

Design the future of energy

Edition 2023

MONITOR

 BENDER



Hospital ship Global Mercy –
always everything perfectly in view

Sustainable and
electrically safe use of H₂

Personal and system protection
in large-scale PV systems



 BENDER

Dear readers,



From left to right: Heinz Nowicki (CSO), Winfried Möll (CSIO), Christian Jerkel (COO), Monika Schuster (CFO), Dr. Kim Listmann (CTO)

We are still experiencing demanding times.

The Covid-19 crisis, the war in Ukraine and climate change has all had a lasting impact and led to major challenges that we continue to tackle. Moreover, we are also facing issues such as supply bottlenecks, exploding energy prices and a lack of suitable qualified staff.

Nonetheless, we believe that it is important to also focus on positive developments, perhaps now more than ever. In this **MONITOR**, we therefore want to share some of the progress that we have made. After all, we use our commitment to and solutions for electrical safety to protect people, conserve the environment and make the world better, day after day.

On the following pages, you can find out how we are advancing research and development projects, making a new recycling facility electrically safe and supporting the construction industry as it converts to electrical drive systems.

You can read all about the latest good news from the Bender world in reports on our activities in Latin America, 25 years of Bender UK and 40 years of Bender Inc. in the USA. In this issue, we also introduce you to our new Chief Operating Officer (COO) Christian Jerkel, and explain how we plan to make testing our devices a faster and more efficient process in the future.

Sustainability continues to be an important topic for society. Given the multitude of challenges faced in this area, we are also continuing to place a consistent focus on the future and are committed to developing innovative solutions for example in the hydrogen sector. With our solutions, we offer electrical safety and actively help to shape the future of energy.

Enjoy reading our magazine.

Yours sincerely,
Management

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Green hydrogen advances the energy transition

Hydrogen can play an important role in a future-proof and sustainable energy supply. Nonetheless, there is still plenty to do before this option can be used safely, reliably and cost-effectively.

Visionary technology

In his novel “The Mysterious Island”, which he wrote 150 years ago, Jules Verne described the process of electrically decomposing water to generate energy. Nowadays, electrolysis is one of the most promising developments for the energy transition. Why? Because hydrogen can be the crucial link between sustainably generated electricity and its permanent flexible availability.

Advancing the energy transition with H₂

At first glance, it's actually very easy: electricity generated by a photovoltaic system, for example, is used to decompose water into its components, hydrogen and oxygen, in an electrolyser. The hydrogen can then be stored and transported with virtually no problems. If energy is needed, the hydrogen can be recombined in a fuel cell, and the energy that is released can be converted into electricity in an emission-free process. This process can be used in fuel cell vehicles and power plants or to generate heat.

From the idea to the solution

Despite this knowledge, the use of hydrogen and hydrogen derivatives is still very much in its infancy. The world has been clinging on to fossil fuels for too long for a variety of reasons. Now, however, we are running out of time due to the progressing climate change, and rapid solutions are needed. For Bender, this represents an excellent opportunity to contribute its concentrated electrical expertise and many years of experience. This is important because hydrogen applications involve not only handling large electrical currents but also mastering the potentially dangerous combination of water and electricity.

Where are we currently at?

At present, there are many promising approaches for the sustainable production and use of hydrogen on a large scale. A multitude of regional, national and international initiatives and associations are committed to developing such ideas. In addition to economical and ecological solutions, such developments also focus on technical feasibility and electrical safety. And this is where Bender comes into play – in two different areas. On the one hand, the company has been actively involved in standards committees and panels for many years, in which it helps to define electrical safety requirements. On the other hand, Bender is increasingly being asked to contribute its expertise in the field of electrical safety in hydrogen projects too.

Industrial enterprises and global players

When it comes to production and storage, some of the driving forces on the scene include innovative hydrogen pioneers and global players from the field of electrolysers, who have set themselves the target of advancing the technical foundations. The users of hydrogen solutions particularly include industrial users with energy-intensive processes, which started to explore new possibilities for a future-proof energy supply at the start of the gas crisis at the very latest – for example companies with large facilities or chemical plants in the process industry.



Green hydrogen needs sustainably generated electricity. Bender ensures that PV fields, for example, are electrically safe.

'One size fits all' is not an option

The energy transition does not depend on one raw material alone, and the same can be said for the use of hydrogen: as of yet, there is no universal solution that ticks all the boxes. This is why a multitude of research projects are pursuing different approaches and also working on the development of possible standards. None of these approaches should try to find solutions that can only be used by one industry, region or group of users. Instead, it is important to consider the energy supply of the future and beyond from a global perspective and to develop higher-level solutions across borders.



Hydrogen can help secure 50 Hz grid stability

Creating a global sustainable H₂ network

The sustainability of hydrogen generation also plays a crucial role. As Roman Schmattloch, Head of Corporate Development at Bender, explains: *“Hydrogen can only come out on top as a holistic option. For this to happen, we need solutions that are technically, economically, ecologically, politically and socially sustainable. This is important if we want to also convince hydrogen sceptics, who are clinging on to the bad status quo out of fear to try good new alternatives. We therefore need to ensure that hydrogen is viewed as an opportunity and not as a risk.”*

A holistic approach to energy

The current switch to electric vehicles is only sustainable if the electricity used by these vehicles is not generated from fossil fuels, and the same applies to hydrogen: The sensible use of hydrogen as an energy source starts with producing the electricity required for the electrolysis. Only when this electricity is generated sustainably can hydrogen become an ecological success story. A great deal of progress has been made in this area in recent years, but there is still plenty to be done.

Sustainable electricity generation

Bender is already active in a multitude of areas connected to the generation of sustainable energy. One of these areas involves large-scale photovoltaic systems with special requirements in terms of electrical safety. (For more information, you can also read the report on page 50). Another area of activity concerns industrial wind power plants, which are usually designed as IT systems, and hydroelectric installations, which also frequently use solutions supplied by Bender. These are just some of the wide variety of fields in which the electrical safety specialists search for future-oriented solutions for a sustainable energy supply in the years and decades to come.

An enabler for process efficiency

When it comes to developing solutions for the sustainable use of hydrogen, Bender is a central enabler of efficiency, process reliability and staff safety. Bender products protect people against electrical hazards.

Companies profit from its solutions because they enable their processes to run efficiently and be electrically safe. On the one hand, it is important that machines and systems can be shut down as quickly as possible in the case of problems to prevent damage. On the other hand, however, it is equally important to avoid false shutdowns and prevent avoidable damages

and downtimes, for example, in the process industry. Furthermore, Bender's intelligent solutions for the monitoring of electrical installations enable a multitude of predictive maintenance applications. Operators can use Bender technology to ensure the high availability of their systems and to identify changes and tendencies of important electrical variables at an early stage.

An important requirement for all the solutions available is that they are easy to handle and reliable in operation. This also covers all required interfaces for measurement technology and communication.

Key facts – hydrogen

Much work needs to be done to achieve climate neutrality by 2050.

- Germany is currently home to around 100 hydrogen refuelling stations, and this number is increasing.
- A multitude of regional, national and international funding programmes are accelerating the use of H₂.
- Many major companies are already making large-scale investments in the field of hydrogen and advancing its development.

- According to forecasts, there will be a huge upswing in the market, which will become a billion-dollar market over the years to come.
- Hydrogen can help to secure network stability at 50 Hz.
- Distribution grid operators and electric utility companies can use hydrogen to cover peak loads and ensure a default supply.

Patience is a virtue for successful development

Given the many pressing questions currently being asked in the areas of energy safety, climate change and political independence, developers are under immense pressure. Nonetheless, it is important that they keep their cool and remain concentrated. After all, some solutions that may be cast aside at first glance may actually prove to contain promising approaches if you take a closer look. And maybe we need to temporarily put up with interim solutions and compromises in these fields in order to maintain a focus on the overarching goal. It is important that everyone embraces the “fail fast” concept, recognises errors quickly and drives changes immediately and iteratively.

Transition and progress

If processes for the use of hydrogen become successfully established, it will take a while until the hydrogen can be generated in a fully sustainable way. Although this is a shame, it is no reason for us not to take advantage of hydrogen and its many benefits. Such a situation would be a necessary intermediate stage of the journey towards achieving the goal of a sustainable energy transition. Bender is actively committed to all aspects of this process and provides companies with advice and support from the development of the system architecture right through to the delivery of suitable devices. —

Are you researching and developing solutions for the use of hydrogen and looking for ways to make the solution electrically safe? Feel free to contact me; I'm happy to help!

Roman Schmattloch
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Bender GmbH & Co.KG
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The fog has lifted Improved vision for everyone on the *Global Mercy*

Having blurred vision when everything looks foggy is an unpleasant problem, both on water and on dry land. Those affected have a strong desire to see clearly again – not only patients in literal terms but also electrical engineers on board in a broader sense.

While doctors on a hospital ship continued to help many patients see again, a project mirrored their work by restoring the vision of the technical officers in the ship's electrical installation. As a result, the officers were able to easily, and above all, quickly, pinpoint insulation faults.

Bringing medical aid to patients

Around five billion people worldwide have no access to safe, affordable surgery. Many of these people live in Africa. The aid organisation Mercy Ships looks after these people. It has been deploying its hospital ships to help them since 1978, in line with the motto that 'if people can't get to a hospital, the hospital will have to come to them'. On board its ships, the international organisation offers free surgeries and treatments.



The supply distribution for the operating theatres was newly installed.



The emergency switchboard with the monitored load groups makes it easier to locate faults.

Voluntary helpers committed to the cause

All doctors on the hospital ships undertake their work in a voluntary capacity. They operate on hernias and facial tumours, close cleft lips and cleft palates, correct deformities and tend to burns. Cataract surgeries are a regular occurrence among the special moments that take place on board the ships. In such cases, people step onto the ship nearly completely blind to have their vision simply restored after a short operation. The pure joy at such results combined with the temperament of grateful people often results in these patients quite literally dancing along the gangway as they celebrate being able to see clearly again.

The largest hospital ship in the world

The new Global Mercy is the first purpose-built hospital ship specifically designed to be a floating medical facility for civilians. It is also the largest hospital ship in the world to be operated by a charity organisation. The vessel is 174 metres long and weighs 37,000 tons. It contains six operating theatres and an intensive care unit with seven beds. Its two hospital decks offer wards for nearly 200 patients to be cared for at any one time. The ship additionally provides space for more than 600 volunteers from all over the globe, who come together to secure the operations of both the hospital and the ship itself: surgeons, chefs, teachers, electricians and, of course, seafarers.



A new, high-quality facility: the installation of the ward on the Global Mercy

Safe electricity for safe surgeries

To fulfil its mission, Global Mercy needs to have a reliable and high-performance electrical system. This system needs to ensure that the ship and its medical equipment are always available and function self-sufficiently both in port and out at sea. The electrical infrastructure of such a large ship is a complex matter, even more so when operating theatres come into play. After all, medical facilities require robust medical IT systems for an isolated power supply. The medical IT system ensures that the system does not have to be shut down if a fault occurs. It therefore guarantees the safety of both staff and patients.

