

RAYLI SİSTEMLER



adeo teknik

Bender Türkiye Resmi Distrübörü



BİZ KİMİZ?



ATR GRUP, enerji ve elektrik mühendisliği alanlarında uzmanlaşmış, mühendislik temelli yaklaşımı ve sahaya dayalı tecrübesiyle faaliyet gösteren kurumsal bir mühendislik grubudur. Kuruluşundan bu yana, endüstriyel tesisler ve kritik altyapılar için **güvenlik, süreklilik ve mühendislik doğruluğunu** merkeze alan çözümler üretmektedir.

Grup bünyesinde yer alan **ADEO TEKNİK**, elektriksel güvenlik ve izleme teknolojileri konusunda uzmanlaşmış olup, özellikle **topraklama, izolasyon izleme, kaçak akım ve enerji sürekliliği** gibi hayati konularda müşterilerine katma değerli çözümler sunmaktadır. ADEO TEKNİK, bu alandaki faaliyetlerini yalnızca ürün tedarikiyle sınırlamamakta; doğru ürün seçimi, uygulama mühendisliği, devreye alma ve teknik danışmanlık hizmetleriyle desteklemektedir.

Bu kapsamda ATR GRUP ve ADEO TEKNİK, dünya genelinde elektriksel güvenlik denildiğinde referans kabul edilen **BENDER** markasının ileri teknoloji çözümlerini, Türkiye pazarının ihtiyaçları doğrultusunda konumlandırmaktadır. BENDER ürünleri; hastaneler, endüstriyel tesisler, enerji santralleri, e-mobility altyapıları ve raylı sistemler gibi **kesintisiz ve güvenli işletmenin zorunlu olduğu** uygulamalarda uluslararası standartlara uygun, kanıtlanmış çözümler sunmaktadır.

ATR GRUP'un en temel farkı; sahadan gelen gerçek ihtiyaçları doğru analiz ederek, **ürün + mühendislik + teknik destek** üçlüsünü tek bir yapı altında sunabilmesidir. Bu yaklaşım sayesinde müşterilerimize yalnızca bir marka veya ürün değil; **uzun vadeli işletme güvenliği, mevzuat uyumu ve sürdürülebilir teknik çözüm ortaklığı** sağlanmaktadır.

Özetle ATR GRUP ve ADEO TEKNİK;

- Elektriksel güvenliği kritik bir mühendislik disiplini olarak ele alan,
- Global markaları yerel saha tecrübesiyle buluşturan,
- Üst yönetim beklentilerine uygun şekilde **riskleri azaltan ve işletme sürekliliğini artıran** çözümler sunan,

kurumsal bir mühendislik grubudur.



Raylı Sistemler için Elektriksel Güvenlik ve İzleme Çözümleri

Türkiye'de raylı sistemler; şehir içi ulaşım, yüksek hızlı tren hatları, konvansiyonel demiryolları ve endüstriyel hatlar dâhil olmak üzere her geçen gün daha karmaşık, daha yoğun ve daha yüksek süreklilik gereksinimi olan altyapılara dönüşmektedir. Bu dönüşüm sürecinde **işletme sürekliliği, can ve mal güvenliği, bakım maliyetlerinin kontrolü ve uluslararası standartlara tam uyum**, raylı sistem yöneticileri ve teknik ekipler için temel öncelikler hâline gelmiştir.

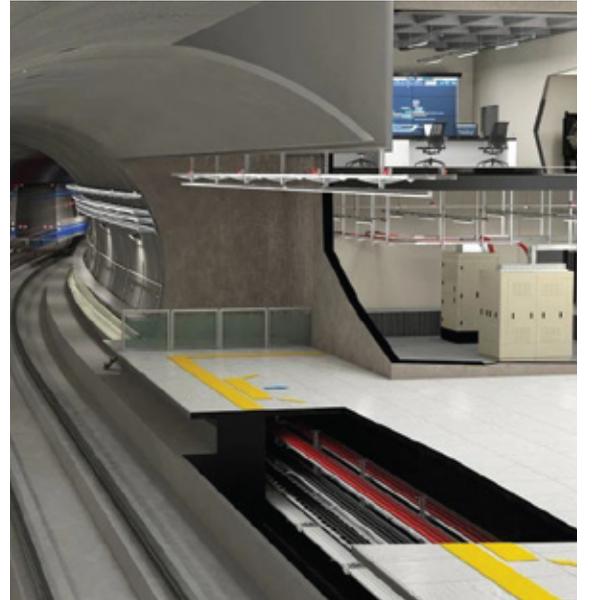
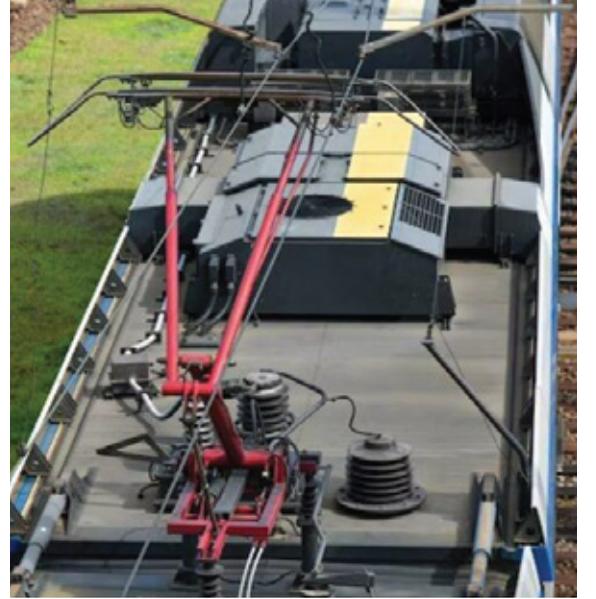
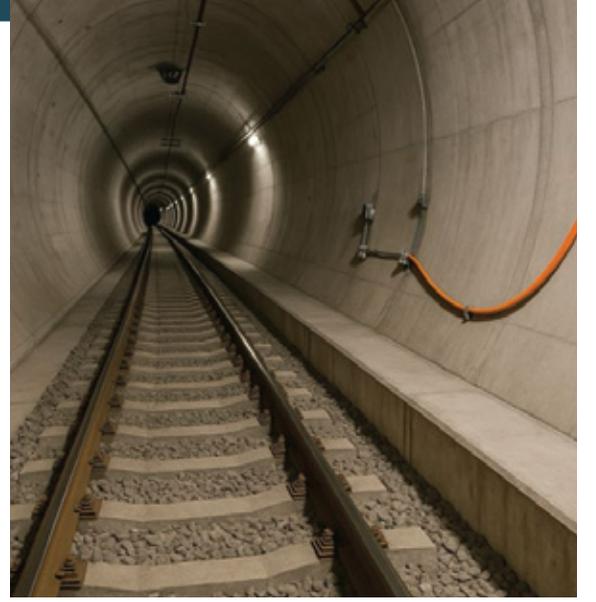
Bu katalog, raylı sistem altyapılarında kullanılan **enerji dağıtımı, sinyalizasyon, tünel ve istasyon elektrik tesisleri, saha ekipmanları ve yardımcı güç sistemleri** için geliştirilmiş modern **elektriksel güvenlik, izolasyon izleme ve arıza konumlandırma** çözümlerini teknik bir bakış açısıyla sunmak amacıyla hazırlanmıştır. İçerikte yer alan çözümler; **kesintisiz işletme, erken arıza tespiti, öngörücü bakım ve standartlara uygunluk** hedeflerini doğrudan destekleyecek şekilde yapılandırılmıştır.

Raylı sistem uygulamalarında, özellikle **IT topraklama sistemleri** ile birlikte kullanılan sürekli izolasyon izleme teknolojileri; ilk izolasyon hatasında işletmenin durmasını engelleyerek, hem güvenliği hem de sistem erişilebilirliğini önemli ölçüde artırmaktadır. Bu yaklaşım, planlı ve plansız duruşların azaltılmasına, bakım ekiplerinin sahaya daha bilinçli ve hedefli müdahale etmesine olanak tanır. Sonuç olarak işletme maliyetleri düşerken, hizmet kalitesi ve yolcu güvenliği üst seviyeye taşınır.

Bu katalogda sunulan çözümler; sinyal güç sistemlerinden makas ısıtma ve tahrik ünitelerine, tünel acil durum enerji altyapılarından istasyon ve depo binalarına kadar geniş bir uygulama yelpazesini kapsamaktadır. Tüm sistemler, raylı sistemlere özel **EN 50155, EN 50121, IEC 61557** gibi uluslararası normlar dikkate alınarak ele alınmış; saha gerçekleri ve işletme tecrübeleri doğrultusunda teknik olarak olgunlaşmış örneklerle desteklenmiştir.

Katalogda yer alan teknolojiler, **Bender**'in raylı sistemler alanında dünya genelinde edindiği uzun yıllara dayanan mühendislik birikimi ve uygulama tecrübesine dayanmaktadır. Amaç; Türkiye'deki raylı sistem işletmecileri, altyapı yöneticileri ve teknik personel için **referans niteliğinde, uygulanabilir, ölçeklenebilir ve geleceğe hazır** çözümler sunmaktır.

Bu dokümanın, saha uygulamalarında karar verici konumda bulunan teknik ekipler için yol gösterici olmasını; planlama, modernizasyon ve işletme süreçlerinde katma değer yaratmasını temenni ederiz.



BENDER Markası ve Raylı Sistemlerde Küresel Yetkinliği

Bender, elektriksel güvenlik, izolasyon izleme ve enerji izleme teknolojileri alanında dünya çapında kabul görmüş, yüksek mühendislik yaklaşımına sahip bir teknoloji üreticisidir. Merkezi Almanya'da bulunan Bender, 75 yılı aşkın süredir; **kritik altyapılarda elektriksel güvenliğin kesintisiz olarak sağlanması, arıza risklerinin erken aşamada tespit edilmesi ve işletme sürekliliğinin artırılması hedefleri doğrultusunda** çözümler geliştirmektedir.

