WaveLog modules User manual

Version 1

REVISIONS HISTORY

Rev. #	Description	Author	Date	Comments
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FIRMWARE VERSION SUPPORTED

Rev. #	Firmware version supported	Date
1	v1.0	5 Jan 05

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1 PRESENTATION

This document describes the functionalities of a WaveLog module, designed to manage digital Inputs/Outputs. It is intended to send a radio frame to a receiver equipment, following the detection of a change of state on digital inputs ; and to act on specifics digital outputs.

It is designed to send radio frames describing the current state of digital inputs, as well as a table containing the last logged events. This table is available by different methods :

- sent on radio request,
- sent periodically, with previously configured period.

This document also defines in an exhaustive way the applicatives data relating to serial dialog frames between a Wavecard and a host equipment , used to reach the data of the WaveLog radio module.

It describes the method to use for the parameters setting :

- selection of the inputs to use,
- configuration of the detection of a change of state,
- override the digital outputs,
- date and time,
- operating mode (periodic transmission, etc...),
- configuration of the radio address of the receiver equipment.

2 REFERENCE DOCUMENTS

Ref	Title	Reference	Version	Date
DR[1]	WaveCard user handbook			

3 PRESENTATION OF THE WAVELOG MODULE

3.1 RADIO FREQUENCY CHARACTERISTICS

This characteristics are given for a temperature range from -20°C to 50°C.

Characteristics	Min	Typ.	Max
Operating frequency			Bands 868 – 868.600 Mhz 868.700 – 869.200 Mhz
Channel width			50 Khz
Frequency drift			16 Khz
Transmission speed			9600 Baud in NRZ mode
Type of modulation			GFSK
Receiver sensitivity(1) for a BER = 1%	-108dbm	-110 dbm	
Transmission power [1]	10 dbm	12 dbm	
Line of sight range			800 m

[1] : The sensitivity and radio power characteristics are given in conduit (load 50 Ohms).

3.2 ELECTRICAL CHARACTERISTICS

Characteristics	Value / Norm
Powered by Consumption in stanby mode	One battery Lithium-thionyl chloride (Li-$SOCl_2$) 3.6Volt < 5µA
Consumption in radio transmission Consumption in radio reception	< 40mA < 17mA
Radiofrequency norm	EN 300-220-1

3.3 PHYSICAL CHARACTERISTICS

- Protection index available :

  IP65 : *totally protected against dust and water spray and splashing from all directions.*

  IP68 : *totally protected against dust and prolonged immersion under certain conditions.*

- Operating temperature range : [-20°C ; +70°C]
- Storage temperature: [0 ; +50°C] **(*)**

  ***(*)** High storage temperatures may result in battery passivation problems. The ideal storage temperature is between 10°C and 30°C.*

4 WAVELOG MODULE FUNCTIONS

4.1 INPUTS/OUTPUTS PHYSICAL CHARACTERISTICS

The WaveLog manages up to 4 dry-contact inputs, and up to 4 digital outputs.

The inputs must be of type non-polarized (dry-contact or open collector). The polarization of the inputs is provided by a port of the internal microcontroller whose tension can vary between 2,5V and 2,7V, it is provided through resistance of recall of 10 Kohms. The characteristics of the entries are as follows :

Parameter	Conditions	Mini.	Typical	Max.	Unit
capacitive load of the connected sensor	Vcc = 2.5 / 2.8 V			10	**nF**
Input voltage low (VIL)	Temperature range = -20°C to 70°C	0		0.4	**V**
Input voltage high (VIH)		0.8 Vcc		Vcc	**V**

The outputs are all digital outputs (nominal Vcc = 2,7 V ± 2%)
Each output can provide a maximum current of 1mA.

When the monitoring of the inputs is activated, The sampling period of the inputs is fixed at 100 ms. Consequently, the WaveLog module can detect changes of state only if the duration of the new state is stable during a time higher than 100 ms.

After being sampled, the samples are stored in a circular buffer. This buffer is used not to lose events, when the system execute another task. It has a storage capacity allowing to accumulate the samples during 20sec.

Periodically, Wavelog treats the samples contained in this buffer and, according to the parameter setting, will generate an event or a sending of alarm.

4.2 MANAGEMENT AND EVENT CONFIGURATION

The Wavelog module can be configured to detect events on monitored inputs. An event is a modification of a state occuring on one or more of the inputs monitored by the module, and corresponding to parameters setting.

An event can be configured by one or more of the following conditions :

- Detection of the rising edge of an input;
- Detection of the falling edge of an input;
- Detection of a state modification of an input;
- Detection of a time expiry on a closed contact.

  For example, a contact is closed during more than 10 seconds.
- Detection of a time expiry on an opened contact.

  For example, a contact is opened during more than 10 seconds.

According to the configuration, each input can generate two types of events :

- An event triggering an alarm message;
- An event logged in internal storage table.

a same event can be logged into an internal storage table, and at the same time, can trigger an alarm message.

The configuration bytes of the inputs is described on chapter 8.5.

4.3 STORAGE TABLE OF THE EVENTS

The events storage table memorize the last detected events. When the table is filled out, the last events crush the oldest ones, This mechanism is called a circular table.

The maximum number of events that can be stored in the table is 500.

A radio command allow to recover in a simple way the last 10 events. Another more complex radio command allow to recover whole or part of the events table. This command use the multi-frame mode of the Wavenis protocol.

Each event stored in the table, contains the following information :

- The current state of sampled input,
- The event type (input number)
- the date and time of the event
- Information relating to the emission of an alarm frame, and to the reception of its acknowledgement.

A detailed description of the various fields is presented at chapter 7.1 relating to the reading of the events table.

4.4 ALARM CONFIGURATION

The WaveLog module can be configured to generate alarms. These alarms are radio frames transmitted to a radio equipment whose radio address was configured beforehand.

Each event detection related to an input can lead to the transmission of an alarm frame.

An alarm frame contains the following information :

- The status of the module,
- The state of the inputs / outputs, when the events was detected,
- The cause of the alarm trigger,
- The date and time of events detection.

The format is described in chapter 8.7.

4.4.1-Preliminary parameter settings

A specific parameter setting allows to define the recipient equipment of the alarm frames, and its relay route, i.e. the possible repeaters equipments installed if the distance between WaveLog and its recipient is larger than the radio range. This parameter setting is carried out by specific radio commands.

4.4.2-Inhibition of the alarms mode on radio problem

When the WaveLog module is configured to send alarms on event detection, the receiving application of alarms has to acknowledge it.

If the module send alarm frames related to 5 consecutive events, without receiving any acknowledgement ; then it will disable the alarm sending mode, by setting the bit b3 of the *Operating mode* byte to 0. This bit will have to be written to 1 to reactivate the mode.

4.5 PERIODIC FRAMES TRANSMISSION

A specific parameter setting allows the cyclic sending of a frame according to a frequency which can be configured. This mode allows a recipient module to check the correct operation of the WaveLog module and to repatriate in a periodic way the state of inputs and outputs contacts.

When this mode is activated, the sending of the frame is carried out periodically until the inhibition of the mode. The sending period is defined in multiples of hours.

The emitted frame allows to visualize the current state of the inputs as well as the last 10 events detected on the inputs of the module.

The structure of the transmitted data is described in chapter 8.8.

4.5.1-Inhibition of the periodic sending mode on radio problem

When the WaveLog module is configured to send periodic frames , the receiving application has to acknowledge each periodic frame received.

If the module send 5 consecutive periodic frames (retries not counted), without receiving any acknowledgement ; then it will disable the periodic sending mode, by setting the bit b1 of the *Operating mode* byte to 0. This bit will have to be written to 1 to reactivate the mode.

4.6 OUTPUTS OPERATING MODE

The digital outputs of Wavelog can be controlled individually. The inactive state is low level, the active state is the high level (2,7V). The maximum current that a digital output can provide is of 1mA.

