ATIM Cloud Wireless

Modbus PLC connector DINRSM / RS485

User Guide

Concerned models:

ACW/LW8-DINRSM

ACW/SF8-DINRSM

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Document version history

Version	Date	Description	Author	Concerned software version
1.0	25/09/2016	Document creation	AM	
1.1	25/11/2016	Corrections	FR	
1.2	13/02/2017	Images updates	AM	
1.3	09/05/2017	Addition of concerned product references	YM	
1.4	11/10/2017	Update of the front image	AM	1.4
2.0	12/12/2017	Modbus master only Downlink configuration	AM	3.1.0
2.1	04/01/2018	Corrections	FR	3.1.0
2.2	16/01/2018	Keepalive frame addition	AM	3.2.0
2.3	09/02/2018	Translation corrections	YM	3.2.0
2.4	30/03/2018	Correction of values for configuring the number of bits of serial link.	AM	3.2.0
2.7	23/05/19	Connections board corrections	SC	3.2.3
2.8	25/02/2020	- Downlink command addition for Modbus writing/reading - Increase of the number of Modbus requests from 32 to 49.	YL	3.3.5

Disclaimer

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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:

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

a. 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.

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.*

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 other 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 center closest to your home, contact your closest local government office, your local waste management service or the business from which you purchased the product.

b. Radio

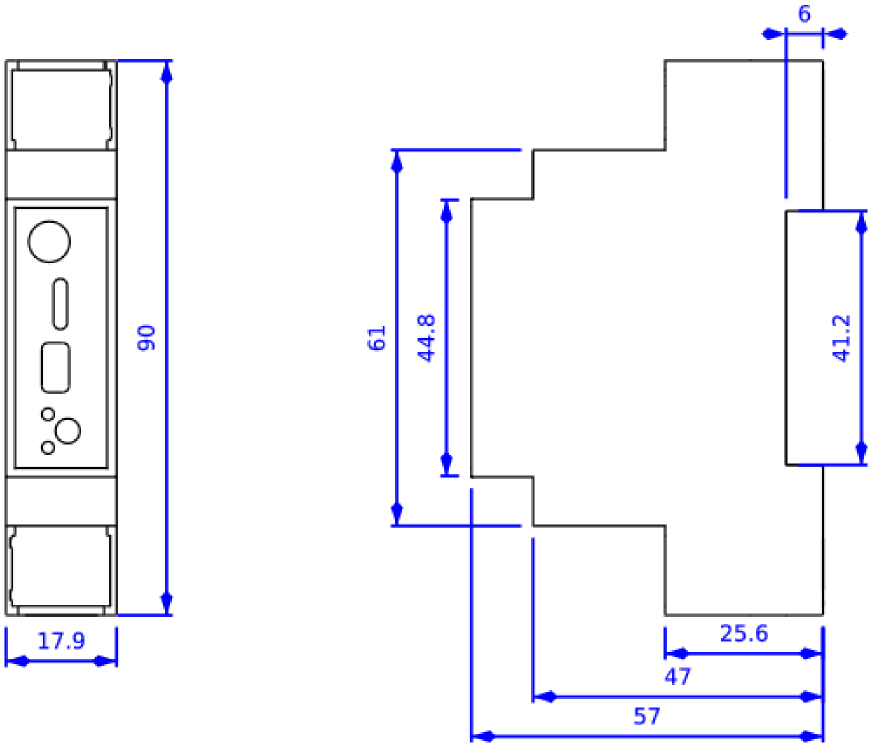
Modems in the ACW line are radio-communication modems that use the ISM (industrial, scientific and medical) bands, which may be used freely (at no cost and with no authorization required) for industrial, scientific and medical applications.

Technical specifications

Dimensions	90 x 57 x 17.9 mm
Antenna	External via SMA connector
Temperature	-20°C to +55°C (operation)
	-40°C to +70°C (storage)
Mounts to	DIN rail
Power supply	1x power supply, 10-30 V DC
Frequency	865 – 870 MHz
Power	25 mW (14 dBm)
Transfer rate	Sigfox: 100 bps LoRaWAN: 300 bit/s to 10 kbit/s

Current draw (24 V)	Sigfox:	Current draw (24 V)
Tx mode (max)	40 mA	Tx mode (max)
Rx mode (max)	30 mA	Rx mode (max)

Space requirements and mounting



Dimensions indicated in mm.

‘Circuit-breaker’-style ACW DIN modems are mounted on a DIN rail.

Installation

c. Positioning

This version was designed for installation in an electrical box made of PVC or metal. If the box is made of insulating material (PVC, ABS, fibreglass), you can also simply use a small ½ wave whip antenna: Ref. ATIM ANT868-12FSC. This antenna must be firmly screwed onto the SMA connector and positioned vertically, preferably pointing upward.

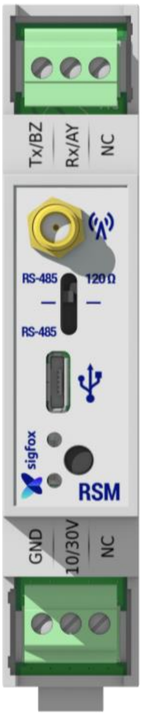
➔ If a metal box is used, the antenna must be positioned outside the box in order to ensure good radio performance and avoid the ‘Faraday cage’ effect.

For optimal results, we recommend that the antenna be positioned high up and at least 1 metre away from all metallic objects.

d. Connecting the modem

Terminal blocks

Name	Description	Input / Output
GND	Earth/Ground (Gnd)	Earth
10/30V	Power supply between 10 V and 30 V	Input (power supply)
NC	Not connected	/
Tx/BZ	RS485 BZ	Bidirectional/differential
Rx/AY	RS485 AY	Bidirectional/differential
NC	Not connected	/



Antenna (SMA)

Before connecting the product to mains power, connect the antenna: either a ½ wave whip antenna (ref. ATIM ANT868-12FSC) or an external antenna — ¼ wave (ref. ATIM ANT868-14S4.0) with a metallic ground plane or ½ wave (ref. ATIM ANT868-12S3.8) — or a roof antenna with a low-loss cable (ref. ATIM ANT868-BZ or ANT868-08).

WARNING
It is mandatory to connect the antenna before powering the product. Failure to do so may cause the product to malfunction and become unusable.

