User Guide

BIFRÖST

High Voltage Measuring Bridge

Issue: E (05/2026) - EN
Item number: 88710

EN
ENGLISH

[This page was intentionally left blank.]

Table of contents

1 General notes, warnings and safety instructions

1.1 General Notes

Safety precautions

This manual contains basic information about commissioning and operating the device/system. Therefore, it must be ensured that this manual is accessible to authorised and trained operating personnel at all times. The operating personnel must read the manual carefully. The manufacturer will not accept liability for any damage to persons or materials caused by a failure to observe the safety instructions contained in this manual.

National standards and regulations must be observed.

Working with products from Megger

The generally valid electrical regulations of the country in which the device is installed and operated, as well as the existing national regulations for accident prevention and any internal regulations (work, operating, and safety regulations) of the operator must be observed.

After working on the system, it must be disconnected from the power supply and secured against being switched on again, discharged, earthed, and short-circuited.

Original accessories are used for system safety and functional reliability. The use of other parts is not permitted and leads to the loss of warranty.

Operating personnel

The system must only be commissioned and operated by authorised, qualified electricians. Under DIN VDE 0104 (EN 50191), DIN VDE 0105 (EN 50110) and accident prevention regulations, the term 'qualified electrician' refers to persons who are able to identify hazards based on their knowledge, experience, and knowledge of the relevant regulations.

Other persons must be kept away.

Intended use

The safety of the supplied system is only guaranteed if it is used as intended. Improper use can result in hazards for the operator, for the system, and for associated systems.

The limits specified in the technical data must not be exceeded under any circumstances.

Reasonably foreseeable misuse

Every use of the delivered device beyond the application limits described in this manual is rated as misuse.

The BIFRÖST is not suitable for depositing and transporting objects.

Declaration of Conformity (CE)

The product meets the following security requirements of the European Council Directives:

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

1.2 General safety instructions and warnings

Behaviour in the event of faults during normal operation

The system must only be operated if it is in perfect technical condition. In the event of damage, irregularity, or faults that cannot be rectified using the instructions in the operating manual, the system must be immediately shut down and marked accordingly. In this case, notify the relevant supervisor. Please contact the Megger service immediately to rectify the fault. The system must not be put back into operation until the fault has been rectified.

Five safety rules

These five safety rules must be consistently applied when working on the electrical connection between the measuring system and the test specimen.

1. Disconnect from the power supply
2. Secure it against being switched back on
3. Test to ensure that it has been disconnected
4. Earth and short-circuit the system
5. Cover or cordon off adjacent live components

WARNING

Danger from loose fitting clothing and loose hair

Make sure you only wear tight-fitting clothing and tied-back hair in the proximity of cable trolleys or motorised cable drums. Avoid wearing clothing with cords, scarves and jewellery which can become entangled.

Persons with pacemakers/defibrillators

Persons with pacemakers/defibrillators may be at risk in the vicinity of the device as a result of the physical processes in the high-voltage system.

Fire fighting in the vicinity of electrical equipment

- Correct extinguishing agent: **Carbon dioxide (CO2)**.
- Carbon dioxide is electrically non-conductive and leaves no residue. It is safe to use on live systems but the appropriate safety distances must be observed. A CO2 fire extinguisher should therefore always be available near the electrical system.
- Improper use of other extinguishing agents may damage the electrical system, for which Megger cannot accept any liability. Furthermore, if a powder extinguisher is used near high-voltage equipment, there is a risk of voltage being transferred to the person using the fire extinguisher (due to the powder mist).
- Please always observe the hazard warnings on fire extinguishers.
- DIN VDE 0132 applies.

WARNING

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 BIFRÖST generates a dangerous voltage of up to 20 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
- Never fail to use safety equipment or put it out of operation.
- Operation requires minimum two people 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.

Wear ear protection

Surge operation can cause high and sudden noise levels. It is strongly recommended to wear hearing protection during surge operation. Keep in mind that this will limit the operator's awareness for ambient dangers.

Due to the increased formation of ozone, sufficient fresh air must be supplied to the operating room during operation.

Behaviour in the event of electrical accidents

In case of high voltage: Make an emergency call, rescue measures are only to be done by trained specialists!

In the event of electrical accidents, proceed as follows:

1. Disconnect the power supply!
2. Make an emergency call and inform the emergency call centre that there has been an electrical accident.
3. If the injured person is conscious:
   - Talk with the injured person.
   - Cover the burn with a sterile dressing.
4. If the injured person is unconscious, check the person's breathing:
   - If the injured person is breathing, place him or her in the recovery position and check breathing frequently until emergency services arrive.
   - If the injured person is not breathing, begin with CPR.

Always see a doctor after an electrical accident, even if you don't have visible injuries or symptoms!

