atim cloud wireless™
PRODUCT LINE

ATIM Cloud Wireless

Metering and Dry contacts inputs MR4

User Guide

Concerned models:

ACW/SF8-MR4

ACW/LW8-MR4

LoRaWAN™

sigfox ready

ATIM Radiocommunications
Chemin des Guillets
38250 Villard de Lans

www.atim.com
info@atim.com

Table of contents

This user guide is applicable to the following references

	Product references	Product version (Visible on the label of the product)
LoRaWAN	ACW/LW8-MR4	A.2
Sigfox	ACW/SF8-MR4	A.2

Document version history

Version	Date	Description	Author	Software version
0.1	23/01/2020	Document creation	AC	V0.0.1
0.2	28/02/2020	Current consumption addition	AC	V0.0.1
0.3	05/03/2020	Correction	AC	V0.0.1
0.4	10/03/2020	Add connector mapping	AC	V0.0.1
0.5	25/03/2020	Correction on measurement frame	AC	V0.0.1
0.6	15/04/2020 28/04/2020	Endianness modification of the fields of the frames. Modification of LED/Buzzer sequencies and magnet usage	YLB/AC	V0.0.1
0.7	06/05/2020	Terminal block wiring update Document title modification + operation mode Error code correction	AC/YLB	V0.0.1
0.8	07/09/2020	Keep alive frame description + product error codes addition	AC	V0.0.2
0.9	23/10/2020	Batteries passivation description	AC	V0.0.3

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.

Trademarks and copyright

Declaration of compliance

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

CE

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-MR products functionalities. It explains operating, configuration and installation modes in functions of different use cases.

a. ACW-MR Product line

ACW-MR product line regroups different types of radio equipment which allow pulse metering, bang-bang control and fraud detection.

Each devices of this product line are available in LoRaWAN and Sigfox version and are delivered with removable batteries. They are can be parametrized through intern switches or via downlink frames on the network (exclusively on LoRaWAN version).

ACW-MR4

The ACW-MR4 is a sensor used for remote metering monitoring (gas, water, electricity, pluviometer meters…) or for remote bang-bang equipment control (eg: starting up/shutting down, opening/closing...).

This sensor can be connected up to 4 independent equipment when they are close enough, allowing devices and network plans savings.

The ACW-MR4 is delivered with two Lithium 3.6V removable batteries packs with a total capacity of 14400 mAh.

CAPT-OPT2 & CAPT-MECA

In addition to the ACW-MR4, there are 2 metering sensors options: an integrated optical sensor, this plug and play device monitors remotely the consumption of an LED optical electrical meter (eg: Linky meters, PME-PMI meters) or an integrated mechanical sensor which traduces the rotation of the meter index into pulses and then to energy consumption. It is delivered and pre-set to memorize the consumption index every 10 minutes and send the last 6 every hour.

CAPT-ILS1

In addition to the ACW-MR4, there is an industrial detector opening/closing door/window/trap. Coupled with an ACW-MR4, it comes wired and preconfigured for immediate installation. This sensor is generally used for intrusion detection. It is also suitable for monitoring Skydome openings or for checking the presence of objects in their parking area. Data is sent through LPWAN technologies (Sigfox / LoRaWAN).

