

Dear Readers,

In a year that has again been successful and dynamic for most of us, the time has come for the final spurt. Internationalisation, production 4.0, digitalisation have again been part of our daily decision-making.

In recent months, these key issues have been complemented by concerns about the global economy, market foreclosures, unresolved trade issues with the US and the lack of clarity surrounding Brexit in Europe. When assessing future risks, these issues are of course taken into consideration.

But is this also true for the security and availability of your power supply? When did you last check this or include it in your company's risk assessment? What would it cost your company if the power grid fails completely or in part for a period X? How long does it take for production to fully resume following shutdown, cleaning or recalibration? What impact does this have on your customers and your supply chain?

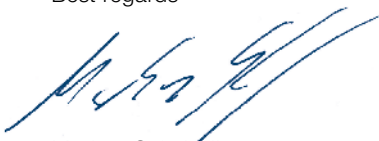
For an increasing number of our customers, this risk analysis is becoming standard worldwide. Electrical safety and availability can no longer be taken for granted and has become a basis for many risk analyses.

We advise you on choosing the right system. Regardless of the system type – unearthed, resistance earthed or earthed – we provide long-term support in the correct monitoring of your systems to enable you to carry out necessary maintenance work at the right time and in a planned manner.

In this issue of MONITOR, find out about the many ways our systems are being utilised and apply them to your own critical areas. Visitors of SPS IPC Drives at the end of November are warmly invited to witness our systems in operation in the Nuremberg exhibition centre's electrical installation.

At this year's international trade fair, Bender can be relied on to offer you tailor-made solutions and inspiration while also delivering maximum safety.

Best regards



Markus Schyboll
CEO



SUBSCRIPTION

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IMPRINT

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System Grounding ...

Page 04

... in the Americas, Australia, South Africa and Other Regions

Industrial power-system grounding in different industries and applications, has evolved over time ...



Safe, CHAdeMO-compliant charging at DC charging stations

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The CHAdeMO (Charge de Move)

electrical interface for electric cars was developed in Japan and is now in cross-brand usage and can be found at every third charging station world-wide.



Integral and future-orientated from a single source

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70 years of electrical engineering – fast, flexible and with great expertise

The company is one of the leading providers of innovative building, IT and communication technology ...

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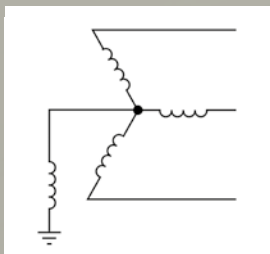


System Grounding

in the Americas, Australia,
South Africa and Other Regions

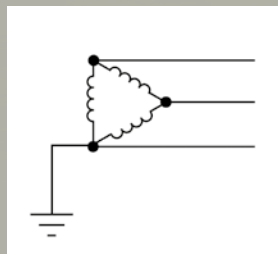
Industrial power-system grounding in the Americas, Australia, South Africa and other regions, in different industries and applications, has evolved over time. Typically, low voltage systems (those below 600 V) employ one of the three most common grounding methods: solidly grounded, resistance grounded and ungrounded. There have been trials and applications that have tried reactance grounding and corner- or center-grounded delta but those are extremely rare. In many areas, a preference for resistance grounding has been growing. There are benefits with resistance grounding, but there should be an understanding of the hazards and potential faults on such systems to best prepare the design engineer not just for code compliance and minimum design requirements, but also for proper system performance and protection.

Figure 1:

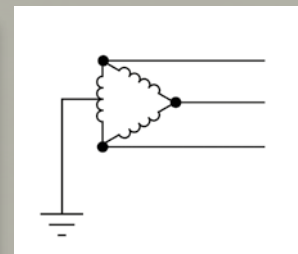


Reactance Grounding

Figure 2:

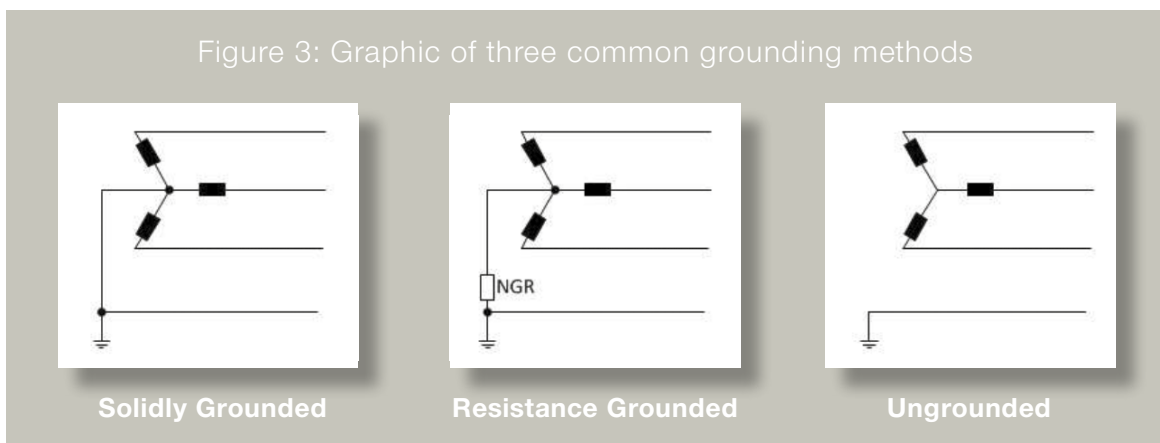


Corner-grounded delta



Center-grounded delta

Figure 3: Graphic of three common grounding methods



The use of resistance grounding started in the 1950's in many of the regions mentioned. Resistance grounding was first used to replace ungrounded systems that had experienced transient overvoltages and the resulting phase-to-phase faults. The transient overvoltages that were caused by intermittent or arcing faults building up charge on systems with distributed capacitance to ground. Distributed capacitance to ground is a common property and well documented especially for cables used in electrical distribution. The more cable in a system, the higher the charging current or leakage to ground. While transient overvoltages are rare, they can and do occur. The resistance grounded system designer must be aware that this can be a problem when resistor current is lower than the charging current of the power system. Modern systems may employ more advanced voltage protection devices than were used previously. Lightning arrestors or Metal Oxide Varistors (MOV's) for example can help prevent the dangerous escalation of transient overvoltages (rated for L-L Voltage).

Resistance grounding is used because it shares the benefits, but not the drawbacks, of both solidly grounded and ungrounded systems. High-resistance grounding and ungrounded systems have many similarities and shared benefits. Unless directly required by local regulations to trip, low-voltage systems can be configured two ways to respond to a ground fault; either 1) trip, or 2) alarm/annunciate the fault and continue to operate.[1] Modern electrical protection systems can use quick fault clearing to help prevent the possibility of transient overvoltages on both high resistance grounded and ungrounded systems. Tripping is often overlooked as a method of protection when production is seen as critical, even though not all loads are critical to the opera-

tion. A power system with one phase faulted to ground has a heightened probability of a second-phase ground fault. The increased downtime that may be caused by a phase-to-ground-to-phase fault should not be overlooked. A system that is set to alarm should at a minimum have a defined time limit to allow operation before de-energizing the system; otherwise it is too easy for production to continue to run indefinitely, increasing the probability of additional failure.

Low-voltage transformers, those rated below 600 V, can be wye or delta connected. The neutral of a wye connection can be solidly grounded or resistance grounded. The grounding resistance can be anywhere in the range of very little (or solidly grounded) to very high (or ungrounded). Typically, ground-fault current is limited to 5 Amps, but many other values can be used. For power-system voltage stability, the system neutral voltage must not be allowed to deviate far from ground potential (to avoid a transient overvoltage condition). To ensure the power system cannot support a transient overvoltage, minimum resistor current rating is equal to system charging current. Charging current is directly related to distributed system capacitance, hence to system size.





FEATURE

▶▶▶ In many cases where system stability is paramount, such as power transmission, the power system is solidly grounded. In low-voltage distribution applications in industrial facilities a solid connection to earth has negative effects during a phase-to-ground fault. The energy available to a ground fault is similar to that of a phase-to-phase fault. The solid connection to ground does not limit the current during a ground fault and there is potential for release of a large amount of energy during every ground fault. Different references mention that 80-90 % of the faults that occur in a facility start out as a single-phase-to-ground fault. Ground faults are often the result of insulation breakdown resulting in an energized conductor contacting a metallic enclosure or frame that is at ground potential. Solid grounding increases the risk of arc-flash exposure to workers, as compared to other grounding methods. The increased awareness of arc-flash hazards, and newer standards such as National Fire Protection Association NFPA 70E Standard for Electrical Safety in the workplace, have done a great deal to help protect workers from one of the hazards of electrical work. These are not the only hazards present in an electrical system although they seem to have taken the spotlight away from contact forms of danger such as shock and electrocution. Additional risk is present in a system that is allowed to operate continuously with a fault on the system.

Markets using Resistance Grounding and Why?

The Institute of Electrical and Electronic Engineers (IEEE) Std 142 [3] stated the purposes of grounding as:

1. Controlling the voltage-to-ground (within predictable limits) to limit the voltage stress on the insulation of conductors. The control of voltage also allows reduction of shock hazard to persons who might come in contact with live conductors.
2. Providing for a flow of current to allow detection of an unwanted connection of conductor(s) to ground. Such detection may then initiate operation of automatic devices to remove the source of voltage from these conductors.

Industries in many countries have used resistance grounding, including: mining, refining, chemical plants, manufacturing, pipelines, datacenters, shore-to-ship power, and pulp, paper and forestry. It is used primarily for safety and in many cases for continuity of service.

Some North American companies may have adopted resistance grounding due to a lack of awareness that ground-fault location systems (IFLS: insulation fault location system) are available for ungrounded systems. The capability of allowing continued operation on ungrounded and high resistance grounded systems is a major advantage over solidly grounded systems and low resistance grounded systems. The ability to automatically locate the ground fault is another advantage that customers value. Preventing downtime is not the only purpose of a ground-fault relay. Ground-fault devices such as insulation monitors and CT-based ground-fault relays are there to detect abnormal conditions. With the correct selection of sensors on individual feeders and the use of hand-held fault locaters they can be used to rapidly determine the ground-fault location. Maintenance personnel can't fix the problem until they know where it is. The savings in person hours is a major benefit of quick fault detection and location. The ground-fault equipment can also automatically trip a circuit to help prevent fire, equipment damage, and arc flashes but the cost of protection can be unscheduled downtime.

Moveable and mobile equipment used in mining and other industries is often required by code to be powered by a resistance-grounded system, and be required to trip on the occurrence of a ground fault. CSA M421 Use of Electricity in Mines, AZ/NZ 2081 Electrical Protection Devices for Mines and Quarries Standards Australia, National Fire Protection Association National Electrical Code (NEC) 2017 Article 250.188 are some of the standards for such portable or mobile power requirements. There are differences, but most are similar in that they require ground conductor monitoring of the cable feeding power to the portable equipment. It is obviously not possible to ground a mining vehicle or rubber-tired vehicle the same way that a facility can be grounded. The cable feeding power to the equipment contains the conductor used to bond the equipment to the supply ground. It is important for anyone that comes into contact with such equipment that the voltage of the frame does not become energized, to prevent touch potential hazards.

Mining codes often require a grounding location for substation neutral grounding resistors that is isolated from chassis ground of the substation. This isolation is to help prevent touch potential elevation at the substation resulting from substation-high-side ground faults and the dangerous transfer of this potential to portable loads, as illustrated by Fault A in CSA M421-16 Appendix A below.

What is the difference between high-resistance grounding and low-resistance grounding? Why are both still being used?