1.3 Signal words and symbols used

The following signal words and symbols are used in this operating instructions and also on the product itself:

Signal word/symbol	Description
DANGER	Indicates a potential hazard that will result in death or serious injury if not avoided.
WARNING	Indicates a potential hazard that may result in death or serious injury if not avoided.
CAUTION	Indicates a potential hazard that may result in moderate or minor injuries if not avoided.
NOTE	Indicates a potential hazard that may result in property damage if not avoided.
	Used to highlight warning and safety instructions in the operating instructions. When present as a sticker on the product, it identifies sources of danger that require the user to read the operating instructions to ensure safe handling.
	Used to highlight warning and safety instructions that explicitly indicate danger of electric shock.
	Used to highlight important information and useful tips for operating the product. Failure to observe may result in unusable measurement results.
	Indicates further information in other operating instructions.

2 Technical description

2.1 System description

Intended use

Due to its high measurement resolution and accuracy, the high voltage measuring bridge is supposed to be used to pre-locate faults of the primary insulation, that are difficult or impossible to locate using other methods like pulse reflection measurements. Typical examples are high-resistive conductor faults in paper insulated (PILC) cables, faults in very long cables (long fault distance) and faults in cross-bonded cable systems.

Furthermore, the system permits in the easiest way the testing of cable sheaths and pre-location and pinpointing of cable sheath faults.

Functional description

To test the integrity of the inner cable insulation or the sheath, the high voltage bridge works in test mode with a voltage of up to 20 kV (negative polarity).

The pre-location of a detected fault takes place using the voltage drop method, in which the current, voltage and resistance before and after the fault location are determined and considered in relation to the cable length. The necessary measuring and calculation steps take place automatically and, after a few seconds, the distance to the fault is displayed. Due to the bipolar measurement, falsifying thermoelectric and galvanic influences can be detected and mathematically eliminated.

The available current of up to 850 mA also enables the "burning" of difficult sheath faults, if necessary.

With its easy-to-read 10 inch display, the device simultaneously forms the central control unit of the system and enables intuitive and fast selection and configuration of the operating modes.

A well-established integrated safety system ensures the safety of the operator by continuously monitoring the earthing and temperature conditions during operation.

The BIFRÖST comes with the following features:

- Dedicated DC test and breakdown detection up to 20 kV
- Dedicated Insulation test up to 20 kV
- Sheath test up to 20 kV
- Sheath Pinpointing up to 20 kV
- Conversion of faults by burning with up to 850 mA
- HVB BIFRÖST with up to 20 kV
- Integrated discharge unit
- Easy and comfortable operation via rotary encoder and touch screen

2.2 Technical data

The BIFRÖST is defined by the following parameters:

Parameter	Value
Insulation Test	
Measuring voltage	1 V ... 20 kV
Measuring voltage ranges	5 kV, 10 kV, 15 kV, 20 kV
Resistance measuring range	100 ... 650 MΩ
DC Test	
Output voltage	1 ... 20 kV ±1.5% (adjustable in steps of 0.1 kV)
Output voltage ranges	5 kV, 10 kV, 20 kV
Leakage current measurement	0 ... 850 mA ±2%
Sheath Test	
Output voltage	1 ... 20 kV ±1.5% (adjustable in steps of 0.1 kV)
Output voltage ranges	5 kV, 10 kV, 20 kV
HVB BIFRÖST	
Output voltage	0 … 20 kV ±1.5%
Output voltage range	5 kV, 10 kV, 20 kV
Accuracy	±1%
Sheath Pinpointing	
Output voltage	1 ... 20 kV ±1.5% (adjustable in steps of 0.1 kV)
Output voltage ranges	5 kV, 10 kV, 20 kV

Parameter	Value
Pinpointing current limits	50 ... 850 mA (in 5 kV range) 50 ... 400 mA (in 10 kV range) 5 ... 200 mA (in 20 kV range)
Pulse mode	Interval / Continuous
Repetition rate (for pulse mode Interval)	0.5 : 1; 1 : 3; 1 : 4; 1 : 6
Burning	
Output voltage ranges	5 kV, 10 kV, 20 kV
Burning current limits	50 ... 850 mA (in 5 kV range) 50 ... 400 mA (in 10 kV range) 5 ... 200 mA (in 20 kV range)
Safety	FΩ protection device Temperature monitoring Lockout-tagout device key for high voltage locking Discharge unit up to 150 kJ
Input voltage range	110 … 230 VAC ±10%, 50 / 60 Hz
Power consumption	2.5 kVA
Display	10.1" colour TFT WXGA 1280x800, capacitive touch screen, 1000 cd/m2, LED-backlight
Memory	4 GB mSATA for program and data
Interfaces	1 x USB 2.0
Operating temperature	-20 °C ... +55 °C
Storage temperature	-40 °C ... +70 °C
Relative humidity	93% at 30 °C (non-condensing)
Dimensions (W x H x D)	74 cm x 103 cm x 65 cm (with folded in handle)
Weight	90 kg
Protection class (in accordance with IEC 61140 (DIN VDE 0140-1))	I
Ingress protection rating (in accordance with IEC 60529 (DIN VDE 0470-1))	IP43

