titron®

BAUR automatic cable fault location system

Image of the cable test van - incl. options

The intelligent system.

For cable fault location, testing and diagnostics

- Convenient to operate with simple user guidance
- High-performance technology and the highest safety standard
- Remote control with the BAUR Remote App*
- Compact version for installation in small vehicles

The new BAUR titron® is a new generation cable fault location system. It is a fully automatic, centrally controlled and intelligent system for cable fault location, cable testing and diagnostics*.

Thanks to the novel operational concept and the high-performance technology, the **titron®** system is able to carry out measurements more rapidly, more easily and with higher precision. The test van's functions are centrally controlled via the BAUR titron software. The intuitive user interface that is perfectly adapted to the cable fault pre-location process supports the operator throughout the entire work process.

Fault location. Recommendations for the cable fault location process are generated based on a multitude of factors that link the system, in an intelligent manner, to an algorithm specifically designed for this purpose. Nevertheless, the user is still, at any time, able to override the given specifications of the system and to carry out the measurement process based on his own experience and knowledge. The well-proven and continuously enhanced methods are available for the cable fault location as well as the newly developed Conditioning SIM/MIM method which makes it even more effective and quick to locate wet cable faults that are difficult to detect.

Testing and diagnostics*. The voltage test and diagnostic functions* are important supplements to the cable fault location system. It is in particular a good opportunity to carry out partial discharge testing for the condition evaluation of the cable system after work has been conducted on buried cables.

NEW

- BAUR Remote App* for remote control of the cable fault pin-pointing process
- Compact, fully-equipped testing and fault location system titron® 40-1C for installation in very small vehicles
- Interface to GIS systems
- 3-phase current coupling methods* for the fault location in branched networks

High voltage and functions

- DC voltage up to 40 kV (up to 80 kV*)
- VLF truesinus® up to 57 kV_{rms}*
- Surge voltage up to 32 kV
- Cable testing
- Cable sheath testing
- Cable fault location
- Tracing
- Cable diagnostics*:
  - Dissipation factor measurement
  - Partial discharge testing and location

Higher efficiency through innovative technology

- Surge energy up to 3000 J, complete surge energy on all voltage levels
- Precise fault location methods for every type of fault and various cables, e.g.
  - SIM/MIM – the most effective method for cable fault location
  - Conditioning-SIM/MIM – helpful in locating wet faults that are difficult to detect
  - DC-SIM/MIM – for flashover faults and intermittent faults
  - Envelope curve display for intermittent faults – even small changes in impedance are made visible and saved.
- Quickest surge sequence with maximum power surge for efficient and rapid fault pin-pointing
- Maximum safety for the operator and the system

*** Options**

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State of the art in cable fault location

Image of the cable test van - incl. options

Central automatic control with complete system monitoring

- Central system control via the powerful industrial PC
- Highest level of efficiency and measurement precision through the optimally adjusted measurement path, combined with modern digital signal processing
- Extremely high reliability by monitoring and recording all system events
- Quick start: ready for operation in just a few seconds

The new intuitive operational concept

- Intuitive modern user interface – no long introduction or familiarisation period is required
- Automated processes for quick and reliable cable fault location
- Optimal operator support during cable fault location provided by the Smart Cable Fault Location Guide
- BAUR GeoBase Map*:
  - 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.
- Quick and easy compilation of clear and precise measurement records – with freely selectable company logo, comments and figures of the measured curves.

Easy and convenient to operate

- 19" monitor for high productivity and greater clarity during the evaluation (a second monitor is available as an option)
- Standard, convenient operation by means of a mouse and keyboard
- Proven Windows 7 operating system
- Installation of office software, e.g. MS Office programs, company-internal ERP systems, GIS and web applications, is possible.
- Printers, laptops and data carriers can be connected via standard connections.
- GIS interface enables an exchange of cable data between your GIS system and the BAUR system software.