These outputs can be either of pulse type or of maintained level type. They can be configured on specific radio requests :

1. to generate pulses with variable durations (from 100ms to 2s by step of 100ms)
2. to position in a stable state (standard use in state transfer mode)

> ***Remark** : To position a stable state is not authorized for self-powered modules. Indeed, keeping an input at the active level can cause an overconsumption which is not compatible with the life duration awaited from this product (several years).*
>
> *This configuration will be allowed if the product is powered by an external power supply.*

- **Impact on consumption**

The management of digital outputs has a considerable impact on the consumption of the battery. The principal factors are:

1. the frequency of outputs management.
2. the current required by these outputs.
3. the duration of the impulses.

The appendix B relating to the autonomy of the product defines for which conditions the life duration are calculated.

4.7 STATE TRANSFER MODE

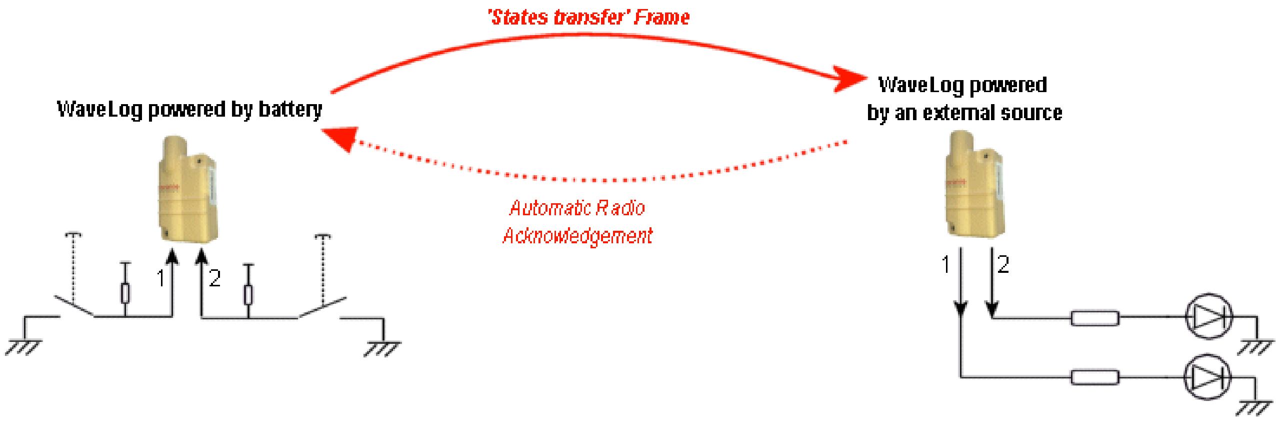
The principle of operation of the state transfer mode is to apply to the outputs of a WaveLog module, a state received from another WaveLog.

However, receiver WaveLog will have to be equipped with an external power supply whereas the transmitter can be self-powered.

A specific factory setting is applied to the WaveLog modules intended to be powered by an external power supply. This configuration allows to activate the states transfer mode.

The states transfer mode uses the emission of alarms frames or frames of 'states transfer' and allows WaveLog to transmit a frame when a state on its inputs changes. This frame must be transmitted so that it is received by another WaveLog recipient which will apply the change of state to its associated outputs.

- Application example :



A rising edge on input 1 of WaveLog will be transfered on output 1 of receiver WaveLog. In the same way, the changes of states on inputs 2,3 and 4 will be transfered on outputs 2,3 and 4. WaveLog recipient has to acknowledge the received alarms frames.

4.8 WAKE-UP SYSTEM MANAGEMENT

In order to reduce module power consumption, a wake-up period parameter setting system is incorporated. This system enables modification of the module wake-up period (default setting 1 s) by entering a time and day of the week :

- The wake-up period default value may be modified;
- Two time-windows with different wake-up periods may be defined;
- Each day of the week may be set in one of the following three cases :
  - Wake-up period default setting
  - Wake-up according to predefined time windows
  - No wake-up period (for safety reasons, the module is not disabled on reception and it wakes up every 10 seconds)

***Note :** The system is disabled by default and must be enabled by writing a specific profile in the wake-up system status word.*

4.9 DETECTION OF CONFLICTS ON INPUTS

The WaveLog module has an internal algorithm allowing to detect conflicts on the monitored inputs. When a bad level is detected, the bit b2 of the *Application Status* byte is positioned to "1".

The inputs must be of type non polarized (dry contact or open collector), if a defect is detected, the inputs are probably in short circuit or a bad level is present. A bad connection of the inputs can generate an overconsumption.

4.10 END OF BATTERY LIFE DETECTION

To detect the end of battery life, the **WaveLog** module uses the power metering principle rather than measurement of the battery voltage. Lithium batteries are, in particular during passivation, unsuitable for the voltage measurement method to determine the remaining capacity.

The **WaveLog** records and evaluates all events (measurements, transmissions) to decrement the power meter according to the battery used. When the meter passes below a predefined threshold, the “end of battery life” is signalled with the APPLICATION STATUS byte (see chapter 6.1).

The initial value of the end-of-life meter is factory-set. It depends on the type and number of batteries used.

4.10.1-Description of the parameters used

Parameter number	Description	Size (in bytes)	Access rights	Default value
0x20	Application Status byte	1	R/W	0x80
0x90	End of battery life detection date	6	R/W	0x00

When the end of battery life is detected, the bit “end of battery life” of the APPLICATION STATUS byte is set to 1. Then, the detection date is memorised and may be read with a radio command. (detail of the date and time format described in chapter 6.3)

5 DATA EXCHANGE PRINCIPLE WITH A WAVELOG MODULE

The WaveLog module uses the **WAVENIS®** protocol

The choice of mode used is initiated by the read element which uses a different set of commands (see WaveCard document) when sending commands to the WaveCard.

The following chart indicates the read modes possible as well as their typical applications.

Read mode	Description	Recommendations
Peer-to-peer	Individual reading with re-transmission management in case of no reply	Standard use
Polling	This mode enables successive polling of several modules in a single operation . The principle consists of waking up several modules with the 1st radio transmission.	To be used when module reading time is an important factor. Re-transmission not possible.
Broadcast and multicast (*)	This mode enables use of a single frame to address all radio modules within reception range. The multicast mode may only address one group of modules.	This mode enables reading of modules without knowing their radio address. Type of use: detection of radio modules within range of the emitter module (installation phases).

