

**LoRaWAN® communication specifications, models A2G-500,  
A2G-520 and A2G-540**

EN



**Differential pressure sensor, model A2G-500**

**Differential pressure air flow sensor, model A2G-520**

**Differential pressure and air flow controller, model A2G-540**

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Prior to starting any work, read the operating instructions!

Keep for later use!

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## Supplementary documentation:

- ▶ This special documentation for LoRaWAN® communication specifications applies in conjunction with the operating instructions “Differential pressure sensor, models A2G-500, A2G-520 and A2G-540” (item number 40452360).

## 1. General information

### 1.1 Object

This document describes the protocol specification for communication between the web app and an A2G instrument. It describes only the specific implementation of the TULIP protocol.

### 1.2 Abbreviations, definitions

|               |                                                                                                                                                                                                                                                                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LPWAN Network | Low Power Wide Area Network, a wireless digital data network category. In this document, LPWAN, for which a specific radio unit is designed and configured for communication.                                                                                                                                                                         |
| Packet        | A unit of radio transmission; it can contain LPWAN management data, as well as zero, one, or several messages following the application protocol described in the present document.                                                                                                                                                                   |
| Instrument    | Differential pressure sensor with wireless transmission, model A2G-5x0. This is an electronic differential pressure sensor. It contains radio modules for low-energy communication with a dedicated “myWIKa wireless device” mobile application available on PlayStore (Android) and App store (iOS) as well as LoRaWAN® communication version 1.0.3. |
| Platform      | Generic term for the data processing and storage system that conveys meaning to the data sent by a radio unit.                                                                                                                                                                                                                                        |
| Channel       | Each parameter measured by an instrument is associated with a channel. Channels are defined by a channel number, the physical parameter they measure and a physical unit.                                                                                                                                                                             |
| FS            | Full Scale, refers to the instrument's “full scale”, a.k.a. the instrument's nominal measurement scale defined by a lower boundary, an upper boundary, and a physical unit. A linear scale is assumed.                                                                                                                                                |

### 1.3 Convention

As a convention, all the traffic that goes from the instruments to the server (via the gateways) is called “upstream traffic”.

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY” and “OPTIONAL” in this document are to be interpreted as described in RFC 2119.

Multi-octet fields are encoded following a “big endian” convention, a.k.a “network order”. That order of octet transmission is the same as the left-to-right reading order.

# 1. General information / 2. Application protocol description

Bits are numbered from left to right, starting with bit 7 representing respectively the most significant octet (a.k.a MSb).

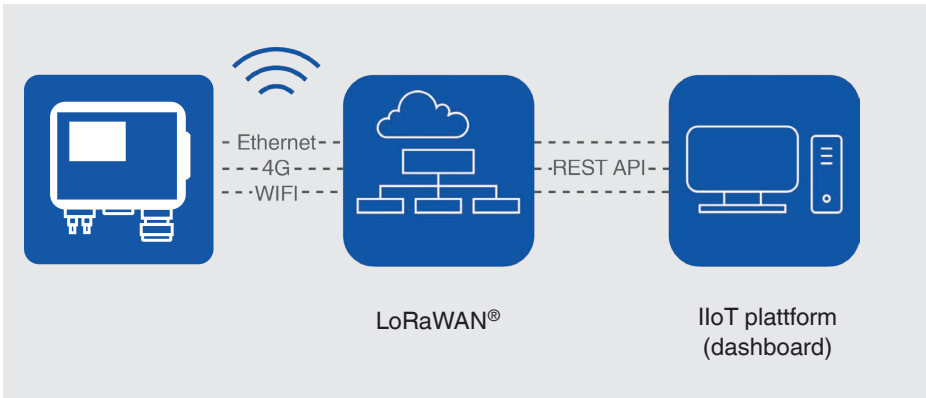
## Example

| Bytes | 0              |                |                |                |                |                |                |                | 1              |                |                |                |                |                |                |                | 2              |                |     |
|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----|
| Bit   | 7              | 6              | 5              | 4              | 3              | 2              | 1              | 0              | 7              | 6              | 5              | 4              | 3              | 2              | 1              | 0              | 7              | 6              | ... |
| Value | 2 <sup>7</sup> | 2 <sup>6</sup> | 2 <sup>5</sup> | 2 <sup>4</sup> | 2 <sup>3</sup> | 2 <sup>2</sup> | 2 <sup>1</sup> | 2 <sup>0</sup> | 2 <sup>7</sup> | 2 <sup>6</sup> | 2 <sup>5</sup> | 2 <sup>4</sup> | 2 <sup>3</sup> | 2 <sup>2</sup> | 2 <sup>1</sup> | 2 <sup>0</sup> | 2 <sup>7</sup> | 2 <sup>6</sup> | ... |

