Fludia
Smart Energy Components

FM442 – User Guide

NB-IoT/LTE-M sensors for remote monitoring

Document Ref FLD11671 version 1.0.3

Product references:

FM442e: electricity meter optical reading
Ref: FM442e_ap

FM442ir: electricity infrared meter optical reading (SML protocol)
Ref: FM442ir_ap

FM442g: gas meter optical reading
Ref: FM442g_ap

FM442p: pulse reading
Ref: FM442p_ap

Firmware versions

This documentation refers specifically to products including the following firmware versions. In most cases, data formats are the same for previous versions, but if you have a doubt, do not hesitate to contact support@fludia.com and we will provide you with the correct document version and/or specific indications.

Product family	Element	Product references	Firmware version
FM432e	Optical head	FM442e_ap	FM210em_v6.0
	Radio/battery box	All references	BPR08_v1.0.2
FM432ir	Optical head	FM432ir_ap	FM210ir_v2.1
	Radio/battery box	All references	BPR08_v1.0.2
FM432g	Optical head	FM432g_ap	FM210g_v3.3
	Radio/battery box	All references	BPR08g_v1.0.1
FM432p	Radio/battery box	FM432p_ap	BPR08p_v1.0.1

Fludia
Smart Energy Components

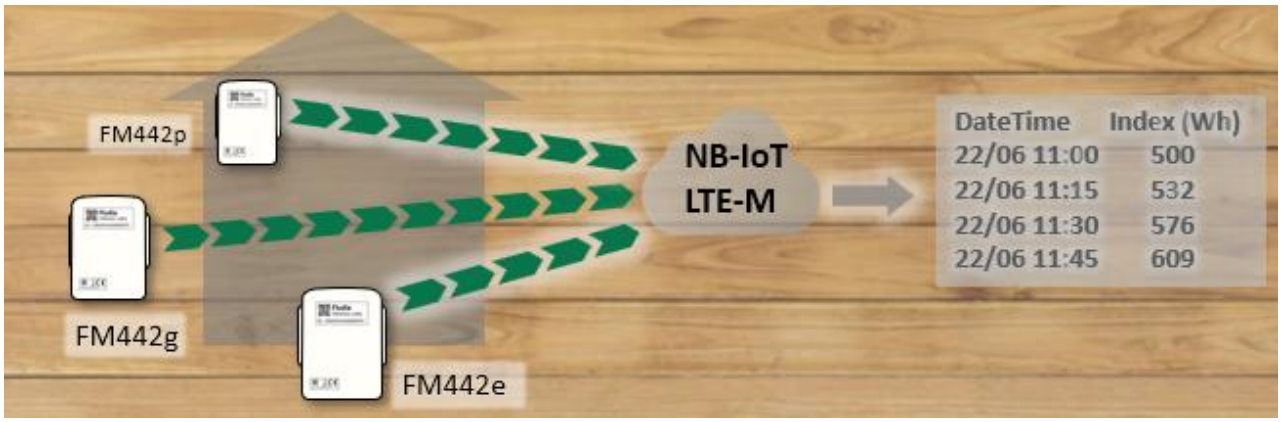
Revision history

Version	Notes	Date
1.0.1	Initial document	2025-04-08
1.0.2	Changes in the API description	2025-05-23
1.0.3	E-POS, E-NEG, E-SUM instead of E_POS, E_NEG, E_SUM	2025-05-25

Fludia
Smart Energy Components

Table of Contents

1. Overview



The basic principle of this remote monitoring solution is to use IoT sensors (FM442x on the graph) that transmit measurement messages over NB-IoT or LTE-M networks to an MQTT broker where they can be fetched by a data server.

The **different types of sensors** are:

- FM442e: optical reading of electricity meters (detecting rotating disk, or blinking light)
- FM442ir: optical reading of electricity meters in Germany (detecting rotating disk, or infrared port with SML protocol)
- FM442g: optical reading of gas meters and some water meters (detecting digit rotation)
- FM442p: detecting pulse outputs of some meters (gas, water, electricity, heat…)

FM442e

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

1. Inserting the SIM card: If there is no SIM card included, insert one in the product.
2. Installing the sensor: stick the optical sensor to the existing meter, or connect the wires, depending on the type of sensor.
3. Connecting to the NB-IoT or LTE-M Network: start the sensor to initiate the network attachment process.

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

- Connecting to the server's API https://fm442.fludia.com/api
- Connecting directly to the MQTT broker (available soon).
- Setting up your own MQTT broker address in the product (in the roadmap)

2. Installing the sensors

2.1 Installing the FM442e (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.

<u>If it is an **electronic meter**</u>, you must position the optical head **switch on B**,

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:

The switch must be positioned **on A**.