Raylı sistemler, Bender'in uzmanlık alanlarının en kritik başlıklarından birini oluşturmaktadır. Çünkü demiryolu altyapıları; geniş coğrafyalara yayılmış, yüksek sayıda alt sistem barındıran ve hata toleransı son derece düşük olan yapılardır. Bu nedenle Bender, raylı sistem uygulamalarına özel olarak geliştirdiği ürün ve sistem mimarileriyle, yalnızca ölçüm yapan değil; **işletmeye doğrudan katkı sağlayan, karar destek üreten ve bakım süreçlerini yönlendiren çözümler** sunmaktadır.

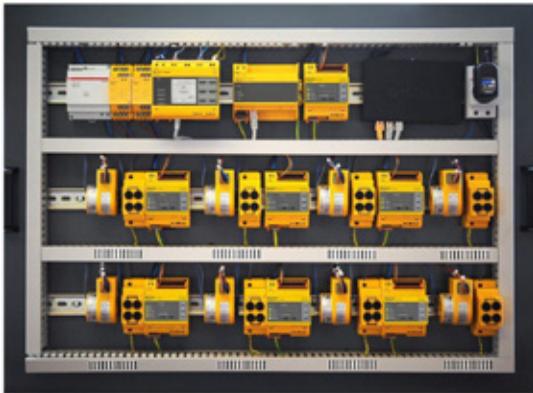
Dünya Geneline Raylı Sistem Uygulamaları

Bender çözümleri bugün;

- yüksek hızlı tren hatları,
- şehir içi metro ve tramvay sistemleri,
- konvansiyonel demiryolu altyapıları,
- sinyalizasyon ve kontrol merkezleri,
- tüneller, köprüler ve açık hat saha ekipmanları,
- istasyonlar, depolar ve bakım tesisleri

gibi çok farklı raylı sistem bileşenlerinde aktif olarak kullanılmaktadır.

Avrupa başta olmak üzere birçok ülkede, ulusal demiryolu işletmecileri ve metro otoriteleri; enerji sürekliliği ve emniyet gereksinimlerini karşılamak amacıyla Bender'in **IT sistem tabanlı izolasyon izleme, toprak arıza konumlandırma ve merkezi izleme** çözümlerini standart altyapı bileşeni olarak tercih etmektedir.



Raylı Sistemlere Özel Mühendislik Yaklaşımı

Bender'in raylı sistem çözümleri, klasik endüstriyel uygulamalardan farklı olarak;

- Uzun kablo mesafeleri,
- Yüksek kaçak kapasitans değerleri,
- Titreşim, sıcaklık ve elektromanyetik girişim (EMC) etkileri,
- Kesintisiz çalışma zorunluluğu

gibi demiryollarına özgü zorluklar dikkate alınarak tasarlanmıştır. Bu kapsamda geliştirilen sistemler; izolasyon direncini yalnızca ölçmekle kalmaz, aynı zamanda **zaman içerisindeki değişimini izler, trend analizi oluşturur ve geçici (short-time) izolasyon hatalarını** dahi kayıt altına alarak bakım ekiplerine anlamlı veri sunar. Böylece arıza, sistem devre dışı kalmadan önce fark edilir ve planlı müdahale imkânı doğar.

Standartlara Uyum ve Uzun Vadeli Güvence

Bender raylı sistem çözümleri;

- EN 50155 (Raylı sistemler – Elektronik ekipman),
- EN 50121 (Elektromanyetik uyumluluk),
- IEC / EN 61557-8 ve 61557-9 (İzolasyon izleme ve arıza konumlandırma)

gibi uluslararası normlara uygun olarak geliştirilmiş ve sahada doğrulanmıştır. Bu sayede Bender sistemleri, hem yeni projelerde hem de mevcut altyapıların modernizasyonunda **uzun vadeli, sürdürülebilir ve regülasyon uyumlu** bir çözüm sunar.

İşletmeye Sağlanan Katma Değer

Bender'in dünya genelinde raylı sistemlerde tercih edilmesinin temel nedenleri şu şekilde özetlenebilir:

İlk izolasyon hatasında işletmenin durmaması

Arızaların erken tespiti ve hızlı konumlandırılması

Öngörücü bakım sayesinde plansız duruşların azaltılması

Saha personelinin güvenliğinin artırılması

Bakım ve işletme maliyetlerinin uzun vadede düşürülmesi

Bu yaklaşım, raylı sistem işletmecileri için yalnızca bir güvenlik yatırımı değil; aynı zamanda operasyonel verimlilik ve hizmet kalitesi yatırımı anlamına gelmektedir.



Katalog İçeriği Hakkında

Bu dokümanda sunulan genel yaklaşım ve marka perspektifinin ardından, ekli kataloglarda **Bender**'in raylı sistemlere yönelik çözüm portföyü **uygulama bazlı ve teknik detaylarıyla** yer almaktadır.

Ekli kataloglar içerisinde;

- Sinyalizasyon güç sistemleri,
- Hat boyu ve saha ekipmanları,
- Makas tahrik ve makas ısıtma sistemleri,
- Tünel ve acil durum enerji altyapıları,
- İstasyon ve depo elektrik tesisleri,
- Taşınabilir ve sabit izolasyon izleme / arıza konumlandırma çözümleri

gibi raylı sistem işletmeleri için kritik öneme sahip uygulamalar, **gerçek saha senaryoları, ölçüm prensipleri ve standart referansları** ile birlikte detaylandırılmıştır.

Kataloglarda yer alan tüm çözümler;

- Kesintisiz işletme hedefi,
- Erken arıza tespiti,
- Bakım süreçlerinin optimize edilmesi,
- Can ve mal güvenliğinin artırılması

odaklarıyla ele alınmış olup, raylı sistem yöneticileri ve teknik personelin **planlama, modernizasyon ve işletme** süreçlerinde doğrudan fayda sağlayacak şekilde yapılandırılmıştır.

Bu kapsamda kataloglar; yalnızca ürün tanıtımı değil, aynı zamanda **teknik bir referans dokümanı ve karar destek kaynağı** olarak değerlendirilmelidir.

Rail Signalling Protection Systems



Design the future
of energy

Approved supplier



Bender is one of the world's leading providers of solutions that make electrical infrastructures smart and safer. Our advanced electrical safety solutions minimise downtime and enhance operational safety and efficiency by ensuring continuous power. By detecting faults early, we can prevent system outages, which helps to reduce boots on ballast and avoid costly delays and penalties. Our products are designed to meet stringent railway standards to maintain power reliability and safeguard passenger safety.

An approved supplier to Network Rail, Bender design and manufacture quality, high performance electrical monitoring solutions for use in the UK's rail infrastructure in areas such as signal systems, trackside power installations and signal boxes.

Rail operators are responsible for ensuring the safety of the UK's rail networks and maximising the availability of thousands of miles of track every day. Smart monitoring solutions developed by Bender deliver continuous monitoring of electrical systems and equipment for earth faults and insulation failure – immediately informing maintenance teams of potential problems which could result in train delays and significant financial penalties for rail operators.

Continuous monitoring of the various power supply systems (an integral part of the track structure which guarantees electrical safety) is a key element in ensuring that operations run smoothly.

Bender worked with Network Rail to develop and approve custom rail signalling protection systems for use in UK rail applications.

Our rail system protection capability includes monitoring of rail switch points heating units and motors, and control voltage network monitoring for railway crossings.

Keeping your network moving!

- Ensure high availability with proactive monitoring
- Accurately locate and pinpoint electrical faults
- Advanced warning of degradation and failure
- Reduce boots on ballast with cloud-based monitoring
- Increase personnel safety with remote maintenance

Rail Signalling Power Protection

Intelligent insulation monitoring and earth fault location technology

Rail operators must ensure the safety and availability of rail networks, safeguard personnel and prevent disruption to passenger services that result in costly fines and penalties.

Electrical signal power systems keep the track infrastructure moving each day. Any insulation faults, failure or damage preventing trains from operating effectively has serious consequences for Network Rail, train operators and passenger journeys. Bender Rail Signalling (RS) integrated insulation monitoring and earth fault location equipment provides protection for railway electrical systems.

Bender RS4 solutions

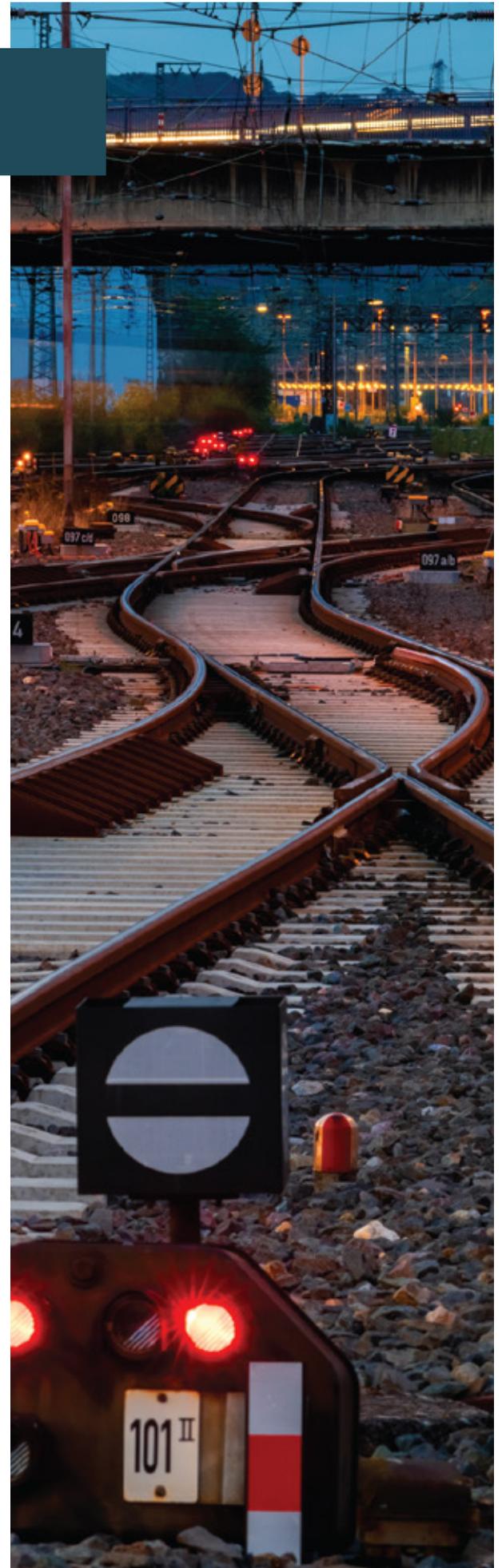
Bender has a proven track record in UK railways with over 1500 rail signalling protections systems installed. The current RS4 solution with enhanced features and capabilities delivers a more accurate and holistic overview of cable health in rail electrical infrastructure.