High-resistance grounding is not well defined in standards, but uses resistors with high ohmic values resulting in low ground-fault

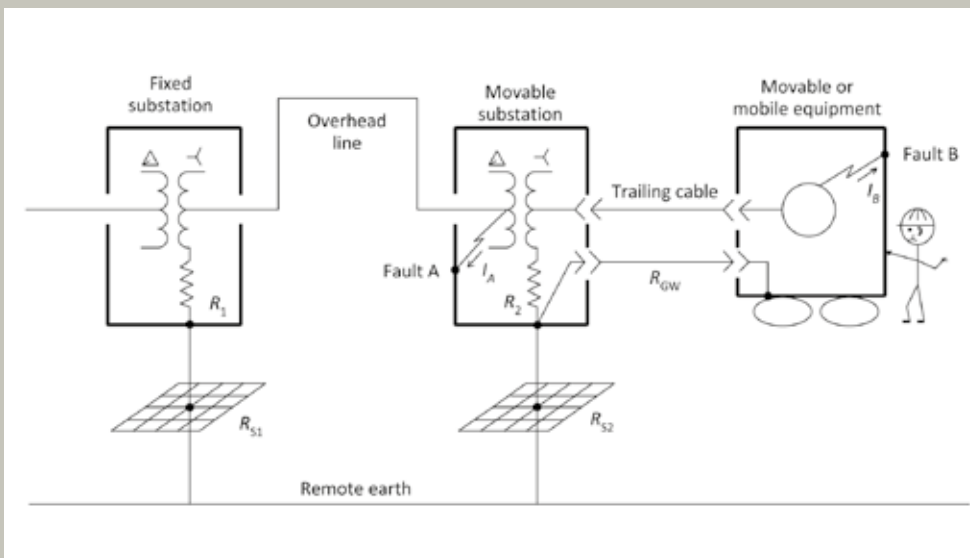


Figure 4: Drawing from Figure A.1, CSA M421-16 – Use of electricity in mines. © 2016 Canadian Standards Association*



*1 "With the permission of Canadian Standards Association, (operating as "CSA Group"), 178 Rexdale Blvd., Toronto, ON, M9W 1R3, material is reproduced from CSA Group's standard CSA M421-16 – Use of electricity in mines. This material is not the complete and official position of CSA Group on the referenced subject, which is represented solely by the Standard in its entirety. While use of the material has been authorized, CSA Group is not responsible for the manner in which the data is presented, nor for any representations and interpretations. No further reproduction is permitted. For more information or to purchase standard(s) from CSA Group, please visit store.csagroup.org or call 1-800-463-6727."



FEATURE

▶▶▶ current levels. Due to the low current levels during phase-to-ground faults, alarming (instead of tripping) can be selected and facility operation is not interrupted. On the other hand, low resistance grounding has the opposite characteristics. In Canada, the Canadian Electrical Code defines clear limits that make design work simpler. In most cases outside of mining, an electrical power distribution system is not required to deenergize due to a ground fault if system voltage is 5 kV or lower and the ground-fault current is limited to 10 A. [3] While the U.S. NEC does not clearly define this level, another American standard, NFPA 70E-2015 Informational Annex O [4] acknowledges high resistance grounding as one incident energy reduction method.

Low voltage systems normally enjoy the benefits of high resistance grounding. Medium and high voltage systems sometimes default to low resistance grounding but they can certainly be high-resistance grounded. Tripping is more common in medium- and high-voltage applications. There is often fewer feeders and loads at 4160 V and higher voltages. Medium voltage

conductors may be given more respect than low-voltage cables. Loads such as transformers are less prone to ground faults than low-voltage motors and heaters.

Generators are a unique application that are often required to be resistance grounded. High resistance can be employed in generator applications to help control fault damage and in some cases control faults to make the system alarm only. Addition of downstream sensitive earth-fault detection is an advantage but it may not be necessary to add single function ground-fault detection devices. Modern devices such as feeder and motor protection relays, adjustable speed drives and some breakers have sensitive ground-fault pickup levels – although they have their own limitations for frequency response and pickup that may make selection of individual ground-fault devices advantageous.

Neutral grounding resistor current flow that is not at the standard power frequency is another abnormality that should be monitored. A disadvantage that can be present on generator systems is the potential for non-fundamental frequency (50/60 Hz) current flow. There have been cases where harmonics such as the 3rd have flowed between generators' neutrals when they have been tied to a common bus [6]. This condition and any other faults caused by harmonics or dc currents when detected early can be remedied before they have had a chance to heat the grounding resistor and cause premature failure. In many European countries the requirement to use a ground-fault device with a wide frequency response range that includes dc, such as the European-defined Type B ground-fault protection device, gives enhanced awareness to abnormal situations and should be considered in all applications where non-linear loads are used.

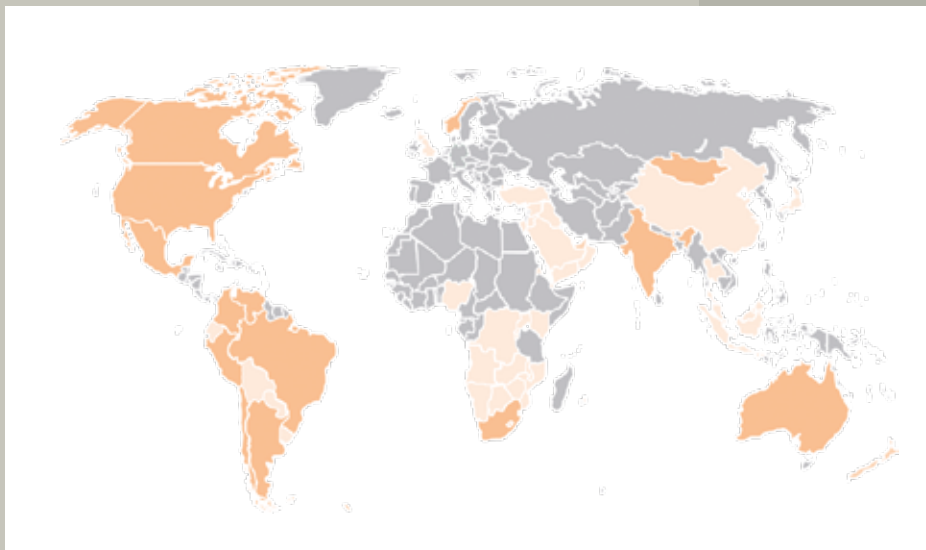
Customer requirements and the understanding of root causes of ground faults advances with time. There is a definite and serious gap in protection if a neutral-grounding resistor fails open. Current transformer (CT) based ground-fault protection cannot function. Such monitoring has been required in many jurisdictions for years while others use the technology because it is a best practice. Code changes in a few jurisdictions have added requirements for detection of open

and shorted grounding resistors (see reference [3] section 10-302) for any impedance grounded system. The US Mine Safety and Health Administration has added special requirements on adjustable speed drives to provide ground-fault protection response that works across the entire output frequency range of the drive. There may be many older systems that are blind to faults that are not at fundamental i.e. 50/60 Hz. The next generation of resistance grounding monitors are available to not only meet such requirements but go beyond the minimum and greatly enhance the protection and performance of a system. Awareness of global standards can lead to product enhancements.

CONCLUSION

No matter how the designer chooses to ground a system there is more than adequate protection available. Bender has advanced solutions to detect insulation failures, with Global experience in applications, codes and standards. ■

*Jeff Glenney, P.Eng , Bender Inc. USA
Torsten Epkes, B.Eng.,
BU Industrial Solutions, Product Management*



■ Focus Market ■ Enhanced Market ■ Known application (rarely)

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- [1] System Grounding and Ground-Fault Protection in the Petrochemical Industry: A Need for a Better Understanding – John P. Nelson
- [2] IEEE Std 142 - 1991
- [3] C22.1-18 Canadian Electrical Code, Part I Safety Standard for Electrical Installations
- [4] National Fire Protection Association NFPA 70E-2015
- [5] Low Zero-Sequence Impedances on Generators – Michael Simpson and John Merrell, August 30, 2000
- [6] 3rd Harmonic Current in a Generator Neutral Earthing Resistor Connected to a Large Cable Network – Jason Mayer and Ryan Turner (2017-PSEC-0804)

Bender introduces Business Units

The Bender Group is set to organise its activities into new business divisions:

Hospital, Industrial and **eMobility Solutions**.

Greater focus on the needs of its customers and faster adaptability, a better definition of corresponding areas of responsibility, and continuing to strengthen the skills found throughout the Group – this is the aim of Bender’s new Business Unit structure.

This new company structure, which empowers operational units with greater skills and responsibility, was a big step for Bender at the start of the year, as it seeks to increase customer proximity and market orientation. In close cooperation with end customers, planners, technical supervisors and experts, the “Hospital Solutions”, “Industrial Solutions” and “eMobility Solutions” Business Units are each developing a well-matched range of services. These cover initial consultation through to implementation and are offered in line with market requirements.

The intent and purpose of the newly formed and clearly allocated areas of responsibility is twofold: establishing a market that is 100% dedicated to the interests of its cus-



"Customer requirements and trends will be **pooled effectively** and well positioned to implement customer-orientated products and solutions"

tomers and implementing and driving this global strategy consistently on an international scale. From now on, global national companies will be organised according to the focuses identified in the Business Units.

In future, information from the various markets will be transmitted directly to the relevant Business Unit. Customer requirements and trends will be pooled effectively and well positioned to implement customer-orientated products and solutions that will also fulfil all international requirements.

Clear processes and responsibilities reduce reaction times and therefore our customers' waiting time. ■

Anne Katrin Römer
Marketing Communication

FIRE AFFECTING

the safety lighting of a shopping centre

It is not uncommon for old existing low-voltage networks in office or business buildings to be subjected to extra loads from additional consumers.

There is a great need for action to investigate this because fires can occur easily. Safety can be achieved by retrofitting Bender's power quality and residual current monitoring systems to the mains power monitoring system in existing distribution systems.

Jörg Steffen Ingenieurgesellschaft, a German engineering company in the building technology and facility management business, recently experienced a fire in the safety lighting system of a shopping centre.



Jörg Steffen

A short while before, as the subject of a Masters dissertation entitled 'Investigation of a low-voltage network in a shopping centre with reference to: power quality, load flow and short circuit' [translation], the low-voltage network of this building complex was subjected to close scrutiny.

To evaluate the power quality of a shopping centre, you need to have a true r.m.s. measuring device (True RMS) that is capable of recording, analysing and evaluating several parallel measurements such as currents, harmonic voltage, interharmonic voltages, asymmetry of the power supply, power frequency, flicker severity and voltage fluctuations over extended periods of time and to very high levels of precision. In this investigation of power quality to DIN EN 50160 (measurement to IEC 61000-4-30 Class A), a Bender PEM735 measuring case was used.

The shopping centre is supplied with power by three local network transformers, each with the same power rating. A PEN bridge can be seen between the PE and N bus bars on all low-voltage main distribution boards (LVMD). The system type from the transformers to the LVMD is a TN-C system and it was established from the LVMD to all outgoing circuits in the form of a TN-S system. For this reason, the entire system type of the shopping centre is a TN-C-S system.

"Nowadays, this system type is not suitable because it no longer satisfies the current standards or specifications of modern protective measures against electric shock", explains Jörg Steffen, the proprietor of Jörg Steffen Ingenieurgesellschaft mbH.



"To evaluate the **power quality of a shopping centre**, you need to have a true r.m.s. measuring device (True RMS) ..."

NEWSWORTHY | BUILDING TECHNOLOGY

►►► Furthermore, due to the use of energy-efficient devices that contain increasingly more power electronics, and that therefore distort the current characteristics, the characteristics curves for current and voltage are no longer linear. Consequently, with a combination of this system type and the use of installed loads such as PCs, power units, electrical charging stations, inverters or frequency converters, various system reactions such as harmonic voltages, stray currents and additional load on the neutral conductor can occur.

"As a result, computer systems can be destroyed, or entire installations can get destroyed by fire", warns graduate engineer [Diplom-Ingenieur] Jörg Steffen, who also strongly recommends a retrofit.



Measurements with the PEM735 measuring case from Bender

When investigating the LVMD 2, the measuring results showed that, compared to the limit values defined in standard DIN EN 50160, the 15th order harmonic voltage was very high (approx. 56 %) (see Figure 1).

Six lifts (61.5 kW), three ventilation systems (114 kW), a smoke extraction system (19 kW) and the general safety lighting system (10 kW) were all connected to outgoing circuits on the LVMD 2. These devices were deemed to be the main causal factors of the levels of harmonic measured.

However, it was no longer possible to implement the recommended installation of a monitoring system (Power Quality & Energy Measurement) with detailed residual current monitoring. Three weeks after the measurement was carried out, and with the arrival of summer temperatures, the feared fire (see Figure. 2) in the safety power supply in the basement and/or on the associated sub-distributor on the 2nd floor

Fig. 1

15th order harmonic tension: Limit value is 0.5%, measured value is 0.78%

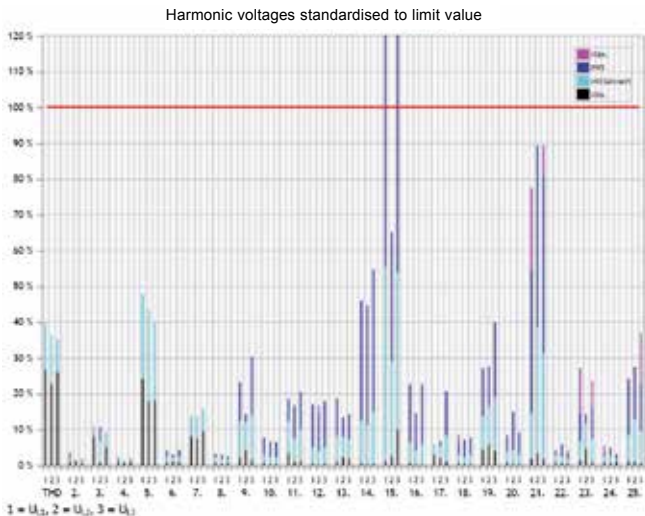




Figure 2: Fire incident with safety lighting

then occurred. All wiring was charred completely and the connected devices were all destroyed. Fortunately, this fire did not cause any unipolar, bipolar or tripolar short circuits. That prevented any significant secondary damage.

