White paper

Power Reliability

Procedure for planning the auxiliary power supply in industrial applications

Find out more about

- Selecting the right power supply
- Interaction between the power supply and DC protection
- Preventing interruptions and failures
- Condition monitoring for auxiliary voltage grids

PHOENIX CONTACT

Overview

This white paper describes the procedure for planning the auxiliary power supply in industrial applications. The focus is on the field of power reliability. Solutions consisting of surge protection, power supply, device protection, and energy monitoring ensure very high system availability. With this approach, unplanned system failures and downtimes can be avoided and efficient sustainable system operation ensured. With “Power Reliability”, Phoenix Contact is providing comprehensive and reliable supply concepts.

Contents

Introduction

Today's industrial plants consist of a large number of intelligent systems. These include an association of mechanics, pneumatics, hydraulics, and electronics combined in increasingly different ways.

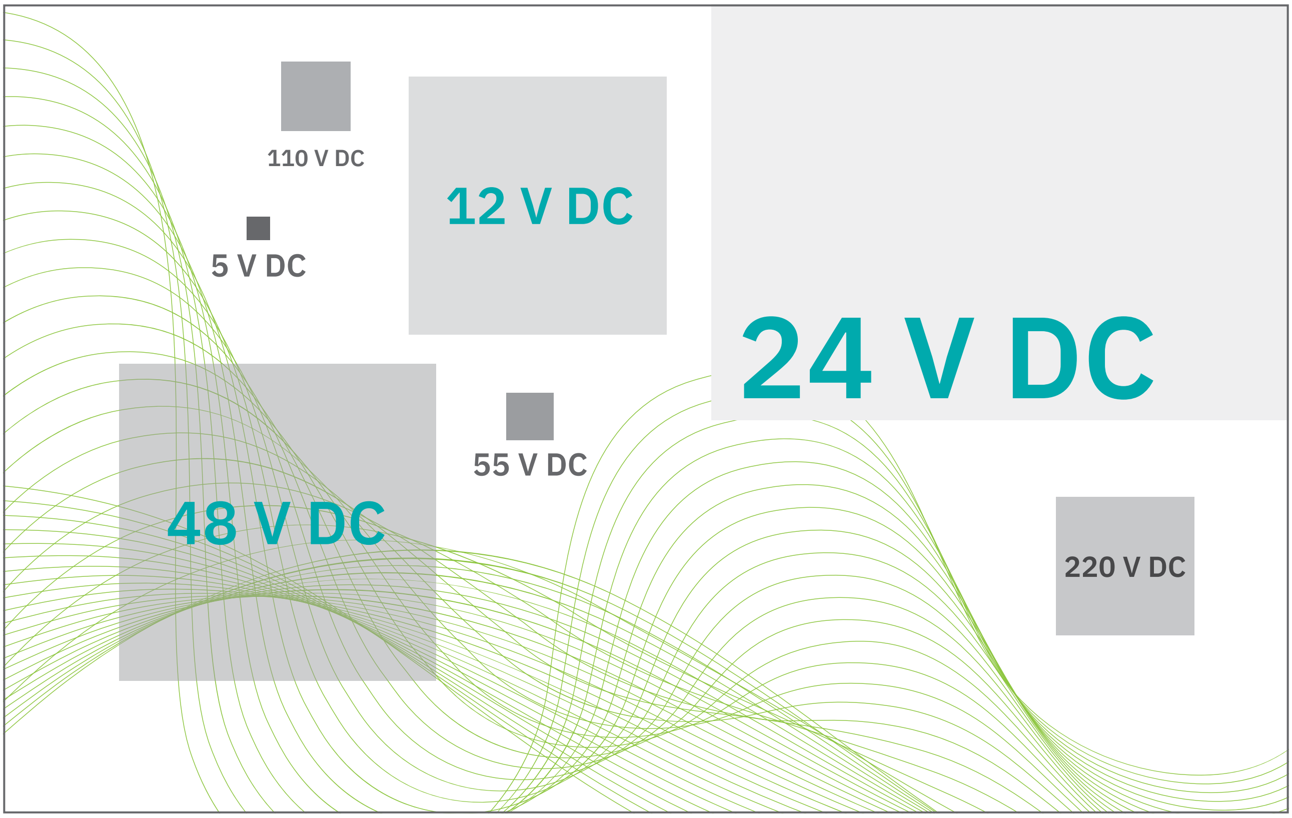
The orchestration of these systems is usually the responsibility of a series of controllers, control units, or master computers that operate through a variety of relays, sensors, limit switches, and cameras. Control programs run highly automated routines: They move robot arms, conveyor belts, and hydraulic cylinders; they pump, heat, and mix liquids until the products are finally packed in barrels, bags, and boxes and find their way to global customers on ships, rail cars, and trucks.

One thing is particularly important for the function of these systems: power – either in the form of gas or heat, but electrical power first and foremost. This is not only used to drive the large loads, but also the control centers. This then supplies the sensitive controllers with their measurement and control technology as auxiliary power.

In most areas, 24 V DC has become established as an auxiliary voltage in the last 30 years. However, voltages of 12 V, 48 V, or in energy systems up to 110 V to 220 V DC are also in use.

The correct design of this auxiliary power supply is the responsibility of the electrical planners, who must take a large number of framework parameters into consideration depending on the application so that ultimately they can create the circuit diagrams and select the components.

The individual steps in the planning process for the auxiliary power supply are explained below.



There are many different auxiliary voltages

Which voltage levels for which application?