Employing tried and trusted Bender measuring technology combined with two decades of product innovation, RS4 variants have increased sensitivity and faster first fault location, enabling engineers to identify issues in advance of failure and respond more quickly.

RS4 solutions deliver multi-tier smart cable insulation monitoring and fault location in order to monitor, provide early warning and pinpoint insulation problems – to prevent rail downtime and improve operations.

Upgrading to RS4

Bender RS2 and RS3 systems have served the railway signalling industry well, but the future demands more. RS4 system technology complies with NR/L2/SIGELP/27725, for Insulation Monitoring and Fault Location Systems used on Signal Power Systems. The RS4 is designed to meet modern challenges head-on, offering unparalleled speed, connectivity, and reliability. As RS2 and RS3 components become increasingly obsolete, now is the time to upgrade and secure the future of your operations.



RS4 Tier 1, 2 & 3 Solutions

RS4 Tier 1

RS4 Tier 1 is our most advanced Rail Signalling Protection System. It delivers the highest level of signal power system insulation monitoring of all the RS4 solutions. It provides full insulation resistance measurement of the system, feeder and individual feeders, monitoring individual subsections of cable and functional supply points (FSP).

Incorporating an earth fault locator (EDS440) and Type B current transformers (CTs) inside FSPs, it evaluates and locates fault sources in a very short time period. The installation in FSP renders the Tier 1 variant class 2 compliant, eliminating the need for earth connection, with all trackside equipment able to be fully integrated into existing FSP enclosures.

The compact and cost-effective RS4 Tier 1 solution is available in 650V mains or 110V supply option, retrofittable to Class 2 and Class 1 equipment, reducing ongoing operational costs. It offers remote fault location to FSP or cable length with exact manual fault finding at 100kΩ. The RS4 Tier 1 data and communications options can be customised to suit specific projects and customer requirements.

Benefits

- The most advanced of the RS4 solutions
- For compliance with NR/L2/SIGELP/27725 Tier 1
- Delivers improved Tier 1 remote fault identification and location at 100kΩ
- Enables earth fault identification and location at FSP level
- Compact for use in SIN119 remedial works
- Available as new or retrofit solution for cost-effective equipment upgrades
- Bespoke data and communication options tailored to individual projects
- Eliminates 650V or earth reference requirement making Tier 1 fully class 2
- Prevent rail downtime through predictive maintenance and fault finding

Features

- Identifies decline in insulation resistance (IR) values
- Individual cable sub-section monitoring at FSP level monitoring for Tier 1 compliance
- Incorporates GSM-enabled data logger equipped for real time direct communication with the Intelligent Infrastructure
- Immediately identifies earth leakage faults in the power system arising from damaged cables, faulty connections, breaks in insulation, and rodent damage
- Portable earth fault location system pinpoints location for maintenance teams
- Delivers enhanced reliability and simplified installation and commissioning
- Facilitates planned maintenance interventions
- Dual adjustable insulation alarms – pre-warning and alarm
- Standardised for use across Network Rail installations
- Supplied in self-contained cabinet, tested and ready for 'plug and play' installation and commissioning alongside existing power infrastructure systems up to AC 650V
- Integral automatic and manual test facility
- Lockable front hinged door with viewing window



RS4 Tier 1

RS4 Tier 2

This mid-range RS4 Tier 2 delivers enhanced monitoring and measurement capabilities over the RS4 Tier 3. This compliant solution enables further increased system availability by providing the full insulation resistance (IR) levels of individual feeders.

Tier 2 compliance is achieved by the use of additional system components including Bender Type B current transformers (CT) and Bender COM465IP condition monitor to enable complex individual feeder measurements.

It provides comprehensive data readings and information on cable health to enable operators a clearer overall assessment of the condition of the Signal Power System.

This product delivers the same functionalities as the Tier 1 solution at PSP level, it is fully upgradable to deliver a Tier 1 solution with the addition of an EDS440 fault evaluator and Type B CT at FSP level.

Benefits

- RS4 Tier 2 comprises of RS4 Tier 3 with additional components
- For compliance with NR/L2/SIGELP/27725 Tier 2
- Provides full insulation resistance at individual feeder level
- Contains additional COM465IP condition monitor for system overview
- Incorporates Type B CTs for enhanced measurement
- Cost effective uplift from the RS4 Tier 3
- Easily upgradable from Tier 3 to Tier 2
- Prevent rail downtime through predictive maintenance and fault finding

Features

- Identifies decline in insulation resistance (IR) values
- Incorporates GSM-enabled data logger equipped for real time direct communication with the Intelligent Infrastructure
- Immediately identifies earth leakage faults in the power system arising from damaged cables, faulty connections, breaks in insulation, and rodent damage
- Portable earth fault location system pinpoints location for maintenance teams
- Delivers enhanced reliability and simplified installation and commissioning
- Facilitates planned maintenance interventions
- Dual adjustable insulation alarms – pre-warning and alarm
- Standardised for use across Network Rail installations
- Supplied in self-contained cabinet, tested and ready for 'plug and play' installation and commissioning alongside existing power infrastructure systems up to AC 650V
- Integral automatic and manual test facility
- Lockable front hinged door with viewing window



RS4 Tier 3

RS4 Tier 3 is an integrated insulation monitoring and earth fault location system. Utilising proven Bender technology seen in previous variants (RS3), this Tier 3 compliant RS4 is designed to comply with Network Rail standard NR/L2/SIGELP/27725. This cutting edge technology is available as a new or retrofit solution, to deliver monitoring and protection for railway electrical systems on the UK's rail infrastructure.

RS4 Tier 3 enables monitoring and fault location with improved accuracy and advanced sensitivity capabilities. The increased sensitivity strengthens fault location from the 20kΩ pre-warning level to 100kΩ.

The Tier 3 system provides overall IR measurements, as well as feeder level fault location. Housed within a Class II GRP enclosure, Tier 3 is lighter and more compact in comparison to the previous RS3 version.

Simple to retrofit and update existing RS3 units, RS4 Tier 3 offers a cost-effective upgrade to legacy equipment that is compatible with existing intelligent infrastructure remote condition monitoring through data loggers.

Benefits

- For compliance with NR/L2/SIGELP/27725 Tier 3
- Improved fault location from 20kΩ to 100kΩ
- Cost effective and easy to upgrade to legacy equipment
- Housed in Class II GRP enclosure for lighter and compact design

Features

- Identifies decline in insulation resistance (IR) values
- Incorporates GSM-enabled data logger equipped for real time direct communication with the Intelligent Infrastructure
- Immediately identifies earth leakage faults in the power system arising from damaged cables, faulty connections, breaks in insulation, and rodent damage
- Portable earth fault location system pinpoints location for maintenance teams
- Delivers enhanced reliability and simplified installation and commissioning
- Facilitates planned maintenance interventions
- Dual adjustable insulation alarms – pre-warning and alarm
- Standardised for use across Network Rail installations
- Supplied in self-contained cabinet, tested and ready for 'plug and play' installation and commissioning alongside existing power infrastructure systems up to AC 650V
- Integral automatic and manual test facility
- Lockable front hinged door with viewing window
- Also available as upgrade components



RS4 Tier 3

Portable Fault Location Solutions

Bender portable fault location solutions offer a more flexible and instant method for engineers to locate faults in the field.

Portable Earth Fault Location System EDS3090

The EDS3090 portable earth fault location system can be used to precisely locate feeder earth faults line side, allowing the repair process to be carried out faster, minimising disruption to rail track and reducing system downtime.

The handheld tester is designed to pinpoint a network earth fault to a specific cable or transformer by detecting the test signal from Bender devices and does not require the cable or transformer to be disconnected.

The unit simply clamps to the cable to carry out the evaluation, enabling spot checks to discover whether a fault is present, in addition to pinpointing faults identified in the vicinity.

RS/PELI Portable Insulation Monitor

This portable insulation monitoring unit is designed to be used trackside to measure and analyse specific sections of the power network to prioritise installation programmes.

The unit is self-powered through connection to the trackside signal electrical network and delivers live monitoring of the system status to immediately indicate if there is an earth fault and the status of the insulation.



Portable case RS/PELI

The RS/PELI portable unit can also be used to provide independent verification of the installed RS system performance.



Portable case EDS3090

Features & Benefits (EDS3090)

- Increased sensitivity for faster fault location
- Application main and control circuits
- Current probes Ø 20/52/115 mm
- Residual current measurement in TN/TT systems
- Mobile insulation fault location systems for IT systems AC 42...460Hz 0...790V / DC 0...960V or de-energised systems
- Measuring clamps 20/52 mm (115 mm optional)
- Robust aluminium case, convenient to carry
- Test devices PGH18... with variable test current 1...25mA
- Integrated test voltage for de-energised systems (PGH186)
- Insulation fault evaluator EDS195P
- Response value insulation fault location:
 - 2...10mA for main circuits
 - 0.2...1mA for control circuits
- Response value residual current measurement 10mA...10A

Electrical safety

in railway technology



Design the future
of energy

The railway industry deals with extremely demanding tasks on a daily basis. The inspection of high-speed railway lines, rail construction and power supply systems is just as much a part of this as the transport of hazardous goods. Regardless of the pressure to be punctual, however, passenger safety remains the overriding priority.