## 2. Application protocol description

### Purpose

The purpose of the application protocol is for the instrument to be able to communicate with an IIoT platform in order for one or several users to use all the features of the instrument remotely.



The protocol was designed to be compact in order to minimise energy consumption (to extend battery life) and also use the shared radio spectrum (to enable more instruments to be connected to a given network) more efficiently.

| LoRaWAN® specification |                    |
|------------------------|--------------------|
| LoRaWAN® specification | LoRa® 868 MHz EU   |
| Version                | 1.0.3              |
| Frequency range        | 863 ... 870 MHz    |
| Transmission power     | 12 dBm             |
| Range <sup>1)</sup>    | ≤ 10 km [≤ 6.2 mi] |
| Max. output power      | 14 dBm             |

- 1) The range depends on the topography. 10 km [6.2 mi] can be achieved in free field conditions and with a spreading factor of 12.

## 3. Principle

### 3.1 Power modes and LoRaWAN® class

The power mode of the A2G defines the communication class for LoRaWAN®.

Battery mode: LoRaWAN® class A

### 3.2 Join procedure

At power on, the module will try to join the network using a join sequence (1 try and 1 retry 3 minutes later if the first try didn't succeed). In the case of fail, it goes to sleep for a defined interval time and then launches a new join sequence.

The join procedure sleep intervals are defined in the LoRa® board firmware as:

- $T_0 = 0 \text{ min}$  and  $+3 \text{ min}$  (first attempt)
- $T = T_{\text{first attempt}} + 10 \text{ min}$  and  $+13 \text{ min}$  (second attempt)
- $T = T_{\text{second attempt}} + 55 \text{ min}$  and  $+3 \text{ min}$  (third attempt)
- $T = T_{\text{third attempt}} + 8 \text{ h}$  and  $+3 \text{ min}$  (fourth attempt)
- $T = T_{\text{fourth attempt}} + 8 \times N \text{ h}$  and  $+3 \text{ min}$

It increases the last period infinitely, until join success or reboot.

| Sequence    | Explanation                       | Difference |
|-------------|-----------------------------------|------------|
| 0 min       | $T_0 = 0 \text{ min}$ (startup)   | 0 min      |
| 3 min       | $T_1 = T_0 + 3 \text{ min}$       | 3 min      |
| 13 min      | $T_2 = T_1 + 10 \text{ min}$      | 10 min     |
| 16 min      | $T_3 = T_2 + 3 \text{ min}$       | 3 min      |
| 1 h 11 min  | $T_4 = T_3 + 55 \text{ min}$      | 55 min     |
| 1 h 14 min  | $T_5 = T_4 + 3 \text{ min}$       | 3 min      |
| 9 h 14 min  | $T_6 = T_5 + 8 \text{ h}$         | 8 h        |
| 9 h 17 min  | $T_7 = T_6 + 3 \text{ min}$       | 3 min      |
| 17 h 17 min | $T_8 = T_7 + 8 \text{ h}$         | 8 h        |
| 17 h 20 min | $T_9 = T_8 + 3 \text{ min}$       | 3 min      |
| 25 h 20 min | $T_{10} = T_9 + 8 \text{ h}$      | 8 h        |
| 25 h 23 min | $T_{11} = T_{10} + 3 \text{ min}$ | 3 min      |
| ...         | ...                               | -          |

### 3.3 Upstream traffic

All upstream traffic generated by the instrument is sent on LoRaWAN® port 10.

An A2G instrument sends messages in five cases:

- Data message, without LoRaWAN® confirm
- Technical alarm message, without LoRaWAN® confirm
- Instrument alarm message, without LoRaWAN® confirm
- Keep alive message for data at least once a day, without LoRaWAN® confirm
- Instrument identification message, without LoRaWAN® confirm

The application server will check the periodic uplink of standard data, depending on the current configuration.

