

MONITOR

18

High availability for reliable operation in waste water treatment facilities

Unearthed power supply and insulation monitoring ensure electrical safety

Universal measuring device PEM353: Square. Practical. Accurate.

Energy data, limit value monitoring and power quality in one device



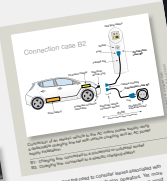
Awaiting
the big eMobility
breakthrough

**ELECTRIC
DRIVING**

Practical Expertise Page A

Connection of charging stations for electric vehicles

Electromobility is gaining momentum. It is not yet clear when electrically powered cars will regularly be purchased with their own charging stations. However, one thing is clear: Home-made, often simple, charging stations will be common. They will require a high number of suitable charging stations to charge electric vehicles with power from the national grid.



NEW

Additional page "Practical Expertise" at the back of the booklet for collection!
Connection of charging stations for electric vehicles

BENDER Group

editorial

EDITORIAL

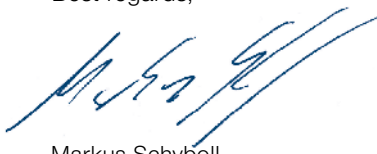
Dear Readers,

Digitalisation, Industry 4.0 and the IoT (Internet of Things) are core themes at practically every trade fair for electrical and facility management, automation and mechanical engineering. This was also evident at the SPS Drives fair in Nuremberg with its focus on “digitalisation”. Digitalisation requires forward-looking technologies, intelligently connected systems and user-friendly product designs. We will be pleased to present our ideas on this topic to you at light + building in Frankfurt, the world's leading trade fair for lighting and facility management, and at the Hannover Messe.

The much-discussed question of whether digitalisation is a revolution or an evolution is of secondary importance to us. Whatever the answer, change is currently evident in all new projects. Every new production line and every automated warehouse needs to be planned and implemented with comprehensive sensor technology and direct interfaces to ERP systems, with digital twins now becoming standard. Yet these developments are still in their infancy and use only a fraction of the potential offered by the new wealth of data. Implementation of all the applications possible will offer at least as much dynamism as digitalisation itself.

But no matter how you digitalise your company, each sensor and data centre can only be as good as their power supplies. Reliable production and capacity planning and predictive maintenance require from the outset power supplies that are continuously monitored and readily available. The question of whether to opt for an earthed, resistance-earthed or unearthed system (IT) is therefore becoming increasingly important for the success of your company. We wish you every success in making the right choice.

Best regards,



Markus Schyboll
CEO



SUBSCRIPTION

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IMPRINT

Bender GmbH & Co. KG.
Londorfer Straße 65
35305 Gruenberg / Germany
Fon: +49 6401 807 - 0
Fax: +49 6401 807 - 259
E-Mail: info@bender.de
www.bender.de

Editorial staff:

Marita Schwarz-Bierbach, Anne Katrin Römer

Graphic & layout:

Natascha Schäfer, www.s-designment.net

Copy-editing/text: Michaela Heck M.A., Textwerk

Photos:

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Awaiting the big eMobility breakthrough

Page 04

On German roads, electromobility has yet to get into its stride. Potential customers are only taking hesitant steps, while manufacturers have an uphill battle against numerous other problems ...



The 'Street lamp charger' is coming

Page 29

The concept, of charging electric cars directly off roadside lighting (street lamps), is as simple as it is smart. Requests for the street lamp variant of the 'Berlin' charging point are coming in thick and fast ...



The future of construction, which you can be part of

Page 50

Cadolto Fertiggebäude GmbH & Co. KG is a member of the Cadolto Group, established in 1890 in Cadolzburg near Nuremberg. The company is the Europe-wide leader in the construction and leasing of modular buildings ...

04 Awaiting the big eMobility breakthrough

- 09 **Bender India wins two awards**
- 10 **International Congress:** Bender present in electrical safety for the hospitals.
- 12 **Protection objective: DC fault currents**

INNOVATIVE PRODUCTS

- 16 **Universal measuring device PEM353:** Energy data, limit value monitoring and power quality in one device
- 18 **isoHV1685D-425:** Optimised Monitoring of Induction Furnaces in the Medium-Voltage Sector
- 20 **Intelligent monitoring of signalling power supplies in Great Britain:** Bender technology follows new standards
- 24 **Insulation monitoring device isoGEN423:** Concealed earth fault monitor function
- 26 **ISOMETER® series iso685:** Decisive advantages through early monitoring of insulation resistances

TECHNICAL APPLICATION

- 29 **The 'Street lamp charger' is coming:** The concept of charging electric cars directly off roadside lighting
- 32 **High availability for reliable operation in waste water treatment facilities**
- 35 **Marienkrankehaus Hamburg:** Renovation and restructuring of the Operating theatres
- 38 **NürnbergMesse relies on the monitoring devices from Bender:** Interview on residual current technology and POWERSCOUT®
- 42 **Bender on board:** Bender supports Formula Student rising stars from Pakistan

BENDER INHOUSE

- 44 **We bring your application to our laboratory:** Test bench for applications in the field of drive technology
- 46 **Safety in Portugal:** SISACOL Sistemas de Automação e Controlo, Lda. – The Portuguese representative of Bender

CUSTOMER PORTRAIT

- 50 **Introducing Bender's partner Cadolto: The future of construction, which you can be part of**

53 EXHIBITIONS 2018

- 54 **INTERVIEW** with Wouter van Beek, Managing Director of Bender Benelux and head of the "Hospital Solutions" business unit

- 56 **PRACTICAL EXPERTISE:** Connection of charging stations for electric vehicles

Awaiting the big eMobility breakthrough

China already ahead of the game

On German roads, electromobility has yet to get into its stride.

Potential customers are only taking hesitant steps, while manufacturers have an uphill battle against numerous other problems which they are largely powerless to influence. As if that were not enough, our politicians are adding pressure by threatening to ban cars with combustion engines. In contrast, China has been going full throttle with eMobility since last year.

To see the current situation with any degree of clarity, we must make a clear distinction between the different perspectives on the problem. While some see eMobility as part of the great march forward, others are much more sceptical. And rightly so as what we wish for is rarely identical to the reality on the ground.

For instance, the range of electric vehicles currently on offer in German car showrooms is very modest, although catalogues and the internet offer the same customers a wider choice. Dealers do not like to be lumbered with slow selling EVs. Add to that the lack of guaranteed range or of an extensive charging infrastructure or the current unaffordability of EVs, and the extent of the problem becomes clear. Yet in Norway, things are quite different.

It is easy to persuade residents of cities where charging stations are readily available to acquire an EV. On the other hand, in the country, with a relatively high proportion of home ownership, potential EV buyers have a definite advantage. They can install a charging station in their house quite easily: all they need to do is apply to the local electricity utility. However, homeowners pay between 2,000 and 3,000 euros for their own private charging point.

A growing trend

Happily, the figures published by the industry association VDA are optimistic. VDA President Matthias Wissmann stated at New Year that sales of EVs have doubled compared to last year. In two years' time, customers will have over 100 German-made EV models to choose from. This represents a threefold increase over the current offering. November 2017 was significant for EVs: they passed the 2% mark for the first time, accounting for 2.1% of all new car registrations. Over the year as a whole, EVs comprised 1.5% of the total, compared to a mere 0.7% in 2016. Overall, 54,500 EVs were sold in 2017: 117% more than in the previous year. The market share for German makes grew from 59% to 65% in the same period. Some 100,000 EVs are currently on German roads.

The German automotive industry will invest 40 billion euros in alternative motors by 2020, but the VDA believes even greater efforts are needed to ensure the electric vehicle market is a success. Only a rapid expansion in charging infrastructure, a smart tax framework, greater battery ranges and tempting prices can ensure that electromobility makes a lasting breakthrough. German motorists will also need to change their attitudes and behaviour.

Securing raw materials

As if all these obstacles and challenges weren't enough in themselves to put a brake on progress in the electric mobility market, the industry has yet to secure supplies of the key raw materials which will be in greater demand in the future, such as lithium and cobalt. The remaining available, economically viable deposits may run out more quickly than forecast, and become more expensive than predicted due to the increase in demand. This is a particular issue with cobalt, used to produce cathodes in high-performance batteries.

When all is said and done, we have still to see the final bill for this technology. Experts predict a bright future for solid oxide fuel cells: these should come onto the market by 2025 coinciding with falling battery prices. This provides yet another excuse for potential EV buyers to delay making that purchase.



▶▶▶ A second life for batteries

If electromobility is to continue to make headway, optimising the economically useful lifetime of the current standard lithium-ion battery will play a key role – a fact which has been largely overlooked in the industry. As the most expensive component in any EV– they currently can cost up to EUR 20,000 (new).

Experts believe that, with careful handling, these batteries should be good for 200,000 road kilometres. That is, unless they are regularly recharged at rapid charging points. However, once they have declined to around 80% of their original power density, it is time for these high-performance batteries to begin a 'second life'. The batteries are retired from in-car service, but can still be reused for several years, perhaps as energy storage for the largely decentralised power system of the future. Another option is to replace old or defective cells from batteries, provided that their overall condition remains satisfactory.

A third option is to recycle LIBs which have reached the end of their useful lives. Since relatively few such large batteries exist at present, no economically viable

procedure for recycling them has become established to date. The aim is not only to recover the lithium they contain, but also up to 95 % of the even more valuable cobalt. Hence there is currently fierce competition to find the best marketing concept for the second life for LIBs. We may look forward with anticipation with suggestions from China.

A difficult mass market

Despite the various uncertainties, German manufacturers are managing to hold their own. Plans are afoot, designs and manufacturing are largely on schedule: contrast this with Tesla, the U.S. company which once wowed the sector, and whose shine is fast wearing off. Tesla's projections that it would produce 5,000 of its first mid-range model every week have failed to materialise: its US plants have made only 1,500 Model 3s in three months. That's quite a gap between their bold projections and the cold realities of complex mass-market EV production processes. Potential German customers for the Tesla 3 have now had to put their hopes on hold until the second half of 2019.



View of the engine bay of the e-Golf



As a comparison, the engine of a Golf TDI

“The growing **international trend towards** electric-drive cars has served to intensify the move away from diesel, not just on German markets.”

The Chinese have internalised the necessity of mastering higher production volumes and are therefore spearheading international market activity, well ahead of the USA. In 2017, 777,000 EVs were sold in China: a 53% increase over 2016. Of these, 90% were also produced by Chinese manufacturers.

The USA is the second-largest market, albeit significantly smaller, with 194,000 new registrations (up 24%). Activity on the European market is dominated by a single, relatively small country: 62,300 EVs were registered in Norway in 2017 (up 39%). EVs' share of the new car market there was 39.3%; in 2016 it was only 29.1%. Shipping and air travel are also to be progressively electrified. The huge take-up of electric mobility in Norway is driven in part by the availability of cheap hydropower.

China wants more

China is not satisfied with the major lead it currently has on Europe and the USA. It is applying some rather drastic regulations to promote electromobility, partly for environmental reasons. A minimum of one in ten vehicles will be required to have an alternative drive system in the the future. A quota is being introduced for manufacturers placing over 30,000 internal combustion engine vehicles a year on the Chinese market. The quota will apply from next year, and will start at 10%; the following year, it will rise to 12%. Financial penalties will be imposed if manufacturers fail to meet the quota – although the system allows points to be bought from other manufacturers. The Chinese government has also set as a long-term goal a complete ban on vehicles with conventional combustion engines, without setting an exact date for this.

German manufacturers in particular face tough conditions on European markets. Within two years at the latest, the sector will need to sell significantly more EVs if Germany is to meet its European CO2 targets, and in order to avoid large fines in Germany itself. The VW Group alone must sell 350,000 EVs by 2023. The big question remains whether car buyers will play ball. The decision to buy a car will be significantly influenced by the ground gained by driverless vehicles, which will weaken demand for owning your own car – a trend that is already evident in cities, especially among the younger generation.

The growing international trend towards electric-drive cars has served to intensify the move away from diesel, not just on German markets. Between January and September 2017, diesel's share of the German market fell from 46.5% to 40.3%, a trend which was also identified on Europe's second-largest diesel market, France. Diesel's share there fell from 53% to 48.6%. In contrast, the EV share of new car registrations rose by 23% to around 26,500. This leaves France behind Germany in the international ranking. The UK also lags behind Germany, at 35,400 EVs (up 21%). Yet electric vehicles account for 1.7% of the market in both the UK and France, still higher than the market share in Germany.

In its latest quarterly report on the global market, the Center of Automotive Management (CAM) based in Bergisch Gladbach, Germany, finds that German manufacturers stand a very real chance of competing with China, indisputably the leading market for electromobility: “Our activity is late in coming, but not too late. There are good prospects for German manufacturers to succeed in the long-distance race for the electric mobility markets of the future.”



FEATURE



Wolfgang Bernhart, a partner at Roland Berger, explains: “China’s success is supported by national subsidies and preferential vehicle licensing. There are also many technologically-advanced startups on the Chinese market, which are steadily becoming established on the premium market, with sufficient capital.”

▶▶▶ Behind in technology terms

Not all experts share this optimism. The latest ‘E-mobility Index’, produced by Roland Berger and Forschungsgesellschaft Kraftfahrwesen mbH Aachen (fka) for the second quarter of 2017, shows Germany losing its top spot in the technology ranking to France. In the first quarter, the two countries shared the top spot. The main reason behind this setback for Germany is that its manufacturers increased the proportion of their ranges devoted to plug-in electric vehicles. These have smaller electrical ranges and lower top speeds. PEVs have smaller battery capacity, and therefore use simpler charging technologies.

The ‘E-mobility Index’ regularly compares the competitive standing of seven car-producing countries in terms of electromobility: Germany, France, Italy, the USA, Japan, China and South Korea. The countries are assessed according to technological, industrial and market indicators. In the second quarter of 2017, China took the top ranking overall for the first time, due to its industry and market leadership.



