

LoRaWAN® IP68 PULSE READER + ANALOG UM3023



LoRaWAN® IP68 pulse reader, enables acquisition of data from the pulse emitting devices and analog interfaces and transmits it wirelessly to the LoRaWAN® network.

LoRaWAN® IP68 pulse reader is meant to be connected to the existing devices' pulse or analog signal output. It is powered by a long-life battery.

OVERVIEW

Efficient

LoRaWAN® IP68 Pulse Reader has a bidirectional, battery powered, long-range transceiver with low power consumption.

Intelligent

Real-time usage data is gathered wirelessly and processed automatically. Data is accessible from your LoRaWAN® provider.

APPLICATIONS

Pulse metering

Frequent reporting provides a detailed usage overview. Can be used with any pulse emitting device (water, electricity, gas meter, etc.).

Analog measurement

Possible to read both 0..10V & 4mA..20mA devices with configurable thresholds

Usage detection

LoRaWAN® Outdoor Pulse Reader can be configured to trigger mode to send alerts when usage is detected.

FEATURES

- Long range wireless data transmission
- Pulse counting
- 4..20mA interface
- 0..10V interface
- Pre-installed long-life battery
- Built-in antenna
- DIN rail mount
- Trigger mode
- Configurable reporting interval
- Maintenance free - install & forget
- Easy installation
- Average life 8 years*
- Secure communication
- Thresholds

* Lifetime depends from the device location and reporting interval.

SPECIFICATIONS

Length:	109 mm
Height:	27 mm
Width:	27 mm
Weight:	72 g
Cable length:	1 m
Operating temperature:	-20°C ... +65°C
Communication range:	up to 15 km*
Tx power:	up to +20 dBm
Rx Sensitivity:	-142 dBm
MAC Layer:	LoRaWAN®
Physical Layer:	LoRa®
Connector:	M8
Body material:	PA6
IP Rating:	IP68
Communication:	LoRaWAN®

* Communication range is dependent on the location of the sensor and nearest base station.

INPUT SPECIFICATIONS

Digital	Max Frequency:	15 Hz
	(Dry contact) Pulled internal to:	3 V
	(Active contact) Max voltage:	6 V
Analog	(4mA..20mA) Max input current:	30mA
	(0V..10V) Max input voltage:	20V

COMMUNICATION

Bit order:	LSB
Usage reporting:	Unconfirmed messages
Status reporting:	Confirmed messages

PORT LIST

fPort	Usage	Transmission	Page
24	Status	↑↑	5
25	Usage	↑↑	12
49	Config request	↑↓	17
50	Configuration	↓↓	28
51	Update mode	↓↓	38
99	Boot/Debug	↑↑	39

For FW version >= 0.8.4

fPort 24 Status Message

Byte 0	Byte 1*	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte ..	Byte n
<i>reported_interfaces</i>	<i>active_alerts*</i>	<i>battery_percentage</i>	<i>battery_index</i>	<i>mcu_temp</i>	<i>temp_extremes</i>	<i>downlink_rssi</i>	Interface status blocks		
		type: uint8 formatted: /2.54	type: uint8 unit: mapped	type: int8 unit: °C		type: uint8 unit: dBm**	Described below		

Bit #	Parameter	Value
0	<i>digital_1</i>	0 - not sent 1 - sent
1	<i>digital_2</i>	
2	<i>analog_1</i>	
3	<i>analog_2</i>	n/a
4	<i>ssi</i>	
5	<i>mbus</i>	
6	<i>user_triggered_packet</i>	0 - false 1 - true
7	<i>active_alerts</i>	0 - not sent 1 - sent

Bit #	Parameter	Value
0	<i>digital_interface_alert</i>	0 - false 1 - true
1	<i>secondary_interface_alert</i>	
2	<i>temperature_alert</i>	
3	<i>RFU</i>	
4	<i>RFU</i>	
5	<i>RFU</i>	
6	<i>RFU</i>	
7	<i>RFU</i>	

Bit #	Parameter	Value
0	<i>min_offset</i>	type: int4 unit: °C formatted: *2
1		
2		
3	<i>max_offset</i>	type: int4 unit: °C formatted: *2
4		
5		
6		
7		

Interface values are reported according to the interface map in the order defined in the interface map

*only sent if *active_alerts* flag is sent in *reported_interfaces* byte

** Absolute value. Multiply with -1 to get the actual value.

Status message can be triggered with 1 second magnet switch (same place as activating). The time between two consecutive packets is dependent of the duty cycle. If the message is triggered too often, it will go to lockdown for 1 hour. It will still be working as meant to, but will not send any data.

digital_interface_channel_payload

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8
<i>state</i>	<i>counter</i>				<i>device_serial</i>			
	type: uint32 unit: <i>medium_type</i>				type: <i>hex</i>			

Bit #	Parameter	Value
0	<i>input_state</i>	0 - open 1 - closed
1	<i>operational_mode</i>	0 - pulse_mode 1 - trigger_mode
2	<i>alert_state</i>	0 - off 1 - on
3	<i>device_serial_sent</i>	0 - false 1 - true
4	<i>medium_type</i>	
5		
6		
7		

Value	Parameter
00	<i>n/a_</i>
01	<i>pulses_</i>
02	<i>water_L</i>
03	<i>electricity_Wh</i>
04	<i>gas_L</i>
05	<i>heat_Wh</i>
..	RFU
0F	RFU

analog_interface_channel_payload

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8
<i>general</i>	<i>instant_value*</i>				<i>average_value*</i>			
	type: float unit: <i>input_mode</i>				type: float unit: <i>input_mode</i>			

Bit #	Parameter	Value
0	<i>input_mode</i>	0 - voltage_10V (default) 1 - current_20mA
1	<i>is_alert</i>	0 - false 1 - true
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	<i>instant_value_reported*</i>	0 - false 1 - true
7	<i>average_value_reported*</i>	

* *instant_value* and *average_value* are only sent when the according flag is set to reported in the *general* byte.