## 4. Upstream format

The LoRa®-transmitted frame is limited in length to 51 bytes (including FOpts bytes). When the length of data exceeds this limit, data is transmitted in multiple frames, otherwise it is transmitted in a single frame containing all data.

- Single transmission

Upstream messages are defined by their type and contents.

| Byte | Size (bytes) | Field                 | Note                             |
|------|--------------|-----------------------|----------------------------------|
| 0    | 1            | Upstream message type | -                                |
| 1    | 1            | Configuration ID      | Current configuration identifier |
| 2    |              | Data                  | Data depending on message type   |
| -    |              | ...                   | -                                |
| -    |              | ...                   | -                                |
| n    |              | Data                  | -                                |

### 4.1 Upstream message type

Decoding message contents depends on its type:

| Hex  | Message types                   |
|------|---------------------------------|
| 0x00 | --Unused and must not be used-- |
| 0x01 | Data message                    |
| 0x04 | Technical alarm                 |
| 0x05 | Instrument alarm                |
| 0x07 | Instrument identification       |
| 0x08 | Keep alive                      |

## 4.2 Data message

The messages are formatted as described in the following table:

| Byte  | Size (bytes) | Field                      | Note                                                                                                   |
|-------|--------------|----------------------------|--------------------------------------------------------------------------------------------------------|
| 0     | 1            | Message type               | Data message type = 0x01                                                                               |
| 1     | 1            | Configuration ID           | Current configuration identifier                                                                       |
| 2-5   | 4            | Pressure                   | Float (IEEE 754)<br>Example: 110.2 [Pa]                                                                |
| 6-9   | 4            | Flow <sup>1)</sup>         | Float (IEEE 754)<br>Example: 650.1 [m³/h]                                                              |
| 10-13 | 4            | IN1 <sup>1)</sup>          | Float (IEEE 754)<br>Example: 96.2 [kPa]                                                                |
| 14-17 | 4            | IN2 <sup>1)</sup>          | Float (IEEE 754)<br>Example: 65.6 [% r. h.]                                                            |
| 18-21 | 4            | IN3 <sup>1)</sup>          | Float (IEEE 754)<br>Example: 23.5 [°C]                                                                 |
| 22-25 | 4            | IN4 <sup>1)</sup>          | Float (IEEE 754)<br>Example: 1 = true [Binary]                                                         |
| 26    | 1            | Relay status <sup>1)</sup> | (Bit 0) = 0 Relay 1 OFF<br>(Bit 0) = 1 Relay 1 ON<br>(Bit 1) = 0 Relay 2 OFF<br>(Bit 1) = 1 Relay 2 ON |

1) These bytes are not sent from a battery instrument to save energy.

### 4.3 Technical alarm message

The transmission of technical alarm messages is event based. When a new alarm occurs and when an alarm disappears a message is sent.

The messages are formatted as described in the following table:

| Byte | Size (bytes) | Field            | Note                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------|--------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 1            | Message type     | Technical alarm message type = 0x04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1    | 1            | Configuration ID | Current configuration identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2    | 1            | Alarm            | <p>These bits are set when the input or output range is exceeded or a bus communication error is present.<br/>0x00 = No technical alarm message pending</p> <p>           Bit 7: Temperature input 4 signal overload<br/>           Bit 6: Temperature input 3 signal overload<br/>           Bit 5: Voltage input 2 signal overload<br/>           Bit 4: Voltage input 1 signal overload<br/>           Bit 3: Modbus communication error<br/>           Bit 2: Analogue output 2 signal overload<br/>           Bit 1: Analogue output 1 signal overload<br/>           Bit 0: Pressure signal overload         </p> |

### 4.4 Instrument alarm message

The transmission of instrument alarm messages is event based. When a new alarm occurs and when an alarm disappears a message is sent.