Complex challenges on board

Mercy Ships contacted Bender to find a solution for the electrical challenges faced on board the Global Mercy. With its decades of experience in safeguarding electrical systems in hospitals and for ship applications, Bender was the ideal partner for the task at hand. During the construction of the Global Mercy, it became evident that the ship had high leakage capacitances due to its extensive system. In the case of insulation faults, this would result in higher residual currents than are usually found in IT networks, thus making the leakage capacitances a challenging problem. Finding the points of failure in a ship of this size would be a complex task indeed. At the same time, the fault location would require the loads (or load groups) to be disconnected. This would, in turn, result in interruptions to the ship's operations, hampering surgeries, patient care and training measures. Furthermore, such consequences would disrupt the tight schedule of the planned aid missions and cause unnecessary costs.

Easily detecting electrical faults

When working on the ship, Bender experts gradually measured its leakage capacitances and identified faults in the system. By doing so, they were, for example, able to determine whether there were areas with particularly high leakage capacitances, which may become dangerous for passengers and the crew. The three coupled IT systems on board the ship were then retrofitted with transformers and ISOMETER® and ISOSCAN® systems from Bender. As a result, the crew can now not only identify insulation faults when they occur on the ship but also determine their location – all in a matter of seconds. The search effort was significantly reduced because only a few loads or an individual distribution now need to be checked (as marked in green on the emergency switch, as shown in the picture page 11) instead of all loads and distributions on board. Critical loads were additionally fitted with individual monitoring systems.

The specialists on board the Global Mercy can now keep a perfect eye on all systems. They can easily and efficiently monitor the power system instead of poking around in the dark. While the doctors on board restore the sight of their patients, the Bender solution has now lifted the fog clouding insulation faults in the ship's electrical installation – so that the marine engineers, too, can see clearly again. —



ISOMETER® iso685

The ISOMETER® iso685 is an insulation monitoring device that has been approved for IT systems in accordance with the standard IEC 61557-8 and according to LR and all other IACS classification societies.



ISOSCAN® EDS440

The ISOSCAN® EDS440 installation fault location devices are used in connection with the ISOMETER® iso685-S-P to localise insulation faults in unearthed power supplies (IT systems).



LINETRAXX® CTAC series

The measuring current transformers of the CTAC series are used to record the test current generated by the ISOMETER® iso685.





Clean separation – Krones and Bender achieve a fail-safe recycling plant

Be it grapes, peaches, meat or fish, nowadays, many foods are sold in practical plastic trays. Although this is hygienic and attractive, it often leads to recycling problems because the multilayer plastics are difficult to recycle.

Now, however, a new recycling plant in Spain is showing how such plastics can be recycled both safely and efficiently. Six washing lines, four mills and the required peripherals were provided by the line manufacturer Krones, and the electrical safety came from Bender.

Recycling instead of incineration

The company Krones AG is based in the town of Neutraubling near Regensburg in Bavaria, Germany. It is a leading international specialist in lines and machinery for the processing of bottles, cans and containers made of glass, aluminium and PET plastics. For a Spanish customer in the recycling industry, Krones has now produced a plastic washing plant with corresponding mills for a highly efficient and fail-safe recycling plant.

The services provided by Krones for this project covered the planning, delivery, installation and initial operation of the plant components. The plant first cleans packaging made of multilayer mixed plastics such as PET and PE before separating them into their individual plastic parts and recycling them. The PET flakes or recycled material obtained from this process can subsequently be used to manufacture products such as new food packaging or fibres for the textile and automotive industries. This approach not only secures raw materials but also reduces the exhaust emissions that would otherwise be produced during the usual incineration of the packaging.

Safe processes in a wet environment

The customer required an efficient and fail-safe washing system to clean the plastic trays at the start of the recycling process. Given the wet process environment, protecting the individuals working at the plant against electric shocks also played an important role in the requirement profile. Moreover, it was necessary to bear in mind that the process reliability of the plant is not only important for the cleaning but also directly influences all subsequent processes. A

shutdown, for example, would not only lead to increased cleaning requirements and delays in bringing the plant back into operation but would also cause real faults in the production process for the plastic pellets. To avoid such problems from the get-go, the customer already decided to opt for the use of an unearthed network (IT system) when planning the project, which is why the specialists from Krones contacted Bender at an early stage. Given that both companies have been working together on a huge variety of projects with a great deal of trust and smooth processes for many years, they were able to get started on planning this project right away.

Intensive electrical safety advice

Jürgen Beier, Head of the Sales division Germany at Bender, was delighted to be contracted for the project and provided both Krones and the customer with advice on topics ranging from the design of the IT system to the selection of the perfect corresponding cable. The result: an electrical system comprised of two IT networks that are independently monitored. The insulation monitoring in both networks is provided by an ISOMETER® iso685. This can be configured with needs-oriented response values and monitors the electrical safety of the network. Occurring insulation faults are indicated, but the system continues to run without any problems after the first fault has been detected. To locate faults as quickly as possible where needed, a total of 27 EDS440 insulation fault locators and 250 current transformers are integrated into the network. In addition to the monitoring of the main circuits, the smaller control circuits are also monitored separately by 2 ISOMETERS® isoRW425.

A customised solution for a complex system

The chosen solution mainly offers the customer three major advantages, all of which are important for meeting its needs. Firstly, the IT system helps to provide the best possible protection against electric shocks for the individuals working in the wet environment. Secondly, the IT system offers the customer increased process reliability because it does not switch off after the first fault and gives the customer sufficient time to correct the result. Thirdly, the insulation fault locators work with the current transformers to ensure that occurring faults are detected quickly and reliably, thus eliminating the need for time-consuming fault location. The developed solution impressed the customer and the Krones specialists in equal measure: *“Bender has developed a reliable and safe solution for the wet environmental conditions and the required process reliability. Our customer is extremely satisfied with the intensive advice and professional implementation,”* reports Frank Scharf, responsible for electrical planning at Krones.

Successful initial operation on location

Bender not only developed the electrical safety concept but also provided personal on-site support for Krones and the customer at the start of the project. Specialists from Bender’s Spanish subsidiary, Bender Iberia,

provided the initial consultations. The switchboards were constructed and installed in Germany and then transported to Spain. Experts from Germany then travelled to Spain to put the measurement technology into operation and to competently accompany the process. This was necessary because IT systems can, logically, only be tested and put into operation with a system that is live and ready for operation. This also offered the customer a further advantage: In addition to testing the function of the IT network, the experts from Bender were also able to use the measured values provided by the insulation monitoring device to check whether the loads connected to the network were functioning correctly or potential weaknesses and insulation faults could already be detected.

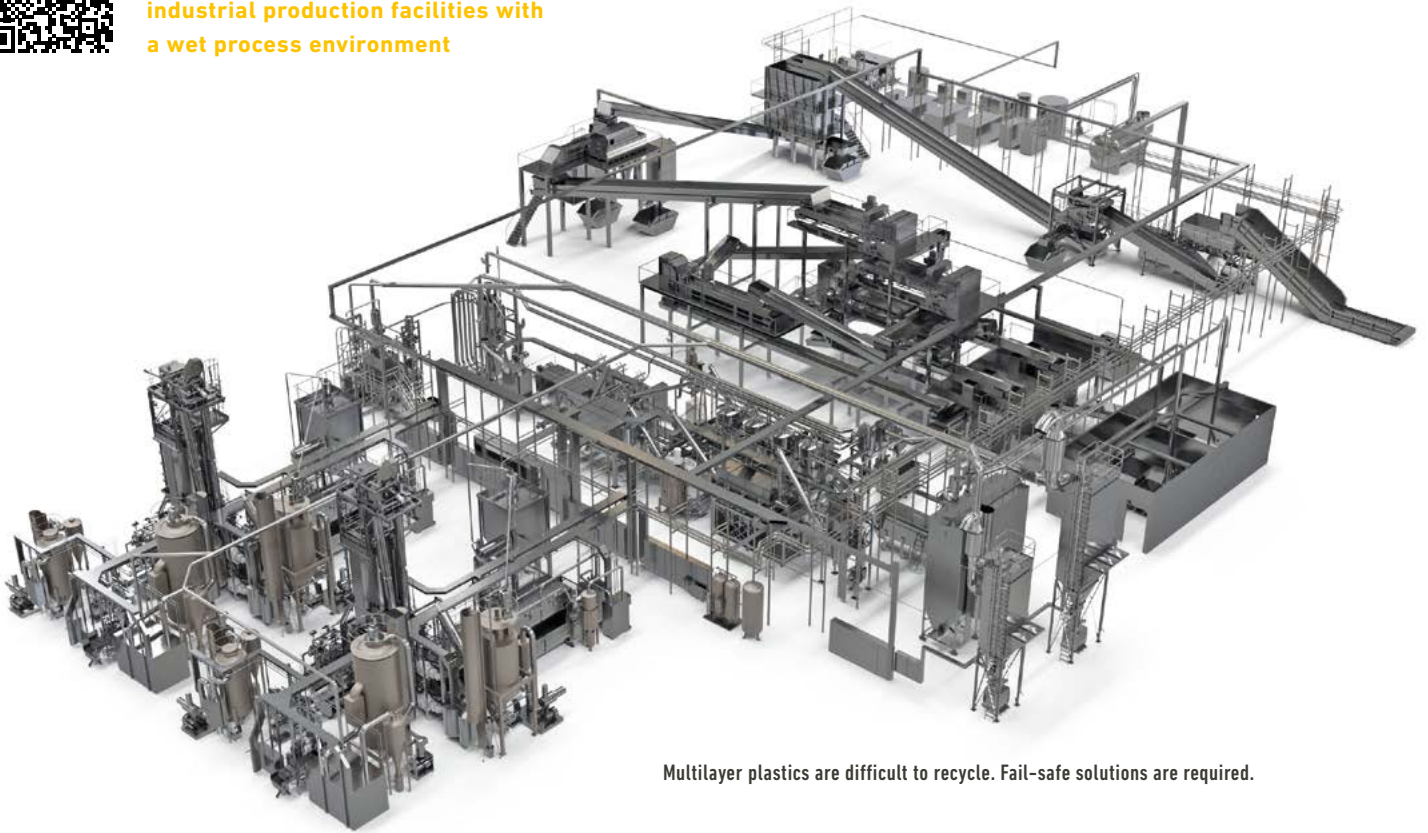
Satisfied partners

After the plant was put into operation, Bernhard Renner, Project Manager at Krones, summarised the project extremely positively: *“We are yet again pleased to have worked with Bender. Its excellent consulting expertise, commitment to the project and safe installation provided our customer with real added value.”*





In this article, you will learn how to protect people and processes in industrial production facilities with a wet process environment



Multilayer plastics are difficult to recycle. Fail-safe solutions are required.

Jürgen Beier Head of the Sales division Germany was delighted about the trust that Kronos placed in Bender and the successfully implemented project. The solution additionally enabled Bender to make an important contribution towards the safe and sustainable use of an electric current. —



»We were yet again able to demonstrate the advantages of our IT system, especially in sensitive areas.«



An electric excavator hard at work: The power supply is provided by three replaceable battery packs.

