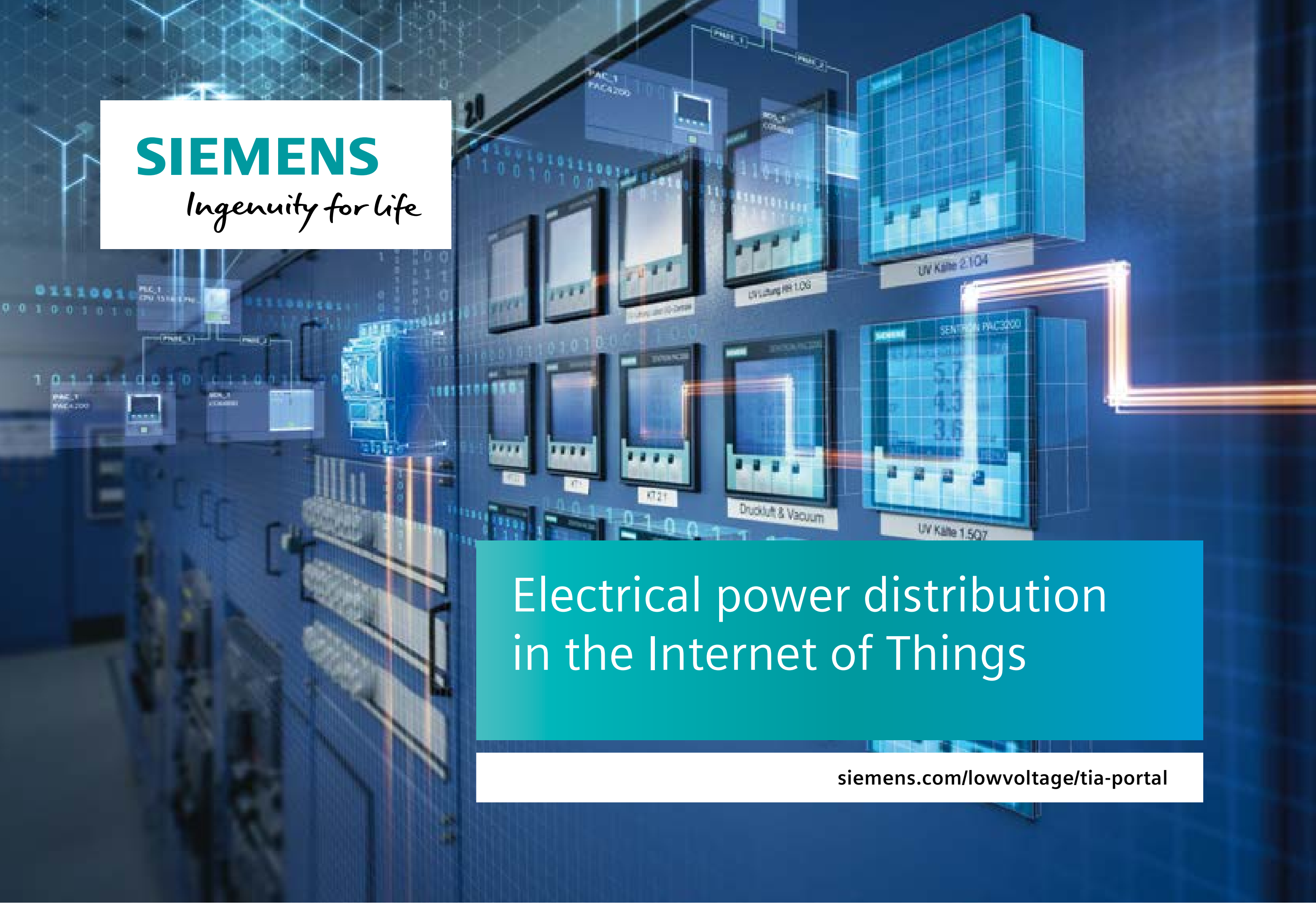

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Electrical power distribution in the Internet of Things

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Industrial manufacturing plants are becoming increasingly networked, are automated in the way they work together, and collect data and monitor systems. This is all made possible by products and systems for electrical power distribution that integrate seamlessly into digital environments. In this way, operational energy efficiency and plant availability can be significantly increased, operating procedures and maintenance optimized and the entire value-added process in control cabinet and plant engineering simplified.

This whitepaper describes the specific demands on electrical power distribution in automated production plants. These include, in particular, automated engineering, fail-safe power supply, the integration of power distribution into comprehensive energy efficiency concepts, and connection to industrial automation and cloud-based IoT operating systems like MindSphere.

Efficient engineering with digital twins

Like the entire energy system, electrical power distribution is also changing, influenced by factors like changing load conditions, a growing number of electrical consumers and, in particular, the increasing networking and automation in industrial environments, buildings and infrastructure. In addition, there are stricter standards and increased demands on operational energy management. As a consequence, planning and operation of electrical power distribution systems are becoming more complex and the technical demands on the underlying products and systems are increasing – especially with regard to their flexibility, and communication and integration capability.

Smooth interaction between hardware and software, with systematic data management, is necessary to ensure the appropriate support for dynamic, networked production environments.