Cable test vans online

- Online support via the Internet
  - With your permission, BAUR's customer service department can access the computer of your cable test van, identify your problem and quickly find a solution.
  - During the fault location, your engineers can share the desktop with the test engineer on site and support him in the analysis of the measurement results (where applicable, a licence for a desktop-sharing program may be required).

*** Option**

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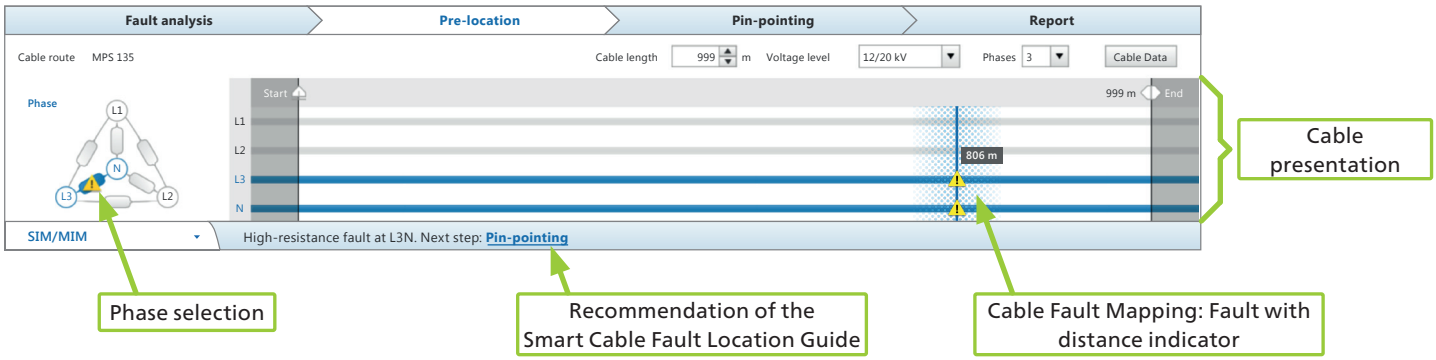
titron®

Find your cable fault with just a few clicks!

Smart Cable Fault Location Guide

- The intelligent Smart Cable Fault Location Guide leads the user step-by-step – quickly and efficiently – to the cable fault.
- A special algorithm continuously analyses the current measurement results which it uses to generate optimum recommendations for the user regarding the further procedure required to reliably locate the cable fault.
- Automatic fault analysis with clear graphical presentation giving a better overview.
- Test voltage wizard:
  - The system recommends voltage values according to the cable data and the fault type.
  - The test voltages can be defined according to the user.
- Automatic cursor positioning at the cable end and at the fault.
- Automatic adjustment of method-related parameters for quick and efficient fault location.
- Clear graphical presentation of the measurement results with helpful functions for the analysis.

All this **with full flexibility for experienced users!** The experienced test engineer can use his know-how directly at any point during the measurement process and select a user-specific procedure.



Comprehensive safety concept in accordance with the latest standards

- Safety concept in accordance with EN 61010-1 and EN 50191
- Monitoring of all safety-relevant parameters (protective and auxiliary earthing, rear door and HV connection sockets)
- Separation in the operating and HV area
- Red and green signal lamp to indicate the operating state
- Emergency stop button in the operating area and optional external emergency stop feature
- Key-operated switch against unauthorised operation
- All operation-related error messages are displayed clearly on the screen and are immediately visible to the user.

