

HYPERION LORAWAN INTERFACE



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1. GENERAL DESCRIPTION OF THE LORAWAN INTERFACE

- The **Hyperion** Lora is compatible to **LoraWAN** 1.0.3 (Class C).
- The Hyperion Lora permanently saves the needed parameters for Lora and its configuration on the Lora-module.
- A re-parametrization is only possible via the meter display or via a Lora downlink message.
- The Hyperion Lora autonomously synchronizes its internal clock at least once per day via a regularly scheduled DeviceTimeReq.
- The Hyperion Lora determines and optimizes its own transmit parameters (data rate, SF-factor etc.).
- The default meter uses an internal antenna for communication. A meter with an external antenna is only available through special request

Please Note:

- Operation of the Hyperion Lora with a SMA connector is only allowed with an attached antenna!
- By default the external antenna is deactivated!
- An improperly installed antenna can damage the Hyperion!

2. HARDWARE DESCRIPTION

The Lora interface of the Hyperion LoRa is based on the Lora transmission standard. This means the meter can reliably transmit data over large distances in environments without a permanent communication.

To ensure a stable and high-performance connection to the LoRa gateway, the meter continuously adapts its transmit and receive parameters automatically.

For easier integration into a network, the connection status can be viewed directly on the meter display.

- Frequency: EU 863870MHz
- Typ: Class C Device
- Two-way communication.
- The Lora interface is available anytime for downlink messages (Class C).
- The interface transmits with a signal strength of 14dbm.

External antenna connection

To connect an external antenna to the SMA-connector, use an antenna with a SMA-plug.

Note that the option for the external antenna must be activated on the meter if an external antenna is attached.

Please note:

- The use of a RP-SMA antenna (with an adapter) is not recommended.
- In case the Hyperion Lora is connected to a Lora network without Class--C support the meter acts as a Class--A device.
- The Hyperion Lora operates with an adaptive data rate. Use as a roaming device should be carefully clarified beforehand.

3. INSTALLATION AND CONFIGURATION

This section covers installation safety, antenna setup, and configuration requirements before operating the Hyperion LoRa meter.

3.1. SAFETY AND PREPERATION

Please note:

- Make sure to disconnect all current and voltage connections before installation of the external antenna.
- Make sure that the SMA connector is fitted correctly. The maximum torque for the union nut must not exceed 1 Nm..

3.2. START OF THE OPERATION

Every meter is shipped with:

- Join-Modus: **OTAA**
- **DeviceEUI** (starting with 10 2C EF)
- **Appkey**
- **JoinEUI** (formerly: AppEUI) (10 2C EF 00 00 00 00 00)

The Dev-EUI and the AppKey can be read out on the display, the JoinEUI (formerly: AppEUI) is `10 2C EF 00 00 00 00 00` on every meter.

- Make sure that the meter is connected correctly (Phase and line sequence, direction of flow of energy).
- Make sure that the current and voltage transformer ratios of the converter counter are configured correctly.

The Hyperion Lora is designed for fast detection of potential problems in connection range or throughput.

Repositioning of the Lora gateway is possible after the installation of the Hyperion Lora.

As long as the recommended distances are adhered to, the meter continues to communicate with the Lora server.

Operation of the meter with a SMA-connector is only allowed with an attached antenna.

4. LORAWAN FUNCTIONAL OVERVIEW

4.1. LORA JOINSTATUS 2/4

Display Information:

- Joined: If the meter is connected to a Lora network.
- Lst. Uplink: ACK/NACK (with or without acknowledge)
- Timestamp of the last Uplink

4.2. LORA STATUS 3/4

Display Information:

- RSSI: The received field strength
- SNR: Signal to noise ratio
- SPF: Spreading factor
- BW: Bandwidth

4.3. LORA JOINMODE 4/4

Display Information:

- Join Mode: OTAA or ABP
- Lst. Downlink: ACK/NACK (with or without acknowledge)
- Timestamp of last Downlink

4.4. LORA APPKEY (ONLY WITH OTAA)

A short press of the **SRVC button** shows the current **AppKey**.

Using the **Arrow right** button you can generate a new **AppKey**.

- A second short press (<2s) of the **SRVC button** exits the edit mode without changing the AppKey.
- A second long press (>2s) of the **SRVC button** finalizes the generation of the new AppKey and exits the edit mode automatically.
- The successful generation of a new AppKey is receipted with a short flashing of the display backlight.