With any future changes of plan or new systems, the appropriate Bender devices will now be installed directly, states Steffen. Before that can happen, all technical system measures must have been completed to prevent the occurrence and/or propagation of a fire. ■

Dipl.-Ing. Jörg Steffen
 JÖRG STEFFEN Ingenieurgesellschaft mbH

"With any **future changes of plan** or new systems, the appropriate Bender devices will now be installed directly."

INFO



About Jörg Steffen Ingenieurgesellschaft mbH

Jörg Steffen Ingenieurgesellschaft mbH für Gebäudetechnik und Facility-Management is the full name of this German engineering company which is involved in the business of building technology and facility management. With its selected partners, the company provides professional advice and innovative planning for technical equipment. It also, with existing plant and systems, provides analysis, evaluation and the devising of alternative solutions and proposals, all founded upon sound business sense.

INNOVATIVE PRODUCTS

NEU

isoCHA425:

Safe, CHAdEMO-compliant charging at DC charging stations



Bender has **specially developed the new isoCHA425** insulation monitoring device **for monitoring the entire charging circuit** in DC charging stations. Monitoring is performed according to the Japanese CHAdEMO charging standard.

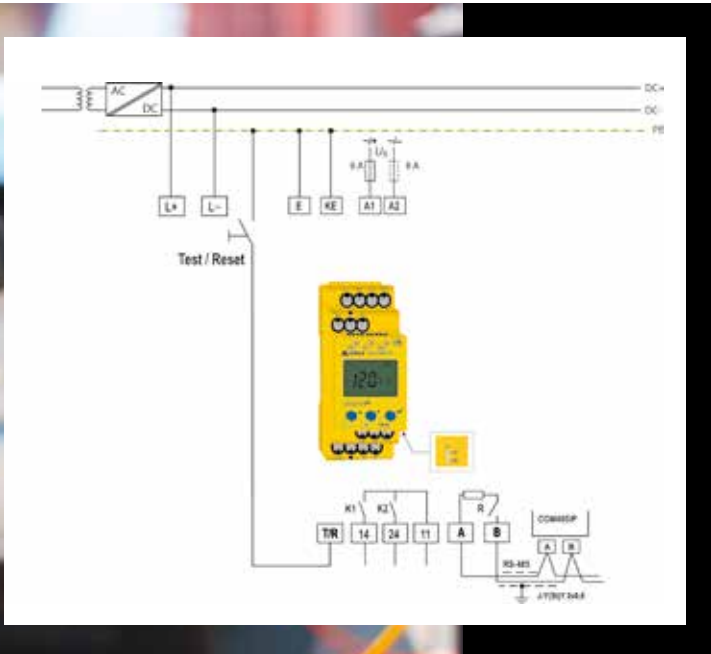
The **CHAdEMO** (Charge de Move) electrical interface for electric cars was developed in Japan and is now in cross-brand usage and can be found at every third charging station worldwide.

The aim is to charge electric vehicles at any power outlet. This means that different system types and protective measures can come into contact during charging. This requires careful coordination and implementation to ensure full electrical safety for users. A DC charging station is the method of choice for the fast charging of electric vehicles.

To guarantee electrical safety in the charging circuit, the DC charging station is set up as an unearthed DC power supply (IT system) complying to IEC 61851-23.

During charging, an insulation monitoring device (IMD) in the charging station monitors the entire charging circuit right up to the electric vehicle. The vehicle's IMD must be deactivated during this process.

Bender now offers, in addition to the CCS-compliant isoEV425, the new IMD isoCHA425 complying to the Japanese CHAdEMO charging standard for DC charging stations.



"A DC charging station is the method of choice for the **fast charging** of electric vehicles."



for the insulation resistance measurement. Partial resistances can be calculated from the total insulation resistance R_F and the faulty conductor ($R \%$). It is also possible to assign a detected fault or faulty conductor to an alarm relay via a menu.

The isoCHA425 is designed for a nominal voltage range between DC 50 V and 500 V. Single-pole insulation faults R_F are detected and reported within 1 second, two-pole insulation faults R_F (insulation fault R_F simultaneously between DC+/earth and DC-/earth) within 10 seconds. The maximum permissible system leakage capacitance C_e is 2 μF .

The device measures insulation resistance R_F and system leakage capacitance C_e to earth. It also measures the system voltage U_n between L+ and L- and the residual voltages U_{L+e} (between U_{L+} and earth), and U_{L-e} (between U_{L-} and earth).

The isoCha425 detects the faulty system conductor DC+/DC-, i.e. the distribution of the insulation resistance between the DC+ and DC- system conductors, from the minimum value of the nominal system voltage, and indicates this with a plus or minus sign

If the values R_F or U_n continuously exceed the response values activated in the "AL" menu for the period t_{on} , a message is output via the LEDs and relays K1 and K2 according to the alarm assignment set in the "out" menu. The operating principle of the relay (n.o./n.c.) and the fault memory can also be set there.

Device functionality can be checked using the test button "T". Parameters are assigned to the device via the LC display and the control buttons on the front panel; this function can be password protected.

The device can be parameterised via the BMS bus, e.g. via a BMS Ethernet gateway (COM465IP) or via Modbus RTU. ■

*Dipl.-Ing. Frank Mehling
BU eMobility Solutions*

INFO

More information: https://www.bender.de/en/products/insulation-monitoring/isometer_isocho425



INNOVATIVE PRODUCTS

NEW

Complex Connections
Made Simple
Made Safe



The New COMTRAXX® CP9xx alarm indicator and operator panel

Alarm indicator, operator and display panels build a bridge between personnel and installed technology. For example, they provide important visual and acoustic information in hospitals and medical locations.

With all the technology required in medical locations, such as operating theatres and intensive care units, the focus of the medical staff must be on caring for the patient. This requires an interface that is as intuitive and as simple to use as possible, as well as an easily accessible installation so that every user receives exactly the information they need – quickly and easily.

In addition, DIN VDE 0100 710 2012-10 requires that an acoustic and visual alarm system be provided in a suitable location for each IT system. This must be able to be monitored by the medical staff. At the same time, the wishes of the users must be taken into account, so that additional messages can be displayed, and operating elements can be controlled centrally.

Bender meets these requirements with the new COMTRAXX® CP9xx series. It provides an ideal overview of all connected systems at all times, alerts in the event of a fault and ensures convenient system control. Because the system is always in view, you can react to problems at an early stage.

CP9xx – the modular all-round system

The CP9xx is an alarm indicator and operator panel for medical locations. It is available in 7", 15.6" and 24" as a touch screen with a glass front. The glass can be easily cleaned and disinfected and thus meets hospital hygiene requirements.

Operation is intuitive via the touch screen. The buzzer, which is essential for alarm messages, is integrated in

the main board and can be set to three volume levels and acknowledged from any panel.

The visualisation is created using an integrated editor. Predefined widgets can visualise information, display switching states and trigger actions over a maximum of 20 different levels. It is just as possible to control surgical lights as to monitor battery-based safety power supply (BSV) systems.

Integrated inputs and outputs (IOs) are expandable. This does not require the IOs to be installed directly in the enclosure of the CP9xx; they can also be located centrally in the control cabinet. In addition, common interfaces such as KNX, Dali, ModBUS, etc. are supported.

The device offers the possibility to display alarms and messages in 24 languages, which can be set accordingly.

If the equipment has to be replaced due to conversion or expansion, there is no need to close the operating theatre for a long time. The CP9xx can be prepared outside the operating theatre. As it has a modular design and all connections are provided with coded plugs, the hardware can be replaced quickly and easily during a pause in surgical operations.

If the 24" variant is not large enough, the CP9xx kit can be used with a monitor with touch function. This makes it easy to implement customer-specific solutions.

The hospital solution for new construction and refurbishment

As shown in figure 1, functional units are required for the operation of operating theatres; these units consist of the CP9xx as an alarm indicator and operator panel, group 2 distributors with an ATICS® transfer switching device and IT system monitoring with insulation fault location via EDS, as well as controllers for operating lights, ventilation, blinds, etc.

Internal communication takes place via the Bender BMS bus.

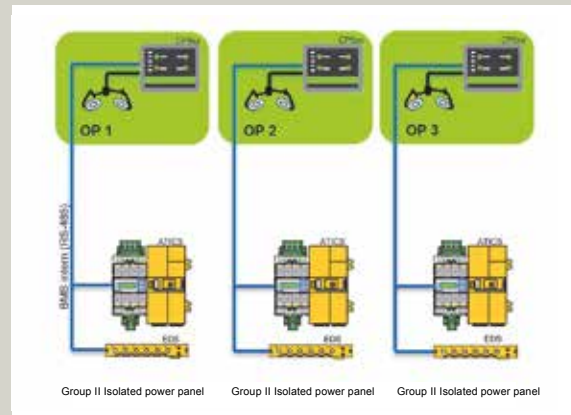


Figure 1: IT systems as an isolated solution for operating theatres

These functional units (see figure 2) are connected via Ethernet to form an intranet. Alarms and messages for an operating theatre can be displayed in the relevant rooms but can also be transmitted to and visualised at a central location, e.g. a nurse's station. Lighting, ventilation and other components can also be controlled centrally.

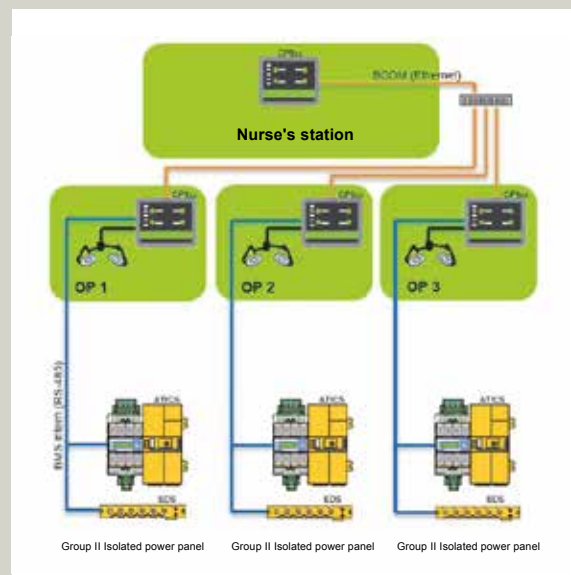


Figure 2: Merging the operating theatres with a central monitoring station

INNOVATIVE PRODUCTS

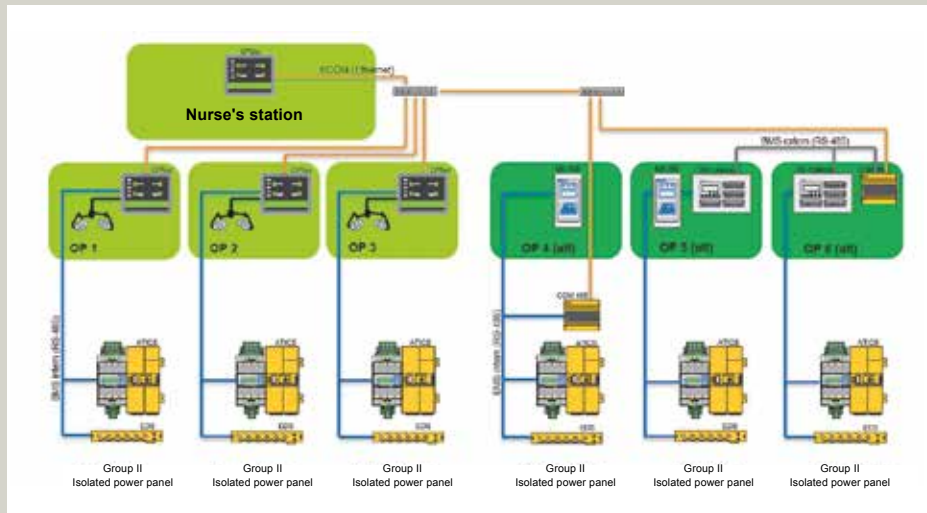


Figure 3: New construction solution merged with existing systems, communication via COM465 Gateway

▶▶▶ This representation of the entire bus system makes it possible to access all devices from any CP9xx and to query and display the required information.

No installation effort is required to expand and change the visualisation. All you have to do is customise the widgets and displays. System updates can be performed quickly and easily via the web application.

