FM232 and F-Link – User Guide

LoRa IoT sensors and micro-bridge for remote monitoring

Document Ref FLD10053 version 1.0.2

Product references:

FM232e: electricity meter optical reading
      Ref: FM232e_nc_1mn, FM232e_nc_10mn, FM232e_nc_15mn

FM232ir: electricity infrared meter optical reading (SML protocol)
      Ref: FM232ir_nc_1mn, FM232ir_nc_15mn

FM232g: gas meter optical reading (ATEX)
      Ref: FM232g_nc_10mn, FM232g_nc_15mn

FM232p-a: pulse reading (ATEX)
      Ref: FM232p-a_nc_1mn, FM232p-a_nc_10mn, FM232p-a_nc_15mn

FM232p-n: pulse reading (non-ATEX)
      Ref: FM232p-n_nc_1mn, FM232p-n_nc_10mn, FM232p-n_nc_15mn

FM232t: temperature measurement
      Ref: FM232t_1mn, FM232t_10mn, FM232t_15mn

F-Link: micro-bridge forwarding LoRa radio messages through Internet
      Ref: F-Link_dc

Firmware versions

FM232e

      Optical head: FM210em_v5.4 (FM232e_nc_1mn), FM210em_v4.6 (FM232e_nc_10mn, FM232e_nc_15mn)
      Radio/battery box: BPR07_V3.1.7

FM232ir

      Optical head: FM210ir_v1.7 (FM232ir_nc_1mn), FM210ir_v1.2 (FM232ir_nc_15mn)
      Radio/battery box: BPR07_V3.1.7

FM232g

      Optical head: FM210g_v3.2
      Radio/battery box: BPR07_v3.1.8

FM232p

      Radio/battery box: BPR07_v3.1.9 (FM232p-a_nc_1mn), BPR07_v3.1.7 (FM232p-a_nc_10mn, FM232p-a_nc_15mn)
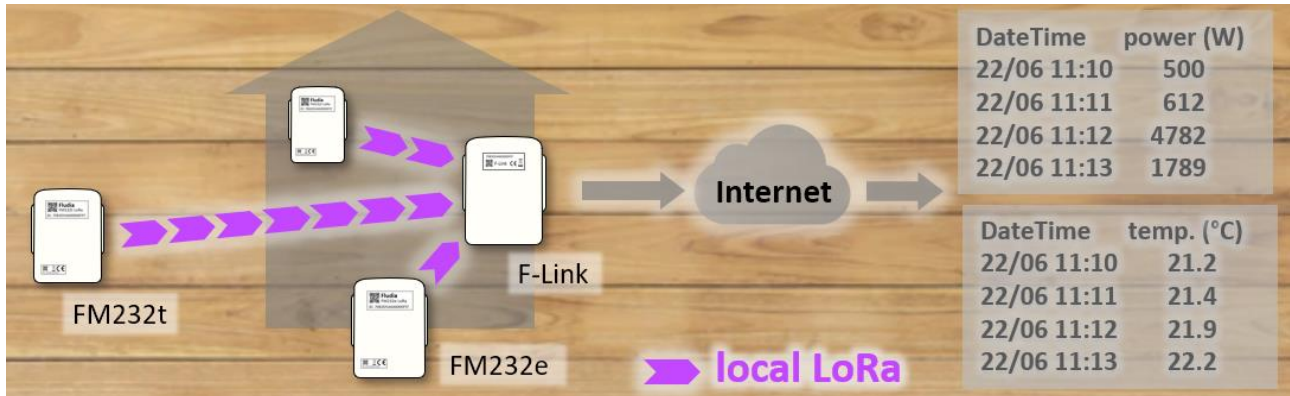
F-Link

      F_Link_v1.1.7

Revision history

Version	Notes	Date
1.0.1	New doc replacing ref FLD9491 (IMC User Guide EN_v1.0.5)	2022-05-17
1.0.2	Minor corrections	2022-05-17

Table of Contents

1. Overview

The basic principle of this remote monitoring solution is to install IoT sensors (FM232x on the graph) using LoRa long range radio to transfer measurement messages to a micro-bridge (F-Link on the graph). The F-Link forwards these messages to a server through Internet.