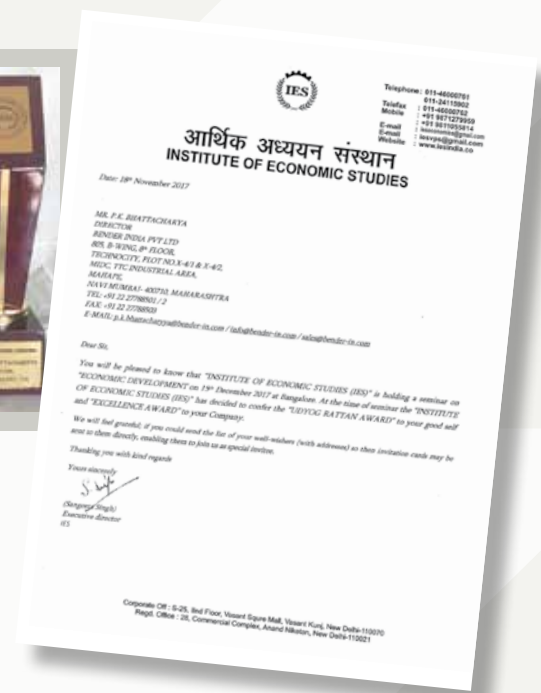
In other words, Daimler, BMW, Audi and VW must take several steps forward in 2018 if they are to regain the technology top spot. There is some consolation in the thought that Chinese manufacturers cannot go on growing at their current pace. According to the latest figures from December 2017, growth was slowing down somewhat compared to 2016 – which was a real boom year. Overall, 2018 is expected to regain a bit more dynamism. ■

*Karl-Heinz Wierz
Wirtschaftskommunikation Stuttgart*



Bender India wins two awards

On 15 December 2017, Bender India Private Limited, a subsidiary of the Bender Group, was awarded the **Leadership Excellence Award 2017** for its contribution to industry development in India during a festive event in Bengaluru. On top of this Mr. Pallav Kumar Bhattacharyya, company director, received the **2017 Udyog Rattan Award** (translated as Jewel of the Industry Award) for industry leadership and contribution to the technical and economic development of the country.



Both awards are conferred by the Institute of Economic Studies (IES), a research center in New Delhi. IES is one of the leading organizations in India which focuses on research who joined forces to investigate issues related to various aspects of the economy and the economic development of the country and to provide expert advice and services.

The institute for economic studies was founded in 1980 by a group of economists, parliamentarians and other prominent personalities from industry. Its goal is to conduct surveys and studies and to promote the Indian economy in close cooperation with various chambers of commerce by its multi-disciplinary activities. Its many members come from all around the world.

In addition to the awards ceremony, the IES event offered managers of various areas the opportunity to meet one another, establish networks, exchange experiences and ideas and to talk about current trends in the field of business management. ■

Pallav Kumar Bhattacharyya, Bender India

NEWSWORTHY



International Congress

Sociedad Mexicana de Arquitectos Especializados en Salud A.C. (SMAES)

The Hospital of the Future

Bender present in **electrical safety for the hospitals.**

The “Sociedad Mexicana de Arquitectos Especializados en Salud A.C.” (SMAES) which is known for the development and promotion of the “architecture for health“, organized in Mexico city, from 16 to 19 of last November, the International Congress "The Hospital of the Future", which had among its objectives:

- Generate specific recommendations to public and private institutions to update models of health care.
- To compare international experience.
- To promote more efficient management of operation, maintenance and safety of hospitals, their engineering, installations, equipment and buildings.
- To offer collaboration with other international organizations.
- To work in the integrated planning, design, standards, construction, maintenance and evaluation of the hospitals infrastructure in Mexico.

The International Congress takes place every two years in different parts of the world, sometimes, as on this occasion, in conjunction with a health trade fair. For this International Congress, which was held at the National Academy of Medicine, at the National Medical Center Siglo XXI, the SMAES in collaboration with the International Federation of Hospital Engineering (IFHE) achieved the participation of important local and international speakers in various areas of health-related issues, highlighting those of the President of the Oriental Republic of Uruguay, Tabaré Ramón Vázquez Rosas and that of IFHE President Douwe Kiestra.

A General Assembly takes place at each congress, where all IFHE members may discuss IFHE policy and activities, as a member Ing. D. Christian Bender participated in the General Assembly.



Insulation monitoring device
LIM2010

In the healthcare trade exhibition our stand was visited by engineers, architects, doctors, students from private and public universities, and hospital managers who were attend by Grupo Ors, our commercial representative for the hospital sector in Mexico.

Bender also shares the vision that hospitals have state-of-the-art technology to improve efficiency and provide the best patient care, which is why it has been present in Mexico since 2016 and since then it has supplied both public and private hospitals with Isolated Power Panels that have the Bender line isolation monitor (LIM2010) incorporated for isolated systems.

But beyond the hospital sector, Bender has also been providing monitoring solutions to prevent ground fault in electrical systems for the industry in segments such as: automotive, paper, power generation, oil & gas.

Bender's perspective in Mexico for the coming years is to continue bringing technology to the hospital environment, to collaborate in the design of an effective, efficient and safe health care model, in addition to continuing to strengthen its presence in the industrial sector, through technology and innovation. ■

Noe Sanchez
Bender Inc./Sales, Mexico



Protection objective ...

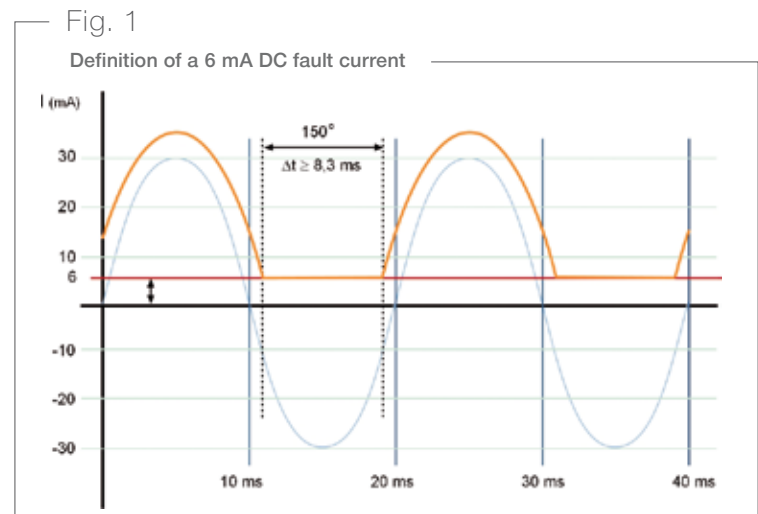
Smart Home, Vehicle-to-Grid, Balcony-Solar (Plug-in Solar), Energy Storage and Power Factor Correction (PFC) are the new buzzwords which, when put into practice, make it more difficult to assess the risks in modern electrical installations. Now with the potential for DC fault currents in such systems, a qualified electrician working on an installation requires extensive specialist knowledge, including detailed knowledge of the standards and an in-depth knowledge of the possible protection and monitoring equipment.

Effects of DC fault currents larger than 6 mA

For DC fault currents greater than 6 mA, saturation effects in the RCD current transformer can cause a negative change in both the response time and the response value when a type A RCD is used. In the worst case, this RCD type is not triggered in the event of a high DC fault current or it becomes "blind". This means the protection function provided by the device can be no longer guaranteed.

To prevent this from happening, either a type B RCD can be used or the potential DC fault current must be detected by some other means to enable the circuit to be disconnected. A combination of type A and type B RCDs in the same circuit is not allowed, and this must be adhered to in new installations or when expanding an existing one.

The following graph illustrates the definition of a 6 mA DC fault current:



... DC fault currents

Normative requirements for devices and installations

According to IEC 61140:2016-01 the following is applicable for devices:

- Plug-in electrical equipment with a rated input ≥ 4 kVA must be designed in such a way that the smooth DC current component superimposed on the protective conductor current is no greater than 6 mA.
- For plug-in electrical equipment with a rated input ≥ 4 kVA and permanently connected equipment regardless of their rated input, information concerning protective measures must be included in the operating manual.
- For DC protective conductor currents greater than 6 mA, suitable protective devices, such as a type B residual current device (RCD) shall be selected.

Consequences:

For device manufacturers, this means that DC fault currents greater than 6 mA must be detected and disconnected with, for example an integrated Bender solution or the device may only be used in conjunction with an upstream type B RCD.

Current building installations

In many building installations, additional protective measures for protection against electric shock in the form of a protective RCD (type A) is included alongside basic protection with overcurrent protection equipment. According to IEC 60755:2017, type A RCDs can only function properly with smooth DC fault currents up to a maximum of 6 mA. For this reason, numerous standards and specifications have been developed in recent years which take this fact into account and which make corresponding demands on electrical equipment (loads, sources or storage) or electrical installations in order to maintain the required protection objectives. The result is that the responsibility not only lies with the manufacturers of plug-in PV plants; charging stations for electric vehicles; energy-saving LED lighting; or energy-optimized drives with frequency converters, but also with planners, builders and the operators of electrical systems.

In IEC 60364-4-41:2005 + AMD1:2017 CSV sub-clause 411.3.3, it states that RCDs are required for "AC socket outlets with a rated current not exceeding 32 A that are liable to be used by ordinary persons and are intended for general use; and AC mobile equipment for use outdoors with a rated current not exceeding 32 A."

The type of residual current protective devices used depends on the type of fault current that is expected.

Selection of residual current protective devices in accordance with IEC 60364-5-53:2001+AMD1:2002

In most AC installations, type A or pulse current-sensitive Residual Current Circuit Breakers (RCCBs) are used when the following types of fault current occur:

Table 1

Breaking capacity of RCD types with respect to the residual current waveforms

Suitable RCCB type	Circuits	Load Current	Residual Current
B	1		
B	2		
B	3		
B	4		
B	5		
B	6		
B	7		
B	8		
B	9		
B	10		
B	11		
B	12		
B	13		

▶▶▶ These pulse current-sensitive RCDs are triggered by sudden or slow rising sinusoidal AC residual currents and pulsating DC residual currents. It can be seen from the circuit diagrams that many loads or switching power supplies (a diode, a capacitor and a resistive load are sufficient) can generate these types of fault current.

However, if new single-phase switched-mode power supplies with PFC (Power Factor Correction - power correction filter) stages are used, then a DC fault current can occur in the event of an insulation fault according to PFC regulation which, according to IEC 60755:2017-10, exceeds the permitted fault current value of 6 mA DC specified for a type A RCD.

Such PFC regulations are increasingly used in switched-mode power supplies as well as in charging equipment for electric vehicles in order to meet stringent EMC requirements (electromagnetic compatibility). Of course, electrical energy storage, electric vehicle/traction/charging batteries, PV modules, etc. can also cause smooth DC residual currents.

If the fault current waveform with respect to DC residual currents greater than 6 mA is not known, protective measures must be taken in the event DC residual currents occur. This is in turn addressed to the installation and the equipment.



Residual current monitor
RCMB420EC

Selection of residual current protective devices – type B RCD or sensitive to all current types

In addition to the fault currents detected by a type A RCD, a type B RCD can also detect forms of the fault current that can occur in subsequent faulty circuits. Residual current protective devices sensitive to all current types (AC/DC) have a frequency range from 0 to 2000 Hz and are intended for single and multi-phase AC systems. They are not suitable for use in pure DC networks.

Using sensors to recognise and disconnect faulty DC currents

The objective of preventing the occurrence of fault currents greater than 6 mA is also described in many standards. The upcoming new IEC 62955:2018-0X describes the solution for a Mode 3 charging station. In this standard, the RDC-DD, consisting of a 6 mA DC detection unit and a switching device, is defined. For some time, standards covering the charging infrastructure of electric vehicles, for example IEC 61851-1 and IEC 60364-7-722 have existed; IEC 60364-7-722:2015-02 says that when DC residual currents greater than 6 mA occur, appropriate measures must be taken.

One measure, for example, may be to detect the 6 mA residual current with a sensor that then enables the disconnection of the faulty equipment by triggering a circuit breaker. A suitable solution for this is Bender's RCMB420EC residual current monitor.

Risk assessment

The electrician tasked with the risk assessment for all work equipment according to industrial safety regulations faces a huge challenge. The type of residual current protective devices selected depends on the type of fault current, and information concerning the correct device to use can be found by searching through the standards.

Unfortunately, there is often no indication or information about possible DC residual currents greater than 6 mA in modern equipment, or of what types of residual current protection and monitoring devices must be used. For this reason, in current or future electrical

“The type of residual current **protective devices** selected depends on the type of fault current, and information concerning the correct device to use can be found by searching through the standards.”



installations in which electronic equipment with PFC, energy storage, charging infrastructure, plug-in PV systems or converter drives (PECS) are increasingly being used, a pioneering type B universal current-sensitive protection or monitoring device, or a combination of a type A RCD with a DC sensor and corresponding disconnection i. e. RCMB420EC is foreseen. ■

*Dipl.-Ing. Holger Potdevin, T-N
Dipl.-Ing. Harald Sellner, T-N
Dr. Catherine Körbächer, T-N
Ulrike Gans, T-N*

Standards that address the 6 mA DC problem:

- IEC 61140:2016-01 sub-clause 7.6.3.4
- IEC 60755:2017-10 sub-clause 5.2.10.2
- IEC 62477:2012-07 sub-clause 4.4.8
- IEC 62955:2018-0X RDC-DD DC-6 mA recognition
- IEC 60364-7-722:2015-02
- IEC 61851-1

Standards can be acquired at www.iec.com or www.beuth.de

INNOVATIVE PRODUCTS

Universal measuring device
PEM353

**Square.
Practical.
Accurate.**



Energy data, limit value monitoring and power quality **in one device**

The PEM353 **digital** universal measuring device is suitable for applications in low-voltage main distribution boards (LVMD), data centres and building installations. As a modern display instrument for electrical quantities, it is equally suitable for monitoring power quality and energy data.

