



Innovative Power Distribution in Data Centers

Concept for profitable and
safe power distribution

Totally Integrated Power

Answers for infrastructure.

SIEMENS

Requirements and Trends in Data Centers

The steadily rising demand for IT support provided for existing and new business processes stimulates the growth in the number of servers and storage systems operated worldwide. Information technology and communications, and data centers in particular, are becoming more and more important for both economic as well as ecological aspects. Annually, the global market for IT services – and thus the space requirements in data centers – is growing by 50 to 60 percent.

Experts assume that power consumption of data centers, which currently amount to around 50,000 in Germany alone, was 8.67 TWh in 2006. This is equivalent to the annual electricity output of three medium-sized coal-fired power plants. Owing to this power consumption, the data centers caused CO₂ emissions of 5.6 million metric tons in the same year, a considerable emission level in relation to our climate.

If no effort is made towards greater energy efficiency in this area, an increase of data center power consumption is to be expected in Germany alone amounting to as much as 12.9 TWh in 2010. Compared to 2001, the CO₂ emissions in Germany caused by data centers would rise by approximately 50 percent by 2010.

The CO₂ issue in connection with the enormous power consumption of data centers places their operators more and more into the limelight of public attention.

This so-to-speak worldwide growth of data centers thus has direct consequences for global power consumption. According to current scientific investigations, power consumption in data centers amounts to about one percent of the total electricity consumption worldwide. Thus, the energy efficiency of data centers is of great economic importance to their operators.

Besides the tremendous energy cost, growing ecological awareness combined with statutory conditions on CO₂ emissions also plays a major part in this context. Business customers expect the highest of technical standards as well as maximum data security and availability from data centers – 24 hours a day. Absolutely reliable, uninterruptible power supply is the unconditional prerequisite for this.



Technology Platform

Totally Integrated Power

Integrated power distribution from the feed-in to the consumer

Totally Integrated Power™ (TIP) refers to integrated electrical power distribution in commercial and industrial buildings; from the medium voltage supply fed in by the utility company right up to the final electrical consumer.

Totally Integrated Power is underpinned by an array of helpful tools and support for accurate design, dimensioning and configuration of electrical power distribution within buildings. A coordinated product and systems portfolio for the construction of these systems is rounded off by standardized interfaces between the system components and the higher-level human-machine interface systems as well as for the connection to control and management systems.

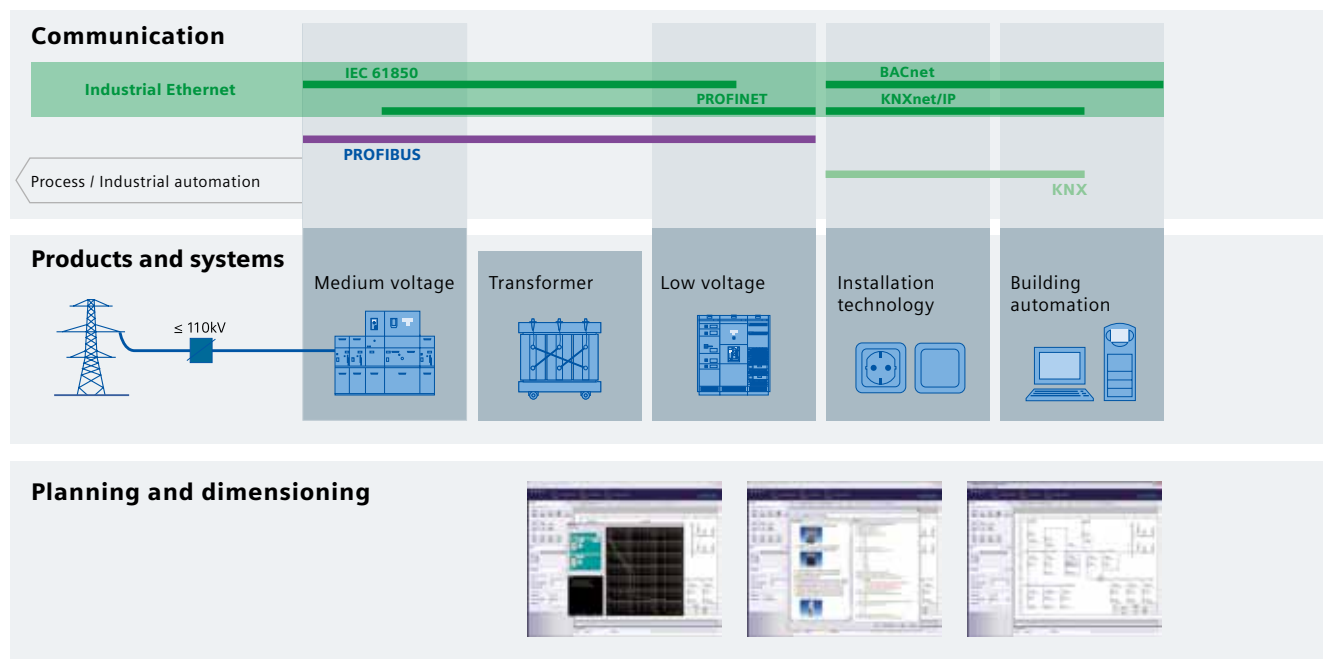
In this way considerable savings can be made across the whole project cycle – from the planning stage, installation and start-up right through to operation. The necessary investments in the electrical infrastructure of the edible oil production plant can be optimized in line with demand and also with subsequent operating costs in mind. This optimization potential represents significant added value for everyone involved in the project.

Optimum planning for cost and time-effective solutions

An optimally dimensioned power distribution system is a key economic factor in edible oils production. Unused capacities cost money. The tried-and-tested, TÜV-certified SIMARIS design® dimensioning software from Siemens provides electrical engineering consultants with an indispensable tool for dimensioning the electrical network for a new construction or expansion of a production plant.

SIMARIS design brings many benefits, including simpler network calculation and selectivity verification. The software also recommends suitable coordinated devices from the integrated Siemens power distribution product portfolio. Electrical network upgrade reserves can be incorporated right from the planning stage to allow for later changes of use. Electrical engineering consultants can make time savings of up to 100% by using SIMARIS design for the various network planning stages.

In addition, Siemens also provides advice and support for electrical engineering consultants through virtually all the planning stages.



