the device) as a signed 8-bit integer, 1 LSB = 1/63 g
5	0..7	Temperature inside the device in degrees Celsius as a signed 8-bit integer

6	0..7	Critical wetness threshold as an unsigned 8-bit integer - the number of electrode segments that have to be wet to trigger an emergency message - this can be set via a downlink message - see Downlinks section below
7..8	0..7	Regular message interval in seconds as an unsigned 16-bit integer, big-endian - this can be set via a downlink message - see Downlinks section below

Profile 1

Regular message: port 2
Emergency message: port 98
Self-test message: port 104

Bytes	Bits	Value
0	0..7	“Profile” identifier - allows different behaviours and message types to be configured on a unit, intended to be set via console or downlink message.
1	0..3	Sensor wetness status for segments 8..11: 0 = dry, 1 = wet
	4	Error in join flag: 0 = no error in join process, 1 = error in join process
	5	Sensor connected flag: 0 = absent, 1 = connected
	6	Self-test failed flag: 0 = pass, 1 = fail
	7	Critically wet flag: 0 = general operation, 1 = sensor wetness exceeds critically wet threshold
2	0..7	Sensor wetness status for segments 0..7: 0 = dry, 1 = wet
3	0..1	Accelerometer reading in x dimension (across narrow width of the device) as a signed 2-bit integer 0 = 0g, 1= 1g, 2 = -1g
	2..3	Accelerometer reading in y dimension (along length of the device) - 0 = 0g, 1= 1g, 2 = -1g
	4..5	Accelerometer reading in z dimension (along the height of the device) 0 = 0g, 1= 1g, 2 = -1g
	6..7	RFU:0
4	0..7	Battery voltage: 1LSB = 10mV, offset by 1250mV resulting in 0..255 mapping to 1250mV to 3800mV
5	0..7	Temperature inside device in degrees Celsius as a signed 8-bit integer

6	0..3	MSBs of 12-bit unsigned, big-endian Regular message interval in minutes
	4..7	Critical wetness threshold as an unsigned 4-bit integer - the number of sensor segments that have to be wet to trigger an emergency message
7	0..7	LSB of 12-bit unsigned, big-endian Regular message interval in minutes
8	0..3	MSBs of 12-bit unsigned counter indicating the number of JoinRequest messages sent by device at startup before receiving a JoinAccept message
	4..7	RFU:0
9	0..7	LSBs of 12-bit unsigned counter indicating the number of JoinRequest messages sent by device at startup before receiving a JoinAccept message
10	0..7	RFU:0

Downlinks

Profile 0

Basic config: port 103

This message sets parameters on the device.

Bytes	Bits	Value
0	0..7	Critical wetness threshold as an unsigned 8-bit integer - the number of electrode segments that have to be wet to trigger an emergency message - valid 1..255 (values above 12 disable emergency messaging)
1..2	0..7	Regular message interval in seconds as an unsigned 16-bit integer, big-endian - valid 60..65535

Profile 1

Basic config: port 105

This message sets parameters on the device.

Bytes	Bits	Value
0	0..3	MSBs of 12-bit big-endian Regular message interval in minutes - valid 1..1440 (24hrs)
	4..7	Critical wetness threshold as an unsigned 4-bit integer - the number of sensor segments that have to be wet to trigger an emergency message - valid 1..12 (values above 12 disable emergency messaging altogether)
1	0..7	LSBs of 12-bit big-endian Regular message interval in minutes - valid 1..1440 (24hrs)
2	0..7	Requested profile to set unit to as an unsigned 8-bit integer less than 2

TTN Payload Decoder

You can find our Severn WLD payload decoder for The Things Network at: laiier.io/severn-wld-ttn- payload-decoder

Support

FAQs

How often does the Severn WLD check for water / send a message?

The Severn WLD device checks for water every minute and sends a periodic “heartbeat” message every 4 hours. The device sends an immediate emergency message upon initial detection of water.

Upon initial detection of water a “confirmed emergency message” is sent immediately. A confirmed message is a message that requires receipt of a confirmation message from the gateway. This is in case the gateway initially wasn’t able to receive the emergency message. If the Severn WLD device does not receive confirmation that the confirmed message was sent, it will try to send the confirmed emergency message again.

Similarly, if the Sensor has been dried the device will send a “confirmed regular message” immediately.

The device sends at least 3 confirmed heartbeat messages within 24 hours. If the device is programmed to send more than 3 heartbeat messages, then those messages are not confirmed. This means that if the Severn WLD device couldn’t send these messages successfully, either because of a bad connection or because the gateway can’t connect, then they will not be seen by the Network Server.

What kind of messages does the Severn WLD device send?

The Severn WLD device sends 4 types of messages: regular, emergency, self-test, and startup.

Startup messages are sent on start-up and send information about the firmware version and the serial number of the device. Self-test messages are sent on start-up and any time a magnet is swiped against the device. Self-test messages send information on the state of the sensor and the device

The emergency messages are sent when the device detects water (the number of wet electrodes is above or equal to the configured threshold) whilst regular messages are sent when there is no water detected (the number of wet electrodes is below the configured threshold). Both these messages send information on the state of each electrode and the overall health of the device.

My device isn't sending messages anymore / doesn't connect to the LoRaWAN gateway. What should I do?

If your Severn WLD isn't sending messages anymore or can't connect to the LoRaWAN gateway, please look at the device's LED. If the LED isn't flashing, do a self-test of the device by swiping a magnet along it.

What happens to the Severn WLD when my gateway loses connection or power or there are communications issues?

The Severn WLD sends messages at least 3 times a day, where it expects a response from the gateway. If it doesn't get that response because of potential communication issues, then it will change its communication settings and send the message again until it can successfully send the message and receive the confirmation. If it is unable to send a message but has tried all communication methods, then it will enter a sleep state and only attempt to send a message every couple of hours. This is to preserve its battery life.

Does the sensor of the Severn WLD need to be replaced before it can be used again?

No, the Severn WLD sensor can be simply dried by wiping the water off its surface and then it can be reused.

How do I remove an installed Severn WLD?

If you want to remove an attached Severn WLD, we advise either twisting the entire enclosure whilst closed until the adhesive loosens or prising off the surface with a small flat head screwdriver. The adhesive on the device is quite strong, so be careful not to damage the surface it is stuck on

Need Further Support?

If you require any further support, please contact support@laiier.io.

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