The PEM353 has a standardised enclosure (DIN 96 x 96 mm) for front panel installation. The compact size of just 7 mm facilitates almost seamless integration.

The integrated RS-485 interface with Modbus-RTU protocol connects it to COMTRAXX® gateways and POWERSCOUT® from Bender, or to other higher-level monitoring solutions, e.g. SCADA systems (Supervisory Control And Data Acquisition) or to building instrumentation and control. In these systems, the measurement data can be stored, processed further for analyses and displayed. Bender gateways also offer a convenient way to setting the parameters for these devices via the device website.

The backlit LC display is equipped with a clear text display. This means that the measurement parameters displayed are clearly legible, and they can be identified

quickly and easily through the display of form abbreviation, measured value and unit. The homepage displays four measurement parameters which the user can select individually. A vector diagram and a harmonic histogram enable initial assessment of the current system status.

Navigation is based on a software-assisted 4-button concept, i.e. the button function is adapted to the context of the respective menu. This in turn makes quick, intuitive operation possible, immediately and without a long familiarisation period.

The PEM353 measures all significant power quality parameters such as

- THD (Total Harmonic Distortion), TOHD (Total Odd Harmonic Distortion), TEHD (Total Even Harmonic Distortion), TDD (Total Demand Distortion)
- Individual harmonics up to 31st order
- k-factor, peak factor and power factor
- unbalance.

A clear overview of the system is provided at all times

The integrated limit value monitoring defines an individual system status and raises an alarm when deviations occur. The operator is alerted to the situation on site by a flashing display. Alarm relaying can be assured via the communication interface and also using digital outputs, e.g. with transfer to a PLC (programmable logic controller). Violations of limit values are logged in the internal event memory.

The fourth current input can be used either to monitor the central earthing point (CEP) or for N-conductor measurement. This enables any possible overload of the N conductor to be detected at an early stage by 3n-harmonics. This reduces the risk of fire, and the risk of overvoltage on single-phase consumers, which may result from a break in an N-conductor.

In the context of energy data monitoring, the PEM353 provides the essential measurement quantities for real energy, and does so with outstanding accuracy (Class 0.5). The package is completed with recording of daily energy values for the preceding two months and monthly energy values for the preceding three years.

Active, reactive and apparent energy levels are counted for each phase, and as a cumulative value. This means that one device can record up to three single-phase resources. Additional meters for active and reactive energy separate the energy flow into import, export, total and net energy. If the sourcing of energy is dependent on tariffs, each of the aforementioned energy meters is available in up to eight different tariffs. Other types of energy, e.g. meters for compressed air, water and gas, can be integrated and accommodated via digital inputs and pulse counters.

The comprehensive equipment features of the PEM353 make it suitable for use as a data supplier for applications such as power quality monitoring and energy data monitoring, and it also serves to improve reliable plant availability by monitoring the N-conductor or the CEP. ■

*Dipl.-Wirtsch.-Ing. Tobias Weiberlenn
Dipl.-Ing. Sandra Schifflke*

Applications and fields of application

- Modern display instrument for electrical quantities
- Power quality monitoring, limit value monitoring and alarm relaying
- N-conductor measurement and monitoring/monitoring of the CEP
- Energy measurement and energy data monitoring.

INFO

More information: <https://www.bender.de/en/products/power-quality-overview>



isoHV1685D-425

Optimised Monitoring of Induction Furnaces in the Medium-Voltage Sector

Device variant isoHV1685D-425 satisfies the stringent requirements for the insulation monitoring of induction furnaces up to AC 2000 V/DC 3000 V.

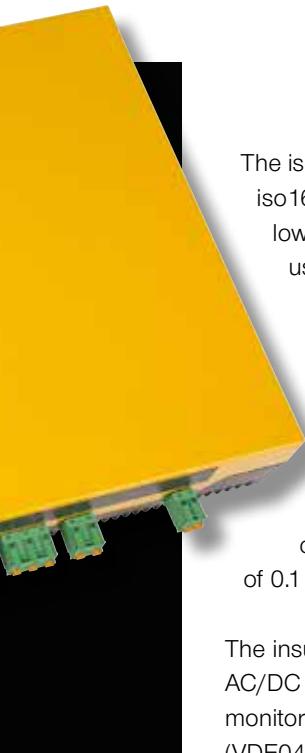
The induction furnace has established itself alongside the electric arc furnace as an alternative smelting device in the global growth business of electrically powered steel-making. It offers benefits in terms of the process and of environmental technology that make it an interesting and cost-effective proposition for use in large as well as small steelworks. Other reasons that make it suitable for successful use in large steelworks include the fact that its power supply is based on high-performance converters, as well as the neutral and basic refractory lining.

Large amounts of electrical power are needed to operate induction furnaces. They source this power through special frequency converters (e.g. inverters), or directly from the mains power grid. This yields various potential sources of fault that can adversely affect or even shut down production and processing operations. To ensure that the technology of today remains dependable in the future, Bender has developed

solutions specifically for this application to ensure failure safety and protection.

In the challenging environment presented by the monitoring of induction furnaces, the device variant isoHV1685D-425 has proven itself to be very capable indeed. In a similar way to other furnace applications, the special requirement of induction furnaces, that operate at a very low level of insulation coupled with a high nominal voltage value, is to find a reliable way of detecting and reporting any drop below a critical insulation resistance threshold.

A particular customer benefit for plant designers deriving from the choice of the isoHV1685D-425 for insulation monitoring is the extended degree of scope it affords for optimising process parameters. For example, a significantly higher level can be permitted for the conductivity of VE water (demineralised water) without jeopardising the insulation monitoring function.



The isoHV1685D-425 extends the device series iso1685 beyond the voltage limits of the low-voltage sector. In particular, it can be used whenever unearthed power supplies (IT systems) with voltages of up to 3(N) AC, AC 2000 V/DC 3000 V are to be monitored, on which system leakage capacitances of 150 μ F will not be exceeded and where the use of a current transformer prompts the expectation of substantial voltage components with frequencies in the range of 0.1 Hz to 460 Hz.

The insulation resistance levels of unearthed AC, AC/DC and DC power supplies (IT systems) are monitored in accordance with DIN EN 61557-8 (VDE0413-8) and IEC 61557-8. Measurements can be conducted safely and reliably, even under the influence of connected current transformers. The separate supply voltage makes it possible to monitor these in a shut down system.

The devices can be operated with the DC 24 V power supply that is commonly available in switch cabinets.

Two separately adjustable response values/alarm relays make it possible to issue messages at an early stage, long before the system reaches a critical condition. If the insulation resistance exceeds the release value (response value plus hysteresis), the alarm relays switch back to the initial position again. The high-resolution graphic LC display can show the existing measured values as well as the alarm messages. Parameters are also assigned to the device via the display and the control buttons on the front panel as well as via the RS-485 interface.

The device combination of the ISOMETER[®] IRDH 275B-1 insulation monitoring device and the AGH507S

coupling device may constitute an alternative with interesting technical properties for the monitoring of furnace applications in purely AC or 3AC IT systems, without galvanically coupled DC circuits.

This device combination can be used at up to AC 2500 V in the frequency range of 50 to 3000 Hz. Despite the high nominal voltage range - after calibration - response values of a few multiples of 10 Ohms can be set. ■

Dipl.-Ing. Dieter Hackl, Standards & Innovation



However, the isoHV1685D-425 offers the operator important benefits compared to the older solutions for purely AC IT systems available on the market, such as the ISOMETER[®] IRDH275B-1 in conjunction with the AGH507S:

- Optimised monitoring of furnace applications in AC/DC IT systems that use frequency inverters
- Coverage of the lower medium-voltage range without additional coupling devices
- Response values also in the lower 100 Ohm range with greatly improved precision
- Plug-in terminals provide durably safe and quick wiring
- Password protection to prevent unauthorised parameter changes
- RS-485 interface for data transmission.

INFO

More information: <https://www.bender.de/en/solutions/mechanical-and-plant-engineering/inductive-heating>



Bender technology follows new standards

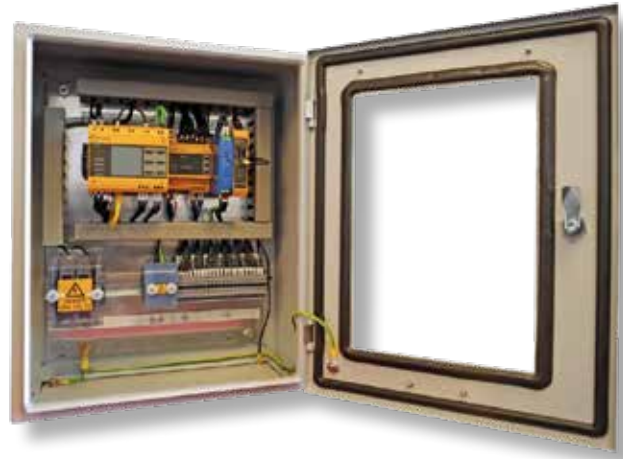
Intelligent monitoring of **signalling power supplies** in Great Britain

Tony Edwards, Industrial Sales Manager at Bender UK has responsibility for the rail sector, looks at how increasing demands for more effective identification of faults is shaping more sensitive and responsive monitoring.





Tony Edwards at the RAILTEX 2017 exhibition with the new RS4 system



The new RS4 system

A new standard for safety in railway systems

Every day rail maintenance crews face the challenge of ensuring that the power systems for operating signalling systems are free from faults to ensure that there is no interruption of service. The integrity of the power supply of railway signalling systems is fundamental to protect passengers and personnel and ensure that the rail network operates efficiently and that trains comply with their schedules.

Faults inevitably occur due to a natural degradation of the infrastructure or other common causes such as rodent damage or water ingress.

The maintenance teams are set targets to rectify those faults – but they can only be achieved by deploying technology which helps them to identify earlier and more accurately where those faults are occurring.

The ideal scenario is technology which gives them early warning of faults which are not yet critical – providing a breathing space to plan and deliver predictive and preventative maintenance solutions.

The new standard (NR/L2/SIGELP/27725) for those products from June 2017 is detailed in the **Network Rail Level 2 Product Specification: Insulation Monitoring and Fault Location Systems for use on Signalling Power Systems**. It sets out Network Rail's vision for Insulation Monitoring Devices (IMDs) and Insulation Fault Location Systems (IFLS) comprising their system requirements, network monitoring architectures, and IMD and IFLS capabilities along with requirements for portable models, and the integration of devices with Network Rail's Intelligent Infrastructure systems.

The document explains that the changes are designed to drive the development of new technology to provide additional parameters, for example capacitance to assess the safety of the Signalling Power System and further reduce the risk of electric shock. It also states that it wants to improve detection of signalling power cable failure before it interrupts a power supply leading to loss of signalling, and improve the ability to pinpoint the position of faults to drive reductions in time and the disruption caused by signalling power cable faults.



INNOVATIVE PRODUCTS

▶▶▶ Network Rail believes better monitoring will ultimately drive reductions in OPEX* and CAPEX** costs, enable the deployment of alternatives to more expensive auto reconfiguration systems, and extend the life of existing cables and networks.

Continuous monitoring of the electrical infrastructure

Bender UK is currently the only UK supplier with approved products to meet this requirement and the company has worked closely with its principal contacts at Network Rail to shape the development of the technology to meet the new standards.

One of the key requirements is the need for enhanced sensitivity to narrow down the area where a fault is occurring. Bender has responded with the new upgraded RS4 system integrated insulation monitoring and earth fault location system.

It is more sensitive than the widely deployed RS3 system and enables 'first fault' location (100 kilo ohms) before the fault becomes critical. It also measures capacitance, voltage and frequency delivering more information to help assess the health of the system.

The insulation monitoring device within RS4 system enables fault monitoring at Tier 3 electrical system network level for the signalling system. It has proved very effective in meeting the "Red" requirements within the standard, which must be complied with and achieved at all times.

Earth Fault Location is the effective solution for sub-network Tier 2 monitoring to assist in locating the fault on a circuit, a key element in the "Amber" requirements within the new standard.

The RS system continually monitors insulation values to show real time status of the power system. When the insulation value (IR) drops, the system records the fault and the Bender units put a test current signal or pulse into the system where a fault exists.

By means of the RS4 technology it is possible to locate insulation faults in the three-digit kOhm range or to assign developing insulation faults to a specific route section.

The new RS4 system is much smaller and more compact to make it easier to incorporate in the panels serving systems operating at a lower power rating.

Later this year, a variant will be available tested and ready for easy 'plug and play' installation and commissioning alongside existing power infrastructure systems up to AC 650 V.



Integration of RS4 devices with Network Rail's Intelligent Infrastructure systems is achieved by incorporating GSM-enabled data loggers equipped for real time communication to deliver immediate notification of insulation faults which are identified by the system.

Portable insulation fault location

Once the fault has been identified on a specific circuit, the portable EDS3090 case is used in the field to pinpoint the location trackside by monitoring the pulse on the cable. In line with

* OPEX Operative Expenditures e.g. maintenance efficiency

** CAPEX Capital expenditures, management of investment goods

the new standard Bender has made significant improvements to the EDS3090 unit which has more sensitive clamps and receiver technology. In practice, traditional technology often only detects and locates faults from 0 kΩ to approx. 7 kΩ. Bender offers solutions that can detect faults in a range from 0 kΩ (short circuit to rack or earth) to 100 kΩ. These insulation fault location systems can be implemented in a stationary and/or portable manner and permit proactive fault location by supplying the most important data concerning the condition of the system.

