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M-bus networks and devices

M-bus (Meter-bus) is new European standard for remote reading of tax instruments as well as various sensor types. The reading of the instruments can be implemented in different ways - from direct reading of device by human to fully automated remote reading of all devices in related networks by central server system using wireless GPRS-connection to each of the networks. Because in Bulgaria it is still underestimated, we have to explain very often what is the fundament of this types of remote reading and how it is made. So, we decided to write this article for you, our future clients, to explain all things, related to remote reading via M-bus.

Definition and purposes

A system for remote reading is a kind of system, which allows reading and saving of data without direct human interference. This data is in common cases energy and water consumption in buildings, heat cost allocation or gas-consumption. Main principle in this networks and systems is the ability to read multiple networks simultaneously and easy upgrade of the system in the future.

Advantages of remote reading

First of all, creating network for automated reading excludes involving stuff (and subjective mistakes) in the future, thus saving time and money. The subjective mistake is completely removed, readings can be done even every minute, which gives statistics and information how to optimize consumption - i.e. energy management in buildings.

Remote reading via m-bus networks allows fully electronic reading of all data with all the advantages in consequence:

- avoids entering of supplier employees in private property
- avoids any human errors
- significantly reduces cost for both suppliers and customers
- allows fully automated remote reading of data in one or more networks (without any human intervention) and automated reports creation
- ensures high data security and prevents malicious attempts of manipulating the data
- allows to minimize readout intervals
- allows placement of meters in distant or hard-to-reach places
- allows fast data readout - practically incomparable with time when a person should read data manually
- creation of databases for every consumer and possibility to make instant reports

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- creation of statistic reports for consumption optimizing (fully automated)

Types of systems

For the time being there are many systems for remote reading, but generally there are two types of networks for data read - wire and wireless data transmission. In wire systems in Europe the most popular protocol is m-bus, and for the wireless systems - variant of KNX-protocol for wireless data transmission, administered by Konnex Association. As with the most things in this world, each of this methods has its own advantages and disadvantages, which we will briefly describe.

M-bus is a new protocol, designed especially for remote reading networks in BMS (Building Management System). The main goals were to be cheap and easy for implementation and support in buildings. All slave devices (tax instruments or converters) are connected via 2-wire cable, polarity does not matter, branches of the network can be random. The cable, which is prescribed from m-bus inventors, is 2x0.75mm2 and the total length of the network can be up to 1200m. The systems is consisted from physical side (two-wire cable), m-bus power device/converter and slave devices with m-bus interface. Up to 250 slave devices can be connect to a single m-bus network. If there are more, segmentation of the network is made by m-bus repeaters. If the device doesn't have m-bus, other devices can be mount such as pulse counters with m-bus. The main m-bus power device has two basic functions: to provide power supply for every unit in the network and to establish communication between slave units and reading device. The reading device (personal computer/notebook, GPRS-modem, phone modem, ethernet controller, PDA, etc.) can be directly connected to m-bus converter or can be connected only when reading has to be done - this doesn't affect the way the system works. Slave devices are powered by the main converter or by embedded accumulator battery, if for some reason main power supply fail.

The KNX protocol, version for wireless data transmission, is an evolution of several previous protocols for building automation, some of them used for remote reading. Data is transmitted at frequency of 868.3MHz. The concept is build around "concentrators" - devices which collect and memorize data from several tax instruments around the concentrator. Because the concentrator has the ability to read only several closest devices (which depends on the distance between concentrator and device, type of the obstacles (walls), radio-air), many concentrators have to be used to connect all devices in a wireless network. The concentrators pass to each other data, i.e. retranslate, and the data must reach the main concentrator at the bottom of the network. At the bottom concentrator a reading device must be placed.

So, from the above facts, main advantages and disadvantages can be derived – m-bus is significantly cheaper to be build and support compared to wireless, either price of tax device and network devices. M-bus also is characterized with bigger reliability and lower speeds. Radio-air disturbance has significant effect on

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KNX-protocol based systems, in some cases it is almost impossible to build working system. M-bus speeds are usually 2400bps, and wireless is 38.4kbps. But there is no big difference in real reading speeds, because of the nature of m-bus - every device is directly connected to the converter, and when reading wireless KNX network, the data is transmitted through multiple concentrators before reaches the main concentrator (which is called overhead).