Technical specifications

a. Product

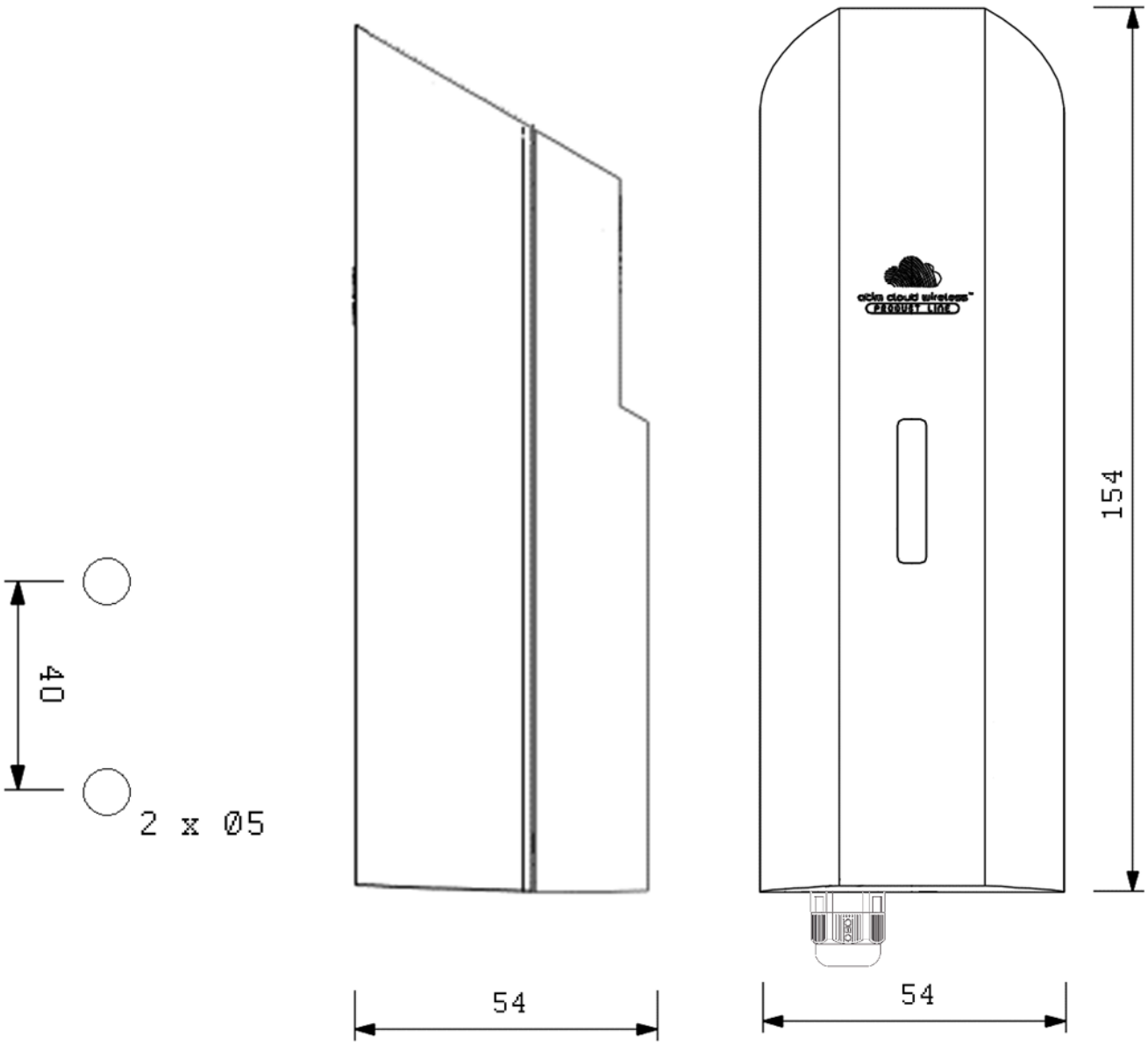
Dimensions	154 x 54 x 54 mm	
Antenna	Integrated (1/4 of wave)	
Temperature	-25°C to +70°C (Operating mode)	
	-40°C to +70°C (Storage)	
Mounts to	Wall, tube or mast, DIN-Rail	
Casing	IP 65	
Power Supply	2x packs of Lithium AA batteries	
Weight	300 g	
Frequency	865 – 870 MHz	
Power	25 mW (14 dBm)	
Rate	Sigfox: 100 bits/s	
	LoRaWan: 300 bits/s to 10 Kbits/s	
Consumption	Sigfox	LoRaWAN
Mode Tx	60 mA	55 mA
Mode veille	< 90 µA	< 90 µA
Mode Rx	50 mA	25 mA

b. Sensors' function

4 digital inputs with edge detection or pulse metering.

Casing

a. Footprint



Maximum diameter of the cable in the stuffing box: 7 mm.

b. Fasteners

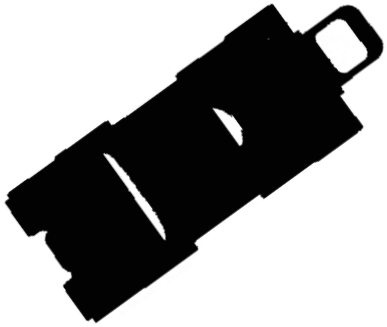
ACW modems are fixed on a flat wall, a mast or on a DIN rail depending on the type of installation desired.

These three types of fasteners are plugged into the back of the case.

Fixing on a flat wall (supplied):

On tube or mast:

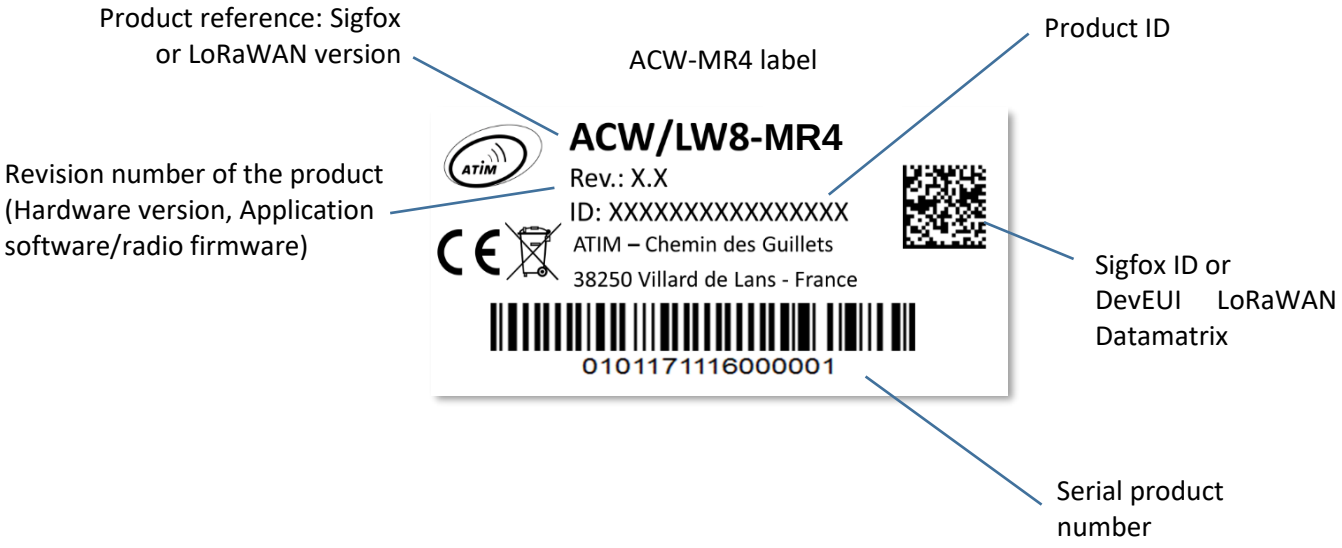
DIN rail mounting:



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

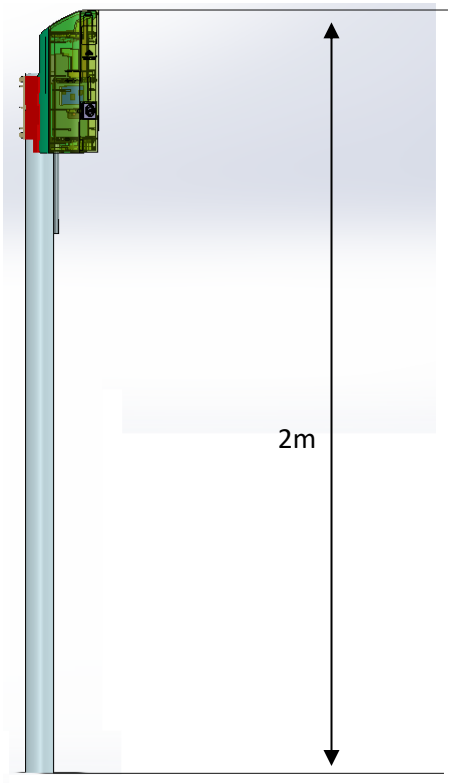
It is necessary to open the box to access on the one hand the micro-USB port allowing the configuration of the module and on the other hand to the connection terminal block.

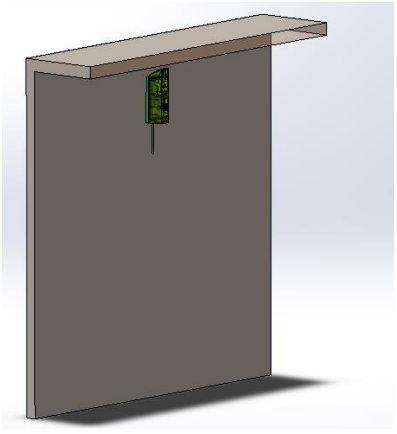
To do this, you must insert the screwdriver into the slot and tilt it downwards to lift the internal tab (see photo opposite). Then pull on the back side to separate the two parts of the case.

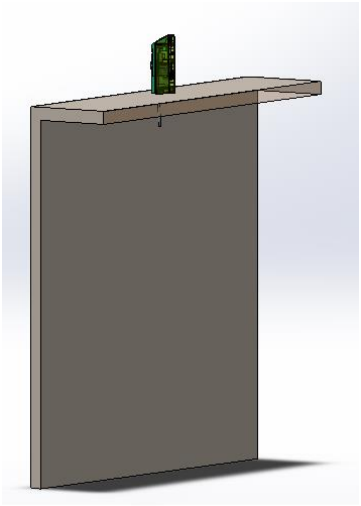
e. Installation

Install the modem at a minimum height of 2m and not glued to the wall, ideally offset at least 20cm Cables must not exceed 10m in length and must be shielded

For optimal results, it is advised to place it high and clear of any metallic obstacle within a radius of 1 meter if possible (see figures below). For information, the antenna is integrated in the box.

