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Unit water meters with wireless data transfer

 BONEGA®2 Czech
patents

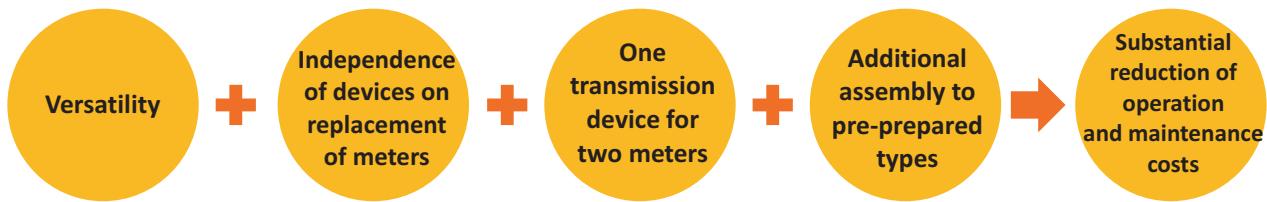
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BONEGA® unit water meters with wireless data transfer

Basic goals of the development:

To reliably record and wirelessly transmit data to a PC from two water meters at the same time.



Versatility

The system of transmitters is designed to be:

- ready to switch from round system to potential later implementation of transfers up to the offices (without necessity to enter the flats)
- the users alone can remotely read out the meters at any time
- open, i.e. not „blocked“ for reserved users only (not blocked for a single service provider)
- universal for other meters (house meters for water, heat, gas etc.)
- ability to receive data from other meters as well (e.g. METRA share heat meters etc.)

Independence of the transmitter on replacement of water meter

One of the substantial ideas in development of patented technical solution of the BONEGA® water meters for wireless transfer was simple yet convenient idea that compared to the competitors, *the device for wireless transmission should be retained also in case of replacement of the water meters.*

It means in practice that a radio device is operational for 11 years, i.e. for two metrological periods („calibration“ required by law for cold and hot water meters after five years). When replacing, the water meter sensor is removed from the original to the new one.

One transmission device for both water meters

Another design goal is making *one electronic transmission unit operable for two water meters at the same time (hot and cold water) and located outside the water meter bodies.* This substantially *reduces material demands.* Another benefit is that the small receiver for the electronic components on the water meter body *has negligible impact on its installation dimensions.* This solution permits successive disassembly and assembly of standalone

water meters. It is therefore possible to replace one water meter in the replacement interval (e.g. for hot water) and later, after calibration expire date, to replace the other water meter (e.g. for cold water) within single transmission unit. In this way, it is possible to successively implement the wireless data transfer. However, this requires both physical and wireless read out during transient period.

Additional assembly to pre-prepared types

An important goal was also *to permit additional assembly of the electronic component* to the water meter types (catalogue No. SA-E, TA-E) already pre-prepared for the sensing components. This allows the users to postpone decision on purchasing of the device for the wireless data transfer.

Substantial reduction of operation and maintenance costs

This proven technical solution brings economic benefits to the customers in long term run in the form of *substantial reduction of the operation and maintenance costs*.

How the patented solution will reflect in specific savings:

1. *Purchase of the wireless data transfer can be performed effectively = in successive steps. Implementation of this system does not require one-off replacement of all water meters, particularly when calibration date did not expire for all of them. It is enough to buy the pre-prepared types and switch to the electronic transmission not until the next replacement.*
2. *Whereas the assumed operation of the electronic device without battery replacement is up to 10 years, the purchase costs are allocated up to 4 water meters (2 water meters for hot water after 5 years + 2 water meters for cold water after 5 years).*
3. *One electronic device controls two water meters which results in reduced total price as well as environmental burden.*

Description of the system patented for us

Compared to the competitors, the BONEGA® water meters do not intentionally form a single compact unit but the electronic part and the water meters are separate.