Guaranteeing electrical safety is an essential component of smooth operation. This applies equally to signal boxes, signalling systems, operational buildings, tunnels and bridges as well as to the rolling stock.

Bender system solutions monitor electrical installations and railway installations and help to prevent critical operating conditions.



Safe railway technology: high availability and cost effectiveness

Standard-compliant solutions by Bender

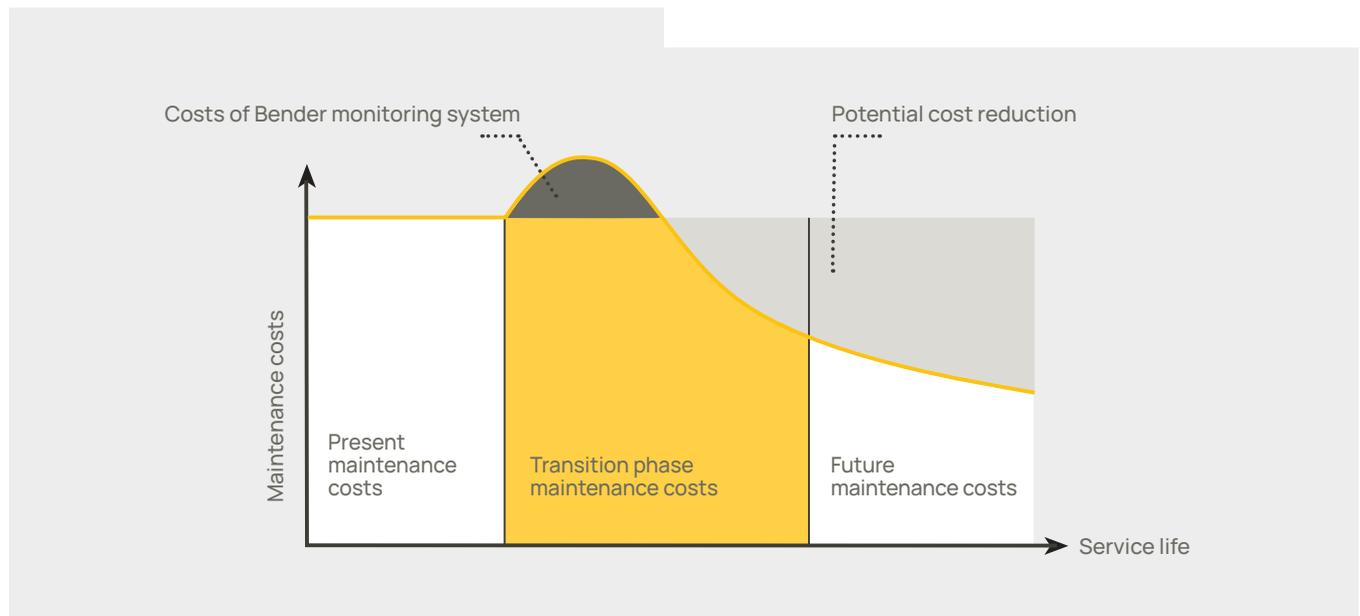
Safe operation and reduced costs

Bender monitoring systems ensure fault-free power supply, help you to quickly locate insulation faults and enable you to prevent downtimes of important parts of the installation.

What is the cost of unscheduled maintenance, unavailability of route sections, insulation fault searches that last for hours or even days? Investing in modern monitoring technology from Bender quickly pays for itself.

Standard-compliant solutions

When it comes to satisfying the stringent safety standards in electrical railway systems, monitoring systems that comply with the applicable standards are indispensable. The most important standards for railway operation are EN 45545 (Fire protection on railway vehicles), DIN EN 50155 (Railway applications – Rolling stock – Electronic equipment) and DIN EN 50121 (Electromagnetic compatibility). Bender solutions are specialised in meeting the challenges of this industry and provide you with the necessary information advantage. This enables you to intervene before critical conditions arise.



Why the IT system is the better choice

The aim: reliable power supply – high availability

Technical installations increasingly depend on their electrical power supply. At the same time, the follow-up costs of unexpected downtimes increase. How well a reliable power supply and high availability of an installation can be implemented later on is already decided when a power supply system is chosen.

TN system, TT system or IT system?

In principle, planners can choose between different system types whose design differs with regard to earthing relations of power supply source and equipment, as well as in the type of neutral conductor and protective conductor. When considered with high availability in mind the IT system may be the best choice.

Operators can evaluate installation data according to their own requirements and use the data for improvements of the installation as well as to correlate the measurement data to other events in the installation. This is a valuable tool to also find the causes of short-time insulation faults.

For often maintenance teams do not stand a chance of reacting to fault messages, of locating and eliminating them within a few hours. Stationary equipment for insulation fault location offers a crucial advantage for such cases.



The five most important advantages of an IT system:

Advantage 1: Continued operation after the first insulation fault

One of the crucial advantages of the unearthed system (IT system) is that the installation can still be operated after the appearance of a low-impedance insulation fault.

Advantage 2: Fire protection

Insulation faults are the most common cause of fire. IT systems reduce the fire hazard due to insulation faults to a minimum.

Advantage 3: Locating the fault during ongoing operation

Suitable devices permit fast insulation fault location without the need to interrupt operation.

Advantage 4: Reduced testing effort

Insulation monitoring devices reduce cost and time expenditure since the R_{iso} measurement for periodic verification is not required. Therefore, operational interruptions are not necessary.

Advantage 5: Increased personal safety

Operators of an installation that use IT systems, offer their employees, visitors, and customers the highest possible level of protection.

Due to the various economic and technical advantages, an unearthed system with high-performance insulation monitoring is almost always profitable in comparatively complex installations.

Signal box, control and safety technology

Monitoring safe railway operation

The smooth operation of the whole railway network is the predominant focus of the signal box and the control and safety technology. A voltage swell in the event of a fault is a particular hazard.

In addition to gauging insulation, the insulation monitoring devices by Bender comply with IEC 61557-8 and measure the line-to-line voltages and the line to earth voltage. This allows early detection of these hazards.

Fault search? Made easy!

To prevent interruptions to operation even in the event of a fault, Bender insulation fault location systems enable a fault search – also in switched off installations (or areas thereof).

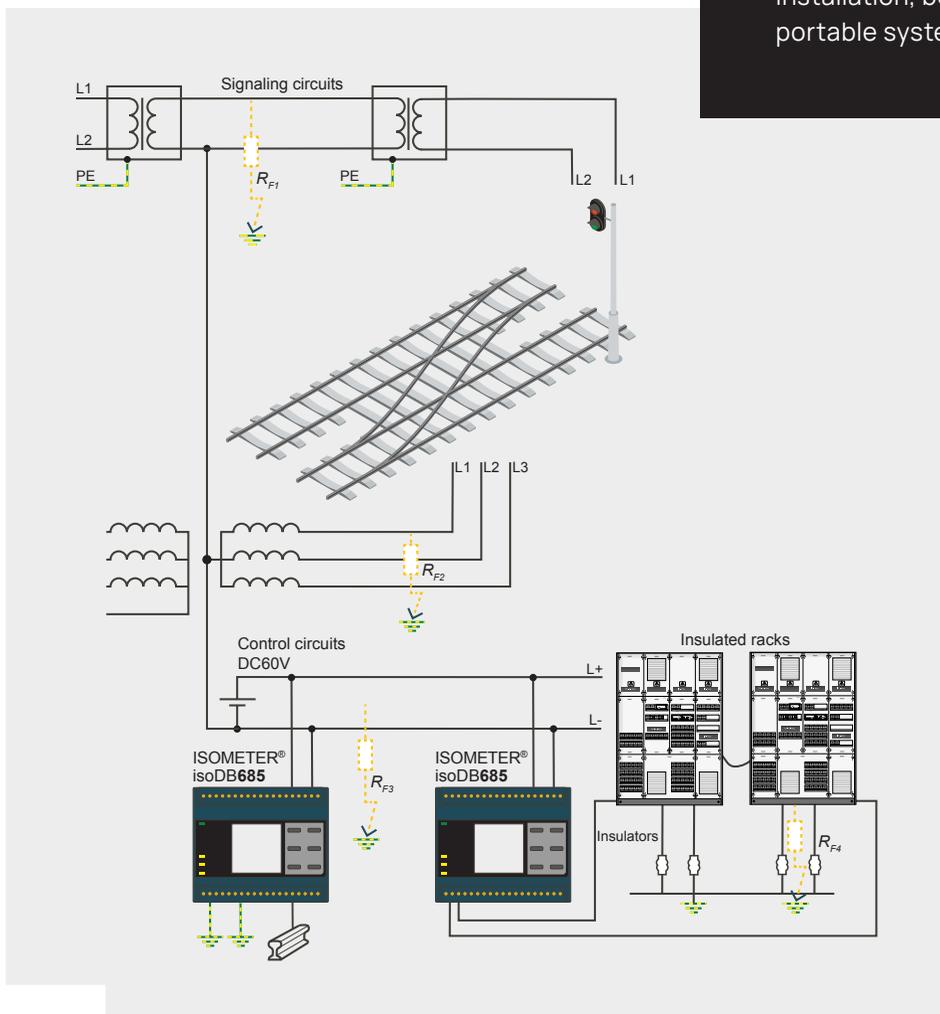
Even large installations can be monitored reliably by Bender insulation monitoring devices. With the size of the installation, the leakage capacitance value increases, however, Bender insulation monitoring devices determine the leakage capacitance value and adjust to it.

Insulation monitoring during an earth-to-rack short circuit

Bender insulation monitoring devices also enable the monitoring of ohmic-coupled systems.

Example Germany, requirement of Deutsche Bahn AG: eliminate insulation fault below 30 kΩ within ten working days

In practice, traditional technology often only detects faults from 0 kΩ to approx. 7 kΩ. Bender offers solutions that can detect faults in a range from 0 kΩ (dead short to rack or earth) to 100 kΩ. These solutions can be implemented without shutting down the installation, both as stationary and/or as portable systems.



