Rittal – The System.

Faster – better – everywhere.

Whitepaper
Smart Monitoring System

ENCLOSURES | POWER DISTRIBUTION | CLIMATE CONTROL | IT INFRASTRUCTURE | SOFTWARE & SERVICES

FRIEDHELM LOH GROUP

Contents

1 Executive summary

Companies are having to face major challenges from the effects of the energy revolution and the measures to be taken against the climate change. Generally, energy efficiency needs to be increased to reduce CO_2 emissions, while at the same time, energy costs have to kept under control despite the rising energy prices. The precondition for efficient energy use is an awareness of all the consumption figures. Measurement technology for recording the flows of energy plays a crucial role here. The legal requirements on large corporations in Germany with regard to energy consumption have changed dramatically in recent years. Rittal now offers an elegant solution for electrical low-voltage distribution systems that are safeguarded by NH fuse-switch-disconnectors.

2 Market requirements in the energy sector

Large corporations are obliged to conduct an energy audit in accordance with DIN EN 16247-1 (Energy audits: General requirements) by 5 December 2015 at the latest. Following the first energy audit, repeat audits must be performed no later than every four years. The responsibility for performing energy audits forms part of the European Energy Efficiency Directive (EED RL 2012/27/EC), which lays down measures for improving energy efficiency, so specifying energy and climate protection targets for all EU member states. Accordingly, the energy audit is mandatory in all EU member states. At a national level, the energy audit obligation for Germany is covered by the Energiedienstleistungsgesetz (Energy Services Act, EDL-G 2015) adopted on 22 April 2015. Companies from other EU member states are again subject to country-specific legislation, which also has to be considered.

According to the European Commission, large corporations are companies with at least 250 employees or an annual turnover of €50 million or more and an annual balance sheet total of at least €43 million.

In Germany, this definition of a large corporation applies to least 50,000 firms. Companies that are part of a corporate group and which are not independent, must also be taken into account in the same way as branch or district offices, regardless of their location. At the moment, there is no statutory duty to conduct an energy audit for small and medium-sized enterprises that are not covered by this definition of a large

corporation. On this point, however, all EU member states are invited to establish incentives and encourage the implementation of energy audits in order to increase energy efficiency and reduce CO_2 emissions.

One good way of defining a company is provided by the information sheet on energy audits from Germany's Federal Office for Economic Affairs and Export Control (BAFA), which can be downloaded free from bafa.de.

The energy audit itself includes a historical record of the use of energy forms such as electricity, natural gas, heating oil, diesel fuel, etc. as well as the energy consumption of buildings, units and systems. At least 90% of the total consumption must be covered by the energy audit. Here, the bills from the individual energy suppliers serve as essential input. At the same time, the essential main consumers must be identified and evaluated in order to provide a representative assessment of a company's overall energy efficiency. An independent and adequately qualified energy auditor, registered in the BAFA public energy auditor list, must be chosen to carry out and conduct the energy audits. The energy auditor assumes responsibility for the organisation, documentation, analysis and evaluation of the energy audit, and reports the results to the management of the company.

The successive implementation of energy saving measures, as called for in the ISO 50001 standard for energy management systems, is not obligatory during an energy audit in accordance with DIN EN 16247-1.

Evidence of the completion of an energy audit is provided on the basis of a final report, which the energy auditor must compile. When requested, this must be presented to the Federal Office for Economic Affairs and Export Control (BAFA), in order to demonstrate the completion of the legally mandated energy audit for enterprises that are not considered small or medium-sized. Energy audits, once conducted, are corroborated on the basis of spot checks in individual companies. Fines of up to €50,000 can be imposed if audits are not performed or if they are incomplete.

Exemption from the responsibility to conduct an energy audit is possible by certifying the energy management system in accordance with ISO 50001 or, in the case of an environmental management system, in accordance with ISO 14001. The initial

certification in accordance with ISO 50001 must be completed by 31 December 2016.

3 Energy audit versus energy management

An energy audit in accordance with DIN EN 16247-1 corresponds to a retroactive actual analysis of energy use and energy consumption over the last 12 months. It serves as the basis for assessing the current energy efficiency and for revealing the potentials for improving energy efficiency. The results of the energy audit are documented in a final report, which the energy auditor must compile.