2.3 Scope of delivery and optional accessories

The scope of delivery includes the following components

Component	Description	Qty	Item number
High voltage bridge BIFRÖST		1	1015364
Mains supply cable	Varies by region:	1	
	EU (Europe): 230 V AC, Type F plug (Schuko), 3 m		90028780
	UK (United Kingdom): 220 V AC, Type G plug, 3 m		90034588
	US (North America): 120 V AC, ANSI NEMA 5 plug, 2.5 m		90034589
	O (Do it yourself): Open end, no plug attached, 3 m		90034997
Cable connection components	To establish the connection to the test object		
	Kelvin clamp HV1/M1, Bifröst	1	2018438
	Kelvin clamp HV2/M2, Bifröst	1	2018654
	ADPT Axi-BE, BE-Adapter (BIFRÖST)	4	2016466
	HKZ T9-BE, Crocodile clamp black	4	2013147
Standardized connection cable sets upon factory request	Consists of options for different connection cable set-ups, jumper cable set-ups, cable trolleys and cable drums	Factory request	Factory request
Lockout-tagout device key		1	2012515
Manual		1	88710

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.

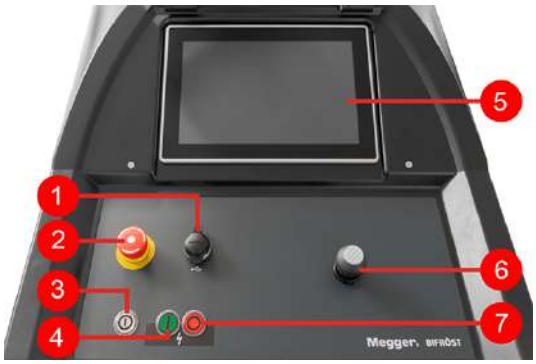
Optional accessories

If the following optional accessories are not included in the scope of delivery, they can be ordered through Sales:

Accessory	Description	Item number
External safety device	For indicating the operating state and for emergency shutdown or locking the high voltage (in accordance with EN 50191)	2012574
Jumper cable connection components[1]	To connect the jumper cable at the far end to the test object	
	HV clamp JC, Bifröst	2018439
	ADPT Axi-BE, BE-Adapter (BIFRÖST)	2016466
	HKZ T9-BE, Crocodile clamp black	2013147

2.4 Display and operating elements

The following operating and display elements are located on the front panel of the BIFRÖST:



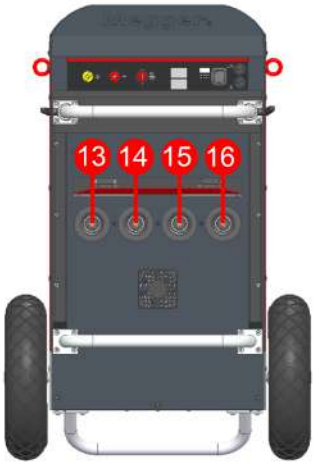
Element	Description
1	USB-port
2	Emergency stop switch
3	ON/OFF button
4	"HV ON" button
5	Display
6	Rotary encoder with tilt function
7	"HV OFF" button

[1]The jumper cable itself is a project-specific part number. To connect one jumper cable to the test objects, 2 of each connection components are needed.

2.5 Connection elements

The following connection and fuse elements are located on the back of the BIFRÖST:

Element	Description
8	Protective earth connection
9	F-U - not applicable
10	Socket for connecting the lockout-tagout device key or the external safety device
11	Mains socket
12	Fuses (2 x T16 A)



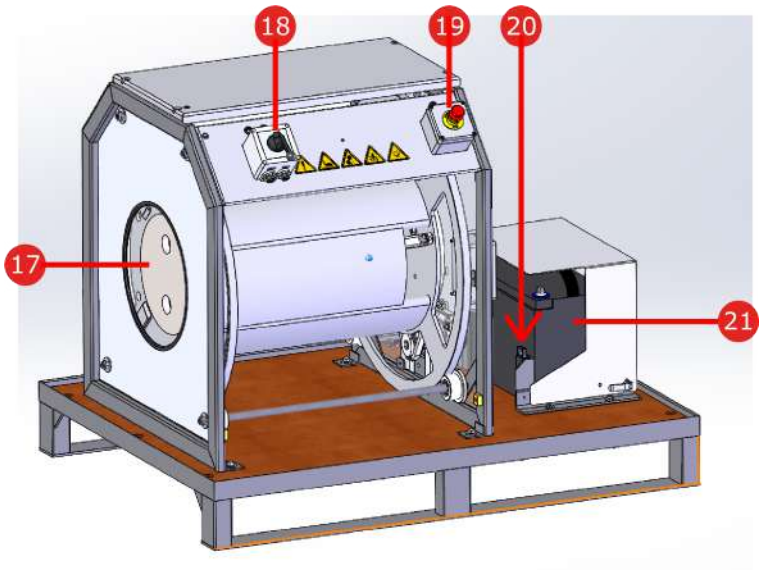
Element	Description
13	HV 1 socket
14	HV 2 socket
15	M 1 socket
16	M 2 socket