This starts during the electrical engineering planning stage, well before the actual construction of an industrial control cabinet. Digital twins can be used to simulate and virtually test how electrification and automation components will work together as part of an automated, efficient control cabinet engineering process. Real-world errors are thus avoided from the very beginning. This requires appropriate planning and configuration programs as well as the availability of all relevant product data, such as macros for e-Engineering systems, 3D models and device circuit diagrams. To enable software-based engineering, Siemens makes the relevant data for automation technology and low-voltage switchgear components available via a central database. The database provides all the relevant information: for each device, it provides up to twelve data types that can be flexibly compiled on-line in a CAx shopping cart, downloaded, and integrated into configuration tools like EPLAN Electric P8. This reduces the effort involved for the electrical planner in terms of planning, configuration, construction, documentation, ordering and commissioning by up to 80 percent.

Fail-safe power supply

In situations where everything is interlinked, system and component availability is more important than ever. In a worst-case situation, if a single element in the manufacturing process fails, the entire system may be damaged, bringing the whole production process to a standstill. The electrical power distribution in automated environments must therefore combine maximum safety with maximum flexibility.

An integrated protection concept for industrial applications includes components for the continuous protection of all plants, machines and systems. That means devices to protect semiconductors and machines, and also to provide protection against short circuits, overloads, voltage spikes, fire and contact.

Selectivity also plays an important part in circuit protection: if a fault occurs in a circuit with several overcurrent protection devices connected in series, like circuit breakers or fuses, only one device will be tripped: the one directly upstream of the fault location. Despite the fault at that one point, the power supply for the rest of the system will continue to run. The error will also be easier to locate and faster to fix.

The 3VA molded case circuit breakers show how powerful protective components can guarantee the necessary safety and flexibility in digital factories. They protect cables, devices and industrial systems against electrical damage and outages by safely cutting the power in the event of faults like short circuits and overloads. In addition, they are taking on an increasing number of other tasks with operational relevance, like recording energy data. They thus serve to create the transparency regarding consumption values and system status that is particularly important in the age of Industrie 4.0, and create the foundation for efficient, safe production processes.

Incorporation into industrial automation

The technical basis for integrating electrical power distribution in automated environments is provided by communication-capable components like the 3VA molded case circuit breakers and 7KM PAC measuring devices from the Siemens Sentron portfolio. The molded case circuit breakers and measuring devices are directly integrated into the TIA Portal and the TIA Portal Energy Suite. Electrification is thus an integral part of the automation solution.

Standardized interfaces ensure that all components in the industrial communication network work together efficiently. All data for molded case circuit breakers and measuring devices are available in the central engineering environment. That means the devices can be parameterized and commissioned directly via the TIA Portal, so engineering requires just one tool, and the power distribution system can be configured intuitively. Condition monitoring and the collection of energy diagnostic data can also be performed conveniently. This means that electrical power distribution can be optimally adapted to automated operating, machine and process sequences, a consistently safe and flexible power supply can be assured, and the overall engineering process is simplified.

Integration in end-to-end energy efficiency concepts

The data gathered on current, voltage and energy can be used for detailed evaluations and systematic management of processes in production automation. Faults in the plant are identified at an early stage, failures are prevented, and operation is made more energy-efficient overall. The energy data can be used to assess the state of the system and the quality of the network, as well as to optimize energy consumption and capacity utilization.

For example, energy consumption per day, shift, line or production unit can be calculated and used as the basis for energy efficiency measures. Evaluating energy consumption during production time compared to non-production time will provide the first indications of potential savings. Comparisons with other plants, for procedures or processes, in a factory or across all locations, will reveal further potentials. Precise, reproducible and reliably established measured values form the basis for systematic energy and plant monitoring. This opens up enormous savings potentials for companies, and is the basis for sustainable operational energy management in the digital age.

Data management in the cloud

Finally, MindConnect components enable all captured energy data to be made available in MindSphere, the cloud-based IoT operating system from Siemens, making it available for specific evaluations. With MindSphere, Siemens offers an open operating system for the Internet of Things. This platform as a service (PaaS) makes it possible to develop, operate and provide applications (apps) and digital services. Huge volumes of data from countless intelligent devices can be captured and analyzed quickly and efficiently in this way.

The resulting recommendations can be used to continuously optimize production plants, in terms of their energy consumption, for example. For predictive maintenance, potential problems can also be identified at a very early stage so that the right decisions can be made at the right time. This enables companies to increase the productivity and efficiency of their entire operation. They benefit from reduced downtimes, increased production, more effective use of their facilities and higher competitiveness overall.

Conclusion

Automated, networked production plants are making new demands on the electric power supply, particularly with regard to security and flexibility.

Intelligent devices, like communication-capable molded case circuit breakers and measuring devices, adapt to all requirements: they create transparency, guarantee optimum system availability, and also minimize the cost and effort of engineering.

In this way, they are making a significant contribution to the safe, efficient implementation of digital Industrie 4.0 applications.

Published by
Siemens AG 2017

Energy Management
Siemensstraße 10
93055 Regensburg
Germany

Article No. EMLP-B10135-00-7600
Dispo 25600
TH 477-171232 1117