



atim cloud wireless™  
PRODUCT LINE

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# ATIM Cloud Wireless

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## Ultrasonic distance measurement

### LVL

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## User Guide



Concerned models:  
ACW/SF8-LVL  
ACW/LW8-LVL



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This user guide is applicable to the following references

	Product references	Product version (Visible on the label of the product)
LoRaWAN	ACW/LW8-LVL	A.0
Sigfox	ACW/SF8-LVL	A.0

## Document version history

Version	Date	Description	Author	Software version
0.1	06/03/2020	Document creation	AC	V0.0.1
0.2	25/03/2020	Correction	AC	V0.0.1

## Disclaimer

The information contained in this document is subject to change without warning and does not represent a commitment on the part of ATIM radiocommunications. ATIM radiocommunications provides this document 'as-is' with no warranty of any kind, express or implied, including but not limited to implied warranties of merchantability or fitness for a particular purpose. ATIM radiocommunications may make changes and/or improvements to this manual or to the product(s) or program(s) described in this manual, at any time.

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## Declaration of compliance

All ACW Atim Cloud Wireless® products comply with the regulatory requirements of the R&TTE Directive (1999/5/EC), article 3:



### **1 SAFETY** (Article 3.1a of the 1999/5/EC Directive)

NF EN60950-1 Ed. 2006/A1:2010/A11:2009/A12:2011 (health)

EN62479: 2010 (power <20mW) or EN62311:2008 (power > 20mW)

### **2 Electromagnetic compatibility** (Article 3.1b of the 1999/5/EC Directive)

EN 301489-3 v1.4.1, EN 301489-1 V1.9.2

### **3 Efficient use of the radio frequency spectrum** (Art.3.2 of the 1999/5/EC Directive)

ETSI EN300 220-2 v2.4.1 and EN300 220-1 v2.4.1

## Environmental recommendations

### Explosive atmosphere

Except for the ACW-ATEX line specifically intended for this purpose, do not use ACW radio modems in the presence of flammable gases or fumes. Using the equipment in such an environment constitutes a safety hazard.

### Environment

Respect the temperature ranges for storage and operation of all products. Failing to respect these guidelines could disrupt device operation or damage the equipment. ACW products in IP65 water- and dust-resistant housings may be placed outdoors, but must not, under any circumstances, be submerged.

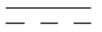
Follow the instructions and warnings provided below to ensure your own safety and that of the environment and to protect your device from any potential damage.



**General hazard** – Failure to follow the instructions presents a risk of equipment damage.



**Electrical hazard** – Failure to follow the instructions presents a risk of electrocution and physical injury.



Direct-current symbol



**WARNING:** do not install this equipment near any source of heat or any source of humidity.



**WARNING:** for your safety, it is essential that this equipment be switched off and disconnected from mains power before carrying out any technical operation on it.



**WARNING:** the safe operation of this product is ensured only when it is operated in accordance with its intended use. Maintenance may only be performed by qualified personnel.



Waste disposal by users in private households within the European Union. This symbol appears on a product or its packaging to indicate that the product may not be discarded with another household waste. Rather, it is your responsibility to dispose of this product by bringing it to a designated collection point for the recycling of electrical and electronic devices. Collection and recycling waste separately at the time you dispose of it helps to conserve natural resources and ensure a recycling process that respects human health and the environment. For more information on the recycling centre closest to your home, contact your closest local government office, your local waste management service or the business from which you purchased the product.

## Radio

Modems in the ACW line are radio-communication modems that use the ISM (industrial, scientific and medical) bands, which may be used freely (at no cost and with no authorisation required) for industrial, scientific and medical applications.

## Prelude

This user guide describes the ATIM ACW-LVL products functionalities. It explains operating, configuration and installation modes in functions of different use cases.

## Technical specifications

### a. Product

<b>Dimensions</b>	100 x 100 x 95 mm (including sensor)	
<b>Antenna</b>	External (SMA connector)	
<b>Temperature</b>	-25°C to +70°C (Operating mode)	
	-40°C to +70°C (Storage mode)	
<b>Mounts to</b>	Tank	
<b>Casing</b>	IP 67	
<b>Battery</b>	2x packs Lithium AA batteries	
<b>Weight</b>	300 g	
<b>Frequency</b>	865 – 870 MHz	
<b>Power</b>	25 mW (14 dBm)	
<b>Rate</b>	Sigfox: 100 bits/s	
	LoRaWAN: 300 bits/s to 10 Kbits/s	
<b>Consumption</b>	Sigfox	LoRaWAN
<b>Tx Mode</b>	60 mA	55 mA
<b>Sleep mode</b>	250 µA	250 µA
<b>Rx Mode</b>	50 mA	25 mA