2.6 Cable elements

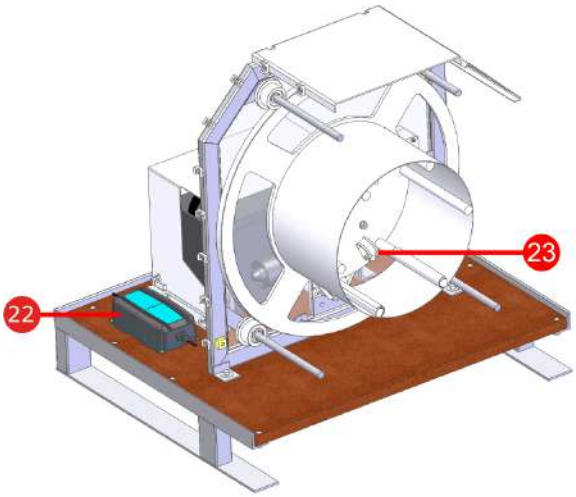
Motorised cable drum set-up

Although the jumper cable is handled in the same way at converter stations, the transportation, storage, maintenance and winding/unwinding procedures differ when using the motorised cable drum.

[This part is only applicable when using a motorised cable drum.]



Number	Description
17	Detachable lid with storage space for the short inner end of the jumper cable. The cable end must always be properly stowed in the drum body before the jumper cable can be unwound or wound.
18	 Motor control switch ↑ Cable winding ↓ Cable unwinding
19	EMERGENCY-OFF
20	Fuse
21	Rechargeable battery



Number	Description
22	Battery Charger
23	Bracket for attaching the jumper cable

Connection cable sets

The connection cable sets used are varying, depending on the factory request upon purchase.

All connection sets have in common the bayonet locks to connect to the cables of the BIFRÖST, as well as clamps to establish the connection to the cables to be tested.

HV-connection set:

For the HV-connection set, the screen (grey) is separated from the HV connection (black).

HV adapter of the HV-connection set.

Screen connection set:

Earthing clamp of the screen-connection set

Screen adapter of the screen-connection set

HV-clamp and Kelvin-clamp

The clamps of the HV-clamp and Kelvin-clamp are adjustable for cables with a diameter of up to 75 mm.

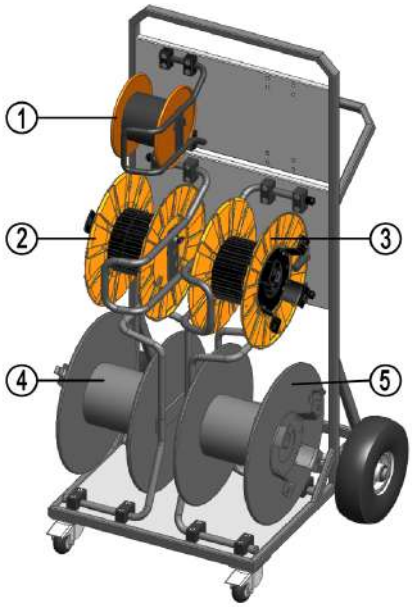
HV-clamp for establishing the connection of the jumper cable to the cable to be tested.

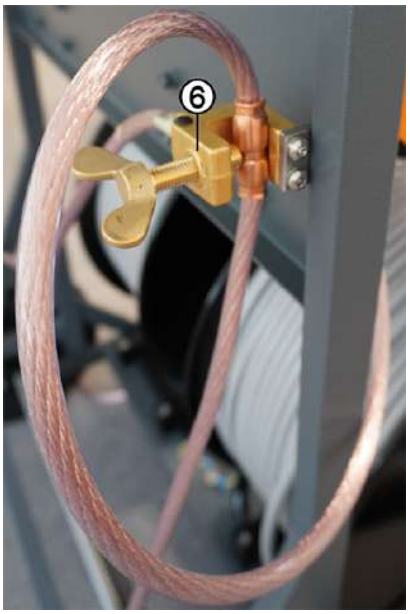
Kelvin-clamp for establishing the connection of the BIFRÖSTjumper cable to the cables to be tested.

2.7 Cable trolley elements

Elements of the cable trolley

The cable trolley stores all cables needed to connect the BIFRÖST with the test objects. The figures below are used as exemplary representation, the actual trolley purchased may vary:





Number	Description
1	Earth cable
2	M 1 plug
3	HV 1 plug
4	M 2 plug
5	HV 2 plug
6	Connecting clamp

2.8 Safety devices

FΩ monitoring

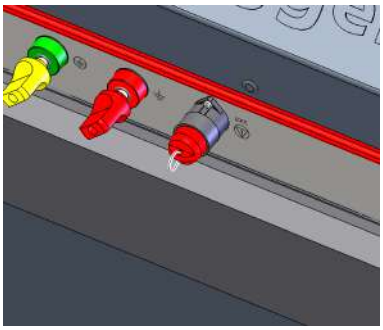
In order to ensure sufficient earthing, the resistance between the operating and protective earth is continuously monitored during operation (FΩ monitoring). This must not exceed 6 Ω.

If the protective device detects that the specified limit values have been exceeded, any high-voltage operation is immediately interrupted automatically and the test object is discharged via a discharge unit. It is only possible to switch on the high voltage again after the earthing conditions have been improved and the measured values are within the tolerance levels.