Electric Power Supply in Data Centers

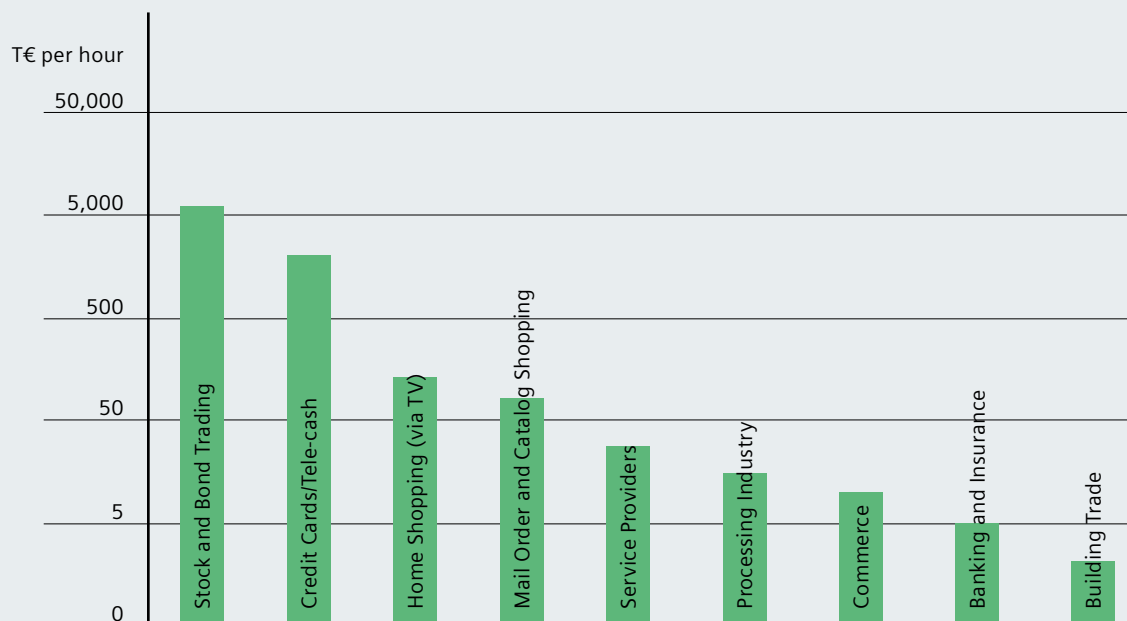
In data centers, electricity must be supplied to all relevant electrical components around the clock with the utmost reliability. Faults or even a power outage and the resulting data loss and interruptions of operations entail incalculable economic damage for data center operators.

Despite the high reliability of supply, power supply interruptions on the part of distribution network operators or power supply companies do take place from time to time. With less than one second, the majority of these faults are so short that a person won't notice them. But even interruptions of more than 10 ms are capable of disturbing IT operation.

The manifold reasons for interruptions of operations demonstrate that integrated electric power supply backed by an uninterruptible power supply system (UPS) plays a crucial role in the data center.

EMC-friendly grid design in the data center is another urgent requirement. This makes the precise co-ordination of the power system, the treatment of the central grounding point and the connection of electric sub-networks by means of suitable switchgear (3- or 4-pole), so that conductive and inductive couplings will be avoided as far as possible, indispensable. Failure to observe this principle will considerably affect the entire infrastructure, starting from corrosion up to extensive disturbances of the data center facilities (computers, communication links, etc.). "Stray" currents caused by a faulty network configuration quite often lead to the partial destruction of IT equipment. Besides these material losses – caused by deficient

Loss event costs



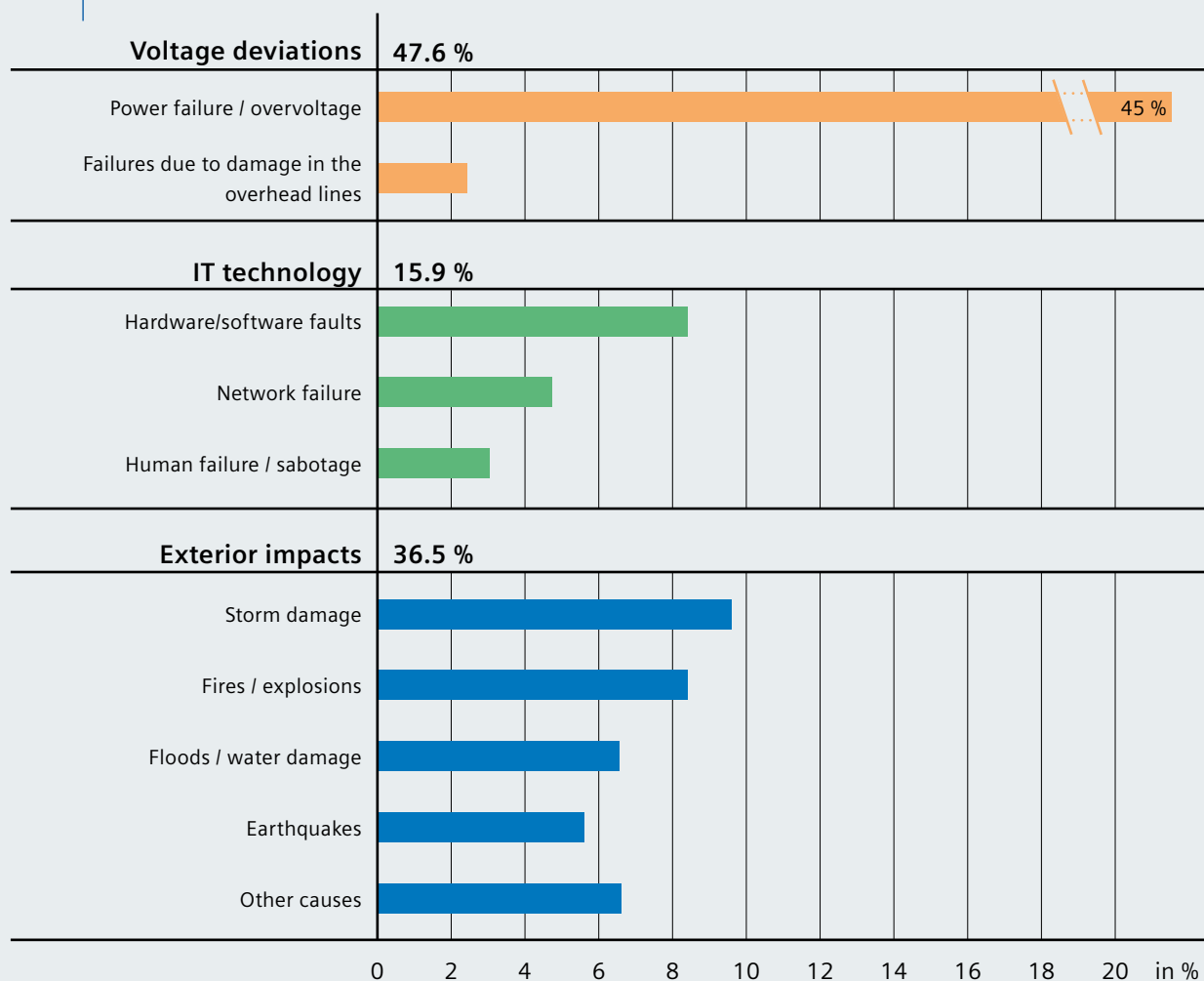
Source: Korthauer, R.; Sölter, W.: Unterbrechungsfreie Stromversorgung, published by ZVEI, 2nd supplemented ed., Frankfurt am Main 2003, p. 8

planning of the central grounding point in the most unfavorable case – the problem may arise that the protective function of “disconnecting in the event of a fault” will fail. This may result in personal injury and endangering lives, with far-reaching consequences under civil law.