The **different types of sensors** available are:

- FM232e: optical reading of electricity meters (detecting rotating disk, or blinking light)
- FM232ir: optical reading of electricity meters **in Germany** (detecting rotating disk, or infrared port with SML protocol)
- FM232g: optical reading of gas meters (detecting digit rotation)
- FM232p: detecting pulse outputs of some meters (gas, water, electricity, heat…)
- FM232t: measuring temperature

The **installation process** consists of three main steps:

1. Configuring the F-Link: providing the F-Link with your Wifi password (not necessary if you are using an Ethernet cable)
2. Pairing the sensors with the F-Link: pressing twice the button on the F-Link side, then starting one of the sensors, then doing the same for the next sensor (pressing twice the F-Link button, then starting a sensor), and so on.
3. Installing the sensors: sticking the optical sensor to the existing meter, or connecting the wires, or just positioning the box, depending on the type of sensor.

Retrieving the data can be done in one of two ways:

- Connecting to the server's API https://fm430-api.fludia.com/v1/API/
- Selecting data and downloading related files from the dashboard

2. Setting up the F-Link

2.1 *Powering up*

Use the provided power adapter to power the F-Link up.

2.2 *Connecting to Internet*

Option 1: use the provided Ethernet cable

This option is the fastest: just connect the Ethernet cable between the F-Link and your existing modem/router (connected to Internet). The F-Link LED on the left will turn green to confirm that it is connected to Internet.

Warning: only works if your local network configuration is "DHCP" (most Internet modems in residential or SOHO).

Option 2: use the Wi-Fi connectivity

This option relies on a pre-existing Wi-Fi connected to Internet. In this case, you need to provide the F-Link with the Wi-Fi password.

This can be done in two ways:

- If you have an android smart phone, the easiest is to download the F-Link android App from Google Play and follow the instructions.
- If you don't have an android smart phone, the way to proceed is to connect to the F-Link embedded Web server.

With the android App:

1. Press long (4 seconds) on the F-Link button to open its Wi-Fi access point. The blue LED should blink.
2. Start the F-Link Android App on your phone or tablet.
3. Follow the instructions.

Without the android App:

1. Press long (4 seconds) on the F-Link button to open its own Wi-Fi access point. The blue LED should blink.
2. On your phone, tablet, or PC, connect to the F-Link Wi-Fi access point, which names looks like "F-Link-70B3D54Axxxxxxxx". This will disconnect you temporarily from Internet.
3. Open a web browser (chrome for example)
4. In the web browser, type the following URL: 192.168.1.1/flink (it is a configuration page build by the F-Link itself)

5. The configuration page appears. You must click on the Wi-Fi icon and select the Wi-Fi you use for Internet connection (usually your Internet box or router). Enter the corresponding Wi-Fi password and click on "OK". The F-Link green LED turns steady ON once it has managed to connect to the Internet.

3. Pairing a sensor with the F-Link

3.1 Open the pairing time window on the F-Link

Press twice shortly on the F-Link button. The yellow LED should start blinking, indicating the activation of the pairing time window. This pairing time window closes after 5 minutes.

3.2 Initiate the pairing on the sensor side

FM232e: connect the cable between the optical head and the radio/battery box.

FM232ir: connect the cable between the optical head and the radio/battery box.

FM232g: connect the cable between the optical head and the radio/battery box

FM232p: connect the cable on both sides (radio/battery box side and meter side) and make sure the meter generates at least one pulse during the pairing time window of 5 minutes.

FM232t: take out the battery and put it back on.

Once the pairing has been initiated, the LEDs on the radio/battery FM232 box will show the progress:

- Red and Green LED blinking together (pairing in progress)
- Green LED blinking alone (pairing successful)
- Red LED blinking alone (pairing failed)
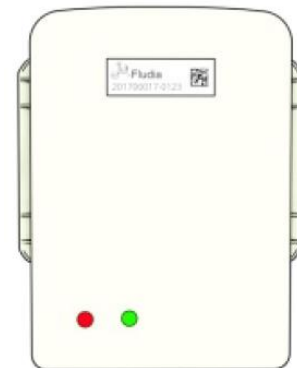
If the LEDs on the radio/battery side blink green twice, red once, green twice, red once and so on, it means that the device has been previously paired to an F-Link (but not necessarily this one). If you want to make sure, remove the batteries, wait for 10 seconds, and put them back on. It resets the pairing so that you can pair from a fresh start.

On the F-Link side, the yellow LED blinking stops when the pairing has been performed.