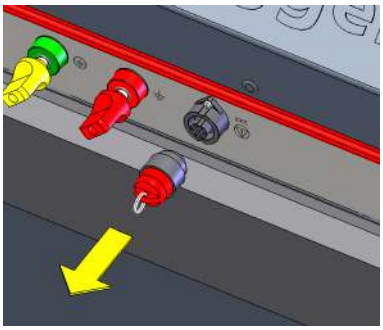
Lockout-tagout device key

For reasons of liability, it must be ensured that measuring devices that emit a hazardous voltage are secured against unauthorised access. For the BIFRÖST, this is done by means of the lockout-tagout device key, which must be screwed onto the socket 10 at the rear of the device in order to activate high voltage.

In the event that the device must be left unsupervised for a period of time, this key must be removed and carried by the person responsible for the device.



High voltage preparation possible



High voltage preparation locked

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.
- The device may only be operated in upright position!
- 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 flash-overs, 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

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 "General safety instructions and warnings" on 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 national regulations (e.g. DIN EN 50191 (VDE 0104)) must be protected 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 earth lead being connected. The earth lead 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 or an earth spike 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 according to national standards, e.g. in EN 50110-1. When working under these operating conditions, insulating protective gloves of class 1 (or higher) according to EN 60903 must be worn!
- To keep people away from the device and its connection cables, secure the immediate vicinity in accordance with local regulations using barriers and warning signs.

3.2 Connecting the cables

Regulations for establishing the connection between the DC cables may vary due to national regulations and internal company directives (work, operating and safety regulations). These regulations have to be observed.

For safe and correct use of additional devices needed to connect the jumper cable to the DC cables, follow the instructions of the associated manuals.

Securing the cable ends for storage, transport and winding / unwinding

Proceed as follows to secure the ends of cables using the jumper cables as example:

1. At one end of the jumper cable, plug the socket of the HV end into the plug of the associated screen end.
2. At the other end of the jumper cable, plug the socket of the HV end into the plug of the associated screen end.

3.2.1 Connecting the BIFRÖST

CAUTION

Risk of electric shock

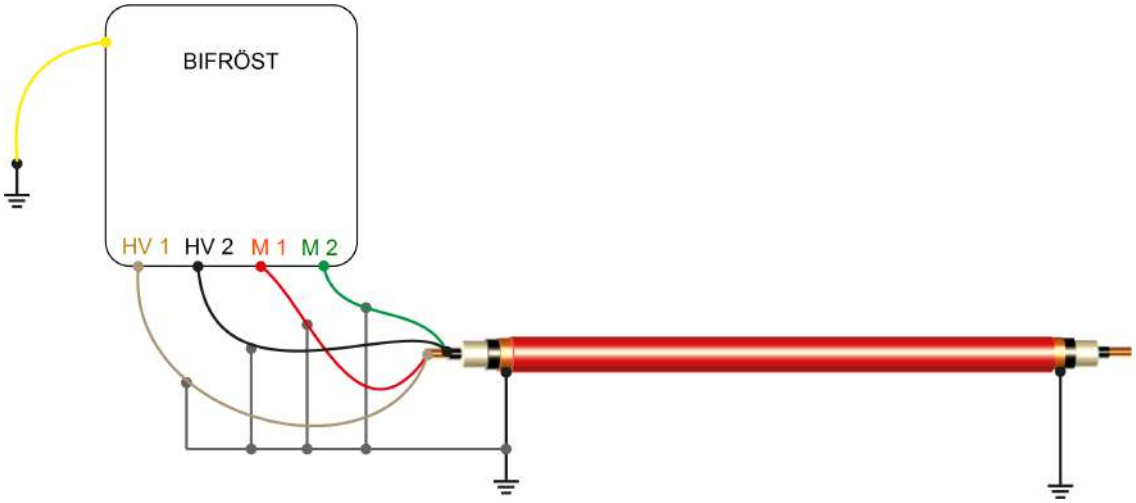
The guidelines for implementation of occupational safety when operating a test system often differ between one network operator and another and it is not uncommon for national regulations (like, i.e. the German BGI 5191) to be used as well. Inform yourself of the guidelines applicable in the area of operation beforehand, and comply with the specified rules for work organization and for implementing the test system.

To keep people away from the test system and its connection cables, secure the immediate vicinity of the test system (the safety area) in accordance with local regulations using barriers and warning signs.

3.2.1.1 Identifying and burning of faulty cables

This connection method can be used for identifying faulty cables using the insulation or DC test or for trying to burn high impedance faults to low impedance.

The BIFRÖST is connected as follows:



The far end must be open.

The cables necessary to connect the BIFRÖST with the test object are stored on a cable trolley.