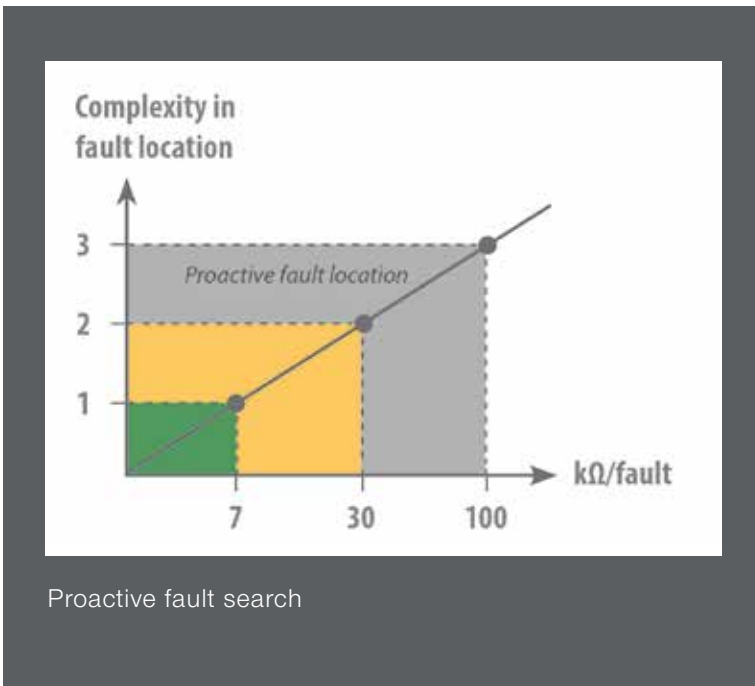
The EDS3090 is self-powered through connection to the trackside signal electrical network. It delivers live monitoring of the system status to immediately indicate if there is an earth fault and the status of the insulation. The portable unit can also be used to provide independent verification of the RS system performance.



Bender UK stand at the RAILTEX 2017 exhibition

The new RS4 system is just part of the huge Bender rail offering which includes power quality meters, insulation monitoring devices and monitoring software for rolling stock, signal power, points heating and trackside use. ■

Tony Edwards
Bender UK



INNOVATIVE PRODUCTS

Concealed earth fault monitor function in insulation monitoring device isoGEN423



The device variant ISOMETER®isoGEN423, known as an insulation monitoring device for use in mobile power generators offers other properties that deliver particularly advantageous benefits. One of these is the concealed earth fault monitoring function, described in greater detail in the following document.

Due to the absence of any product standard for an 'earth fault monitor', a short introduction is first required on this topic, also to avoid any misunderstandings.

Earth fault monitor variants

In the field of protective devices for power distribution grids, i.e. primarily in the medium-voltage and high-voltage sector, there are various earth fault protection functions, some of which are described in IEC 61850 but that are also named in various ANSI codes (e.g. 50N/51N, 50G/51G). In countries in which US standards are applied, earth fault monitors are sometimes deemed to be synonymous with ground fault relays.

In addition to this plethora of definitions is the fact that earth fault protection functions, ground fault

relays and earth fault monitors are not only used in unearthed power supply systems, but are in fact used in all known system types.

The methods used in variants of the earth fault monitor to detect an earth fault also vary very widely.

- In the field of power distribution networks with sinusoidal alternating voltages, differential protection methods are employed.
- With ground fault relays and on a few earth fault monitors, residual current converters are used.
- In particular, the offset voltage measurement method is employed in IT systems. To determine this offset voltage, voltage converters operating as transformers are used, especially in unearthed medium voltage and high voltage systems.

In low voltage systems, the offset voltage is determined by direct measurement of voltage to earth.

All 'earth fault monitor' variants share the following common features.

- The aim is rapid detection of asymmetric, very low-impedance insulation faults (close to 0 Ohm) on an active conductor to earth.
- When a first asymmetric fault is detected, a load or a defective branch must be shut down rapidly.
- Symmetrical insulation faults, caused for example by ageing and a vast array of electrical and physical stress factors and by environmental factors normally associated with operations are not detected.
- The activation threshold sensitivity depends to a very large extent on system parameters.
 - Insulation resistance level
 - System leakage capacitance
 - Mains voltage
- High-impedance insulation faults - we are talking here about a few kOhm – are for the most part not detected.

All of these properties have led to the fact that the most commonly used measuring technology methods used for earth fault monitors are prohibited for use in insulation monitoring devices, as defined in product standard DIN EN 61557-8 (VDE0413-8) or IEC 61557-8.

Also, the function of rapid automatic shutdown, when this occurs in the context of a first asymmetric and very low-impedance insulation fault, more closely resembles the functionality of a residual current device (RCD) than that of an insulation monitoring device. However, unearthed systems (IT systems) are characterised by the fact that, when a first insulation fault occurs, they do not need to be shut down.

Concealed earth fault monitor function

The concealed earth fault monitor function of the isoGEN423 is only for use in IT systems and is intended here for the low voltage sector for use up to a maximum of DC 500 V (400 V + 25%). This function is suitable for use in systems with a maximum of 5 μF system leakage capacitances.

The earth fault monitor function of the isoGEN423 can be used by setting the appropriate operating mode in the 'Set' device menu. If the 'DC' operating mode is set, a rapid tripping becomes possible in DC systems in response to asymmetric insulation faults. The maximum response time here is ≤ 1 s for system leakage capacitances of $C_e \leq 2 \mu\text{F}$.

Compared to the earth fault monitors described above, a rapid shutdown is also possible if the insulation resistance value drops below a limit value for symmetrical insulation faults. Here, response times of ≤ 10 s are maintained for system leakage capacitance levels $C_e \leq 5 \mu\text{F}$ und $R_F \leq R_{an}/2$. In this mode, leakage capacitance C_e is also measured.

CONCLUSION

The rapid shut-down of a power supply based on an offset voltage value is comparable in functional terms to the FU protection switch function from the Fifties. Since this kind of protective device is now prohibited in public power supply systems, for specific applications where the earth fault monitor function is absolutely essential, Bender also offers the option of implementing this safely and to real benefit with the new ISOMETER® isoGEN423. ■

INNOVATIVE PRODUCTS

**Decisive advantages
through early monitoring
of insulation resistances**

Recognise the trend at an early stage



The insulation monitoring devices provided by Bender offer plant operators reliable electrical safety technology which also reduces the plant's maintenance investment considerably and provides an early trend regarding the insulation resistance. The globally proven ISOMETER® series iso685 has now enjoyed strong growth with the new isoHR685. This device variant is able to measure insulation resistances up to the 10 GΩ range.

Early recognition and quality assurance

It is possible to counteract the sudden appearance of an insulation fault at a very early stage: The isoHR685 measures insulation resistances in a range up to 10 GΩ. The measured values are available as a trend graph in the integrated 'isoGraph'. This graphic presentation of the insulation resistance over time enables a trend of the insulation level to be recognised at an early stage. Different time scales are available for this purpose. This makes it possible to initiate plant maintenance long before an insulation fault occurs. The 'isoGraph' also makes it possible to assess the quality of the electrical plant components. By way of example, it is therefore possible to understand whether the insulation level has changed when exchanging devices. From as early as the plant installation stage, records are kept regarding any change in the insulation resistance due to the connection and joining of new components.



Measurement of capacitively coupled systems

A noteworthy feature of the isoHR685 is its ability to monitor long, parallel and capacitively coupled cables. A type of synchronisation enables interference from neighbouring monitoring devices to be suppressed and filtered out. Cables over 100 km in length, and in which various unearthed power supplies (IT systems) are routed can now be monitored. It doesn't matter whether the IT system is implemented as an AC, a DC or an AC/DC system. The AMP measuring method used can be used in all systems and it also determines the system leakage capacitance. In long cables such as those encountered in the oil and gas industry, e.g. to supply oil production facilities installed on the sea bed, energy lines, hydraulic lines and communication lines are grouped together in what is known as an umbilical cable. Since these cables are custom-made, since they have long delivery times and since they are also hugely expensive, it is of great benefit to interpret at an early stage the trend of the insulation level developing within them and to take appropriate remedial action when necessary.

"A noteworthy feature of the isoHR685 is its ability to **monitor long, parallel and capacitively coupled cables.**"

Fault analysis

Customers often have the problem that sudden and transient insulation faults occur in their installations. These faults are reported via a relay point. It is then often difficult to make decisions concerning maintenance measures if the available information only refers to this switch contact. Troubleshooting is difficult and time-consuming in the absence of additional measures. On the other hand a targeted troubleshooting process and plant analysis can be accomplished with the isoHR685 via an integrated history memory with real-time clock. Each reported insulation fault is deposited in a history memory with accurate time stamps showing when faults occur and disappear. This makes it possible to establish which consumer or which system part was switched on, switched off or switched over and at what time. Defective or faulty system parts can then be identified without switching system parts off (avoidance of failures).

Communication

State-of-the-art technology involves the use of programmable logic controllers (PLCs) controlling and monitoring plants. The Modbus TCP interface which is integrated into the isoHR685 allows straightforward communication with available PLC and control systems. All measured values can be read and displayed via this interface in the form of trend graphs. Following a security clearance it is possible to configure all parameters of the device externally and to reset or test the device via Modbus TCP.



INNOVATIVE PRODUCTS

The advantages of the new isoHR685 at a glance:

- 10 G Ω measurement
- Early recognition increases operational safety and makes it easier to plan maintenance
- Synchronisation in capacitively coupled systems
- Fault analysis with scalable history memory
- Assessment of quality of the components used
- High adaptability on systems with different properties
- Straightforward and high-performance communication interface
- Self-explanatory commissioning of a plant
- Comprehensive configuration
- Easy to use



▶▶▶ The device can be connected directly with an available PLC via the IOs (digital inputs and outputs) integrated in the isoHR685. Functions such as the resetting of faults, manual testing or the deactivation of insulation monitoring devices are possible via the digital inputs. Detailed fault information is available via the digital outputs. This includes information about whether the fault occurs in the intermediate circuit or, for example, whether it involves a symmetrical fault or a non-symmetrical fault.

User-friendly operation

A heterogeneous device landscape of a very wide range of manufacturers is far from unusual in plants today. All devices must be put into operation and set correctly. A commissioning wizard which is integrated into the isoHR685 guides the user or installer through the commissioning procedure without the assistance of a manual – in a similar way to devices in the consumer sector. This retrieves

and sets the most important plant parameters. Following successful commissioning, the device is optimally prepared for the monitoring measurement task, it carries out a self test and starts with continuous measurement of the insulation resistance. The settings of the device can be secured and recorded via the integrated web server and merged back into the device if necessary. ■

“The settings of the device can be **secured and recorded** via the integrated web server and merged back into the device if necessary.”

Dipl.-Ing. Jörg Irzinger
T-MIS



INFO

More information: https://www.bender.de/en/products/insulation-monitoring/isometer_isoHR685w

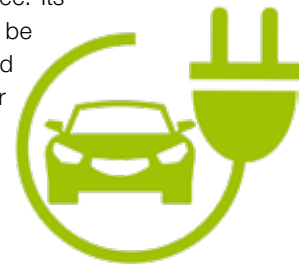


The concept, of charging electric cars directly off roadside lighting (street lamps), is as simple as it is smart. Requests for the street lamp variant of the 'Berlin' charging point are coming in thick and fast.

The 'Street lamp charger' is coming

"The integration of power sockets in existing infrastructure like street lamps [...]" is a "[...] fundamentally available technical solution". This prompts the authors of Germany's nationwide call for financial funding to set up a charging infrastructure as part of the 'Immediate Clean Air Programme 2017 to 2020' [Sofortprogramm Saubere Luft 2017 bis 2020] on 4 January this year. The Ministry employees are also thinking along the right lines with their depiction of 'Street lamp charging' as a low-cost charging infrastructure, and they further reason: "At present, affordable charging facilities are absent in many applications, at places where people park for extended periods and could charge their vehicles, for example overnight. This prevents those affected from being able to consider electric vehicles as a genuine alternative form of mobility. One example of this would be users who either do not have access to a fixed parking space or who are not able to equip the one they have with a charging point".

The Berlin start-up and partner of Bender GmbH & Co. KG, ebee smart technologies GmbH, would have to formulate its founding myth in a similar way. In fact, the vision right from day one of this manufacturer of charging infrastructure, founded back in 2011, was to use the electrical infrastructure already in the public domain for the charging of electric vehicles. What has emerged from this is the 'Berlin' charging point, developed and sold by ebee. Its slimline hardware enables it to be fitted to street lamps quickly and easily, as well as to walls, pillars or to 'urban furniture'.



▶▶▶ Minimum cost, small footprint

“Just drill three holes in each mast and it takes an electrician just thirty minutes to install” – according to ebee CEO Robert Weyrauch, that is all that is needed to connect the ‘Berlin’ charging point to a street lamp. The minimum requirements for installation, according to ebee, are a minimum mast diameter of 115 mm and a minimum mast wall thickness of about 5 mm. In terms of electrical supply lines, a lamp connection phase should be able to support an additional burden of at least 10 A: This equates to a minimum charging scenario of 2.3 kW. Provided that a 3-phase connection exists, it is possible to increase this scenario to 22 kW. Finally, and above all, it must be possible to park directly beside a street lamp. If there is a footpath between parking space and street lamp over which the charging cable would have to be routed, the ebee team considers that to be one of the few ‘genuine’ reasons to obstruct finalisation of this project.

Affordable, future-facing and flexible

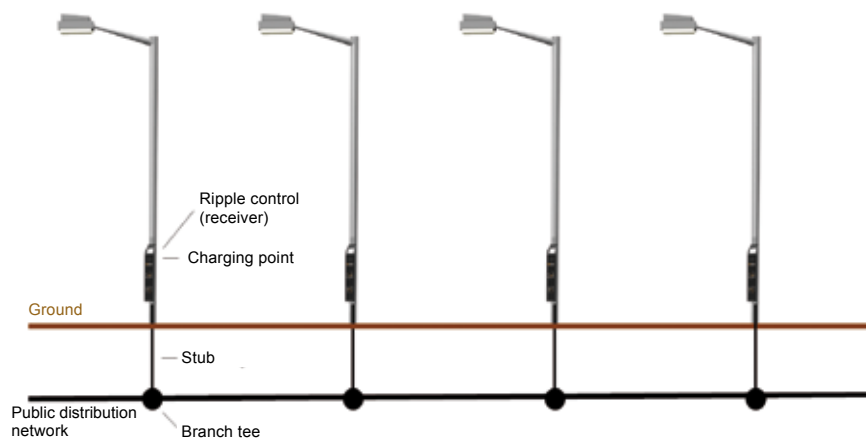
Right from the outset, development specialists at ebee were clear in their own minds that their product would have to live up to the challenging future requirements for intelligent control of charging scenarios. Here, the investment and production partnership that was established in 2014 between Bender and ebee, marked a milestone along the road to today’s market success. The slimline hardware concept of the ‘Berlin’ charging point arose through Bender’s development of a compact charging controller. Thanks to the Bender CC612 charging controller, the ebee street lamp solution is now equipped with highly advanced charging intelligence that will satisfy the challenging requirements faced by the complex charging scenarios of the future (smart charging).