Only a removable revolution meter is located on the water meter alone in easily demountable and sealed casing with bayonet lock **that is thoroughly checked against external magnetic effects**. Sensing is made using a sensor via one litre indicator on the water meter. The sensors are interconnected with a shielded cable with electronic component. Everything is well protected against ingress of impurities and moisture.

Typology of the mobile read out



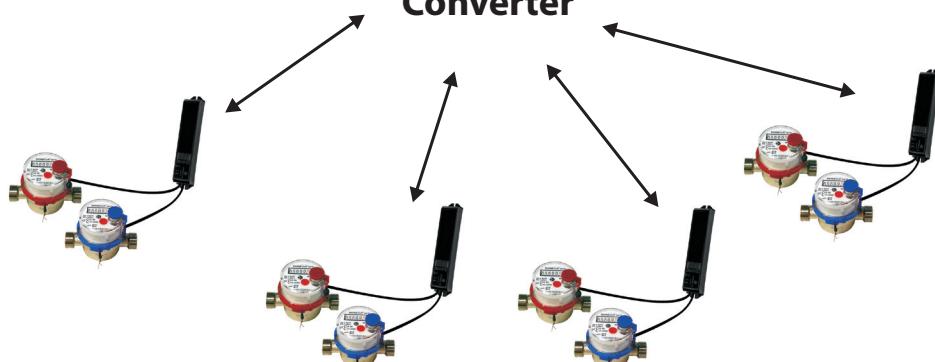
Computer of read out staff in the field

LAPTOP (NOTEBOOK)



There are two devices available for selection to provide connection between PC and transmitters (via Bluetooth with larger reach and USB)