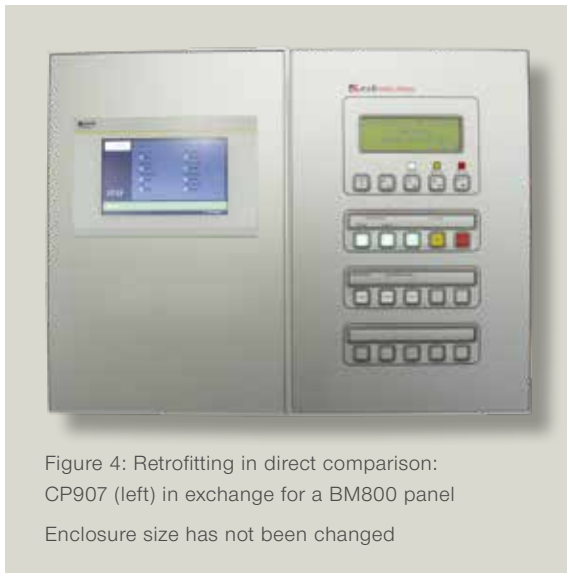


Figure 4: Retrofitting in direct comparison: CP907 (left) in exchange for a BM800 panel
Enclosure size has not been changed

Where a combination with existing control panels is planned, communication takes place via a separate gateway, as shown in figure 3.

Retrofitting

Existing systems with conventional TM panels can be retrofitted very easily in the course of retrofitting measures. A CP9xx including a monitor is implemented in the existing flush-mounted boxes and can be disinfected using an antibacterial-coated foil (see figure 4). Existing IO cards can still be used. ■

*Daniel König, B.Sc.
BU Hospital Solutions, Product Management*



INFO

More information: https://www.bender.de/en/products/operator-control-panels/comtraxx_cp9xx

INNOVATIVE PRODUCTS



Meeting normative requirements in insulation fault location using the EDS441-LAB

For more than 30 years, Bender has been the market leader and specialist for **solutions to locate insulation faults** in complex, isolated power supplies – generally referred to as IT systems.

Ranging from the portable insulation fault locating system PKA3000, the EDS systems EDS200, EDS1000 in a 19" rack, EDS470, and EDS460 and through to the current EDS440, these devices have already helped many system operators to locate insulation faults quickly and reliably. It is already evident that the EDS440 will continue the successful series. Even for large IT systems with high system leakage capacitances, the latest version, the EDS441-LAB, makes insulation fault location even more efficient and reliable.

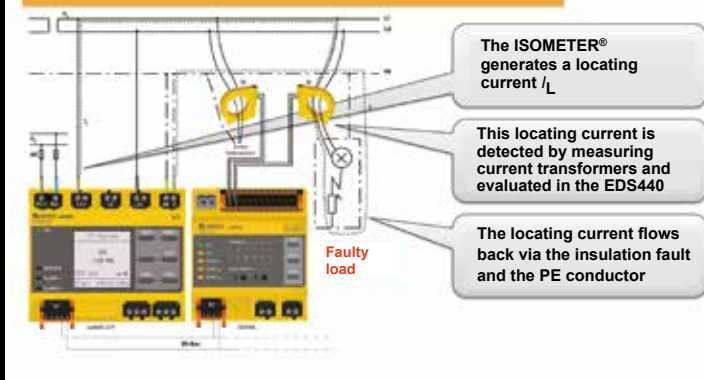
The IT system

IT systems have one great advantage: as set down in DIN VDE 0100-410 and section 411 of IEC 60364-4-41, a first fault does not automatic lead to a shut down of the power supply and thereby to a failure of the entire system. Complex processes and production procedures are then not subjected to unexpected interruptions. Instead, IT systems can continue to operate in a controlled manner and faults eliminated at an appropriate, later point in time. The basis for this are insulation monitoring devices, such as the ISOMETER® from Bender, which comply with the product standard DIN EN 61557-8 (IEC 61557-8). These monitor an



INNOVATIVE PRODUCTS

Principle of insulation fault location



Insulation monitoring device
ISOMETER® iso685



Measuring current
transformer

▶▶▶ IT system's insulation resistance to earth during normal operation and issue reports when the resistance falls below a certain value. The information can then be used to determine an appropriate time for insulation fault location. However, in complex installations and power supply systems spread over wide areas, insulation fault location can become a time-consuming and personnel-intensive undertaking.

This can be overcome by using insulation fault location systems complying with the product standard DIN EN 61557-9 (IEC 61557-9). These automatically search for insulation faults during operation and display faulty outgoing circuits. They are being used in a wide variety of applications such as in hospitals, power plants, industrial plants, offshore platforms and ships.

How does insulation fault location work?

The system basically consists of a locating current injector which is integrated in several ISOMETER® devices, e.g. the iso685-D-P, iso1685DP and IRDH575, and an insulation fault locator in conjunction with one or more measuring current transformers.

If an insulation fault occurs, the ISOMETER® issues a corresponding alarm message. A locating current for the insulation fault location is then immediately generated automatically and a search is started. Via the locating current injector and insulation fault, a closed circuit is created through which a mains voltage-dependent locating current flows. The locating current is detected by all measuring current transformers installed in this circuit and evaluated by insulation fault locators such as the EDS440. The fault can then be localised based on the assignment of the measuring current transformers to the circuits.

Insulation fault location for special requirements

But every measuring principle has its limitations. High-impedance insulation faults associated with large system leakage capacitances can not be detected in applications in very large IT systems, e.g. control systems in power plants. In a 220 V DC voltage system with 100 μF system leakage capacitance, an EDS440 is currently limited to approx. 10 kOhm maximum for localising insulation faults.

The high values for system leakage capacitances result from the sum of the laid cables and the EMC filters (EMC = Electro Magnetic Compatibility) required to suppress interference from loads.

There is also the normative requirement for use in power plants in Russia whereby insulation faults up to 20 kOhm need to be localised. Also required here is a limit for a maximum locating current of 1.8 mA which the locating current injector is allowed to generate. These requirements aim to ensure that sensitive control systems, such as differential protection for transformers in power plants, are not negatively affected by an insulation fault location system. In principle, these requirements can also be transferred to other applications, such as the monitoring of IT systems for sensitive and spatially very extensive PLC controllers. Conventional measuring methods and their corresponding products would not be sufficient for such systems.



The solution to the problem

These requirements were met by using the AC/DC sensitive measuring current transformers W...AB rather than the pulse current sensitive series W..., a modification of the EDS440 and the insulation monitoring device iso685-D-P. This required installing into the iso685-D-P the ability to generate a maximum locating current of 1.8 mA over a longer period to take account of the extended charging time of the large system leakage capacitance. At the same time, the

newly developed EDS441-LAB had to be capable of detecting and evaluating this locating current using the measuring current transformers W...AB. By using appropriate communication via the RS-485 interface (BS bus), it is possible to use the above combination of devices to locate significantly higher-impedance insulation faults at a relatively low maximum locating current of 1.8 mA. The result is a factor many times higher. In the same 220-volt DC voltage system with a 100 μ F system leakage capacitance, an insulation fault of approx. 250 kOhm can be localised. This represents improvement by a factor of 25.

A milestone in localising insulation faults in IT systems

This new measuring technology not only fulfils normative requirements but can now also be used wherever high-resistance insulation faults in high system leakage capacitances are to be localised requiring only a relatively low locating current. This is precisely the case in many sensitive control systems where ruling out faulty controllers is often an absolute requirement. Faulty operation of a controller caused by an insulation fault location system can have fatal consequences, e.g. in nuclear power plants, chemical production plants, trains and signalling systems. ■

*Helmut Becker,
BU Industrial Solutions, Product Management*

INFO

More information: https://www.bender.de/en/products/insulation-fault-location/isoscan_eds441



INNOVATIVE PRODUCTS



Insulation fault location in coupled systems

ISOMETER® iso685-D-P insulation monitoring device with **EDS44x** insulation fault locator and **IOM441** input/output module

With the **ISOMETER® iso685-D-P**, Bender is providing an innovative range of insulation monitoring devices which comply with state-of-the-art technology in terms of reliability, measuring methods, usability and design. In addition to performing the central function of continuously monitoring a system's insulation to earth, the iso685 version of the range offers many additional features which can help increase the level of safety even further, and save costs.

Insulation monitoring and insulation fault location

The larger the unearthed system (IT system) to be monitored, the more difficult it is to locate possible insulation faults. With the aid of automatic insulation

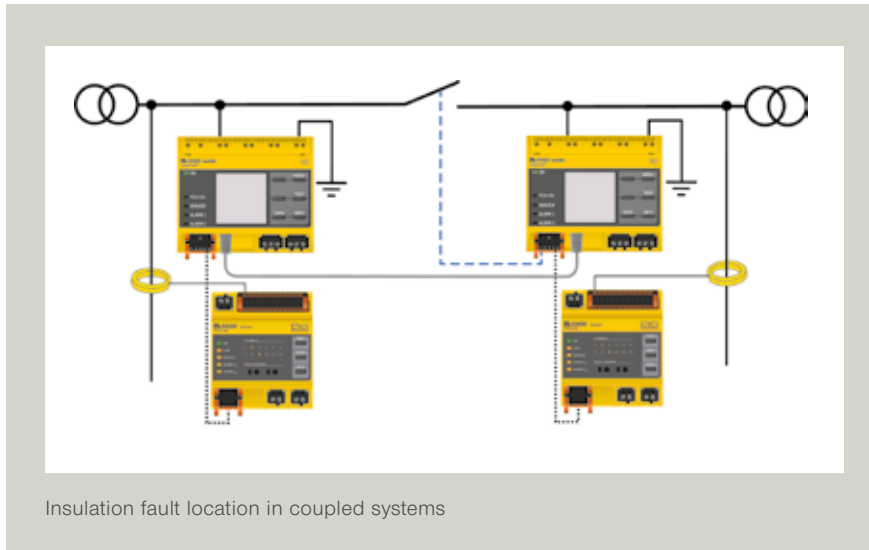
fault location systems, precisely this challenge can be addressed while the system is in operation. As a result, system availability is considerably increased while downtimes are minimized. Additional electrical components are required for insulation fault location systems.

The iso685-D-P version of the iso685 series can be used for systems with insulation fault location. A built-in locating current generator creates a limited locating current to earth when an insulation fault occurs. This locating current can be variably adjusted. With insulation fault locators from the ISOSCAN® series, this locating current can be assigned to a defective load using a measuring current transformer. The iso685-D-P communicates with the EDS440 and EDS441 insulation fault locators via an RS-485 sensor bus or

top-hat rail bus. All settings for the EDS44x devices can be operated and configured via the iso685-D-P web server. It is possible to configure the parameters for each channel separately or all channels at the same time.

for insulation faults is performed simultaneously on both sides of the coupling switch. In large systems with several ISONet participants, it can take several minutes for an iso685-D-P to be granted authorisation to measure, and subsequently to

perform the measurement. Any device in the ISONet group can be granted authorisation to measure and perform a manual insulation measurement, or start up manual insulation fault location, using the ISONet priority function. In the event of a disturbance in the ISONet system, communication errors can be assigned to a relay in order to receive a message.



... in coupled systems

The iso685-D-P insulation monitoring device can also be used in applications with coupled systems. Thanks to the EDSsync function, all iso685-D-P devices in a group and consequently also all EDS devices connected to it participate in the insulation fault location. This function is independent of whether the insulation monitoring in the coupled systems is performed via ISONet or by the disabling of a digital input.

EDSsync function

With the ISONet function, in the example illustrated above, both iso685-D-P devices measure alternately one after the other, completely irrespectively of whether the coupling switch between the systems is closed or open. There is no need for elaborate wiring of an auxiliary contact on the coupling switch. If one of the two devices detects an insulation fault, it automatically switches to insulation fault location operating mode. When the EDSsync function is activated, a search

ISOloop function

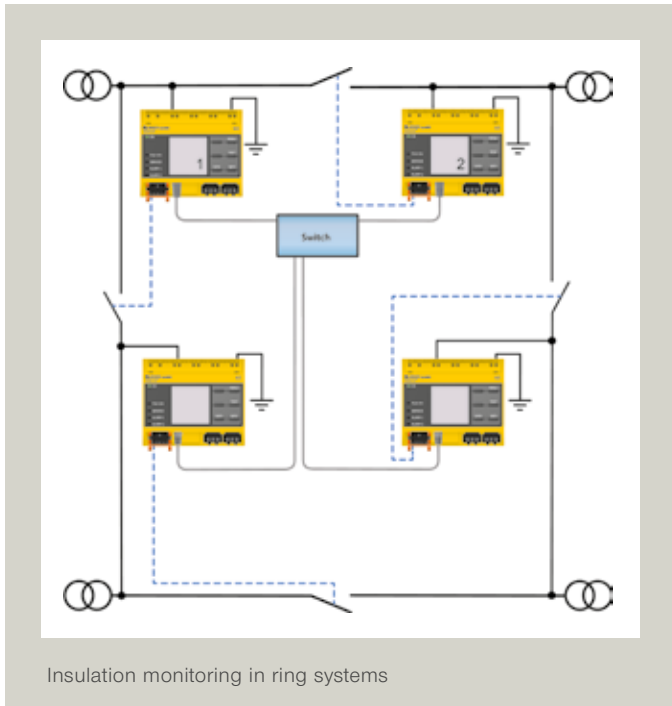
If the iso685-D-P device is disabled by a digital input, permanent insulation monitoring is carried out on both sides. One of the two insulation monitoring devices will only be disabled if both systems are coupled. This ensures a short insulation resistance measuring time and rapid insulation fault location in the event of a fault without a time delay.