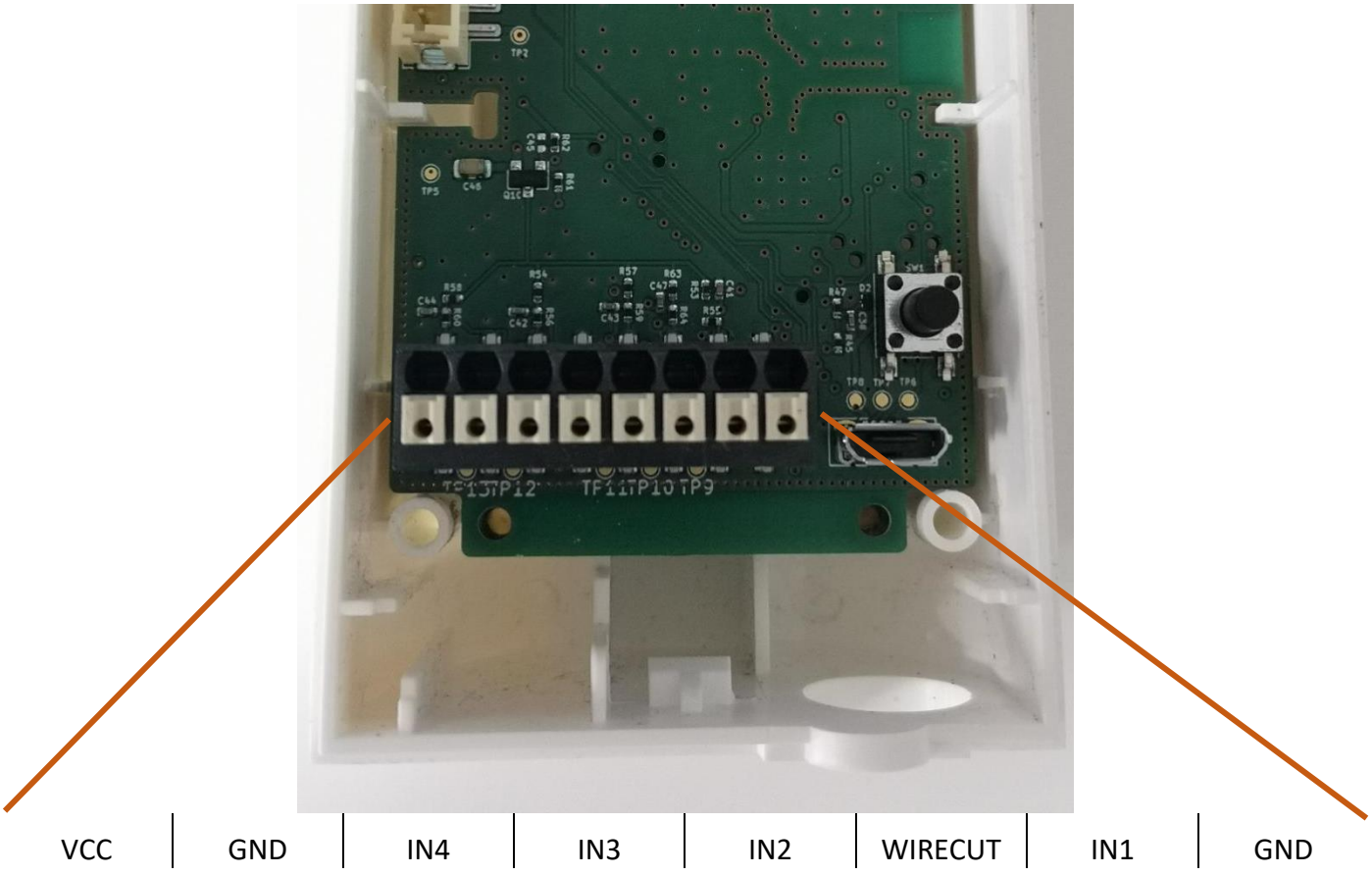






f. Connector Mapping

The connector mapping is as follows:



Operating

a. Operating modes

The operating of the ACW-MR4 is divided between different modes:

- **Operating 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.
- **Configuration mode:** This mode is active FIVE minutes after exiting deep sleep mode and allows configuration of the product in **Bluetooth** using the PC configurator. In addition, radio frames are sent every minute (therefore five frames) to ensure that the product is properly commissioned. After these five minutes, the product returns to operating mode and **Bluetooth** is deactivated (possibility of reactivating it via **Downlink**).
- **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
    - Casing opening
    - 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.

At any time, it is possible to identify which mode the product is in by bringing a magnet close **at least for 2 seconds** to the diamond mark on the case. The product led will light up in one of these colors depending on the mode:

- for operating mode
- for configuration mode
- for deep sleep mode
- for fault mode

b. Product start-up

In most cases, the ACW-MR4 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-shaped marking on the box for 6 seconds. During these six seconds, the product led must flash in WHITE then in GREEN at the end of the six seconds to indicate that the product is on the way.

The ACW then enters the network pairing phase. During this phase, a FUSCHIA 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** led signal: good network quality
- **YELLOW** led signal: medium network quality
- **ORANGE** led signal: bad network quality
- **WHITE** led signal: no information on the network quality

The module will then enter its operating mode and start feeding information back to the network according to the configuration.

In the event of a connection failure (in LoRa only), the ACW will return to its fault mode because no radio transmission can be carried out.

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 a WHITE light signal.

c. Test frame

When the product is in its operating mode (and only in this mode), it is possible to send a test frame including a measurement sample (which avoids waiting for the next measurement frame).

To do this, simply bring the magnet closer until the **GREEN** light signal goes out. The successful sending of the test frame will be indicated by a CYAN light signal.

d. Deep sleep

When transporting or storing the ACW-MR4, it is best to place it in its deep standby mode to limit unnecessary energy consumption.