Highly charged and ready for action

Construction equipment in the Netherlands is now running on electricity

Diesel-powered construction equipment is becoming a thing of the past in the Netherlands. Given that the nation needs to reduce its excessive nitrogen emissions, its construction industry is now also transforming at record speed. The Dutch government has set this industry a strict target: it must be completely emission-free by 2030.

To achieve this, Dutch construction equipment manufacturers are now fully relying on electric drive systems. When it comes to this industrial electrification, Bender Benelux is the partner of choice.

From a nitrogen crisis to a construction crisis

The high nitrogen emissions of the Netherlands have two main origins: livestock breeding and the combustion of fossil fuels, for example, in vehicles or when generating energy. To reduce these emissions, the Dutch government not only wants to reduce the livestock of the nation's farmers by a third but has also introduced a speed limit of 100 km/h (62 mph) on its motorways and is relying on solar and wind power rather than gas and coal-fired power plants. The construction sector, which also requires large quantities of fossil fuels, must comply with strict requirements. In fact, a multitude of housing and infrastructure construction projects are currently on hold due to excessive emissions. This problem in particular is intensifying the huge housing shortage throughout the country. According to a study by the Dutch Central Government Real Estate Agency RVB (Rijksvastgoedbedrijf), a third of the nitrogen emissions produced during a construction project are caused by construction equipment alone. The electrification of heavy-duty construction equipment therefore represents an efficient way to reduce nitrogen emissions in the construction industry – and an increasing number of construction companies in the Netherlands are choosing to pursue this approach.

The goal: zero-emission construction sites

According to Raymond Vergouwe, Technical Sales Consultant at Bender Benelux, the conversion from diesel to electric drive systems in cranes, excavators, asphalt pavers and compactors is now progressing at high speed: *“Since 2019, more and more Dutch manufacturers have added construction equipment with electric drive systems to their ranges. Electrically powered construction vehicles are expected to outnumber their diesel-powered counterparts on construction sites in four years’ time.”* If this progress continues, the construction industry will be well on its way to achieving the ambitious target set by the Dutch government: completely emission-free construction sites. Plans are in place to meet this target by 2030.



Ready to be retrofitted: Brand-new common construction machines are fitted with electric drive systems by specialist retrofitters. (www.urbanmobilitysystems.nl/en)

Advice on electrification

This drive technology conversion poses several major challenges for Dutch construction equipment manufacturers. *“Electrical drive systems and above all, the aspects of electrical safety and the standards that need to be observed represent uncharted terrain for the manufacturers,”* states Vergouwe. The expertise of Bender is therefore in high demand. Electric construction machines with a licence for public roads are subject to the same safety standards as electric vehicles. It is generally a good idea to observe these electrical safety requirements for all types of construction machines. They are designed to ensure that the electric energy can be always used safely – from operating the construction machine to the charging procedure.

Insulation monitoring in high-voltage DC drive systems

The heavy-duty industrial construction vehicles are operated using high-voltage DC drive trains up to 900 VDC. The entire electric drive system is therefore subject to compulsory insulation monitoring to ensure that the vehicles can function without interference and to minimise the risk of electric shocks and fire hazards. Vergouwe and his team provide manufacture electric construction equipment with intensive support and

The Dutch nitrogen problem: Countering the crisis with electric drive systems

Compared to other European countries, the Netherlands has particularly high nitrogen emissions caused by both the combustion of fossil fuels for vehicles and generating energy and agriculture with its abundance of livestock. In 2019, the Supreme Administrative Court of the Netherlands declared that the country was violating EU law by not doing enough to reduce its nitrogen surplus in endangered nature protection areas.

The nitrogen crisis has had a stranglehold on the Netherlands ever since. The government has implemented

a wide variety of measures to reduce nitrogen emissions and to protect nature and preserve its diversity of species. These measures have an impact on farmers, who were now required to radically cut back on their livestock or give up entire farms. Furthermore, the areas of energy production, transport and housing and infrastructure construction, as well as other industrial sectors, all need to produce fewer emissions to comply with the strict threshold values for nitrogen. This represents a huge challenge for the whole of Dutch society.



Plugged in: Electric construction equipment can be charged via AC or DC charging stations.

advice for all issues connected to insulation monitoring. With its ISOMETER® IR155, Bender's product range includes an insulation monitoring device for unearthed DC drive systems (IT systems) in electric vehicles, which is also suitable for equipment such as heavy-duty cranes, excavators or compactors. *"Nonetheless, there is no standard solution for insulation monitoring for electric construction equipment. The solution depends on the precise type of electrification, whether the device is permitted to be used on public roads, whether the drive system is hybrid or fully electric and whether lithium-ion batteries or hydrogen fuel cells are used,"* explains Vergouwe.

Charging solutions on construction sites

A great deal of advice is also needed regarding electrical safety in the charging infrastructure. Three charging possibilities are available to ensure that construction equipment has enough power for a hard day's work: AC charging stations for overnight charging, DC fast charging stations or replaceable battery packs on the construction equipment. AC and DC charging stations are installed directly on the construction site for the duration of the construction phase. Their power supply is provided by a temporary construction site power connection or, if this is too weak or not possible, via off-grid battery energy storage systems (BESS). The replaceable battery packs are charged elsewhere and then returned to the construction site.

Keeping an eye on all safety standards

Both the charging solutions and BESS require safety devices such as insulation monitoring devices in compliance with specific standards. There are also many requirements that need to be observed for smooth interaction between electric construction equipment and charging stations or battery packs. To avoid disturbances to construction site operations, the requirements of automotive standards need to be met. In some cases, doing so is absolutely essential. The insulation resistance monitoring system of the vehicle

is not allowed to impair the insulation monitoring device (IMD) of a DC EV charging station. The best and most reliable solution is to also use an insulation monitoring device from Bender on the vehicle/equipment.



Electric cranes are on the upswing: Crane manufacturers are increasingly relying on cranes with fully electric lifting systems such as this six-axle mobile tower crane. Crane models with electric systems for both lifting and driving are also already available. (www.spieringscranes.com)

Pioneers with great prospects

The nitrogen crisis in the Netherlands has resulted in a great deal of unrest in politics and among society. For Vergouwe, however, the crisis is also a driving force behind innovation that is transforming Dutch construction equipment manufacturers into pioneers: *“Construction equipment with electric drive systems is now being manufactured in series. The electrification of cranes, excavators, compactors, pile drivers, asphalt pavers, drilling jumbos and other heavy-duty machines has become a booming industry segment.”* Such machines are not only sold in the Netherlands but also to other European countries and the USA. Above all in Europe, Vergouwe expects to observe an increasing demand over the next few years, based on the fact that countries such as Spain, Belgium and Germany also have a nitrogen problem and need to reduce their emissions to comply with EU law. Of course, reducing nitrogen emissions is not the only advantage that construction machines with electric drive systems offer for the environment: They also reduce CO₂ emissions and lower noise exposure in inner-city areas. —

DC Industry Applications

Bender is a founding member of the ODCA

At the end of 2022, the German Electro and Digital Industry Association (ZVEI) founded the Open Direct Current Alliance (ODCA) with 33 companies that are leaders in the field. The alliance aims to further advance the DC supply in industrial plants and to force the global establishment of a resource-conserving direct current ecosystem. At the first plenary meeting of the ODCA, several different working groups were created and have now already started their work.

Bender is a founding member

As a founding member of the ODCA, Bender hopes that the hard work of the alliance will lead to an increase in energy efficiency, the optimised use of copper and improved network stability. Bender additionally aims to contribute towards pushing for the use of the IT system in automation technology.

ODCA 
direct current by zvei



Hands-on medical training Bender trains customers in Mexico City

Bender LATAM is expanding its sales radius and strengthening its activities in Latin America. To do so, it is important to have competent and well-trained partners and distributors located nearby. With this requirement in mind, a two-day intensive training course exploring medical applications was held at the site of the newly established regional office Bender Mexico in January 2023.

Focusing on information and communication

Many Bender products are already being used successfully in many countries in Latin America. With the two-day training course, Bender recently offered participants the opportunity to explore Bender products in a practical setting and learn more about other regions and their requirements and standards. *“Our aim was to encourage an exchange of ideas and experiences – on a personal and professional level. By doing so, we wanted to establish a network that will continue to thrive after the training, too,”* explains René Bülow, Vice President of Business Unit Hospital, Bender.

Participants from all over Latin America

The nearly 20 training participants came from nine different countries: Argentina, Brazil, Chile, Costa Rica, Ecuador, Mexico, Paraguay, Peru and Uruguay. Representatives from Bender Mexico, Bender USA, Bender Germany and Bender Latin America also attended the sessions as hosts.



The participants already received plenty of practical input on day one of the training course.

A jam-packed programme with plenty of input

The first day of the course explored the theoretical foundations of the IT system and insulation monitoring in hospitals. This included the presentation of new Bender products for hospital applications, a discussion on the benefits of the products and answers to the many questions posed by participants. One focus of day one was special regional features, the relevant standards (NFPA99 and IEC) and the resulting requirements for electrical safety in medical facilities.

Hands-on training at three stations

On the second day of the course, participants had the chance to put the products presented on the previous day to the test in practice. Three stations were set up for this purpose, at which practical tasks had to be solved in small groups. The stations featured the CP924 Essential control panel, the CP305 as Bender's



On the second day, the teams were tasked with developing solutions for various challenges.

new standard solution in the area of alarm indicator and test combination, a revolutionary IMD insulation monitoring device and LIM, a new solution for line insulation monitoring.

The best medical LATAM application contest

Another element of the event was a contest in which participants presented a special solution for hospital applications to their fellow participants and a jury. The winner of the competition was the entry by the Argentinian partner Elintec, which demonstrated how Bender is involved in the development of standards and helps to improve safety in hospitals.

Pyramids and intensive networking

In addition to electrical safety in hospitals, networking also played an important role over the two days of the course. This occurred both during the work in small groups and in the evening, when the participants could sit and chat long into the night. Furthermore, a group excursion to the pyramids in Teotihuacan also offered plenty of networking opportunities on day three. In the survey conducted after the event, the participants reported that they were pleased with the training in Mexico City and proposed the organisation of a similar training event for other topics and areas of application and in other countries.



A strong network: the team from Bender Latin America was extremely pleased with the event.



TU Munich: Safe research for the energy of the future

When it comes to climate change, handling energy in a sustainable manner is becoming increasingly important. With its application-oriented research on the sustainable generation, transmission, distribution and use of energy, the Technical University of Munich (TUM) is laying the practical foundations needed to achieve this.

Optimal energy conversion

The Professorship of Energy Conversion Technology (EWT) is one of 14 professorships in the Department of Energy and Process Engineering at the Munich-based university. In the professorship, Professor Hans-Georg Herzog and his team focus on designing and optimising electrical drive trains, inductive charging, the onboard network of the future and numerical calculation methods. The researchers work in close cooperation with industrial and university project partners to design, optimise, manufacture and test new and unique drive solutions as turnkey prototypes. A new test laboratory for the EWT has now been created at the Garching Research Campus in the north of Munich. Bender played an important role in the laboratory's electrical safety measures by providing suitable network monitoring products.