Ring systems are regularly used aboard ships. To ensure short measuring times and rapid insulation fault location here too, disabling via a digital input is often selected. These systems have a special characteristic: the ISOloop function can be activated to ensure insulation monitoring and insulation fault location even if all coupling switches are closed. If all coupling switches are closed, one iso685-D-P always remains active if the ISOloop function is activated. There is no need for an elaborate control system via a PLC. The insulation monitoring devices must simply be connected via



INNOVATIVE PRODUCTS

- ▶▶▶ Ethernet and have their parameters configured. This ensures that even insulation faults in loads that are only switched on briefly can be detected.



IOM441 input/output module

Up to 50 EDS can be connected to an iso685-D-P. By combining EDS44x with the IOM441 input/output module, a potential-free contact can be made available for each EDS44x measurement channel. This enables messages to be generated or outputs with unimportant loads to be disconnected so that the IT system can maintain high availability for important loads.

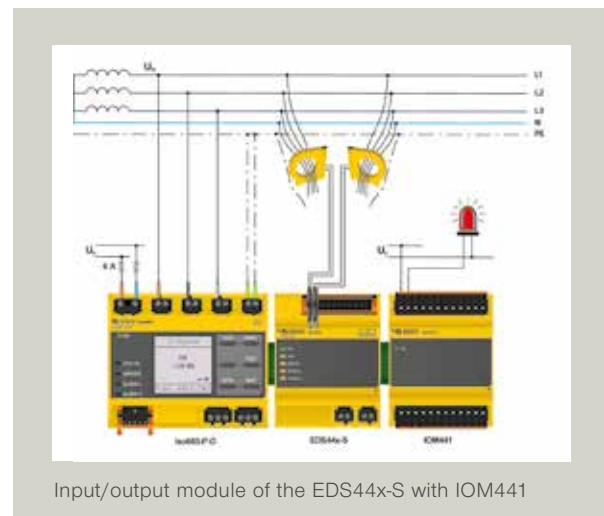
Plain text messages simplify the search

New measuring methods also make it possible to locate high-impedance faults with high system leakage capacitances and low locating currents. The faulty channels are indicated on the display of the iso685-D-P and can be replaced by plain text messages. For example, in the event of an insulation fault on a motor, the message "Insulation fault compressor 1" could be displayed. This allows fault location without having to study a wiring diagram, further facilitating insulation fault location.

Communication

The iso685-D-P can communicate via Modbus TCP, Modbus RTU and isoData. If the iso685-D-P is used together with an EDS44x-L, communication with a higher-level control system must take place via Modbus TCP. In DC systems, the iso685-D-P can be triggered and issue a prior warning if a DC zero sequence voltage to earth is measured. The corresponding response values for this prior warning and the shutdown can be adjusted in 5 V increments. ■

*Dipl.-Ing. Jörg Irzinger
BU Industrial Solutions, Product Management*



INFO

More information: https://www.bender.de/en/products/insulation-monitoring/isometer_iso685-p

Parking and refuelling at the same time

– more dynamics for e-mobility

CONCEPT

“solar filling station Euskirchen”

A parking deck on two levels, which simultaneously functions as a large solar filling station with 32 fuel pumps for electric cars, was built at the end of 2017 in the city centre of Euskirchen. The owner of the multi-storey car park is Euskirchener Baugesellschaft mbH (Eugebau). ▶▶



TECHNICAL APPLICATION

In a first step, 17 parking spaces were given a ceiling e-charging point.

The cable run for the remaining parking spaces in the basement has already been provided by means of an empty conduit system. 12 further outdoor parking spaces on the property in front of the building are also equipped with e-charging points.

The futuristic main feature of this lighthouse project is the total of six LS4 e-charging stations from the Swedish company GARO AB, each with two charging points that draw attention by means of LED strips. The stable aluminium columns in the outdoor area have a charging power of up to 2 x 22 kW. This multi-storey car park is not only one of the largest solar filling stations for electric vehicles in North Rhine-Westphalia. According to the clients, this construction project will also play a leading innovative role nationwide.

Solar-protected and sustainable

In regards to power generation, they were relying on sustainability: The electricity for charging the vehicles partly comes from the solar system on the green roof of the multi-storey car park. The supply is supplemented by green electricity from 100 percent hydropower. If no vehicle is charging, the current is fed into a stationary intermediate battery storage. Only when this is fully charged is excess energy fed into the grid.



The advantage of the ceiling charging points above the individual parking spaces is that, in contrast to a classic charging station, they are not physically damaged by vehicles and can above all be used in a way that they save space and costs. The parking area can be fully utilised.

22 kW ceiling-charging station LEVIAMP

The ceiling-charging stations LEVIAMP from EASYCHARGE.me GmbH installed in the multi-storey car park do not differ that much visually from the larger,

oval ceiling lights of the garage. The 180 degree-swivelling charging arm, on which the socket is located, conveniently and flexibly reaches all charging devices on all types of electric vehicles. After use, it can again easily and compactly retract under the ceiling.

All charging points in Euskirchen can deliver up to 22 kWh. However, since almost all electric cars can currently only charge up to 11 kW, the high charging power means that the infrastructure of this project is future-proof for the next few years. The charging points are interconnected with each other via a controller, which can be used to control the delivery of current from each individual charging station. This dynamic load management enables the intelligent distribution of the total output, so that a normal grid connection of 80 kW is sufficient to serve the vehicles refuelling with electricity.

Bender controls and monitors

The core of the LEVIAMP ceiling-charging solution and also of the LS4 charging station in the outdoor area is the CC612 charge controller from Bender Co. KG, which monitors the internal hardware of the respective charging system. Due to its compact design and size, the charge controller fits seamlessly into the design of LEVIAMP and LS4. The CC612 Charge Controller, which can also be used (as a product variant) in other charging systems such as meters, user interface

modules or sockets, impresses with its sophisticated technology and meets all modern charging control requirements. Various back-end systems can be easily connected via the open communication protocol Modbus. Since most back-end providers work strictly according to the Open Charge Point Protocol (OCPP), the charge controller is compatible with OCPP 1.5 and OCPP 1.6. The charge controller supports the mobile radio standards 2.5G-Edge and 3G-UMTS, therefore guaranteeing reception all over the country and high data transmission rates. WiFi interfaces provide access to home applications. Local configuration and software updates can be conveniently made via other interfaces. With Power-Line-Communication (PLC), the charge controller has a trend-setting technology to automate "Plug & Charge", load management or "Vehicle-to-Grid (V2G)" applications.

Participating companies – together into the future

Completion of the project was made possible in cooperation with the Berlin start-up companies and Bender partners Ebee Smart Technologies and PlugSurfing GmbH, among others. Ebee Smart Technologies supplied the charging points, PlugSurfing GmbH the billing system. If you want to charge your electric car in the parking deck or in front of it, all you need do is register beforehand. The electricity bill is settled via PlugSurfing GmbH. The kilowatt hour costs 30 cents.

Every company involved in this project was and is absolutely determined to develop further. From a technical, commercial and legal perspective, new ground was broken. In addition to parking stations on the roadside and the domestic garage, multi-storey car parks such as these offer great potential for the expansion of the charging infrastructure and the electric mobility age. The car can be conveniently "refuelled" with electricity while the driver is working or shopping. And the combination of e-mobility and green electricity - with "sun in the tank" - makes driving truly environmentally friendly. ■

*Michaela Heck M.A., textwerk
Marita Schwarz-Bierbach, Marketing Communication*



S.A.F.E Initiative

The S.A.F.E Initiative, which was originally founded by the Physikalisch-Technische Bundesanstalt, has already been joined by 30 companies, including several charging station manufacturers.

The aim of S.A.F.E is to make the charging of an electric vehicle at the charging station legally secure (in compliance with calibration law). The key topics are:

- **the encryption in the counter**
- **a transparency software**
- **the type-examination certificate.**

The Austrian company has-to-be and ebee Smart Technologies from Berlin, a subsidiary of the Bender Group, is involved in the development of the transparency software. This manufacturer-independent transparency software for electromobility makes it possible to carry out the signature checks for digital measured values in compliance with calibration law.

Benefits of the transparency software:

- Customers receive a transparent and forgery-proof invoice.
- Manufacturers of charging stations use them to carry out conformity assessment procedures.
- This enables the calibration authorities to carry out their calibration checks with absolute certainty.



TECHNICAL APPLICATION

MEGGIE

Rank 346
of the TOP500 list November 2016

511.1 TFlop/s Rpeak

728 Nodes total

1456 CPUs Intel Xeon E5-2630v4
10C 2.2GHz (Broadwell)
14560 Cores

1344 TB Parallel Storage
based on Intel Enterprise Lustre

Residual current technology in everyday university life

More security, maximum availability and cost-effectiveness
in data centres



Friedrich-Alexander-University (FAU) Erlangen - Nuremberg, Germany

The Friedrich-Alexander-University (FAU), located in Erlangen-Nuremberg, Germany, is one of the largest, research-focussed and internationally oriented universities in Germany. The university was named after two noblemen: the Franconian margraves: Friedrich von Brandenburg-Bayreuth, who founded the university in 1743, and Karl Alexander von Brandenburg-Ansbach, who significantly promoted the university.

Today, the university consists of five faculties, has more than 14,200 employees, about 4,000 academic staff, including 579 professors and has almost 40,000 students. The university is the third largest of its kind in Bavaria, and thus about the tenth largest university in Germany. For historical reasons, the University's locations are spread over the neighbouring cities of Erlangen and Nuremberg, with about two-thirds of students studying in Erlangen and one-third studying in Nuremberg.

In the 2017/2018 winter semester there were 39,780 students. Of these, 19,663 were female students; 4,890 students come from abroad. Currently, FAU offers 265 degree programmes, providing a comprehensive range of subjects, of which 80 are Bachelor's programmes, 94 Master's and 91 State examination programmes (e.g. teaching, law, medicine).

New standards and regulations for data centres require that new approaches must be taken in many places. Steadily increasing performance requirements, the unrestrained increase in energy demand, but also economic aspects nowadays only allow the operation of a state-of-the-art data centre. The trouble-free power supply has become of crucial importance. When using continuous monitoring of the electrical installations, disturbances or even failures can be detected and avoided well ahead of time. The technical managers at the Regional Data Centre Erlangen (RRZE) have recognised the challenges and are therefore using technology provided by Bender.

What does the standard say?

The relevant standards for electrical engineering (among others DIN VDE 0100 444: 2010-10) and also the new standard EN 50600-2-2: 2014 require that TN-S systems be used exclusively in data centres. In the publications on the standards and specifications as well as on the IT baseline protection developed by the BSI (Federal Office for Information Security), the importance of an EMC-compliant installation is always stressed in this context in order to avoid disturbances from stray currents and damage to devices and conductive building components. The fundamental basis, without which all further measures are futile, is a power supply system designed as a TN-S system with a central earthing point.

TN-S systems are of the essence

With regards to TN-S systems, DIN VDE 100, part 444.4.3.2 states: "Installations in new buildings must be set up as TN-S systems from the point of supply. In existing buildings which contain or will probably contain important IT¹⁾ resources and which are supplied by the public low voltage distribution system, a TN-S system should be set up from the start of the installation system."

With older systems (TN-C, TN-C-S)²⁾, conversion to a TN-S system is necessary (fire risk, protection of material assets, protection of people etc.). Furthermore, the orderly condition of the new installation must be maintained on a permanent basis, as even an unintentional bridge between an N and PE conductor can result in unforeseen disturbances.



Following the entry into force of the new EMC guidelines 2014/30/EU, the stricter specifications have been binding since 20 April 2016 at the latest.

Using residual current monitoring to implement the guidelines

Truly reliable statements as to what is happening in the power supply can only be made by permanently monitoring and analysing the power supply. Various values are thus measured in real time at essential nodes in the power supply and recorded for subsequent evaluation. When using these measured values, experts can draw additional important conclusions as to the operating condition of the TN-S system. Uncontrolled residual currents (leakage currents and fault currents due to insulation faults) can impair the system and operational safety.



¹⁾ IT stands for information technology and comprises all technologies relating to electronic data processing.

²⁾ TN-C: The functions of the neutral conductors and the protective conductors are combined in a single conductor in the entire system.

TN-C-S: The functions of the neutral conductor and the protective conductor are combined in a single conductor in one part of the system.

