

Megger[®]



T 22/13 B **15 kV Burn Unit**

USER GUIDE

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Consultation with Megger

The present user guide has been designed as an operating guide and for reference. It is meant to answer your questions and solve your problems in as fast and easy a way as possible. Please start with referring to this user guide should any trouble occur.

In doing so, make use of the table of contents and read the relevant paragraph with great attention. Furthermore, check all terminals and connections of the instruments involved.

Should any question remain unanswered or should you need the help of an authorized service station, please contact:

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Megger accept responsibility for a claim under warranty brought forward by a customer for a product sold by Megger under the terms stated below.

Megger warrant that at the time of delivery Megger products are free from manufacturing or material defects which might considerably reduce their value or usability. This warranty does not apply to faults in the software supplied. During the period of warranty, Megger agree to repair faulty parts or replace them with new parts or parts as new (with the same usability and life as new parts) according to their choice.

This warranty does not cover wear parts, lamps, fuses, batteries and accumulators.

Megger reject all further claims under warranty, in particular those from consequential damage. Each component and product replaced in accordance with this warranty becomes the property of Megger.

All warranty claims versus Megger are hereby limited to a period of 12 months from the date of delivery. Each component supplied by Megger within the context of warranty will also be covered by this warranty for the remaining period of time but for 90 days at least.

Each measure to remedy a claim under warranty shall exclusively be carried out by Megger or an authorized service station.

This warranty does not apply to any fault or damage caused by exposing a product to conditions not in accordance with this specification, by storing, transporting, or using it improperly, or having it serviced or installed by a workshop not authorized by Megger. All responsibility is disclaimed for damage due to wear, force majeure or connection to foreign components.

For damage resulting from a violation of their duty to repair or re-supply items, Megger can be made liable only in case of severe negligence or intention. Any liability for slight negligence is disclaimed.

Since some states do not allow the exclusion or limitation of an implied warranty or of consequential damage, the limitations of liability described above perhaps may not apply to you.

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1 Safety Instructions

1.1 General Notes

Safety precautions This user guide contains basic instructions for the commissioning and operation of the device / system. For this reason, it is important to ensure that the user guide is always available to the authorised and trained operator. They need to read the manual thoroughly. The manufacturer is not liable for damage to material or humans due to non-observance of the instructions and safety advices provided by this user guide.

Locally applying regulations have to be observed!

Labelling of safety instructions The following signal words and symbols are used in this user guide and on the product itself:

Signal word / symbol	Description
DANGER	Indicates a potential hazard which will result in death or serious injury if not avoided.
WARNING	Indicates a potential hazard which may result in death or serious injury if not avoided.
CAUTION	Indicates a potential hazard which may result in moderate or minor injury if not avoided.
NOTICE	Indicates a potential hazard which may result in material damage if not avoided.
	Serves to highlight warnings and safety instructions. As a warning label on the product it is used to draw attention to potential hazards which have to be avoided by reading the user guide.
	Serves to highlight warnings and safety instructions that explicitly indicate the risk of an electric shock.
	Serves to highlight important information and useful tips on the operation of the device/system. Failure to observe may lead to unusable measurement results.

Working with products from Megger It is important to observe the generally applicable electrical regulations of the country in which the device will be installed and operated, as well as the current national accident prevention regulations and internal company directives (work, operating and safety regulations).

After working on the system, it must be voltage-free and secured against reconnection as well as having been discharged, earthed and short-circuited.

Use genuine accessories to ensure system safety and reliable operation. The use of other parts is not permitted and invalidates the warranty.

Operating staff The system may only be installed and operated by an authorised electrician. DIN VDE 0104 (EN 50191), DIN VDE 0105 (EN 50110) and the German accident prevention regulations (UVV) define an electrician as someone whose knowledge, experience and familiarity with the applicable regulations enables them to recognise potential hazards.

Anyone else must be kept away!

Declaration of Conformity (CE) The product meets the following security requirements of the European Council Directives:

- EMV Directive (2014/30/EC)
- Low Voltage Directive (2014/35/EC)
- RoHS Directive (2011/65/EU)

1.2 General Safety Instructions and Warnings

Intended application The operational safety is only guaranteed if the delivered system is used as intended (see page 9). Incorrect use may result in danger to the operator, to the system and the connected equipment.

The thresholds listed in the technical data may not be exceeded under any circumstances.