From reliable point of view, if a node from either network malfunction, the things look almost the same. If a cable is damaged in m-bus network, all nodes after the damage point become invisible for the main converter. If a concentrator fail in KNX-system, all tax instruments he reads become invisible and also all concentrators before him (because as mentioned above each concentrator retranslates data to the next). But the price for fixing the problem is incomparable - only cable segment is replaced in m-bus system, a new concentrator must be placed in wireless system. Here we must point the main disadvantage of m-bus system - if the cable is not damaged, but short circuited, all network become unreachable and unreadable, regardless where is the problem. This must be take in care when building m-bus network, segmentation must be done and other techniques, which will be discussed furthermore in this article.

The main advantage of wireless protocol is the lack of cables, which makes it faster to be build, and also is very suitable for already accomplished buildings, where m-bus cabeling was not the part of the project. In all other cases, especially in new buildings, it is recommended to use m-bus mainly to its cheapness and high reliability.

Creating m-bus network

The main parameter in m-bus network is the count of devices, which shall be read. Also important things are distances between the devices, the maximum distance of the network, type of tax instruments and their interface. The easiest way is to use tax devices, who have m-bus interface. Every major manufacturer provide devices with m-bus interface (IskraEmeco, Minol, Zenner, Kamstrup and others). Very mass tax devices are these, who have pulse outputs, instead of m-bus. Of course, they are cheaper than these with m-bus. Devices with pulse output can be connected to m-bus network via pulse counters with m-bus. Our counters have up to 8 pulse inputs (i.e. 8 devices can be connected) and m-bus interface. Sometimes it is cheaper to use simple tax devices with pulse output and pulse counters with m-bus, than to buy instruments, who have m-bus interface. After defining count and type of devices, the user must choose the main m-bus supply/converter. The main m-bus power units are defined prior the number of slave devices it can support. Mainly 32/64/128/250 m-bus converters are produced by different manufacturers. If the distances are too big or power consumption is too high, the network can be divided in "segments", each segment powered by m-bus repeater. The repeater itself has m-bus input and m-bus output. It can supply also another 32/64/128/250 m-bus devices. From communication point of view, the repeater is transparent, it segments the

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network only in a physical sense. Using repeaters for large networks also increases the reliability of the network according to failures. The communication node (or device for reading and storing data) is the last device in the network, which is connected to the main m-bus power supply converter. The lack of communication node does not affect the normal work of the network - i.e. reading device such as notebook can be connected only when the user wants to read data from slave devices. So, briefly speaking, one m-bus network needs the three following device types:

- m-bus master devices/converters - m-bus masters maintain the voltage and communications in a network. They connect the slave devices and the data collecting devices
- m-bus slave devices - slave devices are all tax and other meters that have m-bus interface for readout as well as all devices connecting various types of meters without m-bus connectivity to a m-bus network (as m-bus pulse counters for connecting water meters/ electricity/etc. meters to a m-bus network)
- data collecting devices - these devices save permanently the data read from tax- and other meters. Usually these are centralized computer systems

Communication nodes

The communication node can be:

- personal computer/server – reads data from tax devices periodically, creates database for customers and consumption, creates reports and calculation
- notebook/PDA – connects to m-bus power converter only when reading is required and reads all data; later this information is uploaded to main server in the central office
- GPRS/Ethernet/phone modem – serves to send data remotely (wire/wireless) to a dedicated server
- others

The main advantage of m-bus systems is that all information about the network is not kept in the slave or master devices. That way if there is need to replace some node in the network this not affect the way of work - the system will be the same as before the replacement (of course, some set up of the replaced device must be done, involving network address and communication parameters). So, data can not be lost, it is save in the server (of course double securing is recommended).