The messages are formatted as described in the following table:

| Byte | Size (bytes) | Field            | Note                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------|--------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 1            | Message type     | Instrument alarm message type = 0x05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1    | 1            | Configuration ID | Current configuration identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 2-3  | 2            | Instrument alarm | <p>These bits are set when an instrument alarm occurs.<br/>0x00 = No instrument alarm message pending</p> <p>Byte 2</p> <p>Bit 7: ADC error<br/>           Bit 6: Pressure sensor no-response error<br/>           Bit 5: Pressure sensor timeout error<br/>           Bit 4: Factory options write error<br/>           Bit 3: Factory options delete error<br/>           Bit 2: Invalid factory options error<br/>           Bit 1: User settings invalid error<br/>           Bit 0: User settings read/write error</p> <p>Byte 3</p> <p>Bit 7: Zero offset over-range error<br/>           Bit 6: Invalid signal source specified error<br/>           Bit 5: Analog output 2 over-temperature error<br/>           Bit 4: Analog output 2 load fault error<br/>           Bit 3: Analog output 2 over-range error<br/>           Bit 2: Analog output 1 over-temperature error<br/>           Bit 1: Analog output 1 load fault error<br/>           Bit 0: Analog output 1 over-range error</p> |

### 4.5 Instrument identification message

The sensor is able to provide its identification.

Generally, this message is sent after the join with a confirm message.

The message is formatted as described in the following tables:

| Byte | Size (bytes) | Field                           | Note                                                                               |
|------|--------------|---------------------------------|------------------------------------------------------------------------------------|
| 0    | 1            | Message type                    | Identification message type = 0x07                                                 |
| 1    | 1            | Configuration ID                | Current configuration identifier                                                   |
| 2    | 1            | Wireless product ID             | Instrument identification A2G = 13                                                 |
| 3    | 1            | Wireless product sub-ID         | Protocol LoRaWAN® = 00                                                             |
| 4-5  | 2            | Sensor module firmware revision | <p>MAJOR.minor.PATCH = v[0-15].[0-15].[0-255]<br/>           Hex-Coded: 0xMmPP</p> |

## 4. Upstream format

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| Byte  | Size (bytes) | Field                           | Note                                                                |
|-------|--------------|---------------------------------|---------------------------------------------------------------------|
| 6     | 1            | Sensor module hardware revision | HW revision code as read from pins                                  |
| 7     | 1            | Hardware assembly type          | See below                                                           |
| 8-23  | 16           | Serial number                   | Alphanumeric (ASCII), example:<br>2Y00001HGHZ                       |
| 24-27 | 4            | Min. measuring range pressure   | Float (IEEE 754)<br>Example:<br>Pressure: -1245.0 [Pa]              |
| 28-31 | 4            | Max. measuring range pressure   | Float (IEEE 754)<br>Example:<br>Pressure: 2487.0 [Pa]               |
| 32    | 1            | UNIT main pressure              | See measuring unit enum<br>Example:<br>Pressure: Pa = 1             |
| 33    | 1            | UNIT main flow <sup>1)</sup>    | See measuring unit enum<br>Example:<br>Flow: m <sup>3</sup> /h = 11 |
| 34    | 1            | UNIT IN1 <sup>1)</sup>          | See measuring unit enum<br>Example:<br>kPa = 2                      |
| 35    | 1            | UNIT IN2 <sup>1)</sup>          | See measuring unit enum<br>Example:<br>% r. h. = 20                 |
| 36    | 1            | UNIT IN3 <sup>1)</sup>          | See measuring unit enum<br>Example:<br>°C = 40                      |
| 37    | 1            | UNIT IN4 <sup>1)</sup>          | See measuring unit enum<br>Example:<br>Binary = 46                  |

1) These bytes are not sent from a battery instrument to save energy.

## 4. Upstream format

### 4.5.1 Wireless module type

| Code | Description |
|------|-------------|
| 13   | A2G         |

### 4.5.2 Wireless module subtype

| Code | Description |
|------|-------------|
| 00   | LoRaWAN®    |

### 4.5.3 Hardware assembly type enum

| Code | Description                 |
|------|-----------------------------|
| 0    | Full                        |
| 1    | 1 analogue output           |
| 2    | Bus                         |
| 3    | Modular                     |
| 4    | 1 analogue output & 1 relay |
| 5    | 2 analogue outputs          |
| 128  | 1 analogue output (24 V)    |
| 129  | Current transmitter         |
| 130  | Battery                     |

