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PRODUCT LINE

Downlink Protocol ATIM

Remote configuration of ACW devices

User Guide

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1 Document version history

Version	Date	Description	Author
1.0	25/07/2017	First version: Protocol explanations V1.0.0	AM - CB
1.1	04/10/2017	Addition of information concerning Protocol in version V1.0.1 and V1.1.0	AM
1.2	18/12/2017	Protocol in version V1.1.1: Management of buffered parameters.	AM - YM
1.3	9/04/2018	Renaming of DINRS to DINMM Add DINRS, DINDIO-8, DINDIO-8 / GPS, DINDIO-16 / GPS	AM
1.4	30/06/2020	Addition of ACW-LVL, DIND44, DIND88, DIND21, NWW-SF, TMxP, MR4, TCR and Renaming of DINDIO16-8 to DIND160-80. Protocol V1.2.0: - Addition of a command for the manipulation of the timestamp. - Extension of the command to recover parameters, it is now possible to recover only the parameters specified. - Addition of the type and version of ARM_BLE in response to the “About” command - Addition of a reprogrammed restart. - Addition of the global parameter (0x04) to configure a product in Local mode or not.	AM – YL -AC

2 Downlink versions concerned by this document

Version	Description
1.0.0	First version.
1.0.1	Checking the validity of downlink frames. Add error codes returned in uplink.
1.1.0	Addition of commands with value. Adding common commands.
1.1.1	Management of buffered parameters.
1.2.0	The timestamp parameter is no longer supported by default, but commands to manipulate the timestamp are implemented by default. The command to retrieve the parameters has been extended, it is now possible to retrieve only the specified parameters. Added the possibility of having a scheduled restart. Add global command (0x04) to configure a product in Local mode (FSK / LoRa) or connected mode (Sigfox / LoRaWan)

3 Frame configuration

A configuration frame consists of one or more configuration parameters / values, one after the other. The size of the parameter value is specified for each of them.

Table 1 : Generic format of a configuration frame parameter

Byte 0	Bytes
N|Param	val

- **N (b7 à b6):** indicating the size of the Val field in number of Bytes.
  - Possible values are:

Table 2 : Parameter value size

N	Y(N) – Number of bytes
0	1 byte
1	2 bytes
2	4 bytes
3	Extended frame sees section Extended configuration frame

- **Param (b5 à b0):** 6-bit value corresponding to the parameter. The possible values are between 4 and 63. See Common parameters.
  - 0 is not tolerated or is defined to indicate an end of frame.
  - The 1 is defined for placing orders, which require feedback. See the Command frame section for more details.
  - The 2 is reserved for sending the unix timestamp.
  - The 3 is reserved to send the period of the life frame.
  - Other values are free and specific for each ACW.

- **Val:** The value of the parameter on Y (N) bytes. The least significant byte first.

3.1 Simple frame configuration

Due to the available data sizes, simple configuration frames are available in three formats.

Table 3: Format of a parameter with a value on 1 byte

Byte 0	Byte 1
0|Param 0x00|Param	val[0]

Table 4 : Format of a parameter with a value on 2 bytes

Byte 0	Byte 1	Byte 2
1|Param 0x40|Param	val[0]	val[1]

Table 5 : Format of a parameter with a value on 4 bytes

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4
2|Param 0x80|Param	val[0]	val[1]	val[2]	val[3]

3.2 Extended frame configuration

To configure a larger value or a subframe, it is possible to create an extended frame of the following format:

Table 6 : Format of an extended configuration frame

Byte 0	Byte 1	Bytes
3|Param 0xc0|Param	Size	Value or subframe

- **N (b7 à b6) = 3:** Indicates an extended frame (of variable size).
- **Param (b5 à b0):** These 6 bits correspond to the parameter. Same function as in the Configuration frame section.
- **Size:** The size in Bytes of the next value or subframe.
- **Value or subframe:** Data specific to the value or subframe. The format of this subframe is free for each ACW.

3.3 Configuration frame for buffered parameters

For example, the configuration of a Modbus frame calls on several parameters. To optimize the limited space of a downlink frame, it is possible to send only the Bytes of the sub-parameters which need to be modified.

All or part of the sub-parameters can be stored in a buffer. Unlike a "classic" parameter, the first Byte of the value corresponds to the index in Bytes in the buffer. Everything must be integrated into a simple or extended configuration frame.