Power supply (bottom terminal block)

The ACW-DINRSM must be supplied with a DC power supply between 10 V and 30 V that can provide a minimum current of 100 mA.

RS485 (top terminal block)

The maximum cable length will depend on the type of serial link and the baud rate in use. A maximum length of 1 meter is appropriate for all use cases.

For an RS485 connection, you have the option to activate the 120Ω termination resistor:

- *upward position (SMA side): resistor activated*
- *downward position (USB side): resistor deactivated*

USB

The USB connector allows you to configure the ACW with a PC and a USB cable. See section « Configuration via USB » for more details.

NOTE
To configure the device, it must be connected to power at 10/30 V DC.

c. Push button

The push button located on the front panel of the housing can be used to initiate a Modbus/Radio cycle. This lets you test the Modbus configuration and radio connectivity. If no Modbus frame is configured, a “keep-alive” frame will be sent.

d. Interpreting the indicator lights

The indicator lights are used to display the state of operation of the DINRSM. In general, a **GREEN** light indicates correct operation, while a **RED** light indicates an error.

Success or failure of an operation

Behaviour

The **RED** or **GREEN** flashes rapidly for about ½ second. A **RED** light indicates failure, while a **GREEN** light indicates success.

Event

- When switching on the device (after a brief delay) to indicate it has started up correctly.
- After a Modbus frame if the response fails (**RED** light).

USB connection or radio activity

When a radio message is sent over the network, the **GREEN** light flashes every half-second while it is being sent. This may last for up to one minute. This light flashes in a similar manner when the product is connected via USB.

Modbus communication

During Modbus communication, the **GREEN** light remains on throughout the entire process. If a Modbus error is detected, the **RED** light will flash rapidly.

Normal start-up behavior

When the device is switched on, after a brief delay, the **GREEN** light flashes rapidly for about ½ second to indicate that the device has started up correctly. The periodic frame is then sent out, based on the statement period specified in the settings. If a USB cable is connected to the DINRSM, the **GREEN** light will flash if that connection is in place.

Parameter settings and configuration

a. Parameter settings

Serial link parameters

The RS serial link can be configured with different parameters. Not all parameter settings are compatible with one another.

The configurable parameters are as follows: 8N1, 8N2, 8E1, 8O1, 7N2, 7O1, 7O2, 7E1, 7E2.

Type of serial link

- Only RS485

Serial link baud rate

- 1200 bps
- 2400 bps
- 4800 bps
- 9600 bps
- 19200 bps (default)
- 38400 bps
- 57600 bps
- 115200 bps

Serial link parity

- No parity (default): N
- Even: E
- Odd: O

Number of bits for the serial link

- 7 bits
- 8 bits (default)

Number of stop bits for the serial link

- 1 bit (default)
- 2 bits

Frame period

A complete radio cycle is composed of two phases: 1/ sending requests to one or several Modbus slave(s), 2/ broadcasting retrieved Modbus data via radio communication.

During requesting phase, up to 49 Modbus request frames are sent through serial link to slave Modbus equipment, which return data requested by the ACW-DINRSM.

During radio emission phase, Modbus registers or bits retrieved by ACW-DINRSM are broadcast under one or several frames according to the configuration.

The interval for this cycle is once per hour by default but can be configured for intervals ranging from 10 minutes to 28 days, in increments of 1 minute.

To ensure compliance with radio standards, it is essential that you select an appropriate interval time for the number of radio frames that will be broadcast. This comes to 15 radio frames for LoRaWAN and 6 radio frames for Sigfox every hour.

Modbus timeout

During Modbus communication, if a slave does not respond during the specified time, an error will be reported. This period is set to 1 second by default and can be set to values from 100 milliseconds to 65 seconds, in increments of 100 milliseconds.

Keep-alive frame parameter

A keep-alive frame can be transmitted periodically. On a Sigfox network, this frame is also used to request the transmission of a downlink frame, thus providing the ability to reconfigure the ACW remotely via radio.

The following periods are available

Deactivated (no keep-alive frame is transmitted).

- Every hour.
- Every two hours.
- Every four hours.
- Every eight hours.
- Every day.
- Every two days.
- Every three days.
- Every four days. (default)
- Once a week (every 7 days).
- Once a month (every 30 days).

Parameter settings for Modbus and radio frames

You can configure up to 49 Modbus frames and a certain number of radio frames, depending on your statement period. A radio frame is defined by the parameters from the Modbus frames.

Therefore, you must configure the following parameters:

Modbus function code

The following function codes are available:

Function code	Name
0x01	Read Coils
0x02	Read Discrete Inputs
0x03	Read Holding Registers
0x04	Read Input Registers

Concatenation with previous frame

This parameter provides the option to not create a new radio frame and to include the result of the Modbus frame with the result of the previous Modbus/radio frame.

Slave address

Indicates the address of the Modbus slave device.

Register or bit address

Indicates the address of the first register or bit to be read.

Radio header

The radio header is a value that is used to identify the type of radio frame. You must choose the correct value in order to identify what data are included in the frame. When concatenation is used, only the header of the first frame will be used.

Number of registers or bits to read

A frame is considered as unused if this value is equal to 0. Depending on the function code you have selected and the number of frame concatenations, you can indicate the number of registers or bits that you want to read. Keep in mind that a Sigfox radio frame cannot contain more than 10 bytes of data, i.e. 5 Modbus registers. A LoRaWAN radio frame cannot contain more than 34 bytes of data, i.e. 17 Modbus registers.