The requirements for various power supply units in different performance classes are diverse: Most of the typical loads, such as relays, contactors, controllers, signal lights, and valves are available in 24 V versions. If, however, cameras and switches need to be supplied via Power over Ethernet (POE), an auxiliary voltage of around 55 V is usually required, which is typically achieved using 48 V power supply units or special injectors. There are also many drive applications that run on 48 V. In addition to this, mini computers – such as a Raspberry Pi – require a 5 V supply.

Depending on the criticality of individual loads, it may make sense to create several different power supply circuits within a voltage level.

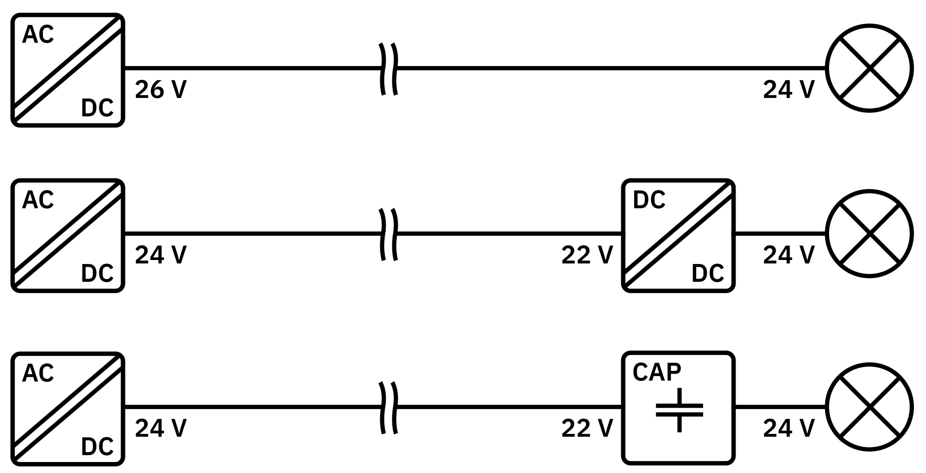
Several power supply circuits may also be useful where different cable lengths are in use – for example, if the voltage drop over longer cables is so great that it is necessary to feed in significantly more than 24 V (e.g., 27 V) to achieve the required 24 V under load at the end of the cable. There are, however, three other options for suppling remote loads with a stable auxiliary voltage, in addition to ramping up the supply voltage on the central switched-mode power supply unit:

1. Using overdimensioned cables to keep the voltage drop as low as possible.

2. Using a DC/DC converter to refresh the voltage just before the load. This option is particularly resistant to different loads, because DC/DC converters can operate with wide input voltage ranges.

3. The use of capacity modules (CAP or BUFFER), which are always suitable when the load and the associated voltage drop is low most of the time and when peak loads only occur occasionally. These then have to be rated for these expected peaks. The capacitor is recharged during the idle phases.

The most reliable way to keep the voltage stable or maintained is through the use of DC/DC converters



Keep voltages constant over long distances and capacitor storage systems. However, unlike overdimensioned, thick copper cables, these are subject to a certain probability of failure. In the end, the choice is a philosophical decision.

When switching several power supply units in parallel to increase the power, it must be ensured that the devices, e.g., from the TRIO and QUINT series from Phoenix Contact, are suitable for this: The output voltage must be adjustable, but in the event of higher loads, there must also be a defined inclination of the output characteristic curve. If this is not the case, the overload of one power supply unit usually also results in an overload of the other power supply unit and thus leads to a ping-pong effect – i.e., to constant switching on and off.

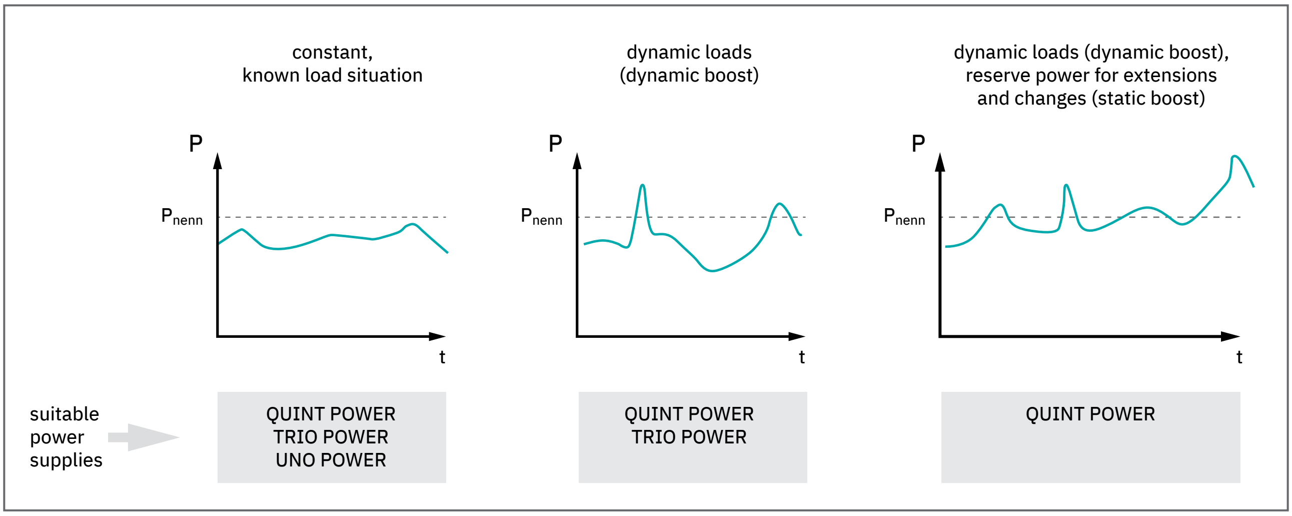
The cable lengths and wire cross-sections should also be designed so that there is a uniform voltage drop until they are combined. This is the only way to ensure the same load and maximum service life of the devices.