From any operating mode (except fault mode), bring a magnet near the diamond marking on the box for **6 seconds.**

During these six seconds, the product led will flash in the color corresponding to the operating mode, then the end of the sequence will be indicated by a **WHITE** fade acknowledging that the product has been put on standby. The magnet can therefore be removed.

e. Radio module activity

Any sending of a radio frame is indicated by three brief **GREEN** flashes of the LED.

f. Threshold exceeded

When thresholds have been configured using the configurator and the measurement values exceed these thresholds, the product LED emits a periodic **ORANGE** flash to notify it.

g. Anti-fraud system

A mechanism (push button) is present on the product to notify any opening of the case during normal operation.

In normal times, the box presses the button. As soon as the back cover is removed, the button is released, triggering the fault mode of the ACW-MR4. An audible and light signal indicates that the opening of the case has been considered. In addition, if the module is connected to a network, an error frame will be sent every 24 hours until its next restart.

h. Substitution to the magnet

You can use the push button on the ACW-MR4 card to perform the same actions as the magnet (activate or deactivate the product, activate / deactivate Bluetooth).

To do this, open the case and exert two simultaneous presses on the push button. An audible signal as well as a white flashing indicates that the button now acts as the magnet (**button pressed = magnet approached**, refer to Product commissioning, Test frame, Deep sleep above to find out how to use the button).

WARNING: Once the manipulations have been completed, press the button again two times to restore it to its main function. An audible signal and a white flashing indicate that the manipulation has been successful.

i. Battery passivation

The ACW-MR4 incorporates a battery depassivation feature, to limit the phenomenon of battery passivation during prolonged phases of deep standby. This feature is automatically activated as soon as the product goes into its deep sleep mode. The product will then be awakened once a day to start the battery depassivation sequence, then the product will return to deep standby by itself.

ACW configurator

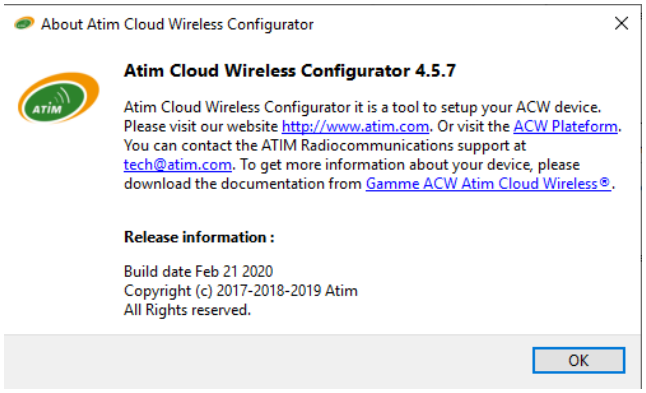
a. Compatible configurator version

For an MR4 with the following application software version:	Use the version of ACW Configurator:
Sigfox: V0.0.1 LoRaWAN: V0.0.1	V5.0.1

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

https://www.atim.com/en/support-2/downloading/

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



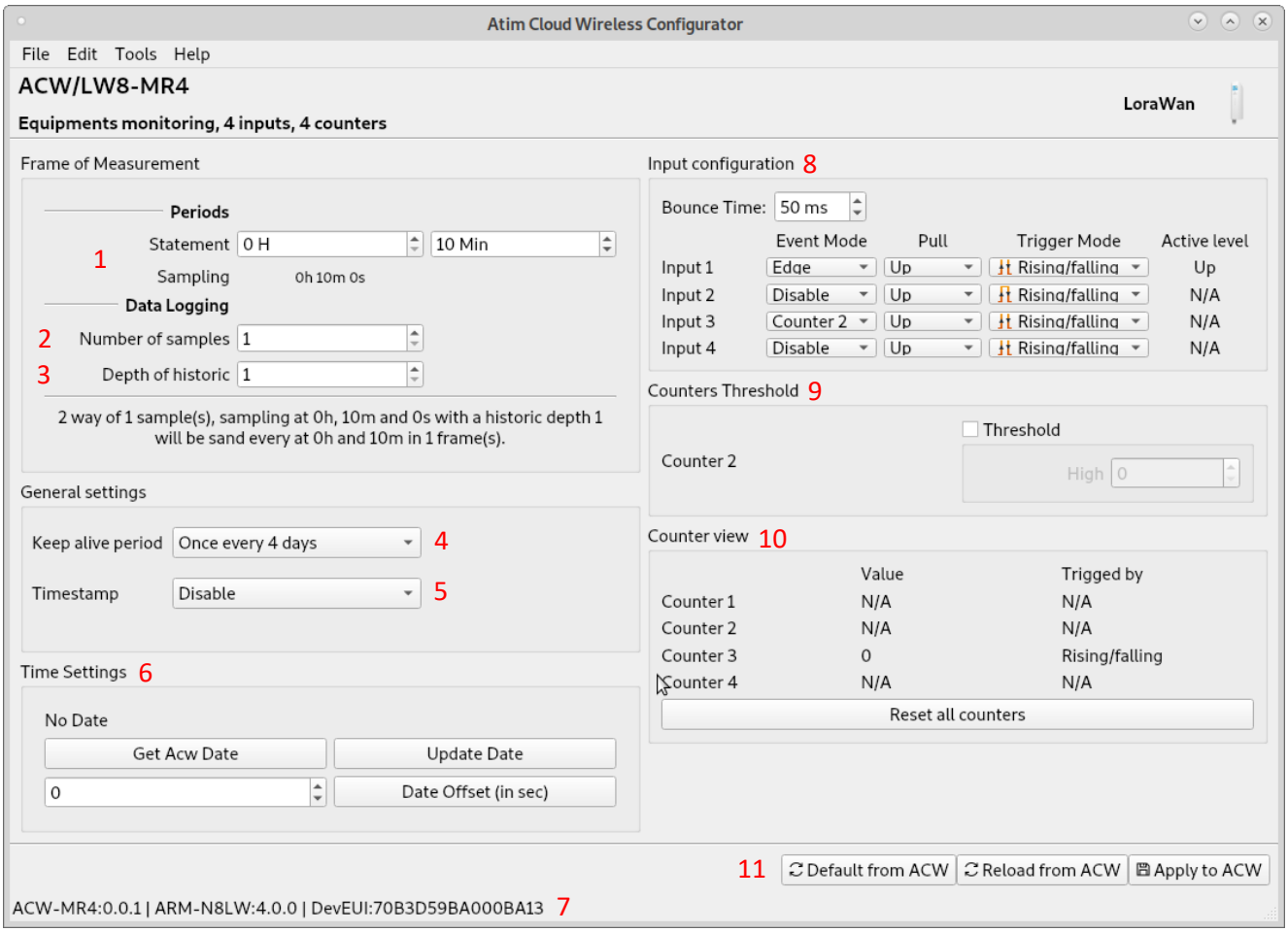
Click on "Help" at the top left of the window then on "About" to display the version number of the ACW configurator.