For more details, see Modbus frame parameters (Code 30 to 61).

b. Configuration via USB

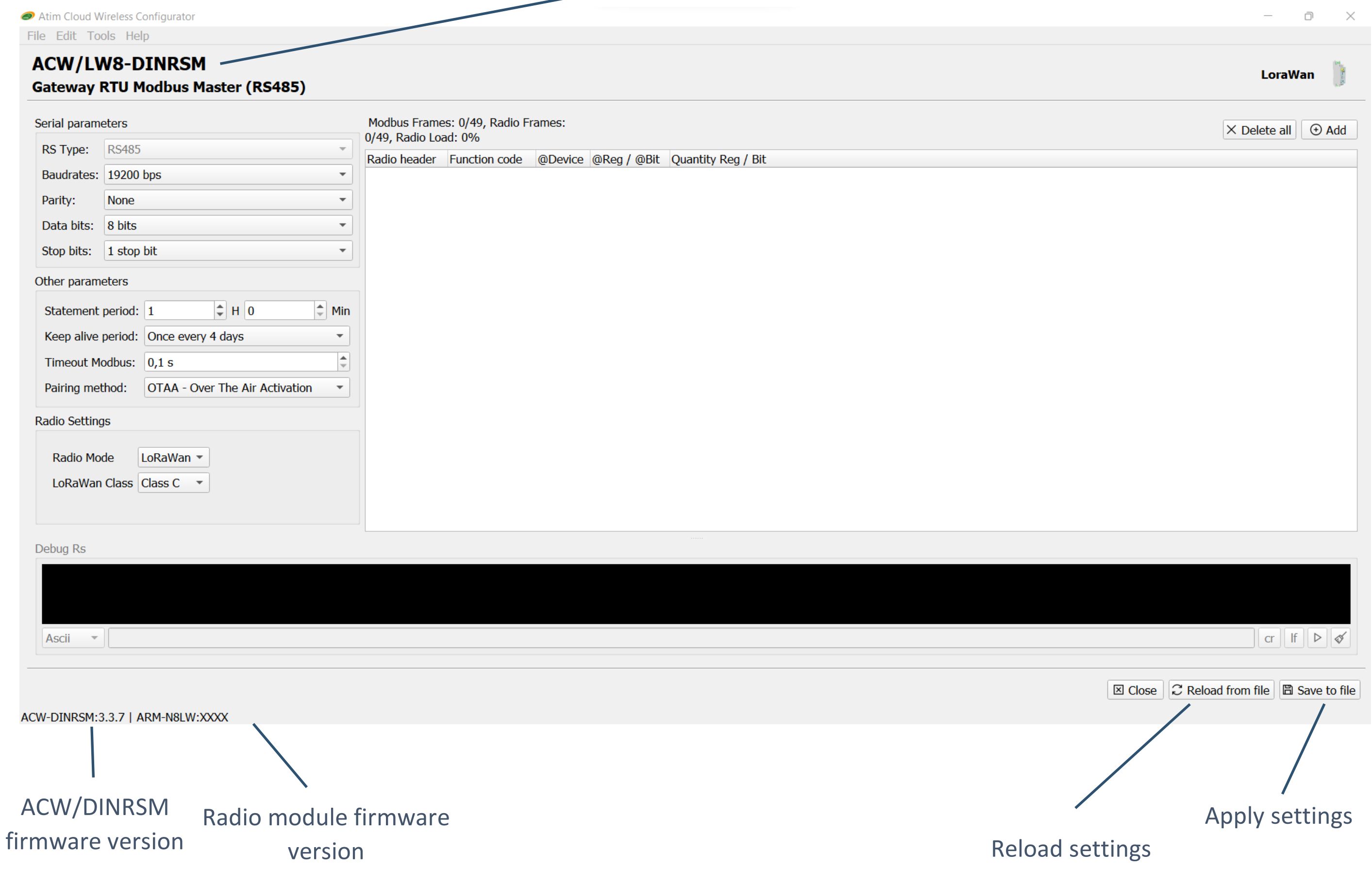
For a DINRSM with application software version	Use ACW configuration tool version
V3.0 or earlier	V3.7.15 or later
V3.2 or later	V4.4.0 or later
V3.3.5 or later	V4.5.9 or later

Download and install the configuration tool “setupACW.exe” at:

https://www.atim.com/wp-content/uploads/documentation/CONFIGURATEUR/ACW/configurateur-acw.exe

Connect the ACW-DINRSM to your computer with a micro-USB cable, then start the ACW configuration tool. When you connect the ACW-DINRSM, the ACW configuration tool window changes to give you access to parameter settings for your device. The current configuration of the connected ACW-DINRSM device is automatically retrieved and displayed.

A window appears, like the one below:



ACW/LW8-DINRSM
Gateway RTU Modbus Master (RS485)

Serial parameters

RS Type:	RS485
Baudrates:	19200 bps
Parity:	None
Data bits:	8 bits
Stop bits:	1 stop bit

Other parameters

Statement period:	1 H 0 Min
Keep alive period:	Once every 4 days
Timeout Modbus:	0,1 s
Pairing method:	OTAA - Over The Air Activation

Radio Settings

Radio Mode	LoRaWan
LoRaWan Class	Class C

Modbus Frames: 0/49, Radio Frames: 0/49, Radio Load: 0%

Radio header	Function code	@Device	@Reg / @Bit	Quantity Reg / Bit

Debug Rs

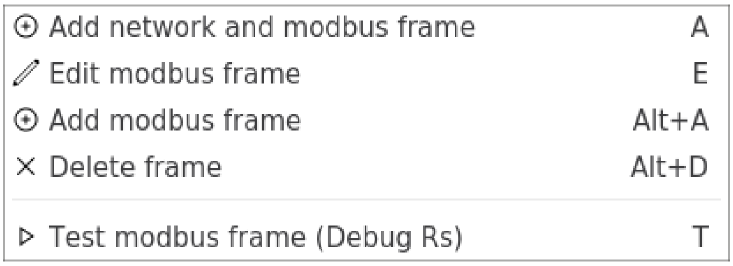
Ascii

ACW-DINRSM:3.3.7 | ARM-N8LW:XXXX

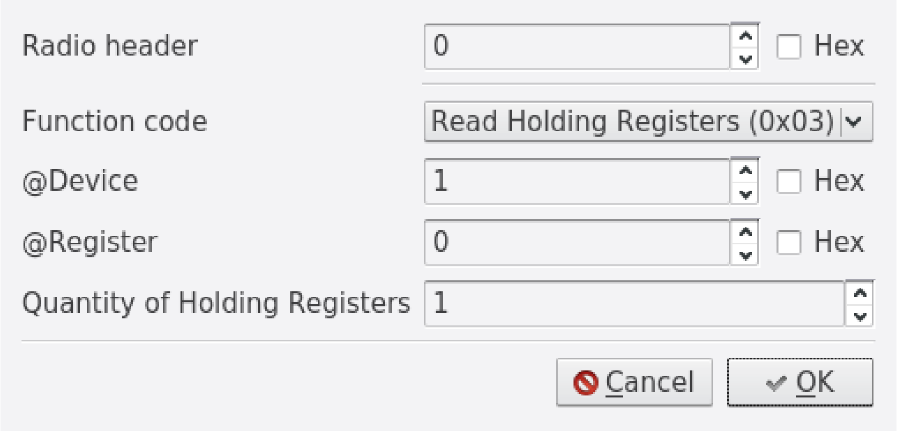
Four major sections can be distinguished here. The 'Serial parameters' section is at the top left, "Other parameters" at the center left, the Modbus configuration section at the right and the debugging area at the bottom.