- **Additional functions:**

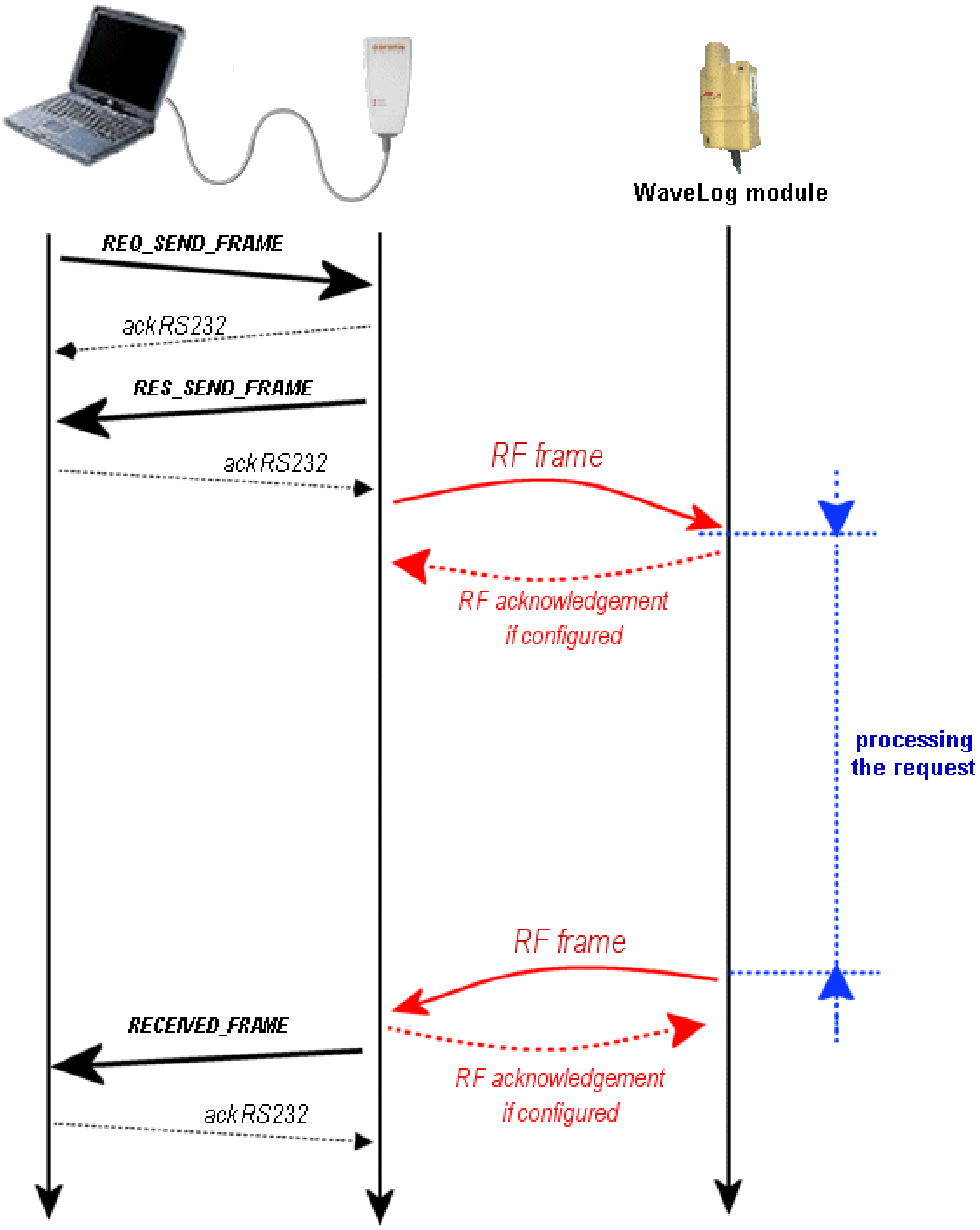
Additional functions	Compatibility	Description	Recommendations
Repeater	Only used in peer-to-peer mode.	This function enables use of a radio module to relay a frame which was not initially intended for this module. This is a default function of the WaveLog module, i.e. it may be read via several repeaters but may also act as a repeater itself when reading another unit.	This function is used when the caller module and the target WaveLog module are outside radio range. The maximum number of repeaters is limited to 3.

Attention: collection of data in multi-frame mode (extended reading of the events table) is not possible in repeater mode.

- **Example in Point-to-point mode :**

> ***Remark*** *: Generally, the exchanges examples given in this document will be in Point-to-point mode, except when the context depends directly on the mode of exchanges.*

This type of radio exchange allows to send a request, then to await a response of the remote equipment.



Note : the commands of Point-to-point exchanges, have the following format: (all the exchanges modes are treated in document [DR1])

CMD	NAME	DESCRIPTION
0x20	REQ_SEND_FRAME	Request to send a radio frame with the waiting for the radio response.
0x30	RECEIVED_FRAME	Received radio frame by the radio board.

The data field of each command must be formatted according to the following table :

CMD	DATA	
	6 bytes	variable (max : 152 bytes)
0x20	**Radio address from equipment to reach**	**Data to transmit**
0x30	**Radio address from transmitter equipment**	**Received Data**

the first byte of the field 'data to transmit' (or 'Received Data') contains an applicative command (or its acknowledgement). That allows to the receptor of the frame to identify the type of requests (or of responses).

	Data to Transmit or Received Data	
	1 byte	151 bytes
REQ_SEND_FRAME	Applicative command	Data relating to the request
RECEIVED_FRAME	Acknowledgement of the applicative command	Data relating to the response

The commands set is available in Appendix 1.

ATTENTION, This document describes only the format of the fields 'Data to Transmit', 'Received Data'. These fields are directly dependent on the access to the functionalities of the WaveLog modules. The other fields of the radio frame depend on the exchanges modes chosen, and are detailed in document [DR1].

5.1 OPERATIONAL LIMIT RELATIVE TO THE VARIOUS COMMUNICATION MODES

When the monitoring of the inputs is activated (via the *Operating mode* byte), the samples are stored in a circular buffer. This buffer is used not to lose events, when the system execute another task. It has a storage capacity allowing to accumulate the samples during 20sec.

Periodically, Wavelog treats the samples contained in this buffer and, according to the parameter setting, will generate an event or a sending of alarm.

By using the modes of communication Polling, broadcast, or muli-frame, according to the environment, certain exchanges can last more than 20 seconds. In this case the end of the buffer will be reached, and some transitions detection might be lost. When the saturation of the buffer is reached, the bit *'acquisition discontinuity of the monitored inputs'* is set to "1" in the *Application Status* byte describes in the chapter 6.1.

6 PARAMETER SETTING OF THE WAVELOG MODULE

6.1 INTERNAL PARAMETERS LIST ACCESSIBLE BY RADIO COMMANDS

The following table describes the internal parameters like their access rights, via the reading or writing radio requests.

N°	Description	Size (in byte)	Access right	Value		
				Default	Minimal	Maximal
0x01	Operating Mode	1	R/W	0x00		
0x02	WakeUp system status word	1	R/W	0x00		
0x03	Default WakeUp period (in second)	1	R/W	0x01	0x01	0x0A
0x04	Start time for 1st time window	1	R/W	0x07	0x00	0x17
0x05	WakeUp period for 1st time window (in second)	1	R/W	0x01	0x01	0x0A
0x06	Start time for 2nd time window	1	R/W	0x12	0x00	0x17
0x07	WakeUp period for 2nd time window (in second)	1	R/W	0x01	0x01	0x0A
0x08	Enalbe time windows by day of the week	1	R/W	0xFF		
0x09	Enable WakeUp periods by day of the week	1	R/W	0x00		
0x0A	number of loop of the table of events	1	R	0x00		
0x0B	Number of events stored in the table (LSB first)	2	R	0x0000		
0x10	Numbers of retries of transmission of alarm frames.	1	R/W	0x01	0x00	0x05
0x11	delay between two retries of transmisstion of alarm frames. (in seconds)	1	R/W	0x3C	0x0A	
0x12	Transmission period of the periodic frames (in multiples of minutes, with a minimum of 60 minutes for the self-powered version)	2	R/W	0x05A0		
0x13	Numbers of retries of transmission of periodic frames	1	R/W	0x01	0x00	0x05
0x14	delay between two retries of transmisstion of periodic frames (in seconds).	1	R/W	0x3C	0x0A	
0x15	Duration of the WakeUp preamble (WUP) of the periodic frames and alarm frames (in multiples of 50ms).	1	R/W	0x03	0x01	0x16
0x20	Application Status	1	R/W	0x80		
0x30	Input 1 configuration byte	1	R/W	0x00		
0x31	Input 2 configuration byte	1	R/W	0x00		
0x32	Input 3 configuration byte	1	R/W	0x00		
0x33	Input 4 configuration byte	1	R/W	0x00		
0x34	stability duration on input 1 (in multiples of 100ms)	1	R/W	0x01	0x01	
0x35	stability duration on input 2 (in multiples of 100ms)	1	R/W	0x01	0x01	
0x36	stability duration on input 3 (in multiples of 100ms)	1	R/W	0x01	0x01	
0x37	stability duration on input 4 (in multiples of 100ms)	1	R/W	0x01	0x01	
0x38	impulse duration on output 1 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x39	impulse duration on output 2 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x3A	impulse duration on output 3 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x3B	impulse duration on output 4 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x85	Group number to use in polling mode	1	R/W	0x00		
0x86	Group number to use in multicast mode (selective broadcast)	1	R/W	0x00		
0x90	Date of detection of end of battery life	6	R/W	0xFFFFFFFFFFFF		

0xA1	Firmware version	1	R			
0xB0	Number of repeaters used to transmit an alarm frame	1	R/W	0x00	0x00	0x03
0xB1	Address of the 1st repeater used to transmit an alarm frame	6	R/W	-		
0xB2	Address of the 2nd repeater used to transmit an alarm frame	6	R/W	-		
0xB3	Address of the 3rd repeater used to transmit an alarm frame	6	R/W	-		
0xB4	Address of the recipient of the alarm frame	6	R/W	0xFFFFFFFFFFFF		

➢ definition of the ***Operating Mode*** byte :

MSB **LSB**

Operating Mode							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
-	-	-	-	**Transmission of alarm frames or 'states transfer' frames, on event** **0 :** deactivated **1 :** activated	**Storage of events** **0 :** deactivated **1 :** activated	**Periodic transmission** **0 :** deactivated **1 :** activated	**Alarm on end of battery life** **0 :** deactivated **1 :** activated

When the transmission of alarm frame on event is activated, the storage of the event in the events table will be automatically induced.