If dynamic changes or even current peaks occur during operation of the application, you should also opt for power supplies from the TRIO or QUINT series, which can also be loaded beyond their nominal power (150 to 200%) for a short time without voltage sags.

UNO and STEP devices, on the other hand, are particularly suitable for constant power outputs or must be overdimensioned for the power peaks. Typical areas of application for these product families include, for example, the supply of devices such as switches, home chargers, access points, and even LED lights, which can be clearly calculated with their constant energy requirements. The design-related advantages of the STEP products truly stand out in the field of building automation in particular.

If the system in question is to be regularly extended or converted, a sufficient power reserve should be provided when selecting the power supply units. For systems with runtimes of more than 20 years, monitoring signals that report overload situations before they become a problem should also be taken into consideration. The QUINT devices feature such a signal and can be permanently overloaded by 25% if there is sufficient cooling.

Despite their high efficiency of usually more than 90%, switched-mode power supply units are subject to heat generation and aging. Depending on the availability requirements of the application and the load, a decision has to be made either for or against redundant structures. Whether redundancy is necessary or not can be determined by what a



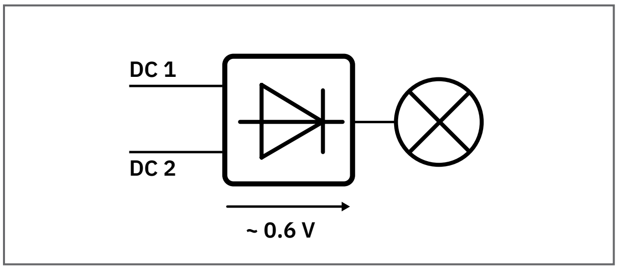
Different load profiles require devices with more or less boost capacities failure would cost the operator. Such costs could be caused by direct production downtimes (automotive production line), the effort involved in restarting (e.g., a chemical plant), or the difficulty of local access (offshore wind turbine generators, remote pipeline compressor stations).

In the case of redundant supply networks, possible sources of error, which have different probabilities depending on the structure, must also be taken into consideration. Redundant power supply units should be supplied via different phases so that the failure of individual phases can be overcome impact-free. Many industrial systems also have several medium-voltage feed-in points. It may make sense to supply the power supply units from these. Switched-mode power supply unit failures can manifest themselves differently, either with an output voltage failure or with a short circuit on the secondary side. To prevent one short circuit in one power supply unit also short-circuiting the other, secondary-side decoupling must be ensured. This can be achieved either with external redundancy modules with diodes or MOSFETs or by using power supply units with MOSFET-decoupled outputs, such as those of the QUINT "+" series. The difference between conventional diodes and MOSFETs is mainly in the voltage drop, and therefore in the power dissipation and heat generation. While diodes typically have a voltage drop of around 0.5 V, MOSFETs have a voltage drop of less than 0.1 V – which at 20 A makes a difference of 10 W to <2 W.

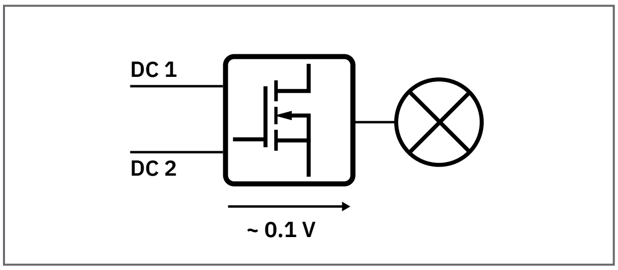
Wherever the potential distribution and switched-mode power supply units are not located in the same control cabinet in particular, external decoupling modules that are located directly upstream of the potential distribution should be used. The resulting redundant wiring also decouples a short circuit in one cable from the other impact-free. In particularly critical cases, the redundant wiring is routed across different paths to the load, where a small decoupling module is installed.

Multi-stage monitoring of the redundancy function should always be carried out so that the first signs of an error can be detected directly and remedied immediately. The best redundancy concept is of no use if the first signs of failure – and therefore the loss of redundancy – go undetected. At a minimum, the conventional DC OK contacts of each power supply should be monitored. One aspect that is frequently overlooked is the consideration of the total current. This must never exceed the maximum current of a device connected in parallel. QUINT-ORING devices feature separate signal outputs for this. The QUINT4 devices can also send messages if they are loaded to more than 50%.

We have now introduced devices such as the QUINT4 IOL, which also monitor usage-dependent aging and provide durability forecasts. These forecasts can provide good assistance in planning maintenance and replacement work. However, such forecasts will always be subject to certain levels of probabilities.