Five safety rules

The five safety rules must always be followed when working with HV (High Voltage):

1. De-energise
2. Protect against re-energising
3. Confirm absence of voltage
4. Earth and short-circuit
5. Cover up or bar-off neighbouring energised parts



Using cardiac pacemaker / defibrillator

Physical processes during operation of high voltage may endanger persons wearing a cardiac pacemaker or defibrillator when near these high voltage facilities.



Fire fighting in electrical installations

- According to regulations, carbon dioxide (CO₂) **is required to be used** as extinguishing agent for fighting fire in electrical installations.
- Carbon dioxide is electrically non-conductive and does not leave residues. It is safe to be used in energized facilities as long as the minimum distances are maintained. A CO₂ fire extinguisher must be always available within electrical installations.
- If, contrary to the regulations, any other extinguishing agent is used for firefighting, this can lead to damage to the electrical installation. Megger disclaims any liability for consequential damage. Furthermore, when using a powder extinguisher near high-voltage installations, there is a danger that the operator of the fire extinguisher will get an electrical shock from a voltage flashover (due to the powder mist that occurs).
- It is essential to observe the safety instruction on the extinguishing agent.
- Applicable is DIN VDE 0132.



Dangers when working with high voltage

Working on high voltage systems and equipment – especially in non-stationary operation – requires particular care and safety-conscious action on the part of test personnel. VDE regulations 0104 on setting up and operating electrical test systems, as well as EN 50191 and national standards and regulations must be strictly adhered to.

- The Burn Unit generates a dangerous voltage of up to 15 kV during measurement operation. This is supplied to the test object via a high-voltage cable.
- The test system may not be operated without supervision.
- Safety equipment must not be circumvented or put out of service.
- Operation requires a minimum of two persons whereas the second person must be able to activate the emergency switch in case of danger.
- To prevent dangerous charge accumulation, earth all metal parts in the vicinity of the high voltage equipment.

2 Technical description

2.1 System description

Application The powerful T 22/13 B 15 kV Burn Unit is mostly used for the conversion of high resistance and intermittent cable faults into low resistance shunts.

This process known as „Burning“ uses the heat of an electric arc to turn the hydrocarbons of the cable insulation at a fault point into conductive carbon. The fault resistance changes to low-impedance values, allowing it to be used for pre-location using the pulse reflection method and pinpointing using the twist method and the distortion-of-minimum method.

In addition to this classical application as a Burn Unit, the following methods are also available for the T 22/13 B in combination with other devices:

- Pre-location using the arc reflection method (ARM Live Burning) in combination with a suitable coupling unit and a time domain reflectometer (TDR)
- Sheath pinpointing in combination with a suitable ground fault detector

Functional description The T 22/13 B 15 kV Burn Unit is short-circuit proof and supplies constant power to the changing fault resistance over a range of currents (constant power characteristics). The burn-out voltage is infinitely variable. Output current and output voltage are displayed on instruments, each with a choice of two measuring ranges. The maximum burn-out peak current is 31 A.

A start preconditioning circuit and a discharge device are built in for safety.

The unit uses a 50 Hz high-voltage transformer which takes its primary supply from a regulating transformer. The burn-out or charging current reaches the output via a bridge rectifier.

In the case of low-impedance faults or operation using an energy separation filter (ESF) the spark gap is opened and the charged capacitor is discharged into the output circuit in relaxation oscillations, with a choke and recovery diodes providing power adjustment to the fault. This allows the T 22/13 B 15 kV Burn Unit to achieve virtually constant power characteristics.

In the case of very low external resistances, e.g. $< 5 \Omega$, overload protection prevents the recovery diodes from overheating. The HV transformer is also protected against overloading.

Product versions The T 22/13 B is provided by Megger either as a portable stand-alone device or as an integrated part of a measuring system (preferably in a test van or on a pallet). While the stand-alone device can be used completely autonomously according to the description in this user guide and is equipped with all necessary safety devices, dependencies and security mechanisms have to be observed when used in combination with other devices, which can be found in the documentation of the respective measuring systems.

Scope of delivery The scope of delivery of the stand-alone device includes the following components:

Component	Item number
Burn Unit	892477610
High-Voltage connecting cable, 2,5 m	893020630
Earthing cable, 2,5 m	893020641
Power cord, 4 m	893020631
Earth clamp	892480646
Earth connection clamp	893020642
User guide	128311145

Check contents Check the contents of the package for completeness and visible damage right after receipt. In the case of visible damage, the device must under no circumstances be taken into operation. If something is missing or damaged, please contact your local sales representative.