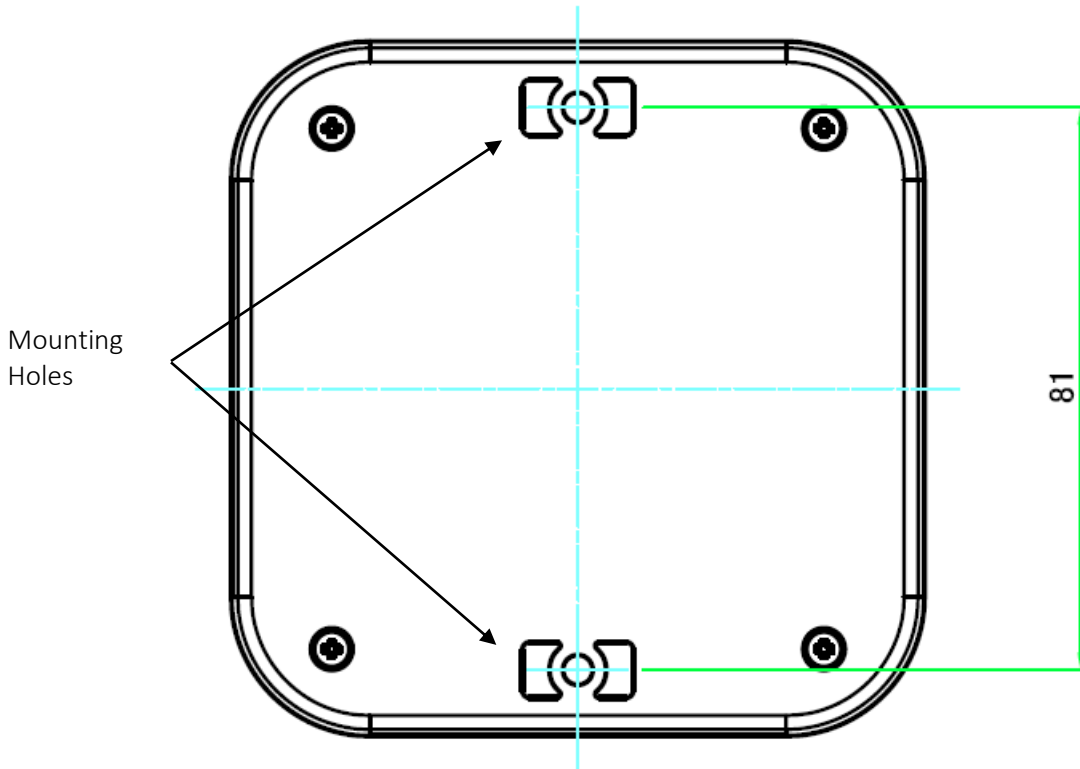
### b. Sensors' specific

Ultrasonic Sensor	Range	20 cm to 5.5 m
	Resolution	1 cm



## Casing

### a. Footprint



### b. Fasteners

ACW-LVL can be screwed directly to a tank thanks to its mounting hardware as follows:



The external diameter of the mounting hardware is 59 mm and the thread pitch is 2 inches

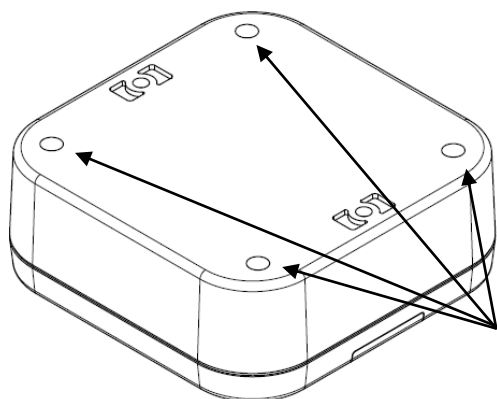
### c. Product Identification

The Sigfox or LoRaWAN IDs of the product are visible on the outside label on the back of the product, inside on the electronic card, and in the status section of the ACW configurator.

For LoRaWAN modems, the communication keys are automatically given by the network (pairing by "Over The Air Activation", or OTAA).



#### d. Installation and dismantling



Screws to dismount the enclosure

It is necessary to open the box to access on the one hand the micro-USB port allowing the configuration of the module.

To do this, you must unscrew the four screws which hold the top and bottom of the enclosure together.