For example, if we have parameter 34 which would in fact be a buffered parameter of 9 Bytes and we want to write 12 and 96 respectively in Bytes 5 and 6, the frame to generate would be the following (extended frame) :

Byte 0 param	Byte 1 Size	Byte 2 Index	Byte 3 Byte 5 of parameter	Byte 4 Byte 6 of parameter
3|34=0xe2	3	5	12	96

- If we want to write 254 in Byte 2, the frame to generate would be as follows (single frame):

Byte 0 param	Byte 2 Index	Byte 3 Byte 2 of parameter
1|34=0x62	2	254

3.4 Common parameters of ACW product line

They must be implemented on all products in the ACW range.

Table 7 : Common parameters

Description	Parameters	Used Byte	Data
Undefined or end of frame	0	0	NA
Command frame	1	1	Cmd
Date setting	2	4	Unix timestamp in minutes LSB first, on Byte 0) **Note:** This parameter is no longer implemented since version V1.2.0
Life frame configuration	3	1	0x00 = Disabled 0x05 = Every hour 0x0a = Every two hours 0x0b = Every four hours 0x0c = Every eight hours 0x06 = Everyday 0x0d = Every two days 0x0e = Every three days 0x0f = Every four days 0x07 = Every week 0x08 = Every month (30 days) **Note:** The ACW-TH escapes the above values. Refer to the ACW-TH documentation for more details. **Note:** Depending on the ACW model, some values are not available. Refer to the documentation of the ACW model concerned for more details.
Radio Configuration	4 (Byte 0 = 0x84)	3	**Byte 1**: Radio mode (0 = Sigfox/LoRa ; 1 = mode local) **Byte 2**: in local mode only, radio channel LSB **Byte 3**: in local mode only radio channel MSB
Frame timestamp	11 (Byte 0 = 0x0b)	1	**0x01 =** each frame contains timestamp (4 bytes are used) **0x00** = frames do not contain timestamp

3.5 Command frame

A command frame is similar to a configuration frame; however, a command frame consists of a single command on the first Byte.

From version V1.1.0, the Bytes following this first Byte correspond to data used by the command. The 0 is not an order and is excluded.

3.5.1 Common commands

The following commands are common to all models in the ACW range. They must be implemented on all products in the ACW range.

Description	Command	Value	Available from
Empty	0	None	V1.0.0
Restart	1	None	V1.0.0
Schedule restart		Restart hour (EPOCH)	V1.2.0
About	2	None	V1.0.0
Reconfigure with default settings	3	None	V1.0.0
Get all configuration parameters	4	None	V1.0.0
Get some of the configuration parameters by specifying them		Parameters list	V1.2.0
Reserved	5		
Reserved	6		
Obtain the version of the protocol used	7	None	V1.1.0
Get date / timestamp	8	None	V1.2.0
Apply a date / timestamp		Date	V1.2.0
Date / timestamp adjustment in seconds		Value in seconds	V1.2.0
Reserved	9		

Table 8 : Common commands of the ACW product line devices

3.5.1.1 Details on command 4 "Parameter recovery"

- ***Get all the configuration parameters***

To request all configuration parameters, the value of this command must not contain a Byte. The values returned by this command are in the same format as the uplink frames, see the Configuration frame section for more information.

Note: The response of this command can be done in several uplinks in the case where all the parameters do not pass in a single frame.

- ***Obtain a part of the configuration parameters by specifying them***

It is possible to request a certain number of parameters, the value of this command must contain as many Bytes as desired parameters. The values of these Bytes must correspond to the codes of the desired parameters. The values returned by this command are in the same format as the uplink frames, see the Configuration frame section for more information.

Note: The response of this command can be done in several uplinks in the case where all the parameters do not pass in a single frame.

3.5.1.2 Details on the command 8 "date manipulation"

- ***Get the date/timestamp***

To request the date, the value of this order must not include a Byte. The value returned by this command is in EPOCH format, corresponding to the number of seconds elapsed since January 1, 2013 at 00:00. This value is defined in UTC time.

- ***Apply a date/timestamp***

To assign a date, a value of 4 Bytes in EPOCH format, since January 1, 2013 at 00:00 UTC time, must be sent. This same value will be returned if everything went well.

- ***Date / timestamp adjustment in seconds***

To adjust the date, a value of 2 Bytes coded in addition to two indicates the number of seconds to subtract or add. A value of 4 Bytes representing the new date in EPOCH format since January 1, 2013 at 00:00 UTC time will be returned.

4 Response frames

Three types of response can be generated:

1. 0x06: Response to a configuration frame.
2. 0x07: Response to a command frame.
3. 0x08: Response to an error frame.

4.1 Response to configuration frames

For each configuration frame, the ACW products respond with an acknowledgment frame. This acknowledgment frame informs independently of the configuration status of each of the parameters that have been passed.