An energy management system certified as per ISO 50001 demands the continuous measurement, analysis and evaluation of energy consumption in comparison to the energy audit. As with other management systems, it is based on the principle of the continuous improvement process (CIP). This means that continuous energy-saving potentials are discovered and that successive energy saving measures are implemented at set time intervals. At the same time, an energy management system ensures continuous transparency in terms of individual energy flows.

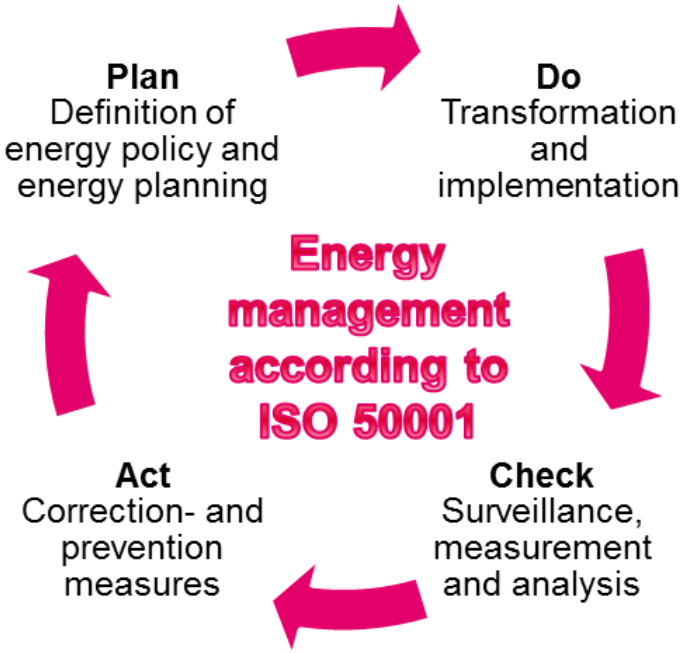

Image: PDCA Cycle One energy management system according to ISO 50001

Advantages and benefits of an energy management system certified in accordance with ISO 50001:

- Saving potentials are detected
- Energy efficiency is increased
- Competitiveness is improved
- Sustainable reduction of carbon dioxide emissions
- Tax breaks
- Positive image effects

In Germany, energy-intensive companies with an annual power consumption of 5 GWh or more are legally obliged to implement an energy management system according to ISO 50001. However, an energy management system also pays off when the power consumption is much lower. Among other things, German companies that compete internationally may be exempted from the renewable energy levy following a successful certification assessment. In 2016, the levy rises by 3% to €06.354 per kilowatt-hour in Germany. The precondition is, that the electricity costs make up 17% or 20% of the gross value added, depending on the company, (Appendix 4 to Section *64 of the EEG* 2014, List 1=17%, List 2=20%) . In addition, up to 90% of the energy tax or electricity tax burden can be reimbursed via the so-called “tax cap”. The legal basis for the tax cap is set out by Section (§) 55 of the *Energiesteuergesetz* (Energy Tax Act) and Section (§) 10 of the *Electricity Tax*. Energy consultation from an audited energy adviser is recommended for the initial consultation and assessment.

4 The hardware components that an energy management system needs

Continuous recording of the energy flows, as is required for energy management systems by ISO 50001, calls for a variety of hardware components.

Using electrical energy as an example, these are:

- Data logging to measure such electrical quantities as electrical work, power, current and voltage

- Measurement transducers that convert the measured values into evaluable signals
- Evaluation electronics, for calculating such electrical quantities as power and work
- Data loggers to record and save the energy data
- An interface to communicate and transfer the energy data

The recording of all energy data may be performed with electronic components, such as data loggers, but also manually, by reading data and writing it down. Energy management software that graphically processes and visualises the energy data is available for monitoring and evaluating the energy data. When claiming funding (which also applies for energy management software among other things) you should make sure that it is listed in the Federal Office for Economic Affairs and Export Control (BAFA) register of fundable energy management software. As many as 193 energy management software applications are currently listed as eligible for funding (as of 30 November 2015).

Rittal has developed an intelligent module to support an ISO 50001 compliant energy management system, so that no complex assembly of different components is needed to continuously record, monitor and evaluate electrical energy flows.