Establishing the connection between BIFRÖST and the test object

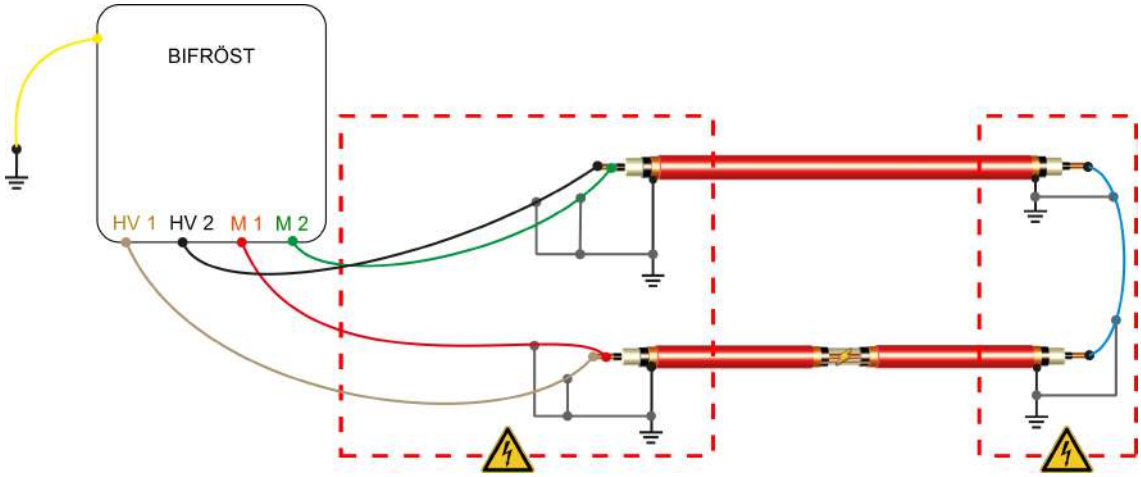
In the following step-by-step instructions, the elements of the cable trolley are marked with black and white numbers, and the elements of the BIFRÖST are marked with red and white numbers. Proceed as follows to connect the device:

1. Connecting the earth cable (1): Unwind the cable as far as necessary and connect it to the protective earth connection 8. Clamp one of the contact sleeves attached to the cable at intervals of a few metres under the connecting clamp (6) on the backside of the trolley.
2. Connect the screen cables to earth.
3. To connect the M 1 plug (2): Unwind the cable as far as necessary and connect it via the HV-connection-set and the screen-connection-set with the test object. Use the cable end on the outer side of the cable drum to plug it into the M 1 socket 15 of the device.
4. Repeat in order for the HV 1 plug (3) (socket 13), the M 2 plug (4) (socket 16) and the HV 2 plug (5) (socket 14).

3.2.1.2 Pre-locating / Testing on HV cables (using one auxiliary conductor)

This connection method can be used for all measurements performed on HV cables, except for the sheath test ("Sheath testing" on page 29).

Using one auxiliary conductor, the BIFRÖST is connected as follows:



The auxiliary conductor must be fault free.

The cables necessary to connect the BIFRÖST with the test object are stored on a cable trolley.

Establishing the connection between BIFRÖST and the test object

In the following step-by-step instructions, the elements of the cable trolley are marked with black and white numbers, and the elements of the BIFRÖST are marked with red and white numbers. Proceed as follows to connect the device:

1. Connecting the earth cable (1): Unwind the cable as far as necessary and connect it to the protective earth connection 8. Clamp one of the contact sleeves attached to the cable at intervals of a few metres under the connecting clamp (6) on the backside of the trolley.
2. Connect the screen cables to earth.
3. Connect the jumper cable at the far end.
4. To connect the M 1 plug (2): Unwind the cable as far as necessary and connect it via the HV-connection-set and the screen-connection-set with the test object. Use the cable end on the outer side of the cable drum to plug it into the M 1 socket 15 of the device.
5. Repeat in order for the HV 1 plug (3) (socket 13), the M 2 plug (4) (socket 16) and the HV 2 plug (5) (socket 14).

3.2.1.3 Pre-locating / Testing on MV cables (using two auxiliary conductors)

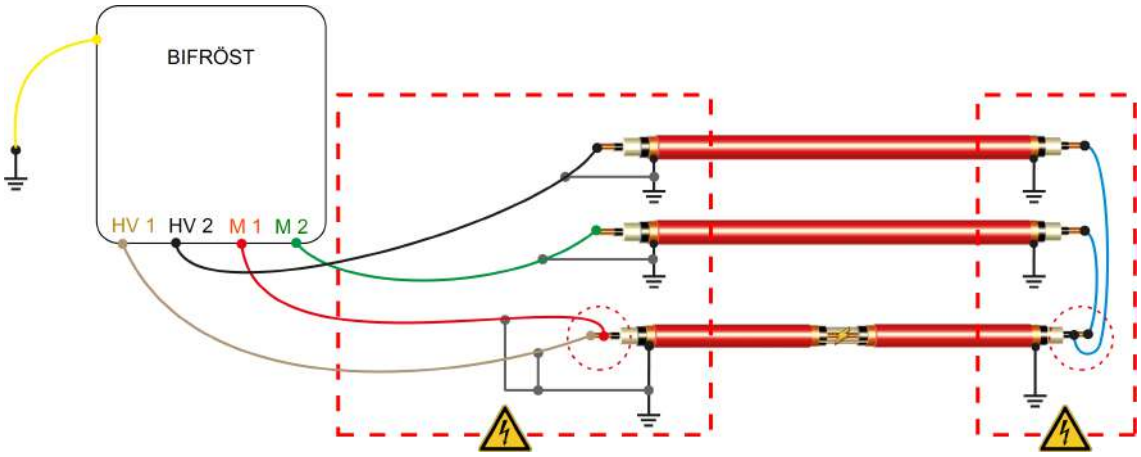
There are various connection methods for MV cables, which are used for the following cases:

- Sheath test: Used to test for an sheath fault ("Sheath testing" on page 29).
- Pre-locating / Testing the inner conductor: Used for all tests of the inner conductor ("Pre-locating / Testing the inner conductor (using two auxiliary conductors)" on the next page).