Message sample

Message in base64

```
TVsXAKJbGAAAAAB4VjQSQQAAAABBWhQxPw==
```

Message decoded to HEX

```
4D5B1700A25B1800000000785634124100000000415A14313F
```

reported_interfaces HEX message

```
0x4D
```

reported_interfaces HEX message converted to binary

```
0b01001101
```

Binary converted to statuses (LSB)

```
1 : digital_1 - sent
0 : digital_2 - not sent
1 : analog_1 - sent
1 : analog_2 - sent
0 : RFU - n/a
0 : RFU - n/a
1 : user_triggered_packet - true
0 : active_alerts - false
```

battery_percentage HEX message

```
0xA2
```

HEX message converted to decimal

```
162
```

Decimal value divided by 2.56

```
63.8 (%)
```

battery_index HEX message

```
0x5B
```

HEX message converted to decimal

```
91
```

Decimal value mapped to voltage

```
3.026 (V)
```

mcu_temp HEX message

```
0x17
```

HEX message converted to signed decimal

```
23 (°C)
```

temp_extremes HEX message

```
0x00
```

temp_extremes HEX message converted to binary

```
0b00000000
```


Binary converted to extremes (LSB)

```
0 : min_offset [0B0000]
0 :
0 :
0 :
0 : max_offset [0B0000]
0 :
0 :
0 :
```

min_offset binary value converted to HEX

0x00

HEX message converted to decimal

0

Decimal offset value multiplied by -2

0 (°C)

max_offset binary value converted to HEX

0x00

HEX message converted to decimal

0

Decimal offset value multiplied by 2

0 (°C)

downlink_rssi HEX message

0x5B

HEX message converted to decimal

91

Decimal value multiplied by -1

-91 (dBm)

digital_1 state HEX message

0x18

digital_1 state HEX message converted to binary

0B00011000

Binary converted to states (LSB)

```
0 : input_state - open
0 : operational_mode - trigger_mode
0 : alert_state - off
1 : device_serial_sent - true
1 : medium_type [0B0001]
0 :
0 :
0 :
```

medium_type binary value converted to HEX

0x01

HEX message converted to medium

Pulses

counter 0x00000000 HEX message flip for MSB

0x00000000

HEX message converted to decimal

0 (Pulse/Trigger)

device_serial 0x78563412 HEX message flip for MSB

0x12345678

analog_1 general HEX message

0x41

analog_1 general HEX message converted to binary

0b01000001

Binary converted to statuses (LSB)

1 : input_mode - current_20mA
0 : aler_state - off
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
1 : instant_value_reported - true
0 : average_value_reported - false

instant_value 0x00000000 HEX message flip for MSB

0x00000000

HEX message converted to float

0 (mA)

analog_2 general settings HEX message

0x41

analog_2 general HEX message converted to binary

0b01000001

Binary converted to statuses (LSB)

1 : input_mode - current_20mA
0 : aler_state - off
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
1 : instant_value_reported - true
0 : average_value_reported - false

instant_value 0x5A14313F HEX message flip for MSB

0x3F31145A

HEX message converted to float

0.692 (mA)

fPort 25 Usage Message

Byte 0	Byte 1	Byte ..	Byte n
<i>reported_interfaces</i>	Interface usage blocks		
	Described below		

Bit #	Parameter	Value
0	<i>digital_1</i>	0 - not sent 1 - sent
1	<i>digital_2</i>	
2	<i>analog_1</i>	
3	<i>analog_2</i>	
4	<i>ssi</i>	n/a
5	<i>mbus</i>	
6	RFU	
7	RFU	

Interface values are reported according to the intercace map in the order defined in the interface map

digital_interface_channel_payload

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4
<i>state</i>	<i>counter</i>			
	type: uint32 unit: <i>medium_type</i>			

Bit #	Parameter	Value
0	<i>input_state</i>	0 - open 1 - closed
1	<i>operational_mode</i>	0 - pulse_mode 1 - trigger_mode
2	RFU	
3	RFU	
4	<i>medium_type</i>	
5		
6		
7		

Value	Parameter
00	<i>n/a_</i>
01	<i>pulses_</i>
02	<i>water_L</i>
03	<i>electricity_Wh</i>
04	<i>gas_L</i>
05	<i>heat_Wh</i>
..	RFU
0F	RFU

analog_interface_channel_payload

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8
Settings	Instant value*				Average value*			
	Float IEEE 754				Float IEEE 754			

Bit #	Parameter	Value
0	<i>input_mode</i>	0 - voltage_10V (default) 1 - current_20mA
1	RFU	
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	<i>instant_value_reported*</i>	0 - false 1 - true
7	<i>average_value_reported*</i>	

* Instant and Average value block are only sent when the according flag is set to reported in he Settings byte.

Message sample

Message in base64

```
DxIBAAAAEAAAAADA2jZcQAt+XkDBQMnXQNxz2UA=
```

Message decoded to HEX

```
0F12010000001000000000C0DA365C400B7E5E40C140C9D740DC73D940
```

Interface map HEX message

```
0x0F
```

Interface map HEX message converted to binary

```
0b00001111
```

Binary converted to statuses (LSB)

```
1 : Digital 1 - sent
1 : Digital 2 - sent
1 : Analog 1 - sent
1 : Analog 2 - sent
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
```

Digital 1 settings HEX message

```
12
```

Interface map HEX message converted to binary

```
0b00010010
```

Binary converted to statuses (LSB)

```
0 : Value during reporting - 0
1 : Trigger mode - true
0 : Alert - no
0 : RFU - n/a
1 : Medium type [0b0001]
0 :
0 :
0 :
```

Medium type binary value converted to HEX

```
0x01
```

HEX message converted to medium

```
Pulses
```

Counter 0x01000000 HEX message flip for MSB

```
0x00000001
```

HEX message converted to decimal

```
1 (Pulse/Trigger)
```

Digital 2 settings HEX message

0x10

Interface map HEX message converted to binary

0b00010000

Binary converted to statuses (LSB)

```
0 : Value during reporting - 0
0 : Trigger mode - false
0 : Alert - no
0 : RFU - n/a
1 : Medium type [0b0001]
0 :
0 :
0 :
```

Medium type binary value converted to HEX

0x01

HEX message converted to medium

Pulses

Counter 0x00000000 HEX message flip for MSB

0x00000000

HEX message converted to decimal

0 (Pulses)

Analog 1 settings HEX message

0xC0

Interface map HEX message converted to binary

0b11000000

Binary converted to statuses (LSB)

```
0 : Mode - 0..10V
0 : Alert - false
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
1 : Instant value - reported
1 : Average value - reported
```

