



Embedded PC with TwinCAT 3 as the efficient core of an integrated data logger solution

PC-based control drives convergence of energy data acquisition and "Big Data"

Optimized energy management in public buildings requires acquisition of information about the consumption of water, electricity and heat resources at the shortest possible intervals through energy monitoring. With this in mind, the Aachen urban region in Germany (StädteRegion Aachen) has followed an example set by the city of Aachen. Together with the city of Aachen's owner-operated municipal enterprise for building management and the IT service provider, regio iT GmbH, the e2watch monitoring system has been implemented to establish enhanced energy monitoring. This technology is based on an integrated data logger solution from Beckhoff Automation.

Using the e2watch energy monitoring system, energy consumption data is made available on the Internet to building users, as well as to interested members of the public in a freely accessible area. This transparency makes building users more sensitive to the need for more economical use of energy resources. Via an internal work area, building managers receive extended detailed evaluations, from which malfunctions or increased consumption can be identified and analyzed in detail, allowing for prompt resolution of the particular issue.

e2watch leverages extensive application experience

The city of Aachen has maintained its keen focus on energy monitoring since the prior project, E-View, started in 2007. The new e2watch system is positioned as a replacement for E-View, with data migration currently in progress. Markus Lehmenkühler from the energy management department of the city of Aachen comments: "The success of our energy monitoring concept is clearly demonstrated by energy cost savings of approximately 600,000 euros since 2007." Currently,



Energy data stored in the Cloud can be analyzed conveniently with the e2watch monitoring system.

about 200 properties are connected to the energy monitoring system, including schools, childcare facilities, administration buildings, swimming pools, and other sports facilities. Energy monitoring via e2watch will initially be operated until the end of 2015, focused on selected properties in municipalities belonging to the urban region, with the goal of gaining experience with the new technology. Connection to further properties is on the agenda in coming years.

The connected properties encompass a total of 1,000 measuring points, broadcasting data at 15 minute intervals. Adding up to an immense volume of information, the system collects around 100,000 data records per day, with each consumption meter obtaining a data volume of 200 bytes. This provides a comprehensive basis for analyses, fault finding, consumption forecasts, and – in the long run – for the identification of optimization potential.

Markus Lehmenkühler describes the requirements necessary for the successful implementation of such energy monitoring systems: "The very short measuring intervals required for energy monitoring can be achieved only through automated data transmission and data preparation. This also includes the simple connection of consumption meters via the established M-bus protocol, the decentralized buffering of energy data on-site, and reliable data transmission to regio iT."

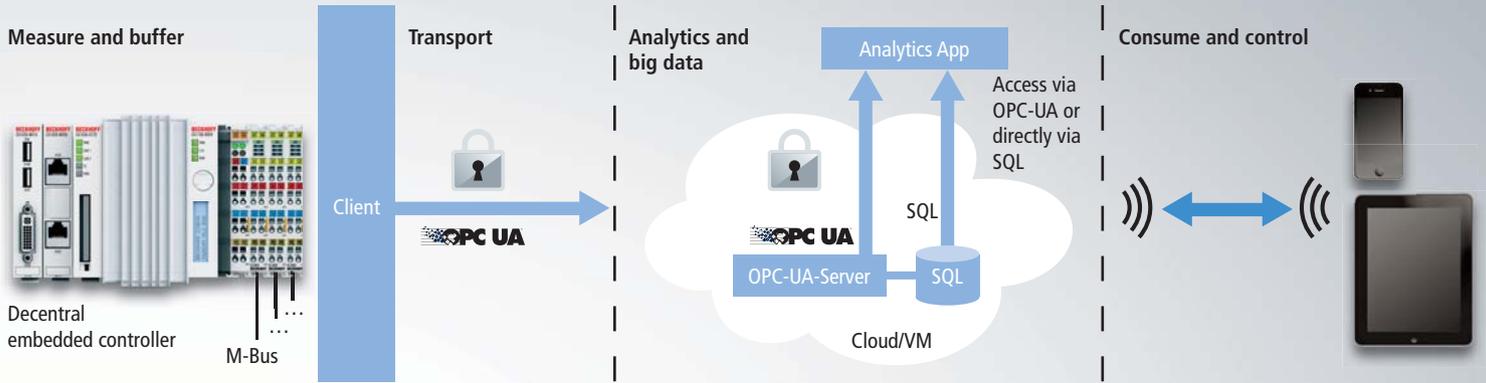
Decentralized data logger with Embedded PC for BDM connection