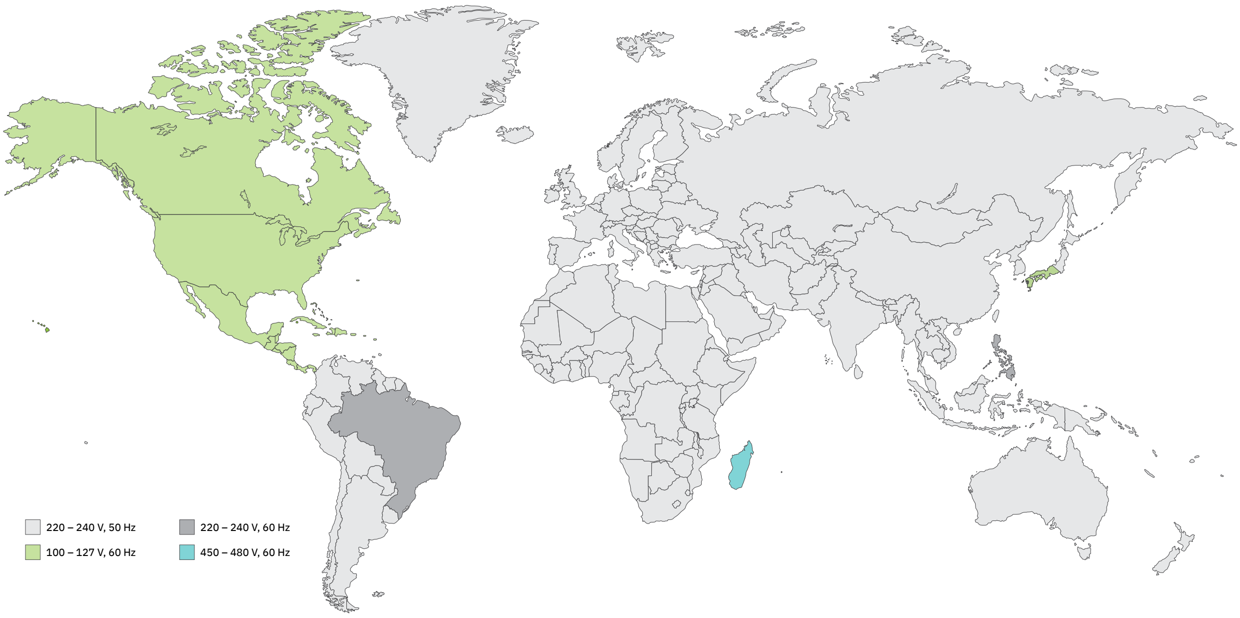


Diode

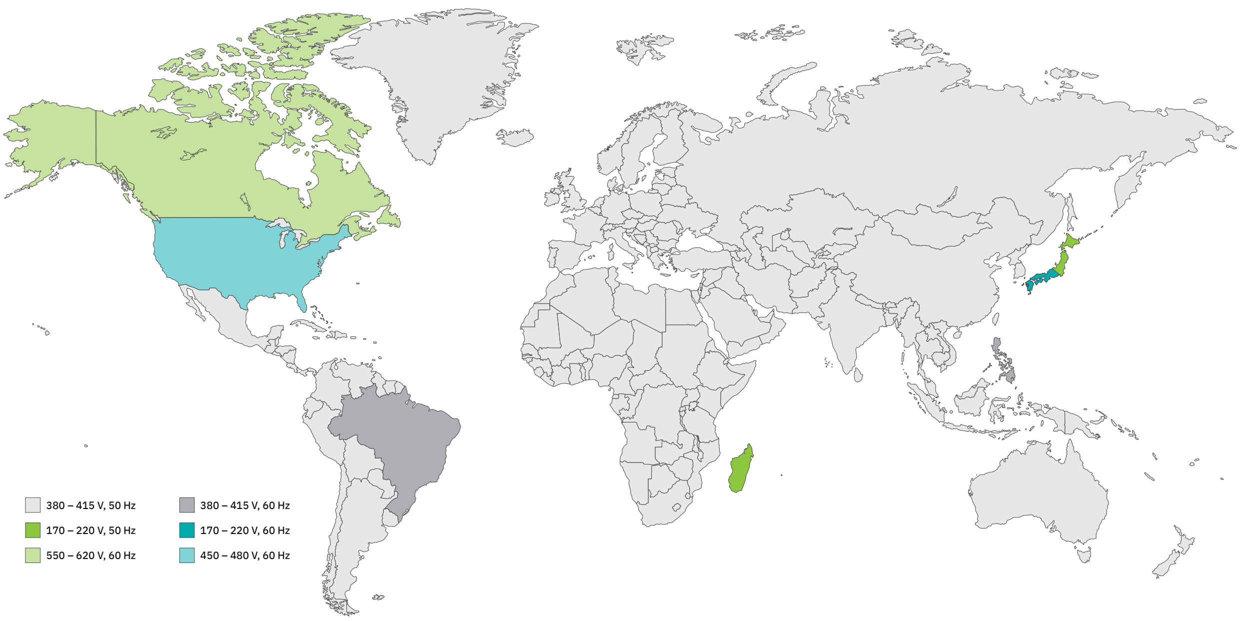


MOSFET

What is the supply system configuration and voltage level in my low-voltage grid?