Generally one m-bus network looks like shown in the picture:

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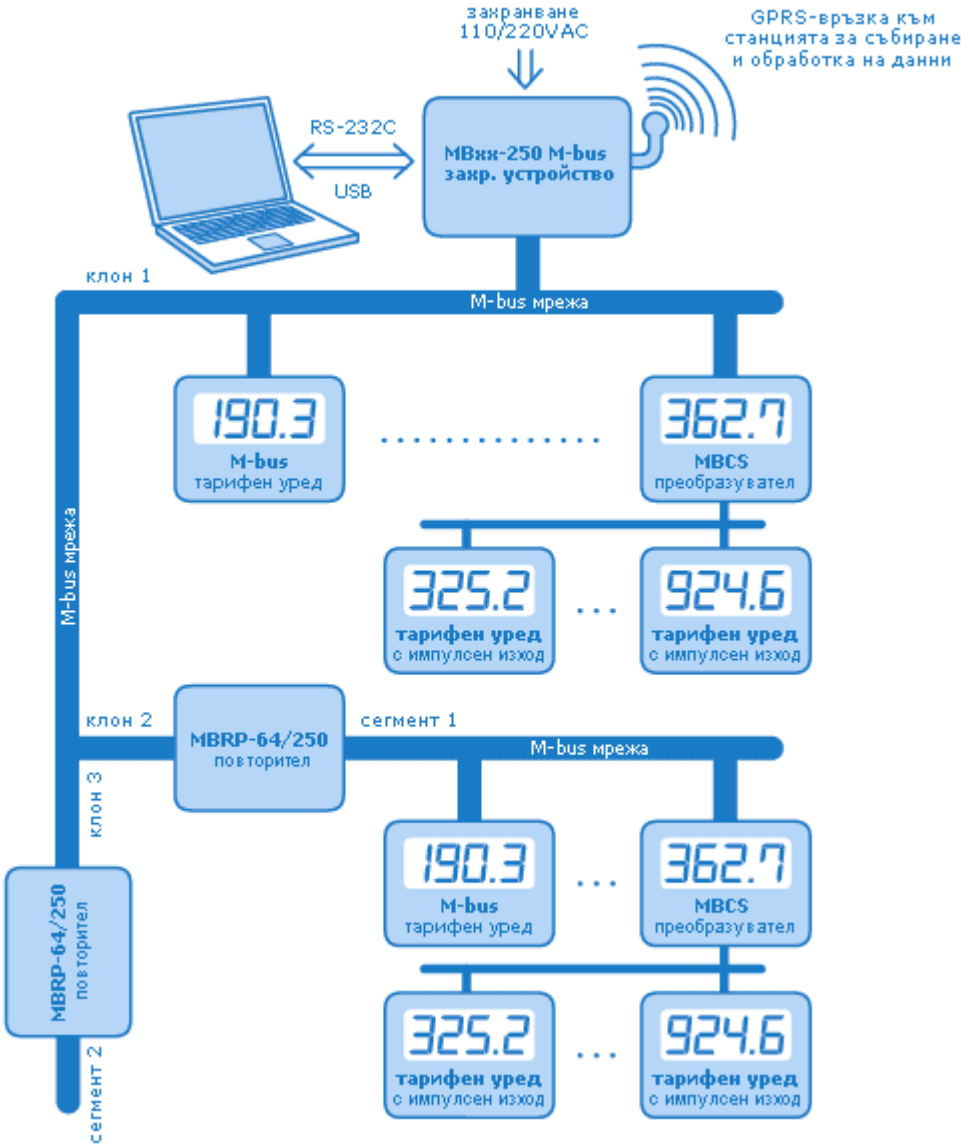

Gineers Ltd. is designing and producing full range of m-bus devices, needed for remote reading system, software, database, calculation and reports, different devices for transmitting data to main server (like GPRS). This includes the following:

- power m-bus converters, type MBRS, for 32/64/128/250 slave devices
- m-bus repeaters, type MBRP, for 64/250 slave devices
- pulse counters with m-bus MBxS with/without display, with/without waterproof, having 2/4/6/8 pulse inputs
- communication devices – GPRS modems, phone modems, Ethernet-communicators
- software for configuration of the net, for local or remote reading, with or without database, reports, calculation (billing), etc.

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Gineers Ltd. is the first bulgarian firm, which develops and offers full range of m-bus products, needed to build system for remote reading. The devices are developed (and we are developing new devices constantly) entirely from our specialists, using the most modern technologies. Configuration and reading software is also written by us, that is why we can do changes for special orders. The fact that we do all gives opportunity for quick reaction in any case, and also to do unique orders, if needed.