If another sensor needs to be paired, go through the process again (open the pairing time window on the F-Link, then initiate the pairing on the sensor side)

4. Installing the sensors

4.1 *Installing the FM232e (optical reading of electricity meters)*

First identify the type of meter you want to measure. It could be either an electronic electricity meter (with a blinking light) or an electromechanical electricity meter (with a rotating disk).

In case the **white cable** is plugged in the radio/battery box, it is recommended to **unplug it (**and leave only the optical side connected**) before proceeding** with the installation.

If it is an **electronic meter**, you must position the optical head **switch on B**, and if it is an **electromechanical meter**, you must position the **switch on A**:

If it is an **electronic meter**, stick the adhesive plastic mount on the meter in front of the meter blinking light (aim through the hole)

Then, position the optical head on top of the plastic mount and tight the black screw.

If it is an **electromechanical meter**, make sure the optical head is properly attached to the adhesive plastic mount with the help of the black screw:

Stick the system on the meter glass panel, making sure the two arrows are perfectly aligned with the meter disk (face the meter and keep your eyes at disc level for better result):

If the arrows are not completely lined up with the disc, loosen the screw, adjust position, and tighten the screw

Connect the white cable between the optical head and the FM232e battery/radio box.

In the case of an electromechanical meter, make sure the optical head is still perfectly aligned with the disk.
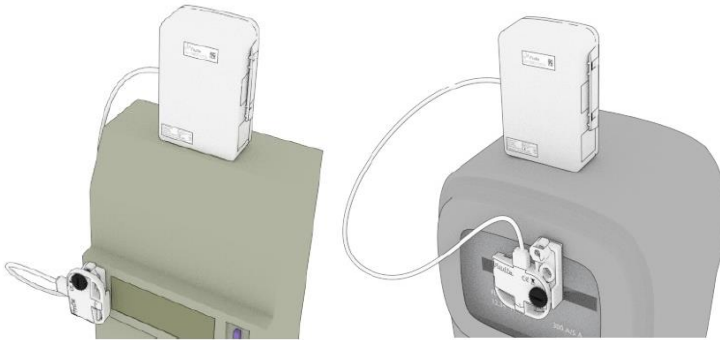
The FM232e starts measuring automatically.

The optical head LEDs (lights) should blink this way:

1. Calibration: red LED blinks for 20 seconds.

2. Validation: green LED blinks every time the meter light blinks (electronic meter) or every time the disk mark (black or red) comes in front of the sensor (electromechanical meter).

3. After 3 minutes, the green light stops completely to avoid wasting battery load.

On the FM232e **battery/radio box, LEDs** (lights) should blink Green-Green-Red. (it only means that this sensor has already been paired to an F-Link). The blinking stops after 30 seconds.

4.2   Installing the FM232ir (optical reading of electricity meters in Germany)

First identify the type of meter you want to measure. It could be either an mME electricity meter (with an infrared port supporting SML protocol) or an electromechanical electricity meter (with a rotating disk).

In case the **white cable** is plugged in the radio/battery box, it is recommended to **unplug it (**and leave only the optical side connected**) before proceeding** with the installation.

If it is an **mME meter**, you must position the optical head **switch on B**, and if it is an **electromechanical meter**, you must position the **switch on A**:

If it is an **mME meter**, stick the adhesive plastic mount on the meter in front of the meter infrared receiving LED (aim through the hole)

Then, fasten the optical head to the plastic mount.

Use the black screw to tighten the optical head to the mount.

If it is an **electromechanical meter**, make sure the optical head

is properly attached to the adhesive plastic mount with the help of the black screw:

Stick the system on the meter glass panel, making sure the two arrows are perfectly aligned with the meter disk (face the meter and keep your eyes at disc level for better result):

If the arrows are not completely lined up with the disc, loosen the screw, adjust position, and tighten the screw

Connect the white cable between the optical head and the FM232ir battery/radio box.