Different mains voltages/frequencies worldwide, 1-phase grid



Different mains voltages/frequencies worldwide, 3-phase grid

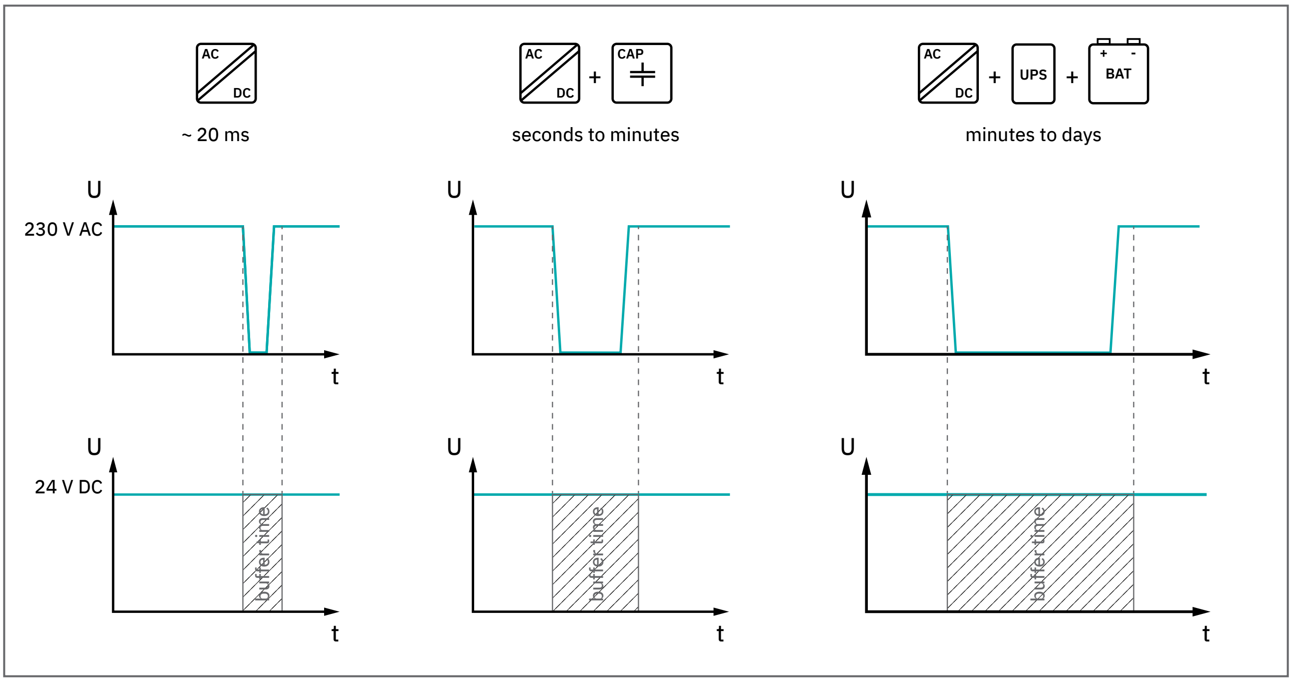
The power grid plays an important role when selecting the switched-mode power supply unit, because not every device is suitable for every grid type. There are various power grids around the world. Most "home power" grids are either 100 V to 140 V or 210 V to 240 V (L-N), or otherwise 380 V to 440 V (L-L), at mains frequencies of 50 Hz or 60 Hz.

However, there are also voltage levels of 500 V to 690 V in industrial plants. In the future, an increase in DC grids between 600 V and 850 V is expected – for example, for storing and using renewable energies and batteries more efficiently and without constant conversions. The supply system configurations also vary. In some regions, just 2 instead of 3 phases are distributed or one phase is grounded. Sometimes ground and neutral conductors are routed together (TN/TNC), and sometimes separately. In many cases, the grounding is star-point, but only 2 or 3 phases are distributed in order to then create a separate grounding system for the load (TT). Particularly in high-availability applications within critical infrastructures such as refineries or hospitals, the power grid is operated in isolation (IT). There is no connection to ground and only one virtual star-point. This has the advantage that a single fault can be detected with the aid of a permanent insulation measurement, but does not lead to failure. A symmetrical load is very important here.

Wherever a system is planned at a fixed location, the grid is already in place; in these cases, the precise identification of compatible power supply units can be based on the supply system configuration and voltage level.

However, if you are planning series machines or systems that can be sold and used worldwide, the design should be as universal as possible. The great advantage of modern switched-mode power supply units over earlier transformers is their wide range input. The internal transformer stages ensure constant generation of the desired output voltage on grids between 100 V and 240 V. The TRIO and QUINT power supply unit families can also be operated on DC grids. IT grids above 400 V place special requirements on the devices; such requirements can usually only be met by devices such as the 3AC-QUINT (AC up to 550 V and DC up to approximately 900 V).

The QUINT devices can even supply grids as special as those in use in railway infrastructure



Buffer mains interruptions correctly

with 16.7 Hz, but as with input voltages of less than 100 V, lower efficiencies and thus higher temperature development is to be expected.

Factors such as grid availability and stability also vary greatly around the world and influence the planning of auxiliary voltage systems. In some regions, there are several minutes of blackout several minutes a day because the energy generated is not sufficient and must be allocated by the hour. In other regions, switching operations in the network or at large customer facilities lead to brownouts, which are characterized by shorter failures of between 10 ms and a few seconds. These brownouts are particularly annoying, because they are often not directly perceptible to people, but make themselves most noticeable to electronic loads such as controllers and operating panels since they usually lead to restarts and the associated production downtimes. Depending on the type and load, switched-mode power supply units from Phoenix Contact ensure a mains failure buffer time of several dozen milliseconds. QUINT4 IPL devices continuously monitor all 3 phases of the supply network. The state can therefore be signaled via different communication protocols so that problems in the gid and the entire application can be detected at an early stage and countermeasures can be initiated.

If asynchronous motors are used in machines, the rotating field during connection is essential for preventing a pump from pumping incorrectly or a stirrer from stirring incorrectly. In mobile machines in particular, the rotating field is checked by so-called phase monitors (e.g., from the EMD or MACX-MR series) and the machine is only started when a right-hand rotating field is present. Alternatively, this information can also be evaluated directly by the QUINT4 IOL devices.

If the mains failure buffer time of the power supply units is insufficient, each auxiliary voltage grid can be extended with capacitor storage systems (e.g., STEP CAP, QUINT CAP, and QUINT BUFFER), which provide currents of up to 40 A for several seconds. This technology is maintenance-free, durable, and can be used within a wide temperature range of -25°C to 70°C.

If applications are so important that several minutes to several hours of mains failure must be bridged, an uninterruptible power supply (UPS) is essential. In these cases, large industrial systems often have central UPS facilities that can supply all the electronic loads for hours.

In other cases, decentral UPSs are used. Phoenix Contact provides selection tables that can be used to easily identify the appropriate energy storage devices in accordance with the electricity and time requirements. It should be noted that, in contrast to capacitor storage systems, battery-based UPSs always require maintenance and regular replacement. Depending on the ambient conditions, load, and storage technology, the battery must be replaced within a time ranging from a few months and several years.