TECHNICAL APPLICATION

▶▶▶ Using residual current technology and POWERSCOUT® in practice

Accordingly, the RRZE uses residual current technology from Bender to record energy consumption and residual currents in a large number of installations.

The objective is:

- To make the energy consumption and process transparent and evaluate them.
- To adjust, evaluate and monitor the changes in the leakage currents in the system correctly and precisely.
- Ensuring the electrical availability.
- Reducing the time and money required for periodic verification as per the German Social Accident Insurance (DGUV) specification 3.
- A standard-compliant operation without RCD using the RCMS residual current monitoring system and the necessary administrative measures.

All of the above does not happen by itself, this type of system monitoring represents a complete change in the way an electrical system is operated. The RRZE is therefore joining forces with Bender to become more and more secure, efficient and fail-safe in the future.



INTERVIEW

We* conducted an interview with Dipl.-Ing. (FH) Stephan Heinrich, who has been working for RRZE for 20 years. As Head of RZ Domestic Engineering, he is responsible for the operation of the central computer rooms.

Mr Heinrich, how do you describe your realm of responsibility?

The RRZE is the IT service provider for Friedrich-Alexander-University Erlangen-Nuremberg (FAU). My role at the RRZE is to ensure the stable operation of the central computer rooms.

One of the challenges is to always adapt the 40-year-old infrastructure (electricity, cooling, fire safety) to current requirements.

In the field of electrical supply, for example, in the past you only had a few "thick" power connections for mainframes. Today, we have well over 500 circuits for the holistic system and system components in the 19" racks.

Mr Heinrich, what does FAU claim regarding electrical safety in its server rooms?

In the past, the usual protective devices for personal and fire safety were sufficient, since there were only a few fixed connections in the computer room. Due to the change to a system consisting of many individual hardware components with "normal" connectors, the

* This interview was conducted on 10 October 2017 by Matthias Niedermann (Technical Office Nuremberg) at FAU.



conditions for the operation have changed. Adapted fire extinguishing systems and safe power supply are therefore a must. In addition to the compliance with the regulations, the safety of employees is our top priority. However, the nearly 100% required availability of a data centre must not be overlooked.

For uninterrupted availability, in accordance with the applicable standards/regulations, new systems have now been set up. What are these new systems?

The permanent RCM measurement was set up as a solution for the manual DGUV-V4 measurement, as well as POWERSCOUT® for an uninterrupted recording and visualisation of all RCM measured values in terms of power quality.

What were your motivations for establishing a permanent RCM measurement?

First and foremost, we were concerned with the fulfilment of the VDE and DGUV requirements and, above all, the personal protection. For system and fire safety, a measurement of the insulation resistance of all cables and lines is required at regular intervals. In a modern data centre like ours, however, it is no longer possible to shut down the power supply and, of course, it is not desired. Therefore, a new approach must be taken. The permanent monitoring of the systems increases the availability of the overall system. And what's there now

is normative compliant personal protection even without RCDs.

What aspects were important to you when deciding on this solution?

On the one hand the sound legal certainty with regard to fire and personal protection, on the other hand the extensive monitoring, with the help of which long-term processes and dependencies can be conciliated with other events. Only the constant recording and documentation as well as the continual access to the system ensure legal certainty, since we do not have an automatic fire extinguishing system yet.

The variant that is being used now also offers a mixture of other benefits, for example, automated monitoring over 365 days/24 hours a day. This will provide us with a prompt error display and message as soon as there is a disturbance; as well as the extensive evaluation and documentation of the measured values.

In addition, the measuring technology used is a one-off acquisition cost that can be easily calculated and amortised.

What experiences were you able to collect during those first few weeks and months?

I now see all the changes since they are automatically recorded and any abnormalities immediately lead to an automatic message. This way, even small disturbances can be detected early and do not cause a failure. Errors that do not constantly occur might not have been noticed otherwise. However, they are now detected by permanent measurement.

How would you describe the system?

Were your expectations fulfilled?

Our expectations were met 100%. First and foremost, we were concerned with the detection of residual currents. Thanks to the visualisation with POWERSCOUT®, all individual residual currents can now be assigned to further events with a uniform time. If the values are exceeded, a simple tracing of the causes is possible. This makes the evaluation of error and mapping much easier now. Therefore, we will include additional computer rooms at FAU in the monitoring process in the future. ■

*Peter Eckert, BU Industrial Solutions, Segment Management
Matthias Niedermann, Technical Office Nuremberg*

Hightech

in a confined space

Das PRIOR 1 Smart Cage – now even safer with Bender technology

PRIOR1 GmbH is the expert for all questions relating to reliable and safe data centres. The 60-strong company with its headquarters in Sankt Augustin and further subsidiaries in Berlin, Munich, Karlsruhe and Westerburg, not only specialises in the planning, construction and equipping of data centres and server rooms.

PRIOR1 also supports its customers when it comes to optimising operations and strategies relating to outsourcing and colocation. Moreover, network planning, certifications, workshops and, for example, fine dust and energy efficiency analyses, also form part of the company's field of activity. At the same time, the company's own assembly and service team works to ensure the fail-safe operation of IT infrastructures. Thanks to many decades of experience, the company is able to identify tailor-made solutions for its customers. Data centres are equipped as turnkey solutions by PRIOR1 GmbH acting as either the general contractor or client's representative for, amongst other things, room-in-room systems, containers, air conditioning and fire safety.

Small data centres offering maximum flexibility

There is ever-growing demand for mini data centres. In industrial and production facilities, for example, they can be set up directly next to machines where they serve to minimise losses of time and security. In small companies they offer a space-saving way to guarantee IT¹⁾ security.

With the Smart Cage PRIOR1 has designed a solution with which valuable space is not filled with racks but with height units and can be adapted to its surroundings. High server and packing density in a compact area can be used wherever IT demands are high yet only minimal space is available.

Features:

- Unlimited flexibility
- Scalability, can be adapted to meet changing needs
- Integration in any room environment
- Electrical and cooling supply can be expanded upwards without restrictions
- All degrees of redundancy possible.

The **19" PRIOR1 Smart System** can be integrated in any given room structure and can be adjusted to meet the specific requirements. All the requirements for a data centre are satisfied, from the redundant air conditioning and energy supply through to tailored security technology.

A very low inherent weight is achieved thanks to the lightweight construction made of aluminium profiles. The structural design makes customised solutions possible. Cable management components, PDU strips and other accessories are all included in the Smart Cage. Innovative air-conditioning base plates can be integrated anywhere in the system layout.

Highly complex room utilisation is possible given the intelligent composition of various technical solutions (air conditioning, UPS, server housing system etc.).

Reliability thanks to Bender technology

To ensure the reliability, maximum availability and cost-effectiveness of such a modern EDP system, which is a must for the majority of companies, an interruption-free power supply is vital, as even brief interruptions of just a few milliseconds can have serious and far-reaching consequences. This not only comprises safeguarding via appropriate redundant supply channels, emergency generating units and UPS systems, but also the complete cabling infrastructure. However, first and foremost, the indispensable basis for fault-free functioning and operation of the necessary support systems is an EMC-safe power supply.

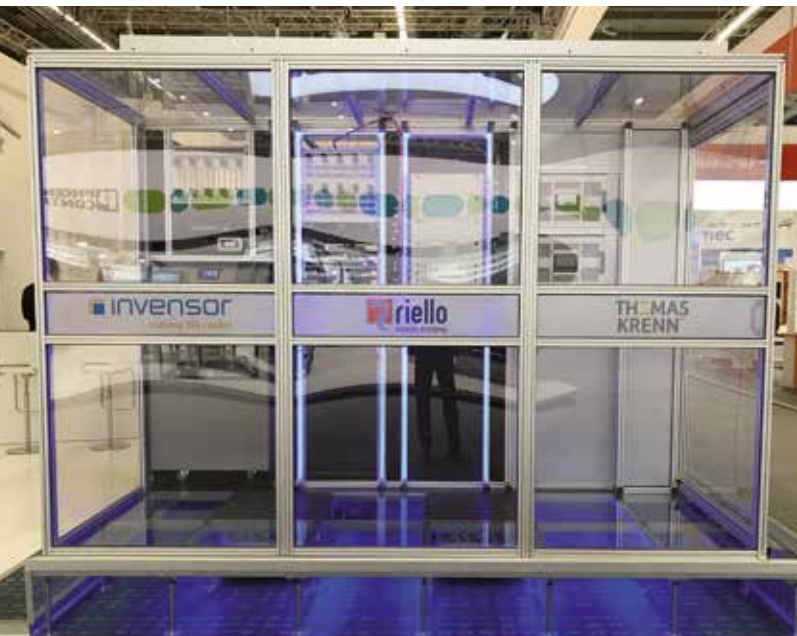


The basis for high availability and safety

In accordance with EN 50600-2-2:2014 and DIN VDE 0100-444:2010-10, only TN-S systems are to be used in data centres. In the publications on the standards and specifications as well as on the IT baseline protection developed by the BSI (Federal Office for Information Security), the importance of an EMC-compliant installation is always stressed in this context in order to avoid disturbances from stray currents and damage to devices and conductive building components. The fundamental



¹⁾ IT stands for information technology and comprises all technologies relating to electronic data processing.



▶▶▶ basis, without which all further measures are futile, is a power supply system designed as a TN-S system with a central earthing point.

With regards to TN-S systems, DIN VDE 100, part 444.4.3.2 states: "Installations in new buildings must be set up as TN-S systems from the point of supply. In existing buildings which contain or will probably contain important IT resources and which are supplied by the public low voltage distribution system, a TN-S system should be set up from the start of the installation system."

With older systems (TN-C, TN-C-S)²⁾, conversion to a TN-S system is necessary (fire risk, protection of material assets, protection of people etc.). Furthermore, the proper condition of the new installation must be maintained on a permanent basis, as even an unintentional bridge between an N and PE conductor can result in unforeseen disturbances.

Following the entry into force of the new EMC guidelines 2014/30/EU, the stricter specifications have been binding since 20 April 2016 at the latest.

Implementation with Bender residual current and energy monitoring

The technical managers at PRIOR1 have recognised the challenges faced and have employed Bender technology in the Smart Cage to record residual currents and monitor energy in the electrical distribution. With installation in the electricity distribution and at the central earthing point in conjunction with a COMTRAXX[®] gateway solution, a central system for monitoring and control as well as simultaneous administration of alarms and documentation has already been able to be implemented at several sites.

A reliable statement regarding the state of the power supply is only possible via a continuous system monitoring and analysis. Various values are thus measured in real time at important nodes in the power supply and recorded for subsequent evaluation. These measurements enable further important conclusions to be drawn as to the operating condition of the TN-S system. Uncontrolled residual currents (leakage currents and fault currents due to insulation faults) can impair system and operational safety.



"The RCM solution replaces the RCD and prevents planned shutdowns due to necessary tests as well as unplanned shutdowns due to errors in the loads."

With this system monitoring, it is possible to readjust, assess and track the changes of the leakage currents in the system professionally and correctly, to ensure electrical availability and also detect and analyse utilisation and consumption on a permanent basis.

Furthermore, the technology used effectively reduces the time and money required for periodic verification as per the German Social Accident Insurance (DGUV) specification 3 and enables standard-compliant operation without RCD with RCM and the necessary administrative measures.

After all, if an RCM is used on a granular basis, the use of RCDs as per DIN VDE 0100-410:2007-06 is not necessary. The prerequisite here is the development of a reporting chain and timely troubleshooting by an electrician.

Big demands on the mini format

For PRIOR1's customers the maximum availability of this small, compact data centre is an important success factor. This requires the highest degree of electrical safety in the power supply. The permanent monitoring of safety-relevant circuits for fault, residual and operating currents as well as stray currents generates information at an early stage on looming critical operating conditions and thus avoids potential failures.

On the one hand, the Bender solutions allow the status of all system components to be monitored in real time without having to switch the systems off, for example, potential insulation faults or PEN bridges can be detected early in the TN-S system in order to guarantee the highest possible level of reliability. On the other hand, this allows the user to monitor the electrical system remotely during operation, to assess any changes which occur and also detect disturbances in good time in order to provide data quickly and reliably to make a decision in case of a fault.



CONCLUSION

With the multi-channel residual current monitoring system and energy measurement, fault and residual currents, operating currents, stray currents and currents in N and PE conductors can all be monitored at key points of the power supply sensitive to alternating, pulsating and universal currents. The RCM solution from Bender replaces the RCD and prevents planned shutdowns due to necessary tests as well as unplanned shutdowns due to errors in the loads. This, in turn, makes an essential contribution to ensuring the high availability of the power supply and also reduces IT expenses and maintenance costs. ■

*Peter Eckert
BU Industrial Solutions, Segment Management*



TECHNICAL APPLICATION

Proven electrical safety technology is now finding its way to Singapore as well



Singapore, an island and city-state, is one of the wealthiest countries in the world. Singaporeans are among the wealthiest people in the world. This is one of the reasons why about 5.6 million people can be offered medical services at the highest attainable standard. Furthermore, huge modernisation projects in the healthcare sector are taking impressive shape in Singapore – and this also raises the level of building safety technology. The advancing normalisation of safety standards, also on an international level, requires reliable and standardised safety solutions in the areas of systems technology and building services engineering.