The format of the acknowledgment frame is as follows:

Table 9 : Generic format of a response frame to a configuration

Byte 0	Bytes
Header ACW (0x06)	Result

- **Header ACW (0x06):** Corresponds to the value of the ACW header of an acknowledgment frame.
- **Result:** Variable size fields, inform about the success or failure of each of the parameters configured by the previous downlink. The least significant Byte (the Byte which contains the parameter bit 0) is sent first.

The size of the result field is defined by the following formula:

Number of Bytes = INT(number of parameters/8)+1

Acknowledgments are represented by a bit for each of the parameters. 0 indicates that the parameter has been considered (no error) and 1 corresponds to a failure (error).

The format of a Result Byte is as follows:

Table 10 : Breakdown of the result

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Ack param7	Ack param6	Ack param5	Ack param4	Ack param3	Ack param2	Ack param1	Ack param0

Note: From version V1.0.1 of the Downlink protocol, if a parameter is not valid, no parameter will be applied. The configuration of the ACW modem will remain unchanged.

4.1.1 Example: Response to a configuration frame

In the case of a configuration frame of two parameters X and Y, with X parameter 1 and Y parameter 2 the possible responses are:

- If the two parameters could be correctly considered by the ACW, the response frame is:

Byte 0	Ack
Header ACW (0x06)	0x00 (0b00000000)

- If Y could be considered (param 2) but not X (param 1), the response frame is:

Byte 0	Ack
Header ACW (0x06)	0x01 (0b00000001)

- If X could be considered (param 1) but not Y (param 2), the response frame is:

Byte 0	Ack
Header ACW (0x06)	0x02 (0b00000010)

- If the two parameters could not be correctly considered by the ACW, the response frame is:

Byte 0	Ack
Header ACW (0x06)	0x03 (0b00000011)

Note: In the case of an ACW-TH, to configure the product in periodic transmission mode (param 0x0700) with sending the life frame once every 8 days (param 0x0302), the downlink frame will then be: 0x07000302 in LoRa , and 0x0700030200000000 in Sigfox (because 8 Bytes of data are required in Sigfox).

The possible responses by Uplink are:

- 0x0600: both configurations are OK
- 0x0601: configuration of the mode is KO, configuration of the keep alive frame is OK
- 0x0602: configuration of the mode is OK, configuration of the keep alive frame is KO
- 0x0603: both configurations are KO

4.2 Response to command frames

For each command frame requiring a response, the format of the frame is as follows:

Table 11 : Generic format of the response frames to a command

Byte 0	Byte 1	Bytes
Header ACW (0x07)	Cmd	Response to a command

- **Header ACW (0x07):** Corresponds to the value of the ACW header of a command response frame.
- **Response to the command:** Variable size fields depending on the order. The least significant Byte is always sent first.

Note: In the case where the response frame is limited in number of Bytes (ex: 12 for Sigfox), two or more successive frames can be created and transmitted.

4.2.1 Response to common commands

Table 12 : Breakdown of the response

<table>
<tr><th>Description</th><th>Command</th><th>Response</th></tr>
<tr><td>Restarting</td><td>1</td><td>No response frame will be sent.</td></tr>
<tr><td>About</td><td>2</td><td>
<table>
<tr><td>Byte2</td><td>ACW TYPE
(See

Table 13)</td></tr>
<tr><td>Byte3</td><td>ACW REV lsb</td></tr>
<tr><td>Byte4</td><td>ACW REV msb</td></tr>
<tr><td>Byte5</td><td>ARM TYPE
(Voir Table 13)</td></tr>
<tr><td>Byte6</td><td>ARM REV lsb</td></tr>
<tr><td>Byte7</td><td>ARM REV msb</td></tr>
<tr><td>Byte8,n</td><td>Serial number (Id lw|sfx) MSB first.</td></tr>
</table>
</td></tr>
<tr><td>Reconfiguration with default settings</td><td>3</td><td>Byte2 = 0 -> OK
Byte2 != 0 -> KO</td></tr>
<tr><td>Get the full configuration</td><td>4</td><td>Configuration frame with all parameters (used or not) of the ACW product</td></tr>
<tr><td>Protocol version to use</td><td>7</td><td>Byte2 = REV lsb

Byte3 = REV msb</td></tr>
</table>

Table 13 : Detail of ACW product type and ARM radio modules

ARM	Value	ACW	Value
UNKNOWN	0	UNKNOWN	0
N8_LP	1	DI2	1
N8_LD	2	MR2	2
N8_SFU	3	TMxD	3
N8_SFD	4	DIO	4
N8_LW	5	DA1	5
N8_LR	6	DINMM	6
P8_LP	7	GW	7
P8_LD	8	TH	8
P8_SFU	9	DIND160	9
P8_SFD	10	DINRS	10
NWW_SF	11	DIND80	11
BLE	12	DINDIO-16/GPS	12
		DINDIO-8/GPS	13
		DIND44	14
		DIND88	15
		LVL	16
		DIND21	17

4.3 Response to error frames

Only available from version v1.0.1: Following the sending of a command or configuration downlink frame, an error can be detected and the uplink frame in the format below will be returned.