Particularly in widely extensive system parts, such as those used for traffic monitoring, pipelines, and pumping stations, the maintenance effort is high, which means that the investment in state-of-the-art storage technologies pays off quickly. In these cases, condition monitoring, such as IQ technology, should also be taken into consideration. In addition to the state of charge (SoC), this technology also indicates the state of health (SoH) and makes additional data accessible via a communication interface. This means that the data can be integrated easily into controllers and master computers, and any necessary maintenance can be planned precisely.

Another frequent task of UPSs is to report a mains failure to a control PC as a shutdown trigger. Together with the information on the available buffer time, the PC can decide whether it needs to be shut down after saving important data or to wait for the mains power to return. This saves unnecessary boot times. The PC and UPS are connected either via USB or LAN and require a small software application on the PC, which, where necessary, will also has a user interface.

How do I protect loads correctly and maintain high system availability?

Protection in electrical systems makes sense for two reasons:

1. Protecting cabling and loads against (thermal) overload in the event of a fault/fire protection.

2. Prevention of voltage dips at important loads not affected by the short circuit/increase in system availability.

In contrast to battery sources, state-of-the-art switched-mode power supply units are usually short-circuit-proof, which means that their short-circuit currents are limited. The behavior of the power supply unit output can follow different characteristic curves. In the event of a short circuit, devices with a U/I characteristic curve supply their maximum current. The voltage is adjusted in accordance with the resistance in the circuit. Such a U/I characteristic curve is useful for charging batteries and starting loads with a high inrush current. During the charging process and while starting such loads, it is only possible to operate other electronic loads, such as controllers, if the voltage available is high enough to support them.

Another output behavior is known as HICCUP. In the event of a longer overload or short circuit, the output of the power supply unit is switched off (e.g., after 2 s) and switched back on again after a certain time (e.g., 8 s). This alternating switching on and off is carried out until the overload or short circuit has been fixed. Cable heating is minimized, but the behavior can be harmful for electronic loads such as controllers.

Based on these explanations, it becomes clear that fire protection is not the first priority when short-circuit-proof switching power supplies with sufficient cable dimensioning are used, but rather a coordinated protection concept to meet the availability requirements of the respective application. In short, the higher the system availability requirements, the more important it is to avoid voltage dips and thus supply devices such as controllers or other control units without interruptions.

In machines with a controller and a manageable number of IOs, at least one fuse circuit should be provided for PLC and HMI, and at least one other for supplying sensors and actuators. With actuators in particular, a distinction should be made between the protection of relays and contactors – which are typically located inside control boxes – and, for example, solenoid valves and small drives, which are located outside. These should be protected separately.

An error outside of control boxes is significantly more common than inside them. The reasons for this are often mechanical, such as objects or production parts that damage cables or moisture on cable glands, plug-in connections, or terminal boxes.

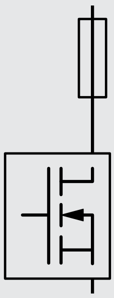
Depending how widely spread out the machine is, it must be ensured that sufficiently large residual currents are generated to trigger the upstream fuse. The cable resistances, maximum currents of the power supply unit, and tripping characteristic curve must match.

If, for example, you use fast-blow 4 A fuses in combination with a simple 10 A switched-mode power supply unit, the cable cross-section can be as large you want, but a short-circuit current of more than 10 A will not occur. This means that the tripping action will take several seconds. During this time, the voltage in all parallel fuse paths is 0 V, and the loads are off. A supply voltage will only be available again once the fuse has melted.

The situation is similar if a B4 circuit breaker is used instead of a fuse. If loads are to be kept in operation in the event of a short circuit, it must be ensured that tripping takes place in less than 10 ms (controllers designed in accordance with IEC 61131-2 can survive a voltage failure of up to 10 ms). Solutions to this include either the use of a larger power supply unit (40 A in the example) – which is associated with significantly higher costs

Possible protection technologies

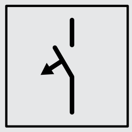
Electronic Fuses



Advantages
- No voltage dips
- Fast tripping
- Almost any power supply unit can be used
- Current value can be set
- Remote activation possible

Disadvantages
- Lower breaking capacity
- Disadvantages with high startup currents
- Knowledge of operation required
- Low voltage range

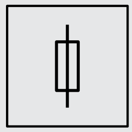
Thermal-magnetic circuit breakers



Advantages
- Available worldwide
- Electrically isolating
- Can be operated by the non-specialists
- All-pole protection possible
- EMI-resistant

Disadvantages
- High tripping current
- Remote activation not possible
- Current value cannot be set

Fuses



Advantages
- Cost-effective
- Available worldwide
- Electrically isolating
- EMI-resistant

Disadvantages
- High tripping current
- Remote activation not possible
- Current value cannot be set
- Requirement for replacement parts

and space requirements – or the use of a power supply unit with special boost functions. For example, the QUINT series can provide six times the nominal current for 15 ms.

Another solution is the use of a circuit breaker that does not trip thermally or magnetically, but shuts down in less than 10 ms if the measured current is exceeds a certain value. The disadvantage, however, is that unintentional tripping cannot always be safely ruled out in the event of high startup or charging currents.

Electronic circuit breakers are also somewhat more expensive and require auxiliary power. They only have a limited breaking capacity of around 300 A, which means that they are not suitable – at least not on their own – for larger battery networks, for example. This is in contrast to typical thermal-magnetic “device circuit breakers”, which can switch off several kiloamps and, because they are in use globally, can be identified and operated this way by any electrically skilled person. Electronic circuit breakers vary greatly from type to type, and personnel will need certain levels of training or at least be given instruction. If giving this instruction cannot be guaranteed for operating or maintenance personnel, the use of electronic circuit breakers should be reconsidered. Examples of this include where ever-changing personnel rectify simple errors on single machines themselves, or where the maintenance personnel working on large systems are replaced frequently.