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.

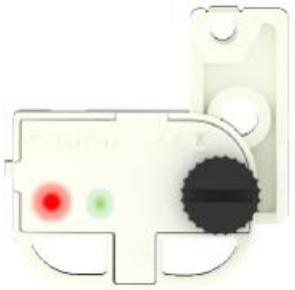
In this example, the index can easily be read if you watch slightly from the side:

But in cases when the index could be partly hidden, it is also possible to install the optical head upside down…

Connect the white cable to the FM442 battery/radio box (right side = orange panel).

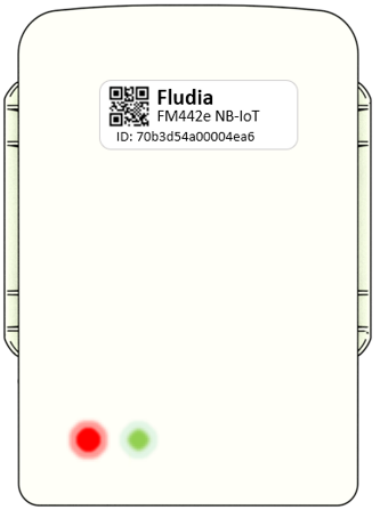
The optical head starts measuring and instructs the FM442e radio/battery box to connect to the network.

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.

The LEDs on the radio/battery box show the progress of **the network attachment process**:



- Red and Green LED blinking together (attachment in progress)
- Green LED blinking alone (attachment successful)
- Red LED blinking alone (attachment failed)

2.2 Installing the FM442ir (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**.

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

Then, fasten the optical head to the plastic mount and 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:

The switch must be positioned **on A**.

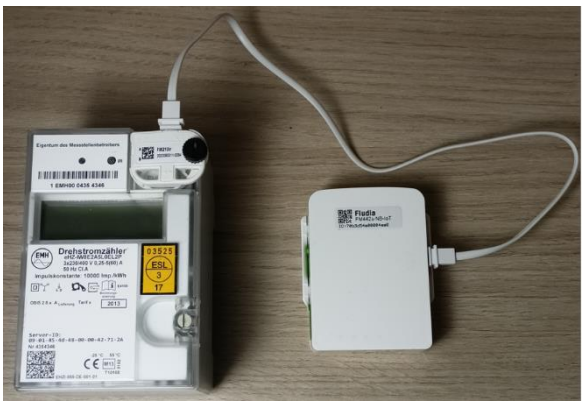
Stick the system on the meter glass panel, making sure the two arrows are perfectly aligned with the meter disk (face the meter and keep your eyes at disc level for better result):

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

In this example, the index can easily be read if you watch slightly from the side:

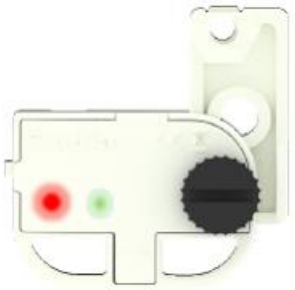
But in cases when the index could be partly hidden, it is also possible to install the optical head upside down…

Connect the white cable to the FM442 battery/radio box (right side = orange panel).



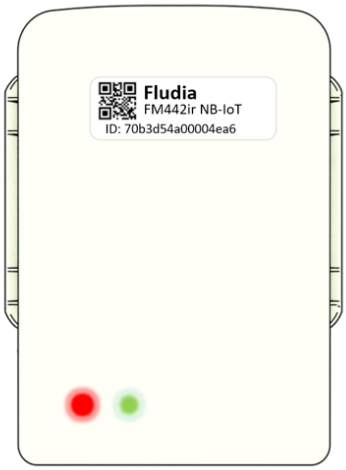
The optical head starts measuring and instructs the FM442ir radio/battery box to connect to the network.

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



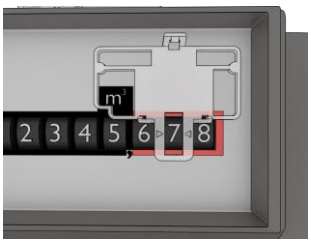
1. Calibration: red LED blinks for 20 seconds.
2. Validation: green LED each time the disk mark (black or red) comes in front of the sensor (electromechanical meter) or each time a correct infrared signal is detected (mME meter).
3. The green light stops completely to avoid wasting battery load (after 3 minutes for electromechanical, after 1 minute for mME).