Byte 0	Bytes
Header ACW (0x08)	Error code

List of the different error codes available:

Error code	Description	Available from
0x00	Non used	V1.0.1
0x01	Error frame: The configuration frame is incorrect, or commands and parameters are present in the same frame.	V1.0.1
0x02	Unknown or inconsistent command: The command is not known to ACW.	V1.0.1
0x03	Unknown parameter: at least one parameter is not known to the ACW.	V1.0.1
0x04	Error while executing the command. The command could not be executed. It is likely that the data sent with this command is incorrect.	V1.0.1
0x05	Wrong buffered parameter. The index corresponds to no box in the buffer. The requested size or the size relative to the index exceeds that of the buffer.	V1.1.1

5 Examples

5.1 Sending multiple configurations

In this example, we want to send the configuration of the life frame every 3 days and change the date to February 2, 2017 at 2:07 p.m. (ATTENTION: This parameter no longer exists since version V1.2.0).

5.1.1 Configuration

Both *Header* are used here:

Name	Param Header	Number of used Bytes	Byte of Header
Keep alive frame	3	1	0x03
Date	2	4	0x82

The value of the date and in Unix timestamp format in minutes. The date of February 2, 2017 at 2:07 p.m. is 1486040820 seconds or 24767347 minutes (0x179eb73).

The possible values for the life frame are shown below:

Value	Periodicity
0x04	Every 10 minutes
0x05	Every hour
0x0a	Every two hours
0x0b	Every four hours
0x0c	Every eight hours
0x06	Everyday
0x0d	Every two days
0x0e	Every three days
0x0f	Every four days
0x07	Every week
0x08	Every month (30 days)

In green is shown the value that we want to apply.

5.1.2 Configuration frame

The frame to send is therefore the following:

Parameter 1		Parameter 2				
0x03	0x0e	0x82	0x73	0xeb	0x79	0x01

5.1.3 The response

- If the two parameters could be correctly considered by the ACW, the response frame is:

Header	Ack
0x06	0x00 (0b00000000)

- If the timestamp could be considered (parameter 2) but not the life frame (parameter 1), the response frame is:

Header	Ack
0x06	0x01 (0b00000001)

- If the two parameters could not be correctly considered by the ACW, the response frame is:

Header	Ack
0x06	0x03 (0b00000011)

5.2 Sending a command

this example, we want to recover the version of the ACW and the ARM module. The Header for an order is 0x01. The command to retrieve version numbers is 0x02. The following frame must be generated:

Header	Cmd
0x01	0x02

The ACW will respond for example the following frame

Header	Cmd	ACW Type	ACW Rev 0x0100		ARM type	ARM Rev 0x5836		ARM serial number 0x001cdc2b			
0x07	0x02	0x04	0x00	0x01	0x04	0x36	0x58	0x00	0x1c	0xdc	0x2b

- 0x04 for the ACW type, here DIO.
- 0x0100 por the 1.0.0 version of the ACW
- 0x04 for the ARM type, here N8_SFD.
- 0x5836 for the 5836 version of the ARM nano.
- 0x001c1c2b for the ARM serial number. Here this deals with the Sigfox ID.

5.2.1 Product restart

To restart the product, the command to send is as follows: 0x0101

Table 14 : Restart frame restart constitution

Byte 0	Byte 1
0x01	0x01 = Restart

The product restarts without sending any response frame.

5.2.2 Retrieving product information

To obtain information about the product (rev ACW, rev ARM, ...): 0x0102

Table 15 : Device information request frame constitution

Byte 0	Byte 1
0x01	0x02 = About

The response is: 0702080305043159002D6818

The decoding is available in Table 16. This gives the following translation: The product is an ACW-TH, its application firmware version is 5.0.3. The radio module is an ARM-N8-SF version 5931, its identifier is 2D6818.

Table 16 : Decoding a response frame to a product information request

Byte	Value	Corelation
0	0x07	Header ACW
1	0x02	Answer to command 'about'
2	0x08	ACW type 08 = TH
3	0x03	Version ACW LSB
4	0x05	Version ACW MSB
5	0x04	ARM type 04 = N8_SFD
6	0x31	Version ARM LSB
7	0x59	Version ARM MSB
8-n	0x002D6818	ID module