It should also be noted that with simple electronic circuit breakers there is no electrical isolation between the input and output. This and an all-position shutdown can only be achieved when special versions of electronic circuit breakers or conventional thermal-magnetic circuit breakers or fuses are used.

Unlike fuses, the use of thermal-magnetic and electronic circuit breakers also allows the option of monitoring. For example, the CBM, CB-E, CBMC, and PTCB ranges feature floating contacts. With the CAPAROC and CBMC ranges, precise current and status information can be obtained via data interfaces such as IO-Link, PROFINET, and Ethernet IP. This means that changes in power consumption can also be monitored during operation and impending failures can be detected at an early stage.

Multi-channel circuit breakers such as CBM and CBMC, and even power supply units with several integrated circuit breakers, such as the TRIO3 CB version, are ideal if the number of loads is constant. Modular circuit breakers such as CAPAROC and PTCB should be used in particular where long system lifecycles and associated extensions and changes are to be expected.

In addition to fuse protection, another aspect is also important for the protection concept when setting up an auxiliary voltage grid: safety.
Voltages of 24 V and 48 V have become particularly prevalent because they are safe when touched and provide sufficient power for automation components. Working with 24 V is significantly less dangerous than

> Voltages below 50 V AC or 120 V DC are generally not dangerous for adults.

with mains voltages up to 230 V. Switched-mode power supplies, such as transformers, generally ensure the safe separation between the mains voltage and the auxiliary voltage; they create a protective extra-low voltage in accordance with SELV (Safety Extra-Low Voltage).

It is possible to always view SELV as a safe choice. Nevertheless, in the vast majority of industrial applications, a connection is created between the mains and auxiliary voltage sides by grounding the negative pole. This turns the safety extra-low voltage into a functional extra-low voltage in accordance with PELV (Protective Extra-Low Voltage). Why is that?

In SELV systems, individual electrical faults such as ground and conductor faults remain undetected and without consequences, which means that system

3,622

electrical accidents reported in Germany in 2023.

Source: bgetem.de

availability is initially higher than with PELV. If a second error occurs in another device, these newly created circuits can cause unwanted or potentially dangerous situations, such as causing a motor to start or a fire to break out due to excessively high currents in cables with a small cross-section.

If – as with PELV systems – the negative pole and all metallic housings are grounded and the fuses, voltage sources, and conductor cross-sections are rated correctly, a simple error occurring will lead directly to a fuse shutting down.

SELV systems can therefore be used if a dangerous situation caused by a second fault can be ruled out (through the use of a plastic housing) or if shutdown is not desired for availability reasons. In this case, however, the first fault must be detected reliably (insulation monitoring) so that it can be located and remedied. Furthermore, in SELV systems, all-pole (positive and negative) protection must be assured so that return conductors are also protected against excessively high currents.

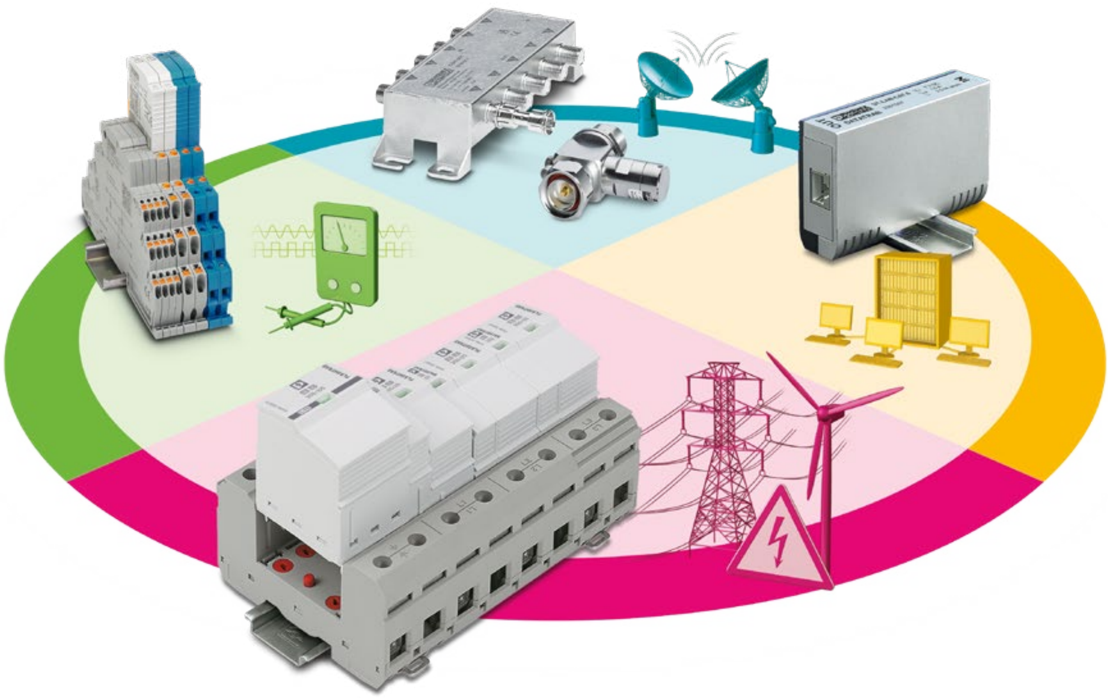
If SELV applications are used on a larger scale and these still need to be buffered by UPSs, systems are often broken down into several parts and electrically isolated from one another using DC/DC converters.