Parameter settings for Radio and Modbus frames

In the Modbus section at the right, you can add radio (network) and Modbus frames, add a Modbus frame to a radio (network) frame, edit a Modbus frame as well as delete and test Modbus frames. Right-clicking in this area will open a context menu (shown below) that lists the various actions just described. You can also access these actions more quickly by using the keyboard shortcuts shown on the right side of the context menu.


Add network and modbus frame A
Edit modbus frame E
Add modbus frame Alt+A
Delete frame Alt+D
Test modbus frame (Debug Rs) T

When adding or editing a Modbus frame, a window like the one below will appear. Use this window to configure all the parameters for your Modbus frame.



Radio header 0 □ Hex

Function code Read Holding Registers (0x03)

@Device 1 □ Hex

@Register 0 □ Hex

Quantity of Holding Registers 1

NOTE
To edit the Radio (Network) header, you will have to edit the first Modbus frame.

The number of Modbus and radio (network) frames is limited. Just above the frame configuration area in the main window, you will see a summary of the number of frames that you have used and the total number that you can use.

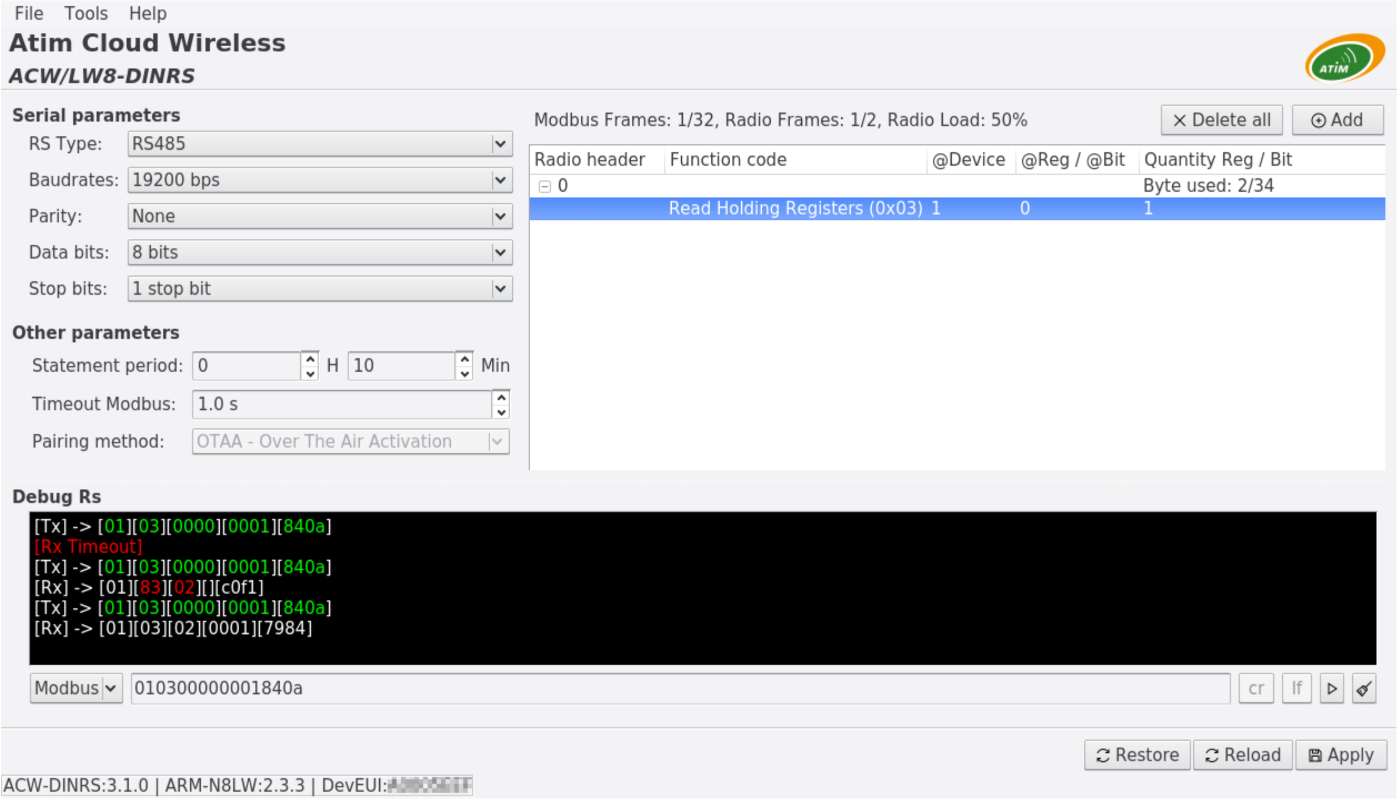
In Sigfox, you can configure one frame every ten minutes for a maximum of 6 frames every hour. +

In LoRaWAN, you can configure one frame every four minutes for a maximum of 15 frames every hour.

Testing Modbus frames

Before testing a Modbus frame, you must connect the ACW-RSM to your Modbus slave device. Next, configure the parameters for the serial link and click ‘Apply’ to apply the serial parameters.

Create a Modbus frame by pressing ‘A’, clicking the ‘Add’ button or by right-clicking and selecting from the context menu. The Modbus configuration window appears. Enter the parameters you want to test, then confirm by clicking ‘OK’. Select the newly created frame and press ‘T’ or select from the context menu. A Modbus frame is created and sent to the debugging terminal at the bottom of the main window, which automatically switches to Modbus mode. If any errors occur, the relevant sections of the affected frames will be highlighted in red.



