BAUR
ensuring the flow

Cable test vans and systems

Prepared for anything



Our responsibility: a stable power network

Maximum security of supply – the primary objective in the field of power supply. In order to guarantee this, extensive expertise is required, as the network infrastructure is complex and demanding. The energy transition also presents us with considerable challenges in ensuring a distributed power supply.

As part of ongoing network expansion, new installations – but also existing cable systems in particular – must be tested and evaluated efficiently, and any problems in the network must be identified and rectified as quickly as possible. Working in partnership with BAUR, you can benefit from our experience, expertise, and innovations. Together, we can ensure that power keeps flowing efficiently and cost-effectively.





BAUR – supporting operators

Ever greater demands are being placed on measurement engineers for them to be equipped, trained, and prepared to handle every type of call-out case. Our approach is to support operators as best as possible in their day-to-day work: with optimally adapted systems that are easy to operate, and through individual processes and measurement methods that can be optimally integrated. For user-friendly and precise cable fault location as well as cable testing and diagnostics. For productive and effective ways of working.

BAUR cable fault location and diagnostics systems

A system with additional value

The complexity of cable networks means that individual measurement engineers are required to perform a wide range of tasks. Even at the resource planning stage, it is often still unclear which equipment will actually be required on site. This is where the systems from BAUR come in. By adapting the equipment to customer-specific requirements and controlling the devices via the intelligent BAUR Software 4, measurement engineers are optimally prepared for whatever activities need to be performed on site.

Every measurement engineer can rest assured that all the requirements in their system are reliably met. The system carries out the work in an efficient manner – without restricting the operator's freedom to make decisions. Flexibility is our highest priority; this means each step suggested by the system can be selected freely. **The cable test van is becoming indispensable for every measurement engineer, as it ensures they are optimally equipped to handle any call-out.**

BAUR offers four types of system solutions for single- and three-phase cables: the titron® and transcable cable test vans, the Syscompact series, and systems for cable fault location that are specifically intended for very long cables.





↑ The titron® system

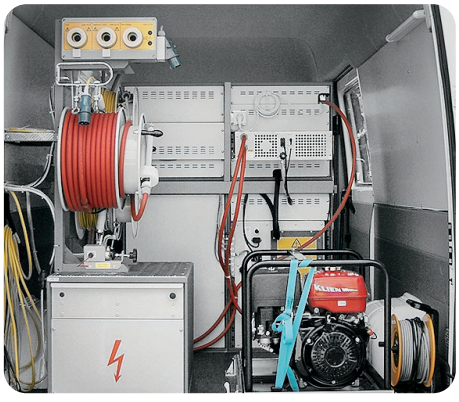


↑ The titron® system





The transcable system



The transcable system



Syscompact 4000


BAUR
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BAUR
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FK BAUR 3

Process steps and methods

FAULT ANALYSIS

Fault analysis makes it possible to determine the characteristics of the fault. The result determines the next steps.

Insulation resistance measurement
to determine the faulty phase and the type of fault.

Cable sheath testing
to detect damage to the outer cable insulation (cable sheath faults).

Voltage test and breakdown detection
to test the dielectric strength of the cable insulation.

PRE-LOCATION

The objective of pre-location is to determine the fault position as precisely as possible, in order to minimise the time and effort needed to pin-point the fault.

TDR
Time domain reflectometry for locating low-resistive faults and cable breaks, and for determining the cable length

SIM/MIM
The secondary/multiple impulse method is the most well-established and precise cable fault pre-location method. High-resistive faults and breakdown faults are ignited by a single HV pulse and the fault distance is measured very precisely several times via the TDR technology and automatically evaluated.

DC-SIM/MIM
Secondary/multiple impulse method in DC mode for pin-pointing intermittent faults. DC voltage is applied to the cable until breakdown. The cable capacitance is used to increase the available surge energy.

Conditioning-SIM/MIM
Difficult to locate or wet faults are first conditioned with surge voltage before a SIM/MIM measurement is carried out.

Decay
Voltage-coupled decay method for locating breakdown faults with high voltage. The oscillating voltage reflection waves are evaluated automatically to determine the fault distance.

ICM
Impulse current method for locating high-resistive faults and breakdown faults. The fault distance is determined by analysing the impulse current diagram. Particularly suitable for use on long cables.

DC-ICM
Impulse current method used in DC mode for locating chargeable breakdown faults for which the cable capacitance is used in conjunction with a surge voltage generator.

Measurement mode with envelope curve display
In this process, even small, intermittent changes to impedance can be made visible by means of an envelope curve and saved automatically.