Protection and process safety

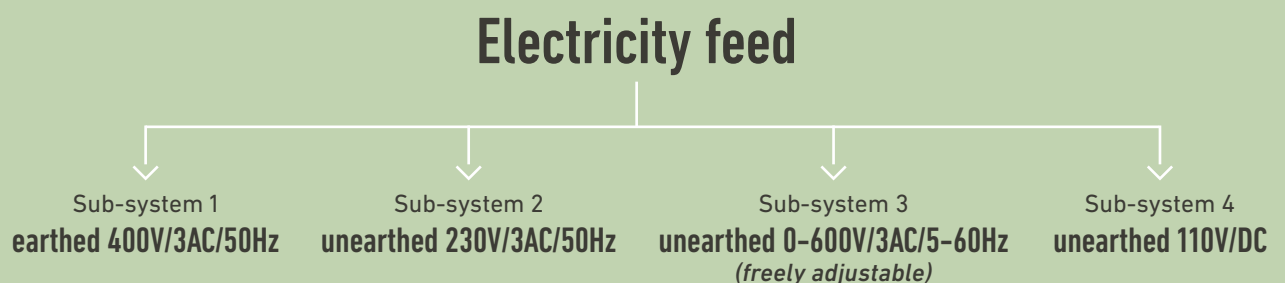
The Munich-based engineering office IEP was contracted to plan the electrical fittings of the laboratory rooms. An important requirement right from the start was the need to combine various safety aspects because the infrastructure is also used for teaching, and it is essential that faults are avoided. The primary aim was therefore to protect the individuals working at the test benches against electric shocks. Furthermore, system and fire protection needed to be guaranteed, and the examination processes themselves also had to be protected.

Intensive safety consulting

The structure of the system offered the possibility of creating four insulated networks in addition to the earthed network. Based on this information, the responsible parties in the EWT and the IEP planners decided to make the most of this advantage for safety purposes. They planned to use insulation and residual current monitoring for all five networks. After reading the comprehensive documentation and technical literature provided by Bender, the EWT and IEP decided to get in touch with the company. After an intensive requirement analysis, Bender was ready to tackle the project. *"To develop an optimal solution, we first had to identify the protection objectives that needed to be fulfilled,"* explains Jürgen Beier, Head of the Sales division Germany at Bender. The experts were then able to provide detailed advice and present the advantages and disadvantages of different solutions. Based on experience, they proposed opting against residual current monitoring in the networks with insulation monitoring. The network monitoring tailored to meet the needs of the EWT not only factored in safety aspects but also considered the costs of the public construction project.

A complex structure of five networks

During the planning stage, it became clear that the entire range of Bender services was ultimately required: *"It was important that the power network was not only well monitored but could also be quickly disconnected where needed in order to protect people, experiments and systems,"* explains Bernd Häuslein, an application engineer at Bender. Given the wide variety of requirements for the different tests conducted by the researchers, the power network of the test laboratory was divided into several sub-systems: one earthed system and four unearthed (IT) systems.



The five sub-systems were supplied by a central medium-voltage transformer.

The test laboratories and workshops used by the researchers require particularly safe power networks, which need to be fail-safe and offer the best possible protection against electric shocks. The specifications set by TUM stipulated that one earthed and four unearthed networks needed to be monitored. Bender products proved to be particularly ideal solutions for fulfilling these requirements.

All five sub-systems were supplied with a current by a central medium-voltage transformer. To guarantee the quality of the power supply from this source, a central power analyser was first installed. This monitors the power quality for the entire supply mains and therefore ensures constant monitoring. It provides users with information on the power quality, for example, the occurrence of an excessive number of flickers or critical THD values for current and voltage. To monitor consumption and the load profile, a total of four PEM353 universal measuring devices were installed in various positions in the system.

Monitoring earthed networks: the RCMB301

12 RCMB301 AC/DC-sensitive residual current monitors with the CTBC60 measuring current transformer core from Bender were used to monitor the earthed network. The modules permanently monitor the electrical system and report any residual currents that occur. If a preset limit is exceeded, a potential-free contact is switched on and sends a message to the test bench staff. The message prompts the operator to locate the fault and thus prevents idle states in the system by avoiding tripping caused by leakage currents and other influences. As a result, faults in the test bench structure can be detected and corrected during the entire test cycle. The researchers can therefore make the most of the opportunity to conduct their work safely and without being interrupted by unnecessary power failures.

Monitoring IT networks and finding faults: the iso685DP

The unearthed networks each contain four ISOMETER® iso685D-P devices for monitoring the insulation values. These, in turn, are each combined with two EDS440 insulation fault location devices to precisely locate insulation faults that occur in the main circuits. The final components in the safety system are the iom441 relay modules, which disconnect the circuit when alarmed by the fault location device and therefore always ensure a fault-free IT system.



A close eye on all power network data at all times!

The system that completes the picture: the CP907

Bender's CP907 control panel is the central element for the monitoring, alarm and analysis of the unearthed networks. It collects and visualises all data on the current status of the power network, including residual and leakage currents. As a result, the data can be clearly viewed and evaluated in a single location. Furthermore, the system was also incorporated into TUM's existing IT network.

Comprehensive Bender expertise in one system

Five networks, two power supply systems and one electrical safety concept – as Häuslein summarises, the installation at TUM was an interesting project for the experienced specialists at Bender: *"The great thing*

about it was that we were able to incorporate our entire range of services – from the earthed network and IT system to the monitoring and right through to the transformers. We are delighted that TUM chose us to provide this solution." After intensive consultation with those responsible for the project at TUM, Bender was able to find an intelligent solution to make researching the energy of the future safer.

A partner for electrical safety: the engineering office IEP

The Ingenieurbüro ElektroPlanung (IEP) engineering office was responsible for the electrical planning for the first construction stage of the new facility for the School of Computation, Information and Technology at TUM. The team led by Managing Director Dieter Arz offers more than 20 years of experience in providing electrical fittings for school, university and administration buildings. For the network monitoring, which represents an essential element of electrical safety for the EWT test laboratory, Dieter Arz chose to rely on the experience and expertise of Bender:

"Bender's extensive product portfolio and excellent consulting expertise played an important role in ensuring the quality and success of the project. As a result, we were able to offer TUM an outstanding solution that is precisely tailored to meet its requirements and provides it with electrical safety on a long-term basis."

The excellent cooperation enabled all of the project requirements to be fulfilled. —



Managing Director
Dieter Arz - Ingenieurbüro
ElektroPlanung (IEP)



Application Engineer
Bernd Häuslein -
Bender



From left to right: Bernd Häuslein (Bender), Norbert Tuschl (Lab employee, TUM), Jürgen Beier (Bender), Rainer Bierbaum (Lab employee, TUM), David Filusch (TUM – Scientific Council), Dieter Arz (Planning office IEP), Rene Göring (Planning office IEP)

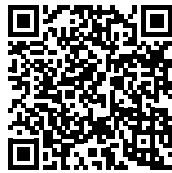
New products



Bringing clarity to operating theatres The COMTRAXX® CP305 Alarm Indicator and Test Combination

The CP305 alarm indicator and test combination informs medical staff about the status of the medical IT power system for operating theatres, intensive care units (ICUs) and accident and emergency departments at all times. This is important given that faults may lead to power failure, which can rapidly put lives in danger in ICUs. Alarm indicator and test combinations therefore report faults at an early stage to prevent dire consequences.

In the German town of Giessen, two CP305 units were installed in the hospital's ICU. The devices clearly show the status on a large 5" touch display: green means that everything is okay, and red indicates a fault. The corresponding error messages are described clearly, and the devices are easy to operate. These new additions represent a new generation of electrical safety at the hospital. After the devices were put into operation, an enthusiastic nurse perfectly summarised their benefits, exclaiming that: *"We can finally help ourselves!"*



Merivaara & Bender High-Quality Fixtures for Operating Theatres

The Grand Promerix and Smarter Practico operating tables were developed for challenging surgeries. They are ergonomic, extremely flexible, simple to use and easy to clean. What's more, they are also available with a variety of accessories that are easy to mount and remove.

The Q-Flow™ surgical lights offer top results for the colour rendering of skin, tissue and blood vessels (CRI = 98). They offer dynamic shadow management, which reduces shadows and ensures optimal light in the operating field at all times. Furthermore, the design of the lights prevents air turbulence and thus reduces the risk of infection. Robust, smooth-running and flexible wall and ceiling supply units round off Merivaara's product portfolio for operating theatres.



Inline Box

Retrofitting residual current monitoring in a data Centre

24 hours a day, 7 days a week, 365 days a year – computing centres are required to work uninterrupted at all times. Residual current monitoring helps to make this possible by detecting faults in the power supply before critical situations or failures occur. In an ideal scenario, the sensors and measuring equipment required for the monitoring are already factored into the planning. Sometimes, however, they must be integrated later down the line.

No space, no disconnection and no interference

A computing centre in northern Germany required the installation of sensors in existing server racks. The installation of the sensors in the existing sub-distribution or the power distribution units (PDU) was not possible due to a lack of space, while the possibility of assembly on the busbar was excluded for liability and warranty reasons. What's more, it was to avoid disconnecting the servers for a long time for the retrofitting at all costs.

The Inline Box as the ideal solution

Bender worked in cooperation with the experienced computing centre specialist, Correct Power Institute GmbH (CPI), to develop a simple, high-quality solution to meet the customer's requirements. The Inline Box contains a CEE plug and a CEE socket for the power supply, an RCMB132-01 AC/DC-sensitive residual current monitoring module and two RJ45 sockets. A MID electricity meter was additionally installed in some of the boxes to allow the power consumption to be properly measured for billing purposes. The box was connected between the power supply and PDU and installed in the false floor.

Residual current monitoring to the final circuit

The solution is now being used in three locations with a total of 214 Inline-Off Boxes. The sensors of multiple Inline Boxes are connected with patch cables, and the data is evaluated and displayed via Modbus RTU with a CP907 control panel. The customer can now make the most of high-quality residual current monitoring of its server racks to the final circuit. It can also detect changes in the electrical installation quickly and reliably without interrupting operations.



The Inline Box is a simple and uninterrupted solution for retrofitting residual current monitoring.

Are you looking for a retrofit solution for your data centre? Feel free to contact me; I'm happy to help!

Peter Eckert

Market Segment Manager Critical Infrastructure
Bender GmbH & Co. KG
peter.eckert@bender.de



Safety first

Bender insulation monitoring upgrades UK rail network

Network Rail is responsible for the UK's railways and demands maximum visibility to assess the health and condition of its power systems supporting signals, points, and communications across its infrastructure. The new generation multi-tier RS4 Rail Signalling Power Monitoring designed by Bender UK, delivers increased sensitivity for first fault location and remote condition monitoring of core-to-earth failures to improve safety, target maintenance and reduce service failures.

New generation monitors approved

Bender monitoring systems have been the principal method of tracking and locating faults on the UK rail signalling power network for two decades. However, less critical emerging faults at lower intervention/insulation limits have been difficult to track and pinpoint. The new generation multi-tier RS4 Monitoring technology delivers the increased sensitivity required by Network Rail with equipment designed to meet the latest Tier 1, 2 and 3 operating standard requirements and help set new levels of safety and resilience. Full approval of new generation multi-tier RS4 Rail Signalling Power Monitoring technology is enabling the UK rail network to upgrade more cost effectively.