Potential distribution is often used downstream of the fuse, because the loads are often protected in groups. The CLIPLINE complete system features a variety of different concepts for this potential distribution. The PTCB portfolio enables distribution directly to terminal blocks through the use of bridge accessories, which saves space and wiring effort. The modular CAPAROC protection system enables multiple connections and 0 V potential distribution.

Especially at low auxiliary voltage levels of <50 V and long cable lengths, the cable should not only be rated for the maximum current value, but much more for the worst possible voltage drop. At the same time, it must be ensured that the voltage at the load is still high enough.

Switched-mode power supply units must also be protected on the primary side. Product-specific specifications and recommendations can be found in every data sheet. Any inrush currents that are above the nominal current depending on the internal structure of the device must be taken into account.

Do I need surge voltage and EMC protection for my system?



Various surge protection components

Surge protection is recommended wherever storms are common, where there are overhead railway lines, electrolysis systems, welding systems or special mains switching operations in the region of use. In the case of any type surge protection, a correctly rated and installed equipotential bonding system must be ensured.

On the mains side, as with the SEC series, this should be as free of line follow current as possible so that upstream protection does not trip in the event of discharge events. Nevertheless, the backup fuse value recommended for the respective type of surge protective device must be observed.

If surge voltages are also to be expected for auxiliary voltage lines or if particularly sensitive loads such as highly precise measuring technology need to be supplied, these should also be equipped with surge protective devices. The TERMITRAB Complete (TTC) surge protective devices safely discharge the disturbances, limit the surge voltages, and thus provide optimum protection for the loads. It is important to select the right type of device for the respective nominal voltage. In addition to cables and loads, an upstream fuse must also protect the surge protection device in the event of a short circuit in the field.

For the isolated grids (SELV) described above, surge protective devices must be selected that have insulation (spark gap) to the equipotential bonding system. This is the case, for example, with type TTC-6P-2-HC-24DC... devices.

Surge protective devices with signal contacts should be used for remote systems, such as secondary substations and well shafts.

If disturbances occur on sensitive loads due to equipotential bonding currents, this can also be decoupled from the rest of the application using an electrically isolating DC/DC converter.

How can I measure my energy flows and increase energy efficiency?

In the face of ever-increasing energy costs, transparency of consumption is very important. Therefore, in addition to the total energy requirement and the individual main load, it may also be useful to measure the auxiliary power requirement. By comparing energy profiles, even emerging system faults can be detected before failure occurs.

When measuring the overall requirement, it must be clarified whether conformity with calibration law is relevant. This is usually the case if the values are used for external billing purposes. In this case, the devices must be compliant with calibration laws and, in Europe for example, be in accordance with the European Measuring Instruments Directive (MID).

In many cases, the consumption values on site may also be displayed on the outside of the control cabinet. Devices are available that are equipped with a display and are suitable for mounting on the DIN rail or directly in the control cabinet door.

In addition, integration into higher-level energy management systems via communication interfaces is common nowadays. Typical protocols include Modbus/TCP and RTU, and now REST and MQTT as well.

EMpro series devices are available for DIN rail mounting, with and without display, as well as for installation in the control cabinet door – in this case with a large display. The above-mentioned interfaces are available as options, as well as devices in accordance with the MID directive.

The high currents of main circuits are not fed directly through measuring devices, but through measuring transducers, which then allow a much smaller measuring current.

The most precise measuring transducers are mounted as closed coils around current rails or cables.

Electrical energy measurement

When subsequently fitting current measuring technology in existing systems, the use of split-core current transformers or coils based on the Rogowski principle can make it easier to install measuring transducers. In this case, the current rails do not need to be removed; instead, flexible Rogowski coils can be wrapped simply around the rails or cables. The accuracy of this measuring principle is slightly lower than conventional transformers. The measuring devices must be suitable for the respective principle used.

No additional measuring technology needs to be installed for energy measurement in the auxiliary voltage grid as long as switched-mode power supply units from the QUINT4 series are installed. These feature a 4 to 20 mA output that can be interpreted by any conventional controller. The consumption of the individually protected current paths can be evaluated through the use of CBMC or CAPAROC fuses.

What is the best way to design the structure of my control cabinet?

As with any electrical planning project, the local environment plays an important role. The following questions should be answered:

1. Are the expected ambient temperatures covered by the temperature ranges of the components?
2. What is the situation with self-heating and heating due to sunlight? Is active cooling required or even possible? Will heating be needed to prevent condensation in the morning hours?
3. If condensation cannot be avoided, it should be ensured that electronic devices have a protective coating and that the control box is equipped with a ventilator.

Depending on the utilization and heating, a clearance of up to 5 cm must be planned between adjacent components and cable ducts. This varies for each device and must be taken from the product documentation. The higher the efficiency of the devices, the lower the clearance necessary.

The mounting direction is also important where temperatures are expected to exceed 40°C. The arrangement of heatsinks, components inside the device, and openings are usually intended for a specific mounting direction to achieve the best possible convection. If this direction is deviated from in warm environments, a certain derating must be accepted or forced convection must be provided, for example through the use of fans. Devices from the QUINT4 PS series feature a signal that warns about heating before a failure occurs, which makes it possible to determine whether there is a lack of convection, incorrect installation, or even a blocked control cabinet fan.

When arranging the space in the control cabinet, it should be ensured that it is always warmer at the top than it is below. This means that devices that cope well with a higher temperature should be installed in the upper area, the others below. Specifically, energy storage systems such as batteries should be on the lower level.

Contact

Planning the auxiliary voltage supply in industrial applications includes a number of important questions, and some of the answers have an impact on the others. The Phoenix Contact portfolio covers every aspect of this. Should open questions arise during the course of an idea, our colleagues in Sales and Product Marketing will be happy to provide personalized advice.

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