Serial parameters

RS Type: RS485

Baudrates: 19200 bps

Parity: None

Data bits: 8 bits

Stop bits: 1 stop bit

Other parameters

Statement period: 0 H 10 Min

Timeout Modbus: 1.0 s

Pairing method: OTAA - Over The Air Activation

Modbus Frames: 1/32, Radio Frames: 1/2, Radio Load: 50%

Radio header	Function code	@Device	@Reg / @Bit	Quantity Reg / Bit
0				Byte used: 2/34
	Read Holding Registers (0x03)	1	0	1

Debug Rs

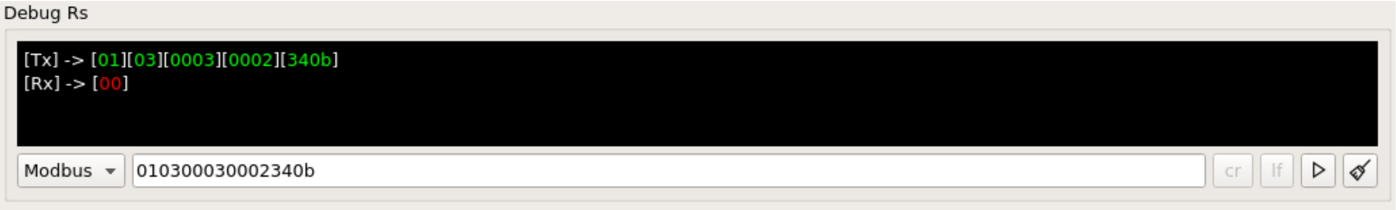
```
[Tx] -> [01][03][0000][0001][840a]
[Rx Timeout]
[Tx] -> [01][03][0000][0001][840a]
[Rx] -> [01][83][02][][c0f1]
[Tx] -> [01][03][0000][0001][840a]
[Rx] -> [01][03][02][0001][7984]
```

010300000001840a

ACW-DINRS:3.1.0 | ARM-N8LW:2.3.3 | DevEUI:[redacted]

In the example above, 3 tests have been performed on the same frame. The first two have failed and the last one has succeeded. In this way, you can adjust the timeout period and the parameters for your frames.

With RS485, if ‘00’ appears after the timeout when testing a Modbus frame, this probably means that the RS485 termination resistor is not activated.



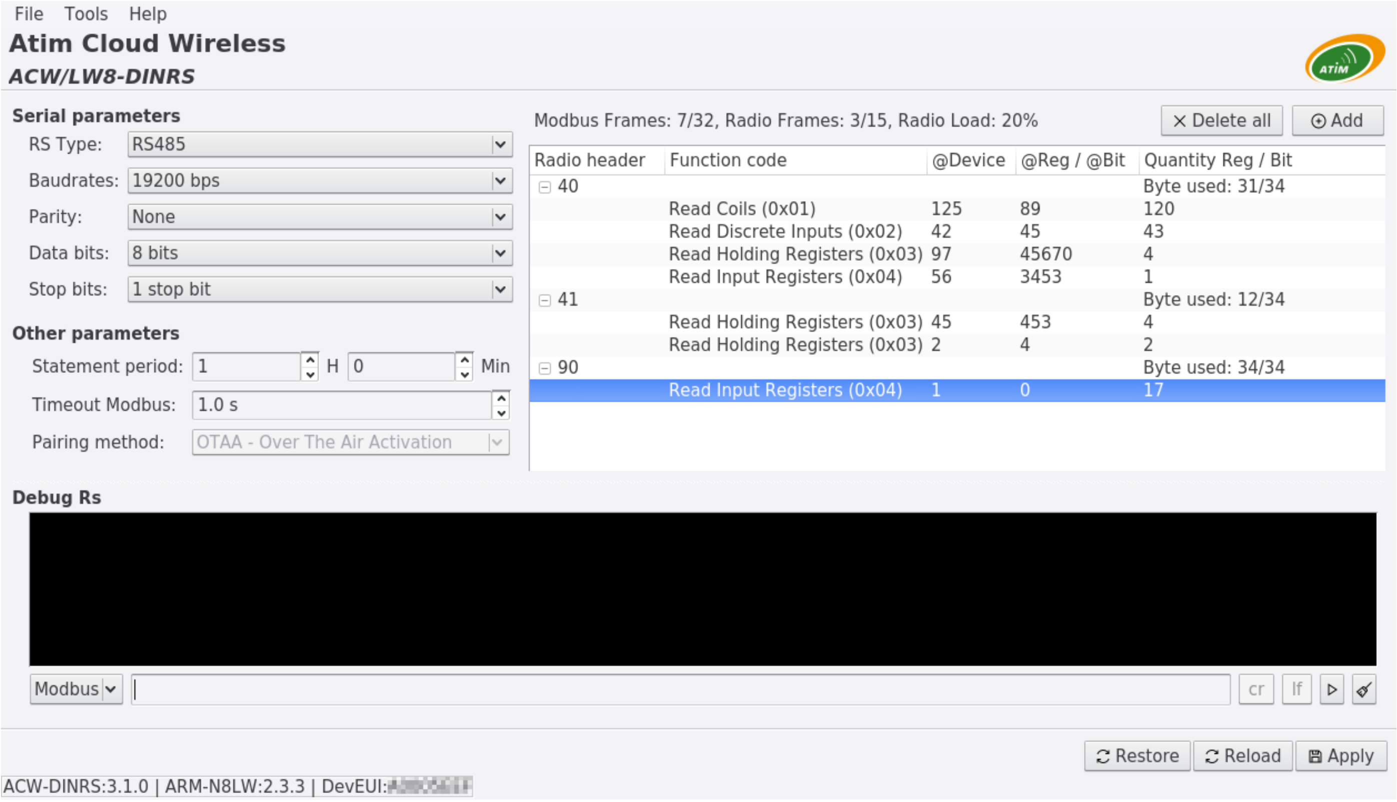
Debug Rs

```
[Tx] -> [01][03][0003][0002][340b]
[Rx] -> [00]
```

010300030002340b

Therefore, you should activate it by flipping the switch on the front of the device.