For municipal operators, the benefits of street lamp charging are fairly self-evident: Using existing electrical infrastructure dispenses with the need to engage in costly earthworks and installation work. In addition, street lamp charging points can be dismantled and re-

located rapidly as needs change. This makes their installation interesting, not only during new-build work but also during the modernisation or renovation of street lighting.

Technical reservations cleared away

Nonetheless, some mayors and municipal utility providers still have some reservations about the decision to go ahead with ‘street lamp charging’ in their communities. These are founded upon the allegedly excessively long charging times involved at street lamps due to their lower charging power. Furthermore, a few view the problem in terms of the absence of separate power accountability, or in the insufficient cross section of power lines in the street lighting grid. Often, the question arises as to where the electrical power should come from for charging points during daylight hours, while the lighting is switched off. “In most cases, it is usually possible to clear away the technical reservations in the course of the initial meeting with a customer”, adds Robert Weyrauch. Since the changeover of public lighting to LED technology, there is usually sufficient surplus current in the street lamps. Due to its ‘close-to-TAB¹⁾’ concept, the ‘Berlin’ charging point also makes it possible to set up a public meter station together with electronic, MID²⁾-calibrated domestic meters and intelligent data communication. In the case of thin cross sections of electrical power lines, charge point performance can be restricted by the intelligent charge controller.



Ultimately, the day-night problem simply does not arise in the case of a distribution network, given that street lamps are connected separately to a main line, which means that

¹⁾ TAB = Technical connection conditions

²⁾ MID = Calibrated meter in the charging station

TECHNICAL APPLICATION



Representatives from E.DIS and the Großbeeren local authority at the commissioning of a 'Berlin' street lamp charging point on 1 November 2017

even during daylight hours, there is sufficient electricity available up to the cable transition point. In the case of a lighting grid, i.e. where the switching of lights down complete streets does not take place until dusk, existing phases can be switched over to continuous current. This means that electrical power is being supplied to street lamp charging points during daylight hours. The disconnectable circuit between lighting and charging point is controlled by ripple control and/or by an interface on the charging point controller.

More charging points than filling stations: **Parking = Charging**

The true benefits of charging from a street lamp really come into their own in the public precincts in towns and cities - specifically wherever a shortage of private garages oblige people to park beside the kerb, and in roadside parking bays. This is where the cultural mobility side of 'street lamp charging' really gains in significance. The fear that the 2.3 kW to 7 kW charging power envisaged for single-phase street lamp charging points may be insufficient for users can be countered by an old saying about petrol stations, 'seek, fill, drive'. In contrast, street lamp charging points are a cost-efficient way of delivering widespread availability of charging points within the public domain. This dispenses with the need for 'seeking'. Given that most drivers only cover short distances most of the time, there is no need for full charging - topping up is all that is involved. Finally, many parking situations, for example at a workplace

or during the night, involve vehicles being parked for long periods. At the end of which, batteries can be fully charged, since even a 3.6 kW street lamp charging point delivers an hourly charge equivalent to about 25 kilometres of driving.

The future of street lamp charging is starting to gain headway. For example, ebee exclusively supplies the winner of the Berlin tender, Allego, with lantern charging points for public operation. Street lamp pilot projects based on ebee's 'Berlin' charging point have been implemented in Bottrop, Aachen Hanover and Cologne. In November 2017, the power grid operator E.DIS inaugurated its first 'Berlin' street lamp charging point in the Brandenburg district of Grossbeeren. To date, a further three ebee-Bender customer companies have achieved success with domestic and international sales of their own street lamp charging point solutions, each one based on the CC612 charge controller.



To an increasing extent, infrastructure operators are starting to become aware of the potential of charging at street lamps. Now car drivers are being asked to become inspired in future by the ebee motto for charging in public precincts:

"We don't drive to charge.
We charge while parked
(beside a street lamp)". 🚗

Dipl. Pol. Peter Wilhelm, ebee smart technologies GmbH, Berlin

Unearthed power supply and insulation monitoring ensure electrical safety

High availability for reliable operation in waste water treatment facilities

A waste water treatment facility has an important task in treating waste water from several municipalities. The Annacis Island Waste Water Treatment Plant in British Columbia is the second largest treatment plant in Canada and has one of the highest levels of process treatment automation in the industry. This waste water treatment facility, maintained by MetroVancouver, treats approximately 175 billion liters of wastewater every year. The plant provides secondary treatment to wastewater for over 1 million residents in 14 municipalities.

Recently, the waste water treatment facility underwent substantial upgrades to ensure it stays online and operational 24/7 for years to come. The current upgrades, which were undertaken by 3 Phase Power Systems Inc. focused on replacing seven Variable Frequency Drives (VFDs) (three 1200 hp units for Influent Pumping Station (IPS), and four 684 hp units for Trickle Filter Pumps). The current VFDs, transformers and motors have been in service since 1997 without any major failure; the upgrade is designed to ensure a minimum of 15 additional years without failure. With an ever-increasing demand of waste water to treat, high operational availability is paramount both to the plant and the surrounding municipalities that rely on the waste water treatment services provided.

The focus of MetroVancouver is to maximize the economic efficiency of their pumps and filters that play a key role in water treatment while maintaining a strict standard of electrical safety throughout the facility. For them to achieve this, MetroVancouver needs to implement a technology that enables them to monitor the safety level of their electrical systems associated with the plant's pumps and filters.

MetroVancouver specified that they did not want to experience a drive failure in the coming 15 years of operation at this treatment facility. As part of this requirement, it was determined that an unearthed system with insulation monitoring has to be installed. In an unearthed system, there is no connection from





filters. Technically, a 12-pulse input VFD is fed by 2 secondary transformers and an 18-pulse input VFD is fed by 3 secondary transformers. The purpose of having multiple transformers feeding the VFD is to get phase shifted outputs which allow for more pulses to be created. Theoretically, the increased pulses reduce the total harmonic distortion from input to output but realistically, there are still some harmonics present despite this.

The selected solution (an unearthed system) that can reliably detect AC and DC faults while being immune to the harmonics from VFDs was necessary to monitor the system in both offline and online instances. This ground fault monitoring device in this ungrounded system would allow maintenance personnel to find and correct insulation deterioration in the early stages, which reduces further damage and avoids expensive and unscheduled stoppages of the VFDs.

source to ground and a single insulation fault from one of the phases to ground would still allow the system to operate. An insulation fault can result from humidity, moisture, mechanical and electrical stresses and exposure to gases, all of which are present in a waste water treatment facility. If the single insulation fault is recognized and corrected in time, the system can remain online until the next issue arises. This feature is advantageous for applications that demand continuous operation, such as this waste water treatment facility.

The specification for offline and online monitoring of the VFDs meant that all input secondary transformers and the output filter to the motor has to be monitored with an insulation monitoring device (IMD). The main problem with having more than one IMD in a circuit is that, because of their connection to earth potential and their internal resistance, they see each other as an insulation fault and possible influence.

A closer look at the electrical system shows that the pumps and filters are fed by variable frequency drives (VFDs) that allow for the plant personnel to control the motor speed and torque by adjusting the input frequency. The difficulty with VFDs is that there are rectifiers, filters and inverters in the circuitry, which can cause AC or DC faults to appear if there is an insulation fault. Additionally, VFDs can inadvertently create harmonics or low-frequency signals which can negatively influence the insulation measurements.



FP200 display and operator unit for devices of the iso685 series without display

1200 hp influent pump motors

To mitigate the effect of harmonics in the system, the plant had implemented 12-pulse input and 18-pulse input VFDs to operate their pumps and

Fortunately for MetroVancouver, there was one device on the market that could handle all these difficult tasks with functionality, reliability and affordability. The ISOMETER® iso685-S-B, a high-end IMD from Bender, was chosen as the perfect solution to



TECHNICAL APPLICATION



Insulation monitoring devices iso685-S-B

▶▶▶ monitor the entire electrical system, which includes the transformers, the VFD and the motor. This IMD is suitable for this application due to its proprietary ability to detect AC and DC faults while being immune to harmonics and its ISONet ability, which allows it to couple with other IMDs in the same circuit. This ISONet feature allows internal separation between the IT system and the installed iso685s so that when the system is energized, only one iso685 remains active to monitor the entire system while the others remain on standby but are separated from the system being monitored. When the system is de-energized, 3 IMDs are required for the 12-pulse input and 4 IMDs are required for the 18-pulse input systems. The increase in IMDs is due to the presence of the diodes in the rectifier circuit which do not allow for the flow of current when the system is de-energized.



web server and BCOM (which enables communication between Bender devices). With an integrated web server, IMD data, i.e. measured data and device parameters, can be conveniently displayed on remote PCs via a web browser, providing crucial information necessary for decision-making. In this application, the iso685's ethernet capability was used to access information which allowed maintenance personnel to get the most up-to-date information on the status of their electrical systems being monitored by Bender devices.

Thanks to Bender's iso685 ground fault monitoring device, the Annacis Island waste water treatment facility increases their economic efficiency by improving operational availability through optimized maintenance while ensuring the safety of plant personnel and equipment. This is a story of great success for Bender and shows the versatility and functionality of a powerful ground fault monitoring device in an ungrounded system. ■

*Sonny Solanki, Bender Canada Inc.
Amir Mojtabeh, Bender Canada Inc.*

With the growing popularity of communication technology in modern industrial infrastructures, such as waste water treatment facilities, the integration of IMDs into a communication network is essentially seamless. Bender IMDs feature an Ethernet interface which can be used for communication with Modbus, an integrated

Marienkrankenhaus
Hamburg

Renovation and restructuring of the Operating theatres



The Marienkrankenhaus

has some 586 beds for in-patients and 37 beds for day-care patients, making it the largest denominational hospital in Hamburg. Every year, more than 98,000 patients receive individual and comprehensive medical treatment here, along with professional aftercare. For more than 150 years, the Marienkrankenhaus hospital has stood for state-of-the-art medical technology and has offered highly-specialised medical treatments combined with traditional Christian values.

With 1,687 employees across 13 specialist departments – from the obstetrics department with postnatal care for premature and newborn babies (Perinatal Centre Level 1) to the treatment of bone fractures in older patients in the Geriatric Trauma Centre – the Marienkrankenhaus hospital offers professional medical support as a centre of medical treatment that provides specialist care along with emergency treatment and acute care.

In particular, the obstetrics department of the DIN EN ISO 9001:2015 certified hospital enjoys an excellent reputation far beyond the borders of the Hanseatic city. Every year, around 3,800 children are born here. This makes the Marienkrankenhaus one of the largest obstetrics units in the whole of Germany.

Renovation – a challenge in a hospital

The renovation of operating theatres in hospitals always represents a particularly difficult challenge. The hospital needs to keep its surgery departments up and running, and at the same time patient safety needs to be ensured.



TECHNICAL APPLICATION



The operating theatres are fully glazed and decorated with maritime images of the coastal landscapes of North Germany.

►►► This is the challenge that was faced by the Marienkrankenhaus in 2016. In total, seven operating theatres were due to be renovated. In addition, a number of other restructuring measures needed to be implemented in the hospital building. The hospital opted for Bender and its MEDICS® products as its partner for electrical installations and electrical power supply systems to the operating theatres, and chose the company Bartsch Elektrotechnik as an experienced electrical contractor.

“It was important to us to find partners who were specialised in the installation of the medical IT power systems (unearthed system) that are required in operating theatres and who could supply the required MEDICS® products from Bender”, explains Thomas Wiese, Head of Electrical Engineering in Marienkrankenhaus Hamburg, adding: “In addition, we wanted to be able to integrate the Bender VIT distribution boards in wall alcoves to save space. To do this, we planned the installation of air/water heat exchangers with Bender.”

Electricity and water

Only by installing air/water heat exchangers on the IT distributors is it possible to save space by mounting the IT systems in wall alcoves. The power losses are dissipated via a water recooling system. This means that there is no need for the alcove/room cooling systems that are otherwise used. The e-Comfort controller is integrated in the control cabinet door for parameterisation of the interior temperature. The alcove is monitored with a leakage sensor. In the event of a malfunction or fault, an alarm is reported via the corresponding Bender MEDICS® control panels.

In total, Bender and Bartsch Elektrotechnik supplied 24 IT system distribution boards, along with two independent SV and UPS IT systems including MEDICS® control panel for every operating theatre or intensive care bed area. The distribution panels contain TÜV-certified automatic transfer switching devices with monitoring for unearthed safety power supplies of type ATICS®-2-63A-ISO and energy-efficient Green Line (GL) versions of the isolating transformers from the ES710 series.



“All power supply statuses for sensitive areas can be **internally and externally** visualised via a state-of-the-art data connection on monitors, tablets or smartphones, thus enabling fast status detection and fault localisation.”

The notifications and alarms from the IT systems, UPS systems and external devices, such as the medical gas supply system, are displayed via the foil-laminated panels with combined text and notification display. All power supply statuses for sensitive areas can be internally and externally visualised via a state-of-the-art data connection on monitors, tablets or smartphones, thus enabling fast status detection and fault localisation. This helps to prevent equipment or system failures – completely in keeping with the Bender motto “Find out today what won’t happen tomorrow”.