The LEDs on the radio/battery box show the progress of **the network attachment process**:



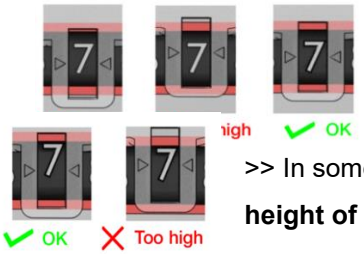
- Red and Green LED blinking together (attachment in progress)
- Green LED blinking alone (attachment successful)
- Red LED blinking alone (attachment failed)

2.3 Installing the FM442g (optical reading of gas meters)



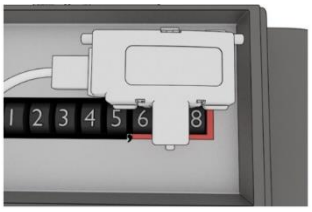
Clean the meter window.

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.

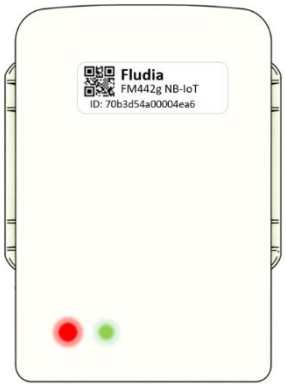
Connect the white cable between the optical head and the FM442 battery/radio box (right side = orange panel).

The FM442g starts measuring and tries to connect to the network.

The optical head red LED (light) should blink for 20 seconds (optical head calibration period)

The **LEDs on the radio/battery box** show the progress of **the network attachment process**:

- Red and Green LED blinking together (join in progress)
- Green LED blinking alone (join successful)
- Red LED blinking alone (join failed)



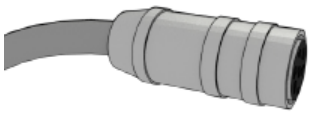
2.4 Installing the FM442p (detecting meter pulse outputs: gas, water, elec, heat…)

The FM442p comes with a cable that needs to be connected to the meter pulse interface. This cable must be plugged into the FM442p on the right side (orange panel).

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.

If the cable is equipped with a “binder” connector, just connect it to the pulse output interface. The “binder” plug is wired so that either 3-5 or 4-6 configuration will work.

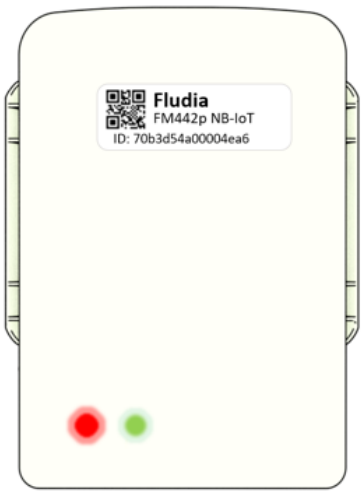


"binder" connector

The FM442p starts measuring and tries to connect to the network either once it has detected a first pulse or once the batteries have been installed.

The **LEDs on the radio/battery box** show the progress of **the network attachment process**:

- Red and Green LED blinking together (attachment in progress)
- Green LED blinking alone (attachment successful)
- Red LED blinking alone (attachment failed)



3. Replacing batteries in a sensor

Batteries used in FM442x products are special Lithium 3.6V batteries (Lithium-thionyl chloride, i.e. Li-SoCl2, A-size spiral cell). 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).

4. Remotely changing parameters

Main parameters that can be changed:

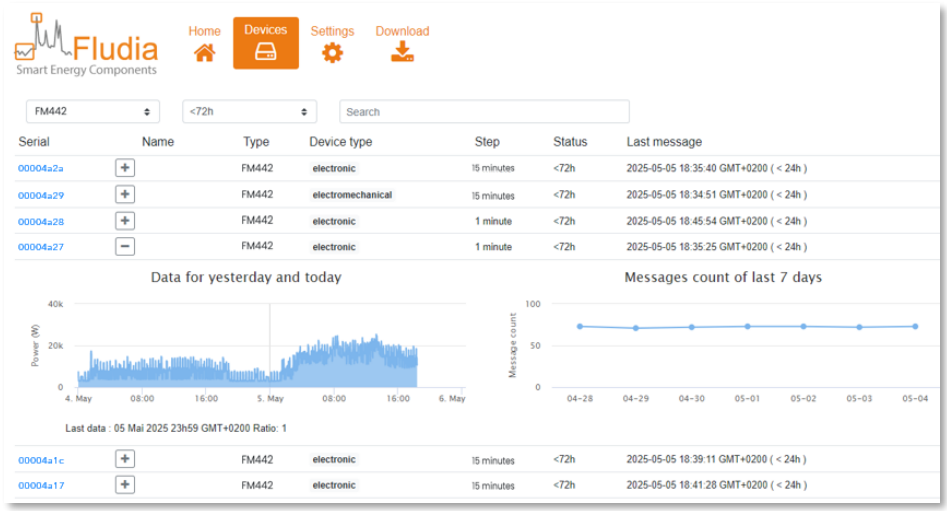
- Measurement frequency
- Number of measurement values in each uplink

5. Accessing the dashboard to check communication and data

Dashboard URL is: 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 (Serial) number, you can access a more detailed page, where you can graphically navigate the measurement data, download corresponding data files and have a look at the raw messages.