Therefore, it must be precisely defined in the planning stage which parts of the installation are to be supplied without interruption from the UPS: This includes IT consumers and their necessary infrastructure (servers, monitoring etc.), installation parts that can be operated with a short-time interruption (cooling, safety equipment for the building infrastructure) and consumers that do not cause any substantial impairment or far-reaching operational consequences in the event of a total loss.

Having been defined, the installation parts and consumers are mapped to their corresponding supply sub-grids. In order to establish the power demand for the UPS system and for the normal and safety/standby power supply, the following power demand quantities – related to a medium power density – can be estimated for data centers during the draft planning stage.

Statistics on the causes for interruptions of operation



Source: Korthauer, R.; Sölter, W.: Unterbrechungsfreie Stromversorgung, published by ZVEI, 2nd supplemented ed., Frankfurt am Main 2003, p. 6

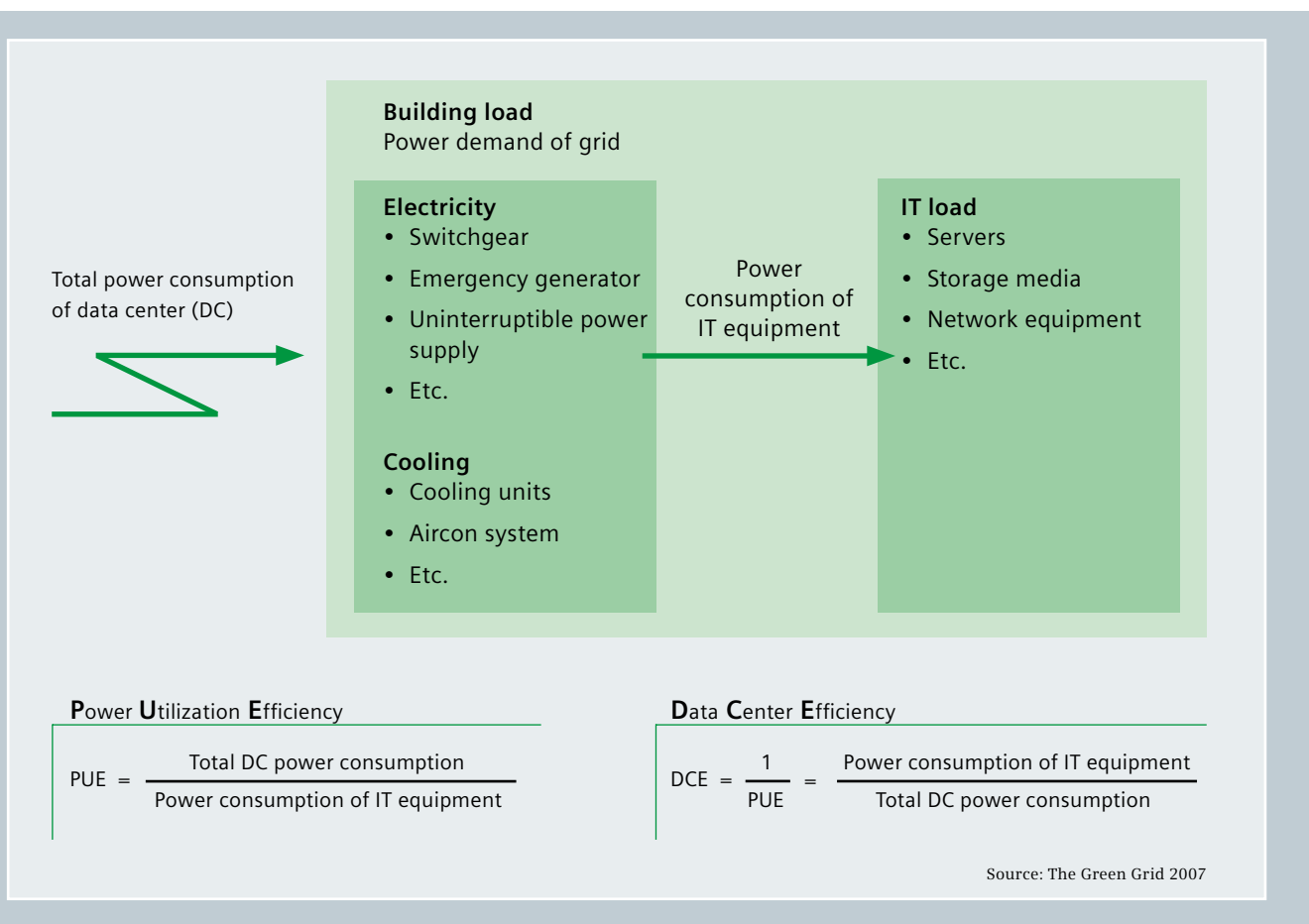


The supply sub-grids are accordingly designed to meet the different demands of operational safety. They are mapped to the power sources, which are laid out more or less redundantly.

In order to be able to classify the degree of operational safety provided, the standard classifications of Tier I to Tier IV have been defined for data centers (see page 10ff.) with Tier IV meeting the highest requirements of availability. Often, the entire data center is designed according to the highest level of availability required, although this would only be necessary for business-critical processes. This entails costs for an unnecessarily redundant infrastructure plus air conditioning and power supply systems, such costs being effective not only during the installation stage but also during subsequent operation. Increasing the level of supply redundancy often entails a reduction of energy efficiency, unless one focuses on the energy efficiency of the overall project.

Energy efficiency of data centers

The power demand of a data center often amounts to megawatts. Thus, the costs of electricity are a substantial part of the operating costs, which is the reason why power losses must be minimized. To this end, it is necessary to keep consumption and the power losses of all installation parts in mind, since these losses are often unknown especially in the partial load range, which is the most common mode of operation. In order to be able to make accurate forecasts in this respect as a basis for counteraction, appropriately sensitive measurements and documentation of such partial energy consumption are mandatory. In this way, the potential for reducing energy consumption and costs can be revealed systematically. Besides the absolute energy consumption of equipment and installation parts recorded in this way, their energy efficiency also plays an important part. To date, binding definitions of the energy performance of data centers and internationally uniform measuring standards do not exist. Other typical indicators, such as the energy consumption per square meter, are not meaningful in this context. This problem requires indicators evaluating the core functions and performance of data centers, i.e. data processing, data transmission and data storage. One meaningful indicator is the power consumption of



IT equipment (servers, storage devices, network equipment) in a data center, for example, which is stated in relation to the total power consumption of the data center. In this context, the power consumption of the IT equipment, which delivers the actual performance of the data center, is called “useful power“. The rest of the electricity consumed is used for the necessary infrastructure of the data center. Here, losses also result from the provision of uninterruptible power supply, power distribution, cooling, air conditioning etc.