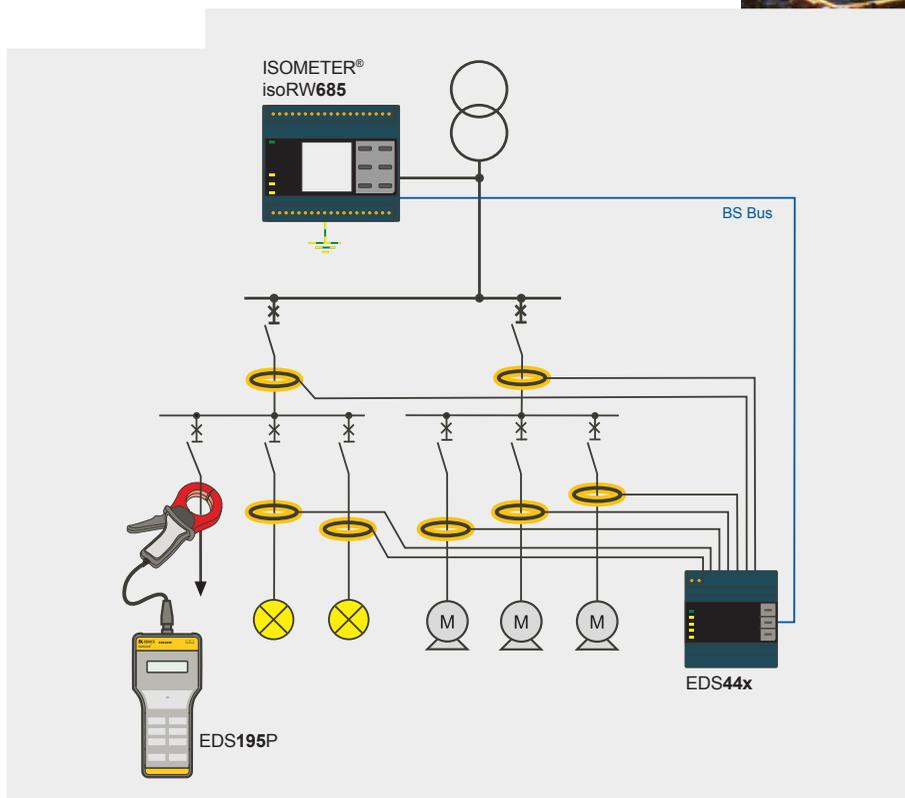
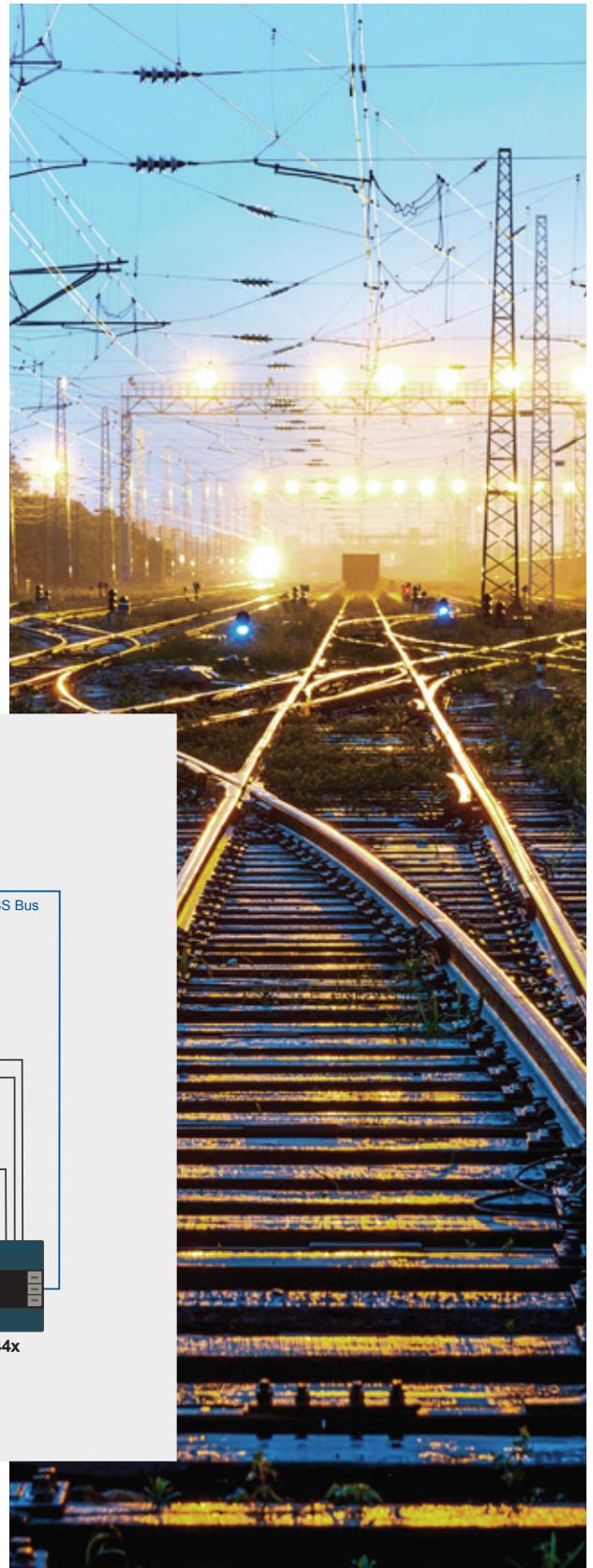
Track field illumination and safety lighting

Shunting - better with lighting!

The power supply system for track field illumination is often designed as IT system. Bender offers insulation monitoring devices that comply with IEC 61557-8. These also adjust to larger systems with several lighting poles, parameterisation of the system size is not required.

Apart from the insulation, Bender insulation monitoring devices measure line-to-line and line and earth voltages. This permits the early detection of voltage swells in the event of a fault.

Also in systems consisting of several lighting poles, an insulation fault can be found quickly. When insulation fault location systems are used, insulation faults can be allocated even to the individual illumination elements.



Locomotives and motor coaches

Safe power supply for drives and auxiliary units

In locomotives and trains hauled by motor coaches different IT systems are employed in parallel. Bender provides solutions for the most different voltage levels. Insulation monitoring devices measure the insulation resistance, the voltage and the system leakage capacitance to earth/chassis.

There are also solutions for the electrical safety of TN systems with different voltage levels: Residual current monitoring continuously monitors different system components and identifies faults. Bender voltage and current relays reliably monitor the different voltage levels and phase sequences even at 16.7 Hz.

Remember: Measuring current at the central earthing point

Bender provides equipment for measuring current at the central earthing point.

Minimising delays – adhering to scheduled timeframes and deadlines for maintenance

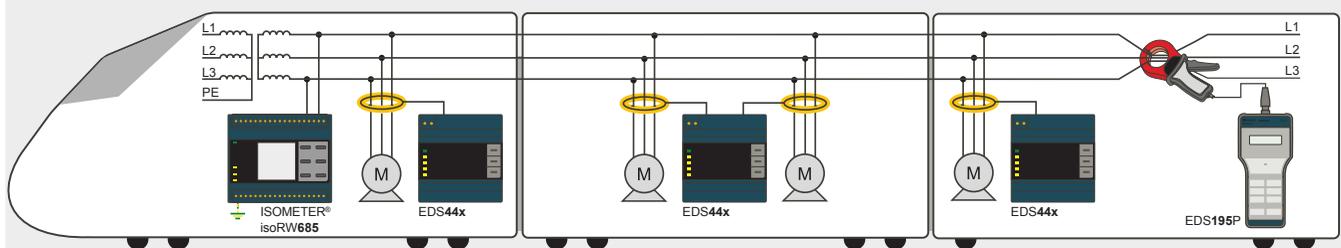
When they are installed as stationary systems, Bender insulation fault location systems permit the fastest fault detection – ready for locating at any time. Alternatively, mobile equipment can also be used in the fault search.

Facilitating standardised work

Bender portable insulation fault location systems enable standardised work processes. Quality levels and timing goals for maintenance can hence be achieved even when employing subcontractors (e.g. an ECM).

EN 50155 – higher vibration level and increased environmental influences

The Bender devices of the RW version have been tested according to EN 50155.



Portable insulation fault location systems use current clamps, which must be positioned around the cables. Ideally, cable input and cover design have already been considered during the engineering planning phase.

Mast switch actuators

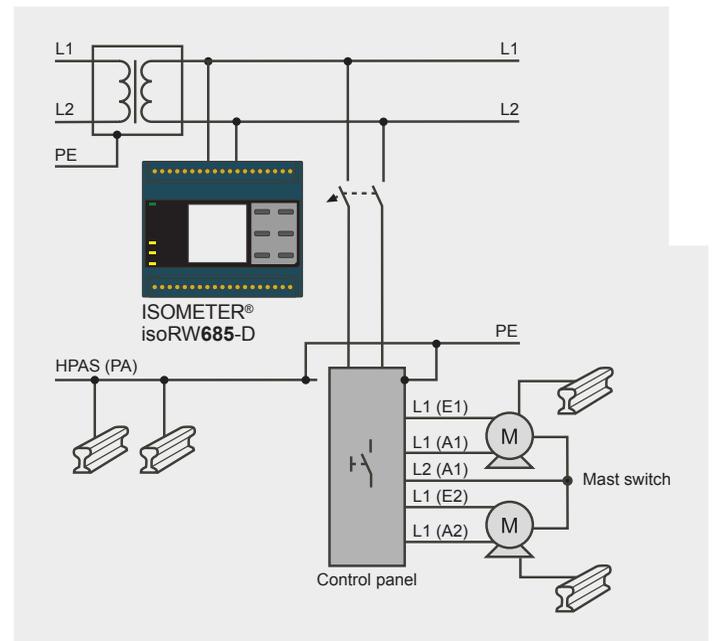
Monitoring safe railway operation

Mast switch actuators are switching devices that, during regular operation, during construction work, after lightning strikes or after accidents must switch the overhead lines reliably. Their functionality can be ensured by insulation monitoring devices that monitor the power supply system continuously. They automatically adapt to the size of an installation and report critical conditions to the supervising system.

