

# **Design of energy measurement systems in industrial sites**

This manual serves as a standard for project architects and designers of energy measurement systems, who are using technologies working with M-Bus protocol. The aim of this standard is to provide a clear and transparent assignment of energy consumptions to technological units (heating, cooling, ventilation, production, lightning,...) or to economical units (renter, economic center,...). Another aim of this standard is to prepare a whole system of measurements for automatic data collection from individual gauges, possible identification of potential energy savings and automation of billings. This document is based on our long-standing experience in operating measuring systems in conjunction with the Enectiva application.

## **Main objectives of our standard are:**

- To help project architects with design of energy measurement systems
- To produce effective and useful measurement systems
- Easy connection to on-line energy management Enectiva

## **It is necessary to measure:**

- Main energy supply
- Main water supply
- Main heat or gas supply

## **Secondary measure the technology consumption:**

- Energy consumption of air conditioning and ventilation
- Energy consumed by cooling
- Water and heat consumption for hot water heating in the case of central heating
- Energy consumption for indoor lightning
- Energy consumption for outdoor lightning

## **Secondary measure whole energy consumption for individual renters or planned rental sections (water, energy, gas)**

If the renter won't be known while doing a realization and the space will be kept as empty preparation will be made for possibility of mounting the measurement in the future. If more units are connected into one unit currently but there is a possibility of dividing them into more tenants, the measuring places will be mounted with something (spacer) that can be

easily replaced for a real gauge.

## **Secondary measurement of economic centers**

In the case of measuring for a comprehensive enterprise, it is necessary to count with secondary energy measurement of individual economic centers. They are generally divided to the secondary measurement of administrative part and the secondary measurement of production part. Another softer secondary measurement is welcomed and depends on the type of operation in the enterprise.

## **Secondary measurement according to size of appliances**

By applying the Pareto principle, 20% of electrical appliances contribute on 80% of whole energy consumption. The biggest appliances need to be measured secondary. In the industry, these are mostly compressors, furnaces, mechanical presses, production and robotics line. At the beginning of measurement design it is important to know the biggest appliances and measure them with secondary measurement.

## **Requirements for gauges**

All used gauges of all energy types have to be equipped with M-bus module with baud rate 2400 Bd/s. It is the generally and internationally used technology which has been designed for automatic data collection. It is characterized by simple installation, responsibility and easy extensionality.

In the case of placing the gauges out of the building (shafts), where isn't possible to take along a communication cable from the building, a gauge with pulse output for wireless data transfer is an acceptable solution.

## **Requirements for M-bus cabling**

Individual gauges are going to be connected with the bus, which is going to be realized with J-Y(St)Y 1x2x0.8 mm<sup>2</sup> type of cable in those places, where it is reasonable to use two pairs. The bus wires will be drained to the switchboard of BMS, eventually to another easily accessible place, where is 230V power supply available. To every cable that leads to the switchboard will be attached a label with description of which part of the bus it is.

In the Switchboard of BMS, there will be left a 6A (B) circuit breaker with a short-circuit resistance of 10 kA for possibility of connecting the central M-Bus master unit and there should be enough space for 16 modules on DIN bar.

There will be an Ethernet cable leading to the switchboard with the possibility of using the technical network of building for remote surveillance.

In the case, that the central switchboard with M-Bus bus will not be able to be equipped with Ethernet connection with technical network, other place where is a good mobile network signal and good accessibility for service operations will be chosen as the new

center.

## **M-bus topology**

Possible topologies of the bus are the star-type and the tree-type. Circular topology isn't allowed.

There is no need to install any terminators on the bus. Its maximum allowable length is 350m.

## **Joining cables**

Joining cables will be realized with WAGO clamps placed in installation boxes with visible "M-BUS" mark.

## **Bus cable management**

M-Bus cables will be routed outside the power lines to avoid communication interferences. In situations where you cannot avoid placing the communication cables next to the power cables, the length of a common line has to be reduced to the minimum.

Please contact us at [project@enectiva.cz](mailto:project@enectiva.cz) if you would like to make a realization of measurement project or if you would like help with the design.