E-RM 30.501

User manual

Electronic radio module
E-RM 30.501 with impulse inputs

APATOR
METRA

Contents

1. Use

Radio module E-RM 30.5xx is used to read impulses from water meter or other devices with impulse output (electric meters, heat meters…) and to wirelessly transmit recorded data. Electronic radio module has two independent channels to read impulses and can be connected to devices that generate impulses using Reed switch or devices with output „open collector".

Radio module E-RM 30.5xx has IR (infra) interface with two-way communication that can be used to configure module, change working modes and get information about set parameters, operation and measured values.
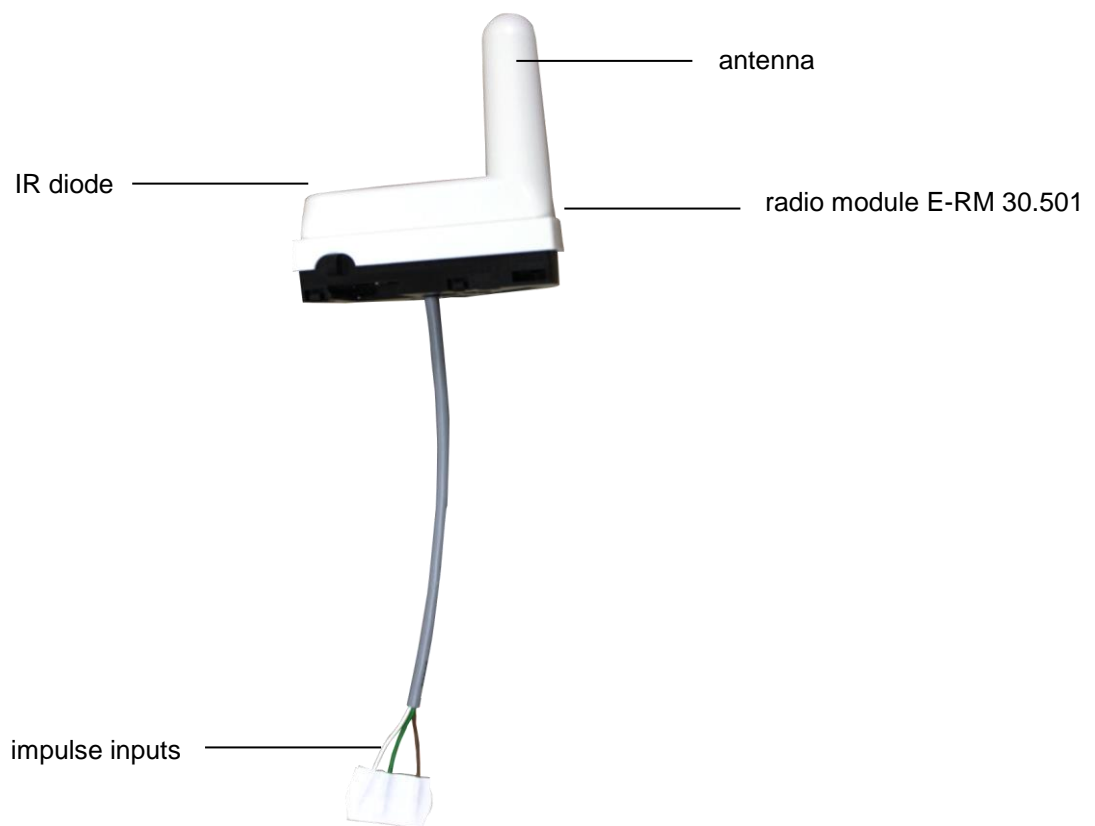

Figure 1.   Radio module E-RM 30.501

2. Design of radio module E-RM 30.5xx

E-RM 30.501 radio module with standard antenna and combination of yearly and monthly billing period.

For connecting radio module to impulse outputs of devices is used three-cable with length of 15 cm. Colour of insulation are following:

- **green wire**: common ground for both measuring channels

- **brown wire**: 1. measuring channel

- **white wire**: 2. measuring channel

Wires have removed insulation on ends and covered with solder (1 cm end).

To connect impulse output with **Reed switch**, impulse outputs are connected between common ground and 1- (or 2.) measuring channel of radio module. In this case **polarity does not matter** – any output can be connected to common ground and to 1. (or 2.) measuring channel.