The tendency of insulation values to decrease slowly over time can be made visible via Bender technology. When communication interfaces are used, predictive maintenance and analysis are possible.

Finding insulation faults easily and without disconnecting

Insulation faults can be found quickly in systems consisting of several poles and mast switches when insulation fault location systems are used. For the faults can then be attributed to the individual mast switches.



Points drive and points heating systems

Heating the points safely in the winter

Frozen points present a safety problem and are the main cause of delays in winter. Continuous offline monitoring of the power supply system guarantees that the points heaters will function when needed, as offline insulation monitoring devices report critical conditions to the supervising system even in switched off condition.

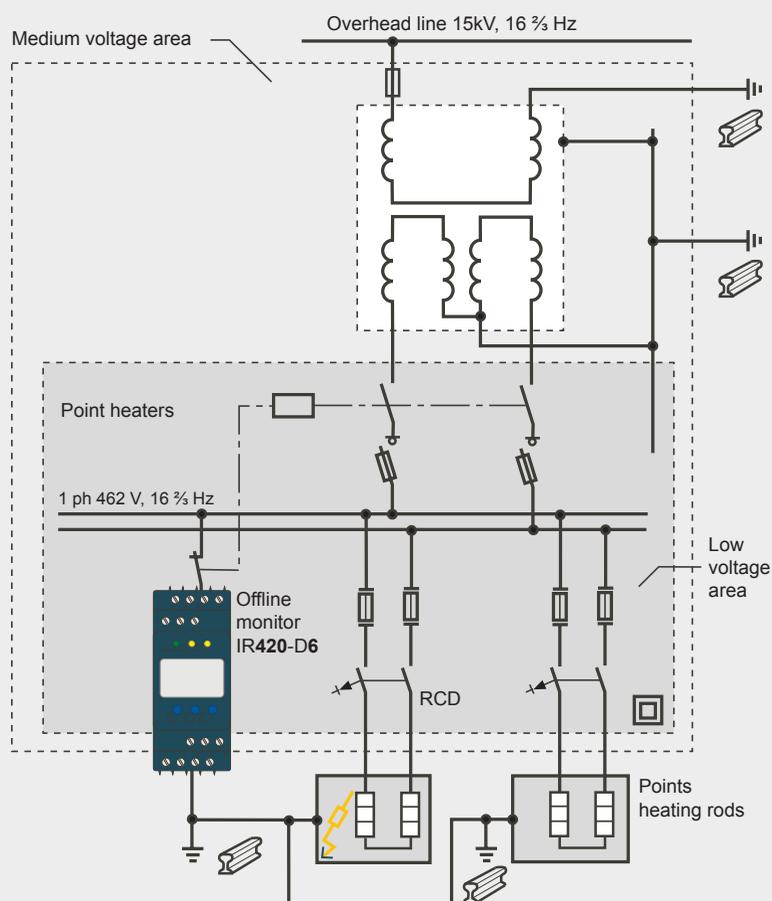
Setting the right course for electrical safety

Points drives are only used when points are switched. To assure that they function reliably when needed, monitoring the power supply system continuously with insulation monitoring devices is recommended. These devices report critical conditions to the supervising system.

When modern communication interfaces are employed, measured data can be analysed and correlated to other events in the installation. This is a valuable tool that helps to find also the causes of temporary insulation faults.

The risk of downtimes

During downtimes, undetected insulation faults may occur due to moisture or other factors impacting on the supply line or the load. When the installation is then reconnected, the protective device trips or motor fires occur, and operation is not possible. Such a situation can be prevented by continuous insulation monitoring that reports insulations faults at an early stage.



Bender technology visualises the behaviour of insulation values over time which makes predictive maintenance and analysis possible.

Railway crossings and safety installations

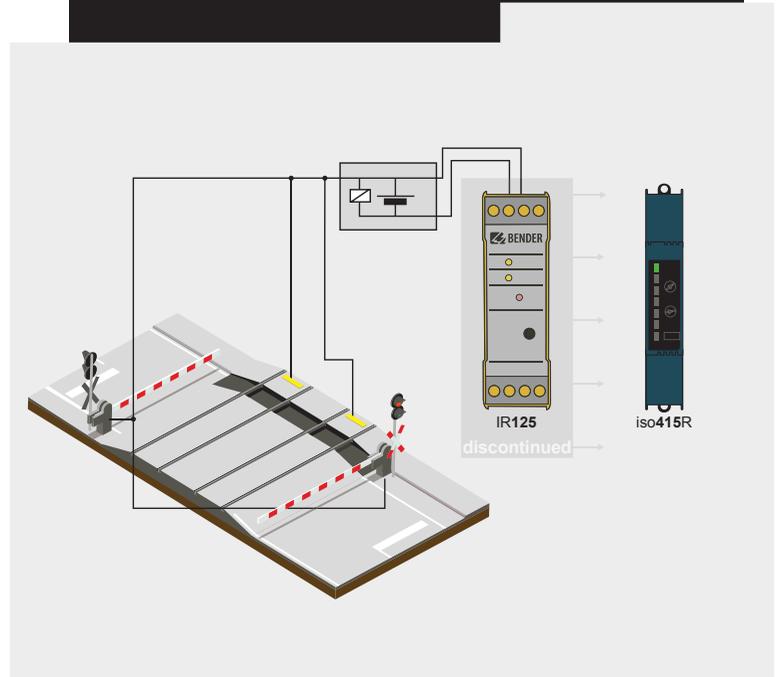
Problem case: temporary insulation faults

Short-time insulation faults are difficult to interpret. Frequently they are no longer present when the service staff arrives on site. In this case, the analysis of measured data and correlation to further events in the signal box help establish the cause.

Electrical safety has the right of way

Reliably functioning railway crossings and safety installations are of vital importance for all transport users. When driving over sensors the train triggers the opening and closing of gates. A failure of these safety installations would bring the train to stop or block cross traffic.

When insulation faults cause control malfunctions, danger arises. These faults can be prevented with Bender technology as it enables continuous monitoring of insulation values over time. Slowly deteriorating values are visualised centrally via the communication interfaces, predictive maintenance and analysis become possible.

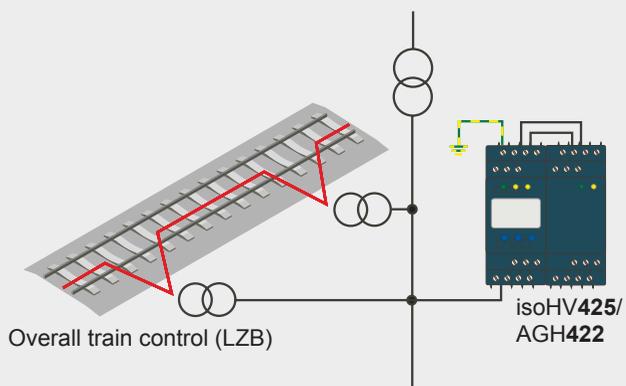


Train safety systems

Safe control of trains in international railway operation

Safe railway traffic must be ensured across the entire railway network. To find insulation faults quickly also in the case of extensive installations and very long railway lines, insulation fault monitoring and locating systems are implemented. These systems can attribute insulation faults down to individual route sections.

The following illustration shows how insulation monitoring is used for an automatic train control system.



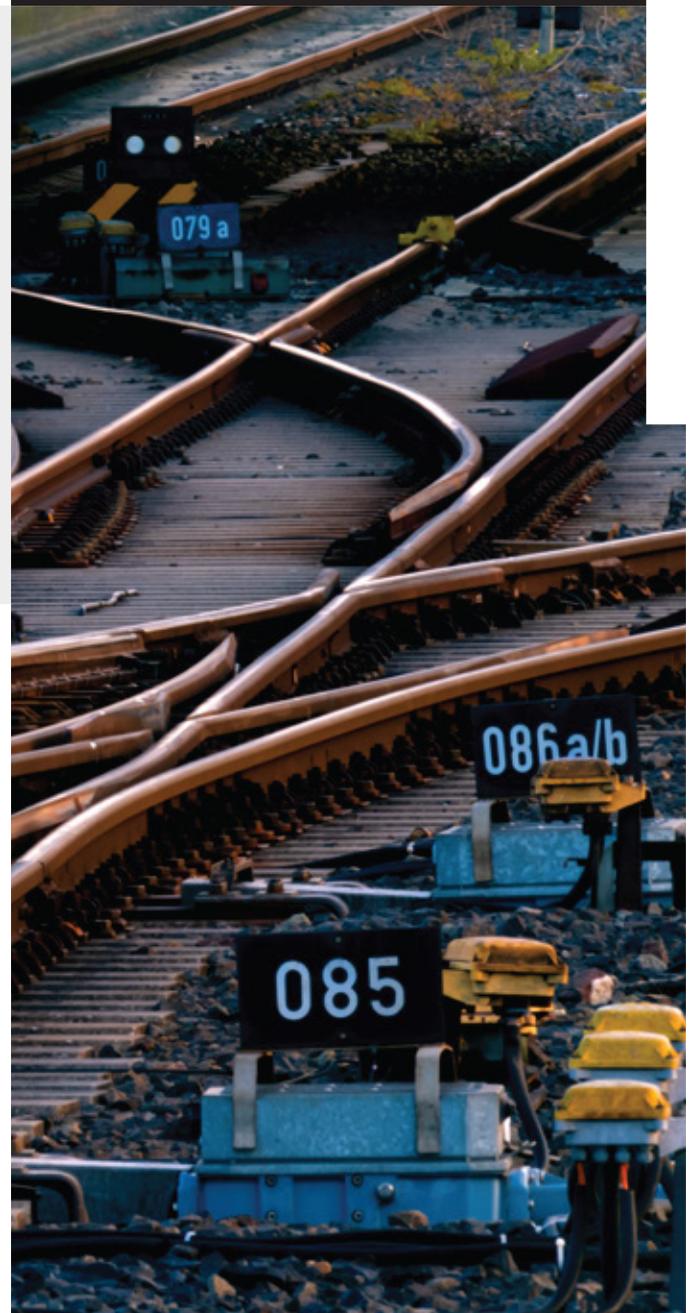
Train control at defined spots

A symmetrical fault to earth can disable the functionality of de-energised train controls at defined spots. The appropriate monitoring option here is continuous insulation monitoring of the de-energised track magnets.