- **Transmission of alarm frames or 'states transfer' frames, on event** : when this bit is set, the monitoring of the inputs is activated (sampling every 100ms). And the sending of alarm frames, or 'states transfer' frames is authorized.

- **Storage of events** : when this bit is set, the monitoring of the inputs is activated (sampling every 100ms). And each transitions detected will be stored in the events buffer.

- **Periodic transmission** : when this bit is set, the inputs are sampled just before sending the periodical frame.

- **Alarm on end of battery life** : authorize to send an alarm frame, when the end of battery life is detected.

- Definition of the ***Application Status*** byte

MSB **LSB**

Application Status							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reset indicator **0 :** not detected **1 :** detected	Conflict detection on digital inputs **0 :** not detected **1 :** detected	-	-	-	-	**acquisition discontinuity of the monitored inputs.** **0 :** not detected **1 :** detected	**End of battery life detected** **0 :** not detected **1 :** detected

> ***The bits are repositioned to zero by a standard command of writing of the parameter Application Status.***

6.1.1-Factory setting

the module is configured in factory with default settings. The configuration is as follows :

- Default WakeUp period set to 1 second.
- No specific WakeUp management activated
- Alarm frames not activated
- monitoring of the inputs not activated,
- Periodical frames not activated.

6.2 PRINCIPLE OF READING AND WRITING OF INTERNAL PARAMETERS

Document [DR1] details the exchanges modes, and their associated requests; with an aim of sending data to a distant module.

This chapter details the data field in order to configure the internal parameters of the Wavelog modules.

	DATA Field	
	1 byte	Max = 151 bytes
REQ_SEND_FRAME	Applicative Commands	Data
RECEIVED_FRAME	Acknowledgement of the applicative commands	Data

There are two commands used to configure the internal parameters of the WaveLog modules, and each one has a corresponding acknowledgement command.

Applicatives Commands	Description
0x10	Request of parameter(s) reading
0x90	Acknowledgement of the request of parameter(s) reading
0x11	Request of parameter(s) writing
0x91	Acknowledgement of the request of parameter(s) writing

***Remark :** In the command byte coding, the Response frame type are taking the Request command byte value with the MSB bit set to 1.*

***It is possible to access up to 10 parameters simultaneously for writing or reading** (all for reading, or all for writing).*

➢ Format of access for parameter(s) reading

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)						
Applicative command	Number of parameters to be read	Number of the 1st parameter	Size of the 1st parameter	Number of the 2nd parameter	Size of the 2nd parameter	...
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	...

- contents of response RECEIVED_FRAME

Data field (max : 152 bytes)								
Acknowledgement of the applicative command	Number of parameters read	Number of the 1st parameter	Size of the 1st parameter	Data of the 1st parameter	...	Number of the nth parameter	Size of the nth parameter	Data of the nth parameter
1 byte	1 byte	1 byte	1 byte	variable	...	1 byte	1 byte	variable

n_{max} **= 10**

When a parameter is not known by the system, or the size is configured with a wrong value, the corresponding data byte in response is set to 0xFF.

➢ Format of access for parameter (s) writing

- contents of request REQ_SEND_FRAME

Data field (max : 152 bytes)								
Applicative command	**Number of parameters read**	**Number of the 1st parameter**	**Size of the 1st parameter**	**Data of the 1st parameter**	**...**	**Number of the nth parameter**	**Size of the nth parameter**	**Data of the nth parameter**
1 byte	1 byte	1 byte	1 byte	variable	...	1 byte	1 byte	variable

n_{max} = 10

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)						
Acknowledgement of the applicative command	**Number of parameters written**	**Number of the 1st parameter**	**Update Status**	**Number of the 2nd parameter**	**Update Status**	**...**
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	...

'Update Status' :	*0x00 : update OK*
	0xFF : update error

6.3 Setting the date and time of the module

Applicative command	Description
0x13	Request to set the date and time of the module
0x93	Response to request to set the date and time of the module

***Remark :** In the command byte coding, the Response frame type are taking the Request command byte value with the MSB bit set to 1.*

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)						
Applicative command	**Day**	**Month**	**Year**	**Day of the week**	**Hour**	**Minute**
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte
0x13			**(1)**	**(2)**		

***(1)** Year = current year - 2000*
***(2)** day of the week : value from 0 to 6*

Value	Day of Week
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)		
Acknowledgement of the applicative command	**Update Status**	**-**
1 byte	1 byte	-
0x93	0x00 : update OK 0xFF : update error	-

6.4 WAKE-UP SYSTEM MANAGEMENT

6.4.1-Description of the parameters used

Parameter number	Description	Size (in bytes)	Access rights	Default value
0x01	Operating mode	1	R/W	0x00
0x02	Wake-up system status word	1	R/W	0x00
0x03	Default wake-up period (in s)	1	R/W	0x01
0x04	Start time for 1st time window (in hour)	1	R/W	0x07
0x05	Wake-up period - 1st time window (in s)	1	R/W	0x01
0x06	Start time for 2nd time window (in hour)	1	R/W	0x12
0x07	Wake-up period - 2nd time window (in s)	1	R/W	0x01
0x08	Enable time windows by day of week	1	R/W	0xFF
0x09	Enable wake-up periods by day of week	1	R/W	0x00

6.4.2-Choice of wake-up mode

These modes are directly dependant on the *'wake-up system status word'* configuration and the values of parameters associated with each mode.

Wake-up system status word							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	**Enable day-of-week selection** 0 : disabled 1 : enabled	**Enable time windows** 0 : disabled 1 : enabled

Wake-up system status word	Wake-up mode
0x00	Case n°1 : Periodic wake-up, without distinction of day of the week
0x01	Case n°2 : Periodic wake-up in specific time windows for certain days of the week, periodic wake-up for the other days
0x02	Case n°3 : Periodic wake-up for certain days of the week, periodic wake-up disabled for the other days
0x03	Case n°4 : Periodic wake-up in specific time windows for certain days of the week, periodic wake-up for some days and periodic wake-up disabled for the remaining days

Remark: before enabling a specific wake-up mode, the parameters associated with this mode must first be set.

6.4.3-Set a new wake-up period

The WaveLog module wake-up default setting is every second. The wake-up period may be easily modified by entering a new value in the “*default wake-up period parameter*'.
Attention, the value associated with this parameter may not exceed 10 seconds.

Attention, an erroneous value of this parameter involves a wake-up every second, the maximum value is 0x0A (10 seconds).

6.4.4-Set a fixed wake-up period for certain days of the week

The wake-up system parameters may be set to allow disabling of WaveLog module periodic wake-up for certain days of the week.

In practice, when periodic wake-up is disabled, the WaveLog polls every 10 seconds.

The parameter setting procedure is as follows :

- ***disable periodic wake-up for certain days****, with the 'Enable periodic wake-up for certain days of the week' parameter.*

- ***Enable selection of the days of the week****, with the 'wake-up system status word' parameter; 'wake-up system status word' = 0x02*

In this way, on days when periodic wake-up is disabled, the module polls every 10 seconds, whereas for the rest of the week the module wakes up at the default period setting.

Enable wake-up periods by day of week							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	**Sunday** 0 : enabled 1 : disabled	**Saturday** 0 : enabled 1 : disabled	**Friday** 0 : enabled 1 : disabled	**Thursday** 0 : enabled 1 : disabled	**Wednesday** 0 : enabled 1 : disabled	**Tuesday** 0 : enabled 1 : disabled	**Monday** 0 : enabled 1 : disabled

Attention, the coding of each bit is reversed, compared to the parameter ' Enable time windows by day of the week'.