"Complex information for a user can be displayed **simply and clearly.**"

As part of a complex reconstruction and modernisation programme at the Mount Alvernia Hospital in Singapore, state-of-the-art supply and power system protection technology was introduced, which reliably ensures the safety of humans and equipment, even in a highly sophisticated electronic environment.

Thus, the Mount Alvernia Hospital Singapore is part of a number of large and significant projects undertaken by Bender GmbH & Co.KG and Bender Solutions GmbH & Co.KG in Singapore. Others include the "National University Hospital", the "Sengkang Community Hospital", the "Changi General Hospital", the "Ng Teng Fong General Hospital", the "NCID Hospital Singapore" and the "Khoo Teck Puat Hospital", all of which were completed over the past 10 years. The associated safety standards for the power supply must be met, as must the demands on the highly complex medical electronic equipment and devices.

History of the hospital

The Mount Alvernia Hospital is Singapore's first private and sole charitable Catholic hospital providing acute care services. The hospital was officially opened with 60 beds on 4 March 1961. Today, the hospital is a 304-bed general acute care unit with tertiary medical capabilities (including rehabilitation) and two multi-disciplinary medical specialist centres. The hospital is supported by over 1,200 accredited doctors, with more than 170 specialists located on the campus. Being a charitable organisation, the annual fiscal surplus of the hospital is channelled back into the development and expansion of the hospital and supports the Assisi hospice and community outreach activities.

Sustainable partnership

With the engagement of German companies, the modernisation of medical facilities has become a tradition in Singapore. The invaluable experiences that have

been gained with German engineering, German planning skills and German know-how are again and again a determining criterion for the inclusion of German companies or German technology when it comes to modernisation projects in the healthcare sector in Singapore.



By the end of 2017, another state-of-the-art surgical department with a total of four operating theatres was brought into operation in Singapore. The new surgical unit, which was completed in just one year of construction after complex reconstruction, supplements the hospital with modern diagnostic and treatment functions for the various medical disciplines.

Strong together

– Protection in sensitive environments

In addition to the use of the latest architecture and medical technology – which is provided by renowned German manufacturers such as MAQUET, the HT Group, etc. – the BENDER Group is participating in the new building, providing a total of 10 IT systems for protection and monitoring solutions in the building technology. In addition to isoMED427P-2 series insulation monitoring devices, IT system transformers of the ES710 / 8000S or ES710 / 3150S series and AN450 series PSUs (Power Supply Unit), EDS151 series insulation fault locators were also used. The completion of the control rooms was made directly in Singapore by a long-standing Bender partner, the Eetarp Engineering Group.



TECHNICAL APPLICATION



“The **hygienic design** of the panels is based on a touch-sensitive surface solution (TCP).”

▶▶▶ Surgical Control Panel (SCP) – The technical monitoring centre

The highlight in each of the four operating theatres are the surgical control panels (SCPs), developed by Bender Solutions GmbH & Co.KG. The hygienic design of the panels is based on a touch-sensitive surface solution (TCP). Complex information for a user can be displayed simply and clearly on the graphic interfaces between human, medical device, building services and electrical safety technology, all provided by Bender. This applies in particular when critical operating situations arise.

The SCP panel offers diagnostic capabilities through a complete system overview from a central location via a web browser, supported by data loggers and history memories.

Moreover, parameter settings (the definition of limit values, entry of individual customer texts, editing of the system configuration, etc.) is possible.

In addition to the integration of external hardware such as time display and timer, nurse paging system and operating theatre light controllers, the monitoring, operation and display of IT systems in the panel, the integrated I/O system (input/output system) offers numerous options for the integration of digital and analogue I/Os with different operating voltages, power, measuring signals or special functions. This affects, among other things, supply systems for medical gases, HVAC systems, room lighting, special power supplies such as UPS (Uninterruptible Power Supply) and history functions.

Communication with facility management systems, such as BACnet, is also possible via common interfaces.

The example of the Mount Alvernia Hospital Singapore is a testament to the complex requirements of building technology coupled with modern engineering science for electrical safety. By applying the engineering expertise of the BENDER Group, which is always focused on its customers' demands, there is a solution for every challenge – not only in the healthcare sector. ■

*Dipl.-Ing. Thomas Gans
Sales Hospital Projects*



Seminar

NEWSWORTHY +++ SEMINAR ANNOUNCEMENT +++



CONFERENCE

13. - 14.02.2019
TÜV Süd Munich

Electrical safety in hospitals

A reliable power supply for operating theatres and intensive care areas **is a must for every hospital.**



In cooperation with **Bender GmbH & Co. KG, TÜV Süd** is offering a two-day event focussing on this topic in Munich in February 2019.

A safe, reliable and efficient power supply is a basic requirement for smooth and economical operation in the medical sector. A safe, reliable and efficient power supply is a basic requirement for smooth and economical operation in medical locations. At the same time, the power supply in these areas must conform to the respective standard. The conference is aimed at technical managers and electricians in hospitals and clinics, those responsible for hospital operating technology, planners and medical device manufacturers.

The topics include safety technology and regulatory questions concerning the unearthed power supply – (IT system) in hospitals and outpatient surgical centres. Operators, planners and manufacturers, as well as the TÜV Süd experts will present practically proven concepts.

The conference “**Reliable power supply for operating theatres and intensive care areas**” is scheduled for the **13th and 14th February 2019**. The event will be held at **TÜV Süd, Chiemsee conference room in Westendstrasse 199, Munich 80686**.

More Information

You can find further information about this event, the conference programme and how to register at www.tuev-sued.de/akademie-de/congress/netztechnik-funktionale-sicherheit/stromversorgung-op-intensiv-1



Secure your seat at the conference. Should you have any further questions, please do not hesitate to contact the TÜV Süd Akademie team. ■

*Marita Schwarz-Bierbach
Marketing Communication*

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Worlds of Data, Brainstorming, Discussions



TechDay 2018 at Bender

„ConneCted“, was the motto of the first Bender TechDay, which took place on 20 June 2018, in the Isodrom in Grünberg. It was the first event of its kind and was a success; guest speakers, Bender employees and colleagues from ebee from Berlin actively exchanged views on current solution concepts and how to achieve them through seminars, specialised topics and presenting gadgets and tools.



At the opening, guest speaker Karel Golta (Indeed Corporation) called on the participants to “reach for the stars”. To want to achieve the virtually impossible and go to places you’ve never been before is the key to success, according to Karel. “One method for driving innovation in a company is so-called ‘Moonshot Thinking’ – a concept that can be traced back to a vision of John F. Kennedy. In 1961, Kennedy made his aim of sending a man to the moon within the next ten years public. Neil Armstrong made that a reality on 21 July 1969”, said Karel. Moonshots are similarly large, new projects – always aiming to improve life, even to revolutionise it. Only thanks to the courage of many discoverers and visionaries to try something new, to develop “mad” ideas and finally to invent new technologies, can there be other fields of business and real innovations. And this day – in particular, the presentation of various tools developed by employees – demonstrated that such courage, curiosity and hunger for the unknown involves many surprises.

From long-term measurements and device diagnostics ...



For example, a tool for long-term measurement, developed by Matthias Becker, is Java-based and allows many digital and analogue signals to be recorded, processed and displayed with a PC via USB. The program was originally developed for his own needs. However, Becker quickly noticed that it was perfectly suited for monitoring the many channels of the ATC500. He now provides it to interested colleagues.

Ulrich von Waldow's tool enables developers to do what is already done in manufacturing and the testing system: device diagnostics via a built-in CAN interface with, when specifying the name of the variable, the option of reading out the variable for the running time from the device. The Python client he programmed enables connection to Bender devices via the so-called UDS protocol. This allows authorised storage areas (RAM) of the microcontroller to be read and even written to during operation.

... to programs for measuring technology microcontrollers and modular testing systems

Michael Sylla and Carsten Hartmann demonstrated, for example, how you can create a program for measuring technology micro controllers using the Matlab Simulink graphic program interface.

The modular testing system presented by Thomas Burk and Florian Wranik provides a construction kit for test setups which allows tests for new devices or functions to be created more quickly based on existing tests.

... and the smart home

Manfred Nicklas presented an expanded form of home automation: with his program, any noticeable behaviour at home is alerted thanks to status alarms on doors and windows. When a smoke alarm goes off, all blinds in the house will go up and the lights will be turned on so that everyone can get out quickly if there is a fire.



Spreading knowledge

Guest speaker Gretta Hohl made a holiday suggestion of a different kind: travelling and teaching. The IT graduate from the Freie Universität Berlin founded teachsurfing.org in her free time. People use the platform to offer lectures or workshops which interested parties (clubs, organisations, companies etc.) can book. It's not profit but communal thinking and an exchange of experience that are the most important concepts in this idea.

Other presentations and lectures on new technologies over time, digital transformation or artificial intelligence as well as blockchain and cryptocurrencies such as Bitcoin, Ethereum or Litecoin rounded off this varied day.

A thoroughly successful event with innovative ideas. Afterwards, 75% of the participants indicated that they had learned something for their day-to-day work, especially with regard to getting the best out of the day for satisfied customers. ■

*Michaela Heck M.A., textwerk
Katja Baier, Program Management Technical Documentation*



"Innovative building, IT and communication technology."

Integral and future-orientated from a single source

70 years of electrical engineering - fast, flexible and with great expertise



Klaus Schöffmann
and his wife at the
70th anniversary
of the company
Elektro Schöffmann

Elektro Schöffmann was founded as a one-man business in 1947 by the master electrician, Hans Schöffmann.

In the meantime the family-run company, Klaus Schöffmann GmbH & Co. KG in Weilheim, continues to be successfully managed in the second and third generation and employs 185 people full time.



Over the years the company has developed beyond the limits of the town and district to become one of the leading providers of innovative building, IT and communication technology in Upper Bavaria.

Its wide ranging clientèle includes municipal and state authorities, companies from industry and technology, hospitals, banks and hotels – for example Rohde & Schwarz Munich, Roche Diagnostics Penzberg and Schloss Elmau Luxury Spa Retreat & Cultural Hideaway.

Elektro Schöffmann always comes up with integral solutions: providing electrical and electronic equipment, taking on electrical installation work, procuring electrotechnical and electronic products in the retail sector, installing lighting, signalling and fire alarm systems, taking care of fire safety, cable infrastructure, lights, lighting accessories, luminous signs as well as other building services in the construction sector.

The company focuses on the complete planning, installation and assembly of electrical equipment and installations with the electrical, power, safety and network engineer-

ing components. Over and above this the company provides a comprehensive repair and maintenance service for existing installations with its highly qualified customer service department. In order to document the level of quality, Schöffmann has been ISO 9000 ff certified since the year 2000.

Electrical engineering

– Professional solutions with innovative power

When it comes to communication technology, live working in the low voltage area, lighting and power installations, switchgear and distribution systems or medium voltage and low-voltage systems, Elektro Schöffmann is the right contact partner. At the start of any project comes extensive consultation, conception and project management. In this respect, all technical requirements and customer needs are integrated – with the focus on the durability and cost-effectiveness of the overall electrical engineering installation from the start. To rectify problems, professionally trained employees are on hand around the clock and will also take care of maintenance, inspections and repairs – with quick reaction and implementation times.

Safety technology

– Protecting and preserving material assets

With fire detection systems, voice alarm systems, safety lighting, smoke alarms, video surveillance systems, fault alarm systems, access control systems, time recording systems as well as lighting and personal paging systems, Schöffmann also ensures safety in many areas with the latest technology. Every year more than 600 people in Germany die from the consequences





▶▶▶ of smoke poisoning, with over 6,000 people being injured; the material damage amounts to millions. For this reason, legislation has issued very strict guidelines for this area. The company's safety technology meets these guidelines and fulfils even the most stringent standards.

Power engineering

– With plenty of energy

From simple low voltage main distribution boards through to complex medium voltage installations up to 30 kV, our employees plan and implement complete power engineering solutions tailored exactly to the needs of the client in question. If required, modernisation work is also carried out on existing installations. On request the customer is given individual energy advice. Specialists in switchgear and distribution boards ensure increased performance and higher energy efficiency.

Network technology

– It comes down to the connection

For the success of any business, system and network technology are critical competitive factors.

Schöffmann ensures smooth information and data processing with innovative and high quality network solutions as well as the hardware and software required for this.