Instant value 0xDA365C40 HEX message flip for MSB

0x405C36DA

HEX message converted to float IEEE 754

3.441 (V)

Average value 0x0B7E5E40 HEX message flip for MSB

0x405E7E0B

HEX message converted to float IEEE 754

3.476 (V)

Analog 2 settings HEX message

0xC1

Interface map HEX message converted to binary

0b11000001

Binary converted to statuses (LSB)

1 : Mode - 4..20mA

0 : Alert - false

0 : RFU - n/a

0 : RFU - n/a

0 : RFU - n/a

0 : RFU - n/a

1 : Instant value - reported

1 : Average value - reported

Instant value 0x40C9D740 HEX message flip for MSB

0x40D7C940

HEX message converted to float IEEE 754

6.743 (mA)

Average value 0xDC73D940 HEX message flip for MSB

0x40D973DC

HEX message converted to float IEEE 754

6.795 (mA)

fPort 49 Configuration Request Message

Byte 0	Operation
0x00	<i>reporting_config_request</i>

Message sample

Message goal: Request device configuration

Header

Select Header HEX code

0x00

Compile message for sending (HEX)

0x00

Control value in base64 to control after sending

AA==

Response

Sent to fPort 49 in the following format

Reporting configuration

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Header	Usage interval		Status interval		Config. map
0x00	uint16 (min)		uint16 (min)		

Bit #	Parameter	Value
0	usage sent	0 - if new data 1 - always
1	RFU	
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Message sample

Message in base64

```
ADwA0AAA
```

Message decoded to HEX

```
003C00A00000
```

Header 00 decoded

```
Response for reporting configuration request
```

Usage interval 0x3C00 HEX message flip for MSB

```
0x003C
```

HEX message converted to decimal

```
60 (Minutes)
```

Status interval 0xA000 HEX message flip for MSB

```
0x00A0
```

HEX message converted to decimal

```
160 (Minutes)
```

Configuration map HEX message

```
0x00
```

Interface map HEX message converted to binary

```
0B00000000
```

Binary converted to configuration (LSB)

```
0 : Usage sent - only if new data
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
```

Byte 0	Operation
0x01	<i>general_config_request</i>

Message sample

Message goal: Request device configuration

Header

Select Header HEX code

0x01

Compile message for sending (HEX)

0x00

Control value in base64 to control after sending

AQ==

Response

Sent to fPort 49 in the following format

General configuration

Byte 0	Byte 1	Byte n
Header	Interface map	Interface config blocks
00		Described below

Bit #	Parameter	Value
0	Digital 1	0 - not sent 1 - sent
1	Digital 2	
2	Analog 1	
3	Analog 2	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Digital interface configuration block

Bit #	Parameter	Value
0	operational mode	0 - pulse 1 - trigger
1	set device serial	0 -no 1 - yes
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	Trigger lenght	
7		

Value	Parameter
00	1 sec
01	10 sec
02	1 min
03	1 h

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8	r Byte 9	r Byte 10	r Byte 11	r Byte 12	r Byte 13
Configuration	Mode	multiplier		divider		Reading			device serial				
		type: uint16 units per pulse default: 1		type: uint16 pulses per unit default: 1		type: int32 unit: medium type			Type : hex				

Bit #	Parameter	Value
0	Interface enabled	0 - disabled 1 - enabled
1	RFU	
2	Multiplier	0 - not sent 1 - sent
3	Reading*	
4	Medium type	
5		
6		
7		

Value	Parameter
00	n/a
01	Pulses
02	Water in L
03	Electricity in Wh
04	Gas in L
05	Heat in Wh
..	RFU
0F	RFU

* Only for pulse mode

Analog interface configuration block

Bit #	Parameter	Value
0	Sampling rate	0 - 1 min (default) 1 - 1 sec*
1	Mode	0 - 0..10V 1 - 4..20mA
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8	r Byte 9	r Byte 10
Config. map	General config.	Parameter config.	Low threshold**				High threshold**			
			Float IEEE 754				Float IEEE 754			

Bit #	Parameter	Value
0	Interface	0 - disabled 1 - enabled
1	RFU	
2	Parameter config.	0 - not sent 1 - sent
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Bit #	Parameter	Value
0	Alert	0 - disabled 1 - enabled
1	Alert thresholds**	0 - not sent 1 - both sent
2	Usage instant value	0 - do not report 1 - report
3	usage average value	
4	RFU	
5	RFU	
6	Alert trigger sample count	
7		

Value	Parameter
00	1 X
01	3 X
02	10 X (default)
03	100 X

* Using the 1 sec interval will shorten the battery life significantly

** Only sent when the threshold flag is set in the Parameter config byte.

Message sample

Message in base64

```
AQ8ZAgAAAAB4VjQSAAUDDAUDDA==
```

Message decoded to HEX

```
010F190200000000785634120005030C05030C
```

Header 01 decoded

```
Response for general configuration request
```

Interface map HEX message

```
0x0F
```

Interface map HEX message converted to binary

```
0b00001111
```

Binary converted to statuses (LSB)

```
1 : Digital 1 - sent
1 : Digital 2 - sent
1 : Analog 1 - sent
1 : Analog 2 - sent
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
```

Digital 1 configured parameters HEX message

```
0x19
```

Interface map HEX message converted to binary

```
0b00011001
```

Binary converted to parameters (LSB)

```
1 : interface - enabled
0 : RFU
0 : multiplier - not sent
1 : reading - sent
1 : Medium type [0b0001]
0 :
0 :
0 :
```

Medium type binary value converted to HEX

```
0x01
```

HEX message converted to medium

```
Pulses
```

Digital 1 mode HEX message

```
0x02
```

Interface map HEX message converted to binary

```
0b0000010
```


Binary converted to statuses (LSB)

```
0 : operational mode - pulse mode
1 : device serial - set
0 : RFU
0 : RFU
0 : RFU
0 : RFU
0 : trigger time - n/a
0 :
```

reading 0x00000000 HEX message flip for MSB

```
0x00000000
```

HEX message converted to decimal

```
0 (Pulses)
```

device_serial 0x78563412 HEX message flip for MSB

```
0x12345678
```

Digital 2 configured parameters HEX message

```
0x00
```

Interface map HEX message converted to binary

```
0B00000000
```

Binary converted to parameters (LSB)

```
0 : interface - disabled
0 : RFU
0 : multiplier - not sent
0 : reading - not sent
0 : Medium type - n/a
0 :
0 :
0 :
```