TRACING AND PIN-POINTING

As precise as pre-location is, it is never able to detect or recognise the existing deviations of a cable route in the ground. These can only be detected by precise pin-pointing.

Acoustic pin-pointing

The most common method used to determine the precise location of high-resistive faults and breakdown faults. High-voltage pulses create electromagnetic pulses on the way to the fault location and generate a breakdown with an audible bang.

Step voltage method

Precise location of cable sheath faults. A voltage drop is generated at the fault which can be located using earth spikes and a receiver.

Tracing

Precise determination of the cable route. Precise cable tracing is essential, particularly with unknown or imprecise cable routes, and saves both time and money.

Twist method or minimum distortion method

Used for pin-pointing short-circuits, depending on the cable type. In this process, the disturbance in the otherwise homogeneous magnetic field that is caused by the fault is measured and located precisely.

CABLE IDENTIFICATION

Usually, multiple cables are laid in a cable route. Once the exact fault position has been determined and exposed, the defective cable must be identified reliably.

Cable identification

Identification of single- and multi-core cables in a cable loom. The measurement engineer is provided with precise information as to which cable needs to be tested and, where necessary, cut.



Testing and diagnostics are used for the comprehensive condition evaluation of cable routes in order to identify weak points in the cable, before they result in failure – for maximum network availability while keeping maintenance and repairs costs to a minimum.

Cable testing

Based on international research as well as decades of practical experience, **VLF cable testing and diagnostics** on medium-voltage systems is now a recognised method among leading bodies and associations. What this means for you is that cable and sheath testing as well as diagnostic measurements with VLF voltage are performed in compliance with standards. You don't have to concern yourself with **standard-compliant work procedures** as we've already taken care of that for you.

Partial discharge diagnostics

Partial discharges occur at fault locations in the cable, e.g. at electrical trees, joints, and terminations. Partial discharge diagnostics is used to determine possible fault locations in cables and accessories before they lead to failure. This makes it possible to rectify the problem in a timely manner and prevent any uncontrolled failures. Partial discharge testing with BAUR devices is performed in accordance with standard IEC 60270.

Dissipation factor measurement (tan δ measurement)

The dissipation factor measurement (tan δ measurement) is a non-destructive and integral procedure that serves to evaluate the condition of an entire cable route. With the dielectric dissipation factor tan δ, the relation of effective power to reactive power of the cable is measured. The measurement provides clear information on the condition of the cable insulation and its ageing condition. Possible replacement activities can be controlled in a targeted manner within the framework of professional asset management.

Full Monitored Withstand Test

Whether dissipation factor or partial discharge measurement - both diagnostics methods have their advantages. However, individually, neither of them can detect all weak points. For this reason, it is worthwhile combining both procedures - whether carried out subsequently or together in one procedure. This gives you valuable, additional information, ensuring greater accuracy during condition evaluation and troubleshooting. The time-saving combination of testing and diagnostics is known as the Monitored Withstand Test (MWT). The MWT also allows the required test duration to be adapted to the cable condition.

truesinus®

truesinus® voltage sources as proven technology for cable testing and diagnostics

The advantages:

- Load-independent measurement results
- Highly accurate tan delta
- Reproducible, precise measurements
- Possible to carry out testing and diagnostic measurements in parallel (Monitored Withstand Test)
- Short measuring time
- Compact voltage sources

Corresponding BAUR systems for every measurement method
from page 12 onwards

Cable test vans and systems











titron®
Mobile workspace creating knowledge on the go



The titron® automatic cable fault location system is characterised by efficient technology and intuitive operation. The new generation high-performance system is based on state-of-the-art technology and provides efficient and reliable cable fault location, cable testing, and cable diagnostics through software support. It provides network operators with extensive knowledge about cable condition and gives them an edge in troubleshooting and fault prevention. Failures and unscheduled repairs can be avoided. This affords certainty in maintenance planning and creates the ideal basis for decisions on replacement investments.



All measurement methods in a single system
Comprehensive cable fault location, testing and diagnostics for extensive knowledge about the cable condition.

Diagnostics philosophy with TD/PD Parallel
Reduction of working time by parallel TD and PD measurement – for significantly more information.

Smart Cable Fault Location Guide
The intelligent cable fault location assistant leads the operator to the fault quickly and reliably by means of fully automated processes.

Extremely convenient mobile workplace
Both functional and comfortable thanks to optimised ergonomics and increased storage space.