### 4.5.4 Measuring unit

| Code | Unit              | Comment     |
|------|-------------------|-------------|
| 1    | Pa                | Pressure    |
| 2    | kPa               |             |
| 3    | mbar              |             |
| 4    | mmWC              |             |
| 5    | inWC              |             |
| 10   | m <sup>3</sup> /s | Flow        |
| 11   | m <sup>3</sup> /h |             |
| 12   | l/sec             |             |
| 13   | cfm               |             |
| 14   | m/sec             |             |
| 15   | ft/min            |             |
| 20   | % r. h.           | Various     |
| 21   | g/m <sup>3</sup>  |             |
| 22   | g/ft <sup>3</sup> |             |
| 23   | kJ/kg             |             |
| 24   | BTU/BLD           |             |
| 31   | ppm               | Relative    |
| 32   | %                 |             |
| 40   | °C                | Temperature |
| 41   | °F                |             |
| 45   | Volt              | Voltage     |
| 46   | Binary            | Digital     |

### 4.6 Keep alive message

Note: The keep alive transmission will occur after a period of 24 h.

| Byte | Size (bytes) | Field                   | Note                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------|--------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 1            | Message type            | Keep alive message type = 0x08                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1    | 1            | Configuration ID        | Current configuration identifier                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2    | 1            | Battery level indicator | <p>Battery level indicator [7]:</p> <ul style="list-style-type: none"> <li>■ 0: no new event</li> <li>■ 1: new event – the instrument has restarted since the last keep alive transmission</li> </ul> <p>Battery level indicator [6...0] = current estimated battery level in percent (from 0 to 100).<br/>0x7F is returned if an error occurred during battery capacity computing (typically an estimated load greater than the battery load)</p> |

## 5. Frame examples

### 5.1 Data converter

There are many online converters available for the conversion from decimal to hexadecimal, HEX to ASCII or for the interpretation of float values according to IEEE 754.

### 5.2 Data message frame example

Example message (hex):

01 01 BE5CF94C 00000000 3B834000 3B548000 43974D76 41BBA348 02

| Byte  | Size (bytes) | Field                      | Message    | Decoded                                 |
|-------|--------------|----------------------------|------------|-----------------------------------------|
| 0     | 1            | Message type               | 0x01       | Data message                            |
| 1     | 1            | Configuration ID           | 0x01       | Configuration identifier                |
| 2-5   | 4            | Pressure                   | 0xBE5CF94C | -0.215794742                            |
| 6-9   | 4            | Flow <sup>1)</sup>         | 0x00000000 | 0]                                      |
| 10-13 | 4            | IN1 <sup>1)</sup>          | 0x3B834000 | 0.004005432                             |
| 14-17 | 4            | IN2 <sup>1)</sup>          | 0x3B548000 | 0.00324249268                           |
| 18-21 | 4            | IN3 <sup>1)</sup>          | 0x43974D76 | 302.605164                              |
| 22-25 | 4            | IN4 <sup>1)</sup>          | 0x41BBA348 | 23.4547272                              |
| 26    | 1            | Relay status <sup>1)</sup> | 0x02       | 0000 0010 -> Relay 1 OFF;<br>Relay 2 ON |

1) These bytes are not sent from a battery instrument to save energy.

5.3 Technical alarm message frame example

Example message (hex):

04 01 23

| Byte | Size (bytes) | Field            | Message | Decoded                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------|--------------|------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 1            | Message type     | 0x04    | Technical alarm message                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1    | 1            | Configuration ID | 0x01    | Configuration identifier                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2    | 1            | Alarm            | 0x23    | 0x23 → 0010 0011<br>Bit 7: Temperature input 4 signal overload = No overload<br>Bit 6: Temperature input 3 signal overload = No overload<br>Bit 5: Voltage input 2 signal overload = Overload<br>Bit 4: Voltage input 1 signal overload = No overload<br>Bit 3: Modbus communication error = No error<br>Bit 2: Analogue output 2 signal overload = No overload<br>Bit 1: Analogue output 1 signal overload = Overload<br>Bit 0: Pressure signal overload = Overload |

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5.4 Instrument alarm message frame example

Example message (hex):