Analog 1 configuration map HEX message

```
0x05
```

Interface map HEX message converted to binary

```
0B00000101
```

Binary converted to configuration (LSB)

```
1 : Interface - enabled
0 : RFU
1 : reporting - sent
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
```

Analog 1 general configuration map HEX message

0x03

Interface map HEX message converted to binary

0b00000011

Binary converted to configuration (LSB)

1 : Sampling rate - 1 second
1 : Mode - 4..20mA
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a

Analog 1 reporting HEX message

0x0C

Interface map HEX message converted to binary

0b00001100

Binary converted to configuration (LSB)

0 : Alert - disabled
0 : Alert threshold - not sent
1 : Instant value in usage message - reported
1 : Average value in usage message - reported
0 : RFU - n/a
0 : RFU - n/a
0 : Alert trigger sample count - n/a
0 :

Analog 2 configuration map HEX message

0x05

Interface map HEX message converted to binary

0b00000101

Binary converted to configuration (LSB)

1 : Interface - enabled
0 : RFU
1 : reporting - sent
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a

Analog 2 general configuration map HEX message

0x03

Interface map HEX message converted to binary

0_B00000011

Binary converted to configuration (LSB)

```
1 : Sampling rate - 1 second
1 : Mode - 4..20mA
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
```

Analog 2 reporting HEX message

0x0C

Interface map HEX message converted to binary

0_B00001100

Binary converted to configuration (LSB)

```
0 : Alert - disabled
0 : Alert threshold - not sent
1 : Instant value in usage message - reported
1 : Average value in usage message - reported
0 : RFU - n/a
0 : RFU - n/a
0 : Alert trigger sample count - n/a
0 :
```

fPort 50 Configuration Message

Byte0	Byte ...	Byte n
Header	Payload	

Different headers with their respective payloads are described below

General configuration

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
Header	Configuration	Usage interval		Status interval		Usage config.
0x00		uint16 (min)		uint16 (min)		

Bit #	Function	Value
0	Usage interval	0 - not sent 1 - sent
1	Status interval	
2	Usage config.	
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Bit #	Function	Value
0	Usage without new data	0 - not sent 1 - sent
1	RFU	
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Message sample

Message goal: Set usage reporting to 2 hour and to be sent even without new data.

Header

Select Header HEX code

0x00

Configuration

Configuration selection

```
1 : Usage interval - sent
0 : Status interval - not sent
1 : Usage configuration - sent
0 : RFU
0 : RFU
0 : RFU
0 : RFU
0 : RFU
```

Selection converted to binary

0b00000101

Selection converted to HEX

0x05

Usage reporting interval

Convert interval 120 to HEX

0x78

Flip HEX value to LSB

0x7800

Usage configuration selection

```
1 : send usage - always
0 : RFU
0 : RFU
0 : RFU
0 : RFU
0 : RFU
0 : RFU
0 : RFU
```

Selection converted to binary

0b00000001

Selection converted to HEX

0x01

Compile message for sending (HEX)

```
0005780001
```

Control value in base64 to control after sending

```
AAV4AAE=
```

Interface configuration

Byte 0	Byte 1	Byte 2	Byte ..	Byte n
Header	Settings	Interface configuration blocks		
0x01		Described below		

Bit #	Parameter	Value
0	Digital 1 reporting	0 - not sent 1 - configured
1	Digital 2 reporting	
2	Analog 1 reporting	
3	Analog 2 reporting	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Digital interface configuration block

Bit #	Parameter	Value
0	operational mode	0 - pulse 1 - trigger
1	device serial	0 - not sent 1 - sent
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	Trigger lenght*	
7		

Value	Parameter
00	1 sec
01	10 sec
02	1 min
03	1 h

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8	r Byte 9	r Byte 10	r Byte 11	r Byte 12	r Byte 13
Configura- tion	Mode	multiplier		divider		Reading				device serial			
		type: uint16 units per pulse default: 1		type: uint16 pulses per unit default: 1		type: int32 unit: medium type				Type : hex			

Bit #	Parameter	Value
0	Interface enable***	0 - disable 1 - enable
1	RFU	
2	Multiplier	0 - not sent 1 - configured
3	reading	
4	Medium type****	
5		
6		
7		

Value	Parameter
00	n/a
01	Pulses
02	Water in L
03	Electricity in Wh
04	Gas in L
05	Heat in Wh
..	RFU
0F	RFU

Bit #	Description	Value
0..30	absolute or offset	if absolute: type: uint31 max: 999999999 if offset: type: int16 bit 0..15 - offset bit 16..30 - 0x7F (RFU)
31	Mode	0 - absolute 1 - offset

* Configured together with Trigger mode. Otherwise must be 00

** Multiplier is sent together with Unit type and True reading. In trigger mode Unit type is invalid and entire packet is discarded.

*** Disabled interface can not have any other configuration

**** Configured together with Multiplier. Otherwise must be 00

Analog interface configuration block

Bit #	Parameter	Value
0	Sampling rate	0 - 1 min (default) 1 - 1 sec*
1	Mode	0 - 0..10V 1 - 4..20mA
2	RFU	
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

r Byte 0	r Byte 1	r Byte 2	r Byte 3	r Byte 4	r Byte 5	r Byte 6	r Byte 7	r Byte 8	r Byte 9	r Byte 10
Config. map	General config.	Parameter config.	Low threshold**				High threshold**			
			Float IEEE 754 0xFFFFFFFF (NaN) - disabled				Float IEEE 754 0xFFFFFFFF (NaN) - disabled			

Bit #	Parameter	Value
0	Interface	0 - disable 1 - enabled
1	RFU	
2	Parameter config.	0 - not sent 1 - sent
3	RFU	
4	RFU	
5	RFU	
6	RFU	
7	RFU	

Bit #	Parameter	Value
0	Alert	0 - disabled 1 - enabled
1	Alert thresholds**	0 - not sent 1 - both sent
2	Usage instant value	0 - do not report 1 - report
3	usage average value	
4	RFU	
5	RFU	
6	Alert trigger sample count	
7		

Value	Parameter
00	1 X
01	3 X
02	10 X (default)
03	100 X

* Using the 1 sec interval will shorten the battery life significantly

** Only sent when the threshold flag is set in the Parameter config byte.

Message sample

Message goal: Adjust the water reading on Digital 1 by -345 liters and configure Analog interface 2 to 4..20mA mode. Set low threshold alert to 12mA. Set alert trigger to 3rd sample (out of threshold bounds). Report instant value in usage message.