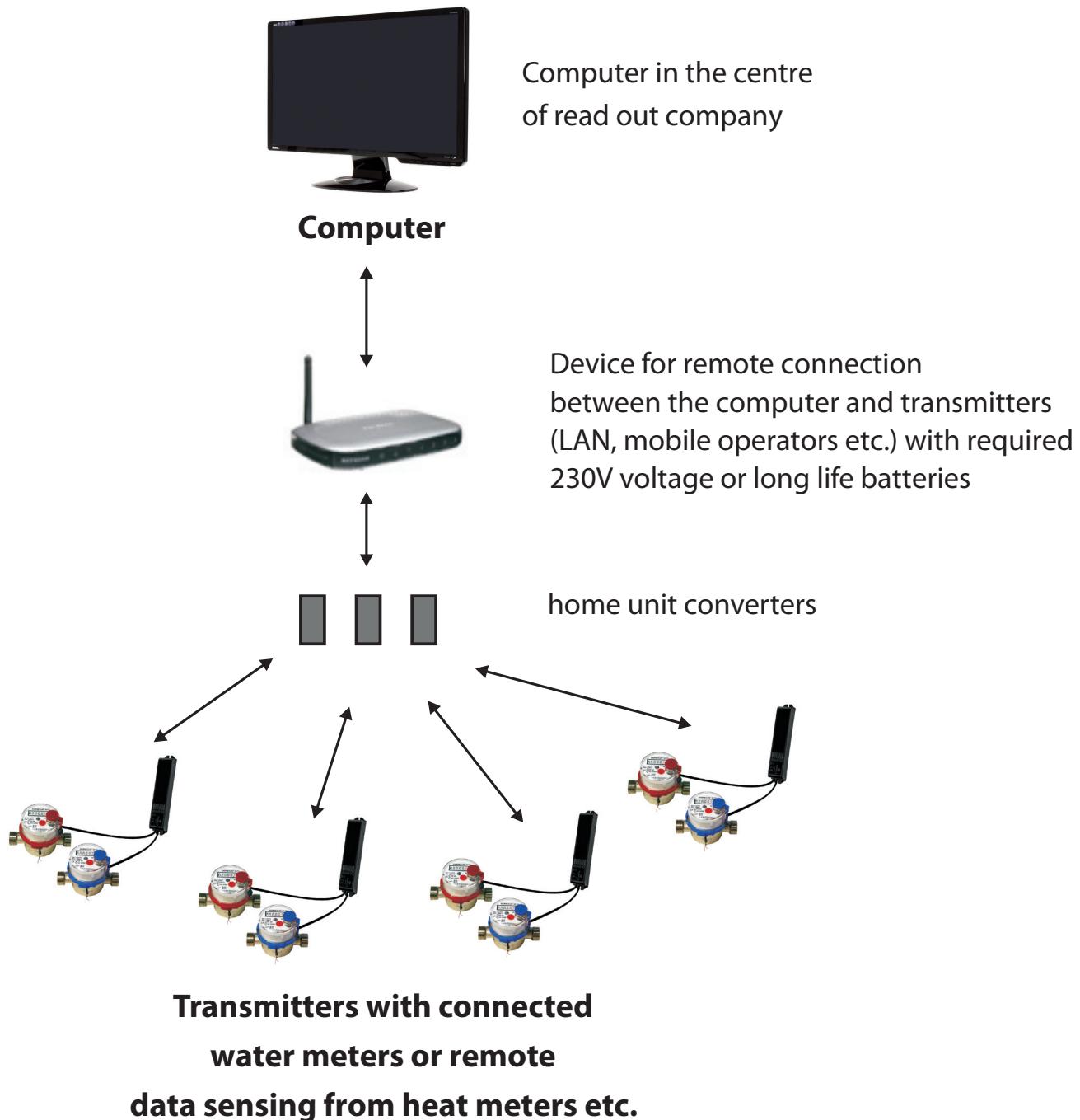
Mobile Converter



Transmitters with connected water meters

The electronic unit effectively records flow rate of two unit water meters at the same time via cables and provides its wireless transfer. The read out takes place remotely (without necessity of entering the flat). Technically, this solution uses a portable mobile unit consisting of a computer and converter (via USB port or Bluetooth) or fixed converters and a modem to an office.

Typology of remote read out



The mobile receiver (converter) for round read out is used as an intermediate for the wireless data reception from the electronic part of the water meter as well as to sending of data to the PC.

Data received in the computer is saved and processed to a spreadsheet form (Excel or text). Therefore, it is not a single-purpose device but a universal computer the user can use for other purposes during the year.

To verify operation, the water meter retains classic mechanical meter as well. Wireless transfer is based on existing successful BONEGA® ultra anti-magnetic unit water meters.

Maximum emphasis is put on protection against misuse by end user (magnetic, mechanic resistance etc.).

Combined BONEGA + METRA round data collection

Available is also the combined round data collection from the BONEGA water meters and METRA share heat meters. Hence, one Czech system effectively supports another Czech system.

The solution is ideal where you are using (or making decision to use) the BONEGA water meters and METRA share heat meters (both with possible remote data transfer).

What are the benefits?

No two different systems need to be used during the round collection for remote data collection in order to bill water and heat consumptions separately.

How does it work?

1. Insert one small USB 868 converter (key tag) to a portable computer for the BONEGA water meter and one USB 868M converter (key tag) for the METRA share heat meters. In case the portable PC has one USB port only, wireless Bluetooth BT868 converter for BONEGA water meters and one USB converter 868M (key tag) for the METRA share heat meters may be used.
2. We will provide you with a PC application for reading data from the water meters and heat meters at the same time. The graphic difference is that the water meters symbolize blue and red drops and the share heat meters are identified by a thermometer.
3. After the application is launched, data starts loading to the computer.