To connect output with **„open collector"** it is necessary to adhere to **correct polarity**. Collector of impulse output is necessary to connect always to 1. (or 2.) measuring channel of radio module and emitter to common ground.

For flawless detection of impulses with radio module, following conditions need to be met:

- minimum time of contact connection: 32 [ms]

- minimum time of contact disconnection: 32 [ms]

- resistance of contact in connected state: < 5 [kW]

- resistance of contact in disconnected state: > 12 [kW]

- minimum allowed voltage for collector (for „open collector"): > 3,6 [V]

- minimum allowed current for connected contact (for „open collector"): > 0,3 [mA]

3. Description

Radio module uses proprietary protocol for data transmission. Data reading can be performed using mobile reading unit **RFU 40** without entering flats or using stationary receiving units **CRS 40** installed in the hallways of a block of flats.

Receiving units allow using data for those units that billing company has decoding files that are supplied with purchased radio modules. Company can do billing only for modules that is authorised for.

Measured data are transmitted in short telegrams in length of ~ **8 [ms]** and protected using encryption. Data are transmitted in „reading period" in shorter interval – approximately **60 [s]**, for remaining of the year in longer interval – approximately 240 [s]. Interval between two following telegrams is not constant, it changes randomly in a specific range. This prevents situation that it is not possible to read data (in relatively short period) from modules transmitting at the same time.

Radio module **E-RM 30.5xx** does not have a display to read data about working mode, set parameters and measured values. Needed values can be read using **IR** interface (or change settings) using **IRU 10.00**.

3.1. Working modes of radio module

- sleeping mode

- mode of automatic activation

- working mode

- error mode

3.2. List of supported commands (features) of module

3.2.1. Setting of date of start of billing period

(setting can be done only in sleeping mode)

Radio module allows both yearly and monthly billing period. By setting day in a date, that determines monthly billing period (allowed range 1. to 28. day), month in date determines yearly billing period.

When setting date, following data are reset:

    a) number of impulses indicated by 1. sensor for current yearly billing period (BP)

    b) number of impulses indicated by 2. sensor for current yearly BP

    c) number of impulses indicated by 1. sensor for current monthly BP

    d) number of impulses indicated by 2. sensor for current monthly BP

    e) number of impulses indicated by 1. sensor for past monthly BP (all 12 BP)

    f) number of impulses indicated by 2. sensor for past monthly BP (all 12 BP)

    g) number of impulses indicated by 1. sensor for past yearly BP

    h) number of impulses indicated by 2. sensor for past yearly BP

3.2.2. Switching between modes of modules (working mode, automatic activation, sleeping mode)

- switching to working mode can be performed from sleeping mode and mode of automatic activation

- switching to sleeping mode can be performed form working mode and mode of automatic activation

- switching to mode of automatic activation and be performed only from sleeping mode

3.2.3. Reset of data for current billing period

(can be performed only in sleeping mode)

Same data are reset as in setting of date of start of billing period.

3.2.4. Total reset of data of radio module

(can be performed only in sleeping mode)

Following data is reset:

    a) number of impulses indicated by 1. sensor for current yearly billing period (BP)

    b) number of impulses indicated by 2. sensor for current yearly BP

    c) number of impulses indicated by 1. sensor for current monthly BP

    d) number of impulses indicated by 2. sensor for current monthly BP

e)   number of impulses indicated by 1. sensor for past monthly BP (all 12 BP)

f)   number of impulses indicated by 2. sensor for past monthly BP (all 12 BP)

g)   number of impulses indicated by 1. sensor for past yearly BP

h)   number of impulses indicated by 2. sensor for past yearly BP

i)   number of impulses indicated by 1. sensor, absolute value

j)   number of impulses indicated by 2. sensor, absolute value

(Total reset of data is different compared to reset of data for current billing period by resetting absolute values of impulses indicated by sensor 1. and 2.)

Technique of performing supported settings is described in **Manual for IRU 10.00**.

3.3.   Sleeping mode

Sleeping mode is suitable for longer storage of radio module. In sleeping mode, module does not record impulses and does not transmit recorded data. Module only updates real time and performs actions in relation to real time. In sleeping mode, the energy consumption is lowered to a minimum.

In sleeping mode you can use **IRU 10.00** to

- reading of recorded data, parameters and mode of module

- setting of beginning of billing period

- switching module to mode of automatic activation or working mode

- reset of data for current billing period

- total reset of data of radio module

3.4.   Mode of automatic activation

Mode of automatic activation is used to make installation of radio module easier. Installation consist of connecting of impulse outputs of a device to module and its attachment. Switching to working mode is automatic.