6.4.5-Set day/night system parameter without distinction of days of the week

The wake-up system parameters may be set to enable configuration of the time windows with different wake-up periods

Whether the user wants a distinction of the days of the week, or not; the parameter ' Enable time windows by day of the week' must be suitably configured. Thus in the case of a time windows activation without distinction of the days of week, every day of the week must be enabled (' Enable time windows by day of the week' = 0x7F).

The time windows function as follows,

- Set the start time for the first time window and its wake-up period ;
- Set the start time for the second time window and its wake-up period ;
- Select the days of the week during which the time windows are enabled ;

  'Enable time windows by day of the week' = 0x7F
- Validate the time window mode with the 'wake-up system status word'.

  'Wake-up system status word' = 0x01

Note: The format of the parameters 'Start time for time windows' is expressed in hour, and its value lies between 0 and 23.

For example, if the start time of time windows at 12h00; the value 0x0C should be configured.

The format of the wake-up periods of each time windows, is the same one as the default wake-up period; i.e. it is expressed in seconds, and cannot exceed value 0x0A.

The format of the applicatives commands for reading and writing internal parameters, is described in chapter 6.2.

Enable time windows by day of week							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	**Sunday** 0 : enabled 1 : disabled	**Saturday** 0 : enabled 1 : disabled	**Friday** 0 : enabled 1 : disabled	**Thursday** 0 : enabled 1 : disabled	**Wednesday** 0 : enabled 1 : disabled	**Tuesday** 0 : enabled 1 : disabled	**Monday** 0 : enabled 1 : disabled

Attention, the coding of each bit is reversed, compared to the parameter ' Enable wake-up periods by day of the week'.

6.4.6-Set the day/night system parameters according to day of the week

The day/night system according to the day of the week parameter setting procedure is the same as that described in the previous chapter with the exception that the “*Enable time window according to the day of the week*” parameter is only set for days required.

For example, we wish to enable the time window from Monday to Wednesday.

The *'Enable time windows according to day of the week' parameter is set to* 0x07.
In this way, the module wakes up during these time windows for a period set in the associated parameters with a specific start time for each window from Monday to Wednesday.

For the other days of the week, the wake-up mode depends on the '*wake-up system status word*' :

- '*Wake-up system status word*' = 0x01
  the bit 1 is not enabled, thus the parameter 'Enable wake-up periods by day of week' is not used ; so the rest of the week, the module uses the default wake-up period.

- *'Wake-up system status word*' = 0x03
  the bit 1 is enabled, thus the parameter 'Enable wake-up periods by day of week' is used, so the wake-up for the rest of the week will depend on this parameter.
  Days with wake-up period enabled : default wake-up period
  days with wake-up period disabled : periodic wake-up disabled (polling every 10 sec.)

The format of the applicatives commands for reading and writing internal parameters, is described in chapter 6.2.

6.5 PARAMATER SETTING OF THE RECIPIENT EQUIPMENT OF THE ALARMS FRAMES

The WaveLog module can be configured to send alarms frames on event or periodic frames. A parameter setting thus allows to define the radio route (possible repeaters) as well as the radio address of the recipient equipment of these frames.

The configuration is carried out using the specific radio command SET_ALARM (value = 0x23.)

On reception of this frame, the WaveLog module automatically memorize the radio address of the transmitting module, analyzes the repeater route and stores it.

Alarms frames can not be transmitted, as long as the command SET_ALARM will not be received by the Wavelog module, or the parameters relating to the alarm route will not be defined.

Applicative command	Description
0x23	Request to initialize the alarm route with the route of this frame (SET_ALARM)
0xA3	Response to request to initialize the alarm route with the route of this frame

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x23	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)	
Acknowledgement of the applicative command	**Update Status**
1 byte	1 byte
0xA3	0x00 : update OK 0xFF : update error

On reception of a SET_ALARM command, the possible alarm transmitter analyse, and store the following pieces of information :

Parameter number	Description	Size (in bytes)	Access right
0xB0	Number of repeaters used to transmit an alarm frame	1	R/W
0xB1	Address of the 1st repeater used to transmit an alarm frame	6	R/W
0xB2	Address of the 2nd repeater used to transmit an alarm frame	6	R/W
0xB3	Address of the 3rd repeater used to transmit an alarm frame	6	R/W
0xB4	Address of the recipient of the alarm frame	6	R/W

The access to these parameters is also possible via the standard radio commands of writing and reading of parameters .

7 INFORMATION RELATIVE TO THE EVENTS TABLE

The events storage table store the last detected events. When the table is filled out, the last events crush the oldest ones, This mechanism is called a circular table.

The maximum number of events that can be stored in the table, is of 500.

A radio command allow to recover in a simple way the last 10 events. Another more complex radio command allow to recover whole or part of the events table. This command use the multi-frame mode of the Wavenis protocol.

7.1 Structure of the events table

Each event stored in the table, contains the following information :

- The current state of sampled input,
- The event type (input number)
- the date and time of the event
- Information relating to the emission of an alarm frame, and to the reception of its acknowledgement.

The structure of the events is as follows,

Status	Cause	Date and Time	
1 byte	1 byte	7 bytes	
Evt_Status	Evt_Cause	Evt-Date	The 10 most recent events are read by the radio command "Read_Last_event" (see appendix 1)
Evt_Status - 1	Evt_Cause - 1	Evt-Date - 1	
Evt_Status - 2	Evt_Cause - 2	Evt-Date - 2	
Evt_Status - 3	Evt_Cause - 3	Evt-Date - 3	
...	...	...	
Evt_Status - 9	Evt_Cause - 9	Evt-Date - 9	
...	...	...	Table being able to be read partially or entirely by the command "Read_Table_Event"
...	...	...	
Evt_Status - 499	Evt_Cause - 499	Evt-Date - 499	

7.1.1-Definition of the STATUS byte

The STATUS byte provides the following information,

- indicates that an emission of radio alarm was sent on event detection.
- presence or not of the acknowledgement in response to the alarm frame.
- State of digital inputs, when the event was detected.

Its format is as follow,

STATUS							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reception of the acknowledgement relating to alarm 0 : False 1 : True	**alarm transmitted on event detection** 0 : False 1 : True	-	-	**logical state read on input 4** 0 : low level 1 : high level	**logical state read on input 3** 0 : low level 1 : high level	**logical state read on input 2** 0 : low level 1 : high level	**logical state read on input 1** 0 : low level 1 : high level

7.1.2-Definition of the CAUSE byte

This byte contains the cause of the event trigger.

CAUSE							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Detection on input 4 0: not detected 1: detected	**Detection on input 3** 0: not detected 1: detected	**Detection on input 2** 0: not detected 1: detected	**Detection on input 1** 0: not detected 1: detected	**Detection of a time expiry on a closed contact** 0: not detected 1: detected	**Detection of a time expiry on a opened contact** 0: not detected 1: detected	**Closing Detection** 0: not detected 1: detected	**Opening Detection** 0: not detected 1: detected

7.1.3-Definition of the DATE & TIME byte

This field has the standard format of the date such as it is defined in the date reading or writing commands, except for the seventh byte which is present in event date, indicating the number of seconds.

Date and Time						
Day	**Month**	**Year**	**Day of week**	**Hour**	**Minute**	**Second**
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte

7.1.4-Reading of the number of events logged

The number of events logged in the table is a parameter coded on two bytes accessible by the standard commands from reading and writing of parameters. (see paragraph 6.1 relating to the description of the parameters). The n° of the parameters is 0x0B.

N°	Description	Size (in byte)	Access right	Default Value
0x0B	Number of events stored in the table (LSB first)	2	R	0x0000

7.2 Initialization of the events table

This command allows to initialize the events table, by processing the following actions :

- Stop the transmission of alarms frame on events detections configured before the initialization.
- Re-initialize the events number parameter to 0. (parameter 0x0B)

It is advised to read the table entirely, before re-initializing it. After intialization, all the old stored events are lost.