In the case of an electromechanical meter, make sure the optical head is still perfectly aligned with the disk.
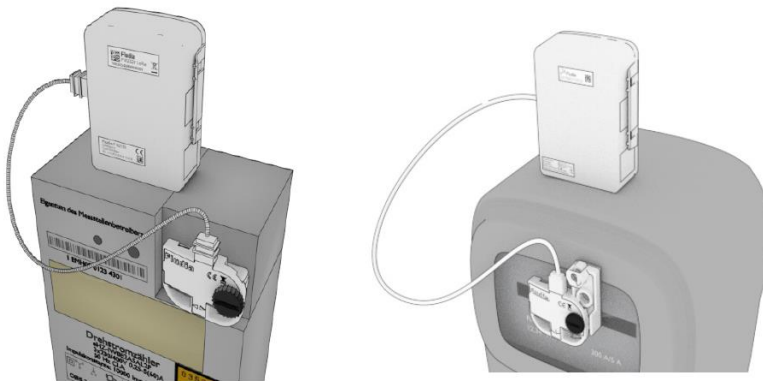
The FM232ir starts measuring automatically.

The **optical head LEDs** (lights) should blink this way:

1. Calibration: red LED blinks for 20 seconds.

2. Validation: green LED each time the disk mark (black or red) comes in front of the sensor (electromechanical meter) or each time a correct infrared signal is detected (mME meter).

3. The green light stops completely to avoid wasting battery load (after 3 minutes for electromechanical, after 1 minute for mME).

On the FM232ir **battery/radio box, LEDs** (lights) should blink Green-Green-Red. (it only means that this sensor has already been paired to an F-Link). The blinking stops after 30 seconds.

4.3   Installing the FM232g (optical reading of gas meters)

In case the **white cable** is plugged in the radio/battery box, it is recommended to **unplug it (**and leave only the optical side connected**) before proceeding** with the installation.
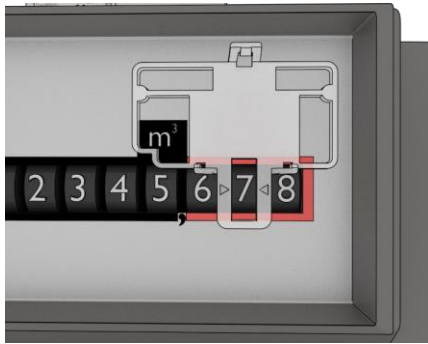
Clean the meter window.

Paste the holder on the glass of the meter, in front of the **prior-to-last digit** of the index, using the provided adhesive (already fixed on the holder).

>> Make sure the arrows of the holder are perfectly at **mid-height of the frame**.
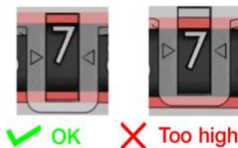
>> In some cases, the digit can be higher or lower than normal. Position the arrows at **mid-height of the frame**, **not** at mid-height of the **digit.**
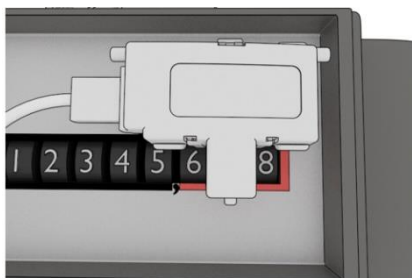
Clip the optical sensor to the holder.

Connect the white cable between the optical head and the FM232e battery/radio box.

On the FM232g **battery/radio box, LEDs** (lights) should blink Green-Green-Red. (it only means that this sensor has already been paired to an F-Link). The blinking stops after 30 seconds.
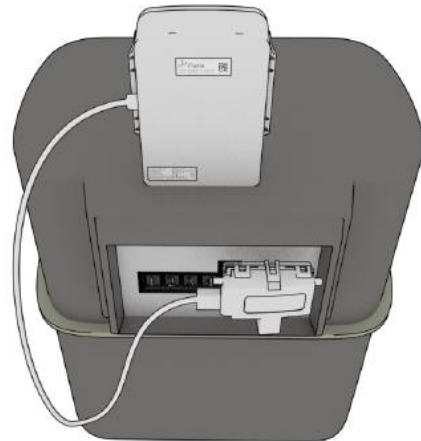
### 4.4 Installing the FM232p (detecting meter pulse outputs: gas, water, elec, heat…)

The FM232p comes with a cable that needs to be connected to the meter pulse interface.

By default, the end of the cable shows two wires: red wire (pulse), black wire (ground).