Joint development with Network Rail

RS4 offers first fault location and remote condition monitoring of core-to-earth failures which account for most faults on signal power systems. It helps to reduce maintenance, decrease infrastructure failures and improve safety by minimising staff trackside intervention. Bender RS4 technology was developed in collaboration with Network Rail in response to the standard NR/L2/SIGELP/27725 which defines requirements for insulation monitoring and fault location for use on IT Electrical Systems where the nominal system voltage does not exceed 1000 V a.c. or 1500 V d.c. Network Rail regulation NR/L3/SIGELP/50001 requires a variation in intervention windows according to the insulation resistance readings. Faults identified at critical stages (20 kΩ or lower) require intervention within 24 hours. Advanced monitoring and insulation fault location at up to 100kΩ

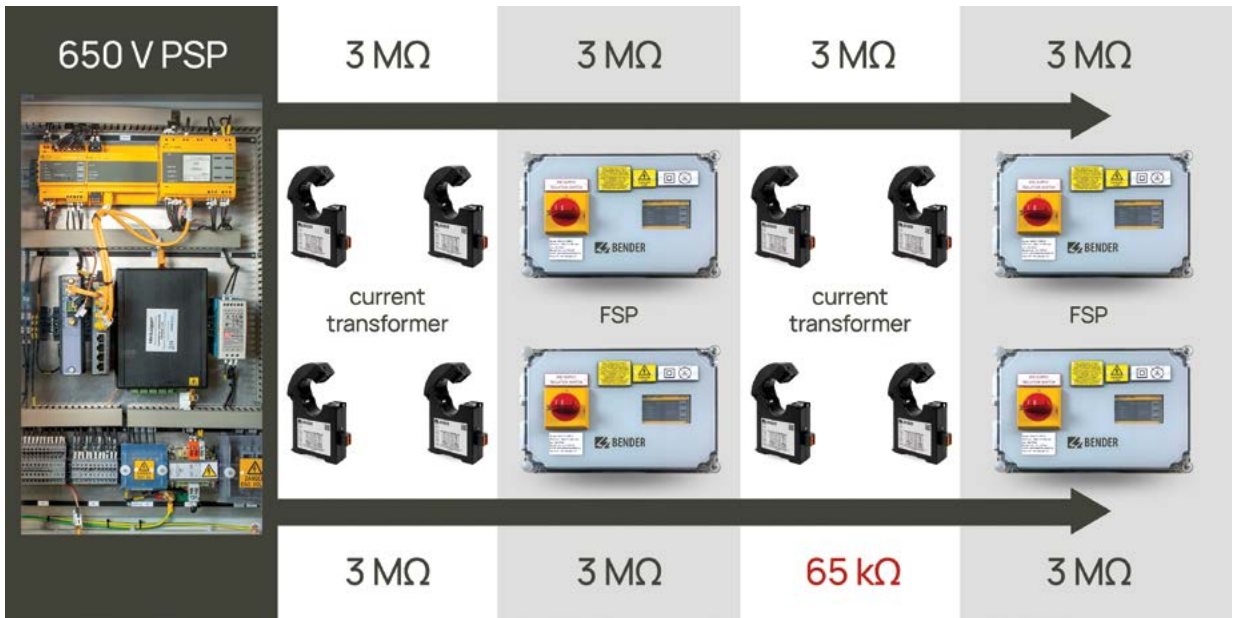


For more than 20 years, Bender is a leading supplier for electrical safety.

increases intervention time, offering the option of dealing faults over a longer timescale through planned and predictive maintenance. Manual cable testing on a 5-year cycle continues to be a requirement, but RS4 is a key step forward in enabling Network Rail to move from periodic testing to a real-time condition-based approach through continuous monitoring.

Positive customer feedback

Tony Edwards, Rail Business Manager from Bender UK commented: "The response from our customers to the Tier 1 and 2 RS4 approval has been very positive. It offers a cost-effective way of upgrading legacy installations to deliver the extra functionality and sensitive monitoring at the new base level." Robert Wilson, Principal Engineer, Power Distribution, for Network Rail believes asset management through insulation monitoring is a key tool in operating railways more efficiently. "Insulation monitoring has moved on significantly over the last few years; earlier systems would tell us we had a problem but not where it was. The new Bender equipment, particularly Tier 1, helps more by locating the problem to between two particular points. Continuous monitoring permits testing without shutdown and disconnecting equipment and provides a real-time health check on the system that enables us to monitor the asset base and to get an early warning of impending problems."



The overview demonstrates the functioning of the new Tier 1 with fault.

Ready for intelligent infrastructure

Comprehensive data readings and information enable operators to make a clearer overall assessment of the system condition and plan maintenance to prevent downtime. Bender’s managed service package cloud access offers customers data uploads every 15 minutes from each feeder. Bender also provides a range of support systems and services, including

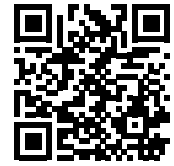
remote condition monitoring designed to integrate seamlessly with future smart infrastructure, and advanced analysis of data collected by both Bender and third-party devices. Robert adds: “We have certainly moved forward and recognise that the more that we can foresee failures then the more that we can do to mitigate their potential effect. To achieve this, there is a clear need to innovate together with manufacturers.”



Robert Wilson, Principal Engineer, Power Distribution, for Network Rail believes asset management through insulation monitoring is a key tool in operating railways more efficiently.

SmartDetect

The consistent conversion to a new generation of devices continues



After the successful launch of the SmartDetect series, Bender is now presenting a range of new SmartDetect residual current monitoring systems. These provide users with a number of advantages: they are easier to operate and offer more interfaces, more application possibilities and more space. Furthermore, new SmartDetect ISOMETER® models will also be launched on the market at the end of the year.

What does SmartDetect stand for?

The advantages of the new generation of SmartDetect devices were already demonstrated by the introduction of the RCM410R SmartDetect residual current monitoring system and the iso415R SmartDetect ISOMETER®. All SmartDetect devices are compact, easy to operate (even via app), and offer more interfaces. They therefore set new standards both in Bender's product portfolio and on the market.

12 new SmartDetect RCMs

In various steps, Bender will introduce a total of twelve new SmartDetect residual current monitoring systems, which are impressive in all aspects: from price to parameter setting and right through to handling. All new RCMs will be available as standard in the variants 1TE

24 V, 2TE 100–230 V and 2TE with a display. The modular design enables the rapid development of new, application-specific models with a uniform look and operating concept.

The Bender Connect App

A further advantage of the SmartDetect devices is the Bender Connect App, which considerably simplifies the parameter setting process. The app enables the parameter settings of the devices to be conveniently programmed before installation – even before they are unpacked. This makes work easier for the specialists using the devices and speeds up on-site installation. All device settings can be conveniently documented as a PDF file. Furthermore, the settings can be exported to be archived for a possible re-import or transmitted to Bender for service enquiries. Confirmed device settings can be easily and directly transferred to other devices for cloning purposes.

A highlight: RCMS4xx

The RCMS4xx devices are a special highlight. As the top models in the series, they offer even better performance and can be used for a wider range of applications. The devices feature four channels with functions that can be freely allocated and enable frequency analysis up to 20 kHz. Customer-specific parameter settings can even be pre-programmed on the delivered device. After the launch of the basic RCMS410 model, further models with a wide-range power supply unit, relay and full-colour display will be launched on the market in the second half of the year.

Coming soon: new ISOMETER® models

Two more SmartDetect ISOMETER® models will also be launched at the end of the year: the iso425L and the iso425-D. The 2TE-wide devices offer all of the aforementioned advantages of the SmartDetect series. Moreover, they also feature two relays, a bus interface and high-quality measurement technology. The iso425-D will have a 1.4" display and four control buttons and be able to be flexibly equipped with several further options. In addition, a variant offering IP68 protection is also being planned. This model will include a special enclosure that makes it ideal for the tough environmental conditions in the construction sector. —

The advantages of SmartDetect devices



More performance in a more compact form



Simple, intuitive operation



Setup via the Bender Connect App



More interfaces



More information and setup options

Seminars and exhibitions

At seminars and the following trade fairs, you are invited to exchange ideas with the electrical safety experts in person. Find out about the current events in the respective regions online:

Exhibitions, trade fairs and events:



Europa Web-Seminars (in English):



America Web-Seminars:



Seminars and Web-Seminars (in Spanish):



Certified specialists

A successful series of online seminars with a Bender Diploma for hospital applications

Last year, the Bender Mexico hospital sales team held a series of online seminars focusing on electrical safety in hospitals over six weeks. The seminar content was designed to address the demands placed on engineers and qualified electricians at hospitals and companies that work for hospitals.

Up to 100 participants

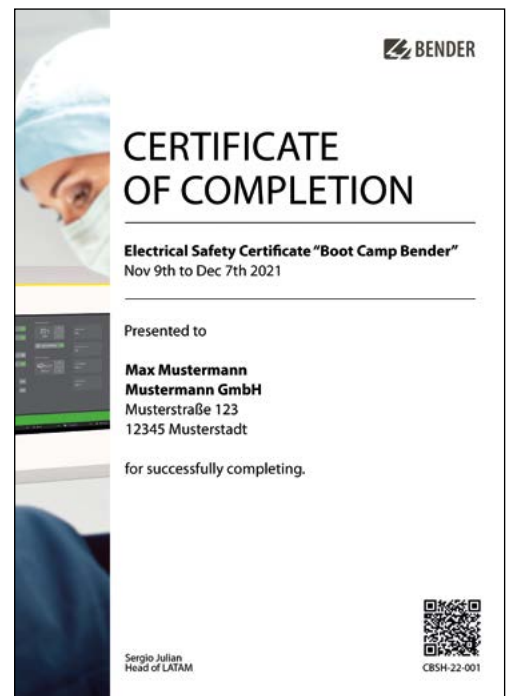
The event with close links to practical applications was advertised on social media and received a resounding response. The online seminars, which each lasted one-and-a-half hours, explored the following topics: standards (IEC and UL), critical power, smart hospitals, Merivaara and applications.

International seminars

The online seminars were hosted by experts from Chile, Germany, Mexico, Spain and the USA. The participants came from Argentina, Bolivia, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Mexico, Nicaragua, Peru, Spain and Venezuela.

Qualified certificates

To receive a certificate for successful participation, the participants were required to attend the seminars regularly and complete their own project focusing on critical power or smart hospitals while considering the applicable standards.



Participants who met all requirements received a Bender Diploma in recognition of their status as specialists for electrical safety in hospitals.

National and international



Certified charge controllers
 Many leading manufacturers of chargers for electric vehicles use the electric mobility platform of the Finnish company eMabler. This platform has chosen Bender's CC612 charge controller as the only charge controller to be awarded its "Certificate of Compatibility". This pre-certification significantly speeds up the certification process of wallbox manufacturers.



01 Award India Best Performance Supplier 2022

In India, Bender India Pvt Ltd was awarded by the management of Amphenol PCD, Chennai, as this year's "Best Performance Supplier of the Year 2022". Amphenol PCD, who are integrators of EV for various Indian Vehicle manufacturers, evaluated its key suppliers on the criteria of quality, cost, delivery and support. The award was presented by Mr Martin Booker, Sr Vice President, Amphenol Industrial Product Group, USA and received by Mr Raghavendra Sajjan-Sr Manager Bender India - South Region.