Quality and experience count

The renovation of the operating theatres in Hamburg was by no means a straightforward task. Each theatre needed to be taken out of operation for the duration



of the conversion work. This meant that other theatres needed to be fully available at the same time for the continued treatment of patients. “It was particularly important here that, in the form of the companies Bender and Bartsch Elektrotechnik, we found partners who are used to operating with great caution in sensitive areas”, explains Thomas Wiese. “We will no doubt be happy to fall back on their specialist knowledge and products again in the future”, emphasised the Head of Electrical Engineering. ■

*Uwe Heckenberg, TB Nord
Friedhelm Leckel, BS-S-CPM*



INTERVIEW on residual current technology and POWERSCOUT®

“Making gains in safety”

NürnbergMesse relies on the monitoring devices from Bender

The exhibition centre in Nuremberg features 15 exhibition halls with approximately 170,000 m² of exhibition space and 50,000 m² of open space. The nearby congress centre has an overall capacity to cater for more than 12,800 participants. Over 30,000 exhibitors and up to 1.4 million visitors participate in events organised by NürnbergMesse in Germany and abroad every year. Almost one in two exhibitors (43 %) and one in five trade visitors came from overseas in 2016.

At the SPS IPC Drives fair 2017, Europe's leading trade fair for electric automation, Bender presented the web-based software POWERSCOUT® and residual current monitoring, that is used on the trade fair exhibition ground, as part of a live demonstration.



We conducted this interview with the engineer Stefan Winkelmann who has worked as Head of Technical Facility Management at NürnbergMesse for over 20 years.



At Bender's booth interested exhibition visitors could view the big screen and gain insights into the electrical installation at NürnbergMesse with POWERSCOUT®. This demonstration showed: POWERSCOUT® brings together all stored data from the measurement and monitoring devices installed on-site and creates easy-to-understand visualisations, analyses as well as user-specific reports of all important measured values. This allowed users to monitor the present status of the whole area.

Disturbances can be detected at an early stage and causes can be eliminated in a timely manner before any damage or system breakdowns occur. This continuous monitoring ensures a safe power supply and makes predictive maintenance possible for the operator. Through a combination of measuring technology and software, you can significantly simplify periodic verification.

“Safety at a very high level”

Mr Winkelmann, what requirements does NürnbergMesse have in terms of electrical safety?

As the Technical Facility Management department at NürnbergMesse, we look after an extensive area featuring 15 exhibition halls and different congress and office buildings. Providing our exhibitors, visitors and employees with a safe supply of power is a basic prerequisite for a successful exhibition.

To further enhance this safety, new systems have been installed at NürnbergMesse. Which ones?

We have installed residual current technology with permanent RCM measurement as a solution for the manual measurement system that has been used to date. The automated residual current report forms the basis for measurements without shutdown in line with DGUV Regulation 3. Furthermore, we decided to opt for POWERSCOUT® to enable life-long recording of all values relating to power quality.

What motivated you to set up a permanent RCM measurement?

The technical department consists of several areas such as facility service, technical facility management for in-house systems, and the building department responsible for new construction work. All three sub-areas also look after electrical engineering.

The large number of current distribution units – there are about 150 on the site – makes it almost impossible to monitor everything continuously. On top of that, you have the interference of a constant stream of people in the electrical systems and also exhibitors and visitors connecting their devices, the quality of which we cannot estimate.



Dashboard





Electrical installation at NürnbergMesse

▶▶▶ Due to the size and structure of the entire site, it is no longer feasible to have our technical staff conduct checks as part of routine patrols in order to stay on top of things.

What alternative solutions presented themselves prior to your decision?

The other option would have been to deploy larger numbers of staff: Assign our service partners and conclude corresponding maintenance contracts, increase our own workforce or commission a one-off assessment – those would have been the options. However, that would have meant permanently higher costs. That is why we opted for the technical variant.

“We opt for the technical variant”

Which aspects were important when it came to choosing this solution?

There are good, modern technical solutions for permanent monitoring, evaluation and documentation. You have to move with the times here. The frequency is three years for the alternative manual check. We just cannot take the risk of a new fault going unnoticed for several months.

By contrast, permanent measurement of the insulation resistance gives us almost constant confidence that the electrical system is in a safe operating condition. Disturbances can be detected at an early stage. Another plus is the comprehensive monitoring through which we can bring long-term trends and dependencies in line with other events. Legal security is also ensured through continuous recording and documentation. The system can be accessed online at any time and from anywhere.

The technical option that we are now using offers us many other benefits:

- one-off procurement costs
- monitoring 24 hours a day for 365 days of the year
- comprehensive evaluation and documentation
- immediate fault display and notification.

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

Shortly after setting up the system, we actually identified a fault in our technical equipment. In an office area, three water heaters had a series defect and were generating very high levels of interference current – however, only when hot water was being used. It probably would have taken us a long time to discover this fault using the old method.

Even though manual measurements continue to run in parallel, we are increasingly focusing on the technical option. (Note: PEN bridges lead to disturbances in electrical systems in a TN-S system)

How has the implementation of the measure been viewed in practice?

In many cases, we work closely with long-standing partners and here we place particular importance on trustful and constructive cooperation. This also allows ambitious projects to be executed, with minimal or no interruption, during while measurements are carried out ongoing operation. Little effort was involved in implementing this measure.

Where do you see the differences between a new installation and the retrofitting of existing installations?

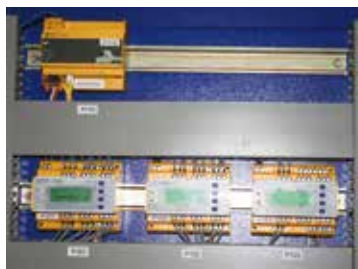
In terms of existing installations, it can be difficult to install standard current transformers in some cases. To this end, however, you now have special flexible current transformers (WF or wrap-around CTs) that can also be used subsequently for large conductors and even power rails. Bender systems are generally included in the planning of new sites and can therefore be equipped with the standard current transformers.



Expectations met – retrofitting planned

What will you decide upon for further construction phases?

The system has met all our expectations. We are therefore planning upgrades throughout the site in the near future and are accelerating our efforts in this regard. New systems will be equipped with this technology from the outset.



Is it possible to integrate third-party devices into POWERSCOUT®?

We already have a comprehensive energy management system on-site, in which more than 1,000 energy consumption meters are integrated for voltage, frequency and harmonics. This data can be used for an even more specific evaluation by POWERSCOUT® if necessary.

Do you have any other requests or suggestions for RCM products or POWERSCOUT®?

We don't have any further requests or suggestions for RCM products at present. We'll collect our findings for POWERSCOUT® along with its documentation and reports. Everything else will follow from operation over time. It may be the case that not all options have been exhausted.

Summary by Mr Winkelmann:

- NürnbergMesse already uses different visualisations in the area of facility management. With POWERSCOUT® they are continuing on their path towards safe operation.
- By combining RCM monitoring and visualisation with POWERSCOUT®, electrical safety is increased and disturbances or defects can be detected in good time. Failures and malfunctions are thus reduced to a minimum.
- We are particularly proud of receiving confirmation from the property insurer that we have always provided a very high level of safety for our employees and customers/visitors, and now we are looking for ways to make even more improvements in this area.

Mr. Winkelmann, I would like to thank you for the interesting conversation. ■

*Matthias Niedermann
Technical Office Nuremberg*



INFO

The POWERSCOUT® website can be found at:

powerscout.bender.de



You can make direct contact there to obtain your personal access.

Bender supports **Formula Student rising stars from Pakistan**

Bender on board

The industrial development of electric cars is advancing rapidly. Their ongoing development depends greatly on the commitment of the next generation of engineers and their ability to innovate. For Bender, this is an important reason for supporting Formula Student Electric (FSE), an international student engineering competition, with its specialist expertise and its technologically best-in-class solution for monitoring electrical safety.



The competition attracts immense excitement worldwide, and the number of teams wishing to take part is growing every year. What is particularly impressive is not just the engineering students' commitment, innovativeness and team spirit but also their professionalism.

It is these qualities that have quite literally “electrified” the first Pakistani team and inspired them to take part, under the name NUST. In just a short period of time, the young engineers have achieved considerable successes in the FSE competition and are also enjoying widespread popularity in their homeland. The team, whose full title is Formula Electric Racing NUST (FERN), is formed of students from the renowned Pakistan Navy Engineering College (PNEC) in Karachi, part of the National University of Sciences and Technology (NUST). For convenience, the team simply goes by the name of NUST.

The group, now composed of 31 highly qualified engineering students, was founded in 2012 and has represented Pakistan in FSE since 2015. In its debut year, NUST participated in races at Silverstone in the UK and at Hockenheim in Germany with the NAS15.

The team has attracted an unusual and impressive amount of interest and pride in its home country. It has achieved this national popularity since its sponsorship by Bank Alfalah, one of the country's largest banks, as part of the institution's programme for promoting young talent, known as the Rising Talent – Discovering the Potential of Pakistan Platform. Ever since then, NUST has attracted enormous attention across all media. The team was even hired to appear in a TV advertisement.

As early as its second season, in 2016, the NUST team participated in the SAE Electric US event, achieving an impressive 17th position among the 122 participants. In the Cost Analysis category, the young engineers even reached fourth place. In doing this, NUST laid the foundations for further honours. In 2016, the team was presented with the Innovation of the Year award by the renowned Pakistan Innovation Forum, which is committed to promoting innovation and the pioneering spirit.

Further plaudits followed in 2017, when NUST was recognised as a TOP Team (in 20th place) at the Momentum Tech Conference 2017, one of Pakistan's leading start-up organisations. In March of that year came the Spirit of Exhibition Award, presented at the ITIF – Asia Auto & Trade Exhibition, the International Trade and Industry Fair.

In politics, too, the rising stars have been attracting attention. They received an invitation from Pakistan's President, Mamnoon Hussain, and had an audience with Admiral Muhammad Zakauallah NI, Commander of the Pakistani Navy. Both expressed their admiration for the team's outstanding achievements.

For the upcoming 2018 season, NUST has set itself the ultimate goal of securing a prominent position in the field of electromobility for its country. The NUST team has already signed up for the FS Germany event.

The team is being supported locally by our representative AI Sanabel Technologies LLC. ■

Andrea Gossel, S-COM

Formula Student (FS), a global engineering competition for students and early-career engineers, has enjoyed growing popularity year on year since it was launched in Europe in 1999. In 2010, the competition was expanded to include the field of electromobility with the addition of the Formula Student Electric (FSE) category. The participating teams are tasked with designing a vehicle driven solely by electricity. Right from the outset, Bender has supported the teams involved in developing and designing pure electric-drive vehicles with its ISOMETER® IR155-3203/3204. Thanks to its low space requirements and its optimised measuring technology, the device is highly suitable for use in electric and hybrid vehicles. Any insulation faults are reliably reported, even in extreme conditions, as might be encountered during acceleration or energy recovery.

In 2017, FS was expanded further with the new Driverless category, in which some teams – also supported by Bender – are testing their skills. In parallel, developments in the field of motorcycles are also under way. Here Bender is supporting the Gauss Motorcycle Project led by the University of Applied Sciences Darmstadt.

Globally, Bender is on board with more than 90 teams competing in the FSE competition.



BENDER INHOUSE

Innovative technology in the laboratory:

We bring your application to our laboratory

Test bench for applications in the field of drive technology

The requirements placed on Bender devices and systems are becoming ever more complex as a result of rapid technological change. In order to ensure high levels of quality and reliability in the future, Bender does more than simply develop its devices on a continuous basis. It also aligns its testing technology to new market and customer requirements continuously with the aim of simulating customer applications as realistically as possible in the laboratory.

It is only in this way that potential problems in the process environment can be identified at an early stage, the key to devising innovative and specific solutions for each customer within the shortest possible time.

Frequency converters for the control of dynamic drives can be found in virtually every industrial system today. The interaction of the different converter components and the associated impact on the power quality present a great challenge for the precise Bender measuring technology. A new universal test bench was planned and implemented by Bender specifically for simulation of these applications in the laboratory.

The fundamental requirements for these were developed by the Engineering department as part of the 2015/16 apprentice project together with the product and market segment management departments. An

„It can simulate loads such as a lift motor, a rolling mill or a crane in order to test the behaviour of Bender devices in applications of this kind.“

extract from the performance specification shows which requirements were stipulated for the test bench:

- Imitation of real load types (rolling mill, lift, crane ...)
- Operation with position and speed control
- Specification of torque curves
- Earthed operation (TN system)
- Unearthed operation (IT system)
- Coupling in the intermediate circuit of frequency converters
- Connection of system leakage capacitances and line filters
- Straightforward exchange of control components.

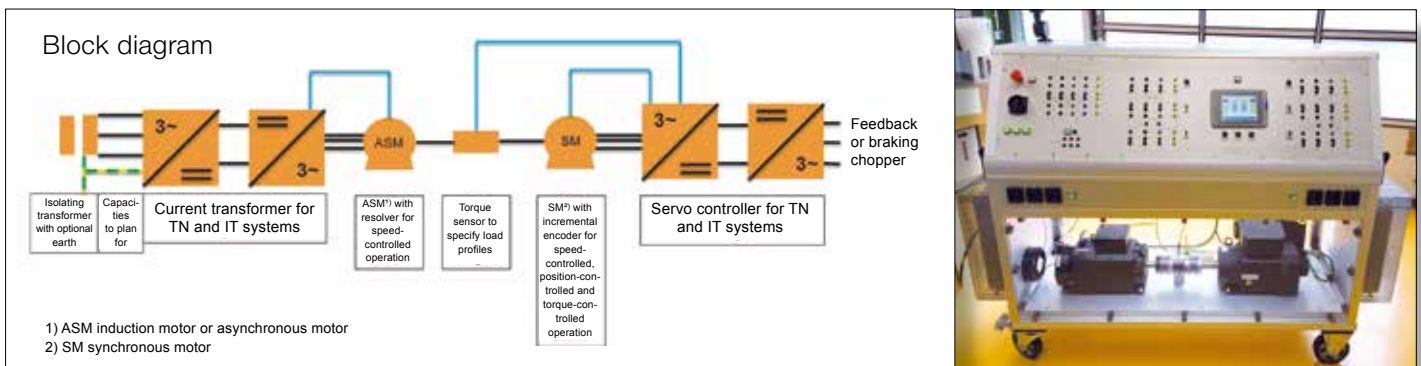
The test bench produced by these promising young people acquiring expertise in drive technology and frequency converters makes it easier than ever before to carry out a range of different simulation and test tasks. By way of example, it can simulate loads such as a lift motor, a rolling mill or a crane in order to test the behaviour of Bender devices in applications of this kind.