Central data management
BAUR Software 4 allows you to create a custom cable database that makes all information – from data generation to analysis – available centrally.

Automatic report generation
Fast and easy compilation of clear and precise measurement logs – with freely selectable company logo, comments and illustrations of the traces.

Central automatic control with complete system monitoring

The titron® system software with a high-performance industrial PC controls the phase and device selection and simultaneously monitors all safety-related functions and parameters. The optimally adapted measurement process and modern digital signal processing achieve maximum efficiency and measurement precision.

Easy and convenient to operate

The titron® provides a pleasant yet functional working environment. For example, a sliding bench seat, which doubles up as storage space, has an optional backrest for greater comfort. Drawers and shelves provide storage space for hand-held measuring devices, documents or the personal belongings of measurement engineers, while the large work surface creates the feel of an office. This is enhanced by the wall-mounted LCD screens. There is also the option of fitting the test van with two screens if required.



Heavy on features, light on its feet – the 3.5 tonne truck that punches above its weight

Despite being laden with features, the BAUR titron® is and remains a 3.5 tonner and therefore offers more payload than its predecessor. This is possible thanks to the lightweight measurement system. Nevertheless, the test van still offers a complete, 3-phase system for cable fault location, testing and diagnostics.

BAUR titron® – the future-proof all-in-one solution.

Cable test vans online

BAUR provides you with online support via the Internet. With your permission, our customer service department can access the computer of your cable test van, identify your problem and quickly find a solution. Or, during the fault location, our engineers can share the desktop with the measurement engineer on site and support him in the analysis of the measurement results.





Comprehensive safety concept in accordance with the latest standards

- Safety concept in accordance with EN 61010-1 and EN 50191
- Monitoring of all safety-related functions (protective and auxiliary earthing, rear door, and HV connection sockets)

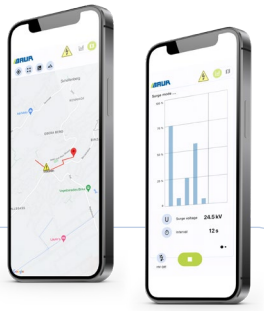
For installation in small vehicles as well

The compact and fully equipped titron® C testing and fault location system is specifically designed for installation in small vehicles.

More detailed information and data sheets on titron can be found on our website at: **baur.eu/titron**

BAUR Fault Location App

Non-destructive and safe pin-pointing



Supported devices

- iPhone, iPad, iPad mini, iPod touch (from iOS version 9.2 onwards)
- Smartphones or tablets with Android operating system (from version 4.0.3 onwards)

Remote control of titron® via smartphone or tablet

During pin-pointing, all the essential functions of titron® can be controlled remotely via the BAUR Fault Location App:

- Switching the surge voltage generator on and off
- Setting the surge voltage and surge sequence (5 – 20 pulses/min, single surge)
- Selecting the surge voltage range

This way, the operator has the possibility of only switching on the high voltage when he reaches the pre-located fault location. Once the fault has been located, the high voltage can be switched off again. Through this, the stress on the cable and the system is reduced to the necessary minimum and the level of safety is significantly increased.



Location and fault position at a glance

The cable data is transmitted from the cable fault location system to the Fault Location App and is displayed in the app in combination with the road map. This allows the operator always to have the latest information on the

- Cable route (if available)
- Pre-located fault position
- Location of the cable test van

Monitoring and adjusting the measurement parameters during the fault location

In the fault location mode, the operator always has an overview of the most important measurement parameters:

- High-voltage status
- Output voltage, max. permissible voltage
- Surge sequence, surge energy, duration of the measurement
- SSG capacitor charge and discharge curve

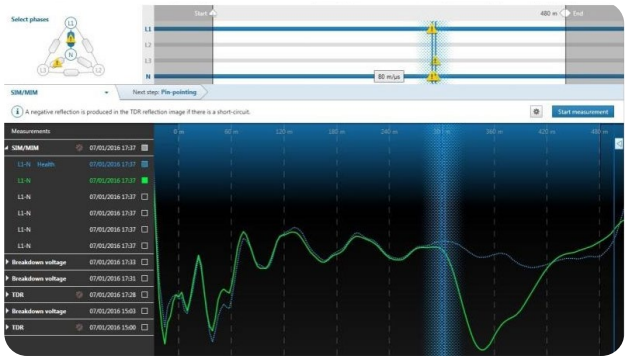
BAUR Software 4 –
for intuitive cable fault location

The BAUR Software 4 covers all the solutions for cable fault location, cable testing, and cable diagnostics, ensuring efficient and precise condition monitoring for cable networks when used in conjunction with BAUR hardware. It includes well-established measurement methods for cable fault location as well as innovative approaches such as Conditioning-SIM/MIM, enabling even faster and more effective localisation of wet cable faults that are difficult to locate.