Header

Select Header HEX code

```
0x01
```

Configuration

Interface selection

```
1 : Digital 1 - configured
0 : Digital 2 - not sent
0 : Analog 1 - not sent
1 : Analog 2 - configured
0 : RFU
0 : RFU
0 : RFU
0 : RFU
```

Selection converted to binary

```
0b00001001
```

Selection converted to HEX

```
0x09
```

Digital 1 configuration selection

```
1 : Interface - enable
0 : RFU
0 : Multiplier - not sent
1 : Reading - sent
x : Medium type
x :
x :
x :
```

Medium type ignore mapped to HEX

```
0x00
```

HEX message converted to binary

```
0b0000
```

Whole binary message assembled

```
0b00001001
```

Binary value converted to HEX

```
0x09
```

Digital 1 mode selection

```
0 : Operational mode - pulse
0 : Serial configured - no
0 : RFU
0 : RFU
0 : RFU
0 : RFU
x : Trigger time
x :
```

Trigger time binary value

```
0b00 (must be 0)
```

Whole binary message assembled

```
0b00000000
```

Binary value converted to HEX

```
0x00
```

Digital 1 reading selection

```
x : Offset
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
x :
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
```

```
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : RFU
1 : mode - offset
```

Offset value -345 converted to binary

0b1111111010100111

Whole binary message assembled

0b1111111111111111111111111010100111

Binary value converted to HEX

0xFFFFFEA7

Flip HEX value to LSB

0xA7FEFFFF

Analog 2 configuration selection

```
1 : Interface - enable
1 : General configuration - sent
1 : Parameter configuration - sent
0 : RFU
0 : RFU
0 : RFU
0 : RFU
0 : RFU
```

Selection converted to binary

0b00000111

Selection converted to HEX

0x07

Analog 2 general configuration selection

```
0 : Sampling rate - 1 minute
1 : Mode - 4..20mA
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
0 : RFU - n/a
```

Selection converted to binary

0b00000010

Selection converted to HEX

0x02

Analog 2 parameter configuration selection

```
1 : Alert - enable
1 : Alert threshold - sent
1 : Instant value in usage message - reported
0 : Average value in usage message - not reported
0 : RFU - n/a
0 : RFU - n/a
x : Alert trigger sample count
x :
```

Trigger sample count decimal value 3 mapped to HEX

```
0x01
```

HEX message converted to binary

```
0b01
```

Whole binary message assembled

```
0b01000111
```

Binary value converted to HEX

```
0x47
```

Analog 2 low threshold value 12.0 converted to hex

```
0x41400000
```

Flip HEX value to LSB

```
0x00004041
```

Analog 2 high threshold value NaN converted to hex

```
0xFFFFFFFF
```

Flip HEX value to LSB

```
0xFFFFFFFF
```

Compile message for sending (HEX)

```
09|09|00|A7FEFFFFFF|08|07|02|47|00004041|FFFFFFFF
```

Control value in base64 to control after sending

```
CQkAp/7//wgHAKcAAEBB/////w==
```

fPort 51 Update message

Byte 0
Header
FF

Activate update mode for BT update for 2 minutes. if nothing is done the device will reboot, join and resume working

NB! **Only** unconfirmed messages should be used for this message.

Message sample

Message goal: Set device to update mode

Header

Select Header HEX code

FF

Compile message for sending (HEX)

FF

Control value in base64 to control after sending

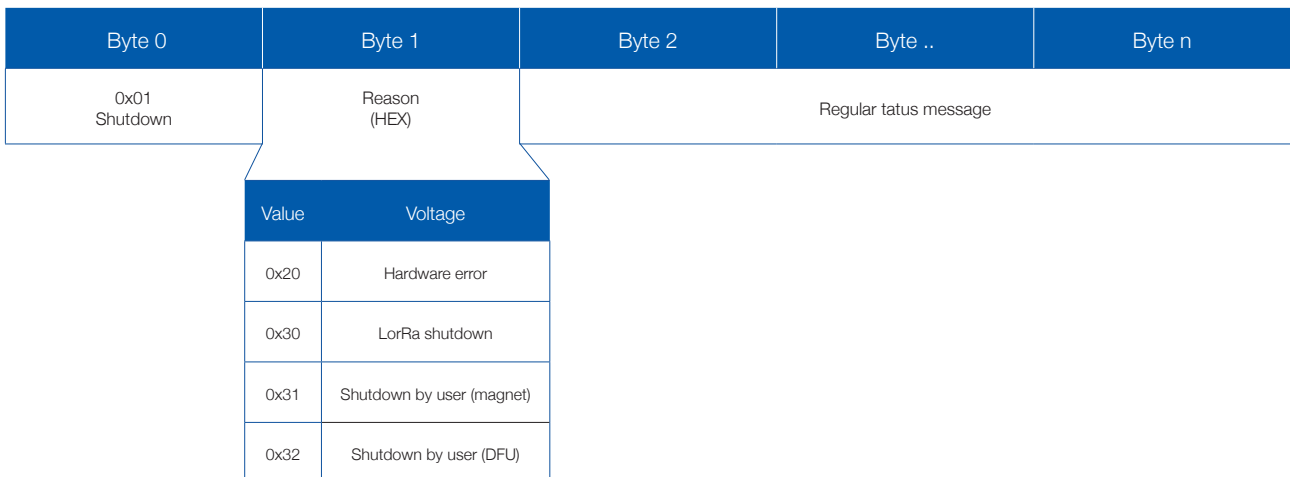
/w==

fPort 99 Boot/Debug Messages

Boot message



Shutdown message



Configuration failed packet

Byte 0	Byte 1	Byte 2
0x13 Config failed	fPort (uint8)	Error code (uint8)

Value	Error
2	Unknown fPort
3	Packet size short
4	Packet size long
5	Value error
6	Protocol parse error
7	Reserved flag set
8	Invalid flag combination
9	Unavailable feature request
10	Unsupported header
11	Unavailable hw request