The design for the controlled system of the plant was developed in conjunction with Baumüller Nürnberg GmbH. Following careful selection of all components, it was possible to plan and construct the mobile test bench in such a way that it can be used for the IT system as well as the TN system, meeting all the requirements imposed on it.

With the assistance of the corresponding sensor technology, customer specific applications in the field can be registered and subsequently displayed in the laboratory. They are “digitised” there and merged with the test bench controller. In this way it is possible to adapt Bender technology to suit specified requirements on an individual basis.

The digital era demands a high level of flexibility and fast response times. This test bench is a milestone in testing technology at Bender and it is just one example of what will become possible in future. ■

Jens Schäfer, T-Q-V





AGENTS CORNER

The Portuguese representative of Bender

Safety in Portugal

SISACOL Sistemas de Automação e Controlo, Lda. was founded in 1998 by technical experts active in the Portuguese electricity market, and it started its activities from a small office with the delivery of electric switching and measuring devices as well as medium-voltage systems. In March 2018 the company will celebrate its twentieth anniversary.



António Carlos
Chief Sales Officer,
CSO

In 2007 the company moved into new, larger premises in the S. Marta do Pinhal industrial area of Corroios, a town 20 km south of Lisbon. This relocation marked the start of the modernisation of the company. At the same time, it also provided the company with the opportunity to replenish its workforce with young and dynamic staff with higher academic qualifications. This delivered the perfect combination of acquired expertise and improved theoretical technical knowledge.

Equipped for the future

Against the background of steadily increasing customer requirements, in 2010 SISACOL obtained certification for its management system in accordance with the standard NP EN ISO 9001:2008 – as a guarantee for continuous improvement of the services offered and of the company's internal processes.

At the same time, in response to various customer requests, the company started setting up its own engineering department for the areas of Design and Development, Technical Testing, Commissioning and Customer Service.

2018 will be another milestone in the company's development. Thanks to the relocation to the industrial park in Seixal and the move to a new building with a floor space of 650 m², SISACOL is now in a position to meet the challenge of its forecast growth over the next few years. This year, SISACOL will also update its management





Safety in control cabinets

system in line with the standard NP EN ISO 9001:2015 – with a focus on continuous and sustainable growth in new business areas.

Partner of Bender

Since 2005, SISACOL has assumed the role of representing Bender GmbH & Co. KG in the Portuguese market. Here, the focus always has been – and remains to be – on medical technology applications (IT systems for the medical sector and control panels in hospitals) as well as industrial solutions that have since been established as benchmark solutions for the domestic market. At the same time, an attempt was made to implement all of the solutions available from Bender – from simple insulation monitoring systems through fault location systems in medical IT system distribution boards to hospital control panels. More recently, SISACOL has been working together with the regulatory authorities. In addition, the company also offers technical advice and consultancy services for hospitals in order to present the advantages of using the ATICS® transfer switching and monitoring devices, particularly in conjunction with insulation fault locators.

The new Portuguese directive RTIEBT (technical regulations for low-voltage systems) was published in 2007. These regulations, which are based on standard IEC 60364/section 801, are unique in Europe. They define the requirements that must be met by power supply in public buildings such as administration buildings, hospitals, schools, business and service buildings etc. – particularly with regard to the safety of people and equipment.

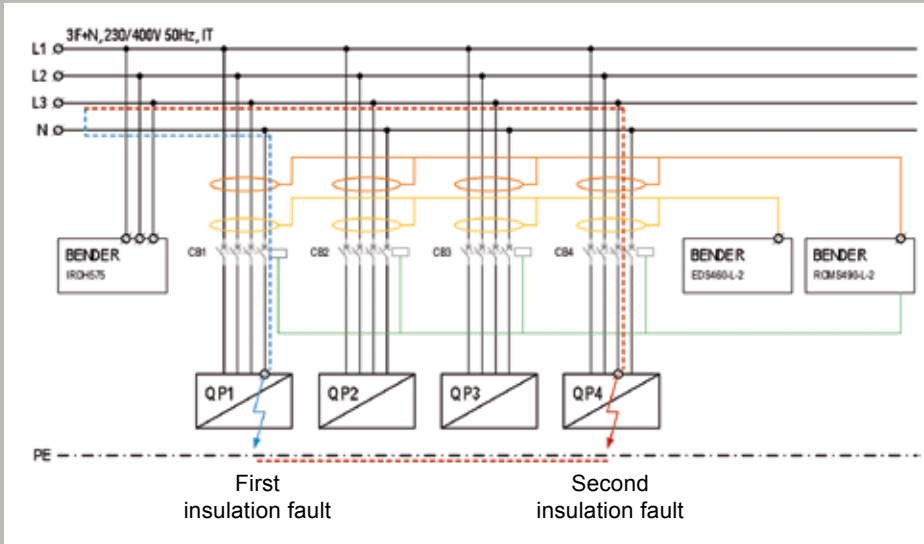


Tiago Luís Francisco,
Chief Technical Officer, CTO
and his team

According to RTIEBT, electrical systems must be equipped with a control cabinet (safety cabinet) that is fed via an isolating transformer. This contains, among other things, continuous insulation monitoring for the transformer and a redundant power supply via an emergency power generator or via an own uninterruptible power supply (UPS) specially provided for this purpose.

In addition, the continuous insulation monitoring of the AC 400 V system must also be equipped with a remote display in the maintenance room or in the entrance to the building.





Circuit diagram of the installation



Low voltage security panel with switch gear and Bender devices

►►► Depending on the safety level of the building, the monitoring system needs to be equipped with an insulation fault locator (EDS) for detection of insulation faults in real time and – where necessary – residual current monitoring.

This new regulation has enabled SISACOL to develop new business fields and unlock a new market for power supplies for safety installations, which had not existed previously.

Electrical safety for the Criminal Investigation Department in Lisbon

The new building of the Polícia Judiciária (Criminal Investigation Headquarters) was inaugurated in Lisbon in 2016. The Bender monitoring devices that are installed play a very important role in this new building, which features state-of-the-art safety technology.

In this installation, the main loads of the safety cabinet – such as the emergency lighting, telecommunication systems, special lifts and signal displays of the heliport as well as the fire alarm systems and burglar alarm systems of the building – are supplied with 630 kVA via an isolating transformer.

The control cabinet itself features one IRDH-575B1-435 insulation monitoring device and one EDS460-L-2 insulation fault locator in the unearthed power supply (IT system) for monitoring and detection of a first fault. In addition, a residual current monitoring system of type RCMS490-L-2 was installed in order to detect a second insulation fault and ensure automatic isolation of the power supply.

Since the police work must not be in jeopardy at any time, electrical safety in this building and preventative maintenance are paramount. With this in mind, the project team decided that, in addition to the insulation fault location, an indirect contact (second insulation fault) would also need to be detected and remotely displayed. This is because this is the only way to guarantee the reliability and availability of the electrical system under all operating conditions and to ensure its proper operation in all sections. If the first fault is not remedied by the service teams within an appropriate response time, the RCMS490 unit acts to protect people and systems if a second insulation fault occurs.

In addition, this also boosts the reliability of the overall system, as the options for using residual current circuit breakers – which can trip unexpectedly when a first insulation fault occurs – are limited.

The ability to call up information from both systems is unique and represents a competitive advantage in the market. It enables the service teams to prepare promptly for the maintenance and repair work that needs to be carried out at the corresponding loads. ■

*Tiago Luís Francisco
SISACOL, Portugal*

“Since the police work must not be in jeopardy at any time, electrical safety in this building and preventative maintenance are paramount.”



From left to right: The low voltage security panel with switch gear and Bender devices and on the right side the 630 kVA isolation transformer 400/400 V.



Introducing Bender's
partner **Cadolto**

The future of construction, which you can be part of

1890 in Cadolzburg near Nuremberg. The company is the Europe-wide leader in the construction and leasing of modular buildings for the healthcare sector. The Group's best known projects include the world's first modular construction hospital (Hochgebirgsklinik Davos, CH), the Charité Berlin temporary hospital, the world's first modular construction data centre in Leverkusen and the Nye Kirkenes sykehus hospital, Norway, which is constructed to passive house standards.



The advantages of Cadolto's modular construction technology:

“Besides very **fast delivery to the highest quality** standards, these include architectural freedom of design, cost effectiveness and sustainability.”

The right operating theatre unit delivered to order? A hospital that is designed precisely to requirements and erected in just a few days? Rapid relocation, extension or dismantling of complete buildings on the hospital site? Virtually without construction work and noise? With no compromise on technical equipment? These options are what modular construction specialist Cadolto offers – as Germany's market leader in healthcare buildings.

Maximum level of prefabrication and extensive product range

From intensive care, ward, nursing, CT and MRT units to hybrid operating theatres and diagnostic units, the company based in the Nuremberg metropolitan region has accumulated extensive experience through the successful completion of over 700 projects. With every project, Cadolto has further developed its technology and its 90 percent prefabrication level is currently the highest in the construction sector. In addition to highly complex healthcare buildings, Cadolto designs, constructs and installs data centres, clean room and laboratory buildings, office and administration buildings, residential buildings and radio, transmitter and carrier stations.

All building trades from a single source

Design, production and installation: at Cadolto, all trades work alongside one another. Architects, designers, building physicists, structural analysts, building equipment engineers and many others besides design and prefabricate complete buildings in the factory. The civil engineering work is carried out and the foundations laid in parallel, so that there are no gaps and valuable time is saved.

Like conventional building, but quicker, more flexible and more sustainable

As hospitals and clinics often have to evolve dynamically, the advantages of Cadolto's modular construc-

tion technology suit such structures: besides very fast delivery to the highest quality standards, these include architectural freedom of design, cost effectiveness and sustainability. In addition, Cadolto offers project-specific financing options such as rental, lease-purchase, purchase or leasing.

The flexibility for later modifications such as conversion, extension or dismantling is virtually unlimited and therefore especially sustainable. And if a module is nevertheless to be taken out of service, it can be almost completely recycled. A particular advantage where the hospital continues to function is the minimal level of emissions from the construction site due to the short time required for installation. Major construction site traffic and large amounts of packaging waste generated by conventional building work are also avoided.

Large-scale turnkey projects

The modules leave the factory fully equipped, including all medical, laboratory and building services facilities through to furniture, tiling, curtains and façades. On site, a specialist workforce installs and connects the modules precisely and rapidly to create ready-to-use buildings. As temporary or permanent solutions.

Current major projects also illustrate this perfectly:

Hospital in Kirkenes

The new-build hospital “Nye Kirkenes Sykehus” was designed to passive house standards as a three-storey building with a building services room on the roof. As Kirkenes is located north of the Arctic Circle, the time window for construction was very short. The Norwegian engineers were, therefore, highly impressed with the rapid on-site installation facilitated





The new-build hospital „Nye Kirkenes Sykehus“ in Kirkenes, Norway



Norrlands Universitetssjukhus Umeå, Sweden

►►► by the prefabricated Cadolto modules. The 16,300 m² hospital, which offers the highest level of specialist care, was built entirely in modular form with A&E facilities, operating theatres and delivery rooms, radiology laboratories and inpatient rooms as well as surgical, medical and psychiatric outpatient departments and was recently handed over to the client.

Temporary building and extension of the A&E department, Augsburg Hospital



Cadolto established a new record in Augsburg. As this was not only the largest project ever completed by the company in Germany, but also represented a huge challenge in terms of the complexity of the task and the schedule. The newly erected, six-storey building, consisting of 156 modules, was connected to the existing building on several levels and supported on reinforced concrete stilts.

In addition, its future subsequent conversion had to be included in the design.

The temporary building with a total floor area of approximately 8,200 m² will initially house three intensive care units, a dialysis unit and an extension to the A&E department in the form of an admission ward. At a later date, the ground floor will be redesigned and floors 1 to 3 converted into standard wards.

Norrlands Universitetssjukhus Umeå, Sweden

Cadolto recently installed two temporary buildings for the four-storey extension to the Norrlands Universitetssjukhus in Umeå in the Swedish province of Västerbottens län. They comprise 141 modules, have a gross floor area of 6,800 m² and were prefabricated with all the medical equipment, building services and furniture already in place. Thus, the two hospital buildings were handed over ready for use, in each case in less than six months from the award of the contract.