4. Read out may take place in two modes:
 - a) according to „Read out schedule“ that defines what transmitters need to be sensed. When the receiver finds a transmitter, it receives data and moves data from the left hand side of the screen to the right hand one. Following loading is complete, the application displays a finish message.
 - b) according to „Read out all reachable“, where the software captures everything reachable and records data.
5. In principle, the read out means that one row equals to one transmitter. For the water meters, series number, current status, history, signal strength etc. are displayed. For the share meters, series number without more values is displayed.
6. In your office, you need to transfer data (in simple text or Excel format) to your existing billing software (you see – we don't push you to change your billing software). Data is transferred in the following way:
 - a) data from the BONEGA water meters is transferred directly by standard copy & paste (Ctrl+C and Ctrl+V).
 - b) data from the METRA share heat meters is transferred by transmitting data via the converter (BONEGA key tag) for the METRA share heat meters with USB 868M identification. At the moment of insertion, the USB converter in the PC switches from receiver to transmitter. In this way, data is decoded via original round equipment of METRA. Thus, via the original METRA converter to the original METRA application. METRA offers you to purchase the original converter, SW, and licence to the share heat meters.

Advantages of the system

Assembly benefits

1. *Installation of the device does not require any additional configuration or mechanical start.* The electronic system activates automatically after pre-specified volume of the primary water flow rate (3l). Frequent assembly errors caused by human factor are thus excluded (omitted activation of the electronic devices etc.) and higher qualification of staff is prevented, which simplifies the assembly.
2. The unit for automatic activation *transmits for some time* (48 hours) *more frequently* to allow potential fast inspection.
3. *Minimum height spatial demands* in immediate vicinity of the water meter. Only revolution sensor is located in the water meter and the electronic unit may be installed elsewhere within 50 cm from the water meters.

4. **Simple assembly of the sensor:** design of the case for the sensor ensures outflow of water potentially entering when replacing the water meters and simple assembly of the sensor. The sensor cover has bayonet cap.
5. **Colour coding of the sensors** (blue and red cap) *prevent mistakes in reverse installation of the sensors.*

Operational reliability

1. **Long life.** *The electronic part will operate for at least 11 years.*
2. The electronic transmission unit is also fitted with the alarm adapted to start signalling of emergency in case of battery life drop under pre-defined level. In this way, the operator gets *one year in advance* (when reading out) *a warning message about low battery level.* In the next read out period, i.e. after one year, the collecting electronic unit needs to be replaced. This provides protection against interruption of operation.
3. High IP rating – IP 67 (resistant to permanent submersion into water and fully resistant to dust). The sensors and electronic components are hermetically sealed, which guarantees *operational reliability in very harsh environment as well.*
4. Thanks to *retaining backup mechanical meter*, the water consumption can be detected right from the meter in case of electronic components failure.
5. The electronic components and *energy consumption from the battery is activated automatically after first pre-defined water flow (3l).* This saves energy for radio transmission in time from production to transport, warehousing until the date of assembly (which may take up to several months).

Protection against misuse

1. High level of *protection against effects of an external magnet* both for the sensor of revolutions and the water meter.
The magnetic connector of dry-running water meter is protected by a magnetic cage as the sensors of the meter operation. Some competitive water meters lack of any anti-magnetic protection so that common „school-class“ magnet stops their operation.
2. **Protection against external „pirate“ breach**
The system for the wireless data transfer uses transmitter only without receiver, so hacking it out is impossible. No better quality anti-magnetic shielding of the sensors is known than the one applied for the BONEGA® water meters.
3. **Protection of the radio transmitted data uses encryption.** However, this is not a encoded block to a specific supplier.