Insulation monitoring: isoHV425+AGH422

- in accordance with IEC 61557-8
- with coupling device
- up to AC 1000 V
- Modbus RTU



Electrical safety in tunnels

Safe power supply even in case of a disaster

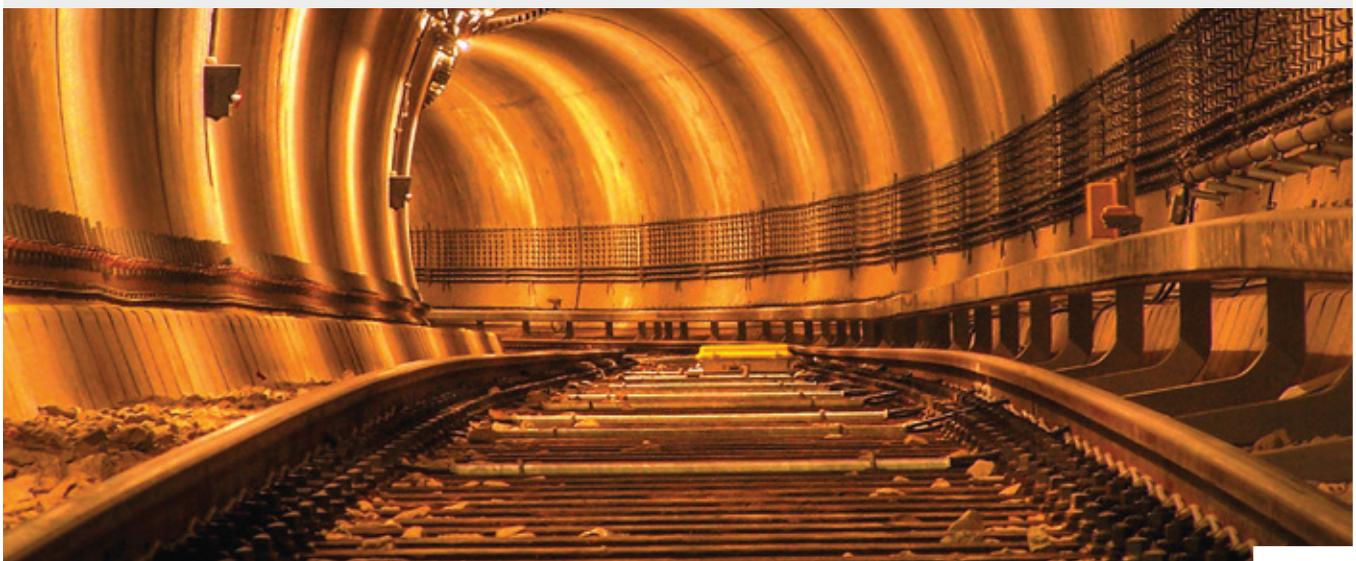
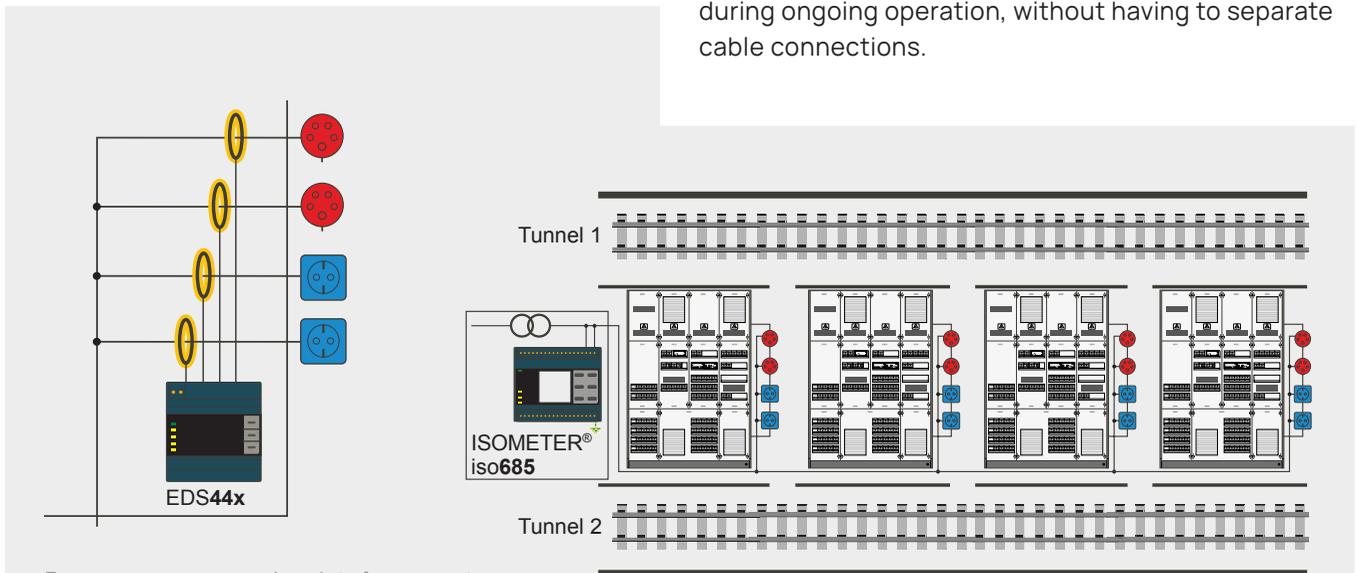
Train routes in mountainous landscapes lead across a sequence of tunnels and bridges. The route operator must be prepared for a train accident in a tunnel. Along the route rescue organisations are equipped for assistance in case of a disaster. To support the rescue plan, hydrants and emergency power supply points are installed in the tunnels. Rescue teams thus have quick access to water and electrical energy in sufficient quantities. According to guideline 954.0107, in Germany the power supply has to be designed as an IT system.

Securing a functioning power supply for rescue teams even in case of a disaster

So that the emergency responders can rely on a functioning power supply in the event of a disaster, continuous insulation monitoring is required. With such monitoring, critical conditions of an installation are reported to the supervising system in time.

Fast localisation of insulation faults

Even in the case of extensive electrical installations, Bender insulation fault locating systems can attribute electrical faults to individual tunnel sections. A further advantage: They can be used to find insulation faults during ongoing operation, without having to separate cable connections.



Portable generators

Electrical safety when using portable generators

Portable generators are implemented in maintenance measures and in the case of a disaster. They need to function quickly and reliably. The amendment of DIN VDE 0100-551 clearly specifies that periodic verification is no longer required when insulation monitoring according to DIN EN 61557-8 has been installed.

Furthermore, setting an earth spike is no longer required if the protection plan consists of protective separation with insulation monitoring. Bender offers solutions for insulation monitoring of the installation to secure electrical safety of portable generators and connected equipment.



Building technology: Railway stations and depots

Safer building technology for satisfied customers

Modern railway stations are service centres that depend on a safe power supply. The service centre should also be able to function if an electrical fault occurs in a small part of the installation. RCMS (residual current measuring systems) detect faults long before a normal residual-current circuit breaker would shut down. Therefore, availability of the system as a whole is increased.

Technology that quickly pays for itself: The RCMS improves and simplifies maintenance and fault location.

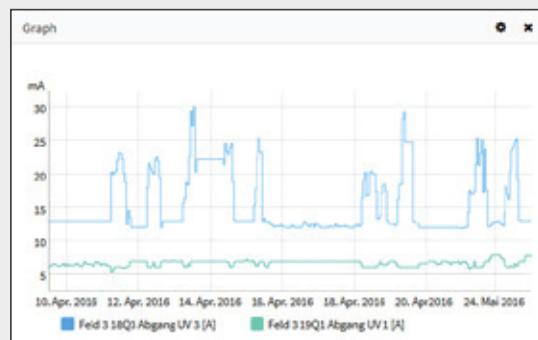
So that even the slowly deteriorating insulation values are detected, Bender technology uses modern communication interfaces for visualisation and thus enables predictive maintenance and analysis.

Transparency for electrical installations

Power quality problems generate costs. Electrical overloads on equipment, overheating and disruptions do not have to be a given. These occurrences can be prevented by targeted energy management with the PQ devices from Bender.

Energy management

The Bender measuring devices of the PEM series also capture energy and performance data. Therefore, setting up measuring points for the purpose of invoicing becomes uncomplicated. Bender energy meters with MID compliance labelling are suitable for this, as they meet the corresponding calibration requirements.



Monitoring and analysis made easy with the browser-based POWERSCOUT® software

Universal measuring device: PEM353



POWERSCOUT®

Find out today what won't happen tomorrow

Moisture, aging, dirt, mechanical damage or faults due to the impact of current, voltage and temperature cause malfunctions in every electrical installation. The web-based software solution POWERSCOUT® helps you detect malfunctions at an early stage and eliminate the causes in an economically reasonable way. This guarantees high safety and operational reliability of the installation and reduces costs.

Analysis – as individual as your installation – as simple as possible

Predictive maintenance prevents downtimes, reduces costs and staff requirement. POWERSCOUT® informs you about the condition of your electrical installation at all times, since the informative visualisations with flexible dashboards can be retrieved via any display device, be it a smartphone, a tablet or a PC. On request, POWERSCOUT® sends you reports with the data shown as graphs at specified intervals.

Continuous monitoring instead of random tests

Manual data acquisition is time consuming, error prone and only provides random results. With POWERSCOUT® you have the complete data of your installation at your disposal at any time, since all measured values are saved automatically and continuously. Your data is stored reliably and remains available for years.