If the meter output shows a polarity, make sure to connect the cable accordingly.

pulse
ground

If the cable is equipped with a "binder" connector, just connect it to the pulse output interface. The "binder" plug can be wired either in 3-5 configuration (default) or in 4- configuration (then, there is a colored ring around the cable).
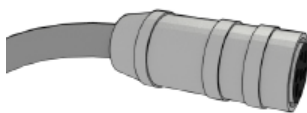
"binder" connector

4.5 Installing the FM232t (measuring temperature)

Just position the FM232t box wherever you want to measure temperature. For measuring in-house temperature, it is recommended to position the FM232t box around 1 meter above the floor and, if possible, not too close to a wall (especially outside walls).

Warning: the FM232t box is not "rain-proof". So, to measure outside temperatures, it is recommended either to position it in a place protected from the rain, or inside a "rain-proof" additional box (a full waterproof box should be avoided because of the risk of water vapor infiltration and condensation).

5. Replacing batteries in a sensor

Batteries used in FM232x products are special Lithium 3.6V batteries (Lithium thionyl chloride or Li-SoCl2). You should only replace them by similar batteries, of good quality, form renown manufacturers, and make sure that they are positioned the right way (+ side and – side are indicated both on each battery and at the bottom of the battery compartment).

The usual format of the batteries is A, but AA works also (though the energy is lower).

It is possible to use only one battery instead of two, but the expected lifetime will be of course accordingly reduced.

In case of an ATEX certified product such as the FM232g, when operating in an ATEX zone you should only use certified batteries provided by Fludia, so that the product is still considered certified.

Once batteries have been removed, the product loses pairing parameters. Therefore, there is a need for pairing after the batteries have been changed.

6. Accessing the dashboard to check communication and data

In a Web browser, type the following URL: https://fm400-api.fludia.com/console

The login and password have been provided by email at the moment of purchase.

The dashboard displays the list of sensors and some indicators (Version number, time-step, elapsed time since last connection…).

By clicking on the + sign, you can unstack two graphs, one showing measurement data and the other message counts.

By clicking on the ID number, you can access a more detailed page, where you can graphically navigate the measurement data and download corresponding data files, and have a look at the raw messages.

The top part of this page shows a graph with the measurement data. By default, the displayed period is two days, but a different period can be selected in the calendar.

It is possible to go back and forward in time, one day at a time, by clicking on the "Previous day" or "Next day" button.

The type of data on display can be chosen and be either curve data (interval data, can refer to electric power or gas volume for example) or index data (cumulative quantity, can refer to cumulated energy or cumulated volume for example).

There are two options for curve data: "fill missing data" or "show missing data". The "fill missing data" option creates values by spreading the energy evenly over the missing points. The "show missing value" does not create new values and the mssing periods appear clearly as blanks on the graph.

Index data is always provided without filling missing values.

By clicking on the "download" button a csv file is being created and downloaded containing the measurement data on display, with the selected option. Once opened in a spreadsheet, measurement data looks like the example below.

Timestamp (s)	Power without ratio (W)	Power with ratio (W)	Ratio	Type	Step (minute)	Date
1652468580	272	272	1	FM232	1	2022-05-13 21:03:00 GMT+0200
1652468640	647	647	1	FM232	1	2022-05-13 21:04:00 GMT+0200
1652468700	2079	2079	1	FM232	1	2022-05-13 21:05:00 GMT+0200
1652468760	1749	1749	1	FM232	1	2022-05-13 21:06:00 GMT+0200
1652468820	1409	1409	1	FM232	1	2022-05-13 21:07:00 GMT+0200
1652468880	2580	2580	1	FM232	1	2022-05-13 21:08:00 GMT+0200

7. Retrieving data from the server with the API

The access is done through HTTPS with the following URL:

https://fm430-api.fludia.com/v1/API/

Each query to the API needs authentication using the Basic Auth access. The login and password are provided separately by email (they are the same as the ones used to access the dashboard).

If needed as a first step before implementation, there are several ways to explore the API:

a. CURL command line: curl -u "login:password" "https://fm430-api.fludia.com/v1/API/..."

b. Postman tool

c. swagger.fludia.com (list of requests and test capability)

7.1 Device list request

GET https://fm430-api.fludia.com/v1/API/FM400

returns the list of devices (Last 8 characters of the device ID), the timestamp of the last received message for each device and some additional attributes.