4. Extremely advantageous is that the transmission unit is *adapted for programming* using the input encoding impulses where the input of these encoding impulses goes *only mechanically via contacts not accessible during the operation*. At the same time, they are protected both electrically and magnetically. This solution *guarantees still unachievable protection level against external unauthorized intervention to the water meter*. In addition, this protection design does not require any other technical means.
5. *Detection of breach of cable leads* to the sensors (e.g. piercing with a pin). Current date and time is saved to the memory in case of tampering.
6. The transmission unit *is connected with* the sensors of the meter operation *by shielded cables (length 50cm), of which connection* at the sensors of the meter operation as well as the transmission unit is designed *as externally non-dismountable*.
7. The mechanic meter operates *independently on the electronic units*, which creates backup monitoring of water consumption.
8. The water meter cap *has a safety lock against endless rotation*, however with identification of the +/- 360° movement for simplified visual inspections of the meter balances.
9. The embedded *sensor* in the case with the bayonet lock *is sealed after assembly*.
10. The system of electronic sensing always adds the flown litres to the plus balance. This means also in cases where the water meter was installed either by mistake or intentionally in reverse position.

User benefits

1. As standard, BONEGA® *offers for sale the pre-prepared water meters with the sensor case for additional installation of the wireless data transfer to the users* (the water meters are de facto ready for the electronic units). The benefits are that the user has to face with purchase of the new water meters but he may not convinced for purchase of the wireless data transfer for various reasons. However, the user may purchase the water meters that will allow the transfer in the future. Similarly, the user may think of cases where replacement for cold water meters only is due in a specific year.

2. *Open system*

The end user is not strictly bound to a service provider. The converter is a universal device (without proprietary encryption to any production series of the transmitters, business ID, tax ID, quantity and therefore, any BONEGA water meters may be read out after their purchase).

3. *Reach in round collection up to the fifth floor and more*

The reach of sensing from the external side of a house is usually up to the fifth

ground floor and more, or despite an elevator in motion where the elevator alone is de facto the „Faraday Cage“.

4. *We can transfer data from other meters as well.*

Thanks to the open system, our transmitters can transfer data from selected heat meters (indicators) or other water meters, gas meters (under condition that they have corresponding output). This service is not related to our products only.

5. *The output from the data transfer is optional for the user both in Excel or text format.*

Therefore, data can be transferred to any existing user software (even older based on MS-DOS).

6. *We do not push our customers to buy a new PC, for the system can usually be employed on the existing user equipment.*

7. *Purchase costs for the electronic components are distributed for up to ten years thanks to the separated system,* which stands for the cycle of two replacements of water meters for hot and cold water. Therefore, the system requires replacement of the water meters only after the first period expires. From the design point of view, long life is due to sturdy, long life battery, and effective consumption.

8. *Finer resolution of consumption* of cold and hot water compared to the competitors (current balance of the meters with 1l accuracy).

9. *High frequency of transmission* and random interval of transmission minimize time required for read out. The transmission interval is 20-24 seconds in the read out period from 1 December – 1 March. These extremely short intervals are achieved thanks to effective consumption. For other days in the year, the transmission frequency is every 4 minutes 24 hours a day.

10. *Two types of converters according to your option*

- small (handy converter) for USB connection
- big Bluetooth converter (the advantage is that it is harder to be lost or put somewhere, could be worn on the belt).

11. *Communication of the big mobile converter* with a laptop, MDA or PDA takes place *via wireless Bluetooth-like transfer* for simplified work of the operators.

12. Return *valve to prevent return flow* (installation during assembly is recommended).

13. *Possible expansion of the system with the protection against flooding of a flat or alarm at high consumption* (leaking toilet or similar) for extra surcharge. In principle, it is a special electronic unit with a valve that receives radio transmission of paired water meter(s) and evaluates excessive flow rate. The user may define the limits. The output may be e.g. to a valve in the flat or common valve for the house or as a warning notice via SMS message etc.