The BAUR Software 4 scope of performance far exceeds standard features; the operator is also assisted by the intuitive operational concept and helpful support functions.

Connect and go – the new operational concept

An ergonomic and intuitive software interface speeds up work processes and makes it easier for operators to do their jobs. Standardised sequences are simple to call up and start, while the software guides operators through more complex measuring tasks. Measurement results are clearly presented and can be interpreted at a glance. This means that new staff can easily find their way around the interface and quickly obtain reliable results. However, the software also offers an expert mode in which experienced measurement engineers have direct control over processes and parameters. Help is also at hand for users whilst locating faults, with cable data and measured values linked to maps so that operators can quickly see where the problem lies.



The BAUR Software 4 display enables clear visualisation of all important settings, fault location parameters, and cable data. The bottom part of the screen shows the measurement results and allows important events to be logged straight away.

Features and benefits:

- BAUR OpenStreetMap*:
  - Unique combination of road maps, including the cable route
  - GPS-based system location determination
  - Cable routes and cable faults displayed on the map
- Cable Mapping Technology CMT: Overview of cable accessories and faults in relation to the cable length
- All data on the cable route such as geographic position, voltage level, joints, all measured values, etc. are automatically saved and can be accessed at any time.
- Import and export of measurement data with available cable route data

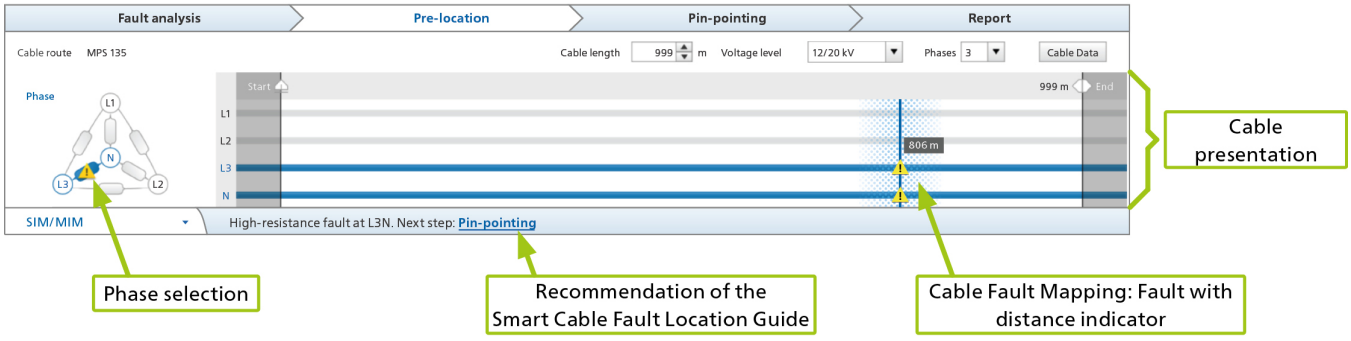


Stop searching and start finding with the Smart Cable Fault Location Guide

The Smart Cable Fault Location Guide makes for faster, easier cable fault pre-location and pin-pointing. A special algorithm continuously analyses the current measurement results, which it then uses to generate optimum recommendations for how the operator should proceed in order to reliably locate the cable fault. Automatic fault analysis and clear graphic display of the measurement results with helpful functions for evaluation provide a better overview.

This means that new staff can easily find their way around the interface and quickly obtain reliable results. However, the software also offers an expert mode in which experienced measurement engineers can directly control the processes and parameters.

The full flexibility of the software provides optimal support during the measurement processes whilst giving users the option to use their own expertise and select user-specific procedures at any time.





BAUR Software 4 –
for easy and comprehensive condition evaluation of cables

The new BAUR Software 4 allows you to quickly detect and evaluate the cable condition in accordance with your own diagnostics philosophy. The intuitive operational concept supports asset managers and measurement engineers working on site, firstly with the extremely efficient measurement process and secondly through precise condition monitoring of cable networks. Fast: The BAUR Software 4 elevates application and evaluation to a new level – thereby enabling further optimisation of the condition-based maintenance of cable networks.