This coefficient of data center energy efficiency has also been incorporated in the Green Grid initiative.

The Most Important Pillar of Power Supply in the Data Center

Uninterruptible power supply (UPS)











UPS systems are used in order to avoid possible, negative consequences of short power failures. They filter interferences, such as voltage surges or voltage dips and bridge interruptions in the grid. This helps to prevent transmission faults, computer crashes, program errors and data loss.

However, the systems typically used for bridging gaps can only take over supply for such critical loads for a limited amount of time, so that either interaction between the UPS and standby power generating system or the use of safe shutdown software is required for the targeted shutdown of data center applications.

Static UPS systems

Reliable monitoring and adjustment of the load current supply is the essential function of a UPS system. Static UPS types are divided into three categories, since they function differently in details in line with their differing technical design and since they provide different output voltage qualities. The European standard EN 62040-3 defines and describes the classification and the corresponding determination methods for static UPS systems

Types of grid faults and matching
UPS solutions acc. to EN 62040-3

Line faults	Time	e.g.	IEC 62040-3	UPS solution	Arrester solution
1. Power failures	> 10 ms		VFD Voltage + Frequency Dependent	Classification 3 passive standby operation (offline)	–
2. Voltage fluctuations	< 16 ms				–
3. Voltage peaks	4...16 ms				–
4. Undervoltages	Continuous		VI Voltage + Independent	Classification 2 line interactive operation	–
5. Overvoltages	Continuous				–
6. Lightning strikes	Sporadic		VFI Voltage + Frequency Independent	Classification 1 doubleconversion operation (online)	Lightning and overvoltage protection (IEC 60364-5-534)
7. Surge	< 4 ms				
8. Frequency fluctuations	Sporadic				–
9. Voltage distortion (burst)	Periodic				–
10. Voltage harmonics	Continuous				–

Source: Korthauer, R.; Sölter, W.: Unterbrechungsfreie Stromversorgung, published by ZVEI, 2nd supplemented ed., Frankfurt am Main 2003, p. 17



Particular features to be observed

The following are important planning features for dimensioning and installing a UPS system:

- Nominal output power at required load power factor
- Connection values, such as the input and output voltage and output frequency
- Currents, conductor cross sections and connection possibilities for UPS inputs and outputs
- Efficiency ratio and power loss
- Data on UPS fusing for different operating modes
- Conducted interference on the network input and input power factor
- Maximally available battery bridging time at nominal load
- Data on the battery system and on battery charging/discharging
- Permissible ambient parameters, such as operating temperature, humidity, implemented degree of protection, fire protection requirements and air conditioning
- Noise
- EMC protection
- Dimensions and weights

Rotating (dynamic) UPS

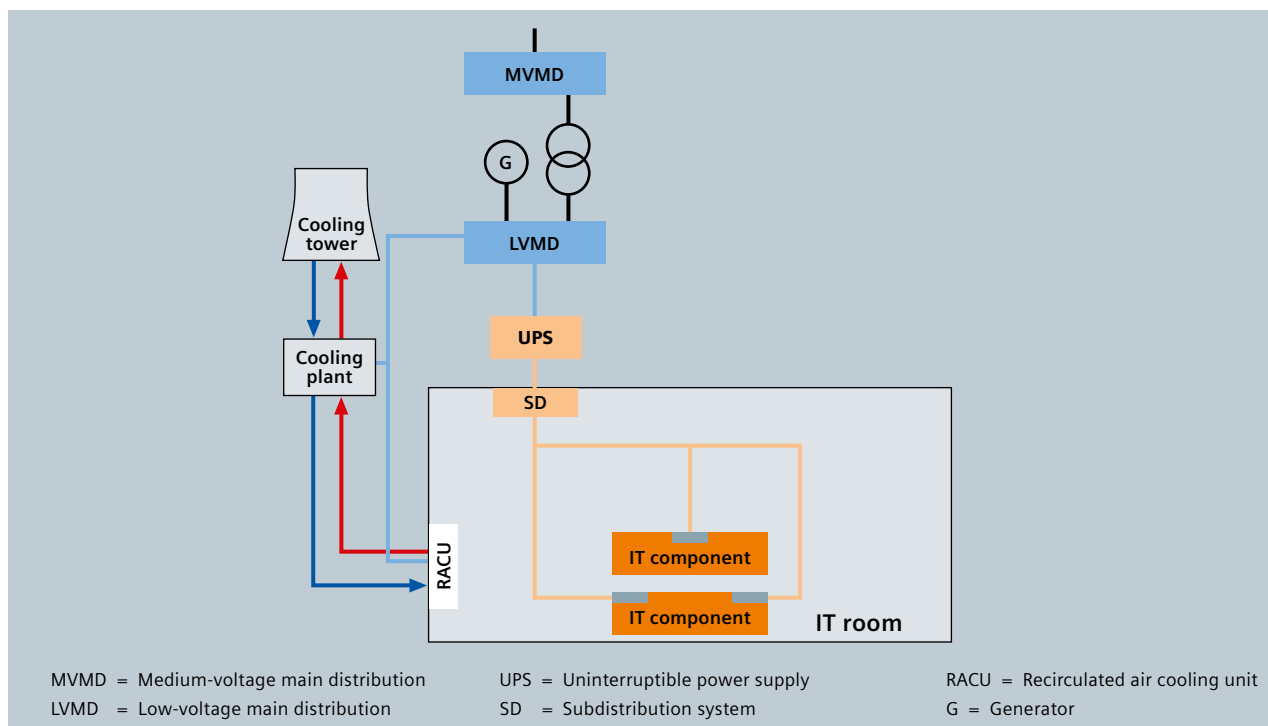
A rotating UPS, also called dynamic UPS, is an alternative to static UPS systems. In this type of UPS, the load supply is implemented with the aid of a rotating machine plus inverter. Dynamic UPS systems can be used to handle all types of loads. If required, they can be easily expanded to ensure the best possible availability of power supply.

Standby power generating sets

If we are not dealing with a short-time interruption of power supply, standby power generating sets should be able to take over within seconds to ensure long-term power supply and hence the availability of IT systems. These are autonomous standby units for power generation. In most cases, these units are generators powered by diesel engines. In line with the desired bridging time, the storage of sufficient fuel reserves must be provided for.