The newly created **AppKey** can now be read out by a short press of the **SRVC button**.

4.5. LORA DEVADDR (ONLY WITH ABP)

A short press of the **SRVC button** shows the current **DevAddr**.

Using the **Arrow right** button you can generate a new **DevAddr**.

- A second short press (<2s) of the **SRVC button** exits the edit mode without changing the DevAddr.

- A second long press (>2s) of the **SRVC button** finalizes the generation of the new DevAddr and exits the edit mode automatically.
- The successful generation of a new DevAddr is receipted with a short flashing of the display backlight.

The newly created **DevAddr** can now be read out by a short press of the **SRVC button**.

4.6. LORA NWKSKY (ONLY WITH ABP)

A short press of the **SRVC button** shows the current **NwkSKey**.

Using the **Arrow right** button you can generate a new **NwkSKey**.

- A second short press (<2s) of the **SRVC button** exits the edit mode without changing the NwkSKey.
- A second long press (>2s) of the **SRVC button** finalizes the generation of the new NwkSKey and exits the edit mode automatically.
- The successful generation of a new NwkSKey is receipted with a short flashing of the display backlight.

The newly created **NwkSKey** can now be read out by a short press of the **SRVC button**.

4.7. LORA JOINMODE (AVAILABLE WITH OTAA AND ABP)

You can set the parameter by briefly pressing the **SRVC button**.

Use the **Arrow right** to select the desired **JoinMode**.

- A second short press (<2s) on the **SRVC button** exits the editing mode without changing the JoinMode.
- A second long press (>2s) on the **SRVC button** closes the new JoinMode and exits edit mode automatically.
Successful saving is acknowledged with a brief flash of the display light.

Note: After successfully changing the JoinMode, you must provide your LoRa server with the new keys.

4.8. OTAA - OVER THE AIR ACTIVATION

The Lora interface of the Hyperion energy meter can use **OTAA**.

The communication module controls the encryption with the Lora network server and joins the network.

There can only be a **1:1** connection between the meter and the Lora network. This type of communication offers increased security against interference by third parties.

4.9. LORA JOIN

Performing a (re-)join

You can set the parameter by briefly pressing the SRVC button.

You can select "Reboot" with the Arrow right.

- A second short press (<2s) on the SRVC button exits edit mode without changing anything.
- A second long press (>2s) on the SRVC button starts the (re)join and exits edit mode automatically.
Successful saving is acknowledged with a brief flash of the display light.

4.10. LORA-TEST

Send an immediate uplink message with the configuration of slot 1 to the LoRa network.

You can set the parameter by briefly pressing the SRVC button.

The uplink is triggered with the Arrow right.

- A second short press (<2s) on the SRVC button exits edit mode without changing anything.
- A second long press (>2s) on the SRVC button starts the uplink and exits edit mode automatically.
Successful transmission is acknowledged with a brief flashing of the display light.

Note:

- This uplink can only be sent if slot 1 is marked as active.
- This uplink can only be sent if no Duty-Cycle-Restrictions apply.

4.11. LORA ANTENNA

Enables easy switching between internal and external antenna.

You can set the parameter by briefly pressing the **SRVC button**.

Use the Arrow right to select the antenna.

- A second short press (<2s) on the SRVC button exits the editing mode without changing the antenna configuration.
- A second long press (>2s) on the SRVC button saves the selection and exits edit mode automatically.
Successful saving is acknowledged with a brief flash of the display light.

DANGER:

- Ensure that the meter is de-energized when installing the external antenna.
- The meter can be damaged if the installation instructions are not followed.

- Follow the instructions!
- The antenna must be attached before you change this setting!

4.12. LORA INTERFACE

Enables a **soft reset (SoftReset)** of the LoRa module or resetting to factory settings (**Factory RESET**).

You can set the parameter by briefly pressing the SRVC button.

You can select the reset with the Arrow right.

- A second short press (<2s) on the SRVC button exits the editing mode without changing anything.
 - A second long press (>2s) on the SRVC button completes the reset and exits edit mode automatically.
- The successful reset is acknowledged with a brief flash of the display light.

A reset of the LoRa module does not change or affect any measurements, meter readings or other measurement-relevant processes of the Hyperion LoRa.

4.13. JOIN REQUEST

As long as no join request has occurred, the Hyperion regularly attempts to establish a connection to a Lora network.