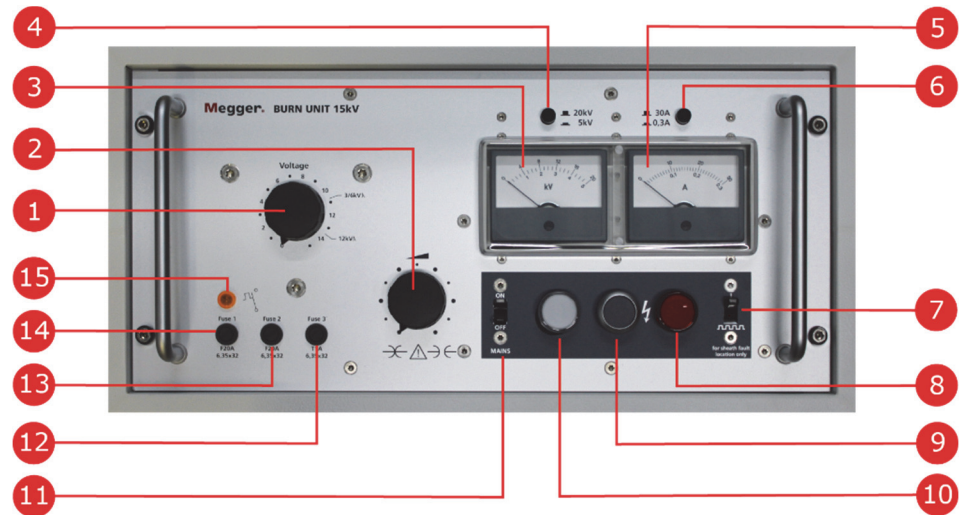
2.2 Technical Data

The T 22/13 B is defined by the following parameters:

Parameter	Value
Power supply	230 V + 5% / - 10%, 50 Hz (suitable transformer for connection to 120 V, 60 Hz available on demand)
Current consumption	max. 16 A
Power consumption	3,5 kVA
Output voltage/no load	max. 15 kV
Output current in short circuit: <ul style="list-style-type: none">• without power adjustment• with power adjustment	300 mA 25 mA
Peak current	31 A
Overload protection for	HV transformer recovery diodes leakage protection resistor
Clock circuit for	Ground fault measurements
Operating system	any
Dimensions	548 x 585 x 254 mm (approx. 21½" x 23" x 10")
Weight	57 kg (approx. 126 lbs)
Ambient temperature range <ul style="list-style-type: none">• in Operation• transport and storage	-25 °C to +55 °C -40 °C to +70 °C
Relative atmospheric humidity	93 % at 30 °C

2.3 Display and operating elements

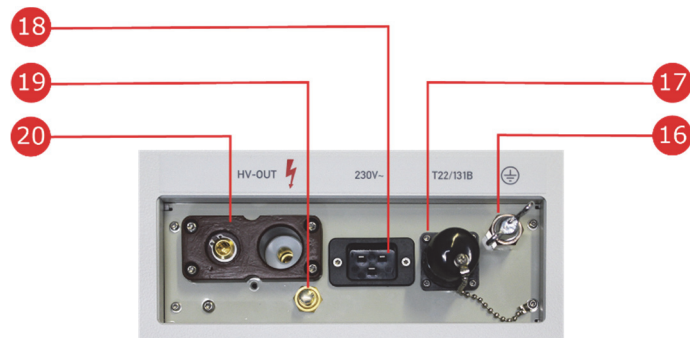
The following operating and display elements are located on the front panel of the T 22/13 B:



Element	Description
1	Adjustment of regulating transformer
2	Adjustment of spark gap
3	Voltmeter 0...20 kV
4	Switch for voltmeter, measuring range 5 kV / 20 kV
5	Ammeter 0...30 A
6	Switch for ammeter, measuring range 0,3 A / 30 A
7	Switch for clocking
8	"HV On" indicator lamp
9	"HV On" button
10	Mains control lamp
11	Mains switch
12	Control fuse Si3 T1A
13	Main fuse Si2 F20A
14	Main fuse Si3 F20A
15	Indicator lamp for malfunctions

2.4 Connection elements

The following connection and fuse elements are located on the back of the T 22/13 B:



Element	Description
16	Terminal for protective ground
17	--- not in use anymore --- (short circuit plug has to be plugged in at all times)
18	Mains socket
19	Safety switch (shutdown when HV plug is removed)
20	HV socket