Result example:

```
[
  {
    "Nom": "",
    "SerialNumber": "a000596c",
    "Type": "FM430",
    "Type_decodage": "V2",
    "Type_capteur": "Electronique",
    "Version_firmware": "21",
    "DerniereReceptionOK_TS": "1649066589",
    "Pas": "10 minutes",
    "Actif": "actif",
    "Pile_faible": "0",
    "Ratio": "1"
  },
  {
    "Nom": "",
    "SerialNumber": "a000596d",
    "Type": "FM430",
    "Type_decodage": "V2",
    "Type_capteur": "Electromécanique",
    "Version_firmware": "21",
    "DerniereReceptionOK_TS": "1649067662",
    "Pas": "10 minutes",
    "Actif": "actif",
    "Pile_faible": "0",
    "Ratio": "1"
  }
]
```

Attributes :

SerialNumber: last 8 characters of the device ID (device ID is found on the device front panel label, not to be confused with SN number… a bit confusing, but it comes from older ways to deal with device identification).

Type: FM430 refers to all LoRa devices (FM232x and FM432x).

Type_decodage: version of message decoding performed by the server (no use for normal API usage).

Type_capteur: Electronique (electronic electricity meter), Electromécanique (electromechanical electricity

meter), IR (infrared SML german electricity meter), gaz (gas meter), pulse (pulse detection), Température (temperature).

Version_firmware: firmware version

DerniereReceptionOK_TS: timestamp of the last received message

Pas: measurement time step (1 minute, 10 minutes, 15 minutes, 1 hour)

Actif: "actif" signifies that the device has sent at least 1 message in the last three days (otherwise, it is "inactif").

Pile_faible: low battery indicator. Equals 1 when the battery voltage is under a threshold, 0 otherwise (indicator available only for some of the sensors... if not available, the value is NULL)

Ratio: indicates the value of the constant that might be used to multiply the data (taken into account only in a specific request not presented in this document). This constant can be set through the API (for example to take into account the constant of an electromechanical meter in Wh per disk turn). Default value is 1.

7.2 Interval data request

GET
https://fm430-api.fludia.com/v1/API/pxm/**SerialNumber**[?limit=**n**[&tsDeb=**x**&tsFin=**x**]&show_missing=true]

Input data

SerialNumber	
limit	Maximum number of messages to be collected
&tsDeb=	First Timestamp
&tsFin=	Last Timestamp
show_missing	Option to process missing data

Returns the list of interval data, with related UTC timestamps.

&tsDeb= et &tsFin= are timestamps (in seconds) to filter data from tsDeb to tsFin (not mandatory).

&limit=n to limit to n last values.

show_missing chooses the way to process data. It is "false" by default.

Query « pxm »	show_missing=false (default)	show_missing=true
Missing radio message	Missing data are filled-up by averaged values	Missing data are not filled-up

Result example (first value is the TimeStamp, second value is the measurement value, without taking any ratio into account):

```
[
  [
    1628860800,
    57.2
  ],
  [
    1628861400,
    52.8
  ]
]
```

Depending on the sensor type (Type_capteur), the measurement values have different meaning:

- Electronique (optical reading of electronic electricity meter): the value is an average power (in Watt, to be multiplied by a constant if the meter comes with such a constant)

- Electromécanique (optical reading of electromechanical electricity meter): the value is an average power (in Watt, to be multiplied by a constant if the meter comes with such a constant)

- IR (optical reading of infrared SML german electricity meter): the value is an average power (in Watt)

- gaz (optical reading of gas meter): the value is a volume (in tens of dm3, if the sensor has been correctly positioned on the digit left to the dm3 digit)

- pulse (pulse detection): the value is the number of pulses detected over the time step

- Température (temperature): the value is the average temperature over the time step

7.3   Index data

GET https://fm430-api.fludia.com/v1/API/index_brut/**SerialNumber**[?limit=**n**[&tsDeb=**x**&tsFin=**x**]]

Input data

SerialNumber	
limit	Maximum number of messages to be collected
tsDeb	First Timestamp
tsFin	Last Timestamp

&tsDeb= et &tsFin= for timestamps (in seconds) to filter data from tsDeb to tsFin (not mandatory).

&limit=n to limit to n last values.