Our software – your benefits:

- Better decisions based on comprehensive condition evaluation of the cable network
- Saves time on site thanks to automated sequences and report generation
- Easy operation thanks to the intuitive operational concept

The measurement methods

The BAUR Software 4 is used together with BAUR test and diagnostics systems for cable testing, cable sheath testing, and diagnostics with dissipation factor measurement or partial discharge testing.

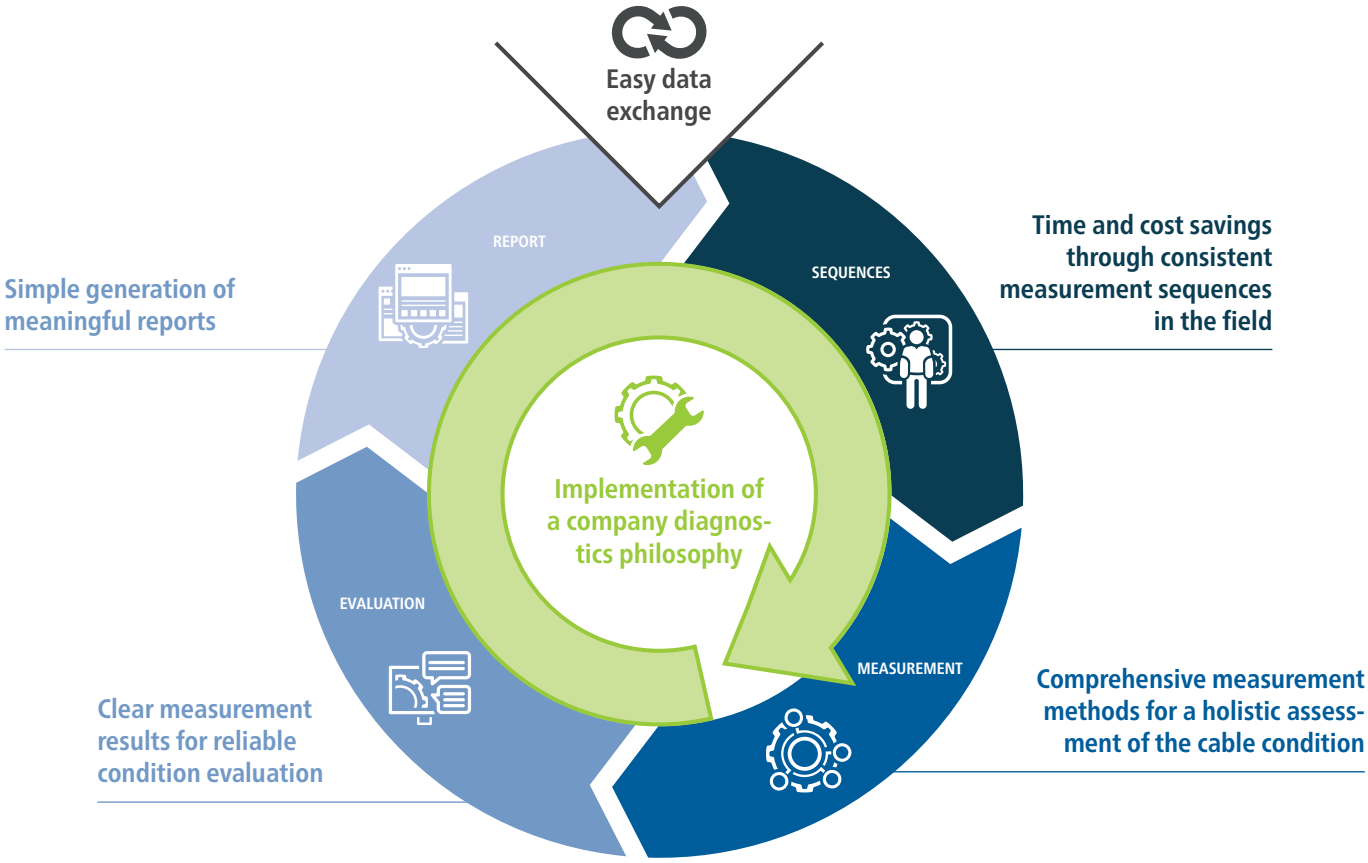
Cable testing
- Cable testing (VLF truesinus®, VLF square wave, DC voltage)

TD
- Dissipation factor measurement

PD
- Partial discharge testing

TD & PD
- Parallel dissipation factor and partial discharge measurement





Your own diagnostics philosophy as the basis

Operators can either use standardised diagnostics sequences or create their own company-specific diagnostics sequences. To do this, in-house specifications for various cables or various phases in the network life cycle, such as commissioning or maintenance, are simply created within the diagnostics sequences. The criteria, ranging from current standards and guidelines through to company-specific specifications, are thus stored at the start of every measurement and the engineer starts the measurement procedure with just a few clicks.