3

Commissioning



WARNING

General safety instructions for set-up and commissioning

- The safety guidelines for the operation of mobile testing systems often differ from one network operator to another and are frequently subject to national regulations (such as the German BGI 5191). Before the measurement session, find out what the applicable guidelines are and follow the rules set out therein precisely, in respect of the organisation of work and the commissioning of the mobile test system.
- Select a location that is sufficient for the weight and size of the system and which ensures that it stands securely.
- When setting up or connecting the device, make sure that it does not impair the functional capability of any other systems or components. If other systems and components have to be modified, be sure to reverse these measures once the work has been completed. Always take the special requirements of these systems and components into account and only carry out work on them after consulting and obtaining approval from whoever is in charge of them.
- In the event of large differences in temperature between the storage and installation locations (cold to warm) condensation may form on components carrying high voltage (condensation effect). To avoid any risk of damage to people and devices caused by voltage flashovers, the system must not be operated when in this condition. It should rather be left in the new environment to acclimatise for approximately one hour before putting it into operation.

3.1 Electrical connection



This section describes exclusively the electrical connection of a stand-alone device.

When installed in a test van, the device is already permanently connected to the mains supply, the grounding system and the HV path of the test van. Detailed instructions on how to connect the test van electrically can be found in the accompanying user guide.

When using the stand-alone device in combination with other devices (such as an energy separation filter or a reflectometer), the connection details can be found in the enclosed documentation or requested from the sales partner.

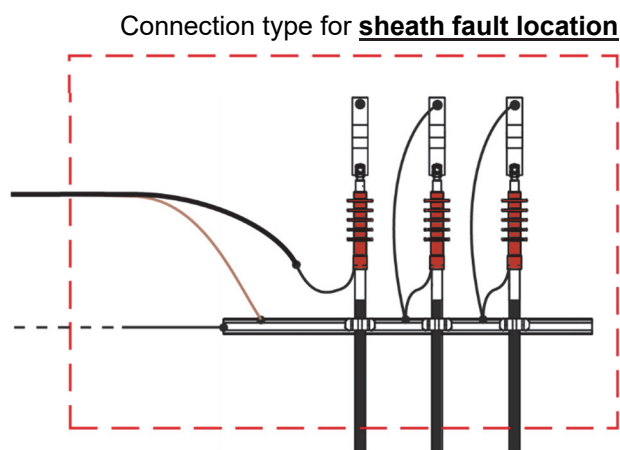
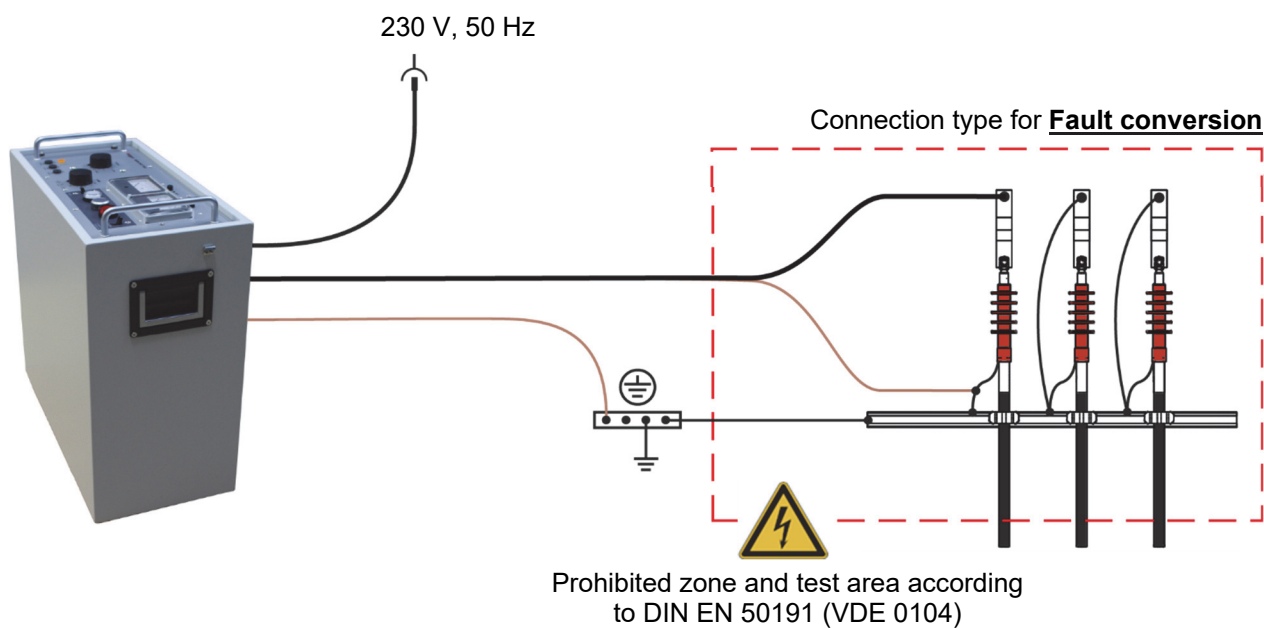