Message sample

Message in base64

```
AFsAmEwACAQEAAE=
```

Message decoded to hex

```
00|5B00984C|000804|04|00|01
```

Header 0x00 decoded

```
Boot message
```

Device serial 0x5B00984C HEX message flip for MSB

```
0x4C98005B
```

Firmware version

Major version in HEX

```
0x00
```

HEX value converted to decimal

```
0
```

Minor version in HEX

```
0x08
```

HEX value converted to decimal

```
8
```

Patch version in HEX

```
0x04
```

HEX value converted to decimal

```
4
```

Reset reason 04 HEX message

HEX message converted to reason

```
Soft reset
```

General info 00 HEX message converted to info

```
Configuration not restored
```

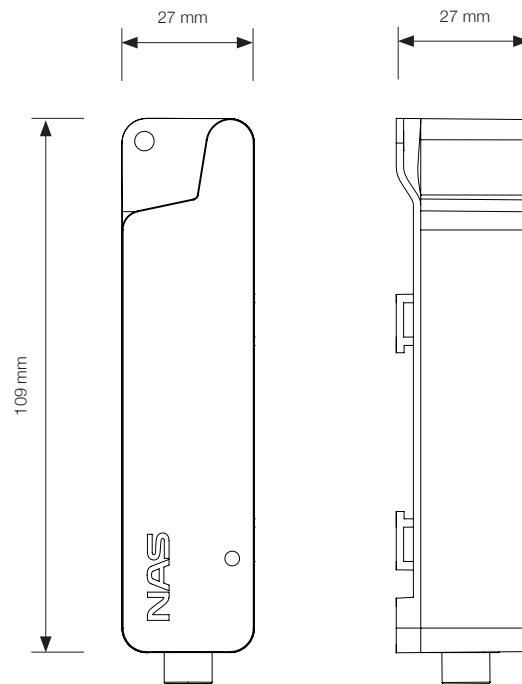
Hardware configuration 01 HEX message converted to configuration

```
Digital + Analog
```

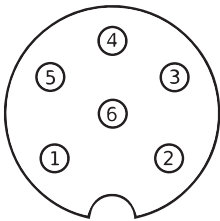
BATTERY OFFSET CHART

255 - Not measured	206 - 3,486	154 - 3,278	102 - 3,07	50 - 2,862
	205 - 3,482	153 - 3,274	101 - 3,066	49 - 2,858
254 - 4	204 - 3,478	152 - 3,27	100 - 3,062	48 - 2,854
253 - 3,95	203 - 3,474	151 - 3,266	99 - 3,058	47 - 2,85
252 - 3,9	202 - 3,47	150 - 3,262	98 - 3,054	46 - 2,846
251 - 3,85	201 - 3,466	149 - 3,258	97 - 3,05	45 - 2,842
250 - 3,8	200 - 3,462	148 - 3,254	96 - 3,046	44 - 2,838
249 - 3,75	199 - 3,458	147 - 3,25	95 - 3,042	43 - 2,834
248 - 3,7	198 - 3,454	146 - 3,246	94 - 3,038	42 - 2,83
247 - 3,65	197 - 3,45	145 - 3,242	93 - 3,034	41 - 2,826
246 - 3,646	196 - 3,446	144 - 3,238	92 - 3,03	40 - 2,822
245 - 3,642	195 - 3,442	143 - 3,234	91 - 3,026	39 - 2,818
244 - 3,638	194 - 3,438	142 - 3,23	90 - 3,022	38 - 2,814
243 - 3,634	193 - 3,434	141 - 3,226	89 - 3,018	37 - 2,81
242 - 3,63	192 - 3,43	140 - 3,222	88 - 3,014	36 - 2,806
241 - 3,626	191 - 3,426	139 - 3,218	87 - 3,01	35 - 2,802
240 - 3,622	190 - 3,422	138 - 3,214	86 - 3,006	34 - 2,798
239 - 3,618	189 - 3,418	137 - 3,21	85 - 3,002	33 - 2,794
238 - 3,614	188 - 3,414	136 - 3,206	84 - 2,998	32 - 2,79
237 - 3,61	187 - 3,41	135 - 3,202	83 - 2,994	31 - 2,786
236 - 3,606	186 - 3,406	134 - 3,198	82 - 2,99	30 - 2,782
235 - 3,602	185 - 3,402	133 - 3,194	81 - 2,986	29 - 2,778
236 - 3,606	184 - 3,398	132 - 3,19	80 - 2,982	28 - 2,774
235 - 3,602	183 - 3,394	131 - 3,186	79 - 2,978	27 - 2,77
234 - 3,598	182 - 3,39	130 - 3,182	78 - 2,974	26 - 2,766
233 - 3,594	181 - 3,386	129 - 3,178	77 - 2,97	25 - 2,762
232 - 3,59	180 - 3,382	128 - 3,174	76 - 2,966	24 - 2,758
231 - 3,586	179 - 3,378	127 - 3,17	75 - 2,962	23 - 2,754
230 - 3,582	178 - 3,374	126 - 3,166	74 - 2,958	22 - 2,75
229 - 3,578	177 - 3,37	125 - 3,162	73 - 2,954	21 - 2,746
228 - 3,574	176 - 3,366	124 - 3,158	72 - 2,95	20 - 2,742
227 - 3,57	175 - 3,362	123 - 3,154	71 - 2,946	19 - 2,738
226 - 3,566	174 - 3,358	122 - 3,15	70 - 2,942	18 - 2,734
225 - 3,562	173 - 3,354	121 - 3,146	69 - 2,938	17 - 2,684
224 - 3,558	172 - 3,35	120 - 3,142	68 - 2,934	16 - 2,634
223 - 3,554	171 - 3,346	119 - 3,138	67 - 2,93	15 - 2,584
222 - 3,55	170 - 3,342	118 - 3,134	66 - 2,926	14 - 2,534
221 - 3,546	169 - 3,338	117 - 3,13	65 - 2,922	13 - 2,484
220 - 3,542	168 - 3,334	116 - 3,126	64 - 2,918	12 - 2,434
219 - 3,538	167 - 3,33	115 - 3,122	63 - 2,914	11 - 2,384
218 - 3,534	166 - 3,326	114 - 3,118	62 - 2,91	10 - 2,334
217 - 3,53	165 - 3,322	113 - 3,114	61 - 2,906	9 - 2,284
216 - 3,526	164 - 3,318	112 - 3,11	60 - 2,902	8 - 2,234
215 - 3,522	163 - 3,314	111 - 3,106	59 - 2,898	7 - 2,184
214 - 3,518	162 - 3,31	110 - 3,102	58 - 2,894	6 - 2,134
213 - 3,514	161 - 3,306	109 - 3,098	57 - 2,89	5 - 2,084
212 - 3,51	160 - 3,302	108 - 3,094	56 - 2,886	4 - 2,034
211 - 3,506	159 - 3,298	107 - 3,09	55 - 2,882	3 - 1,984
210 - 3,502	158 - 3,294	106 - 3,086	54 - 2,878	2 - 1,934
209 - 3,498	157 - 3,29	105 - 3,082	53 - 2,874	1 - 1,884
208 - 3,494	156 - 3,286	104 - 3,078	52 - 2,87	
207 - 3,49	155 - 3,282	103 - 3,074	51 - 2,866	0 - N/A