Schematic Representation of a Data Center according to its Classification in the Tier Topology

Tier I: Simple supply grid



Main features

- No redundant feed-in components and supply lines
- Faults in the supply system may cause an interruption in the IT components
- The system is susceptible to interruptions as a result of scheduled and non-scheduled events
- Complete shutdown for maintenance work at the supply system is necessary
- **Availability: 99.67 %**

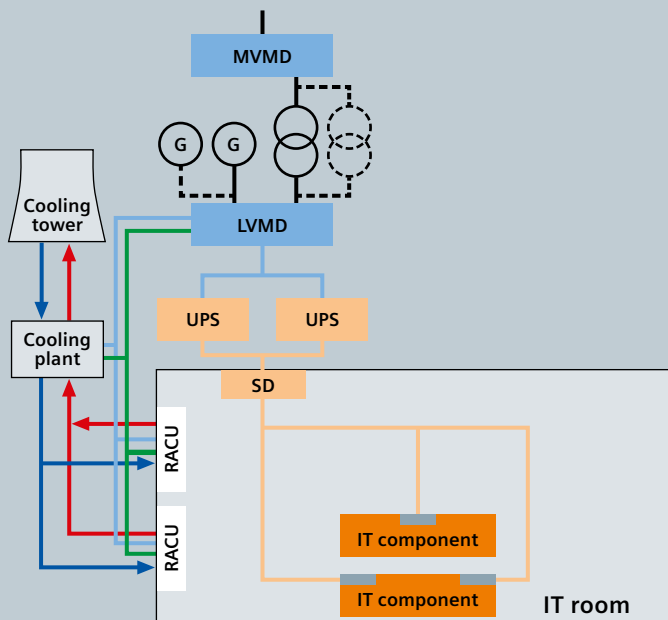
Applications

- Smaller businesses using IT technology to cope with internal processes
- Businesses regarding their web presence mainly as a passive marketing tool
- Start-up businesses without the need of computer-based customer care

“The Uptime Institute in the United States has defined a so-called ‘tier classification’ for the data-center infrastructure. The four tier levels each indicate the high and ultra-high availability of data centers.”



Tier II: Supply grid with redundant feed-in components



MVMD = Medium-voltage main distribution
LVMD = Low-voltage main distribution

UPS = Uninterruptible power supply
SD = Subdistribution system

RACU = Recirculated air cooling unit
G = Generator

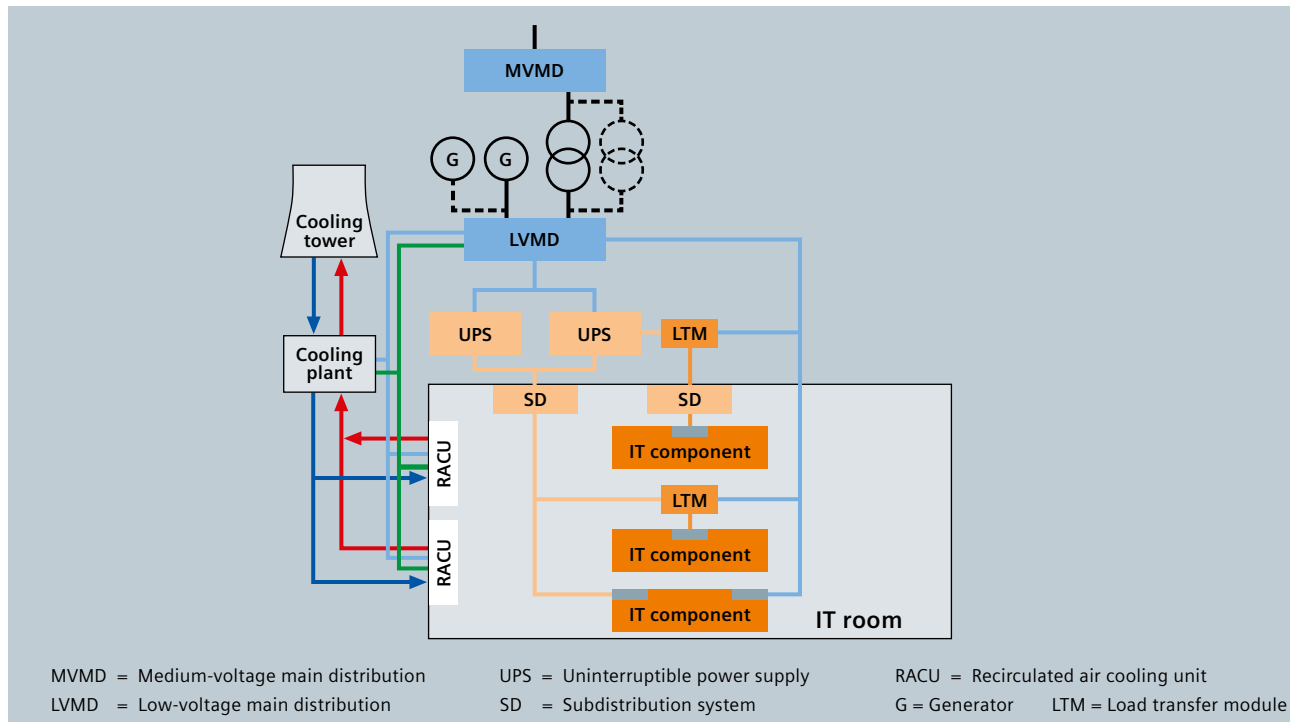
Main features

- Redundant UPS installations and generators are required
- No redundancy of the supply lines
- Faults in the supply system may cause an interruption in the IT components
- The system is susceptible to interruptions as a result of scheduled and non-scheduled events
- Shutdown for maintenance work on the system is necessary
- **Availability: 99.75 %**

Applications

- Smaller businesses mainly using the IT during normal business hours so that shutdown after work is possible without any problems
- Computer systems for software developers (taking account of night runs), CAD firms
- Businesses which, though using their Internet connection for business purposes, “merely” risk delays and data loss in case of IT non-availability but no business-critical delays