14. *The existing system may be expanded at any time with the converters and central unit* for the house for collection of all data with direct connection to a billing authority. Physical collection is prevented in this solution because the consumption is monitored continuously. You can link sending of SMS as warning against flooding etc. to it. The system of transmitters is universal and switching to remote transmission to offices can be made without modifications, or vice versa. Extension of the transfer does not require entry to the flats.
15. *The development and production takes place in the Czech Republic* with the guarantee of easy communication, service, technical support, innovation, or other adaptations.
16. *For use for one as well as two water meters.* The system is fully functional if used for a single water meter only.
17. User of the flat, owner or operator may *perform physical inspection of water consumption from the mechanical meter* or compare the consumption reported by the meter and electronic unit.
18. *The demountable, but sealable assembly separation of the electronic unit from the water meter* achieved production of an assembly for meters read out where in case of replacement of the meters for failure or re-calibration *it is not necessary to change the electronic read out components as well*, i.e. the meter balance sensors and the transmission unit. This is due to the fact that connection of the meter operation sensor to the meter is made as demountable connection with a sealing member.
19. *Radio-detectable consumption history* (13-month-history of the cold and hot water meter balance). It can therefore cover change to tenants, complaints, monitoring, and more.
20. The investment and operation *costs are lower* because *the transmission unit is common for two meters.*
21. Even the end user can remotely read out his/her consumption after purchase of the SW converter.
22. The wireless transmission can easily reveal fraudulent behaviour of some dishonest flat users.

Comparison with the competitors

1. Some competitive water meters (despite their manufacturers insist that the water meters are hardly susceptible to magnets) sense the flow rate with unshielded needle contact that can be influenced by any small magnet (e.g. even for schools).
The BONEGA water meters sense the flow rate with thoroughly shielded needle contact.

2. In most cases, the competitive water meters use a radio system with receiver and transmitter, which brings many problems (e.g. battery discharge by interference coming from devices working in the same transmission band, hacker tampering).
The BONEGA water meters have transmitter only and intentionally separated from the water meter body.
3. Many competitive water meters are secured only by warning against interruption of cable (which is physically apparent) and not against short circuiting (e.g. piercing with a thin metal object).
The BONEGA water meters are protected by warning message in case of short circuit.
4. The competitive water meters use 25mW power for longer reach and therefore, the system must operate in a band where higher power is permitted. However, there are often devices with higher transmission power in this band and therefore, interference in a larger radius is possible (up to 1,000m with direct visibility at 25mW).
The BONEGA water meters operate at 868MHz with transmission power 10mW.
5. The competitors link the systems of the remote data transfers to their meters only.
6. Extremely short transmission data packets reduce energy demands, possibility of interference, and reduced radio smog.
7. Not only current balance of the meter may be archived and sent but the meter balance in hour, daily, monthly or annual intervals. In this way, no data is lost in case of short-term power failure of the transmitter.
8. The unit offers a wide range of configuration opportunities. It is possible to configure what and how often things have to be transmitted, to configure limit levels of the alarm states and conversion coefficients, conditions for activation of the transmitter, its behaviour in the activation and operation mode etc. This configuration takes place already in the production. We can meet specific requirements of our customers.

In the pipeline of the series production and sale:

1. Patent-protected revolutionary dry-running water meter. This will be a unique water meter unstoppable by the biggest, most available neodymium magnet.
2. Remote data transfer from water meters or other meters up to the offices. This will be an open system with potential use of already mounted BONEGA transmitters for the round data collection. It will contribute to reduced purchase costs and permit successive switch of the data transfer from the round one to the remote data transfer.



Figure 1: Water meter with revolutions sensor



Figure 2: Electronic unit (transmitter)



Figure 3: Small mobile converter (USB)



Figure 4: Big BT mobile converter (with Bluetooth system)

Technical parameters

Electronic unit of the transmitter

- Operation and storage temperature: +5 to +50 °C
- Operation and storage humidity: 0 ~ 100% RH
- Power supply: Lithium battery, not serviceable by user
- Expected life: 10 years
- Battery discharge warning message: yes
- Dimensions of the electronic unit: Ø35 x 150 mm
- Length of shielded cables of sensors: 50 cm
- IP rating: IP67 (resistant to permanent submersion into water and fully resistant to dust)
- Mechanic environment class: M1
- Electromagnetic environment class: E1
- Automatic activation of activity: after flowing of 3l of water
- note: at the end of life (about 11 years), the transmitter may not be refurbished