5 NH measurement module

The intelligent NH measurement module is a perfect fit for Rittal NH fuse-switch-disconnectors of sizes 00 – 3 within the 0 – 600 A current range. The NH fuse-switch-disconnectors with their usual NH fuses to protect against overload and short circuiting are available in versions for direct installation on mounting plates or for mounting on a 3-pole busbar system with a 60 mm bar centre distance. The retrofitting of existing Rittal NH fuse-switch-disconnector can also be performed easily. The effort needed for installation and wiring is minimal. At the same time, the NH measurement module offers a high level of protection against direct contact with live parts.

Three current converters are integrated in the measurement module for three-phase current measurement, there is a voltage tap for the contact tracks to the three-phase voltage measurement, and a measurement transducer to convert the current values into evaluable signals. Evaluation electronics calculates all the other relevant electrical variables.

Image: NH - fuse switch disconnectors with NH - measurement module

Alongside the current and voltage, the other possible values to be measured include the frequency, the active, apparent and reactive power, the active, apparent and reactive work, and the phase shift angle cos phi. This is both for each phase (L1, L2, L3), as well as phase-to-phase (L1-L2, L2-L3, L1-L3). The NH measurement module can be used either with or without a connected neutral conductor. Without a neutral conductor connected, the evaluation electronics assumes a symmetrically loaded system (current on neutral conductor = 0 ampere). The L2 phase is used as a reference for the neutral conductor.

In addition, a mains quality measurement is possible up to the 31st harmonic, in order to analyse and evaluate the quality of the existing supply grid.

The measuring accuracy of the built-in current converter is Class 0.5. The overall measuring accuracy of the NH measurement module is Class 2. Thus, the requirements of ISO 50001 for energy management systems are met (according to which the measured data must be accurate and reproducible).

The integrated 24 V power pack means that no external 24 V voltage supply is required for the evaluation electronics. The voltage required for this purpose is provided by a voltage tap on the contact tracks of phases L1 and L2. Similarly, the electronic circuitry can be powered via the CAN bus interface, while simultaneously using the Rittal CMC III monitoring system with a 24 V DC voltage. This means that

start-up is possible without a 230 V AC voltage being applied to phases L1, L2 and L3.

The configuration and installation of updates is made via a USB interface on the NH module. An integrated flash memory allows data to be logged in CSV format, data which can then be evaluated with Microsoft Excel, for example. The memory size (64 MB) and a log interval of 15 minutes permits data storage for up to one year, depending on the amount of data desired. The oldest files are automatically overwritten as soon as the maximum possible flash memory capacity is reached. Over 50 parameters can be logged.

Additional interfaces are available for the NH measurement module for communication and transmission of the measured data. These includes the Modbus RTU field bus, commonly used in industry, as well as the CAN bus, which represents especially low susceptibility to interference and high fault tolerance. Two RJ45 jacks each are available for both interfaces. The two field buses can also be operated in parallel.

It is possible to integrate the NH measurement module in the Rittal CMC III monitoring system via the CAN bus. Based on the CAN bus optimised by Rittal, address assignment is automated for the NH measurement module, as well as for existing sensors such as temperature, smoke, access, and vandalism monitoring sensors, so that no further configuration work is required (such as allocating a device address).