Acquisition, storage and forwarding of the data is implemented via decentralized data loggers in the respective properties. These are supplied by Beckhoff

as an integrated solution, considerably reducing on-site installation expenses. A CX-series Embedded PC running TwinCAT 3 automation software forms the core of each data logger. The KL6781 M-bus master terminal is used for the convenient integration of the consumption meters into the control technology. In addition, the data logger can be simply connected and commissioned via the e2watch portal without special TwinCAT knowledge; therefore, no programming work is required.

The data logger acquires the measured data on-site, buffers them locally, and synchronizes the information at freely configurable times with the e2watch system at regio iT. In case of concrete fault diagnoses, there is also an option to directly initiate the data transmission. Markus Lehmenkühler comments: "The data are transmitted from the data logger to regio iT, where they are prepared and stored in a Big Data Management system (BDM) as the basis for the e2watch energy monitoring system."

The standard OPC UA (Unified Architecture) protocol with integrated security is used for data transmission to the BDM. As an OPC UA client, the controller pushes the information via a Microsoft SQL database into regio iT's BDM for further analysis. On the client side, i.e. on the Embedded PC of the data logger, TwinCAT 3 PLC is used (for the logic) with a PLCopen-standardized OPC UA Client (for the data transfer) and database server (as the local buffer). TwinCAT 3 runs with an OPC UA server on the server side at regio iT.



Across Germany there are potentially between 5,000 and 10,000 single-purpose buildings that are suitable for Smart Energy concepts with Cloud connectivity such as e2watch.

Efficiency, security, and flexibility assured

According to Markus Lehmenkühler, PC-based data logging offers numerous advantages in practice: "First, we benefit from the complete system from a single supplier. Accordingly, this makes the installation simpler, eliminates additional wiring work, and minimizes error frequency. Second, PC Control from Beckhoff offers an industry-proven, powerful, adaptable, and freely programmable system. Thanks to TwinCAT 3, we have benefited from object-oriented programming in the development of the application. This applies to the implementation of the M-bus protocol and the different, but nevertheless very similar, meter variants, because the similarities can be mapped very efficiently through object-oriented programming practices."

In addition, data security is similarly important. OPC UA offers the option of secure data transfer, standardized according to IEC 62541. The connection requires "only" a router with a NAT and/or SPI firewall; the connection technology used (DSL, ISDN, analog) is irrelevant. Further VPN connections are not required, so there are no additional hardware costs or administration tasks.

Markus Lehmenkühler views the high flexibility of the PC-based data logger as a further benefit: "The original M-bus data loggers had much poorer remote maintenance options and were rather inflexible. If necessary in the context of the system migration, however, even their reduced functionality can be mapped and enriched with added value as required using TwinCAT." Measuring intervals of almost any desired length can be stored locally with



The data logger used in Aachen, Germany is approx. 40 cm in height and width, requires little space, and can be installed as an integrated solution with minimal effort.

the Embedded PC. Over 100,000 measuring cycles, each with 40 measuring points, were stored without problem in tests. Such a high-performance buffer is particularly important in Markus Lehmenkühler's view; no measured values are lost, even in the event of an interruption in the connection between the measuring point and BDM.

Further information:

- www.e2watch.de
- www.regioit.de
- www.beckhoff.com/TwinCAT3
- www.beckhoff.com/urban