Comparable results – better basis for decision-making

The sequences can be exported directly to all BAUR measurement systems used and can be adapted at any time as required. These standardised measurement cycles provide asset managers with reproducible and comparable measurement results that show not only the condition but also the ageing of a cable route over time – the ideal basis for making informed decisions concerning network planning and investment in maintenance.

Evaluation made easy

All measurements and tests (including all condition data for every cable route) are stored in the central cable database. The results are represented graphically during the process, even while evaluating the measurement. At the end of measurement, the overall condition of the cable route is displayed along with the results of the individual measurements.

All information at a glance:

The BAUR Software 4 automatically generates reports on the measurements that have been performed. The reports contain all the information about the tested cables and can be exported as a PDF file. The diagnostics results and condition evaluation can also be easily presented in graph and table format.



transcable

Flexible, individually configurable system for cable fault location and diagnostics

Testing up to DC 110 kV

Surge voltage generators up to 3000 J

VLF truesinus® up to 57 kV_{rms} / 80 kV_{peak}

Modular concept

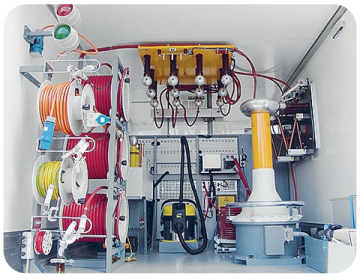
Integrated diagnostics

↓ Extended Syscompact 3000 system









↑ Semi-automatic transcable system, 3-phase, 110 kV

↑ transcable system, 1-phase

transcable is an automatic or semi-automatic, single- or three-phase cable fault location system. Through the modular design, the individually functional modules work independently from one another. This means that the transcable system can be easily extended at any time.

transcable offers a very diverse range of functions. In addition to the required testing technology for cable fault location and cable testing, the truesinus® technology enables precise and meaningful software-supported cable diagnostics with dissipation factor measurement and partial discharge testing.

Universal application

Due to its modular design, the transcable system enables the integration of multiple options such as a PHG VLF test system, surge voltage generators with different voltage ranges, or DC voltage testing up to 110 kV. The system therefore supports universal use, even on high-voltage cables and in offshore areas.

More detailed information on transcable can be found on our website: **baur.eu/transcable**

Cable test van equipment

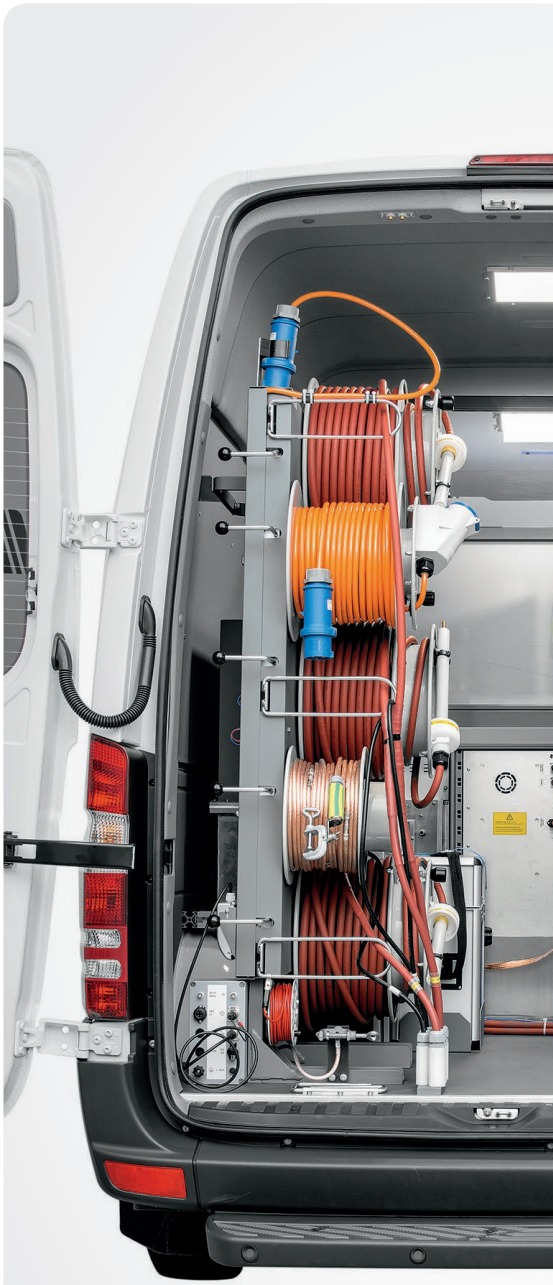
Options that leave nothing to be desired

In terms of equipment and convenience, BAUR systems offer every option you can think of:

- Accessories for various fault location methods
- Diverse safety devices and protective equipment (e.g. isolation transformer)
- Cable drum rack with motor drive
- External emergency off unit according to EN 50191
- Heating or air conditioning systems

Our experts will be happy to help you plan and configure your individual system.