Pairing the ACW-MR4 with the configurator can be done in two ways:

- **By USB**: open the case of the ACW-MR4 and connect it to a computer with a micro-USB cable.
- **By Bluetooth**: make sure that Bluetooth is activated

Do not leave the product connected to the configurator (via USB or Bluetooth) unnecessarily, otherwise the autonomy of the product will be seriously degraded.

b. ACW-MR4 setup



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 (4). 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 (5)

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 (6).

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 (7).

Inputs configuration

On the ACW-MR4, the 4 inputs can be configured individually (8). So, for each entry you can configure:

- **Input function**: front detection, metering or disabling
- **Type of line draw**: to ground or towards power supply
- **Trigger front**: rising, falling edge or both.

In addition, it is possible to configure an anti-bounce time which corresponds to the wait following a level change before taking it into account (bounce time).

Finally, when the input is configured for edge detection, and only in this mode, its current state is indicated on the right (under "Active level").

Metering thresholds setup

In the case where an input is configured as a counter, it is possible to activate a threshold detection function allowing to alert by a radio frame that the counter has exceeded a certain value (9).

Meters overview

When an input is configured as a counter, it is then possible to have a real-time display of the value of the counter and of the triggering input (10).

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.

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

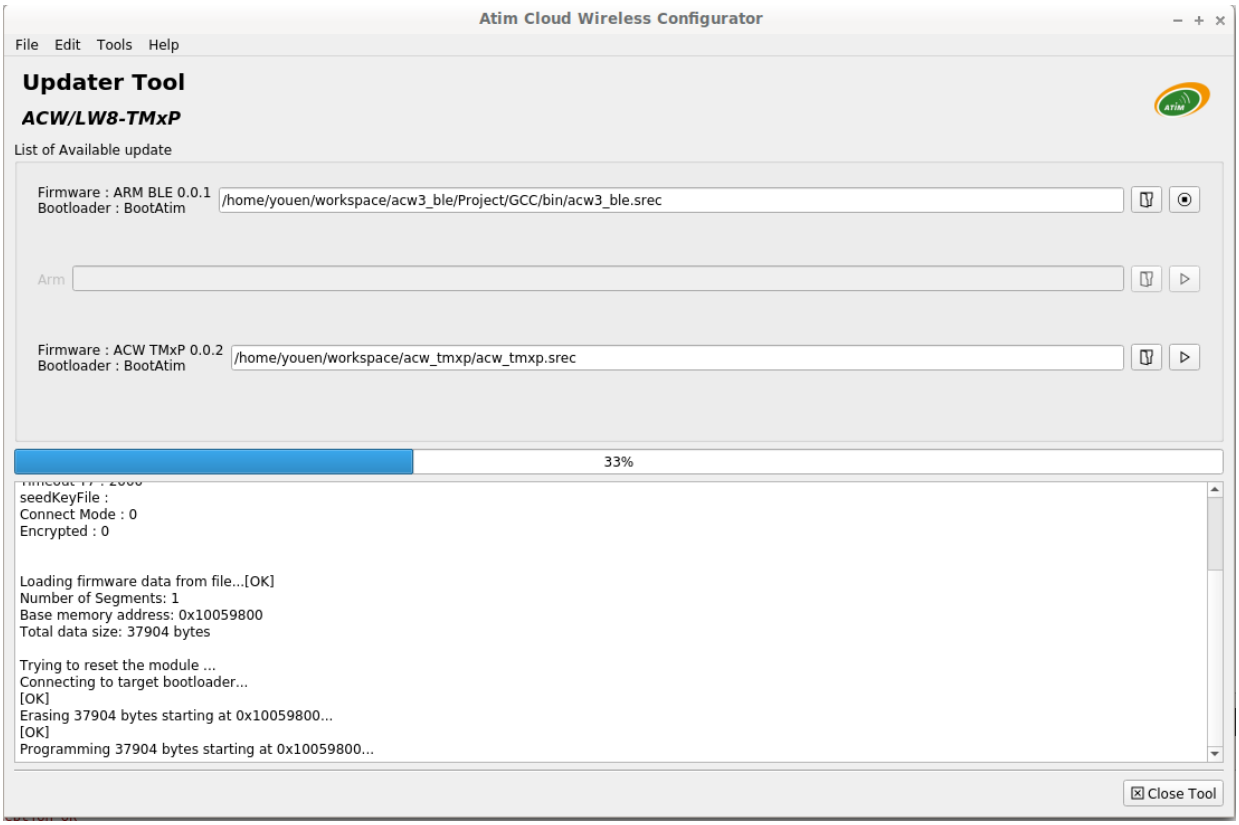
Sensors parameters:

- Inputs 1 and 2 deal with meter 1 and meter 2 respectively
- Pull up “+”
- Rising edge detection

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 (Only Sigfox)
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 channels 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		Numbers of channel		Type of measurement			

In the case of ACW-MR4, **the measurement type** can be worth **0x01** for the state of the inputs or **0x04** for the value of a counter. The state of the four inputs of the MR4 is on 1 byte, the value of a counter on 4 bytes (**Little Endian** encoding, LSB first.

In the case of input status measurement, the channel number will always be 0. In the case of a counter value, the channel number + 1 will correspond to the counter number (see the table below).

Type of measurement	Units	Data size	Data type	Descriptions
0x01	Bit	1 byte	Bit field	States of all 8 inputs
0x04	Pulse	4 bytes (Big Endian)	Unsigned integer	Counter value

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:

(Size in bytes of the measure) * (number of samplings) * (depth history)

Examples: for a frame containing the state of 8 inputs (measure 0x01 on 1 byte) with a history depth of 1 and a number of samples of 3, we are left with 3 bytes of data (1x1x3).

Alert measurement frame

Notes: *For the ACW-MR4, alerts only apply when a counter is exceeded.*

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		Number of the channel		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 here identical to that of the measurement frame (ie 0x04 in hexadecimal for the ACW-MR4).

The sample that caused the alert is then inserted afterwards (with **Big Endian** encoding - MSB first).

Keep alive frame

The life frame is sent at regular intervals according to the configuration applied (by default 4 days) and contains the battery levels of the product when empty (the product does nothing) and when charging (the product is transmitting a frame radio)..

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp = 0	Measurement frame = 0	Reserved = 0	Keep alive frame = 0x01			

Following this header are 4 bytes, 2 for the empty battery level and 2 for the charging battery level.

The frame is therefore split as follows: 0xAABBBBCCCC

0xAA being the frame header (always equal to 0x81), 0xBBBB the empty battery level (value in millivolts, MSB coding) and 0xCCCC the charging battery level (value in millivolts, MSB coding)

Example: 0x81 0d24 0c68
0d24: empty battery level = 3364 mV therefore 3.364 V
0c68: battery charging level = 3176 mV therefore 3.176 V

Error and alarm generic 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
0x81	ERR_UNKNOWN	
0x82	ERR_BUF_SMALLER	The data table is full, impossible to write any additional data
0x83	ERR_DEPTH_HISTORIC_OUT_OF_RANGE	The history depth is too large or too small for the frame
0x84	ERR_NB_SAMPLE_OUT_OF_RANGE	The number of sampling is too large or too small for the frame
0x85	ERR_NWAY_OUT_OF_RANGE	The number of the channel in the header of the frame is too large or too small
0x86	ERR_TYPEWAY_OUT_OF_RANGE	The type of measurement in the frame header is too large or too small
0x87	ERR_SAMPLING_PERIOD	Bad structure of sampling period
0x88	ERR_SUBTASK_END	End of a sub-task after leaving an infinite loop
0x89	ERR_NULL_POINTER	Pointer with value “NULL”
0x8A	ERR_BATTERY_LEVEL_DEAD	Critical battery level
0x8B	ERR_EEPROM	EEPROM is corrupted
0x8C	ERR_ROM	ROM is corrupted
0x8D	ERR_RAM	RAM is corrupted
0x8E	ERR_ARM_INIT_FAIL	Radio module initialization has failed
0x8F	ERR_ARM_BUSY	The module is already busy (possibly not initialized)
0x90	ERR_ARM_BRIDGE_ENABLE	The module is in bridge mode, cannot send data by radio
0x91	ERR_RADIO_QUEUE_FULL	Radio queue is full
0x92	ERR_CFG_BOX_INIT_FAIL	Error during black box initialization
0x93	ERR_KEEP_ALIVE_PERIOD	Wrong keep alive frame structure
0x94	ERR_ENTER_DEEP_SLEEP	The device entered deep sleep mode
0x95	ERR_BATTERY_LEVEL_LOW	Low battery
0x96	ERR_ARM_TRANSMISSION	A transmission has been initiated but an error has occurred