Receiving part of the transmitter

- Range of the meter for cold water: 0 ~ 65536 m³
- Range of the meter for hot water: 0 ~ 65536 m³
- Resolution (current): 1l
- Maximum detectable flow rate: 6 m³/hour
- Type of sensor: needle contact
- Magnet resistant: yes
- Cable damage detection: yes
- Excessive flow rate detection: yes (for extra costs)

Radio part of the transmitter

- Operating frequency: 868MHz band
 - Radiation: safe and not hazardous to health
(corresponding to EU standards)
 - Frequency of transmission:
More frequent with 20–24s interval is:
 - in read out period from 1 December to 1 March (3 months)
 - each first three days in a month (i.e. at least one business day in a month)
 - 4 days after installation (expanded to 4 days due to installation on Friday and read out on Monday)
- For other days in the year, the transmission frequency is every 4 minutes.**

Frequency of transmission depends on status of internal clock of the transmitter. This information is also included in the transmission. More frequent transmission occurs during read out period; less frequent in the other months of the year.

In order to avoid regular overlap in transmission by multiple units, the transmission interval is not always the same. Time between two transmitted messages is slightly untuned by random numbers generator. In addition, transmission does not have a fixed time frame; only minimum and maximum message interval is defined. This contributes to the most optimum distribution of the transmission over time and quick data collection. High frequency of transmission and random interval of transmission minimize time required for read out. These extremely short intervals are achieved thanks to effective consumption.

- Transmitted data protection: yes (encryption)
- Reach in housing area: > 25m depending on local conditions (from the place in front of a house, the reach is up to the 5th ground floor and more)

Fixed part of the transmission:

- information whether the water meter is for cold or hot water
- unique series number of the unit
- identification of unit manufacturer
- encryption method used
- firmware version
- low battery voltage detection
- meter error
- detection of two limit flow rates

Optional part of the transmission

- current meter, date and time
- meter value in previous hour
- meter value at the end of the day (in last four days)
- meter value at the end of the month
- meter value at the end of the year
- alarm messages

Information required for unit configuration

- „VF“ and „K“ coefficient of connected CYBLE meter sensor
- Listing of transmitted optional data (meters) and their frequency per day

Regularly transmitted data

- Unique identification number
- Current meter balance of cold and hot water (1l resolution)
- Cold and hot water meter balance at the end of billing period (resolution 10l)
- Monthly history of cold and hot water meter balance: 13 months backwards (resolution 10l)
- Current date and time
- Alarms (break of cable leads to the sensors, decreasing battery voltage)

Converters:

a) small USB converter – USB 868 type (for Bonega data transfer)

- To be inserted to a USB port in a laptop (notebook)
- Drivers required are installed automatically
- Internet connection (wi-fi) is required for installation of the drivers

b) small USB converter – USB 868M type (for Bonega data METRA)

- To be inserted to a USB port in a laptop (notebook)
- Drivers required are installed automatically
- Internet connection (wi-fi) is required for installation of the drivers

c) Big converter – BT type (Bluetooth system)

- | | |
|---|-----------------------|
| - Operation time (with brand new batteries) | 30 ~ 40 hours |
| - Warning message for depleted batteries | 30 minutes in advance |
| - Signalling of status, radio reception, communication | yes |
| - Possibilities of recharging: via USB connector or car cigarette lighter | |

Computer

Existing IT technology of the user may advantageously be used. This means a laptop, PDA or MDA

Manual read out

Manual read out is also possible by entering the mechanical meter balance manually to the computer. Also recorded is information that the balance was recorded manually and name of the person who entered this meter balance. This information is used for tracing purposes as prevention against misuse

- ▶ High metering accuracy
- ▶ Unique protective elements
- ▶ Extraordinary technical benefits
- ▶ Excellent anti-magnetic resistance

Anti-magnetic unit water meters **BONEGA®**

We differ from the others...