#### e. Installation

Install the modem at a minimum height of 20cm and a maximum of 5.5 meters above what it is expected to measure (the sensor can only detect a distance from 20 cm up to 5.5 meters).

For optimal results, it is advised to place it high and clear of any metallic obstacle within a radius of 1 meter if possible.

# Operating

## a. Operating modes

The operating of the ACW-LVL is divided between different modes:

- **Operation mode:** this is the default mode when starting the product. In this mode, the module periodically sends measurements according to the configuration applied (if the product has never been configured, the factory configuration applies, see [Factory settings](#)).
- **Deep sleeping mode:** this standby mode mainly allows you to put the product to sleep from the time it is put into service until it is installed on site. In this mode no measurement or radio communication functions are possible.
- **Fault mode:** This mode allows the normal operation of the module to be interrupted when a critical event occurs. The nature of the event can be multiple:
  - Measurement function error
  - Low Battery (less than 15% of the maximum battery level)
  - Empty Battery (less than x% of the maximum battery level)
  - Radio module error
  - Automated tests errors
  - Application error

The entry in the Fault mode is shown by a **RED** LED blinking of the product.

If the error does not come from the radio module, the product will send 3 radio frames every 24 hours containing the error code (s) (see [Frames format](#) for error codes). In addition, the product will emit an audible and luminous warning depending on the nature of the event.

Once in this mode, the module must be restarted (by disconnecting and reconnecting the battery or by command in Downlink) to return to its normal operation.

## b. Product start-up

**Note:** If the battery packs of the ACW-LVL are already connected, refer directly to [Product commissioning](#).

The ACW-LVL is intended to be powered by two packs of two non-rechargeable batteries (however, it can operate with 1 single pack, which will reduce its autonomy).

The start-up is done automatically after connecting the first battery pack. The ACW-LVL goes directly into the pairing phase to connect to the nearest network

**Note:** Before putting a module into service, it is imperative that it be provisioned on a platform of the Sigfox or LoRaWAN network so that it can join the nearest network.

During this phase, a WHITE light signal with a fading effect indicates that the search phase is in progress.

If the connection is successful, the product will emit an audible signal and a light signal depending on the quality of the network:

- **GREEN** light signal: good network quality
- **TURQUOISE** light signal: average network quality
- **YELLOW** light signal: low network quality
- **ORANGE** light signal: bad network quality

The module will then enter its operating mode and start to send information to the network depending on the configuration.

In case of connection failure, the ACW will return to its fault mode because no radio transmission can be made.

**WARNING: For information on the quality of the Sigfox or LoRaWAN network, it is necessary to provision a Downlink. It is this one which will make it possible to decide on the quality of the network. The product emits at startup (directly for Sigfox after the Join phase for LoRaWAN), a test Uplink described in the chapter Classic frame (frame type 0x02). If a Downlink is provisioned, the information on network quality will then be relayed by the ACW (light and sound signal). If no Downlink is provisioned, the ACW will always display the ORANGE light signal.**

### c. Product commissioning

In most cases, the ACW-LVL is started up before delivery (battery packs already connected) and then placed in deep standby to limit consumption.

To place the product in its operating mode, bring a magnet close to the diamond marking on the box. The module should start to emit an audible signal - a beep every second - and a light signal in the following sequence: **BLUE – GREEN – RED – TURQUOISE – PURPLE – YELLOW**. When the light signal goes out, remove the magnet.

The ACW then enters the network pairing phase. During this phase, a WHITE light signal with a fading effect indicates that the search phase is in progress.

If the connection is successful, the product will emit an audible signal and a light signal depending on the quality of the network:

- **GREEN** light signal: good network quality
- **TURQUOISE** light signal: average network quality
- **YELLOW** light signal: low network quality
- **ORANGE** light signal: bad network quality

The module will then enter its operating mode and start to send information to the network depending on the configuration.

In case of connection failure, the ACW will return to its fault mode because no radio transmission can be made.

#### d. Bluetooth Enabling / Disabling

The ACW-LVL incorporates Bluetooth to allow configuration and update of the wireless product.

**Note:** Bluetooth functions are only accessible from the operating mode.

To know the status of Bluetooth, approach a magnet less than 3 seconds at the diamond marking on the box. The light signal indicates the Bluetooth status as follows:

- **GREEN** light signal: Bluetooth ENABLED
- **RED** light signal: Bluetooth DISABLED

To change the Bluetooth status, just leave the magnet for three seconds, until the light signal changes from green to red (to deactivate Bluetooth) or from red to green (to activate it).