These join requests occur randomly over a period of ~ 10 minutes to counteract bandwidth problems when several meters are in the same network.

The uplink and downlink counter is reset to 0 after restarting the Hyperion Lora.

4.14. LORA CONNECTION TEST

The Hyperion Lora checks its connection to the Lora network at least once a day.

You can configure the data packets so that an ACK is requested for each uplink transmission.

If this option is set, the meter can react much faster to a connection interruption.

If the Hyperion Lora

- does not receive an ACK to its uplink messages within 24 hours,
- or the connection check (once every 24 hours) for continued connection to the Lora network fails, it automatically starts a new **(re)join process**.

This check for continued connection to the Lora network can also be done via time synchronization (**DeviceTimeReq**) or an uplink message to a dedicated fPort with an ACK.

The Hyperion Lora energy meter can acknowledge every downlink transmission received.

5. CONFIGURATION OF THE MEASURED VALUE TRANSMISSION

5.1. GENERAL DESCRIPTION

- You can configure which measured values are to be sent at which interval via a downlink message.
- Only measured values from the data logger and logbook are available for readout.
- There are 10 "slots" available for this configuration, which are represented by the fPorts 1-10.
- Only **10** measurements can be saved per slot.
- Lower slots have a higher priority.
- The following measurement registers are transferred by default: See **Default-Uplink**
- You can configure the interval at which the data is transmitted.
The interval can be set from 1 minute to a maximum of 67,500 minutes (45 days).
- Do you want your Lora network to send an ACK for each transmission received from the meter? Yes/No?
 - If Yes: If the network does not acknowledge the packet, the meter will resend the packet
- Select whether this profile is active or not.

Please Note:

- If you only change the transmission interval, the downlink message only contains the 2 interval bytes and the flags for ACK and active without further register data.
- If the airtime of the counter does not allow a transmission that is too long, the transmission will only be sent partially or not at all.

5.2. DESCRIPTION OF THE DOWNLINK MESSAGE

The BitOrder is LSB, the ByteOrder is LittleEndian.

Configuration of which registers are sent.

Length in bytes: 4 bytes - 13 bytes fPort: 110

Byte	Description	Example
0-1	Time interval in minutes	0x01 0x00 0xFF 0xFF
2	Configurations-Flags	
3-12	ID's of registers in the transmission	0x03...
	CRC8	see definition

5.3. CONFIGURATION FLAG BYTE

Byte	Bit	Description
00000000	1	Settings are unchanged
00000000	2	No ACK expected after upload
00000010	2	ACK expected for every upload
00000100	3	Make a (re)join after approx. 60 minutes to an existing/new network
00000000	3	Not defined
00001000	4	Connection deactivated
00000000	4	Connection activated
00010000	5	not defined
00000000	5	not defined
00100000	6	not defined
00000000	6	not defined
01000000	7	not defined
00000000	7	not defined

A list of possible register-IDs can be found in the Measurement tab

Note:

- If only byte 0 + 1 + configByte + CRC8 are sent, the transmission interval and the configuration flags are changed accordingly.
- The measurement registers are not changed.

Example for 1-Minute-Interval Setting

```
var data =[0x01, 0x00, 0x08, 0x53];
```

0x01 0x00 → 1 minute interval

0x08 → No ACK, no re-join, port is active.

0x53 → CRC-8 checksum

Example of Register Transfer

This example shows the required data downlink for an uplink of the energy registers

"Active & Reactive Energy import & Export Tariff 1&2" every minute.

```
var data = [0x01, 0x00, 0x0A, 0x01, 0x03, 0x04, 0x05, 0x06, 0x07, 0x08, 0x09, 0x0A, 0x83];
```

0x01 0x00 → 1 minute interval

0x0A → ACK, no re-join, port is active.

0x01 → Timestamp

0x03 – 0x0A → Register selected for uplink.
0x83 → CRC-8 checksum

6. UPLINK-MESSAGE

The following messages can be sent from the Hyperion Lora:

- Join / Rejoin request
- Time synchronization
- Monitor network membership
- Sending measurement registers

6.1. JOIN / REJOIN

The Hyperion Lora performs a join / rejoin with a Lora network.

6.2. DEVICETIMEREQ / TIME SYNCHRONIZATION

In normal operation, the Hyperion Lora attempts to determine the current time and date regularly (min. once every 24 hours, max. once per hour).