Tier III: Supply grid maintained during normal operation



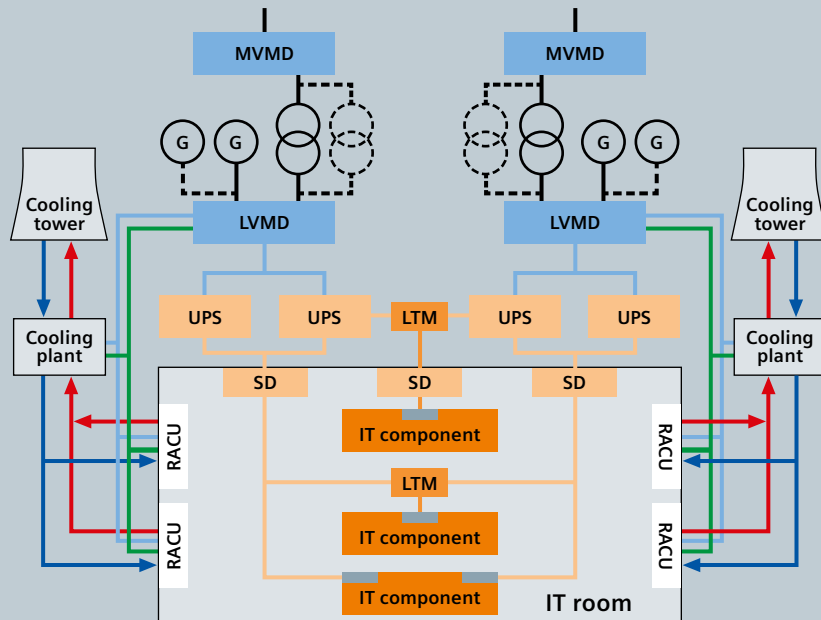
Main features

- Redundant UPS systems, transformers and generators are required
- Redundant supply lines to the IT components are required
- Every component of the feeder and the supply line can be switched to a non-operating state in a defined mode for the purpose of scheduled maintenance without shutdown, continuous supply is ensured by the redundant components or supply lines.
- The system is susceptible to interruptions as a result of non-scheduled events
- Dual power packs in the IT components or load transfer modules (LTM) in the grid between UPS and IT component required for continuous operation during maintenance work
- The risk of interruption increases during maintenance
- Faults in the supply grid may cause an interruption in the IT components
- **Availability: 99.98 %**

Applications

- Businesses or service providers that have to be ready for operation for their internal and/or external customers around the clock, such as service centers or emergency facilities which can however be accessed or are capable of working in another way if computers are off-duty during short periods of time (e.g. during maintenance)
- Businesses whose IT facilities are used for electronic business processes, but where service for customers is not impaired during maintenance or shutdown times
- Businesses operating in different time zones, but in such a way that different regional business hours do not result in any drawbacks

Tier IV: Fault-tolerant supply grid



MVMD = Medium-voltage main distribution
LVMD = Low-voltage main distribution

UPS = Uninterruptible power supply
SD = Subdistribution system

RACU = Recirculated air cooling unit
G = Generator LTM = Load transfer module

Main features

- Redundant UPS systems, transformers and generators are required
- Redundant supply lines to the IT components are required
- Every IT component has a dual power pack
- A single worst-case fault somewhere in the supply grid must not affect the IT component
- Every component of the feeder and the supply line can be switched to a non-operating state in a defined mode for the purpose of scheduled maintenance without shutdown, while supply is continued via the redundant components or supply lines
- Dual power packs in the IT components or load transfer modules (LTM) in the grid between UPS and IT component required for continuous operation during maintenance work or in the event of a fault
- Complementary systems and supply lines must be physically separated (barriers), so that single faults will not affect both systems
- The supply system is not susceptible to interruption as a result of a single scheduled or non-scheduled event
- The risk of interruption could increase during maintenance

- Fire alarm, fire suppression, or “Emergency Power Off” (EPO) function may cause an interruption of the IT components
- **Availability: 99.99 %**

Applications

- Businesses with an international market presence having to reliably provide a service during 24h, 365 days throughout the year to remain competitive
- Businesses based on e-commerce, electronic market transactions or financial services
- Globally operating businesses active in different time zones so that employees can access important resources and their customers can use the most up-to-date applications at any time

Availability of Tier Topologies

Establishing the availability rates for the individual tier topologies is based upon information on maintenance times and average failure rates of individual components or equipment. This is therefore a purely theoretical assessment and should only be utilized for the comparison of the individual tier topologies if the same boundary conditions apply to all topologies.

In practice, the availability of such a tier topology is basically determined by the following:

- Quality of the individual components
- Quality of component assembly into installations
- Electric power supply structures
- Design maturity of the individual technologies
- Experience gained with these technologies
- Operator staff and service quality
- Monitoring systems etc.

In an extreme case, even a Tier IV structure might be less well available than a Tier I structure.

For the planning engineer, as well as the installation company and the operator of such a supply grid, this means that only an evaluation and co-ordination of the whole complex of components, systems, technologies and human resources will create the optimum in terms of cost and benefit.



Integration is the Trump Card

In co-operation with the consultant for electrical engineering, Siemens develops solutions for power distribution in data centers that take into account all operator requirements from the outset. Here, a single supplier provides the well-matched products and systems for an integrated solution.

The following projects may serve as excellent models for the successful use and benefit of Totally Integrated Power for power distribution in data centers:

Airbus Data Center, Hamburg, Germany

- Renewal of the power supply for a data center
- Solution with communication-capable modules to integrate power supply into the building control system of the data center
- Use of busway systems instead of cables to reduce the fire load on the building
- Increased operational safety of power supply and thus better availability of the connected computers

Info AG Data Center, Hamburg, Germany

- Construction of a new data center
- Solution for power distribution using busway systems and integrating measuring instruments to monitor power supply
- Busway systems were laid horizontally in the floor area: Measuring instruments were placed on the busbar trunking using power tap-off units; this enables easy and cost-saving swapping of the instruments in case of changing requirements
- Customer requirements regarding a high degree of operational safety and monitoring of data center operation have thus been met



Components for Power Distribution in a Data Center

When operating a data center, cost savings regarding electrical energy and maintenance cost for power distribution components can be attained by using efficiency-optimized products and systems as well as more efficient building automation systems.

Medium-voltage main distribution

The factory-assembled, gas-insulated medium-voltage NXPLUS C circuit breaker switchgear by Siemens is perfectly suited for the purpose of medium-voltage power distribution with a feeder current ≥ 630 A.

Interruptions of operation owing to damaging environmental impact are eliminated by the hermetically sealed switchgear containers and the no-maintenance operating mechanisms situated outside the NXPLUS C switchgear container. Current and voltage transformers outside the switchgear container provide for optimal accessibility. A seamless logic interlocking principle, minimal fire load plus the option of aseismic design ensure the maximum of operational safety.



- Up to 24 kV
- Up to 31.5 kA
- Up to 2,500 A
- Profitable thanks to the well proven vacuum switching technology
- Type-tested in compliance with IEC 62271-200
- Hermetically sealed pressure system with SF₆ filling for the entire life cycle
- Metal enclosed and metal clad
- Can be installed and expanded without requiring extra work at the gas system
- Equipped with no-maintenance, 3-pole indoor vacuum circuit breakers, therefore no maintenance for life
- Supply extension in the existing switchgear building and subsequent increase of performance possible owing to pluggable busbars

Medium-voltage switchgear

The type-tested and gas-insulated Siemens 8DJH switchgear for secondary distribution networks up to 24 kV is particularly suited for medium-voltage distribution below the medium-voltage main distribution level. It is very economical thanks to its extremely low life-cycle cost due to the fact that it doesn't require maintenance, is independent of climatic impact, has minimum space requirements and features maximum



availability. Thanks to its innovative developments, such as its modular design, no-maintenance vacuum circuit breakers and its expansion options requiring no gas work on site, the switchgear can be called a secure investment. Products from the SIPROTEC family of protective devices as well as products from other manufacturers can be integrated.