Configuration example



Atim Cloud Wireless

ACW/LW8-DINRS

Serial parameters

RS Type: RS485

Baudrates: 19200 bps

Parity: None

Data bits: 8 bits

Stop bits: 1 stop bit

Other parameters

Statement period: 1 H 0 Min

Timeout Modbus: 1.0 s

Pairing method: OTAA - Over The Air Activation

Modbus Frames: 7/32, Radio Frames: 3/15, Radio Load: 20%

Radio header	Function code	@Device	@Reg / @Bit	Quantity Reg / Bit
⊟ 40				Byte used: 31/34
	Read Coils (0x01)	125	89	120
	Read Discrete Inputs (0x02)	42	45	43
	Read Holding Registers (0x03)	97	45670	4
	Read Input Registers (0x04)	56	3453	1
⊟ 41				Byte used: 12/34
	Read Holding Registers (0x03)	45	453	4
	Read Holding Registers (0x03)	2	4	2
⊟ 90				Byte used: 34/34
	Read Input Registers (0x04)	1	0	17

Debug Rs

ACW-DINRS:3.1.0 | ARM-N8LW:2.3.3 | DevEUI:[redacted]

In this example, we have 3 radio frames with headers of 40, 41 and 90 plus 7 Modbus frames. Radio frame 40 contains 4 Modbus frames; radio frame 41 contains 2 Modbus frames; and radio frame 90 contains just one Modbus frame.

The figure below shows the radio frames that will be sent out (if the Modbus slaves respond):

Radio frame 40

Byte	1	2	3, ..., 17	18, 23	24, .., 31	32, 33
Data	0x03	40	Values of the 120 bits from frame 1	Values of the 43 bits from frame 2	Values of the 4 registers from frame 3	Values of the register from frame 4

Radio frame 41

Byte	1	2	3, ..., 10	11, ..., 14
Data	0x03	41	Values of the 4 registers from frame 5	Values of the 2 registers from frame 6

Radio frame 90

Byte	1	2	3, ..., 36
Data	0x03	90	Values of the 17 registers from frame 7

Transmitting information on IoT networks (Sigfox/LoRaWAN)

a. Keep-alive frame

This frame is sent to the network instead of the periodic frames if no Modbus frame is configured.

Frame format:

Byte	1	2	3	4	5	6
Data	0x01	Power supply voltage of radio core on standby (millivolts – typically 3300 mV)		Power supply voltage of radio core when transmitting (millivolts – typically 3300 mV)		0x64

b. Periodic frame (or triggered by pressing button)

This frame is sent to the network at a regular, configurable interval (the statement period).

Frame format:

Byte	1	2	3,4 …
Data	0x03	Header	Values of Modbus registers and/or bits read from the slave(s)

The header is a configurable parameter and must be set correctly to decode the frame. Modbus registers are sent in a 2-byte format in MSB order.

c. Error frame

This frame is sent to the network when a Modbus or internal error occurs. Internal errors may arise due to an incorrect Modbus configuration.

NOTE
This frame replaces a faulty radio frame. If the data in the radio frame were valid, they will be lost.

Byte	1	2	3	4	5	6	7	8	9
Data	0x83	Parameter	Radio header	Error code	@Slave	Function code	@Register MSB	@Register LSB	Number of registers

The parameters of the Modbus frame are sent back to identify which frame failed. An error code is also included to tell you which error occurred, so that you can correct your configuration if necessary. The error codes are explained below:

Error code	Description
0x00	**Reserved, not used**
0x01	**Illegal function**: The Modbus server does not support the specified function code; it may not be configured or implemented.
0x02	**Illegal data address**: One or more register or bit addresses are not permissible. This is due to a register or bit address outside of the slave's addressable range. This can occur if the specified number of registers or bits is too large and extends outside of the authorised range of registers or bits.
0x03	**Illegal data value**: One or more values in the Modbus frame are not permissible.
0x04	**Server failure**: A non-recoverable error has occurred on the slave device.
0x05 - 0xF9	**Reserved, not used**
0xFA	**Timeout**: the Modbus frame has not received a response within the specified time period. This occurs when the timeout value is too small or if the slave device is not present on the serial link.
0xFB	**CRC error**: The Modbus CRC returned by the slave is incorrect. This may be caused by a bad connection between the devices.
0xFC	**Modbus frame error**: A communication error has occurred. The Modbus frame is ill-formed and cannot be decoded. This may be caused by a bad connection between the devices or by incorrect parameter settings for the serial link. Other factors can also cause this error.
0xFD	**Modbus buffer too small**: The memory buffer for Modbus communication is full. This occurs when the number of registers or bits to be read is too large. To resolve this error, you must reduce the number of registers or bits read into the Modbus frame. This error can also be caused by incorrect parameter settings for the serial link.
0xFE	**Radio buffer too small**: The memory buffer for radio communication is full. This occurs when the number of radio frames is too large. To resolve this error, you must reduce the number of register or bits read into one or more Modbus frames, and/or reduce the number of radio frames.
0xFF	**Internal error**: An unspecified internal error has occurred. This can result from a number of different causes.

NOTE
The codes in blue are returned directly by the Modbus server and the codes in green are specific to the ACW-DINRSM.

Receiving information from IoT networks (Sigfox/LoRaWAN)

You can use this feature if your product includes a compatible radio version.

- Sigfox radio firmware: Version **5931** or later
- LoRaWAN radio firmware: Version **2.3.3** or later

The document ATIM_ACW-DLConfig_UG_EN.pdf explains how exchange frames work for this function.

NOTE IMPORTANTE
When you send the command to request the ACW configuration, several uplink frames will be sent. During this process, ANY DOWNLINK FRAME you send will not be processed and will be lost.

a. Parameters

The following is a description of all the accessible parameters.

Serial link parameter setting (Code 10)

Size and Code (Byte 1)	Value (Bytes 2 and 3)
0x40|10=0x4a	0xYYYY

The value (0xYYYY) is broken down into several parts to contain the entire serial configuration.

NOTE
The low byte / LSB is first.

The default configuration is 0x5041. This corresponds to a serial link of type RS485, 19200 bps, no parity, 8 bits of data and one stop bit (8N1).

Type of serial link – Byte 2 – bits 0 to 1

The possible values in byte 2 for these bits are:

- 0x01 = RS485 (default)

Serial link speed – Byte 2 – bits 4 to 7

The possible values in byte 2 for these bits are:

- 0x00 = 1200 bps
- 0x10 = 2400 bps
- 0x20 = 4800 bps
- 0x30 = 9600 bps
- 0x40 = 19200bps (default)

- 0x50 = 38400 bps
- 0x60 = 57600 bps
- 0x70 = 115200 bps

Serial link parity – Byte 3 – bits 0 to 1

The possible values in byte 3 for these bits are:

- 0x00: No parity. (default)
- 0x01: Odd parity.
- 0x02: Even parity.