- Pre-locating a sheath test with two auxiliary conductors: Recommended method to pre-locate a sheath fault, when both auxiliary conductors are fault-free. ("Pre-locating a sheath fault (using two auxiliary conductors)" on the facing page).
- Pre-locating a sheath test with one auxiliary conductor. Recommended method to pre-locate a sheath fault, when only one auxiliary conductor is fault-free ("Pre-locating a sheath fault (using one auxiliary conductor)" on page 28).
- Pinpointing a sheath fault: Used to pinpoint a pre-located sheath fault ("Sheath testing" on page 29).

Pre-locating / Testing the inner conductor (using two auxiliary conductors)

Using two auxiliary conductors, the BIFRÖST is connected as follows:



Observe the position / order of the connecting cables, where the connection is circled in red.

The auxiliary conductors must be fault free.

The cables necessary to connect the BIFRÖST with the test object are stored on a cable trolley.

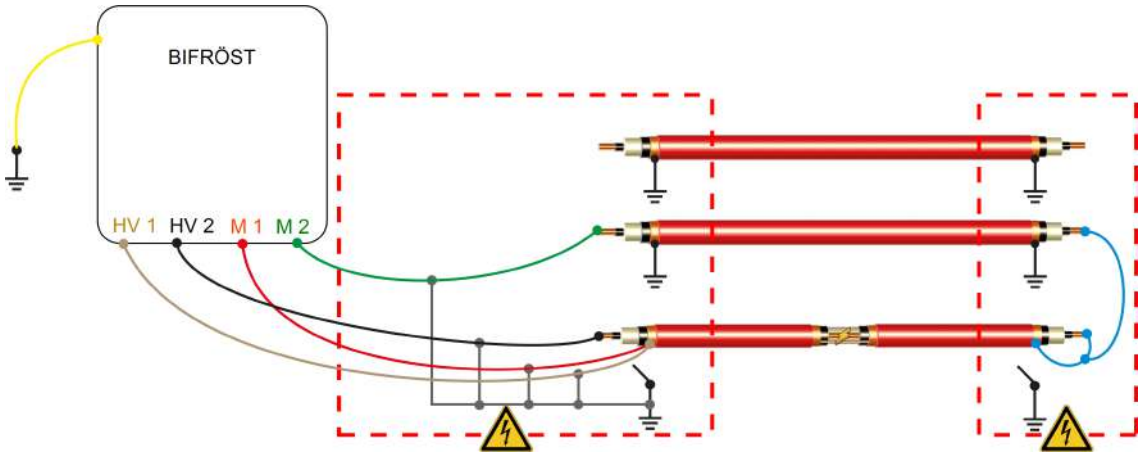
Establishing the connection between BIFRÖST and the test object

In the following step-by-step instructions, the elements of the cable trolley are marked with black and white numbers, and the elements of the BIFRÖST are marked with red and white numbers. Proceed as follows to connect the device:

1. Connecting the earth cable (1): Unwind the cable as far as necessary and connect it to the protective earth connection 8. Clamp one of the contact sleeves attached to the cable at intervals of a few metres under the connecting clamp (6) on the backside of the trolley.
2. Connect the screen cables to earth.
3. Connect the far end according to the image above.
4. To connect the M 1 plug (2): Unwind the cable as far as necessary and connect it via the HV-connection-set and the screen-connection-set with the test object. Use the cable end on the outer side of the cable drum to plug it into the M 1 socket 15 of the device.
5. Repeat in order for the HV 1 plug (3) (socket 13), the M 2 plug (4) (socket 16) and the HV 2 plug (5) (socket 14).

Pre-locating a sheath fault (using two auxiliary conductors)

Using two auxiliary conductors, the BIFRÖST is connected as follows:



The auxiliary conductor must be fault free. The screen of the cable to be pinpointed needs to be disconnected from earth. At the far end of the cable to be pinpointed, the screen and the inner conductor must be connected via jumper cable. The inner conductor of the cable connected to M 2 must also be connected to the cable to be pinpointed via jumper cable.

The cables necessary to connect the BIFRÖST with the test object are stored on a cable trolley.