Result example (first value is the TimeStamp, second value is the index value):

```
[
  1628860800,
  578956
],
[
  1628861400,
  578958
]
]
```

Depending on the sensor type (Type_capteur), the index values have different meaning:

- Electronique (optical reading of electronic electricity meter): the value is the cumulative energy since installation (in Watt.hour, to be multiplied by a constant if the meter comes with such a constant)

- Electromécanique (optical reading of electromechanical electricity meter): the value is the cumulative

energy since installation (in Watt.hour, to be multiplied by a constant if the meter comes with such a constant)

- IR (optical reading of infrared SML german electricity meter): the value is the cumulative energy provided by the meter (in Watt.hour)

- gaz (optical reading of gas meter): the value is the cumulative volume since installation (in tens of dm3, if the sensor has been correctly positioned on the digit left to the dm3 digit)

- pulse (pulse detection): the value is the cumulative number of pulses since installation

- Température (temperature): the value is the average temperature over the time step

7.4 Message list

GET https://fm430-api.fludia.com/v1/API/trames?SerialNumber=**SerialNumber**[&limit=**n**&offset=**m**]

Input data

SerialNumber	
limit	Maximum number of messages to be collected
offset	Number of last messages to avoid

&limit=n to limit to n last messages. &offset=m to avoid the last m messages.

returns the last n messages received from the device:

```
[
  {
    "SerialNumber": "000017c5",
    "TsReception": 1649080309,
    "Valide": true,
    "Data":
"5b000615330fe30b120b030b660af7107e142a1600163015e40b870b1f0ec90be2067509df0daa0fca131016
1e",
    "Variables": {},
    "Rssi": -77,
    "Snr": 11
  },
  {
    "SerialNumber": "000017c5",
    "TsReception": 1649079109,
    "Valide": true,
    "Data":
"5b00061037095b04bf06d504bf04a307760a880c6a0c5a0c74074406800f870f7a151d18171a461be6191c14
14",
    "Variables": {},
    "Rssi": -77,
    "Snr": 8
  }
]
```

8. Contact

For further information or advice please contact us:

Fludia

support@fludia.com

01 83 64 13 94

4 ter rue Honoré d'Estienne d'Orves

92150 Suresnes, France

9. Annex A: product references and what they mean

FM232e: electricity meter optical reading

- Ref: FM232e_nc_1mn => no compression, average power measured over 1 minute; message sent every 20 minutes including 20 values
- Ref: FM232e_nc_10mn => no compression, average power measured over 10 minutes; message sent every 80 minutes including 8 values
- Ref: FM232e_nc_15mn => no compression, average power measured over 15 minutes; message sent every 120 minutes including 8 values

FM232ir: electricity infrared meter optical reading (SML protocol)

- Ref: FM232ir_nc_1mn => no compression, average power measured over 1 minute, message sent every 15 minutes including 15 values.
- Ref: FM232ir_nc_15mn => no compression, average power measured over 15 minutes, message sent every 120 minutes including 8 values

FM232g: gas meter optical reading (ATEX)

- Ref: FM232g_nc_10mn => no compression, volume measured over 10 minutes, message sent every 80 minutes including 8 values.
- Ref: FM232g_nc_15mn => no compression, volume measured over 15 minutes, message sent every 120 minutes including 8 values.

FM232p-a: pulse reading (ATEX)

- Ref: FM232p-a_nc_1mn => no compression, volume measured over 1 minute, message sent every 20 minutes including 20 values.
- Ref: FM232p-a_nc_10mn => no compression, volume measured over 10 minutes, message sent every 80 minutes including 8 values.
- Ref: FM232p-a_nc_15mn => no compression, volume measured over 15 minutes, message sent every 120 minutes including 8 values.

FM232p-n: pulse reading (non-ATEX)

- Ref: FM232p-n_nc_1mn => no compression, volume measured over 1 minute, message sent every 20 minutes including 20 values.
- Ref: FM232p-n_nc_10mn => no compression, volume measured over 10 minutes, message sent every 80 minutes including 8 values.
- Ref: FM232p-n_nc_15mn => no compression, volume measured over 15 minutes, message sent every 120 minutes including 8 values.

FM232t: temperature measurement

- Ref: FM232t_1mn => average temperature measured over 1 minute; message sent every 20 minutes including 20 values
- Ref: FM232t_10mn => average temperature measured over 10 minutes; message sent every 80 minutes including 8 values
- Ref: FM232t_15mn => average temperature measured over 15 minutes; message sent every 120 minutes including 8 values

F-Link: micro-bridge forwarding LoRa radio messages through Internet

- Ref: F-Link_dc