Number of bits for serial link – Byte 3 – bits 4 to 5

The possible values in byte 3 for these bits are:

- 0x00 = 7 bits of data.
- 0x10 = 8 bits of data. (default)

Number of stop bits for serial link – Byte 3 – bits 6 to 7

The possible values in byte 3 for these bits are:

- 0x40: 1 stop bit. (default)
- 0x80: 2 stop bits.

Modbus timeout parameter (Code 13)

Size and Code (Byte 1)	Value (Bytes 2 and 3)
0x40|13=0x4d	0xYYYY

The value (0xYYYY) is indicated directly in milliseconds (low byte / LSB first). The default configuration is 100 ms (0x0064). The minimum value is 10 ms (0x000a). The maximum value is 65000 ms, i.e. 65 seconds (0xfde8).

Statement Period parameter (Code 14)

Size and Code (Byte 1)	Value (Bytes 2 and 3)
0x40|14=0x4e	0xYYYY

The value (0xYYYY) is indicated directly in minutes (low byte / LSB first). The default configuration and minimum value is 10 minutes (0x000a). The maximum value is 40320 minutes, i.e. 4 weeks.

Modbus frame parameters (Code 30 to 61)

These parameters are 'buffered' parameters: one or more parts of the configuration can be applied/accessed. Refer to the document 'ATIM_ACW-DLConfig_UG_FR_vx.pdf' for more details.

The buffer for this parameter consists of 6 bytes, as follows:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Function code Concatenation	@Slave	@Reg/bit LSB	@Reg/bit MSB	Header	Number of registers/bits

NOTE
By default, all these bytes are set to 0.

Function code – Byte 1 – bits 0 to 2

This parameter corresponds to the Modbus function code. The possible values in byte 1 for these bits are:

- 0x01 = Function code 0x01, Read Coils.
- 0x02 = Function code 0x02, Read Discrete Inputs.
- 0x03 = Function code 0x03, Read Holding Registers.
- 0x04 = Function code 0x04, Read Input Registers.

NOTE
By default, the value is 0x00. If a frame is activated (number of registers or bits is non-zero) and this value is set to 0x00, this will cause an internal error when the frames are sent.

Concatenation – Byte 1 – bit 7

This parameter is masked with the function code parameter to concatenate multiple registers from multiple Modbus frames in a single radio frame. The possible values in byte 1 for these bits are:

- 0x00 = No concatenation or creates a new radio frame.
- 0x80 = Activates concatenation of the registers read in with the previous radio frame.

LIMITATION

If the first frame (Code 30) activates concatenation, this frame will be considered as deactivated.

If a frame activates concatenation (e.g. Code 42) and the preceding frame is not activated (e.g. Code 41), then this frame will be considered as deactivated.

@Slave – Byte 2

This parameter corresponds to the Modbus ID or the address of the Modbus slave.

@Reg/bit – Byte 3 and Byte 4

This parameter corresponds to the address of the register or bit where the read operation should start. Byte 3 corresponds to the low-order byte of the value and byte 4 corresponds to the high-order byte of the value.

Header – Byte 5

This parameter corresponds to a value that is sent directly in a radio frame to identify the frame. It is used in periodic frames (see 'Statement Period parameter (Code 14)).

NOTE

When concatenation is used, only the header of the first frame (Modbus) will be used in the radio frame.

Number of registers/bits – Byte 6

This parameter corresponds to the number of registers or bits to be read. A value of 0 deactivates the frame. The maximum value will vary depending on whether concatenation with other frames is activated or not. For LoRaWAN, the maximum value is limited to 17 registers or 255 bits in one radio frame; in Sigfox, the number of registers is limited to 5 registers or 80 bits in one radio frame.

NOTE

In other words, you have 34 bytes of data available for your register values with LoRaWAN and 10 bytes available with Sigfox.

b. Commands

Restart

To restart the ACW-DIN-RSM remotely, you must send it the following command:

Byte 1	Byte 2
0x01	0x01

The ACW will restart and will not send a confirmation.

About

To obtain information about the ACW-DINRSM, you must send it the following command:

Byte 1	Byte 2
0x01	0x02

The ACW will return the information in the following format:

	Description and Value
Byte 1	Response to command frames: 0x07
Byte 2	'About' command: 0x02
Byte 3	Type of ACW: DIN RS – 0x06
Byte 4	ACW version (LSB)
Byte 5	ACW version (MSB)
Byte 6	Radio type: 1. Local – 0x01 2. Local long distance – 0x02 3. Sigfox uplink only – 0x03 4. Sigfox uplink/downlink - 0x04 5. LoRaWAN – 0x05
Byte 7	Radio version (LSB)
Byte 8	Radio version (MSB)
Byte 9,n	Serial number (devEUI|sfx) (MSB first).

NOTE
In LoRaWAN, the four high-order bytes are replaced by 0.

Restore default parameter settings

To restore the default parameter settings, you must send the following command:

Byte 1	Byte 2
0x01	0x03

The ACW will return a confirmation in the following format:

	Description and value
Byte 1	Response to command frames: 0x07
Byte 2	‘Default settings’ command: 0x03
Byte 3	Indicates whether the reconfiguration was successful: - returns 0x00 to indicate that the configuration was successful. - returns a value other than 0x00 to indicate that the configuration failed.

Obtain complete configuration

To obtain the complete configuration (parameter settings) for the ACW, you must send it the following command:

Byte 1	Byte 2
0x01	0x04

The ACW will return multiple frames with all its parameter settings:

	Description and value
Byte 1	Response to command frames: 0x07
Byte 2	‘Obtain complete configuration’ command: 0x04
Byte 3, n	The parameters contained in the configuration frames.

Obtain the protocol version in use

To obtain information about the version of the ATIM Downlink protocol implemented in the ACW-DIN-RSM, you must send it the following command:

Byte 1	Byte 2
0x01	0x07

The ACW will return the version number in the following format:

	Description and value
Byte 1	Response to command frames: 0x07
Byte 2	‘Protocol version’ command: 0x07
Byte 3	Protocol version (LSB)
Byte 4	Protocol version (MSB)

Modbus request

To achieve a Modbus request, you would need to send the below command:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9 .. 12
0xC1	Size	0x7F	@Modbus Slave	Function code	@Reg/bit LSB	@Reg/bit MSB	Number of registers/bits	Value of bits/Register to force

Size - Byte 2

Frame size from Byte n°3.