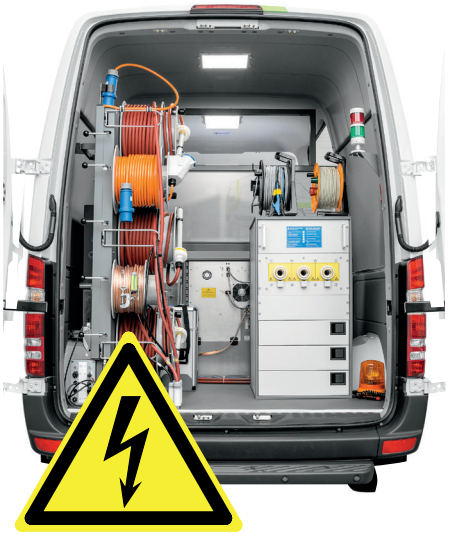
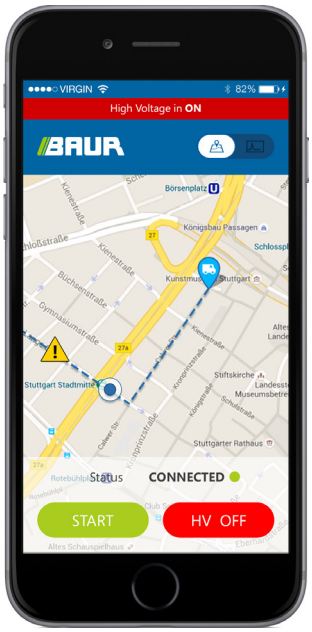


Image of the cable test van - incl. options

titron®

Gentle and safe pin-pointing with the BAUR Remote App*



Remote control of the titron® via smartphone or tablet

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

- Switching the surge voltage generator on and off
- Setting the surge voltage and the 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.

Advantages

- Less stress on the cable
- Less wear and tear to the system due to significantly reduced operating time
- High level of safety for the testing personnel and the environment
- More efficient fault pin-pointing due to the monitoring and adjustment of voltage parameters directly on site during the pin-pointing process

Location and fault position at a glance

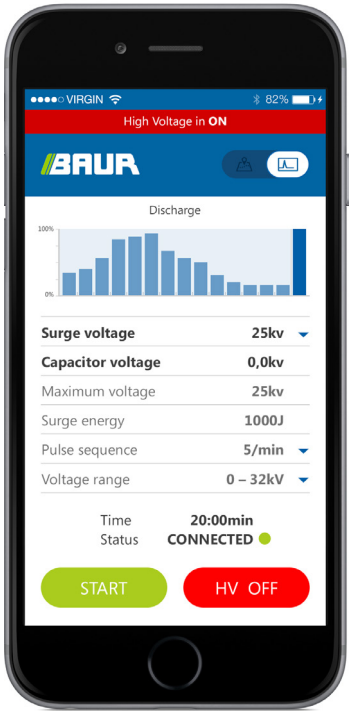
The cable data of titron® are transmitted to the Remote App and, in combination with the street map, are displayed in the app. This allows the operator always to have the latest information on the