The meter sets its internal clock according to the following criteria:

- If the old time and the new time differ by less than 2 seconds, the meter accepts the new time as time synchronization and sets the new time.
- If the difference is more than 2 seconds, the meter queries the current time at least 3 more times to ensure that the new time is correct.

After the start or when the internal buffer for the RTC is used up, the meter checks the time with at least 3 DeviceTimeReq requests.

These 3 time queries take place in a time frame of 3 minutes.

Please Note:

- The operator of the Lora infrastructure must ensure that the meter can synchronize its time regularly to ensure proper operation of the Hyperion energy meter. The Lora DeviceTimeReq command is the optimal solution for this.

6.3. SENDING OF MEASURED VALUES

The Hyperion Lora transmits all required registers directly from its data logger via Lora without changing the data.

The requested measurements are read out from the data logger at the due date.

The transmission must therefore start and end in the transmission interval.

Example for a transmission interval of 15 minutes:

- 09:00:02 The communication module Lora reads the last data log entry. The values stored there are from 09:00:00.
- 09:00:03-09:14:59 The counter tries to transmit the data over the Lora network.
- 09:15:02 The Lora communication module reads the last data logger entry. The values stored there are from 09:15:00.

Please note:

- If you operate several counters in the same Lora network, the transmissions of these counters may overlap.
- If the Hyperion Lora its packets due to network conditions such as SF . too high or too slow to transmit data rate, the counter sends only one data packet. All further readings will no longer be transmitted at a later date. Please make sure that your meter and the Lora network are configured to allow full data transmission.

6.4. CONSTRUCTION OF UPLINK PACKAGES

The bit order is **LSB**, the byte order is **LittleEndian**.

The first four bytes are always the time stamp of the data logger Logger.

6.5. FIRST TELEGRAM AFTER JOIN WITH A LORA-SERVER

fPort: 100 Length: 29

BYTE	DESCRIPTION
0-3	current system time
4	Type
5-8	Serial number
9	Type
10	Serial number
11	Type
12-13	Current transformer primary
14	Type
15-16	Current converter secondary
17	Type
18-19	Voltage converter primary
20	Construction
21-22	Voltage converter secondary
23	Construction
24-27	MID Year of certification (BCD)
28	CRC 8bit

Example of a Package

System time

Serial number 22150405

Meter type Converter Counter -> 2

Current transformer ratio 5:5

Voltage transformer ratio 100:100

MID year of certification 2022

CRC should be 0x65

```
VAR DATA = [0X68, 0X9B, 0XA8,    // SYSTEMTIME 0X62A89B68
0X62,
```

	// -> 1655217000
	//->Thursday, 14. Juni 2022
	// 16:30:00 GMT+02:00 DST
XF1, 0X05, 0X04, 0X15, 0X22,	// Serial number 0x22150405
	//-> 22150405
0XF7, 0X02,	// Meter type 0x02 -> 2
0XF3, 0X05, 0X00,	// Current transformer primary 0x0005
	//-> 5
0XF4, 0X05, 0X00,	// Current transformer secondary 0x0005
	//-> 5
0XF5, 0X64, 0X00,	// Voltage transformer primary 0x0064
	//-> 100
0XF6, 0X64, 0X00,	// Voltage transformer secondary 0x0064
	//-> 100
0XF8, 0X02, 0X00, 0X02, 0X02,	// MID year, BCD -> 2022
0X65]	// CRC-8 Checksum

7. DEFAULT UPLINK

After the first start or after the reset to the factory settings, the meter sends the following telegram:

- fPort: 1
- Length: 27
- Interval: every 15 minutes the most recent entry from the data logger of the counter.

BYTE DESCRIPTION

0-3	Time stamp	0x03
4	Typ	
5-8	Effective energy import L123 T1	0x04
9	Typ	
10-13	Importing effective energy L123 T2	0x05
14	Typ	
15-18	Effective energy exports L123 T1	0x06
19	Typ	
20-23	Effective energy exports L123 T2	0x07
24	Typ	
25	Error code	0xFF
26	CRC 8-bit	

The fPorts 1-10 can be changed individually as described in downlink messages.

8. MEASURED VALUE REGISTERS AND STATUS CODES

8.1. 8.1 MEASURED VALUE REGISTERS

The energy measurements and technical information are read out from the data logger of the Hyperion energy meter Lora.