0x97	ERR_ARM_PAYLOAD_BIGGER	Message size is too large for the capacity of the network
0x98	ERR_RADIO_PAIRING_TIMEOUT	Impossibility to pair to a network within the fixed period
0x99	ERR_SENSORS_TIMEOUT	A timeout has been reached out on the sensor
0x9A	ERR_SENSOR_STOP	The sensor did not report a value after reading
0x9B	ERR_SENSORS_FAIL	The sensor has stopped to operate
0x9C	ERR_BOX_OPENED	Casing opening
0x9D	ERR_BOX_CLOSED	Casing closing

Only codes 0x8A and 0x95 are followed by additional data corresponding to the battery level in millivolts. This value is coded in two bytes, the most significant byte first (MSB).

Warning: for codes ranging from 0x81 to 0x92, the product will enter its FAULT mode and will no longer perform its measurement function. For codes ranging from 0x93 to 0x9D, these correspond only to alarms, the product therefore continues to operate normally.

MR4 specific frame

This ACW-MR4-specific frame is used to notify changes of state on the WIRECUT input

Byte 1 - Header							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
New generation = 1	Timestamp	Measured frame = 0	Reserved = 0	Alert frame = 0x0F			

Following the frame header is a byte indicating the change of state on the WIRECUT input. Its value is fixed and equals 0x1C. This byte is followed by a last byte indicating the current state of the WIRECUT entry:

- 0x01 => WIRECUT not cut
- 0x20 => WIRECUT cut

b. Examples of frames

Measurement frame

1 counter input (counter 1) and 1 edge detection input (input 2), without time stamp, no history and a sample number of 1.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0xA0 (new generation measurement frame, no history, 1 sampling)	0x01 (channel 0, measurement type: state of inputs)	0xFD	0x04 (channel 0, measurement type: metering value)	0x00	0x00	0x00	0x52

Byte 3 corresponds to the state of the inputs, so input 2 is low. The value of the counter on channel 0

(counter 1) is 0x00000052 (82 in decimal).

Here is a frame following a change of state on input 2 (sent immediately).

Byte 1	Byte 2	Byte 3
0xA0 (new generation measurement frame, no history, 1 sampling)	0x01 (channel 0, measurement type: state of inputs)	0xFF

The state of the inputs is only found in the frame.

Alert measurement frame

For exceeding the threshold value defined for the counter:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
0x8D (new generation alert frame)	0x54 (exceeding high threshold channel 0, distance measurement	0x00	0x00	0x38	0x29

The sample that triggered the threshold on channel 0 (counter 1) is 0x00003829 (14 377).

Downlink

This functionality is available on ACW-MR4 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-MR4 are as follows:

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

Parameter code (Byte 1)	Parameter code (Byte 2)	Parameter code (Byte 3)	Parameter code (Byte 4)	Parameter code (Byte 5)
0x94	0b00YY0ZZZ	0xYY	0xZZ	0x00

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

Example: 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. Inputs setup

Parameter code (Byte 1)	Parameter value (Byte 2)
0xXX **(depends on the input to configure)**	0bAABB0CCC

Each input being independently configurable, there is a different parameter code for each of them:

Input 1 => parameter code = 0x16

Input 2 => parameter code = 0x17

Input 3 => parameter code = 0x18

Input 4 => parameter code = 0x19

For the value of the parameter (byte 2), the byte is divided into three parts:

Bits 7,6 (AA) => choice of trigger edge: Rising edge - AA = 1; falling edge - AA = 2; Rising and falling edges – AA = 3

Bits 5,4 (BB) => choice of draw resistance: pull up - BB = 1; pull down – BB = 2.

Bits 2-0 (CCC) => choice of input mode: Front detection - CCC = 1; counter 1 - CCC = 2;

counter 2 - CCC = 3; counter 3 - CCC = 4; counter 4 - CCC = 5

c. Threshold counters setup

Parameter code (Byte 1)	Frame size (Byte 2)	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	…	Byte 22
0xD5	0x14	0xWW	0xXX	0xYY	0xZZ	0 = disabled threshold 1+ = enabled threshold		

This parameter is used to configure the threshold value for the 4 counters.

The configuration for a counter extends over 5 bytes: the first 4 for the threshold value (0xZZYYXXWW) and the last byte to activate or deactivate the threshold.

For counter 1, the configuration extends from byte 3 to byte 7, for counter 2 from byte 8 to byte 12, for counter 3 from byte 13 to byte 17 and for counter 4 from byte 18 to byte 22.

d. Input bounce time configuration

Parameter code (Byte 1)	Parameter value (Byte 2)
0x1A	0xXX

This parameter is used to configure the debounce value of the inputs in milliseconds

The value of the parameter 0xXX can therefore be between 0x0A and 0xFF

Technical support

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

https://www.atim.com/en/support-2/technical-support/