- 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



Supported devices

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

*** Option**

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Technical data

		titron® 3-phase	titron® 1-phase	titron® compact
I. High voltage				
Surge voltage				
Surge voltage ranges	0 – 8 kV, 0 – 16 kV, 0 – 32 kV	✓	✓	✓
Surge energy	3,000 J @ 8, 16 and 32 kV 2,050 J @ 8, 16 and 32 kV 1,540 J @ 8, 16 and 32 kV	Surge energy of choice	Surge energy of choice	Surge energy of choice
Surge capacitor extension	SZ 1550: / SZ 2650:	Option	Option	Option
With surge energy class 3,000 J:	1,820 J @ 4 kV / 2,890 J @ 4 kV			
With surge energy class 2,050 J:	1,580 J @ 4 kV / 2,660 J @ 4 kV			
With surge energy class 1,540 J:	1,460 J @ 4 kV / 2,530 J @ 4 kV			
Surge sequence	5 - 20 pulses/min, single surge	✓	✓	✓
Capacitor charge time	Max. surge voltage 32 kV in 3 s	✓	✓	✓
DC voltage and VLF voltage				
DC voltage	0 – 40 kV, I_{max} = 50 mA	✓	✓	✓
DC voltage and VLF voltage (optional):				
VLF high voltage generator viola		Option	Option	Option
DC voltage	0 to ±60 kV			
VLF voltage	truesinus® 0 – 42.5 kV_{rms} / Rectangular 0 – 60 kV			
Frequency range	0.01 – 0.1 Hz			
Max. capacitive load	up to 10 µF; 1 µF @ 0.1 Hz at 42.5 kV_{rms} 3 µF @ 0.03 Hz at 42.5 kV_{rms}; 8 µF @ 0.01 Hz at 40 kV_{rms}			
VLF high voltage generator PHG 70		Option	Option	Option
DC voltage	0 to ±70 kV; I_{max} = 10 mA @ 70 kV; 90 mA @ 20 kV			
VLF voltage	truesinus® 0 – 38 kV_{rms} / Rectangular 0 – 57 kV			
Frequency range	0.01 – 1 Hz			
Max. capacitive load	up to 20 µF; 3 µF @ 0.1 Hz at 38 kV_{rms}			
VLF high voltage generator PHG 80		Option	Option	Option
DC voltage	0 to ±80 kV; I_{max} = 1.8 mA @ 80 kV; 90 mA @ 20 kV			
VLF voltage	truesinus® 0 – 57 kV_{rms} / Rectangular 0 – 80 kV			
Frequency range	0.01 – 1 Hz			
Max. capacitive load	up to 20 µF; 1.2 µF @ 0.1 Hz at 57 kV_{rms} 3 µF @ 0.1 Hz at 38 kV_{rms}			
II. Cable testing				
DC voltage testing	up to 40 kV, I_{max} = 50 mA	✓	✓	✓
	60 / 70 / 80 kV*	Option	Option	Option
VLF testing	38 / 42.5 / 57 kV_{rms}*	Option	Option	Option
Cable sheath testing	up to 40 kV, I_{max} = 50 mA Standard setting: LV network max. 4 kV / HV network max. 5 kV Max. voltage adjustable	✓	✓	✓
III. Cable fault location				
Insulation resistance measurement				
Measurement range	0 Ohm – 5 GOhm / Test voltage: up to 1,000 V	✓	✓	✓
3-phase measurement L-N, L-L	via HV connection	✓	–	–
3-phase measurement L-N, L-L	via LV connection with TDR connection cable, 50 m	Option	Option	✓

✓ = included in standard delivery / Option = available as an optional extra / – = not available

* see optional high-voltage sources above

Technical data

	titron® 3-phase	titron® 1-phase	titron® compact
III. Cable fault location			
Pulse reflectometry			
Automatic calculation of the cable length and fault distance	✓	✓	✓
Measurement mode ▪ Automatic measurement mode ▪ Differential measurement to compare recorded traces ▪ Mean value calculation; continuous measurement ▪ Stop after recording the change ▪ Envelope curve display for the location of intermittent faults			
Pulse voltage: 20 – 200 V; Pulse width: 20 ns – 1.3 ms Output impedance: 8 – 2,000 ohm; Data rate: 400 MHz Resolution: 0.1 m (at v/2 = 80 m/µs); View range: 10 m – 1,000 km Velocity of propagation (v/2) 20 – 150 m/µs; Accuracy: 0.1% relating to the measurement result			
Pre-location methods			
▪ **TDR** Time Domain Reflectometry	✓	✓	✓
– 3-phase measurement L-N, L-L via HV connection	✓	–	–
– 3-phase measurement L-N, L-L via LV connection with TDR connection cable, 50 m	Option	Option	✓
▪ **SIM/MIM** secondary/multiple impulse method up to 32 kV	✓	✓	✓
▪ **DC-SIM/MIM** secondary/multiple impulse method used in DC mode up to 32 kV, I_{max} = 120 mA	✓	✓	✓
▪ **Conditioning-SIM/MIM** fault conditioning with subsequent secondary/multiple impulse method	✓	✓	✓
▪ **ICM** impulse current method up to 32 kV	✓	✓	✓
▪ **DC-ICM** impulse current method used in DC mode up to 32 kV, I_{max} = 120 mA	✓	✓	✓
▪ **Decay** decay method up to 40 kV	✓	✓	✓
▪ **Determination of breakdown voltage** up to 40 kV*	✓	✓	✓
▪ **3-phase current coupling methods** For pre-locating cable faults in branched low-voltage and medium-voltage networks: Differential comparison method, comparison method type 1 and type 2	Option	–	–
▪ **Measuring bridge measurement** for the pre-location of cable and cable sheath faults (shirla – BAUR sheath test and fault location device)	Option	Option	Option
Fault conditioning through burning			
Voltage 0 – 10 kV, up to 32 A; 2.3 kVA	Option	Option	Option
Voltage 0 – 15 kV, up to 90 A; 6 kVA	Option	Option	Option
Pin-pointing methods			
▪ **Acoustic pin-pointing:** Voltage ranges: 0 – 8 kV, 0 – 16 kV, 0 – 32 kV**	✓	✓	✓
– UL 30 universal receiver, ground microphone, headphones	Option	Option	Option
▪ **Step voltage method** up to 40 kV, I_{max} = 50 mA; standard setting: LV network max. 4 kV / HV network max. 5 kV; max. voltage adjustable	✓	✓	✓
– UL 30 universal receiver / KMF 1 earth fault locator	Option	Option	Option
▪ **Tracing, audio frequency methods** (twist method and minimum distortion method)	Option	Option	Option
Equipment for audio frequency methods and tracing:			
– TG 600 integrated audio frequency transmitter, 600 VA	Option	Option	–
– TG 20/50 mobile audio frequency transmitter, 20 VA/50 VA	Option	Option	Option
– UL 30 universal receiver, SP 30 search coil	Option	Option	Option