02 LANline Award Provider of the Year for "Measurement Technology for Cabling"

Bender has yet again been awarded the LANline Award for "Provider of the Year". In the reader survey conducted by the trade magazine, Bender achieved third place in the category "Measurement Technology for Cabling". LANline claims to be the market's leading German specialist publication for IT, networks and data centres.

Hyperloop project

The Technical University of Munich tunnels its way to victory with Bender



Safety as a success factor: The safety concept with an IT-system was also included in the overall evaluation.

Through the tunnel at 1,000 km/h

Elon Musk's Hyperloop project aims to accelerate future mobility with trains that transport passengers through a tunnel at a speed of 1,000 km/h (620 mph). A team from the Technical University of Munich developed an innovative tunnel boring technology for the project and won the first Hyperloop competition among 400 other teams. The aim of the competition was to bore a tunnel that was 30 metres long and 50 centimetres wide. The candidates were also judged on their safety concepts.

Safety first – when boring too!

After intensive consultations with Bender experts, the students opted for the development of an unearthed network (IT system). This makes the tunnelling technology less susceptible to electrical failures and thus reduced the risk that they would be eliminated from the competition. Furthermore, the IT system increases the electrical safety for the individuals working at the tunnelling site, especially if they have not completed an electrical health and safety briefing. Bender provided the TUM Boring team with its measurement technology free of charge and set it up ready to be used.



Control cabinet of tunnel boring technology with Bender components.



TUM Boring is currently developing its tunnelling technology for the "Not-a-Boring Competition" 2022/23. We would like to wish the team another successful experience and are delighted to continue helping to shape the safe mobility of the future. Read the entire story of the TUM Boring project at:

www.tum-boring.com/



Design the future of energy

Bender shines the spotlight on its “yellow boxes”

When you visited us at the Hannover Messe trade fair in April, something may have caught your eye: Bender recently adopted a brand-new look. So why the change?


“Design the future of energy”, our mission statement for the trade fair, is the compass that points the way for the Bender Group with its 15 international companies and more than 100 distributors worldwide. It reflects the aim of the group of companies: to continue to be a reliable and valuable contact for all technical questions

concerning electrical safety all over the globe and to support developments with a future-oriented approach.

The “yellow boxes” will continue to play a central role in this approach and will therefore also accompany the new corporate design as a key element over the years to come.

For the sake of sustainability, we are gradually converting our communication material to incorporate the new corporate design so that existing brochures and promotional gifts can be used up rather than being thrown away.





40 years of Bender Inc. The globalisation of electrical safety began in the USA

Dirk Christian Bender was a visionary with grand ambitions. He wanted to transform the company he had taken over from his father, Walther Hans Bender, into a globally successful organisation. To achieve this goal, he researched highly promising countries – and the USA was the top of his 1980 list. Just three years later, the first subsidiary, Bender Inc., was founded in Exton, Pennsylvania.

Over the past 40 years, this start-up with four employees has developed to become a specialist for electrical safety with customers throughout the USA.

Understanding markets and recognising opportunities

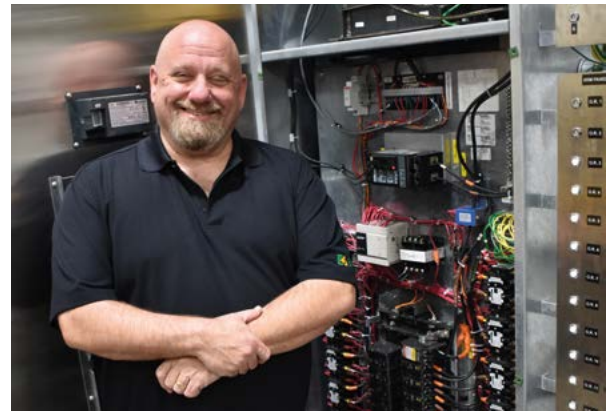
In his list of countries from 1980, Dirk Christian Bender noted that the USA offered good market opportunities regarding hospitals in particular. After it was founded on 19 April 1983, Bender Inc. therefore started out by consistently focusing on this area of application. With its innovative product developments and clever market activity, the company has continued to grow ever since. In 1987, for example, Bender Inc.'s main customer, ISOTROL, moved away from California and left most of its employees behind. Bender Inc. made the most of this abundance of expertise and experience and founded the Bender Medical Products division, in which the former ISOTROL employees produced insulated switchboards. In 1995, Bender Inc. acquired both ISOTROL and the company Isolation Systems Products in Ontario, Canada. These new additions were followed by further acquisitions in important market sectors. In 2004, for example, Bender Inc. in California also got involved in the film business. Its subsidiary Bender Entertainment Systems rented out earth leakage (EL) circuit breakers to the film industry to protect production crews during filming.

Successful innovations in the USA

Over the past four decades, Bender Inc. has hugely increased Bender's brand awareness and successfully introduced all important Bender innovations in the USA: the new EDS series in 1993, which was the first insulation fault locator for unearthed systems, and the fault current and residual current monitoring systems for unearthed networks in 2003. In 2009, it introduced the ISOMETER® product line for electric vehicles and the ISO-F1 for the Kinetic Energy Recovery Systems (KERS) used in Formula One racing, which use the kinetic energy produced when a car brakes to provide new acceleration. These developments laid the foundation for the future market of e-mobility.

Further advancing e-mobility

When Bender Inc. was founded 40 years ago, it marked the start of Bender's progression to become one of the world's leading providers of innovative electrical safety solutions. Back then, Dirk Christian Bender already



From four to 75 employees today - and Dave Bradley is one of those who have been with the company the longest: for more than 30 years, he has been on the road for electrical safety in hospitals on behalf of Bender Inc.

identified the USA as a key market with corresponding growth potential. Nowadays, Bender Inc. is a successful company with headquarters based in Exton and with regional representatives and distributors throughout the USA. Bender solutions have successfully established themselves in a top position in the electrical safety market. The USA continues to be an important key market for Bender in the present day, currently offering potential in areas such as creating a safe charging infrastructure and supplying components for electric vehicles.

Walther Hans Bender's original vision of comprehensive protection against the dangers of electrical currents is the big idea that is still driving the activity of Bender's subsidiary in the USA today. —



25 years of Bender UK Strong team and continuous growth

With more than 90 employees, Bender UK is one of the largest Bender subsidiaries. In 2022, Bender UK celebrated its 25th anniversary - and a remarkable success story in terms of electrical safety.

BENDER JUBILEE

Successful in Great Britain and Ireland

From Ulverston in the North West of England, Bender UK serves public and private sector customers throughout the UK and Ireland. In doing so, Bender UK supports and supplies the British Navy, Network Rail and many hospitals, among others.

Very good business development

Gareth Brunton, Managing Director, is proud of Bender UK's growth: "This includes not only our annual turnover, which has doubled on average every five years. Our staff numbers is likely to exceed 100 this year. We've entered new markets like e-mobility and built a strong base in critical industries."



Bender UK's head office in Ulverston, Cumbria.

Old acquaintances and new faces

To mark the anniversary, a big celebration including a team-building event was held. Sandy Murray, Head of Finance, was thrilled by the pleasant atmosphere: "For many of our new employees, this was the first opportunity to meet colleagues in person. For others, it was a long-awaited reunion after the lockdown period." With so much team spirit, the next 25 years are sure to go well! —



Bender UK: A strong team for electrical safety



SELAM Update

Our social-electrical aid foundation in Ethiopia continues

In this MONITOR issue, we want to provide you with the next update on our first social-electrical project, Bender@SELAM. A great deal of progress has been made over the last few months.



Bender covers the costs of the 3-year training for the whole class.

A brief review

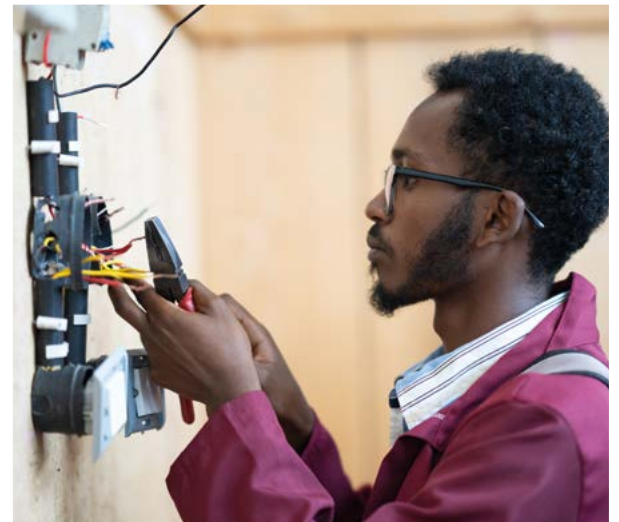
In 2021, we launched the project Bender@SELAM in cooperation with the Swiss aid organisation SELAM. Our project is all about helping to facilitate vocational training for young people in Ethiopia. Our long-term objective is to give all participants the opportunity to secure a future career, a good income and a livelihood for their families. Bender covers the costs for the 3-year long-term training of the entire class. Bender also financed the short-term training, which was initiated as a bridging measure due to the worldwide Corona pandemic, together with the donations collected during Bender's anniversary year.

Successful completion of short-term training

All 30 participants were able to successfully complete the short-term training that began in April 2022. The compact training programme is comprised of four months of theory lessons followed by an internship at a company. The vocational training is aimed at unemployed young adults with the goal of helping them to improve their prospects in the labour market.

Long-term training has started

The long wait for the start of the long-term training programme is over. The potential new trainees have been waiting for the final examination results needed to register for vocational training since October and have encountered numerous unplanned delays on the part of the Ethiopian government. At the beginning of March, the ministry announced the so-called "cut-off points", the minimum average marks required for each professional pathway. All interested applicants can now register for official vocational training. If there are no further delays, the first academic year of training will begin over the next few weeks. We are already very excited for it to start and wish all participants all the best and every success in their training. —



Electrical safety offers career perspectives.



Learn more about
SELAM here

Bender global

Bender Mexico

A new regional office on track for success

Bender LATAM opened its office in Mexico in September 2022. Following the extremely positive market development, the opening was the next logical step in order to provide customers with better support and advice on location.

A dedicated team in Mexico City

Bender Mexico employs four members of staff. The team led by Managing Director Sergio Julian contains two sales engineers, a junior sales and service engineer and an office manager. The office currently focuses on projects in the hospital and industry sectors but also supplies products and services to customers in the mining, oil and gas industries and to data centres. In the future, it also expects to experience growing demand in the field of e-mobility.

Close contact with partners and customers

As a result of its hard work and commitment, Bender Mexico has secured an outstanding market position. The availability of the regional office acts as the perfect foundation for providing partners with better information and qualification opportunities. Its two main partners, Grupo Ors and Grupo RAAD, for instance, make the most of support in the form of regular online and in-person training sessions. Another prime example of such support on location was a large event on the topic of the "Smart Hospital", which welcomed more than 50 customers in January.



The Bender Group management visits the newly opened location in Mexico City.