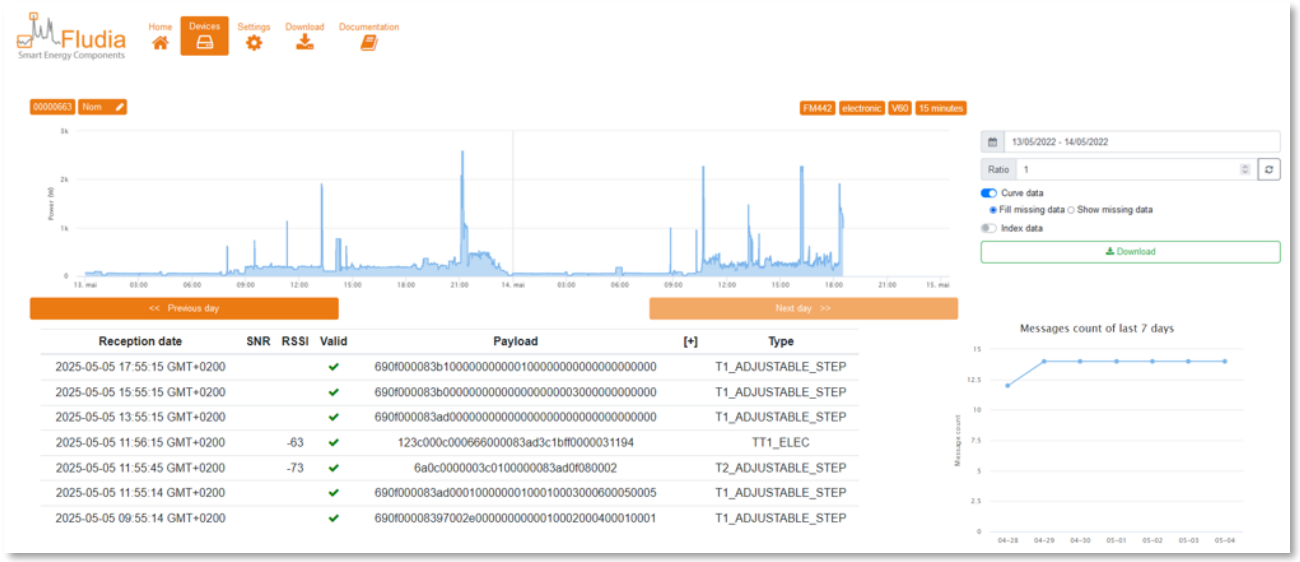
The top part of this page shows a graph with the measurement data. By default, the displayed period is two days, but a different period can be selected in the calendar.

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 (could be called interval data and can refer to electric power or gas volume for example) or index data (cumulative quantity, that 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 missing 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 created and downloaded containing the measurement data on display, with the selected option.

6. Retrieving data from the server with the API

The access is done through HTTPS with the following URL:

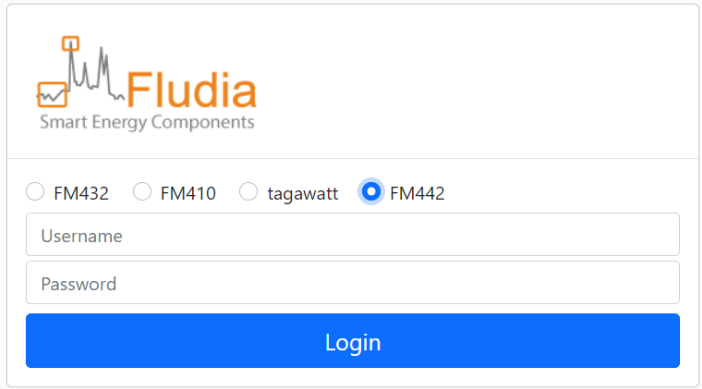
https://fm442.fludia.com/api

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

Exploring the API:

The API is described in a swagger:

https://swagger.fludia.com



Make sure to select FM442.