In mode of automatic activation radio module performs detection of impulses for both sensor and when registering 5 impulses in a single channel, modules switches to working mode.

In mode of automatic activation you can use **IRU 10.00** to

- read measured data, find out parameters and mode of module

- switching mode to sleeping or working mode

3.5.   Working mode

In working mode, module fulfils its intended function – detecting impulses in both channels, transmits in regular intervals measured data and updates real time.

In working mode you can use **IRU 10.00** to:

- read measured data, find out parameters and mode of module

- switching mode to sleeping mode

3.6. Error mode

Module switches itself to error mode in case of wrong value of parameter, non-valid content of RAM or in case of error when writing to permanent memory of microprocessor. In error mode, module only updates real time.

In error mode you can use **IRU 10.00** to:

- read measured data, find out parameters and mode of module

If module switches to error mode, it is necessary to send module to manufacturer that is equipped with diagnostics for repair.

4. Build

Radio module **E-RM 30** consists of upper part of case with an IR diode and lower part with a cable ~ 15 [cm] long that is sealed in lower part of case using sealing glue. Both parts of the case protect a PCB with electronical components, antenna and battery. Lower part of case is fixed to the upper part using 3 screws and it furnished with a seal to prevent water entry. There is a seal under screws as well.

Both parts of the case are moulded form a plastic.

Upper part of the case is marked using laser, it contains type of radio module, serial number in numbers and in barcode optionally sign of authorised company.

Device is equipped with 16-bit microprocessor and very low power consumption, radio module and powered by lithium battery.

5. Technical specification

Environment temperature:	+5 to +50 [°C]
Power supply:	3 [V] lithium battery
Lifetime:	12 years + 1 year in sleeping mode
Data backup:	every day backup of measured data including real time
Function control:	automatic
IR interface:	two-way
Radio module:	one way, transmitting
Dimensions:	70 x 43 x 69 [mm]
Material:	PC
IP rating:	IP 64

5.1. Technical specification of radio module

Working frequency:	868 MHz
Transmission power:	< 5 [mW]
Class of duty cycle:	1 (percentage of duty cycle < 0,1 [%])
Length of transmission:	< 8 [ms]
Range:	in block of flats ~ 70 [m] (according to local conditions)
	Note: all metal construction elements such as elevators, electrical boxes… that negatively affect range of radio signal need to be considered.
Transmission frequency:	in interval 60 to 66 [s] for a period of one month from the beginning of yearly billing period and for three days after the beginning of monthly billing period, for the rest of the year in interval 240 to 246 [s]
Data encryption:	yes

5.1.1. Data transmitted by radio module

Radio module transmits following radio packets with structure that cannot be changed:

- serial number of radio module (9 digits)

- indication of loss of flow for 1. sensor (from beginning of past yearly BP to date of reading)

- indication of loss of flow for 2. sensor (from beginning of past yearly BP to date of reading)

- impulses indicated by 1. sensor, absolute value, [0; 268 435 456], differentiation 1 impulse

- impulses indicated by 2. sensor, absolute value, [0; 268 435 456], differentiation 1 impulse

- impulses for past yearly BP indicated by 1. sensor (start state = 0), range <0; 16 777 216>, differentiation 1 impulse

- impulses for past yearly BP indicated by 2. sensor (start state = 0), range <0; 16 777 216>, differentiation 1 impulse

- impulses for past monthly BP indicated by 1. sensor (start state = 0), range <0; 4 194 304>, differentiation 1 impulse

- impulses for past monthly BP indicated by 2. sensor (start state = 0), range <0; 4 194 304>, differentiation 1 impulse

- date of reading, (day, month, year)

- date of beginning of billing period (day, month)

5.2. Data available via IR interface

- serial number of radio module (9 digits)

- date of reading, (day, month, year)

- date of beginning of billing period (day, month)

- monthly number of impulses indicated by 1. sensor for -1. to -12. monthly BP backwards, range <0; 4 194 304>, differentiation 1 impulse

- monthly number of impulses indicated by 2. sensor for -1. to -12. monthly BP backwards, range <0; 4 194 304>, differentiation 1 impulse

- impulses for current yearly BP indicated by 1. sensor (start state = 0), range <0; 16 777 216>, differentiation 1 impulse