Miguel Rosales and Manuel Arroyo (both Bender Mexico) Monika Schuster (CFO Bender), Heinz Novicki (CSO Bender), Sergio Julian (Managing Director Bender Mexico)

Enkom Active

Our new distribution partner in Finland

Enkom Active has been a new Bender partner in Finland since January 2023. The company has taken over the business activities of our previous partner Agentuuri Neumann, which will continue to support Enkom Active in a consulting role. Bender solutions are an outstanding fit for the product portfolio of Enkom Active. The distributor has been offering high-quality electrical components for the electrical industry for more than 30 years and supplies its products to both industrial manufacturers and system integrators.



Focusing on electric mobility and medical

The industry, electric mobility and medical market segments represent one of the focuses of Enkom Active, which it now wants to expand with the help of Bender. *"We are delighted to have found such a strong, well-positioned partner that can help us to further explore the existing market potential in Finland and to make the most of it with a future-oriented approach,"* states Wolfgang Gross, Vice President EMEA at Bender, welcoming the new Partner. Enkom Active is part of the Lagercrantz Group, a listed B2B tech group with 65 companies specialising in value-creating technologies for niche segments.

Bender takes over the company BSK Datentechnik

Bender has taken over its long-standing development partner BSK Datentechnik. The newly acquired company specialises in solutions for the automotive supplier industry.

Developing hardware and software

BSK implements all steps of hardware development, from the original design to the production of samples and right through to creating manufacturing documents for series production. One of the company's focuses is placed on the area of functional safety. BSK additionally develops customer-specific firmware, application software for Windows and UNIX environments and special diagnosis systems for the development, production and parameter setting of control devices.



A well-coordinated team: Bender and BSK Datentechnik.



Global Sales Meeting 2022

After countless telephone conferences, Teams meetings and e-mail exchanges throughout the Covid-19 pandemic, we finally celebrated a personal 'meet-up' last summer. More than 150 participants from all over the globe travelled to the two-day Sales Meeting, where they enjoyed a varied programme in an impressive setting.

Global Sales Meeting 2022: more than just a snapshot!

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Welcoming the world of electrical safety

The international Bender Sales Meeting is a unique opportunity to gather information, gain ideas and inspiration, maintain contacts and expand networks. All Bender sales partners worldwide were therefore invited to the event. Partners from 45 different countries gratefully accepted the invitation and intensively made the most of the opportunities it provided. In addition to 50 members of staff from the Bender headquarters, 34 representatives from Bender Group members and 70 representatives from distributors also attended the Sales Meeting.

Networking, updates and success stories

The two days of the event were packed full of highlights: In best-practice presentations and workshops, the EMEA, AMERICAS and APAC divisions presented current challenges and solutions in areas such as electric mobility, renewable energies and hospital engineering. Representatives from the Bender headquarters provided an insight into new series of devices, offered practical training sessions and reported on the goals and visions of the Bender Group.



The participants were impressed by the diverse event programme.

APPsolutely new and extremely communicative

A special event app enabled the participants to maintain an overview of the wide range of highlights available. The app contained a clear list of all talks, speakers and venues and facilitated easy communication between participants. It may well be used again at the next Global Sales Meeting, which is planned to take place in 2024.

A close-up of the Leica Museum

The event venue was a special highlight in itself: the Leitz-Park in Wetzlar, Germany, is home to the headquarters of the Leica Group, which is famous for its legendary cameras. In the neighbouring Leica Museum, the guests were treated to an extraordinary interactive evening event with an exciting journey through the history of camera technology. As you would expect, the participants also had plenty of opportunities to share ideas and experiences and take some photos themselves. —



Networking on all channels strengthens the Bender spirit.

Automated product examinations

Fit for the future with lasting quality

Anyone who wants to advance the future of energy needs to ensure that every device functions perfectly. Bender's final examination process recently welcomed a new, automated addition – with 100 % traceability included.

Safety is always the top priority

It is a well-known fact that electricity is dangerous, and that Bender helps to eliminate this risk. To provide electrical safety, it is essential that every work step, from production through to the final examination, is carefully planned and implemented. Only by doing so is it possible to reliably protect processes, systems, and above all, people. Achieving this is essential, especially given that Bender products are used in many sensitive areas such as hospitals, power plants, electric charging stations and chemical plants.

Safe is safe

Bender currently tests around 4,500 different products with varying voltages, connections and test specifications and different batch sizes. Each product is subject to a strict test protocol. To reliably meet the high testing requirements, Bender develops and manufactures most of its test equipment in its own department.

A lack of skilled staff makes automation essential

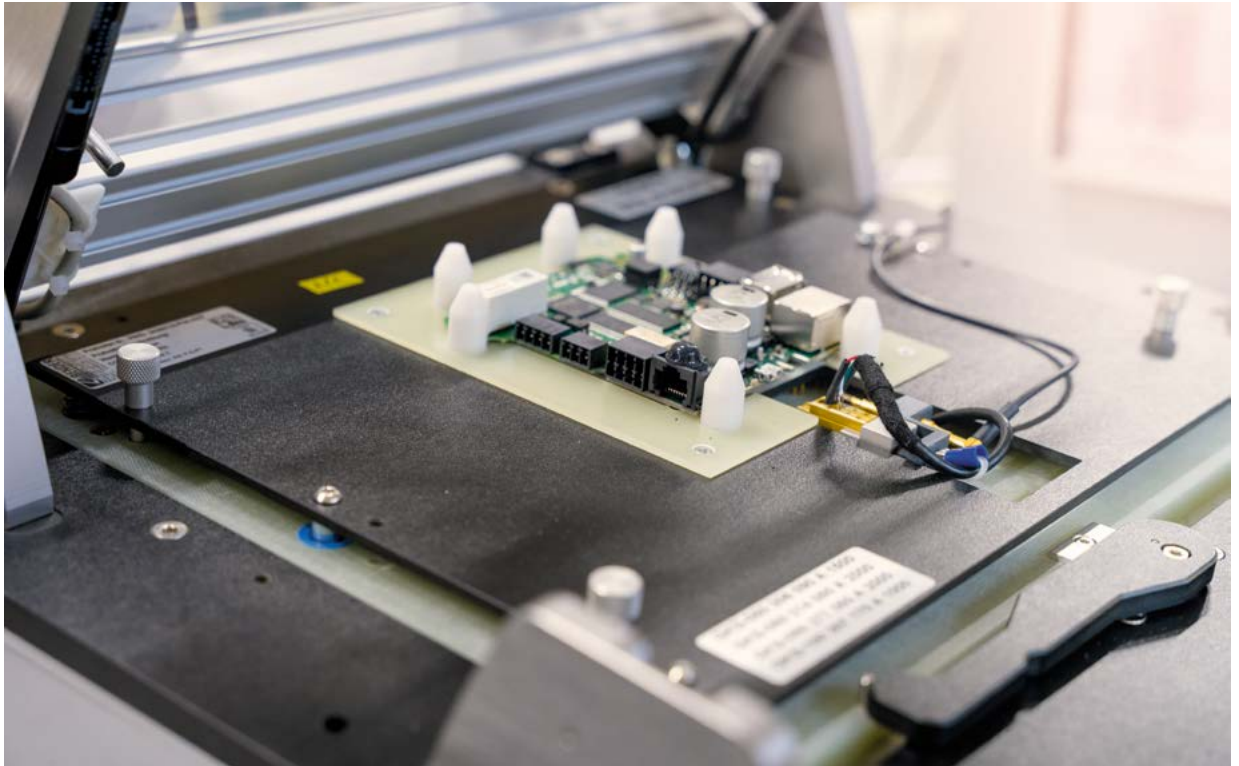
Like most companies, Bender also requires a significant number of skilled employees, more than the labour market is currently able to provide. It is therefore important to evaluate procedures in order to identify areas in which technical solutions, namely automated processes, can be used. One example of such an area is the complex final examination of products, which is now being simplified by an impressive solution.

Different test procedures

Up until recently, Bender has used individual tests and semi-automatic examinations to check its products. The introduction of the new automated test station has now significantly increased its examination capacities with no detrimental effect on the quality of the testing. In fact, the opposite applies: The system provides error-free results in a shorter time and is therefore the ideal solution for all products manufactured in larger batches. Products with medium batch sizes and specialised products will also continue to be examined manually.

Individual examinations are complex

Many products are manufactured in small batches and undergo complex and time-consuming examinations. A trained, skilled employee first must connect the



The assembly is contacted in the test adapter and undergoes an automatic function test.

device and test its functions in a live state based on a stipulated test protocol. Different values and functions are examined depending on the product in question, for example, current, voltage and resistance; temperature; reaction or actuating times and the function of interfaces, switches and touch displays. The examination can take up to three minutes per product and therefore represents one of Bender's most labour-intensive processes.

Smart Klaus keeps an eye on everything

Products manufactured in larger batch sizes are examined using a semi-automatic procedure supported by "Smart Klaus". In this inspection procedure, a camera installed above the inspector monitors and documents each individual test step. Thanks to this solution, less-qualified staff can also work at these test stations without making the test or its result any less reliable.

The ideal solution for quicker and more reliable testing

Bender has been using a semi-automatic test station in its operations since the end of February. This station examines up to eight devices, which are clamped in a holder and have a current passed through them, at the same time. The test program is conducted fully automatically and significantly reduces the testing times. This advantage is particularly significant in the current times of high supply pressure because it helps users quickly and reliably meet market demands. The test station is above all used to examine devices for the automotive industry, in which the quantity of units requiring inspection has vastly increased thanks to the positive and well-received upswing in automotive business.

Securing the location and supply availability

By automating its test station, Bender is not only combating the acute lack of skilled staff but also making a clear statement in support of its Grünberg location, where it plans to continue to develop and manufacture solutions for a safe power supply in the future. —



Mastering standards, measurements and ageing Large-scale PV installations in terms of electrical safety

The electrical safety of large-scale photovoltaic installations is a challenging task. In addition to the effects of natural ageing, weather conditions and other influencing factors also need to be taken into consideration.

Adaptive measuring ISOMETERS® offer a safe and simple solution in accordance with the requirements of applicable standards for countering problems throughout the entire operating time of PV installations.

Read more about
how to operate
photovoltaic systems
electrically safe and
economical

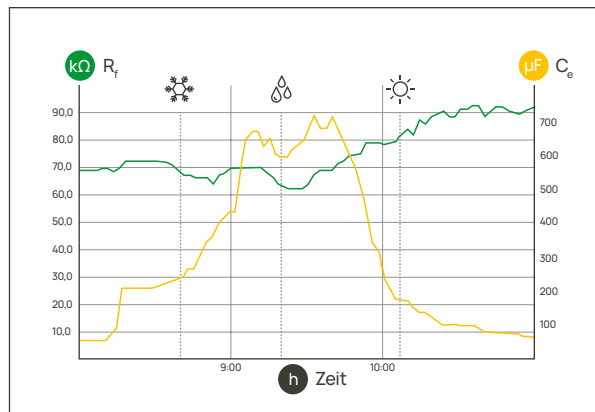


Normative requirements

Pursuant to the standard “IEC 60364-7-712:2017 – Low-voltage electrical installations – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems”, PV installations must be fitted with insulation monitoring devices. These insulation monitoring devices must meet the requirements stipulated by the standard “DIN EN 61557-8 – Electrical safety in low-voltage distribution systems up to 1,000 V AC and 1,500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems (IEC 61557-8:2014)”. Annex C of the standard describes how insulation monitoring devices for PV installations must also comply with dynamic reference properties. The MPP tracker integrated into every inverter permanently controls these properties based on the optimal operating point. Insulation monitoring devices need to use measurement technology to correctly process the resulting fluctuations in the direct current of the PV generator, especially when it is started up in the morning and switched off in the evening.