WARNING

Safety instructions for the electrical connection

- The system may only be connected to **de-energized** equipment. The general safety instructions and, in particular, the five safety rules (see page 7) must always be followed prior to connection to the test object.
- Follow the specified connection sequence.
- All the cables at the measuring point that are out of operation and are not to be tested must be shorted and earthed.
- Because the amount of voltage applied to the test object poses a danger in the event of contact, the prohibition zone around live parts as defined in DIN EN 50191 (VDE 0104) must be cordoned off in a way that it cannot be breached.
- The ends of the cables must be shielded to ensure that contact is not possible. When doing so, be sure to take all branches of the cables into account.
- The device should never be operated without the earthing cable being connected. The earthing cable establishes the connection between the device and protective earth and ensures that the device is touch-proof. Earthing provided through the earth contact of the mains connection is not sufficient. An earthing tester can be used to check the protective earthing. Unless reliable earthing can be guaranteed, the entire measurement setup must be considered live. In this case, follow the instructions of the sections related to live working in EN 50110-1. When working under these operating conditions, insulating protective gloves of class 1 (or higher) according to EN 60903 have to be worn!

Connection diagram The following figure shows the simplified connection diagram:



Procedure To connect the T 22/13 B to the test object, proceed as follows:

Step	Action	
1	Connect the device's protective earth connection 16 to a suitable point on the protective earth system (station earth or other suitable foundation earth electrodes).	
2	Insert the supplied earth probe into the ground as close as possible to the device and connect the earth probe to the auxiliary earth connection via the red reference earth cable 20 .	
3	If you want to perform a <u>fault conversion</u> on a phase-shield-fault, ...	If you want to perform a <u>sheath fault location</u> , ...
	... connect the shield of the HV connection cable to the earthed shield of the test object (system earth). Connect the internal conductor of the HV connection cable to the phase conductor of the test object.	... connect the shield of the HV connection cable to the earth rail of the cable system to be tested (system earth). Connect the internal conductor of the HV connection cable to the shield of the test object. The earthing of the shield must be removed at both ends of the cable.
4	Connect the supplied power cord to the device's power receptacle 18 and to a power socket.	

4 Performing measurements

Prepare devices involved If the T 22/13 B is operated in combination with other devices or as part of a test van, it has to be ensured before starting the measurement that the necessary safety requirements are met and that all devices involved are set to the correct operating mode.


If the conversion of the fault resistance is to be followed live on a TDR, first there must be a reference image recorded with it, then the recording of the fault trace must be started.




Detailed information on how to proceed can be found in the user guides of the involved devices or the test van.

4.1 Conversion of fault resistance (Burning)


Procedure To conduct a conversion of the fault resistance perform the following steps:

Step	Action
1	Turn mains switch 11 on. Result: Green mains control lamp 10 is on.
2	Turn regulating transformer 1 and spark gap 2 as far anticlockwise as it will go.
3	At the start, the switch for ammeter 6 may be set to 0,3 A in order to be able to better perceive the onset of the burning process. When opening the spark gap (see step 8), at the latest, the switch for ammeter must be set to 30 A, as the output current of the Burn Unit is not displayed in the 0.3 range with an open spark gap.
4	Press the "HV On" button 9 . Result: The indicator lamp "HV On" 8 is on.
5	Increase the voltage by slowly turning the regulating transformer 1 clockwise, while observing the voltmeter 3 . <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p>CAUTION When burning on low-voltage cables, the voltmeters has to be observed particularly closely. Under certain conditions, the change of the fault can lead to a ramp-up of the voltage. This could result in values that exceed the maximum permissible cable voltage. In this case, a shutdown should be carried out immediately via the mains switch 11. As the T 22/13 B 15 kV Burn Unit is equipped with a peak voltmeter, even transient voltage peaks are displayed so that risks to the cable can be avoided.</p> </div>
6	Increase the voltage until a voltage flashover occurs at the fault position. Result: At the moment of the flashover, the output current increases abruptly while the displayed output voltage decreases visibly.