- In case of requests:
  - 0x01 = Function code 0x01, Read Coils.
  - 0x02 = Function code 0x02, Read Discrete Inputs.
  - 0x03 = Function code 0x03, Read Holding Registers.
  - 0x04 = Function code 0x04, Read Input Registers

The size must match to the value of 6, because Bytes 9..12 are not necessary in case of reading requests; and the global size of the command must not exceed 8 Bytes, in order to allow its emission through a Sigfox downlink.

- In case of requests:
  - 0x0F = Function code 0x0F, Write Coils (Exclusively available on LoRaWAN version)
  - 0x10 = Function code 0x10, Write Holding Registers (Exclusively available on LoRaWAN version)

The size includes, in addition, the number of extra Bytes representing the number of registers/bits to force. It can therefore vary from 7 to 10.

As the global size will necessarily exceed 8 Bytes (from 9 to 12 Bytes), these two writing requests will not be available on Sigfox versions.

@Modbus slave - Byte 2

This parameter deals with the Modbus ID or the Modbus slave address.

Function code - Byte 5

The possible values for the function code are:

- 0x01 = Function code 0x01, Read Coils.

- 0x02 = Function code 0x02, Read Discrete Inputs.
- 0x03 = Function code 0x03, Read Holding Registers.
- 0x04 = Function code 0x04, Read Input Registers
- 0x0F = Function code 0x0F, Write Coils (Exclusively available on LoRaWAN version)
- 0x10 = Function code 0x10, Write Holding Registers (Exclusively available on LoRaWAN version)

@Reg/bit - Byte 6 and Byte 7

Address of the first register/bit of the slave to read or write. The Byte n°6 deals with the least significant byte of the value and the Byte 7 deals with the most significant byte of the value.

Number of registers/bits - Byte 8

This parameter deals with the number of registers or bits to read or write.

In case of function codes 0x0F, Write Coils and 0x10, Write Holding Registers this parameter is limited in size, because the downlink can not exceed 12 Bytes. (Requests 0x0F, Write Coils and 0x10, Write Holding Registers are exclusively available on LoRaWAN versions)

This deals to:

- For the function code 0x0F: Number of bits ≤ 32bits
- For the function code 0x10: Number of registers ≤ 2 registers (1 register = 2 Bytes)

Values of bits/Registers to force - Byte 9 .. 12

Values exclusively to inquire for function codes 0x0F, Force WriteCoils and 0x10, Write Holding Registers. In case of other requests, these Bytes must not be included in the command to send.

The ACW will return a response to the "Modbus Request" command, as described :

	Description and value
Byte 1	Answer to frames of command: 0x07

<table>
<tr><td><b>Byte 2</b></td><td>Modbus request command: 0x7F</td></tr>
<tr><td><b>Byte 3..n</b></td><td>
<table>
<tr><td>Function code
0x01, 0x02</td><td>Byte(s) including the reading of requested bits. The number of Bytes turned back dealing with the number of multiples of 8 from the number of requested bits plus 1.
Eg : If the reading of 7 bits is requested, the answer will only hold one Byte grouping all 7 bits.
If 9 bits are requested, the answer will hold with 2 octects.</td></tr>
<tr><td>Function code
0x03, 0x04</td><td>Bytes holding the requested registers values.</td></tr>
<tr><td>Function code
0x0F</td><td>The answer does hold one only Byte (Byte 3) which deals with the number of written bits (coded on 1 Byte)</td></tr>
<tr><td>Function code
0x10</td><td>The answer does hold one only Byte (Byte 3) which deals with the number of written registers (coded on 1 Byte)</td></tr>
</table>
</td></tr>
</table>

Example of commands

Modbus request

- ***Reading request of 9 bits on the slave 1 from bit 211***

Request: 0xc1 0x06 0x7F 0x01 0x01 0xd3 0x00 0x09

Answer: 0x07 0x7F 0b$X_{217}X_{216}X_{215}X_{214}X_{213}X_{213}X_{212}X_{211}$ 0b0000000X_{218}
With X_y : value of the bit y

- ***Reading request of 2 registers on the slave 1 from register 15***

Request: 0xc1 0x06 0x7F 0x01 0x03 0x0F 0x00 0x02

Answer: 0x07 0x7F 0xYYYY$_{15}$ 0xYYYY$_{16}$
With 0xYYYY$_z$: value of register z (coded on 2 Bytes)

- ***Writing request of 15 bits on the slave 2 from bit 520***

Request: 0xc1 0x08 0x7F 0x02 0x0F 0x08 0x02 0x0F 0b$X_{527}X_{526}X_{525}X_{524}X_{523}X_{522}X_{521}X_{520}$ 0b0$X_{534}X_{533}X_{532}X_{531}X_{530}X_{529}X_{528}$
With X_y : value of the bit y to write

Answer: 0x07 0x7F 0x0F

- ***Writing request of 2 registers on the slave 2 from register 456 (0x0006 for the register 456 and 0x1A98 for the register 457)***

Request: 0xc1 0x0A 0x7F 0x02 0x10 0xC8 0x01 0x02 0x0006 0x1A98

Answer: 0x07 0x7F 0x02

Troubleshooting

a. The modem cannot be configured via USB or the configuration tool page does not refresh

- Check whether the power supply is correctly connected to the modem
- Check whether the light is flashing
- Make sure that Windows Update is activated, the PC is connected to the Internet and driver installation has completed. Also make sure that you have an up-to-date version of the configuration tool (File menu -> Update).
- Replace the USB cable
- If you receive an ‘Error writing configuration’, unplug the USB cable and plug it back in

b. Radio data not received

- Check whether the power supply is correctly connected to the modem
- Check whether the modem has been registered on the network
- Check whether radio network coverage is available

c. Modem LED is not flashing

- Check whether the power supply is correctly connected to the modem
- Configure the modem using the USB configuration tool

Technical support

For any further information or technical question, you can open a ticket on our technical support dedicated webpage.