- Up to 24 kV
- Outgoing feeder currents up to 630 A
- Busbar current 630 A
- Factory-assembled and type-tested
- Individual panels and panel blocks can be lined up as desired – no gas work required on site
- Safe-to-touch encapsulation
- Hermetically sealed pressure system with SF₆ filling for the entire life cycle

Medium-voltage circuit protection

The better the plant and protection technologies are matched, the higher is the availability of power supply in the data center. The diversity of SIPROTEC protection technology supplied by Siemens – with its unique technology and intelligent algorithms – reliably protects all equipment, ensuring selective fault tripping even under the most difficult circumstances. Owing to their CFC logic, SIPROTEC protection devices can be adapted to all customer requirements



and demands, and they can also be interlinked. Their integrated evaluation software helps to analyze the course of fault cases that were recorded precisely.

- Everything from a single supplier because there is just one device family in a uniform design
- Just one SIPROTEC device handles all tasks in the feeder circuit: protecting – controlling – measuring – automating
- Just one operating program (DIGSI 4) is sufficient for all protective devices and all configuring and operating tasks
- User-friendly, easy parameterization
- Aids for speedy commissioning
- Cost saving in engineering owing to the direct data exchange between the engineering tools of the bay control units and the substation control system
- Remote communication permits fast fault clarification and thus targeted service missions on site

Distribution network transformers

GEAFOL transformers feature a performance range from 50 kVA up to 20 MV and nominal voltages up to 36 kV.

No-maintenance Siemens GEAFOL transformers are energy-saving, as they have low losses and are thus designed especially for economical long-time use. They are flame-retardant, self-extinguishing, and do not emit toxic gases in case of fire in the building. Using these transformers in the load center creates a high degree of efficiency, which is an important key to cutting data center operating costs.



- Highly profitable in continuous operation due to loss-optimized characteristics
- Profitable thanks to aluminum rather than copper windings
- The choice of installation site is facilitated because transformers comply with the most stringent of safety classes regarding surroundings, climate and fire (e.g. flame-retardant and self-extinguishing)
- Performance increased by up to 50% thanks to the installation of cross-flow fans
- Installation in the switchgear room together with the low-voltage main distribution board allowed due to separation by means of fire protection walls F90A (no additional firewalls necessary)
- Low noise thanks to high-quality magnetic core design
- Long service life due to minimized air and dirt infiltration to the coil core
- Pre-assembled, type-tested transformer connection pieces for busbar connection to optimize operational safety (EMC, fire load, short-circuit capacity etc.)

Low-voltage main distribution boards

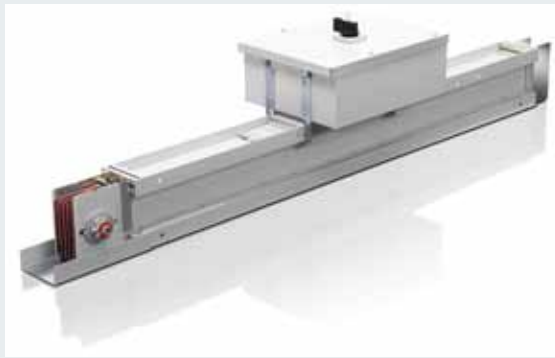
Type-tested SIVACON low-voltage switchboards with compartmentalized functional areas provide a high degree of safety for man and machinery and limit the effects of accidental arcs and fault propagation to a minimum in the event of a fault. Flexible, withdrawable-unit or plug design is excellently suited to the needs of data centers, as components can quickly and easily be replaced without extended service interruptions.



- Maximum installation safety thanks to the use of type-tested switchgear assemblies
- Space saving with installation areas of 400 mm x 500 mm or above
- Variable busbar position (top/rear) possible
- Cable/ busbar connection from the top, bottom or rear
- Combination of different mounting technologies possible within one panel
- The degree of protection is maintained (max. IP54) in switch test and disconnection position when the door is closed
- Maximum personal safety owing to arc-fault-proof door lock system
- Flexible adaptation of the internal compartmentalization to individual needs
- Uniform operating interface for all withdrawable units
- High-efficiency ventilation system with maintenance benefits
- Worldwide network of SIVACON partners safeguards service and availability

Busway systems for data centers

In order to substantially reduce the fire load on the data center, **SIVACON 8PS busway systems** are a good alternative to cables in many places. Owing to their high short-circuit strength, their minimal fire load due to the sheet-steel enclosure and their flexibility regarding the placement of current taps virtually anywhere even when fitted later, they provide important advantages over cables. The connection between a SIVACON busbar and the SIVACON S8 low-voltage switchgear is, of course, also type-tested, thus forming a safe system. In addition, communication-capable modules in the outgoing current feeders allow for an interfacing to building control systems. The **LX busway system** is particularly suited as main supply busbar connecting the low-voltage



main distribution board and the busbar systems supplying the racks.

SIVACON 8PS, BD2 system

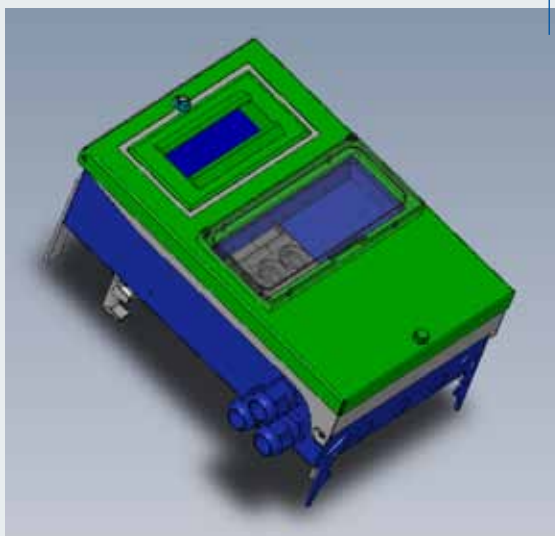
BD2 type busbars are used to supply the racks. This system is in particular used for applications from 160 A to 1,250 A featuring an increased safety demand. Anti-rotation feature, guided mounting, tested fire barrier and functional endurance in case of fire ensure a high degree of safety in data centers. A special finish of the power tap-off units with a twin cover increases computer availability: Extension and alteration work can be performed without that the affected circuits need to be disconnected. Non-affected computers in the rack can thus continue to be operated without any interruption.