Applicative command	Description
0x04	Request to initialize the events table
0x84	Response to request to initialize the events table

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x04	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x84	-

7.3 Reading the 10 last events

The following commands allows to read the 10 most recent events of the events table.

Applicative command	Description
0x03	Request to read the 10 last events of the events table
0x83	Response to request to read the 10 last events of the events table

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x03	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)						
Applicative command	**Application Status**	**Current state of the I/Os**	**Last Event**	**Event (N-1)**	**...**	**Event (N-9)**
1 byte	1 byte	1 byte	9 bytes	9 bytes		9 bytes
0x83	See chapter 6.1	See chapter 8.4				

Note :The format of this frame is strictly identical to the format of the periodical frames.

7.4 Extended reading of the events table

The following commands allows to read the entire events table, or just a part of it.

Applicative command	Description
0x06	Request to read the events table
0x86	Response to request to read the events table

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)		
Applicative command	Number of events to be read (coded in MSB first)	Number of the most recent event to be read (coded in MSB first)
1 byte	2 bytes	2 bytes
0x06		

Note : When the field 'number of the most recent event to be read' is set to 0x0000, the module sends the latest events to facilitate the reading.

The size of the information sent by the WaveLog module is so important, that the radio module must transmit several responses frames.

The module uses then the WAVENIS multi-frames mode (except if the relaying mode is used), which allows to optimize the radio exchanges with the interrogative equipment. It successively sends towards the requesting equipment several frames containing the logs of most recent to oldest. The mechanism of radio acknowledgement is activated in an automatic way by the radio module when it transmits successively its responses frames.

Note :The maximum number of events being able to contain in the response frame is 16 when no repeater is used.

In relaying mode, the maximum number of events being able to be read is of 13 per frame.

- contents of response RECEIVED_MULTIFRAME

Data Field (max : 152 bytes)								
Applicative command	Frame number	Total number of frames	index of the first returned event (MSB first)	index of the last returned event (MSB first)	Most recent Event	Event N-1	...	Event N - n
1 byte	1 byte	1 byte	2 bytes	2 bytes	9 bytes	9 bytes	...	9 bytes
0x86								

Note :The index of the events is defined in the ascending order i.e. that the most recent event has the highest index. If the number of events stored is 300, the most recent event has index 300.

If the numbers of required logs do not exist, the response frame has the following format :

Data Field (max : 152 bytes)	
Applicative command	**Frame number**
1 byte	2 bytes
0x86	**0xFF : error**

Note :*If the number of required logs is higher than the number of logs available, the module returns the logs available.*

Operational limits of the multi-frames mode :

The Wavenis protocol does not allow the use of the mechanism of multi-frames in relaying mode, i.e. when the module is read through various repeaters equipment.

Then it's up to the requesting equipment to format the requests frames so that the response holds only on one frame.

Typically, in relaying mode, the requesting module must carry out the reading of the stored events per packets of 12 events maximal, 12 correspondent with the number of events which can be read through 3 repeaters.

Example : if the number of logged events is 200, the requesting equipment must send the following frames:

Frame 1 : reading of 12 events, starting from the 200th

Frame 2 : reading of 12 events, starting from the 188th

Frame 3 : reading of 12 events, starting from the 176th

...

Frame 16 : reading of 12 events, starting from the 20th

Frame 17 : reading of 12 events, starting from the 8th

Be careful, At the end of the buffer and with each entry of a new event, event 300 is updated. If this entry takes place during the reading in several point-to-point requests or via repeaters, an intermediate event is likely not to be read.

To avoid that, it is advised to stop storing the events by modifying the configuration bytes of the inputs (parameters 0x30 to 0x33, see chapter 8.5), before reading the table.

After reading entirely the events table, it is advised to use the command of initialization of the events table when event 300 is reached.

8 EXPLOITATION FUNCTIONS OF THE WAVELOG MODULE

8.1 READING OF THE MODULE TYPE

The type of module is obtained by interrogating the WaveLog module with the GET_TYPE command.

Applicative command	Description
0x20	Request to read the module type (GET_TYPE)
0xA0	Response to the request to read the module type

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x20	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)				
Acknowledgement of the applicative command	**Module type**	**RSSI value[1]**	**Current WakeUp period (in second)**	**Equipment type[2]**
1 byte	1 byte	1 byte	1 byte	1 byte
0xA0	0x1E : WaveLog		Default value = 0x01	0x1E by default

(1) the value of RSSI (Received Signal Strength Indicator) indicates the reception level of the received frame. This parameter can be used for the installations but is not useful from an application point of view.

(2) The equipment type indicates if a Wavenis module is integrated in more complex equipment. The equipment type, and module type have the same value (default value 0x1E).

8.2 READING OF THE FIRMWARE VERSION

The firmware version of the module is obtained by interrogating the distant module with GET_FIRMWARE_VERSION command.

Applicative command	Description
0x28	Request of reading the firmware version (GET_FIRMWARE_VERSION)
0xA8	Response to the request of reading the firmware version

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x28	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)			
Acknowledgement of the applicative command	**Character 'V' in ASCII format**	**Mode de communication**	**Firmware version**
1 octet	1 octet	2 octets	2 octets
0xA8	0x56	Par défaut = 0x00A3	

Remark : *Possible values for the mode of transmission*

	Value
868 MHz single channel 4800 baud	0x0012
868 MHz frequency hopping 9600 baud	0x00A3
868MHz single channel 9600 bauds with channel selection	0x00A2

8.3 Reading the date and time of the module

The Date and time of the module has not the same format as the Date and Time stored in the events table.

The Date and Time of the module is coded on 6 bytes, while the date of the events table is coded on 7 bytes. The difference is that the time of events contains a byte for the second. It is used to timestamp the change of state.

Applicative command	Description
0x12	Request to read the data and time of the module
0x92	Response to request to read the data and time of the module

Remark : *In the command byte coding, the Response frame type are taking the Request command byte value with the MSB bit set to 1.*

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x12	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)						
Acknowledgement of the applicative command	**Day**	**Month**	**Year**	**Day of the week**	**Hour**	**Minute**
1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte
0x92			**(1)**	**(2)**		

(1) *Year = current year - 2000*
(2) *day of the week : value from 0 to 6*

Value	Day of Week
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

8.4 Reading the current state of the Inputs/ Outputs of the module

Applicative command	Description
0x01	Request to read the current state of the I/O of the module
0x81	Response to request to read the current state of the I/O of the module

Remark : *In the command byte coding, the Response frame type are taking the Request command byte value with the MSB bit set to 1.*

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Data**
1 byte	-
0x01	-

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)		
Acknowledgement of the applicative command	**Application Status**	**Current State of the I/Os**
1 byte	1 byte	1 byte
0x81	**(1)**	**(2)**

(1) Application Status : please refer to the description, on chapter 6.1.

(2) Current state of the I/Os : this byte is defined as following.

Current State of the I/Os							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
S4	S3	S2	S1	E4	E3	E2	E1

E1 to E4 : current state of the inputs
S4 to S1 : current state of the outputs.

8.5 Parameter setting of the events and their associated actions

The definition of the events is carried out by configuring the configuration bytes of inputs 1 to 4 (parameters 0x30 to 0x33), using standard WRITE_PARAM command.

These bytes allows to define the inputs profile triggering the memorization in the internal table, and the profile of the inputs allowing to send an alarm frame.

The parameters 0x34 to 0x37 represent the durations (in multiple of 100ms) used for the detection modes of a duration of contact closing or opening, of the inputs.