DIMENSIONS



WIRING GUIDE

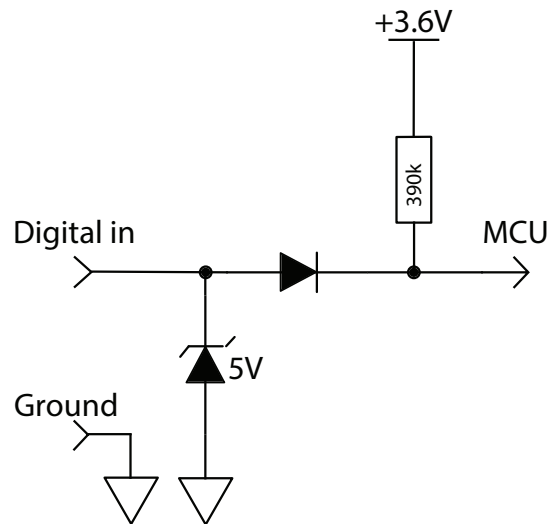


M8 Sensor side

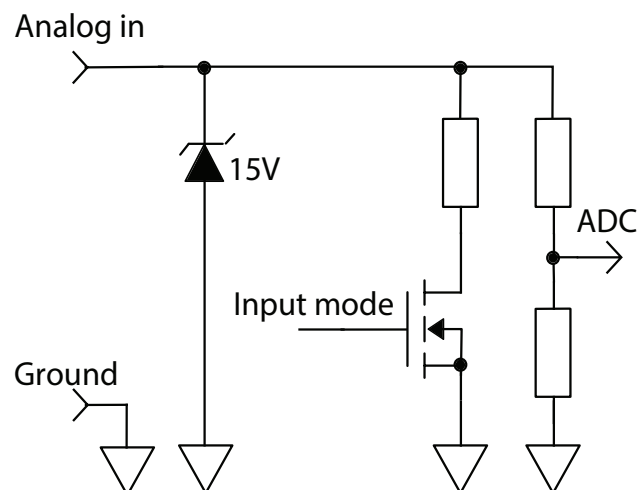
Pin	Wire color	Function
1	White	Digital 1
2	Brown	Analog 1
3	Grey	Analog 2
4	Black	Common ground
5	Blue	Digital 2
6	Pink	n/a