These measurements are stored at the end of a measuring period (15 minutes).

Please note:

Changes to the configuration of the Hyperion, e.g. current converter ratio, are updated in the data logger at the end of a measurement period.

ID	TYP	DESCRIPTION	UNIT	RESOLUTION
0X00	ulnt32	Index	Index	
0X01	ulnt32	Time stamp	Zeit	Epoch
0X02	ulnt32	Original timestamp of the entry	Zeit	Epoch
0X03	ulnt32	Effective energy import L123 T1	Wh	1 Wh
0X04	ulnt32	Effective energy import L123 T2	Wh	1 Wh
0X05	ulnt32	Effective energy export L123 T1	Wh	1 Wh
0X06	ulnt32	Effective energy exports L123 T2	Wh	1 Wh
0X07	ulnt32	Reactive energy imports L123 T1	varh	1 varh
0X08	ulnt32	Import reactive energy L123 T2	varh	1 varh
0X09	ulnt32	Export reactive energy L123 T1	varh	1 varh
0X0A	ulnt32	Exports of reactive energy L123 T2	varh	1 varh
0X0B	Int32	Int32 Actual performance L123	W	1 W
0X0C	Int32	Actual performance L1	W	1 W
0X0D	Int32	Actual performance L2	W	1 W
0X0E	Int32	Actual performance	W	1 W
0X0F	Int32	Electricity L123	mA	1 mA
0X10	Int32	Electricity L1	mA	1 mA
0X11	Int32	Electricity L2	mA	1 mA
0X12	Int32	Electricity L3	mA	1 mA
0X13	Int32	Electricity L4 (zero conductor, only for current converter meters)	mA	1 mA
0X14	Int32	Tension L1-N	V	100 mV
0X15	Int32	Tension L2-N	V	100 mV
0X16	Int32	Tension L3-N	V	100 mV
0X17	Int8	Performance factor L1	-1..1	0.01

0X18	Int8	Performance factor L2	-1..1	0.01
0X19	Int8	Performance factor L3	-1..1	0.01
0X1A	Int16	Frequency	Hz	0.1 Hz
0X1B	ulInt32	Medium performance	W	1 W
0X1C	ulInt32	Effective energy import L123 T1	kWh	1 kWh
0X1D	ulInt32	Importing effective energy L123 T2	kWh	1 kWh
0X1E	ulInt32	Effective energy export L123 T1	kWh	1 kWh
0X1F	ulInt32	Effective energy export L123 T2	kWh	1 kWh
0X20	ulInt32	Import reactive energy L123 T1	kvarh	1 kvarh
0X21	ulInt32	Import reactive energy L123 T2	kvarh	1 kvarh
0X22	ulInt32	Import reactive energy L123 T1	kvarh	1 kvarh
0X23	ulInt32	Import reactive energy L123 T2	kvarh	1 kvarh
0X24	ulInt64	Effective energy import L123 T1	Wh	1 Wh
0X25	ulInt64	Import work L123	Wh	1 Wh
0X26	ulInt64	Effective energy exports L123 T1	Wh	1 Wh
0X27	ulInt64	Effective energy exports L123 T2	Wh	1 Wh
0X28	ulInt64	Reactive energy imports L123 T1	varh	1 varh
0X29	ulInt64	Import reactive energy L123 T2	varh	1 varh
0X2A	ulInt64	Export reactive energy L123 T1	varh	1 varh
0X2B	ulInt64	Exports of reactive energy L123 T2	varh	1 varh
0XF0	ulInt8	Error code		
0XF1	ulInt32	Hex Serial number		
0XF2	ulInt32	Hex Plant number		
0XF3	ulInt16	Current transformer primary		
0XF4	ulInt16	Current converter secondary		
0XF5	ulInt16	Voltage converter primary		
0XF6	ulInt16	Voltage converter secondary		
0XF7	ulInt8	Type of counter		
0XF8	ulInt32	MID Year of certification		BCD
0XF9	ulInt32	Year of manufacture		BCD
0XFA	ulInt32	Firmware Version		ASCII
0XFB	ulInt32	MID measurement version		ASCII
0XFC	ulInt32	Producers		ASCII
0XFD	ulInt32	Hardware-index		ASCII
0XFE	ulInt32	Current system time	time	Epoch

8.2. STATUS CODES

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