**WARNING: Do not leave the magnet for more than 4 seconds at the risk of starting the deep sleep sequence of the product.**

Once Bluetooth is activated on the product, it will be possible to configure or update it from the configurator (see [ACW Configurator](#)).

Notes: *If Bluetooth is activated, and no connection is made for 5 min, it is automatically deactivated to save the battery.*

#### e. Deep sleep

When transporting or storing the ACW-LVL, it is best to place it in its deep sleep mode in order to limit unnecessary energy consumption.

When the product is in operating mode, bring a magnet near the diamond marking on the case for 6 seconds.

The Bluetooth enabling / disabling sequence will first be done during the first three seconds (disregard it).

Then a beep sounds every second with a white flashing which accelerates.

After six seconds entering deep sleep mode is indicated by a fading light signal and an audible signal. The magnet can be removed.

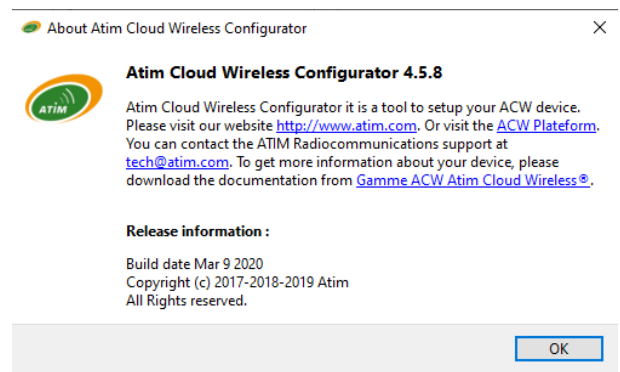
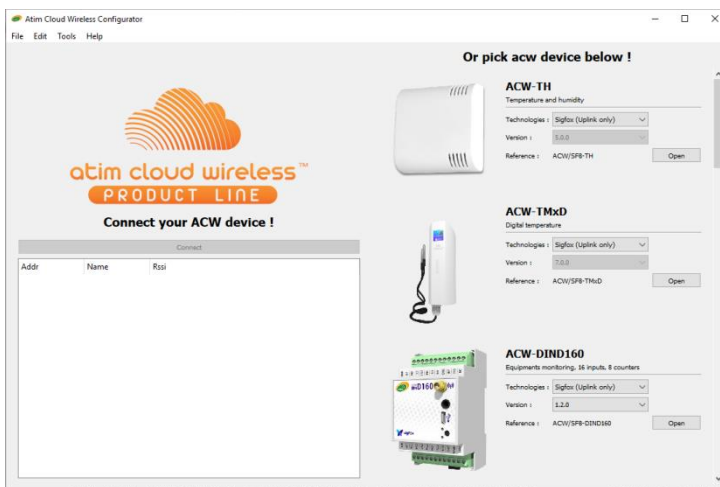
# ACW configurator

## a. Compatible configurator version

For an LVL with the following application software version:	Use the version of ACW Configurator:
Sigfox: V0.0.1 LoRaWAN: V0.0.1	V4.5.8

Download and install the configuration software setup 'setupACW.exe' at:

<http://www.atim.com/docs/downloadcheck.php?ID=3536>



When the ACW Configurator is launched, the waiting window appears on the screen.

Click on "Help" at the top left of the window then on "About" to display the version number of the ACW configurator.

Pairing the ACW-LVL with the configurator can be done in two ways:

- **By USB:** open the case of the ACW-LVL and connect it to a computer with a micro-USB cable.
- **By Bluetooth:** make sure that Bluetooth is activated (see [Bluetooth Enabling / Disabling](#))

## b. ACW-LVL setup

The screenshot shows the 'ACW/SF8-LVL Monitoring level' configuration window. The interface includes the following sections and highlighted elements:

- Frame of Measurement:** Contains 'Periods' (Statement: 0 H, 10 Min) and 'Data Logging' (Number of samples: 1, Depth of historic: 1). A note below states: '1 way of 1 sample(s), sampling at 0h, 10m and 0s with a historic depth 1 will be send every at 0h and 10m in 1 frame(s)'. Red numbers 1, 2, and 3 are placed near the Statement, Number of samples, and Depth of historic fields respectively.
- Level Measurement:** Shows 'Last level measured' as N/A and 'Level offset' as 10 cm. Red number 4 is placed near the Level Measurement section header.
- Level Threshold:** Includes a checked 'Level Threshold' box, 'High' (800 cm), 'Low' (20 cm), 'Hysteresis' (+/- 10 cm), and 'Duration' (1 s). Red number 5 is placed near the Level Threshold checkbox.
- General setting:** Includes 'Keep alive period' (Once every day) and 'Timestamp' (Disable). Red numbers 6 and 7 are placed near these fields.
- Time settings:** Includes 'No Date' (No Date), 'Get Acw Date', 'Update Date', and 'Date Offset (in sec)'. Red number 8 is placed near the No Date field.
- Level viewer:** A large area for monitoring, showing 'Distance' and 'Filling rate' plots. The 'Depth min' is set to 20 cm. Red number 10 is placed near the top of this section.
- Footer:** Shows 'ACW-LVL:0.0.1 | ARM-N85FU:XXXX' and buttons for 'Close', 'Reload from file', and 'Save to file'. Red number 11 is placed near the Close button.

### Emission period and samples in the frame

The transmission period (1) corresponds to the time interval between each sending of a measurement frame. This period can be configured from 10 min to 255 h and its default value is 1 hour.

In addition, it is possible to configure the number of samples in a frame (2). Thus, several measurements will be carried out before the sending of the frame which will contain all these measurements.

For example, with a period of 12 minutes and a number of samples of 4, a measurement will be made every 3 minutes and the 4 samples will be sent in a single frame every 12 minutes.

Finally it is possible to apply a redundancy of the data (3), which means that samples having been sent in the frame n-1, n-2 or n-3 could be sent again in the frame n to the continuation of the new measurement samples (the most recent sample first in the frame and the least recent last).

For example, for a history depth of 3, the data of the last 2 frames will be sent, in addition to the new data, in the next frame.

### Keep alive frame period

A life frame can be sent periodically (6). This frame will raise the supply voltage of the product.

The value of this period can be configured from 1 hour to 1 month. By default, the value is set to 4 days.



## Frame timestamp

It is possible to deactivate / activate the time stamping of all radio frames (7)

**WARNING: This option when activated monopolizes 4 bytes in the frame which cannot be used for useful data.**

## Product clock

If the time stamping function is activated, it is essential to configure the internal clock of the product from the configurator, which will retrieve the system clock from the computer to apply it to the product (8).

**Note:** It is advisable, each time you connect to the configurator, to check the product clock to avoid excessive time drift.

## Product versions

When connecting to the product, the configurator retrieves all the software versions of the product (product software and radio module software) as well as the network identifier (9).

## Sensors configuration

On the ACW-LVL, the sensor configuration is basic. There is only an offset parameter to apply to the distance returned in the radio depending your use case (4).

In addition, there is a live tracking of the distance returned by sensor (the offset is applied to this value to) when the ACW-LVL is connected to the configurator.

There are also two progress bars (10):

- One to indicates the distance
- One to indicate the filling rate (depending on depth min and max)

## Distance threshold setup

You can configure threshold to get an alert through radio in case the distance is lower or higher a given value (5). The threshold parameters are as follows:

**High:** the higher threshold value.

**Low:** the lower threshold value.

**Hysteresis:** the range in which the alert is not effectively considered (a dead zone between threshold value to avoid unwanted alert triggering).

**Duration:** The time during which the value measured should stay higher or lower than threshold to trigger the alert.

In addition, the threshold feature can be disable by unchecking the checkbox "Level threshold".

## Setup validation

After having filled in all the configuration parameters, it is essential to click on the "Apply to ACW" button to send the configuration to the product (11).

It is also possible at any time to read the current configuration of the product which will update the parameters on the configurator or to reset the default configuration of the product.



Once the configuration is complete, do not leave the module connected via USB. This operating mode is very energy intensive. When you remove the USB link without disconnecting the battery, the module automatically returns to normal operation.

### c. Factory settings

Radio frames settings:

- Radio frame emission period: 10 minutes
- Number of samplings: 1
- History depth: 1

General settings:

- Keep alive frame emission period: 4 days
- Timestamp: disabled

Sensors parameters:

- Level offset: 0 cm

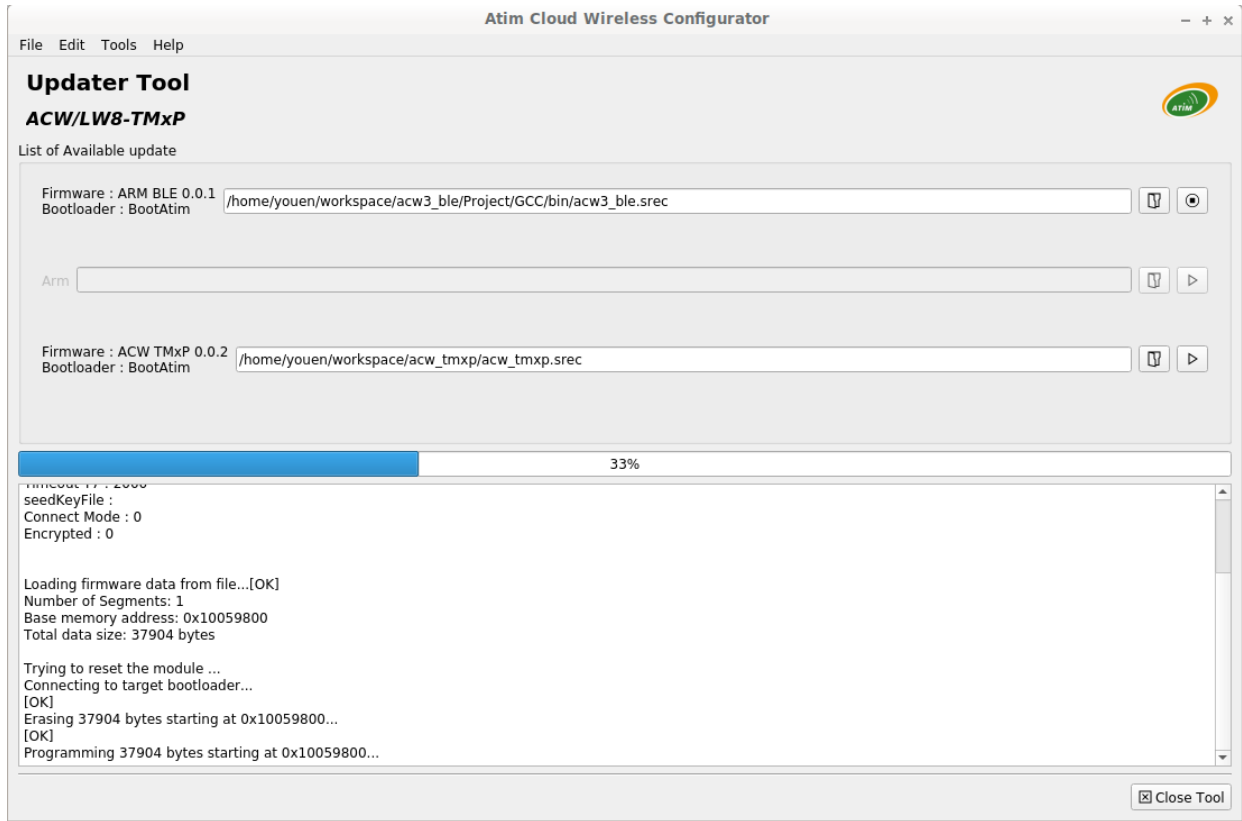
Threshold parameters

- Threshold Enable
- High: 800 cm
- Low: 20cm
- Hysteresis: +/- 10 cm
- Duration: 1 second

## d. Updates of ACW

When connected with Bluetooth Low Energy to the product, it is possible to update the different software that composes it.

To do this, go to the menu *Tools->Updater (CTRL+U)*



## Frames format

### a. Sigfox and LoRaWAN

Uplink frame			
Byte 1	Byte 2	...	Byte n
Frame header	Frame-specific data		

We can differentiate three types of frames:

- **Classic frame; New generation:** Very close to the old frames, the difference is that you can activate the timestamp. These are for example the life frame, the error frame, the response to configuration frames, ... These last frames are common to all ACWs but, it is also possible to have other independent frames for each ACWs.
- **Measurement frame; New generation:** These frames consist of samples of the different values of each of the channels that an ACW can read. Beforehand, the number of samples and the depth of the history will be inserted in the header.

**Note:** The number of samples and the depth of the history are in common for all the channels of the frame.

- **Alert frame (threshold crossing); New generation:** These frames combine a conventional frame and a measurement frame. They consist of a header warning that a threshold has been exceeded, followed by samples of each of the channels for which a threshold has been exceeded.

### Classic frame

Byte 1 - header							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
New generation = 1	Timestamp = 1 - enabled 0 - disabled	Measurement frame = 0	Reserved = 0	Type of frame			

If Timestamp is enabled, 4 bytes with the value of the Timestamp will precede the header (byte 1).