New, attractive and still available

A pre-owned or rented building? A quickly installed ward unit? An operating theatre in just two weeks? A residential or administration building urgently required? Cadolto can deliver to a tight schedule. At a fixed price, to hire or buy, at a fixed date - tailored fully to your needs and requirements. Always with the maximum level of prefabrication, to the highest quality standards and ready for use immediately. ■

www.cadolto.com

EXHIBITIONS 2018



EXHIBITIONS INTERNATIONAL

HCDE – China Hospital Construction & Development Conference
20. – 23.04.2018 | Zuhai, China | Stand: C20

9th Annual National Electric Mobility Canada Conference and Trade Show (EV2018)
24. – 27.04.2018 | Ottawa, ON, Canada

Canadian Institute of Mining, Metallurgy and Petroleum
Leading not-for-profit technical society of professionals in the Canadian minerals, metals, materials and energy industries
06. – 09.05.2018 | Vancouver, BC, Canada

IADC Drilling Onshore
17.05.2018 | Houston, TX, USA

RSSI
21. – 24.05.2018 | Omaha, NE, USA

ELECTRO-TEC – Trade show days for communication, building, light and installation technology
23. – 24.05.2018 | Bern, Switzerland

Global Electric Power Tech 2018
30.05 – 01.06.2018 | Seoul, South Korea

Expo Eléctrica Internacional
05. – 07.06.2018 | Mexico City, Mexico

POWERTAGE
Meeting point for the Swiss electricity industry
05. – 07.06.2018 | Zürich, Switzerland

Canadian Mining Expo 2018 – The Big Event
06. – 07.06.2018 | Timmins, ON, Canada

EXPO Solar 2018
13. – 15.06.2018 | Ilsan, South Korea | Stand: Wonlee

PPFIC Pulp and Paper Conference
17. – 22.06.2018 | Appleton, WI, USA

TENAGA 2018
Asean's premier mechanical & electrical engineering show
17. – 19.07.2018 | Kuala Lumpur, Malaysia

ASEAN M&E Show
17. – 19.07.2018 Kuala Lumpur, Malaysia

EV China
The Most influential New Energy Vehicle Exhibition
18. – 20.07.2018 | Shanghai, China

Medical Fair Asia – 12th International Exhibition on Hospital, Diagnostic, Pharmaceutical, Medical & Rehabilitation Equipment & Supplies
29. – 31.08.2018 | Singapore

The Green Expo
04. – 06.09.2018 | Mexico City, Mexico

BEX Asia – A GREEN FUTURE WORTH BUILDING
05. – 07.09.2018 | Singapore

DCD South East Asia 2018 – Datacenter Dynamics
11. – 12.09.2018 | Singapore

Electric & Hybrid Vehicle Technology Expo
11. – 13.09.2018 | Novi, MI, USA

Canadian Healthcare Engineering Society 2018 National Conference & Exhibition (CHES 2018)
16. – 18.09.2018 | St. John's, NL, Canada

SPI – Solar Power International
24. – 27.09.2018 | Anaheim, CA, USA

IEEE Petroleum & Chemical Industry Technical Conference
24. – 26.09.2018 | Cincinnati, OH, USA

Healthcare Estates – Exhibition, Conference, Awards
09. – 10.10.2018 | Manchester, United Kingdom

SIEF 2018 – Seoul International Electric Fair
10. – 12.10.2018 Seoul, South Korea

EP China – 17th International Exhibition on Electric Power Equipment EV2018VÉ
15. – 17.10.2018 | Peking, China

MATELEC – International Trade Fair for the Electrical and Electronics Industry
13. – 16.11.2018 | Madrid, Spain

OSEA 2018 – The gateway to Asia's Oil and Gas industry
27. – 29.11.2018 | Singapore

EXHIBITIONS NATIONAL

Hannover Messe
23. – 27.04.2018 | Hanover



SMM Hamburg (Shipbuilding, Machinery & Marine Technology)
04. – 07.09.2018 | Hamburg



Innotrans
18. – 21.09.2018 | Berlin



Wind Energy Hamburg
25. – 28.09.2018 | Hamburg



SPS/IPC/Drives
27. – 29.11.2018 | Nuremberg



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



10.04., 11.04. and 12.04.2018	Regensdorf Switzerland
18.04.2018	Montreux, Switzerland
19.04.2018	Geneva, Switzerland
24.04.2018	Lausanne, Switzerland
26.04.2018	Fribourg, Switzerland
28.08.2018	Montreux, Switzerland
06.09.2018	Basel, Switzerland
18.09.2018	Bern, Switzerland
25.09.2018	Pfäffikon, Switzerland
24.10.2018	Locarno, Switzerland
06.11.2018	Bern, Switzerland
14.11.2018	Lucerne, Switzerland
20.11.2018	Landquart, Switzerland
27.11.2018	Regensdorf, Switzerland



Wouter van Beek

Managing Director of Bender Benelux and head of the “Hospital Solutions” business unit.

CAREER OUTLINE

Wouter van Beek, 54 years old, lives with his family in Baarle-Nassau in the Netherlands, on the border with Belgium.

The trained electronics engineer previously worked at AGN Engineering, a small development company where, among other things, he was responsible for healing stimulators.

He has been the Managing Director of Bender Benelux since April 2000 and, on the 1st of January 2018, was also named the head of the “Hospital Solutions” business unit.

Holistic safety for hospital technology

Protecting life and health – the Bender “Hospital Solutions” business unit

Mr van Beek, when did you join Bender?

I started as a Bender representative in the Netherlands 24 years ago and initially worked in the insulation monitoring sector for ships, petrochemical and railway applications. Here, I was closely involved in the development of safety systems for low-voltage electrical installations on board ships, in (petro) chemistry facilities and medical locations. Since April 2000 I have been the Managing Director of Bender Benelux. Two years later the hospital technology sector was added in the Netherlands and Belgium.

You became the head of the “Hospital Solutions” business unit at the beginning of 2018. What motivated you to take on this role, particularly in this field?

High demands are made of the reliability of the power supply for medical applications. Even just a short power failure can jeopardise the health of the patient, or can even be life-threatening: Treatments and therapies cannot be stopped and repeated, examination results must

be saved. Bender has enjoyed success in this field for some time now with its various systems and solutions. Today, however, more and more systems are interlinked. The non-availability of electrical systems and complete processes must be avoided. This applies to hospitals and clinics as well as old people’s homes, care homes, GP practices and medical treatment centres – in the interests of residents, patients and staff. It is my personal conviction that growth in this market, a crucial one for Bender, can only be achieved through the active collaboration of everyone involved, and through the international exchange of expertise. My experience from Benelux provides me with a sound basis for this.

“Today **more and more** systems are interlinked.”

“There is an ever **greater need** for control, automation, communication and monitoring systems.”

Why is the hospital market so important, including for Bender?

Bender offers much more than just a range of electrical safety products for intensive care units and operating theatres (Group 2 rooms), its portfolio also comprises holistic safety solutions for medical facilities. Today, complete automation can be provided for, right down to individual process areas, and the overall communication in a facility can be controlled. For example, we offer solutions for controlling operating theatre doors; if surgery is being performed inside, these block the doors or close and open them automatically. We also have display units for doors which provide details on the surgery under way and, if necessary, emit external alarms (back-up power supply off, laser warning on, etc.) which serve to warn and protect patients, medical staff and third parties. This is a key aspect for monitoring the procedures during surgery, taking any necessary measures and also avoiding postoperative infections.

“**Holistic solutions** for the electrical safety of intensive care units and operating theatres.”

What is the main area of interest and what are the needs of hospital operators?

The requirements of hospital operators continue to grow and are not restricted to electrical safety. There is an ever greater need for control, automation, communication and monitoring systems. In modern hospitals, operational and error messages in the electrical system can be automatically reported by the Bender insulation fault locators extremely quickly. This saves both time and money and prevents the risk of a second simultaneous error. There is now a greater need than ever before for open, flexible systems with which a better power supply can be realised for all medical applications and this is the right solution for the health sector.

What will be your main duties as head of the unit?

To promote the concept practised in the Netherlands whereby Bender plays a central role in surgery and connects all the systems from the building control system through to workflow management as an example for the rest of the world. It is my task to develop the core business even further and drive forward adaptations for the local market. We want to raise awareness of Bender around the world. I will endeavour to manage this to enable as many of the Bender sales partners as possible to benefit from the experience of others and offer mutual support and also bundle together the Bender offering. I want Bender to become an attractive international business partner for operators of hospitals and medical locations. In the future, the national and international market needs to have different systems that link the core business more closely to processes.

What are your main goals?

Ultimately, the term “medical locations” should always be associated with Bender. The focus must also be on expanding the service to reflect the growing complexity of the systems.

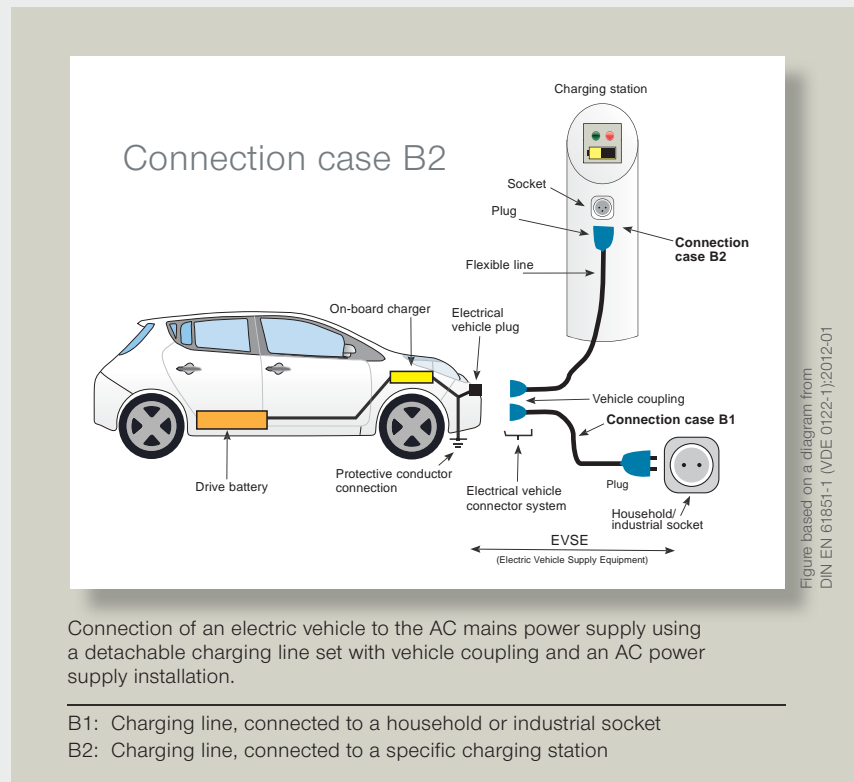
“Benefit from the **experience** of others and offer mutual support.”

Mr van Beek, thank you very much for the interview. ■

*Michaela Heck M.A.
textwerk-heck*

Connection of charging stations for electric vehicles

Electromobility is gaining ground. It is not yet clear when electricity will power the majority of passenger vehicles. However, one thing is certain: at some point, almost every vehicle will be powered electrically. This will require a large number of suitable charging stations to charge these electric vehicles with power from the national grid.



The comparatively high-power requirements of charging stations and the need to consider issues associated with 'simultaneity factors' present serious challenges to energy providers and grid distribution operators. Yet more aspects need to be taken into consideration when connecting charging stations to domestic networks to avoid risk to users or to the upstream electrical system.

Depending on the electric vehicle model and the charging station used, charging procedures can be sub-divided into different modes. A key differentiating factor is the level of electrical power available (currently ranging from 3.7 kW to 22 kW).



Practical Expertise

▶▶▶ **Charging mode 1:** Connection of the electric vehicle to the AC mains power supply using standard socket outlets on the mains side and line conductors, neutral conductors and protective conductors. Here, the charging current must not exceed 16 A and 250 V for singlephase alternating current and 480 V for three-phase alternating current.

Charging mode 2: Connection of the electric vehicle to a AC mains power supply (which does not exceed 32 A and 250 V with a single phase or 480 V for three phase) using standardized socket outlets and line conductors, neutral conductors and protective conductors together with a pilot function and a residual current device between the electric vehicle and plug or as part of an in-cable control box (ICCB). The in-cable control box must be located in the plug or at a distance of up to 0.3 m from the plug or the Electric Vehicle Supply Equipment (EVSE).

Charging mode 3: Connection of the electric vehicle to the AC mains power supply using a dedicated EVSE. Here, a pilot function extends to control equipment in the EVSE which is connected permanently to the AC mains power supply.

Charging mode 4: Connection of the electric vehicle to the AC mains power supply using an external charging device. Here, a pilot function extends from the electric vehicle to the device which is connected permanently to the AC mains power supply.



Only charging modes 2, 3 and 4 ensure:

- Continuity of the protective conductor is monitored.
- A fault current device sensitive to all current types is provided which protects the upstream electrical system from DC fault currents in the event of an error.
- The vehicle is connected correctly.

To assure electrical safety, the requirements of IEC 60364-4-41 (or DIN VDE 0100-410) must be implemented. Furthermore, IEC 60364-7-722:2015-02 (or DIN VDE 0100-722) stipulates

that every charging station must be supplied by its own power circuit.

In addition, charging modes 2, 3 and 4 offer integrated protection in the event of a smooth DC residual current. If an existing socket-outlet or vehicle connector according to IEC 62196 is to be used to charge electric vehicles, first ensure that the power circuit is suitable (e.g. cable cross section). According to IEC 60364-7-722:2015-02, a residual current device (RCD) is required for each charging socket-outlet and every charging circuit must be protected with its own overcurrent protective device.

It is important to remember when selecting the RCD that protective safeguards against DC residual currents must be provided, which can also be integrated in the charging station. Suitable equipment is a type B RCD or a type A RCD in conjunction with suitable equipment (such as the Bender RCMB420EC residual current monitor) to disconnect the supply in the event of DC residual currents > 6 mA.

Since charging stations are operated at their rated output, particular attention must be paid to environmental conditions (temperature, installation type, voltage drop, bending radii etc.).

To comply with prevailing technical connection conditions (TAB 2007), individual devices above 12 kW require notification and approval. As per the new draft of the German low-voltage technical connection regulations (TAR Niederspannung: E VDE-AR-N 4100:2017-05), only charging devices for electric vehicles with a rated output greater than 12 kVA require the approval of the grid operator. Also, charging devices for electric vehicles with rated outputs in excess of 4.6 kVA need to be declared to the grid operator. ■

BENDER Group

The Bender Group with its main office in Gruenberg/Hesse has 70 representations and 14 subsidiaries with nearly 720 employees worldwide.

You can find your regional contacts at www.bender.de.



Bender GmbH & Co. KG
Londorfer Str. 65 • D-35305 Gruenberg / Germany

Fon: +49 6401 807-0 • Fax: +49 6401 807-259
E-Mail: info@bender.de • www.bender.de



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Power in Electrical Safety