✓ = included in standard delivery / Option = available as an optional extra / – = not available

* See optional high-voltage sources in section "I. High voltage"

** For surge voltage data and available options, see section "I. High voltage"

Technical data

Options for all titron® variants

IV. Cable diagnostics			
Dissipation factor measurement and VLF testing		**Technical data**	
VLF testing and diagnostics system PHG 70 TD or **PHG 80 TD**:		Technical data of the dissipation factor measurement:	
VLF truesinus® test Dissipation factor measurement	0 – 38 kV_{rms} or 0 – 57 kV_{rms}	Load range Measurement range Accuracy	≥ 10 nF, optional 500 pF 0.1 x 10^{-3} – 1,000 x 10^{-3} 1 x 10^{-4}
VLF testing and diagnostics device viola TD 19": VLF truesinus® test Dissipation factor measurement	0 – 42.5 kV_{rms}	Technical data of the dissipation factor measurement: Load range Measurement range Accuracy	 10 nF – 10 µF 1 x 10^{-4} – 21,000 x 10^{-3} 1 x 10^{-4}
Partial discharge testing and VLF test			
VLF testing and diagnostics system PHG 70 PD or **PHG 70 and portable PD diagnostics system PD-TaD 60:** VLF truesinus® test Partial discharge testing	0 – 38 kV_{rms}	Technical data of the partial discharge testing for all variants: Theoretical measurement range Sampling rate PD measurement range Accuracy Resolution Velocity of propagation (v/2)	 10 – 12,800 m (at 80 m/µs) 100 MSamples/s (10 ns) 5 pC – 100 nC Approx. 1% of cable length 0.1 pC / 0.1 m 50 – 120 m/µs
VLF testing and diagnostics system PHG 80 PD: VLF truesinus® test Partial discharge testing	0 – 57 kV_{rms}		
VLF testing and diagnostics system PHG 80 and portable PD diagnostics system PD-TaD 60: VLF truesinus® test Partial discharge testing	0 – 57 kV_{rms} 0 – 42.5 kV_{rms}		
VLF testing and diagnostics device viola 19" and portable PD diagnostics system PD-TaD 60: VLF truesinus® test Partial discharge testing	0 – 42.5 kV_{rms}		
Dissipation factor and partial discharge measurement and VLF testing			
VLF testing and diagnostics system PHG 70 TD PD or **PHG 70 and portable PD diagnostics system PD-TaD 60:** VLF truesinus® test Partial discharge testing Dissipation factor measurement	0 – 38 kV_{rms}	Technical data of the partial discharge testing: see above Technical data of the dissipation factor measurement: Load range Measurement range Accuracy	 ≥ 10 nF, optional 500 pF 0.1 x 10^{-3} – 1,000 x 10^{-3} 1 x 10^{-4}
VLF testing and diagnostics system PHG 80 TD PD: VLF truesinus® test Partial discharge testing Dissipation factor measurement	0 – 57 kV_{rms}		
VLF testing and diagnostics system PHG 80 and portable PD diagnostics system PD-TaD 60: VLF truesinus® test Partial discharge testing Dissipation factor measurement	0 – 57 kV_{rms} 0 – 42.5 kV_{rms} 0 – 42.5 kV_{rms} or 0 – 57 kV_{rms}		
VLF testing and diagnostics device viola TD 19" and portable PD diagnostics system PD-TaD 60: VLF truesinus® test Partial discharge testing Dissipation factor measure-ment (with PD-TaD 60)	0 – 42.5 kV_{rms}	Technical data of the dissipation factor measurement: Load range Measurement range Accuracy	 10 nF – 10 µF 1 x 10^{-4} – 21,000 x 10^{-3} 1 x 10^{-4}