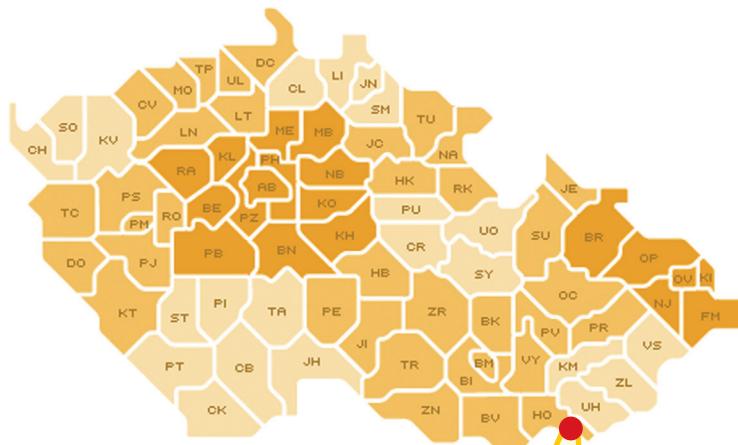
- ✓ Extremely high metering accuracy
 - ▶ Accuracy class „B“ in all assembly positions
- ✓ High sensitivity to start up
 - ▶ Real start up flow rate of the BONEGA® water meters is under 8 litres per hour
- ✓ Unique anti-magnetic resistance
 - ▶ Extraordinary effectiveness 94 – 130 kA/m
- ✓ Patented disability of endless rotation of the meter (avoids tampering with the meter)
- ✓ Side covering that disables external meter tampering... and more



- ✓ Comfortable meter balance read out (meter size and possibility of rotation in the selected range)
- ✓ Protective swivelling lid
- ✓ Surface treatment (nickel coating)
- ✓ High quality of materials and design (ruby bearings etc.)
- ✓ Hygienic certificate
- ✓ Long warranty and life...

... we absolutely trust to our product.

BUSINESS CONTACT

**BONEGA®, spol. s r.o.**

Potoční 302
696 66 Sudoměřice nad Moravou
the Czech Republic

GPS: N48° 51' 59.23", E17° 15' 29.53"

Export manager:

Ing. Michal Hudeček
mobile: +420 605 518 724
SKYPE: michal.hudecek

Division of unit water meters:

Ing. Jana Janečková
jana.janeckova@bonega.cz
mobile: +420 604 207 548

Sales department:

Lenka Švirogová
lenka.svirgova@bonega.cz
tel./fax: +420 518 335 216
tel.: +420 518 335 333-5 (klapka 101)
mobile: +420 734 346 996
SKYPE: bonega.lenka
www.bonega.cz

For detail information about all products, please visit www.bonega.cz/vodomery

REFERENCE



Due to high metering accuracy and reliability, the BONEGA water meters were chosen by international Landis + GYR company for potential application worldwide. Landis + GYR employs 5,000+ employees in 30 countries of the world.

Reference contact:

Tomáš Hejl

+phone: +420 602 534 999



SKUPINA ČEZ

The BONEGA water meters proved well also in the Czech Republic, among others in an important pilot project of ČEZ: WE CAN SAVE – YOU CAN SAVE. In principle, this is the wireless data transfer from all energy meters in a house to a modem located in the electric energy meter. Data is then transmitted over electricity grid to the distribution points to concentrators and for processing. Then, data goes back to the owners and users of flats.

For more information about the project, see:

<http://www.muvrchlabi.cz/data/news/217-doc/brozura.pdf>



Successful project for PRE and VEOLIA consisting in data transfer from house water meters.

Reference contact:

Ing. Petr Karel

head metrologist

phone: +420 272 172 438

For detail information about all products, please visit

www.bonega.cz/vodomery