Test credentials are:

- Username: example
- Password: example

You can also use your own credentials, communicated by email after purchase of the first units (email sent when the products are shipped)

The following chapters describe the most useful requests :

6.1 Device list request

```
GET https://fm442.fludia.com/api/devices
```

returns the list of devices associated to this account, the timestamp of the last received message for each device and some additional attributes.

Model:

id_device	string id of the fm442 in hexadecimal string
custom_name	string custom name of the device
ratio	integer ratio
sensor_type	string elec / meca / em / ir (E-SUM) / ir (E-POS) / ir (E-NEG) / ir (E-POS+E-NEG) / gas / pulse
sensor_version	string
modem_version	string
time_step	integer time step in seconds
is_low_battery	boolean
ts_last_message	integer timestamp of last message

ratio: indicates the value of the constant that might be used to multiply the data. This constant can be set through the API (for example, for taking into account the constant of an electromechanical meter in Wh per disk turn). Default value is 1.

sensor_type:

- Optical head for electricity meter (FM210e optical head, part of the FM442e product)
  - elec: optical head switch in position B, for LED blinking electricy meter
  - meca: optical head switch in position A, for electromechanical meter (spinning disk)
  - em: elec/meca not confirmed yet (documented, but should not happen)
- Optical head for German mME meters with infrared prot and SML protocol (FM210ir optical head, part of the FM442ir product)
  - ir (E-SUM): measurement values related to OBIS code 16.8.0
  - ir (E-POS): measurement values related to OBIS code 1.8.0
  - ir (E-NEG): measurement values related to OBIS code 2.8.0
  - ir (E-POS+E-NEG): measurement values related to OBIS codes 1.8.0 and 2.8.0
- Optical head for gas meters (FM210g optical head, part of the FM442g product)
  - gas
- Wire connection to a pulse output meter (no optical head, FM442p product)
  - pulse

is_low_battery: 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)

Example:


```
[
  {
    "id_device": "70b3d4a00000001",
    "custom_name": "name",
    "ratio": 1,
    "sensor_type": "gas",
    "sensor_version": 23,
    "modem_version": "1.0.1",
    "time_step": 60,
    "is_low_battery": 0,
    "ts_last_message": 1739976782
  }
]
```


6.2 Data request

GET https://fm442.fludia.com/api/devices/{device_id}/data

Returns the list of successive measurement values (data), with related UTC timestamps.

Parameters

id_device	string id of the fm442 in hexadecimal string
ts_start	string min date
ts_stop	String max date

Model:

data	integer series of [Timestamp, value] (typically: each value is an index increment over n minutes, or an average Power over n minutes)
type	string data types: Power / Power (E-SUM) / Power (E-POS) / Power (E-NEG) / Gas increment / Pulse increment
step	integer time step (n minutes, default n=15)

Example:


```
[
  {
    "data": [
      [
        1628860800,
        1057.2
      ]
    ],
    "type": "Power"
  }
]
```

6.3 Index request

GET https://fm442.fludia.com/api/devices/{device_id}/index

Returns the list of cumulative measurement values (indexes), with related UTC timestamps.

Parameters

id_device	string id of the fm442 in hexadecimal string
ts_start	string min date
ts_stop	String max date

Model:

data	integer list of cumulative values (typically: each value is the energy index consumed since the device start up)
type	string data types: Index / Index (E-SUM) / Index (E-POS) / Index (E-NEG) / Gas index / Pulse index
step	integer time step in minutes

Example:


```
[
  {
    "data": [
      [
        1628860800,
        1658
      ]
    ],
    "type": "Index",
    "step": 30
  }
]
```


7. Contact

For further information or advice please contact us:

Fludia

support@fludia.com

01 83 64 13 94

37 avenue Edouard Vaillant

92150 Suresnes, France

Fludia
Smart Energy Components

8. Annex A: product references and what they mean

FM442e: electricity meter optical reading

- Ref: FM442e_ap => adjustable parameters = measurement frequency, among other things, can be changed remotely. Default config: index increment measured over 15 minutes; message sent every 240 minutes including 16 values.

FM442ir: electricity infrared meter optical reading (SML protocol)

- Ref: FM442ir_ap => adjustable parameters = measurement frequency, among other things, can be changed remotely. Default config: index increment measured over 15 minutes; message sent every 240 minutes including 16 values.

FM442g: gas meter optical reading

- Ref: FM442g_ap => adjustable parameters = measurement frequency, among other things, can be changed remotely. Default config: index increment measured over 15 minutes; message sent every 240 minutes including 16 values.

FM442p: pulse reading

- Ref: FM442p_ap => adjustable parameters = measurement frequency, among other things, can be changed remotely. Default config: index increment measured over 15 minutes; message sent every 240 minutes including 16 values.