05 01 4821

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| Byte | Size (bytes) | Field            | Message | Decoded                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------|--------------|------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 1            | Message type     | 0x05    | Instrument alarm message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1    | 1            | Configuration ID | 0x01    | Configuration identifier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2-3  | 1            | Alarm            | 0x4821  | Byte 2 = 0x48 → 0100 1000<br>Bit 7: ADC converter error = No error<br>Bit 6: Pressure sensor no-response error = Error<br>Bit 5: Pressure sensor timeout error = No error<br>Bit 4: Factory options write error = No error<br>Bit 3: Factory options delete error = Error<br>Bit 2: Invalid factory options error = No error<br>Bit 1: User settings invalid error = No error<br>Bit 0: User settings read/write error = No error<br><br>Byte 3 = 0x21 → 0010 0001<br>Bit 7: Reserved for future use<br>Bit 6: Invalid signal source specified error = No error<br>Bit 5: Analogue output 2 over-temperature error = Error<br>Bit 4: Analogue output 2 load fault error = No error<br>Bit 3: Analogue output 2 over-range error = No error<br>Bit 2: Analogue output 1 over-temperature error = No error<br>Bit 1: Analogue output 1 load fault error = No error<br>Bit 0: Analogue output 1 over-range error = Error |

### 5.5 Instrument identification message frame example

Example message (hex):

07 01 0D 00 1203 05 00 325930303030314847485A0000000000 C49BA000 451B7000  
01 0B 2D 03 28 29

| Byte  | Size (bytes) | Field                           | Message                                                              | Decoded                                       |
|-------|--------------|---------------------------------|----------------------------------------------------------------------|-----------------------------------------------|
| 0     | 1            | Message type                    | 0x07                                                                 | Instrument identification message             |
| 1     | 1            | Configuration ID                | 0x01                                                                 | Configuration identifier                      |
| 2     | 1            | Wireless module type            | 0x0D                                                                 | 13 → A2G                                      |
| 3     | 1            | Wireless module subtype         | 0x00                                                                 | 00 → LoRaWAN®                                 |
| 4-5   | 2            | Sensor module firmware revision | 0x1203                                                               | MAJOR.minor.PATCH<br>→ Firmware version 1.2.3 |
| 6     | 1            | Sensor module hardware revision | 0x05                                                                 | Hardware revision 5                           |
| 7     | 1            | Hardware assembly type          | 0x00                                                                 | Full assembly                                 |
| 8-23  | 16           | Serial number                   | 0x32593030<br>3030314847<br>485A000000<br>0000<br>(5 bytes reserved) | 2Y00001HGHZ                                   |
| 24-27 | 4            | Min. measuring range pressure   | 0xC49BA000                                                           | -1245                                         |
| 28-31 | 4            | Max. measuring range pressure   | 0x451B7000                                                           | 2487                                          |
| 32    | 1            | UNIT main pressure              | 0x01                                                                 | 1 = Pa                                        |
| 33    | 1            | UNIT main flow <sup>1)</sup>    | 0x0B                                                                 | 11 = m³/h                                     |
| 34    | 1            | UNIT IN1 <sup>1)</sup>          | 0x2D                                                                 | 45 = V                                        |
| 35    | 1            | UNIT IN2 <sup>1)</sup>          | 0x03                                                                 | 3 = mbar                                      |
| 36    | 1            | UNIT IN3 <sup>1)</sup>          | 0x28                                                                 | 40 = °C                                       |
| 37    | 1            | UNIT IN4 <sup>1)</sup>          | 0x29                                                                 | 41 = °F                                       |

1) These bytes are not sent from a battery instrument to save energy.

5.6 Keep alive frame example

Example message (hex):

08 01 CB

| Byte | Size (bytes) | Field                   | Message | Decoded                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------|--------------|-------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0    | 1            | Message type            | 0x08    | Keep alive message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1    | 1            | Configuration ID        | 0x01    | Configuration ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2    | 1            | Battery level indicator | 0xCB    | <p>(from right to left)</p> <p>Bit 7: 1 → instrument has restarted since last keep alive message</p> <p>Bit 6...0: 75 % battery level</p> <p>0xCB → 1100 1011</p> <p>1 → instrument restarted</p> <p>100 1011 = 75 → 75 %</p> <p>Battery level indicator [7]:</p> <ul style="list-style-type: none"><li>■ 0: no new event</li><li>■ 1: new event – the instrument has restarted since the last keep alive transmission</li></ul> <p>Battery level indicator [6...0] = current estimated battery level in percent (from 0 to 100).</p> <p>0x7F is returned if an error occurred during battery capacity computing (typically an estimated load greater than the battery load)</p> |



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