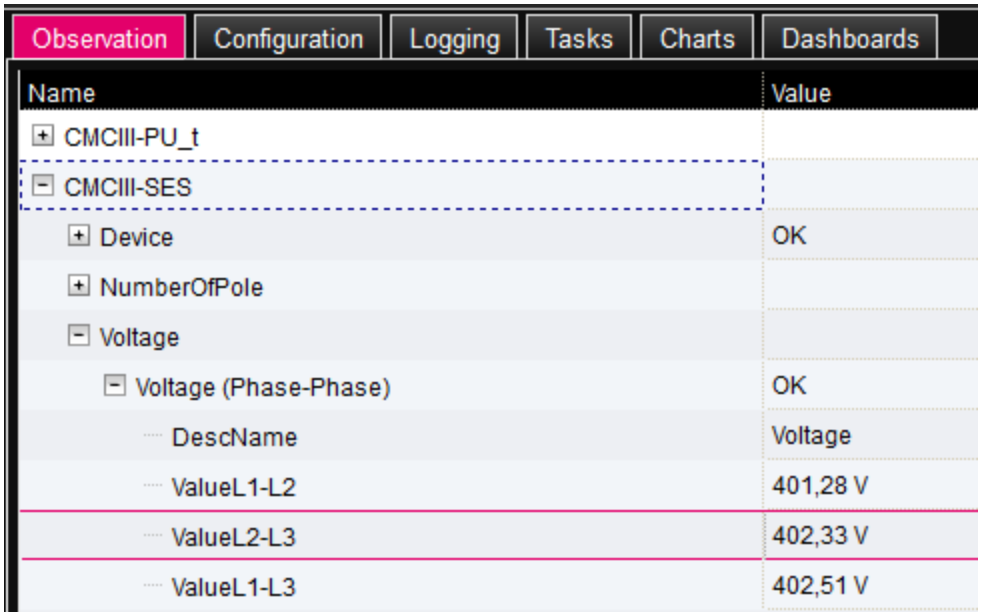

Image: Web interface of CMCIII PU

At the same time, the CMC III monitoring system functions as a gateway and translates into in all common Ethernet protocols, such as TCP/IP v4, TCP/IP v6, FTP, SNMP, and SMTP, etc. An integrated OPC UA (Unified Architecture) server to exchange information between all the company's subsystems also forms part of the scope of the CMC III monitoring system.

Thanks to the CMC III monitoring system's web-based user interface, all the energy data can be displayed in real time and visualised with corresponding graphs. In addition, threshold values can be set for individual parameters, while alarm functions can be defined. When an alarm occurs, it is possible to send an alarm message via e-mail or text (SMS). Access to the web interface is via a standard Internet browser and by entering the IP address and access data.

6 NH measurement module accessories

An illuminated LCD display with standard dimensions of 96 x 96 mm for installation in an enclosure door is one of the NH measurement module's accessories. With the aid of the LCD display, all the measured values can be displayed and graphically visualised on site. The range of accessories also includes a suitable 24-V power pack. The data communication and the necessary supply of voltage between the LCD display and the power pack is via a standard patch cable with an RJ12 connector. The NH measurement module is connected to the power pack for the display via the RTU field bus. Twenty NH measurement modules can be shown on a display.

Image: Display and Power Supply Monitoring

7 Conclusion

With the Smart Monitoring System, consisting of the NH measurement module, the CMC III monitoring system, an LCD display as well as a suitable 24-V power pack,

Rittal is offering, for the first time, a smart and safe compact solution for successful energy management in accordance with ISO 50001.

The NH measurement module is a perfect fit for Rittal NH fuse-switch-disconnectors of size 00-3 which permit measurement in the 0 – 600A current range. The effort needed for installation and wiring is minimal. Thanks to the variety of interfaces, the NH measurement module may be optionally connected to a CAN bus or else via a ModBus RTU to a higher-level control system. The compatibility with the CMC III monitoring system makes configuration easy and permits the visualisation of the NH measurement module via a web-based user interface. The integrated flash memory means that data logging in CSV format can also be performed. Updates can be installed, or the actual configuration of the NH measurement module can be performed via the USB interface. An (optional) LCD display makes it possible to retrieve measured data on site and in real time.

With Rittal’s compact and safe Smart Monitoring System, nothing now stands in the way of an ISO 50001-compliant energy management system.

8 List of abbreviations

CAN	Controller area network
CMC III	Computer Multi Control
CSV	Comma seperated values
DIN	Deutsches Institut für Normung e.V.
EN	European norm
FTP	File Transfer Protocol
IP	Internet protocol
ISO	International Organisation for Standardization
LCD	Liquid Crystal Display
NH	Niederspannungs-Hochleistung (low voltage, high power)
OPC	Open Platform Communications

RJ	Registered Jack
RTU	Remote Terminal Unit
SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
USB	Universal Serial Bus

9 Sources

http://www.bafa.de/bafa/de/energie/index.html

https://www.stromeffizienz.de/industrie-gewerbe/handlungsfelder/energiemanagement.html

http://www.bmwi.de/DE/Presse/pressemitteilungen.html

DIN EN ISO 50001:2011

DIN EN 16247-1:2012

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- Enclosures
- Power Distribution
- Climate Control
- IT Infrastructure
- Software & Services

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