Different type of frames:

Frame type	Size of data	Descriptions
0x00	--	Reserved
0x01	5 bytes	Keep alive frame
0x02	0 byte	Downlink request for network testing
0x03	8 bytes	Reserved
0x04	--	Reserved
0x05	1 byte	Test frame with counter
0x06	Variable	(Cfg box) Response to a setup frame.
0x07	Variable	(Cfg box) Response to a command frame.
0x08	Variable	(Cfg box) Response to an incorrect frame.
0x09	--	Reserved
0x0a	--	Reserved
0x0b	--	Reserved
0x0c	--	Reserved
0x0d	Variable	Alert measurement frame (threshold crossing or back to normality), sampling follow up of each channel in alert
0x0e	Variable	General error - (see page 23)
0x0f	Variable ...	Subframe for ACW. Depending on the ACW

Measurement frame

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp	Measurement frame = 1	History depth (-1) Max: 4		Number of samplings (-1) Max: 8		

If the Timestamp is enabled, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

**WARNING: if Depth of history or Number of samplings is greater than 1, the frame emission period will be added after header (byte 1) on two bytes (Little Endian encoding, LSB first)**

For each channel, a header is inserted afterwards and is constituted as follows:

Channel header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved = 0		Channel's number			Type of measurement		

In the case of ACW-LVL, **the measurement type** is 0x07 on 2 bytes for the distance in centimeters.

In the case of the ACW-LVL, there is only 1 way (i.e. 1 sensor) the channel's number will always be 0.

Type of measurement	Units	Data size	Data type	Descriptions
0x07	cm	2 bytes (Little Endian – LSB first)	Signed integer	Distance in centimeters <ul style="list-style-type: none"> <li>➤ Resolution: 1cm</li> <li>➤ Max value: 32767cm</li> <li>➤ Min value: -32767cm</li> </ul>

Then follow the data of the measurement sample(s) (depending on the configuration of the product). The number of bytes sent can be determined as follows:

$$(\text{Size in bytes of the measure}) * (\text{number of samplings}) * (\text{depth history})$$

**Examples:** for a frame containing the distance (2 bytes), with a history depth of 1 and a number of samples of 3, we are left with 6 bytes of data (2x1x3).

#### Alert frame

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp	Measurement frame = 0	Reserved = 0	Alert frame = 0x0d			

If the Timestamp is activated, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

For each of the channels in alert a header is inserted and is constituted as follows:

Channel Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Alert type		Channel's number		Measurement type			

The type of alert field is used to identify whether it is a breach of the high threshold, the low threshold or a return between the thresholds.

These values are defined as follows:

Value	Description
0x00	In between thresholds
0x01	Exceeding the high threshold
0x02	Exceeding the low threshold
0x03	Reserved

The measurement type field is identical here to the measurement frame (i.e. 0x07 in hexadecimal for the ACW-LVL).

The sample that caused the alert is then inserted afterwards.

## Error frame

byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp	Measurement frame = 0	Reserved = 0	Error frame = 0x0e			

If the Timestamp is activated, 4 bytes with the Timestamp value will be preceded by the header (byte 1).

For each error message, a header is inserted and is formed as follows:

Error frame header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Index of message				Error message length			

The **message index** field is used to prioritize messages when several errors occur.

The **length of the error message** field indicates the size in bytes of the error message.

The following byte identifies the nature of the error that occurred:

Error code	Type of error	Description
0x00	ERR_BUF_SMALLER	Data table is full, cannot write additional data to it
0x01	ERR_DEPTH_HISTORIC_OUT_OF_RANGE	The history depth is too large or too small for the frame
0x02	ERR_NB_SAMPLE_OUT_OF_RANGE	The number of sampling is too large or too small for the frame
0x03	ERR_NWAY_OUT_OF_RANGE	The number of the channel in the header of the frame is too large or too small
0x04	ERR_TYPEWAY_OUT_OF_RANGE	The type of measurement in the frame header is too large or too small
0x05	ERR_SAMPLING_PERIOD	Bad structure of sampling period
0x06	ERR_KEEP_ALIVE_PERIOD	Bad structure of the keep alive frame
0x07	ERR_SUBTASK_END	End of a sub-task after leaving an infinite loop
0x08	ERR_NULL_POINTER	Pointer with value "NULL"
0x09	ERR_BATTERY_LEVEL_LOW	Low battery level
0x0A	ERR_BATTERY_LEVEL_DEAD	Critical battery level
0x0B	ERR_EEPROM	EEPROM is corrupted
0x0C	ERR_ROM	ROM is corrupted
0x0D	ERR_RAM	RAM is corrupted
0x0E	ERR_SENSORS_TIMEOUT	A timeout has been achieved on the sensor
0x0F	ERR_SENSOR_STOP	The sensor did not return a value during a reading