Especially the following properties of the SIVACON 8PS busway system, type BD2 contribute to data center safety:

- Ca. 30% less fire load than cables owing to sheet steel enclosure
- Complies to short-circuit-proof cabling; unlike cables, no additional measures are necessary
- EMC-friendly
- Safe operation as a result of being type-tested low-voltage switchgear and controlgear assemblies (TTA) in accordance with IEC/EN 60439-1 and -2
- Different color coding possible upon request (e.g. blue for normal supply busbars and red for safety supply busbars)
- Easy retrofitting in case of scheduled or on-the-spot changes of locations or connected loads of equipment

power tap-off unit and twin cover



Air circuit breakers

SENTRON 3WL air circuit breakers are used as incoming/outgoing feeder circuit breakers, tie breakers and distribution switches in electrical installations. They are used for switching and protecting generators, transformers, busbars and cables, distribution boards, motors and capacitors.

- Easy engineering, configuration and retrofitting thanks to their modular design in just 3 sizes, few components and uniform accessories
- Integrated communication concept for PROFIBUS and MODBUS
- 4 switching capacity categories of the short-circuit switching capacity for all applications
- Very reliable and long-lasting
- Effective diagnosis management, measured values form the basis for efficient load management to produce power demand profiles and allocate costs to cost centers



Molded-case circuit breakers

SENTRON 3VL molded-case circuit breakers are used as incoming/outgoing feeder switches in low-voltage switchgear. They are also used as switching and protective devices for motors, transformers and capacitors and as power switches with features for stopping and disconnecting in conjunction with lockable rotary operating mechanisms and connection covers.

- Easy engineering, configuration and retrofitting thanks to their modular design, few components and uniform accessories
- Fully communication-capable via PROFIBUS DP and MODBUS
- Wide product range from 16 to 1,600 A
- Three switching capacity categories for making and breaking capacity: Low-priced solution for all customer requirements
- Customer-specific solutions available ex works



Switch-disconnectors with fuses

SENTRON 3NJ62 pluggable switch-disconnectors with fuses are installed wherever many cables for power distribution must be fitted in low-voltage distribution boards in a very confined space.

- Easy engineering, configuration and retrofitting
- Type-tested in compliance with IEC EN 60947-3
- Conversion, retrofitting and replacement without disconnecting the switchgear
- Developed for switchgear in plug-in design
- Fuse replacement in de-energized state
- No maintenance
- High degree of operator protection
- Operating handle only in OFF position
- Unambiguous switch position indication



Multi-function measuring instrument

The SENTRON PAC3200 multi-function measuring instrument is a built-in device for power distribution systems and control cabinets. It precisely and reliably acquires current, voltage, and power factor as well as energy and power values for electric feeder circuits or individual loads. In addition, it is equipped with an Ethernet interface (with Modbus TCP) as standard and optionally with PROFIBUS DP or Modbus RTU. The free SENTRON powerconfig software is available for configuration, which facilitates the configuration of several measuring instruments at a time.

- Basis for exact cost allocation, due to high measuring accuracy
- Wide range of functions, hence only one instrument variant required for different measuring tasks
- Easy handling due to intuitive user prompting with multi-language clear-text display
- Fast installation owing to quickly latching holder; installation also possible without tools



Sub-distribution boards and small distribution boards

Maximum safety, suitable for application in the vicinity of people, can also be attributed to our ALPHA distribution boards. They are equipped with low-voltage circuit-protection technology from Siemens. Siemens as a renowned technology leader in the field of residual-current-operated circuit breakers provides a comprehensive protection concept with a broad and well-matched product portfolio for protecting, switching, measuring and monitoring tasks. Floor-mounted distribution boards are on every floor. They are the link between the low-voltage main distribution board in the basement and the small distribution boards on the various floors of the data center.

- Type-tested and partially type-tested distribution board system
- End-to-end product range for all distribution boards from 63 A to 630 A
- These distribution boards for electrical installations can easily and quickly be planned using the ALPHA SELECT software



Low-voltage circuit-protection devices

A further challenge that is met in connection with power supply in data centers is the protection of human life. Our products and systems are designed in such a way that the affected installation parts and power consumers are immediately disconnected from supply, thus ensuring that people and property remain

unharmed. Siemens BETA circuit protection range provides fuse systems and protective switches that cut off the current in the event of a short circuit and provide protection against hazardous shock currents in case of direct or indirect contact with live parts.



Low-voltage motors



Siemens IEC low-voltage motors are compact and highly efficient class EFF1 motors. As they are equipped with copper rotors, they are capable of attaining very high efficiency values. Compared with traditional motors, power losses can thus be reduced by up to 40%. Thanks to their universal range of applications they prove their value in almost any area of the data center. Type 1LE1 energy-saving motors are particularly suited for use in the HVAC installation, which plays an important part especially in a data center and consumes correspondingly large amounts of energy.



Professional Planning Aids

Planning electrical power distribution for commercial and industrial buildings has never been as complex as it is today. The planning process demands a great deal of specialized knowledge and experience. With an experienced partner at their side, electrical engineering consultants can implement their conceptual expertise more quickly and easily and concentrate on the important things. The software tools SIMARIS design, SIMARIS curves and technical manuals from Siemens offer comprehensive support, from the preliminary planning stage right through to implementation planning.

SIMARIS design and SIMARIS curves

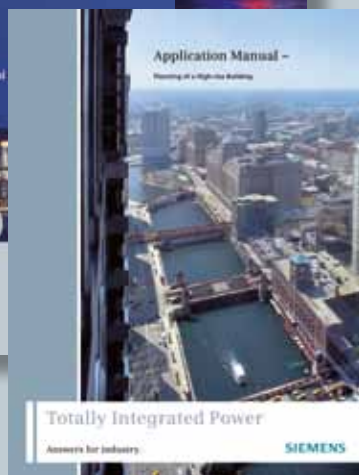
The **SIMARIS design** dimensioning software supports our complete, integrated and high-quality portfolio from medium voltage technology through to wall outlets. The user-friendly TÜV-certified tool also generates the necessary selectivity verification, for instance for emergency power supply systems. It also lightens the load enormously in routine work such as implementing changes and considering variants. The free **SIMARIS curves** software performs comparisons between the tripping characteristics of Siemens protective devices and fuses (IEC). SIMARIS curves can simulate possible parameter settings in protective devices to determine the optimal selective behavior of two series-connected devices. In addition, characteristic let-through current and let-through energy curves are also provided. A printout documents the selected settings.

Application manuals

Siemens application manuals offer electrical engineering consultants a wide knowledge and information base to draw on when designing electrical power distribution systems.

There are three volumes, available from regional Siemens contact partners (www.siemens.com/tip/support):

- The application manual “Basic Data and Preliminary Planning of Power Distribution Systems” provides electrical designers with in-depth information to support them in their work during these two phases.
- The application manual “Draft Planning of Power Distribution Systems” provides useful information on this project phase.
- The application manual “Planning a High-Rise Building” documents concrete applications of the power distribution products and systems using the example of an office tower.





Further Information

You can find more information on
Totally Integrated Power on the Internet at:
www.siemens.com/tip

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