INPUT SCHEMATICS

Digital input

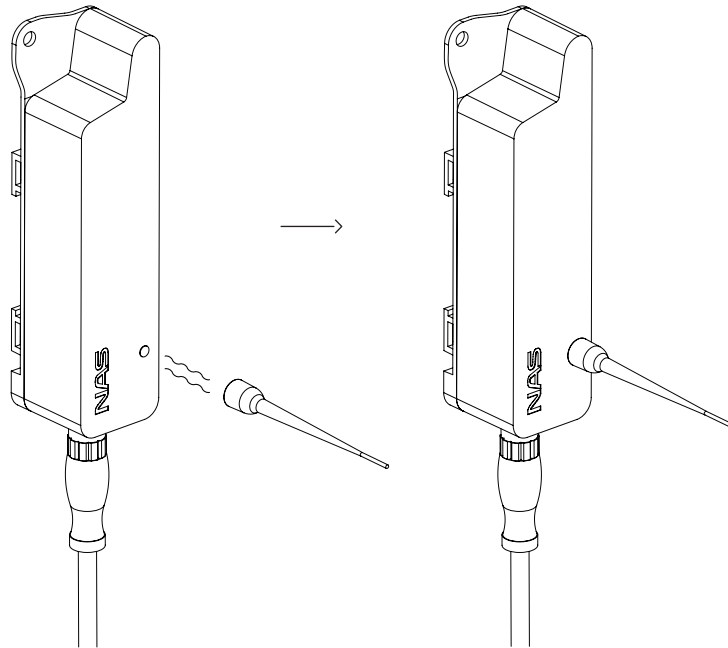


Analog input

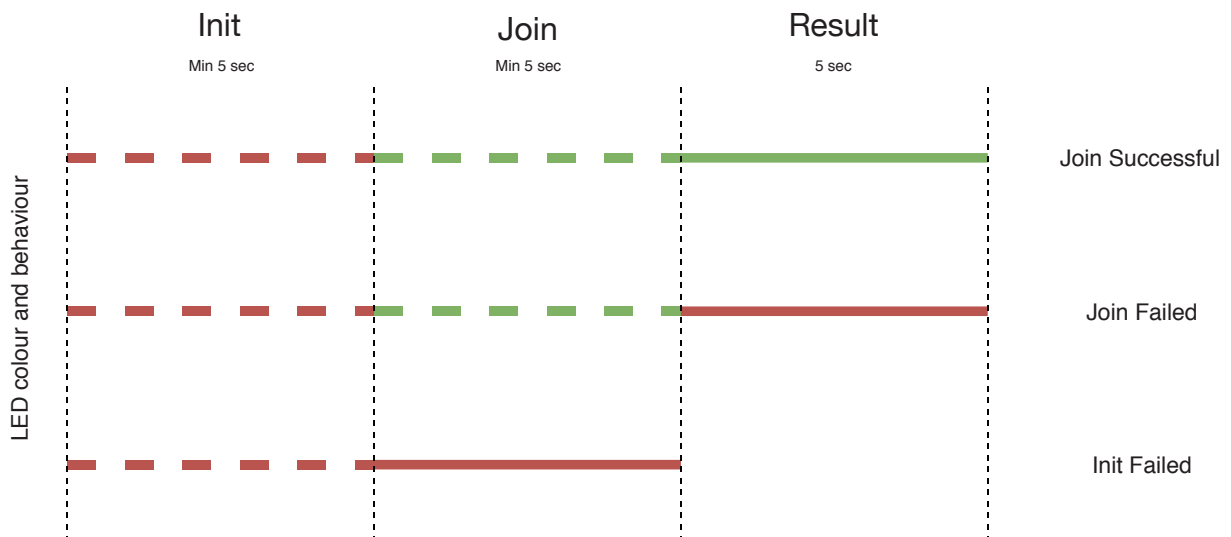


ACTIVATION

To activate the device, hold the magnet against the device (see illustration) for atleast 1 second. You can remove the magnet when the red light starts to flash.

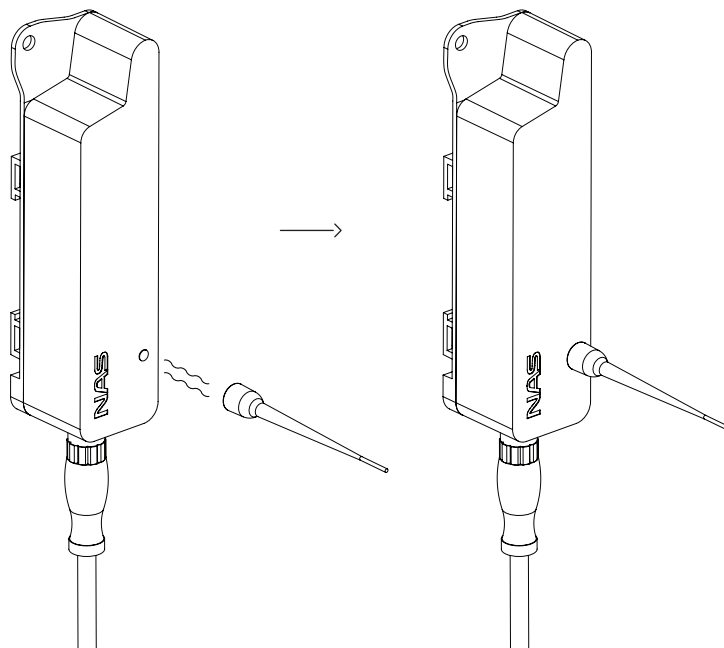


LED behaviour during activation

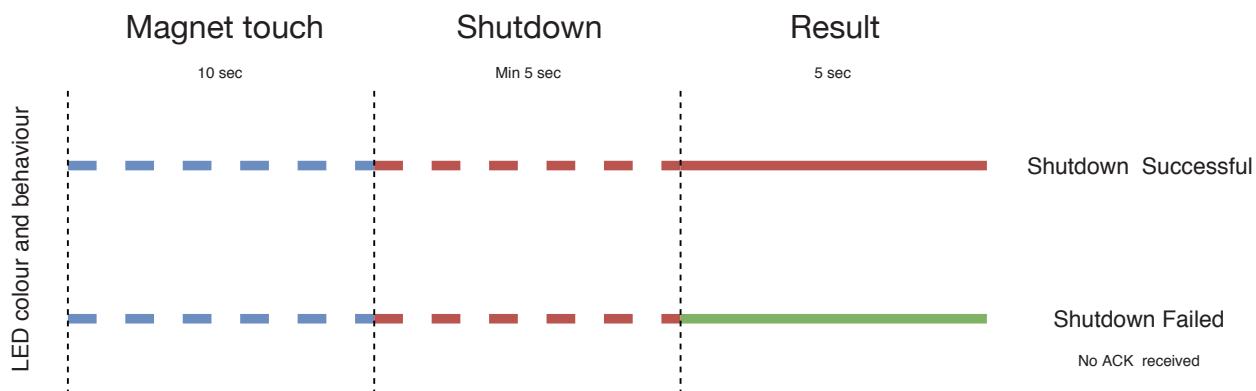


SHUTDOWN

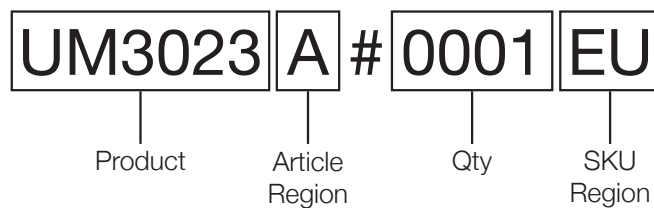
To activate the device, hold the magnet against the device (see illustration) for 10 seconds. You can remove the magnet when the red light starts to flash. During shutdown the device will send the shutdown message. If it does not get the ACK for it, it will cancel the shutdown.



LED behaviour during shutdown



ORDERING INFORMATION



Product/SKU	Package qty	Version
UM3023x#0001xx	1	Digital + Analog

Article region	SKU region	Frequency
A	EU	868 MHz
B	AU	922 MHz
C	US	915 MHz
D	AS	923 MHz
F	KR	922 MHz
I	IN	866 MHz

CONTACT INFORMATION

Nordic Automation Systems AS

www.nasys.no

info@nasys.no

REVISION HISTORY

1.0 - First version

1.1 - Added communication protocol.

1.2 - Communication protocol updated to 0.5.0

2.0 - Support for fw 0.7.0

- RSSI as absolute value
- Analog interface support
- Updated battery mapping
- Configuration request

2.1 - Interface schematics, LED behaviour

3.0 - Support for FW 0.8.4 (first draft)

- Boot packet battery info removed, config restored added
- Status packet optional active_alerts Byte, added battery % byte, added temperature extremes byte. Added device serial option for digital interface
- Configuration packet new multiplier logic. Possible to offset reading instead of only setting. Possible to add device serial to digital interfaces. On digital interface config mode has been made mandatory. On analog config general has been made mandatory.
- Configuration request packet has separate request for interface config.

All content contained herein is subject to change without notice. Nordic Automation Systems reserves the right to change or modify the content at any time.