- impulses for current yearly BP indicated by 2. sensor (start state = 0), range <0; 16 777 216>, differentiation 1 impulse

- impulses for past yearly BP indicated by 1. sensor (start state = 0), range <0; 16 777 216>, differentiation 1 impulse

- impulses for past yearly BP indicated by 2. sensor (start state = 0), range <0; 16 777 216>, differentiation 1 impulse

- impulses for current monthly BP indicated by 1. sensor (start state = 0), range <0; 4 194 304>, differentiation 1 impulse

- impulses for current monthly BP indicated by 2. sensor (start state = 0), range <0; 4 194 304>, differentiation 1 impulse

- impulses indicated by 1. sensor, absolute value, range <0; 268 435 455>, differentiation 1 impulse

- impulses indicated by 2. sensor, absolute value, range <0; 268 435 455>, differentiation 1 impulse

- indication of loss of flow for 1. sensor (from beginning of past yearly BP to date of reading)

- indication of loss of flow for 2. sensor (from beginning of past yearly BP to date of reading)

- impulses indicated by 1. sensor, absolute value, [0; 268 435 456], differentiation 1 impulse

- impulses indicated by 2. sensor, absolute value, [0; 268 435 456], differentiation 1 impulse

- date of last loss of flow for 1. sensor in current yearly BP, (day, month)

- date of last loss of flow for 2. sensor in current yearly BP, (day, month)

- date of last loss of flow for 1. sensor in past yearly BP, (day, month)

- date of last loss of flow for 2. sensor in past yearly BP, (day, month)

- counter of radio module resets

- remaining battery lifetime [days]

- current module mode

- approximate voltage of battery of radio module, (with accuracy of +/- 0,15 [V])

6. Installation of module E-RM 30.5xx

Installation of radio module can be done in following modes:

- sleeping mode

- mode of automatic activation

6.1. Installation of radio module in sleeping mode

This is the **recommended way of installation**. When connecting impulse output of measuring device to some of the impulse inputs of radio module there is no indication of possible faulty impulses that can occur when installing module in mode of automatic activation (more below). In sleeping mode, radio module does not detect impulses and does not transmit any radio data. After attaching connected wires we will switch module to working mode using **IRU 10.00.**

Disadvantage of this way of installation is a necessity of having **IRU 10.00**, on the other hand we are in control of the installation.

6.2. Installation of module in mode of automatic activation

In mode of automatic activation, module regularly test both impulse inputs for a presence of impulses. If it registers on one input at least **5 impulses**, module switches to working mode automatically. In mode of automatic activation module does not transmit any radio information.

Disadvantage of this way of installation is **possible faulty indication of impulses** that can occur e.g. by manipulation with wires of both measuring channel that can happen when connecting them to grounding wire. **Indication of faulty impulses** can occur also when connecting impulse input of radio module with Reed switch of a device when the magnetic contact is in turned on position before we attach the connection permanently.

Note:

After installation of radio module to water meter or other device with impulse output it is necessary to record status of counter of connected device. Radio module only counts detected impulses, it does not have any information available about counter of connected device.

7. Transport

Radio module **E-RM 30** can be transported under following conditions:

- devices can be transported by all usual means of covered transport

- devices need to be packaged in original boxes from manufacturer

- devices in original packaging need to be stored in a way that there is not risk of mechanical damage during transport

- they must not be transported among aggressive substances

- temperature for transportation in range of -10 to + 50 [°C]

8. Storage

Radio module **E-RM 30** can be stored under following conditions:

- devices need to be packaged in original boxes from manufacturer

- temperature for storage in range of +10 to + 30 [°C]

- relative humidity of environment in range of 45 to 75 [%]

- devices need to be stored in clean covered areas without presence of aggressive substances and stored in a way that prevents its mechanical damage

9. Disposal

This device falls under special mode of waste disposal according to legislation about waste.

10.   Defects

Defects of **E-RM 30** are only by manufacturer.

11.   Warranty

If the radio module **E-RM 30** according to instruction in User manual, manufacturer offers warranty for the device according to applicable law if not agreed otherwise.

Manufacturer can refuse a warranty claim if the device is used in contrary of User manual or is damaged:

- during transport and storage by customer, or its customer

- during installation or dismantling to device of customer or its customer

- during unauthorized manipulation and installation to other device than defined in the manual

- in case the device was exposed to different environment than specified in the manual

- in case the device was mechanically or some other way damaged

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