Basis for periodic verification

The automated POWERSCOUT® report on residual currents forms the basis for measuring without switch-off in accordance with the periodic verification as per IEC 60364-6. Since this verification must be carried out to maintain the correct status of electrical installations and stationary electrical equipment, for example by continuous monitoring of the installation by electrically skilled persons.

In this case, it is a smart move to rely on continuous monitoring with multi-channel residual current monitoring systems (RCMS) and an evaluation adapted to the system (e. g. using the CP907-I). The automatic POWERSCOUT® reports based on this monitoring enable the electrically qualified person in charge to adjust the times when the insulation test shall be performed as part of the periodic verification.



Typical application: CP907-I

Analyses

- Recording insulation values continuously
- Recognising connections and optimising maintenance
- Cross-installation evaluation options
- Access from any place
- Supporting investment decisions

Preventive maintenance

- Higher availability
- Continuous monitoring
- Early detection of gradually developing insulation faults
- Early detection and reporting of temporary insulation degradation
- Lower costs due to unexpected malfunctions and shutdowns incurred

Reports

- Historical comparisons
- Safe storage of measured values
- Event and alarm statistics

System control centre

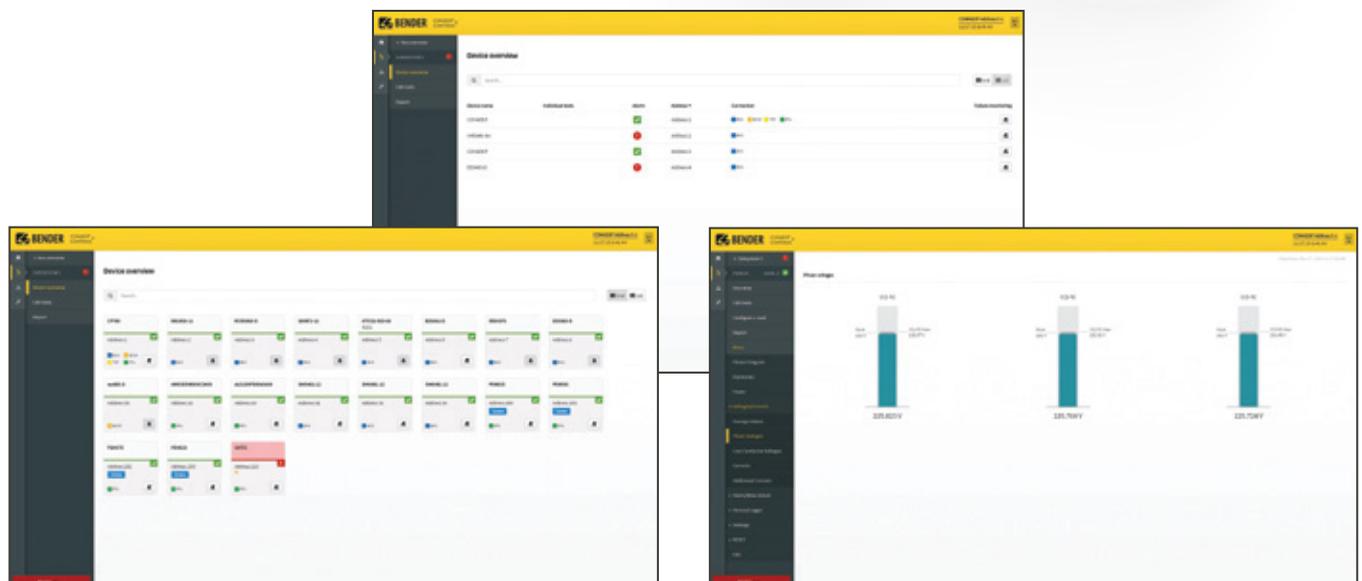
Interconnection and visualisation made easy

The COMTRAXX® monitoring systems are used in a wide range of applications. However, what they have in common is that the user needs to obtain relevant information quickly and easily. In the event of an alarm, the system informs actively via e-mail, switch contacts or by forwarding information to supervising control systems. To carry out an analysis or create a report, the user can fall back on data that was captured previously. The Bender system control centre permits both alarms and the retrieving of history information – in one system. Data is collected from all connected measuring devices, evaluated and processed differently depending on the respective application. For this, the browser-based system offers many advantages:

- all users work live in one system (there are no locally stored system copies that have to be maintained manually)
- additional users can access the system with every device that runs on a browser (no user licences or additional hardware required)
- exandable, hence systems are adaptable in size and fit for the future (no additional hardware required when the installation is expanded)

- Software is updated only centrally (no local maintenance of user access and evaluation software)
- Support in real time by Bender Remote Assist

Starting with the overview over the entire installation with the integrated visualisation tool to the detailed power quality evaluations: The Bender system control centre supports users since operation is intuitive and it provides guided support during fault analysis.



Device data displayed on the web user interface (COM465IP)

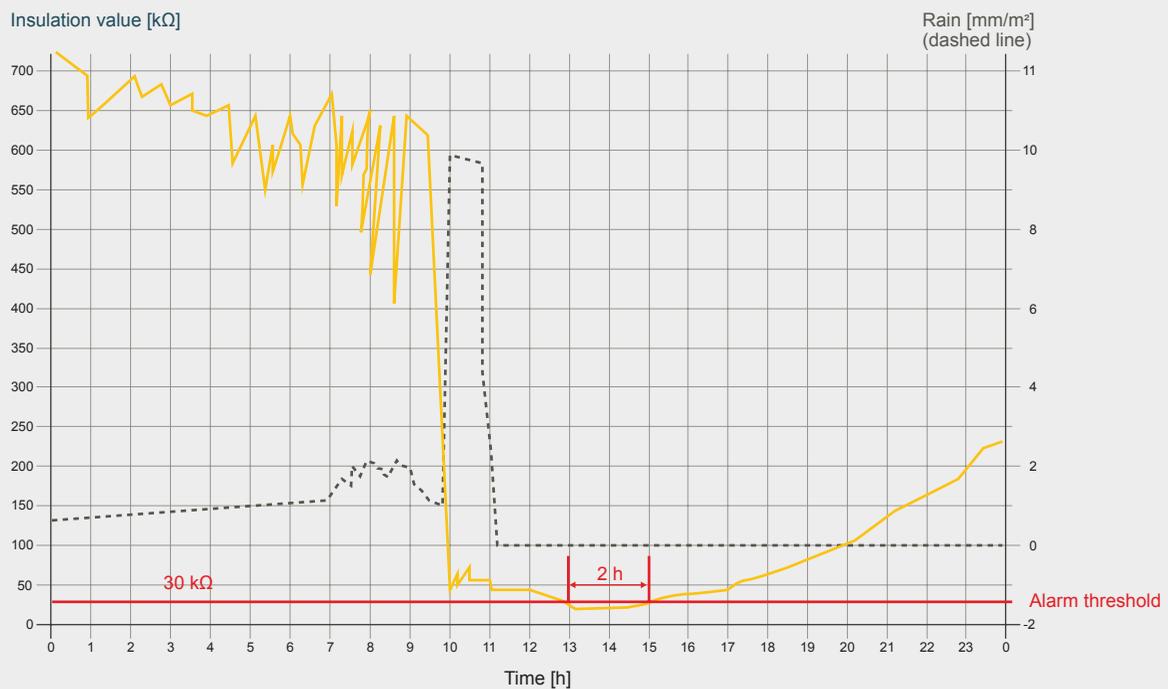
Insulation fault location

Interpreting short-time insulation fault messages correctly

Temporary insulation faults are difficult to interpret. If, for example, the insulation value falls below the alarm notification threshold value for only two hours and then rises again to a normal level, the on-site service technicians often do not stand a chance of finding the cause of the fault. Maintenance must then be ended without fault elimination, and the faulty insulation remains a hazard for the system.

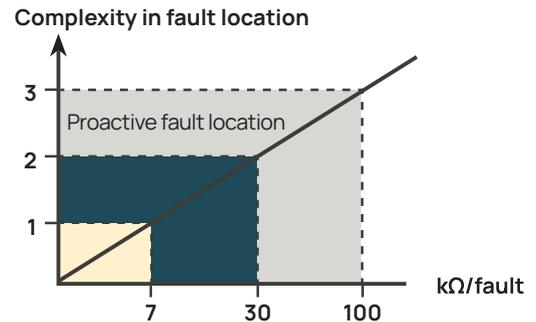
The solution:

Modern communication interfaces and the browser-based POWERSCOUT® software bring together all measured data and permit correlating it to further events in the system. For example: comparison of insulation values to weather data. In many cases, rain showers significantly reduce the insulation value of damaged cable installations. Stationary insulation fault location systems can identify the affected route section or damaged component already when the rain starts to impact the installation.



Proactive fault location

In practice, traditional technology often only detects faults from 0 kΩ to approx. 7 kΩ. Bender offers solutions that can find faults up to 100 kΩ. These insulation fault location systems can be employed as stationary and/or portable systems and supply the data about the installation condition that is important for proactive fault location.



Insulation fault location in switched-off areas of the installation

Insulation fault searches can be conducted also in switched-off sections of the installation. De-energised but galvanically connected cables, as well as single-conductor cables with low currents can be directly enclosed by current clamps or transformers. Bender insulation fault locators generate the measurement signals themselves.

Fault location in cable installations made easy

In order to rapidly find insulation faults also in the case of extensive electrical installations, the implementation of stationary insulation fault location systems is preferred. These systems can attribute insulation faults down to individual route sections. A further advantage is: Bender fault location systems find insulation faults during ongoing operation, without the need to disconnect cables.

Insulation fault location during ongoing operation

Just as the stationary equipment, also the portable insulation fault location system EDS309x permits detection of insulation faults without cable disconnection.



Good to know: Stationary solutions for insulation fault location can also be retrofitted. Mobile and stationary solutions by Bender comply with IEC 61557-9.



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