0x10	ERR_SENSORS_FAIL	Sensor has stopped to work
0x11	ERR_ARM_INIT_FAIL	Radio module initialization has failed
0x12	ERR_ARM_PAYLOAD_BIGGER	Message size is too large for network capacity
0x13	ERR_ARM_BUSY	The module is already busy (possibly not initialized)
0x14	ERR_ARM_BRIDGE_ENABLE	The module is in bridge mode, impossible to send data by radio
0x15	ERR_ARM_TRANSMISSION	A transmission has been initialized but an error has occurred
0x16	ERR_RADIO_QUEUE_FULL	Radio queue is full
0x17	ERR_CFG_BOX_INIT_FAIL	Error when black box initialization

Depending on the nature of the error message, additional data may be inserted afterwards (for example the battery level).

## b. Examples of frames

### Measurement frame

Measurement frame without time stamp, no history and a sample number of 1.

Byte 1	Byte 2	Byte 3	Byte 4
0xA0 (new generation measurement frame, no history, 1 sample)	0x07 (channel 0, measurement type: distance)	0x22	0x01

In this frame the sensors returned the value 0x0122 (290 centimeters)

Measurement frame without time stamp, no history and a sample number of 2.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0xA1 (new generation measurement frame, no history, 2 samples)	0x003C Radio transfer period	0x07 (channel 0, measurement type: distance)	0x22	0x01	0x75	0x01	

The bytes 2 and 3 notify the radio transfer period, here 60 minutes (i.e. 1 sample measured each 30 minutes)

The two samples returned are 0x0122 (290 centimeters) and 0x0175 (373 centimeters).



## Alert frame

For exceeding the threshold value defined:

Byte 1	Byte 2	Byte 3	Byte 4
0x8D (new generation alert frame)	0x47 (exceeding high threshold channel 0, distance measurement)	0xAF	0x01

The sample that triggered the threshold on channel 0 is 0x01AF (431 centimeters).

## Downlink

This functionality is available on ACW-LVL fulfilling the following conditions:

	Application software:	Radio firmware:
Sigfox version	V0.0.1	V5.9.3.1
LoRaWAN version	V0.0.1	V4.0.0

The operation of the Downlink is explained in the document ATIM\_ACW-DLConfig\_UG\_FR\_v1.4, relating to version V1.2.0 of the ATIM Downlink Protocol (see this document for all parameters and commands common to all products).

The parameters specific to ACW-LVL are as follows:

### a. Configuration of the frame parameters (sending period, number of samples, etc.)

Parameter code (Byte 1)	Parameter value (Byte 2)	Parameter value (Byte 3)	Parameter value (byte 4)
0x94	0b00YY0ZZZ	0xYY	0xZZ

For byte 2, the two bits YY correspond to the history depth (max = 3) and the three bits ZZZ correspond to the number of samples per frame (max = 7).

Bytes 3 and 4 correspond to the period for sending a frame (= 0xYYZZ) ranging from 1 minute to 255 hours (15,300 minutes).

Eg: Byte 2 = 0x13

4 samples per frame + addition of the four samples sent to the previous frame.

Byte 3 = 0x02 and byte 4 = 0x54

Emission period = 0x0254 = 596 minutes

### b. Configuration of the distance offset parameter

Parameter code (Byte 1)	Parameter value (Byte 2)
0x16	0xYY

The value of byte 2 is the offset in cm from -20 to + 20 cm in hexadecimal.

### c. Threshold setup

Parameter code (Byte 1)	Frame size (Byte 2)	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
<b>0xD5</b>	0x07	High threshold		Low threshold		hysteresis		Duration

For the threshold setup, the byte 0 is the header for an extended downlink frame + the number of the parameter (0xC0 | 0x15).

The byte 2 indicates the size of the following data.

Bytes 3 and 4 holds the high threshold value in centimeters (byte 3 = LSB, byte 4 = MSB)

Bytes 5 and 6 holds the low threshold value in centimeters (byte 5 = LSB, byte 6 = MSB)

Bytes 7 and 8 holds the hysteresis value in centimeters (byte 7 = LSB, byte 8 = MSB)

Byte 9 holds the duration value

## Technical support

For any information or technical problems, you can contact our technical support:

**[www.atim.com/fr/technical-support](http://www.atim.com/fr/technical-support)**