Contact us via
baur.eu/contact

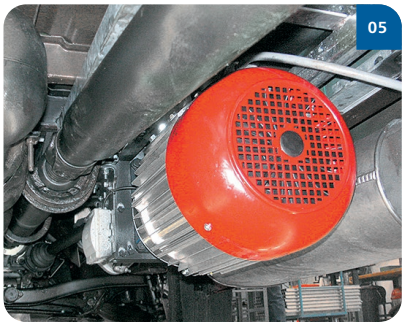


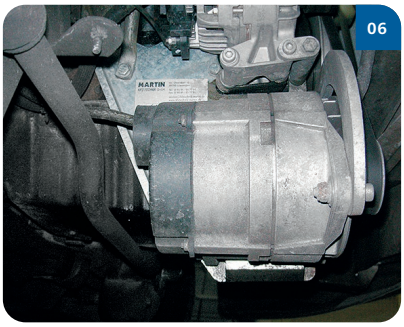

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09

01 / Example of options in the high-voltage area: motorised cable drum rack, external emergency off unit, and TDR connection cable
02 / Example of optional seat console with storage space
03 / Example of optional drawer with matching inlay
04 / Example of an air conditioner
05 / Example of a synchronous generator, underfloor
06 / Example of an electronic generator
07 / Signal lamp
08 / Warning light
09 / Test vans of all sizes are equipped by BAUR.

Syscompact
Compact and multifunctional

Mobile cable fault location to meet your needs
The devices in the Syscompact series are multifunctional cable fault location systems in modular 19 inch rack technology, making them an attractive alternative to large systems. These systems offer various cable fault location methods and deliver fast and reliable operation. The equipment and structure is designed individually according to your needs. Syscompact is available as a portable system on wheels or as block units for installation in a cable test van – the ideal basis for smaller budgets, without compromising on performance.







↑ **Syscompact 400 portable**
Syscompact 400 portable is used for the pre-location and pin-pointing of cable faults on low- and medium-voltage cables and is excellently suited to mobile use without the need for permanent installation in a vehicle.

BAUR cable fault location – the advantages at a glance:

- Precise and reliable cable fault location
- Well-established fault location methods for every type of fault and various cables
- Modular system, can be easily extended for cable testing and diagnostics



↑ **Syscompact 400**
for installation in a small van or container.



↑ **Syscompact 4000**
for faster and easier cable fault location thanks to the novel operational concept of the BAUR Software 4 and integrated location methods.

More detailed information and data sheets on the Syscompact series can be found on our website at: **baur.eu/syscompact**

Long submarine and land cables for global power supply

Indispensable and robust, but sadly not indestructible.

Submarine power cables are indispensable for reliable power supply. Among experts, submarine cables are actually classified as critical infrastructure. This is on account of the harsh installation environment and mechanical stress caused by currents, fishing, and anchors.

BAUR XL-CFL solutions are specifically designed for effective and precise cable fault location on long submarine and land cables. Contact us to discuss your custom solution package.

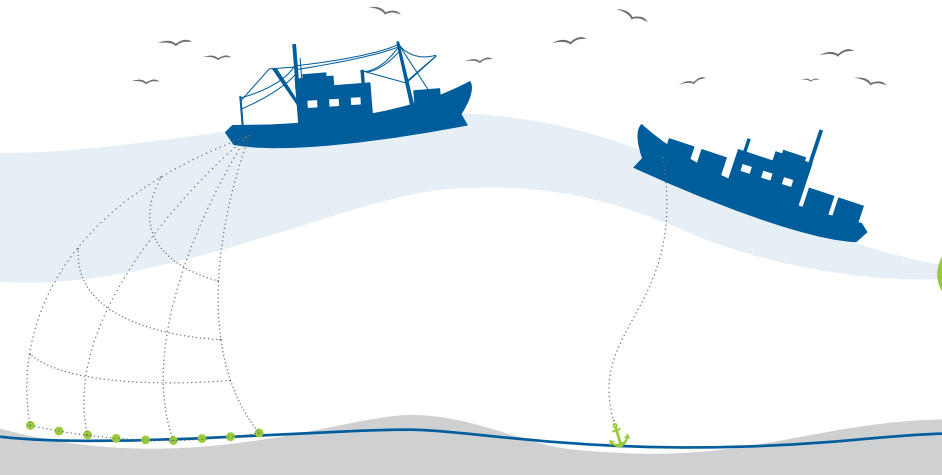
The impact of cable faults enters a new dimension