Technical data

		titron® 3-phase	titron® 1-phase	titron® compact
V. Safety and protective features				
Safety standard	in accordance with EN 50191 and EN 61010-1	✓	✓	✓
Electrical safety	Overvoltage category IV/300			
Safety monitoring	Protective earthing, operational earthing, auxiliary earthing, potential monitoring, HV connections, rear doors, emergency off button			
Monitoring of the supply voltage	Overvoltage protection, undervoltage protection			
Isolation transformer	5 kVA or 7 kVA with switch current limiter	Option	Option	Option
VI. System data				
Phase and device selection				
Automatic phase and device selection		✓	✓ (Device selection)	–
HV connection				
– 3 x 1-phase HV connection cable, 50 m		✓	–	–
– 3 x 1-phase HV connection cable, 80 m		Option	–	–
– 1-phase HV connection cable, 50 m		–	✓	✓
– 1-phase HV connection cable, 80 m		–	Option	Option
– Cable drum rack		✓	✓	✓
– Cable drum rack with motor drive		Option	Option	Option
LV connection				
– LV connection panel to connect external measuring devices		✓	✓	✓
– TDR connection cable, 3-phase, 50 m, on hand drum		Option	Option	✓
External emergency off unit with signal lamps, incl. connection cable, 50 m		Option	Option	Option
Operating system and display				
Operating system	Windows 7 Ultimate 32-bit (or higher)	✓	✓	✓
Memory	4 GB RAM			
Hard disk	SSD industry standard			
Display	TFT monitor 19", screen resolution: 1280 x 1024			
	Second TFT monitor, 19"	Option	Option	Option
Software and data management				
User interface	available in 22 languages	✓	✓	✓
Data export format	PDF			
Data synchronisation	USB			
GIS interface	Export/import GIS data			
BAUR GeoBase Map	90 days test licence			
	Full version	Option	Option	Option
BAUR Remote App	For remote control of the surge voltage generator	Option	Option	Option
Emergency control	via laptop	Option	Option	Option
Systems supply and operating conditions				
Input voltage	190 – 264 V, 47 – 63 Hz	✓	✓	✓
Max. power consumption	7.5 kVA | UPS 500 VA for industrial PC			
Ambient temperature	HV area: -20 °C to +50 °C; operating area: 0 °C to +50 °C			
Storage temperature	-20 °C to +60 °C			
Synchronous generator	7 kVA, 230 V	Option	Option	Option
Travel Power generator	with electrical unit 5 kVA, 230 V	Option	Option	Option
Battery-Power system	For battery operation, battery capacity 5 kWh, 230 V	Option	Option	Option
Fan heater	230 V, 2,000 W	Option	Option	Option
Air condition	230 V	Option	Option	Option
Weight				
Standard version		From 800 kg	From 800 kg	From 450 kg

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