Lighting technology

– The light element

Elektro Schöffmann relies solely on future-orientated LED technology. This is because LEDs, and their advanced development OLED, use a totally different lighting principle to light sources that came before them. They are around 15 times brighter than a classic light bulb and, with a light yield from 100 to 140 lumens per watt, are well ahead in terms of energy efficiency.

Planning

– For a safe future

Good planning and competent support are the most important requirements for success. Elektro Schöffmann looks back on many years of experience and the expertise gained from hundreds of projects. A watchful eye is always kept on the specifications, including those required by legislation. ■

Michaela Heck M.A.
textwerk

EXHIBITIONS 2018/2019



EXHIBITIONS INTERNATIONAL

Iectosuisse – Association for Electrical Engineering, Power and Information Technologies

06.11.2018 | Bern, Switzerland | Stand: Optech AG

Key Energy – Where energy meets the future

06. – 09.11.2018 | Rimini, Italy

It Room nfra

13.11.2018 | 1931 Congressentrum Den Bosch, Netherland

MATELEC

International Trade Fair for the Electrical and Electronics Industry

13. – 16.11.2018 | Madrid, Spain

Install day

23.11.2018 | Kart Expo Brussels, Belgium

OSEA 2018

The gateway to Asia's Oil and Gas Industry

27. – 29.11.2018 | Singapore, Singapore

Go MOBILITY

27. – 28.11.2018 | Ficoba, Irun, Spain

Machinebouw

06.12.2018 | 1931 Congressentrum Den Bosch, Netherland

Intersolar India

11. – 13.12.2018 | Bangalore, India

Nepal Medical Show 2018

14. – 16.12.2018 | Kathmandu, Nepal

CEI – Energy storage and efficiency

30.01.2019 | Rome, Italy

Subsea Expo

05. – 07.02.2019 | Aberdeen, UK | Stand: 127

The Future of Operating Theatres

14.02.2019 | Salford University Manchester, UK

IEEE 6 IAS Electrical Safety, Technical, Maintenance and Projects Workshop

13. – 15.02.2019 | Calgary, Canada

CEI – Industry 4.0

28.02.2019 | Milan, Italy

Expo Electrica Norte Monterrey

26. – 28.03.2019 | Monterrey, Mexico

CIM Convention 2019

28.04. – 01.05.2019 | Montreal, Canada

EV2019VE Conference & Trade Show

06. – 09.05.2019 | Quebec City, Canada

Expo Arminera Buenos Aires

07. – 09.05.2019 | Buenos Aires, Argentina

Elfack 2019

07. – 09.05.2019 | Gothenburg, Sweden

Exponor Chile

27. – 30.05.2019 | Antofagasta, Chile

Expo Eléctrica Internacional

04. – 06.06.2019 | Mexico City, Mexico



EXHIBITIONS NATIONAL

SPS/IPC/DRIVES 2018

27. – 29.11.2018

Nuremberg

Hall 4, Stand 351



Hannover Messe 2019

01. – 05.04.2019

Hanover



Electric & Hybrid Vehicle Tech Expo 2019

Europe's largest and fastest-growing trade fair and conference for H/EV and advanced battery technology

07. – 09.05.2019

Stuttgart



INFORMATION DAY for industrial electricians of Electrosuisse – Association for Electrical Engineering, Power and Information Technologies

28.02.2019 Basel, Switzerland

13.03.2019 Bern, Switzerland

14.03.2019 Bern, Switzerland

20.03.2019 Pfäffikon, Switzerland

21.03.2019 Pfäffikon, Switzerland

26.03.2019 Regensdorf, Switzerland

27.03.2019 Regensdorf, Switzerland

28.03.2019 Regensdorf, Switzerland

19.03.2019 Geneva, Switzerland

26.03.2019 Lausanne, Switzerland

02.04.2019 Montreux, Switzerland

10.04.2019 Fribourg, Switzerland





Mario Lehr

Leader Business Unit eMobility Solutions

CAREER OUTLINE

Mario Lehr is 33 years old and lives with his family in Reinhardshain near Grünberg, six kilometres away by bicycle from the Bender GmbH & Co. KG headquarters. He has been with Bender for 17 years and has headed the eMobility Solutions Business Unit since April 2018.



eMobility will change many things positively

Rethinking required – Bender Business Unit "eMobility Solutions"

Mr Lehr, how long have you been working for Bender?

I started in 2001 – first as an apprentice, and then during my dual studies of general electrical engineering at the Technical University Mittelhessen (THM), I went through various stations at Bender.

In 2008, I entered the field of hardware development and was involved in the development of the ISOMETER® iso-F1, the insulation monitoring device for hybrid racing cars in Formula 1. After extra-occupational VDI further training as an electromobility engineer, I took over project management for HW/SW Automotive in 2012, as part of our cooperation with Hella to integrate our technology into their battery management systems.

In 2015, I switched to product management with a focus on technology in the railway market segment and again completed a part-time Master of Business Administration (MBA) at the THM.

Since April 2018 you have been the head of the "eMobility Solutions" Business Unit. What motivated you to take on this role in this field in particular?

Since I have always been closely involved in the development of safety systems and insulation monitoring devices for the railway and electromobility sectors, I can contribute some experience regarding automotive processes and vehicle sensors. All three current product areas, from vehicle and infrastructure sensors to charging technology, offer enormous growth potential.

I am deeply convinced that our technology plays a decisive role in all these areas. Bans on diesel driving, for example, are forcing people to confront electromobility and new mobility concepts. Vehicles with electric or hybrid drive are becoming increasingly popular and affordable for private individuals as well – a very exciting and at the same time challenging new business segment for Bender.

Why is electromobility so important, and for Bender too?

Bender offers more than just a range of products for electrical safety. We are the technology leader in active insulation monitoring for electric vehicles, we claim to build the best charge controller in the world and to continuously develop our solutions further. As a company, Bender will also be able

to operate more efficiently and cost-effectively in other areas of the company thanks to new processes and high volumes.

How do you see the sector developing?

The conversion from internal combustion engines to electric motors will also lead to new approaches at large companies such as BMW, Daimler and VW. Supply chains will be designed differently. Employees will need to be retrained. Some companies will disappear. On the other hand, new companies, job profiles and courses of study will emerge. Change is unstoppable: Mobility will be electrified.

Do you see any trouble with that?

In the field of eMobility many things are not necessarily more difficult, but simply different. We are continuously working on the creation and establishment of new processes and work-flows in order to comply with the rules of the game of eMobility. Compared to typical industrial Bender products, electromobility is already under enormous price pressure today, with significantly higher and strongly increasing quantities at the same time.

With electromobility, the question is what end consumers – often private individuals – are prepared to pay for electric mobility. How much can Bender security or charging technology cost, for example, for a wallbox in a private garage? What delivery time is acceptable? How much can a car with Bender insulation monitoring cost? Thus, we are forced to think in other dimensions and have to take into account the currently very long delivery times for electronic components in order to adequately cover the market despite the sharp rise in demand for end products. Often, quantity forecasts feel like a glimpse into the crystal ball, but we also have to learn how to deal with this.

What does your daily work look like? Which moments and tasks do you find particularly stimulating?

I am particularly excited by the acquisition of new customers and the cooperation with ebee in Berlin.

ebee is, so to speak, the software forge of the charge controllers and, at the same time, offers the appealing character of a start-up – a very interesting and successful combination. With ebee, Bender provides the latest technology, the heart of charging stations, so to speak. The customer, for example, the charging stations manufacturer, is responsible for production and design. For the end customer, such as a municipality, however, the system should ultimately be as inexpensive as possible and public charging should be affordable.

In order for the high development costs of very intelligent and networked batch controllers to pay off, there is a need for high

quantities. This, in turn, is a major task for production, purchasing, sales and logistics. Therefore, rethinking – internally as well – is necessary overall in order to be successful together in the long term.

Which new features do you wish to emphasise in the future?

As head of the BU, I have a supervisory role. I have to instruct, convince and motivate my colleagues within the company, but I don't have to pretend that everything is a perfect solution. Employees may and should think and shape – they can also make mistakes, but must learn from them. It is important to me that everyone contributes their own ideas and functions as a team for every new development or customer project right from the start. The workforce can and must actively shape the future.

Above all, however, we need to reduce inhibitions. For example, to help them lose their shyness towards electromobility, for the last two years every one of our employees has been able to use an in-house electric vehicle – both professionally and privately.

What concrete objectives have you set?

My goal is to make Bender even more international in the field of electromobility by 2019. Today we mainly serve Germany and the Nordic countries in Europe. But we must also establish sustainable structures in the so-called key countries, such as China and the USA, but also Spain, Italy and the Netherlands. Two thirds of the world market are dominated by China. China is thus clearly the driver and pulse of electromobility. This is where we need to orient ourselves in order to keep pace and position our technology.

What do you think are Bender's biggest advantages in this area?

The media often discuss the suitability of electromobility for everyday use, but we do not need pure electric vehicles with long ranges to use Bender products. Even if vehicles are not completely electrically powered, e.g. plug-in hybrid vehicles with a range of only 30 kilometres, our portfolio makes a significant contribution to the industry. Even at short ranges, insulation monitoring in the vehicle and a charging station are required – ideally "Bender technology inside".

Please complete the following sentence:

To me, Bender means...?

... positive change – shaping the future together!

Mr. Lehr, thank you very much for the interview. ■

Practical implementation of the central earthing point

Newly constructed electrical installations designed as earthed systems (TN systems) now need to be installed as TN-S systems.

"444.4.3.1 TN-C systems are not to be used in newly constructed buildings that contain or are likely to contain a significant amount of information technology equipment. Maintaining TN-C systems in existing buildings is not recommended when these buildings contain or are likely to contain a significant amount of information technology equipment."

From DIN VDE 0100-444:2010-10 Low-voltage electrical installations- Part 4-444: Protective measures - Protection against interference voltages and electromagnetic disturbances

Power supply systems designed as TN-S systems with central earthing points are the basis for high levels of system availability and safety. For a newly constructed installation, it is sufficient to set up a clean TN-S system from the supply point. From PEN splitting to PE and N, no further connection exists between the neutral conductor and earth (PE). This design guarantees a high level of electromagnetic compatibility within the system and largely avoids interference currents on equipotential bonding conductors, shielded cables and third-party conductive components in the building structure. ▶▶▶



CEP monitoring with a residual current sensor from Bender

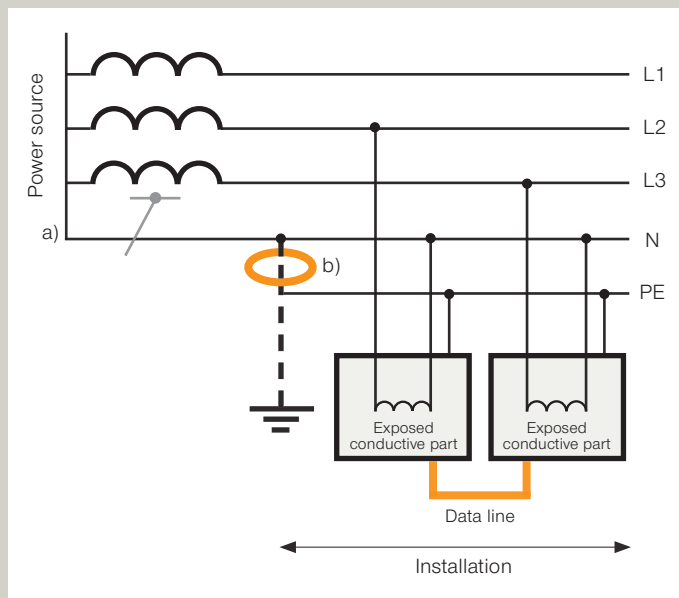
Practical Expertise

▶▶▶ Ideally, however, the entire installation should be set up in the TN-S system from the transformer so that only a single, so-called central earthing point is installed. Such a design fully avoids the undesired interference currents referred to above. Maximum electromagnetic compatibility is also guaranteed for operating the electrical installation.

The design also offers a further, decisive advantage: a special current transformer can be used at the central earthing point to monitor the electrical installation's entire leakage and residual currents.

All leakage current from the installation flows through this measuring point. Abrupt changes in the measured leakage current indicate a new PE-N bridge, a PE-N reversal or a low-impedance earth fault. Using a residual current monitor with a history memory is worthwhile here. The device's data logger and alarm messages can be used to accurately track when significant changes in current occur via the CEP. In practice, this information can also be used to deduce the cause (e.g. maintenance work on components in the installation) and narrow down the fault location.

Recommended structure in the TN-C-S system with monitored central earthing point



- a) Do not earth transformer neutral point directly
- b) Central earthing point of the main distribution board with monitoring

This guarantees that the TN-S system remains "clean" throughout the entire service life of the installation and that no unwanted connections are created between the neutral conductor and earth (e.g. due to maintenance work or faults during installation and expansion). ■

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