Parameter number	Description	Size (in bytes)	Access right	Default value	Minimal value
0x30	Input 1 configuration byte	1	R/W	0x00	
0x31	Input 2 configuration byte	1	R/W	0x00	
0x32	Input 3 configuration byte	1	R/W	0x00	
0x33	Input 4 configuration byte	1	R/W	0x00	
0x34	stability duration on input 1 (in multiples of 100ms)	1	R/W	0x01	0x01
0x35	stability duration on input 2 (in multiples of 100ms)	1	R/W	0x01	0x01
0x36	stability duration on input 3 (in multiples of 100ms)	1	R/W	0x01	0x01
0x37	stability duration on input 4 (in multiples of 100ms)	1	R/W	0x01	0x01

The format of the configuration bytes for each input is as follows :

Configuration byte							
events triggering an alarm				events stored in internal table			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Detection of a time expiry on a closed contact 0: no action 1: alarm	**Detection of a time expiry on a opened contact** 0: no action 1: alarm	**closing detection** 0: no action 1: alarm	**opening detection** 0: no action 1: alarm	**Detection of a time expiry on a closed contact** 0: no action 1: stored in table	**Detection of a time expiry on a opened contact** 0: no action 1: stored in table	**closing detection** 0: no action 1: stored in table	**opening detection** 0: no action 1: stored in table

Note : When a bit relating to alarms is positioned to 1, the storage in the table will be also carried out automatically on event detection even if the associated storage bit is not activated.

8.6 parameter setting of the WakeUp preamble duration of alarms and periodicals frames.

The emission of periodic frames and alarms frames can be penalizing for the WaveLog module in term of consumption. It is thus important for the alarm frames to be shortest as possible.

An internal parameter allows to define the duration of the WakeUp preamble which precedes the data in emission (in multiple of 50ms). It acts of the parameter n°0x15.

N°	Description	Size (in byte)	Access right	Value		
				Default	Minimal	Maximal
0x15	Duration of the WakeUp preamble (WUP) of the periodic frames and alarm frames (in multiples of 50ms).	1	R/W	0x03	0x01	0x16

This parameter must be in adequacy with the WakeUp period of the recipient equipment. I.e. that the duration of the WakeUp preamble must be slightly higher (a few 10ms) than the WakeUp period of the recipient equipment.

By default the duration is fixed at 150 ms and thus corresponds to a WakeUp period of 100ms.

With a WakeUp period of 1s, the duration must be higher or equal to 1050ms.

In the same way, if the alarm frames (or periodicals frames) must have to be relayed via repeaters, the duration of the WakeUp preamble must then be fixed at 1050ms minimum, because the repeaters awake all the 1s.

8.7 Format of the alarms frames

After detection of an event, if the configuration mode authorizes the sending of alarms, the module will send an alarm frame with the following structure :

Data Field (max : 152 bytes)					
Applicative command	**Application Status**	**Current state of the I/Os**	**Detected Event 1**	**Detected Event 2**	**Event Date**
1 byte	1 byte	1 byte	1 byte	1 byte	7 bytes
0x40	See chapter 6.1				See chapter 7.1

- **Current state of the I/Os :** same byte as obtained with command 0x01 (please refer to chapter 8.4)

- **Detected Event 1 :**

Detected Event 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	-	**End of battery life** 0: not detected 1: detected

- **Detected Event 2 :**

Detected Event 2							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Detection on input 4 0: not detected 1: detected	**Detection on input 3** 0: not detected 1: detected	**Detection on input 2** 0: not detected 1: detected	**Detection on input 1** 0: not detected 1: detected	**Detection of a time expiry on a closed contact** 0: not detected 1: detected	**Detection of a time expiry on a opened contact** 0: not detected 1: detected	**Closing Detection** 0: not detected 1: detected	**Opening Detection** 0: not detected 1: detected

8.7.1-Acknowledgement of the alarm

Once the recipient has received the alarm frame, it has to send an acknowledgement frame to the initiator of the alarm :

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)	
Command of acknowledgement of the alarm	**Data**
1 byte	-
0xC0	-

After receiving the acknowledgement, the WaveLog module (initiator of the alarm) stores this acknowledgement by positioning a bit with "1" in the events table to the site of the event having generated the alarm frame.

8.8 Format of the periodical frames

Applicative command	Description
0x41	Periodical Frame
0xC1	Acknowledgement of the periodical frame

the content of the periodic frames is as follows :

Data Field (max : 152 bytes)						
Applicative command	**Application Status**	**Current state of the I/Os**	**Last Event**	**Event (N-1)**	**...**	**Event (N-9)**
1 byte	1 byte	1 byte	9 bytes	9 bytes		9 bytes
0x41	See chapter 6.1	See chapter 8.4	See chapter 7.1			

- **Status :**

STATUS							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
reception of the acknowledgement relating to alarm 0 : False 1 : True	**alarm transmitted on event detection** 0 : False 1 : True	-	-	**logical state read on input 4** 0 : low level 1 : high level	**logical state read on input 3** 0 : low level 1 : high level	**logical state read on input 2** 0 : low level 1 : high level	**logical state read on input 1** 0 : low level 1 : high level

- **Cause :**

CAUSE							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Detection on input 4 0: not detected 1: detected	**Detection on input 3** 0: not detected 1: detected	**Detection on input 2** 0: not detected 1: detected	**Detection on input 1** 0: not detected 1: detected	**Detection of a time expiry on a closed contact** 0: not detected 1: detected	**Detection of a time expiry on a opened contact** 0: not detected 1: detected	**Closing Detection** 0: not detected 1: detected	**Opening Detection** 0: not detected 1: detected

8.8.1-Acknowledgement of the periodical frame

Once the recipient has received the alarm frame, it has to send an acknowledgement frame to the initiator of the alarm, using the REQ_SEND_FRAME request :

Data Field (max : 152 bytes)	
Command of acknowledgement of the alarm	**Data**
1 byte	-
0xC1	-

8.9 Control of the digital outputs

the FORCE_OUTPUT command allows to modify the state or to generate an impulse on one or more selected outputs.

Note : The interval between two consecutive transmissions of the FORCE_OUTPUT command must not be lower than 5 seconds. This is used to avoid problems relating to non acknowledgment of the request which imply up to three re-tries of transmission of the same request.

Applicative command	Description
0x02	Request to override the outputs of the WaveLog module
0x82	Response to override the outputs of the WaveLog module

8.9.1-Description of the parameters used

N°	Description	Size (in byte)	Access right	Value		
				Default	Minimal	Maximal
0x38	impulse duration on output 1 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x39	impulse duration on output 2 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x3A	impulse duration on output 3 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14
0x3B	impulse duration on output 4 (in multiples of 100ms)	1	R/W	0x01	0x01	0x14

Note : the parameters must be initialized, before sending the request to overide the outputs.

8.9.2-Format of the commands

- contents of request REQ_SEND_FRAME

Data Field (max : 152 bytes)			
Applicative command	Outputs selection byte	selection of the type of activation	Output Level byte
1 byte	1 byte	1 byte	1 byte
0x02			

- **Outputs selection byte :**

OUTPUTS SELECTION BYTE							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	**Output 4** 0: not selected 1: selected	**Output 3** 0: not selected 1: selected	**Output 2** 0: not selected 1: selected	**Output 1** 0: not selected 1: selected

- **Selection of the type of activation :**

SELECTION OF THE TYPE OF ACTIVATION							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	**Output 4** 0: pulse 1: permanent state (if allowed)	**Output 3** 0: pulse 1: permanent state (if allowed)	**Output 2** 0: pulse 1: permanent state (if allowed)	**Output 1** 0: pulse 1: permanent state (if allowed)

- **Output level byte :**

OUTPUTS LEVEL BYTE							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	**Output 4** 0: 0 Volt 1: 2.7 Volt	**Output 3** 0: 0 Volt 1: 2.7 Volt	**Output 2** 0: 0 Volt 1: 2.7 Volt	**Output 1** 0: 0 Volt 1: 2.7 Volt

Note :*This byte will be taken into account only if a permanent state is requested and authorized.*

- contents of response RECEIVED_FRAME

Data Field (max : 152 bytes)	
Applicative command	**Execution Status**
1 byte	1 byte
0x82	0x00 : currently executing 0xFF : error

8.10 parameter setting of the 'states transfer' mode

The receiver of the 'states transfer' frames must be equipped with the factory configuration, correspondent to a module powered by external power supply. In the contrary case, the 'states transfer' frame will not be treated nor acknowledged.