Step	Action
7	<p data-bbox="528 284 1431 315">Wait until the cable fault is burned down and no significant voltage is visible.</p> <div data-bbox="528 365 1449 512" style="border: 1px solid black; padding: 5px;">  <p data-bbox="683 389 1342 488">CAUTION Premature opening of the spark gap can lead to excess voltages (doubling of voltage by travelling waves).</p> </div>
8	<p data-bbox="528 571 1431 638">Slowly open the spark gap 2 until continuous flashovers (100 Hz rate) can be heard.</p> <p data-bbox="528 651 1374 683">Now, at the latest, the switch for the ammeter 6 has to be set to 30 A.</p>
9	<p data-bbox="528 701 1441 768">As soon as the displayed current value no longer increases, stop the burning process by turning 1 and 2 as far anticlockwise as possible.</p>
10	<p data-bbox="528 788 1066 819">Switch of the device via the mains switch 11.</p> <p data-bbox="528 842 1222 873">Result: The measuring circuit is automatically discharged.</p>


4.2 Perform sheath fault location

Procedure To locate a sheath fault, proceed as follows:

Step	Action
1	Turn mains switch 11 on. Result: Green mains control lamp 10 is on.
2	Turn regulating transformer 1 and spark gap 2 as far anticlockwise as it will go.
3	Ensure, that the switch 7 is not set on clocking.
4	Set the switch for ammeter 6 to 0,3 A.
5	Press the "HV On" button 9 . Result: The indicator lamp "HV On" 8 is on.
6	Increase the voltage to the admissible value or until sufficient current flows by slowly turning the regulating transformer 1 clockwise.
7	Set the switch 7 to clocking.
8	Locate the sheath fault using an earth fault locator (e.g. ESG NT2). <hr/> <hr/>  Detailed instructions on how to operate the earth fault locator can be found in the corresponding user guide. <hr/> <hr/>
9	Switch of the device via the mains switch 11 . Result: The measuring circuit is automatically discharged.

5 Disconnecting the device from the test object

When disconnecting the test system, proceed in reverse sequence to the order in which the connection (see page 15) was made. The following safety instructions must be strictly adhered to.

	<p>WARNING</p> <p>Danger of electric shock</p> <ul style="list-style-type: none">• Follow the five safety rules (see page 7).• Even if switched off properly and discharged using the discharge device, the system components that were under voltage should only be touched once they have been discharged using a suitable discharge rod as well as having been earthed and short-circuited.• Only undo the earthing and short-circuiting measures when the test object is to be operated again.
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6 Troubleshooting

Behaviour in the event of malfunctions of normal device functions If problems occur, they may be diagnosed and corrected using the following table:

Problem	Possible cause / remedy
Device does not turn on.	Check the three fuses 12, 13 and 14 and, if necessary, replace with suitable replacement fuses.
High Voltage cannot be switched on and the indicator lamp 15 signals a fault.	<p>Check, if...</p> <ul style="list-style-type: none"> the short-circuit plug is plugged into the socket 17, the HV connection cable is completely plugged and locked into the HV socket 20 and the operational earth (shield of the HV connection cable) is properly connected. <p>If this doesn't help another try can be made after approx. 30 minutes.</p>
When burning with high currents, the device switches off after some time or indicates a malfunction via the indication lamp 15.	Take a cooling break of approx. 30 minutes.

Behaviour in the event of continuous faults In the event of damage, irregularity or faults that cannot be rectified using the instructions in this user guide, the system/device must be immediately taken out of service and marked accordingly. Please contact the Megger service immediately to correct the problem. The system/device must not be put back into service until the fault has been rectified.

7 Storage, cleaning and maintenance

Storage If the system is not used for a long period of time, it should be stored in a dust-free and dry environment. Persistent humidity, especially in combination with dust, can reduce critical insulation gaps that are essential for safe high-voltage operation.

Cleaning The housing surfaces and controls should be cleaned with a mild cleaning agent. Naphtha, acetone, lyes or similar agents must not be used under any circumstances, as they damage the housing surfaces.

Repair and maintenance Repair and maintenance work has to be carried out by Megger or authorised service partners using original spare parts only. Megger recommends having the system tested and maintained at a Megger service centre once every two years.

Megger also offers its customers on-site service. Please contact your service centre if needed.

The connections and connection cables of the system must be regularly checked for integrity and the absence of damage in accordance with the applicable national and company agreements.