The environment as an influential factor

Changes in the insulation value in PV installations are caused by factors such as the interaction between temperature and moisture. After a frosty night, the morning moisture can cause the leakage capacitance (C_e) of a PV installation to increase tenfold while reducing the insulation resistance (R_i) by 30% at the same time. This phenomenon additionally occurs in the case of rain or snow, as well as in areas with increased humidity, for example, in close proximity to bodies of water. Conventional insulation measuring devices are unable to intelligently factor in these changes and therefore deliver incorrect measurements. These, in turn, can have a negative impact on the protection of humans and the installation.



Intelligent insulation monitoring devices identify fluctuations in the insulation resistance (R_i) and leakage capacitance (C_e) caused by environmental influences throughout the day and factor them into the evaluation.



Ageing PV installations with considerably deteriorating electrical properties will lead to increasingly large problems in the years to come

Age as a risk factor

A second major challenge faced by operators of PV installations is degradation. More and more installations are getting past their prime and becoming damaged, for example, when foils in the PV panels become loose or porous and let moisture in. As a result, the insulation value deteriorates. Such problems are accompanied by the so-called PID (potential induced degradation) effect in outdated semiconductor structures. In such cases, the leakage current and the voltage potential cause negative ions to move away from the semiconductor. In parallel, positive ions free themselves from the glass surface, enclosure and surrounding environment and move towards the semiconductor. This polarisation effect can be reversed using so-called PID shifting. In this process, the insulation monitoring is deactivated, and the entire PV generator is set at a high, positive potential (a voltage against earth of up to +1,000 V). After PID shifting has been carried out, the insulation monitoring technology must be adapted to suit the new status of the installation so that correct measurements can be recorded.

An electrically safe solution

Bender insulation monitoring devices for PV installations are designed to handle fluctuating environmental conditions, MPP tracking and deactivation during the PID shifting in accordance with the requirements of applicable standards. Their adaptive measurement method automatically adapts to environmental influences (frost, moisture and dryness). It reliably records the insulation resistance (R_i) and the leakage capacitance (C_e) at all times. After a PID shift, the devices immediately adapt to the external conditions and deliver correct measurements without interference. —

The qualified engineer Dipl. Ing. Tilo Püschel examines the reduced output and electrical safety of large-scale PV installations and knows how intelligent insulation monitoring can be used to combat related problems.



Christian Jerkel

COO and member of the board of directors

Have you ever had a special experience with electrical safety?

In my childhood and teenage years, I was already interested in electricity and liked to tinker around with electrical components. When one of my disco lights broke, it didn't take me long to realise that the contact in the E27 socket was bent downwards. So what did I do? Without thinking, I grabbed it to pull it back up. Of course, doing so meant that I also closed the circuit, which led my father to make a statement about my more than careless action that is now somewhat legendary here at Bender: "I knew you wouldn't switch it off!"

Mr Jerkel, you have now been at Bender for around one-and-a-half years – what have been your first impressions?

Friendly, personal and very motivating. I spent a long time working for corporate groups, where many things are different. Based on this experience, I can identify a number of areas that can and should be tackled at Bender. At the same time, I can also see plenty of things that should definitely remain just the way they are.



Do you have an example?

Yes, the friendly and personal communication and working atmosphere are wonderful and suit my personality. I am a direct and open person and have an open-door policy. Anyone is welcome to visit me in my office to tell me what they want or need. We then work together to find a sensible solution.

Isn't that a bit too much? You do have a team of around 200 employees, after all.

No, it's not. After all, people form the focus of my interests. I want to recognise, support and promote their strengths and potential, which can then be developed in a targeted manner for the good of the company. In order to do so, it's essential that I listen to them.

What do you consider to be the main focuses of your work?

As Chief Operating Officer, I am responsible for the operational business of the company. In other words, it's up to me to make sure that everyone works perfectly. I approach my work as a clear thinker, analyst and optimiser. Process automation is my professional passion. I visit our production facilities and instantly see things that can be improved to benefit everybody.

Professional background

Christian Jerkel is an industry expert with a wealth of practical experience. He started out as a qualified radio and television engineer at Siemens, where he worked his way up to the position of Plant Manager. He then moved to a prominent automotive supplier company, where he made use of his analytical and structured skills, first as Deputy Head of Operations and later as Industrial Director / Vice President of Production.

For me, people are always the number one focus!

What exactly do you mean?

Let's take product testing as an example. Here, I have noticed that although we are manufacturing more and more products, I am significantly lacking in qualified staff who can test all these products. If you ask me, this is screaming out for automation, which is why I am looking into which work steps can be converted and how such opportunities can be used.

Are you a numbers person?

Not really, no. I'm all about people. That said, numbers are, of course, one of the main tools in my position. If I want to do a good job, which is definitely my aim, I need to keep an eye on all KPIs and understand how they are connected and influenced. This is why I want to know where we stand, where we are going, what we've produced and what it costs on a day-to-day basis – not to mention how we can improve, of course.

How do you think Bender is developing?

If I look at the figures, I think we are making outstanding progress. We have ambitious aims and are striving to achieve them with a great deal of energy. Nevertheless, there is still a lot to be done in order to reach these goals. Here at Bender, I get the feeling that I can use my experience and background to bring fresh impetus to several areas and to initiate developments that may not have been all that important.

You became a member of the Board of Directors after a year at the company. Why is that good for Bender?

First and foremost, I am delighted to have taken this step together with the company. It is good for Bender because it shows that I take my role here seriously. I am not a business consultant who just pops into the company, introduces some rationalisation measures, sends his bill and then disappears again. As a member of the Board of Directors, I must take responsibility for the consequences of every decision I make – not just now but also in the long run. This really spurs me on, which in turn benefits Bender. —

Complete the following sentence:

For me, Bender is ...

»»The future
and my home.««



Our compass for the future

My grandfather founded Bender with a clear vision: He wanted to protect people from electricity. Together with my father, this vision was not only implemented, but also developed and advanced step by step and distributed worldwide. Starting in mining, solutions for hospitals, industry and finally eMobility followed. Furthermore, we are developing products and technologies today that no one could have imagined 75 years ago. This is precisely what shows the core of Bender: Being a pioneer – the never-ending search for new solutions and innovations.

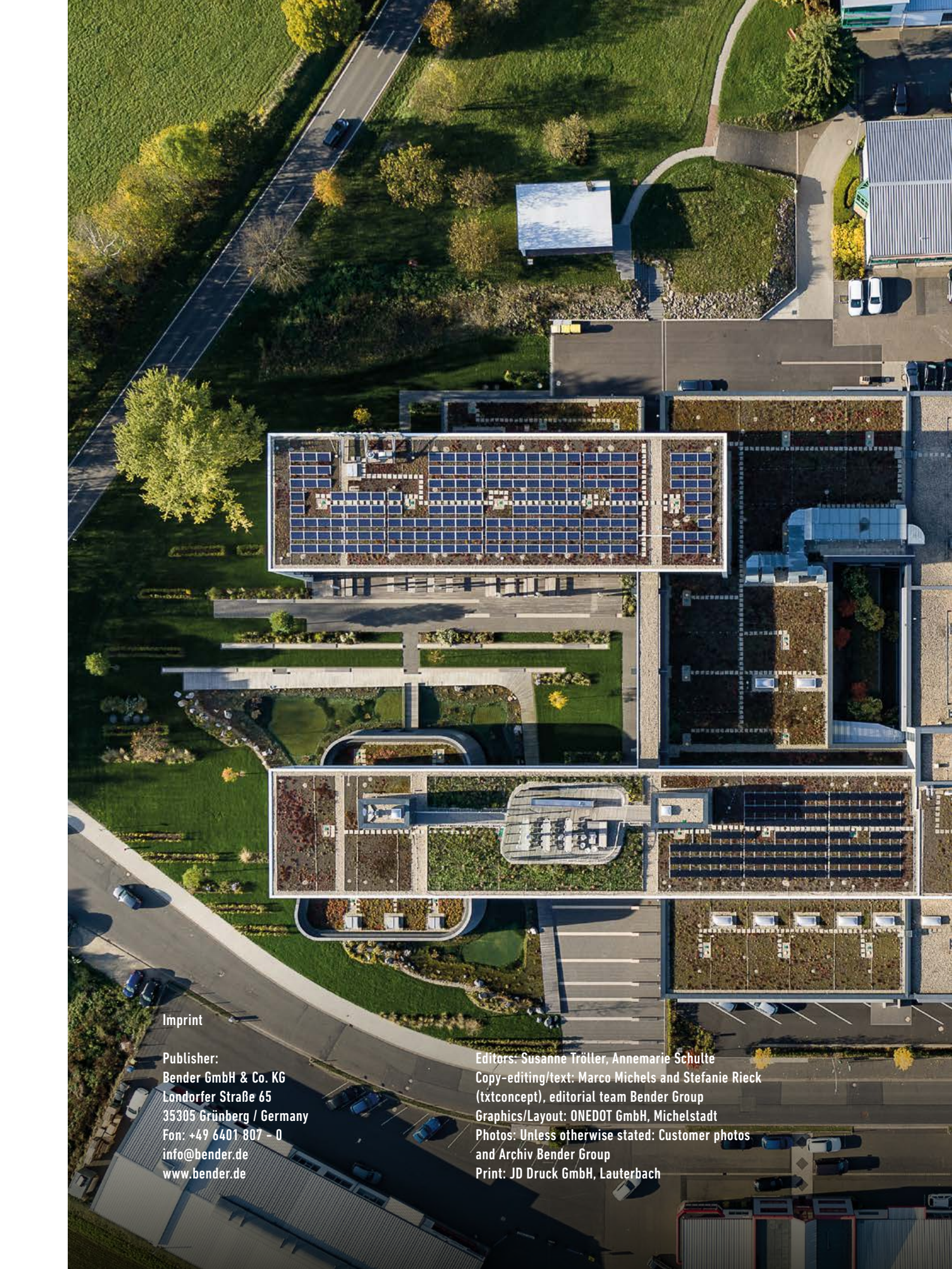
We design the future of energy

This core has already attracted many great companions into the company, who have lifted Bender to new levels time and again. This core drives us as a team not to stand still and rest on our successes. We want to always lead the way by developing products and solutions for you that enable new, sustainable technologies and make them electrically safe.

We make electricity smart and safer

As part of the founding family, it is important to me that you know: We look forward to all the upcoming answers we may develop for your questions - today, tomorrow, and the day after tomorrow. Together we are shaping the future of energy. That is our compass.

Dorothea Bender Fernández,
Chairwoman of the Bender Group Advisory Board



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