When a submarine cable is damaged, cable fault location and repair is usually a complex and time-consuming process. The protracted downtime translates into losses in the millions for the cable operator – with the downtime costs growing day on day!

Many cable operators therefore invest in a suitable fault location system even before the cable is put into operation. Immediate availability when a fault occurs means that the fault can be located straight away, thus reducing cable downtime in the long term.

More stringent safety requirements cannot be met with traditional cable fault location

Depending on the fault type and breakdown voltage, high voltage may be used for cable testing and cable fault location. Long cables store a lot of energy during this process. Most devices and measurement systems are unable to cope with the discharge of this high level of energy, which ultimately causes damage to the devices and poses a danger to operating personnel. You should therefore rely on proven BAUR solutions from the outset that are specifically designed for long land and submarine cables.



The biggest threats to submarine cables:
External forces exerted by heavy ships' anchors and trawl nets of fishing boats at all sea depths.

Submarine cable
Seabed

BAUR solutions
for XL cable fault location

The XL-CFL systems are tailored to the system-specific requirements. This includes:

■ Marine-grade containers ■ Hermetically sealed HV and operating areas ■ Air conditioning system for maritime climate, also for excess pressure in the container ■ Screen to protect against spray ■ Discharge unit adapted to the system size ■ Pressure relief according to the spatial volume and possible arcing faults ■ Appropriately dimensioned earthing cross sections

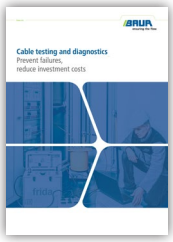
Device type	Area of application	Advantages	BAUR solution	Additional info
Portable devices	■ For cable fault location at multiple locations of use ■ For cable systems with high relevance – high costs in the event of cable failure, high risk for security of supply **FEATURES:** ☑ **Long cables** ☐ All measurement methods	■ Small and convenient ■ Fast transportation to place of use ■ Great flexibility of use ■ TDR fingerprint in accordance with Cigre TB 773, Cigre TB 610, Cigre TB 680, Cigre TB 490, Cigre TB 496 ■ IEEE 1234-2019	 **shirla**  **IRG 4000 portable**	**Modified systems for use on long cables.**
Mobile systems	■ For cable fault location at multiple locations of use ■ For cable systems with very high relevance – very high costs in the event of cable failure, very high risk for security of supply ■ Fastest possible availability and operational readiness **FEATURES:** ☐ Long cables ☑ **All measurement methods**	■ Compact: all cable fault location methods integrated into a single system ■ Fast transportation to place of use ■ Immediate use ■ Great flexibility of use ■ Very high degree of efficiency ■ Proven system solution	**Systems on wheels for use within the switchgear**  **Cable test van** 	
Stationary XL-CFL systems for long cable systems, can be deployed at both ends	■ For cable systems with extremely high relevance – extremely high costs in the event of cable failure, extremely high risk for security of supply ■ Tailored cable fault location system integrated in a ■ measurement container Immediate availability when stored in the switchgear **FEATURES:** ☑ **Long cables** ☑ **All measurement methods**	**Time savings** ■ No loss of time due to transportation ■ Immediate deployment in the event of a cable system failure ■ Cable fault location within the shortest possible time / on the first day ■ Suitable for very long cables **Precision** ■ Improved positional accuracy thanks to deployment at both ends of the cable **Cost savings** ■ Reduction of downtime and holding time costs – these can amount to several €100,000 per day ■ Investment pays for itself after just one fault	**Cable fault location systems in measurement containers**   	

LOW

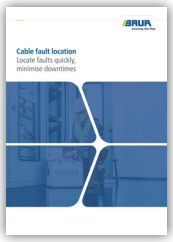
COST RISK IN THE EVENT OF CABLE FAILURE

HIGH

Other BAUR Brochures



Cable testing and diagnostics



Cable fault location



Insulating oil testing



Product overview

Further product information is available at:
baur.eu/brochures





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