To activate the 'states transfer' mode, it is necessary to configure parameters according to following steps :

- To write the parameters 'inputs configuration byte' by activating the sending of alarm on change of states;
- To set the WakeUp preamble (WUP) duration of the emission of the frames with 1100ms;
- Adjustment of the relays route of alarms, and the address of recipient WaveLog;
- Activation of the sending of alarms frames in the 'Operating mode' parameter.

Once these four steps carried out, the WaveLog module will transmit alarms frames towards recipient WaveLog. The acknowledgement of these frames will be carried out in an automatic way by using the same relays route in opposite direction.

Note :*This procedure is exactly the same as the alarm configuration. Indeed, the 'States transfer' frame is an alarm frame which is sent to another Wavelog (powered by external source).*

8.10.1-Configuration of the parameters to be used

N°	Description	Size (in byte)	Access right	Value		
				Default	Minimal	Maximal
0x15	Duration of the WakeUp preamble (WUP) of the periodic frames and alarm frames (in multiples of 50ms).	1	R/W	0x03	0x01	0x16
0x30	Input 1 configuration byte	1	R/W	0x00		
0x31	Input 2 configuration byte	1	R/W	0x00		
0x32	Input 3 configuration byte	1	R/W	0x00		
0x33	Input 4 configuration byte	1	R/W	0x00		
0xB0	Number of repeaters used to transmit an alarm frame	1	R/W			
0xB1	Address of the 1st repeater used to transmit an alarm frame	6	R/W			
0xB2	Address of the 2nd repeater used to transmit an alarm frame	6	R/W			
0xB3	Address of the 3rd repeater used to transmit an alarm frame	6	R/W			
0xB4	Address of the recipient of the alarm frame	6	R/W			

The inputs to be used are configured by command of writing of parameters 'Input N configuration bytes'. Please refert to chapter 8.5.

An alarm frame sent on detection of a time expiry will be acknowledged, but will not have incidence on the outputs of the recipient WaveLog.

8.10.2-Adjustment of the WakeUp duration

The recipient WaveLog of alarms frames has a default WakeUp period of 1 second when its wakeup by time window is deactivated. So that the 'States transfer' frames are correctly received, it is imperative to transmit them with a WakeUp preamble a little higher than the WakeUp period of the recipient. The length of WakeUp preamble can be configured via the command of writing of the internal parameters (parameter 0x15).

The 'States transfer' mode is incompatible with the WakeUp management by time window.

8.10.3-Activation of the sending mode of the 'states transfer' frames

The 'States transfer' mode on the monitored inputs is activated by writing the bit b3 of *Operating mode* parameter, via the command of writing of the parameters.

APPENDIX A : Applicative commands set

Applicatives Commands	Name	Description
PARAMETERS ACCESS		
0x10	READ_PARAM	Request of parameter(s) reading
0x90		Acknowledgement of the request of parameter(s) reading
0x11	WRITE_PARAM	Request of parameter(s) writing
0x91		Acknowledgement of the request of parameter(s) writing
PARAMETERS SETTING OF THE MODULE		
0x20	GET_TYPE	Reading of the module type
0xA0		Response to the request of reading of the module type
0x28	GET_FW_VERSION	Reading of the firmware version
0xA8		Response to the request of reading of the firmware version
0x12	READ_DATE	Request to read the date and time of the module
0x92		Response to the request to read the date and time of the module
0x13	WRITE_DATE	Request to set the date and time of the module
0x93		Response to the request to set the date and time of the module
MANAGEMENT OF THE EVENTS TABLE		
0x04	INT_TABLE_EVENT	Request to initialize the events table
0x84		Response to the request to initialize the events table
0x03	READ_LAST_EVENT	Request to read the 10 most recent events of the events table
0x83		Response to the request to read the 10 most recent events of the events table
0x06	READ_TABLE_EVENT	Request to read part or the totality of the events table
0x86		Response to the request to read part or the totality of the events table
INPUTS / OUTPUTS MANAGEMENT		
0x01	READ_IO_STATE	Request to read the current state of the inputs / outputs of the module
0x81		Response to the request to read the current state of the inputs / outputs of the module
0x02	FORCE_OUTPUT	Request to overide the outputs of the Wavelog module
0x82		Response to the request to overide the outputs of the Wavelog module
ALARMS MANAGEMENT		
0x23	SET_ALARM	Request to initialize the alarm route with the route of the received frame
0xA3		Response to the request to initialize the alarm route with the route of the received frame
0x40	ALARM_TYPE	Alarm frame
0xC0	ACK_ALARM	Acknowledgement of the alarm
PERIODICAL FRAMES		
0x41	PERIODIC_STATE	Periodical frame
0xC1	ACK_PERIODIC	Acknowledgement of the periodical frame

APPENDIX B : Life duration and profile of use

The purpose of this chapter is to present average life duration of the product according to several types of profiles of use.

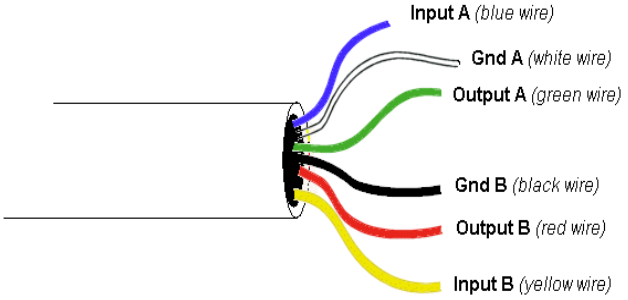
The life duration of the product depends on several applicative factors, relating to the radio network and the management of the I/O., but also of the environmental conditions (variations in temperature...). The indications of this chapter apply to the WaveLog products self-powered by lithium battery embedded in the standard case.

The life duration announced in table below cannot be contractual but is given in an indicative way.

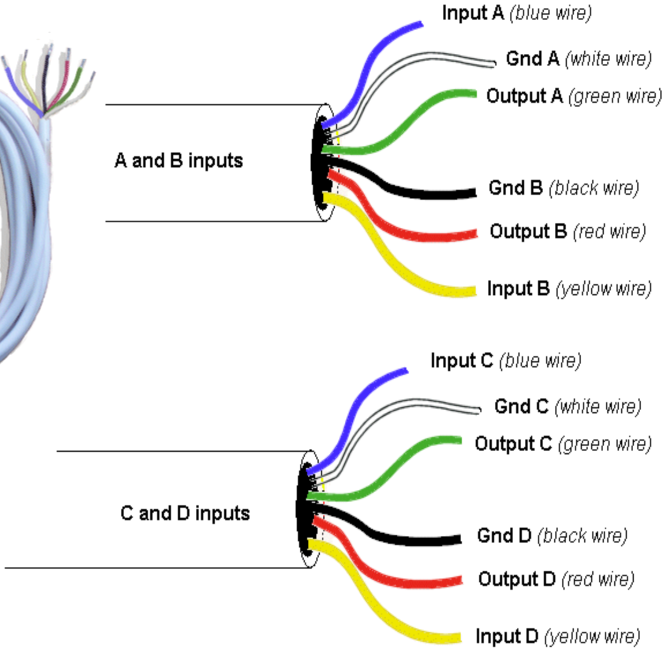
Number of alarm frames per day	Number of complete readings of the events table per day	number of reception of frames not intended for the module per day	Length of the WUP for the periodical frames and alarms (in ms)	number of periodical frames transmission per day	number of generated pulses on the outputs (per day)	Duration of the impulses on the outputs (in ms)	**Average life duration (in years)**
10	0	10	150	0	0	0	16,44
10	1	10	150	24	0	0	12,75
100	1	100	150	1	4	500	6,89
100	1	100	1100	1	4	500	3,22
100	24	1000	1100	24	100	500	0,99

APPENDIX C : Wiring details

- **Wavelog – 2 inputs**



- **WaveLog – 4 inputs**


Input A (blue wire)
Gnd A (white wire)
Output A (green wire)
A and B inputs
Gnd B (black wire)
Output B (red wire)
Input B (yellow wire)
Input C (blue wire)
Gnd C (white wire)
Output C (green wire)
C and D inputs
Gnd D (black wire)
Output D (red wire)
Input D (yellow wire)