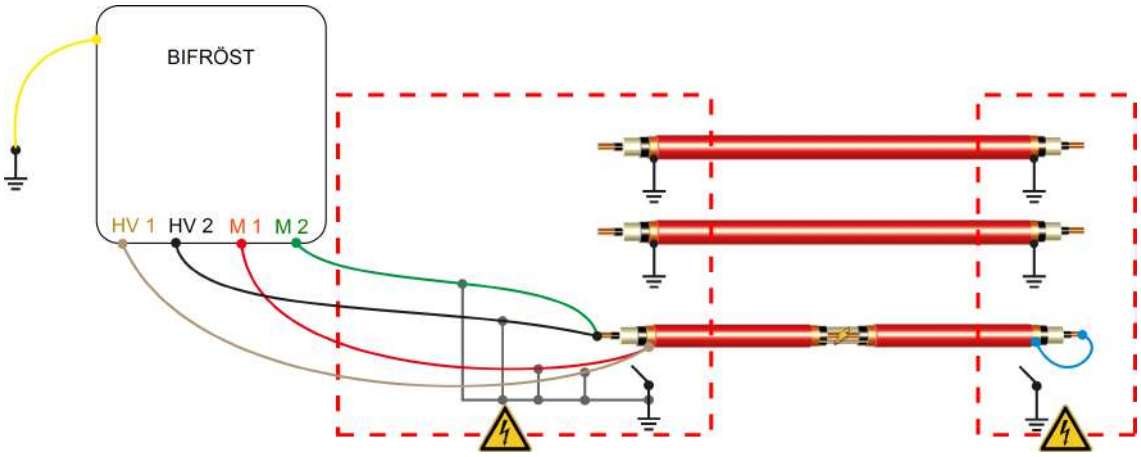
Establishing the connection between BIFRÖST and the test object

In the following step-by-step instructions, the elements of the cable trolley are marked with black and white numbers, and the elements of the BIFRÖST are marked with red and white numbers. Proceed as follows to connect the device:

1. Connecting the earth cable (1): Unwind the cable as far as necessary and connect it to the protective earth connection 8. Clamp one of the contact sleeves attached to the cable at intervals of a few metres under the connecting clamp (6) on the backside of the trolley.
2. Connect the screen cables to earth.
3. Connect the far end according to the image above.
4. To connect the M 1 plug (2): Unwind the cable as far as necessary and connect it via the HV-connection-set and the screen-connection-set with the test object. Use the cable end on the outer side of the cable drum to plug it into the M 1 socket 15 of the device.
5. Repeat in order for the HV 1 plug (3) (socket 13), the M 2 plug (4) (socket 16) and the HV 2 plug (5) (socket 14).

Pre-locating a sheath fault (using one auxiliary conductor)

Using one auxiliary conductor, the BIFRÖST is connected as follows:



The auxiliary conductor must be fault free. The screen of the cable to be pinpointed needs to be disconnected from earth. At the far end of the cable to be pinpointed, the screen and the inner conductor must be connected via jumper cable.

The cables necessary to connect the BIFRÖST with the test object are stored on a cable trolley.

Establishing the connection between BIFRÖST and the test object

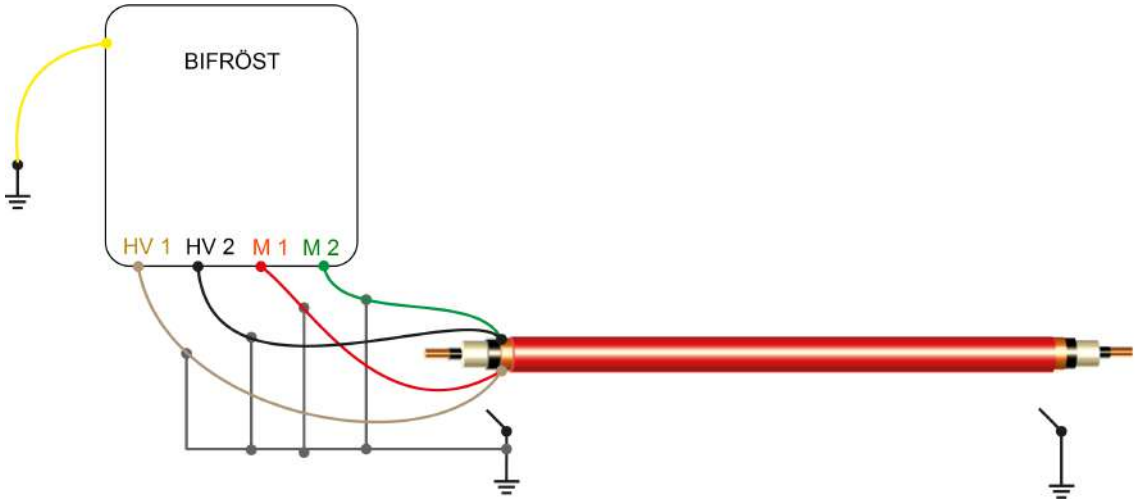
In the following step-by-step instructions, the elements of the cable trolley are marked with black and white numbers, and the elements of the BIFRÖST are marked with red and white numbers. Proceed as follows to connect the device:

1. Connecting the earth cable (1): Unwind the cable as far as necessary and connect it to the protective earth connection 8. Clamp one of the contact sleeves attached to the cable at intervals of a few metres under the connecting clamp (6) on the backside of the trolley.
2. Connect the screen cables to earth.
3. Connect the far end according to the image above.
4. To connect the M 1 plug (2): Unwind the cable as far as necessary and connect it via the HV-connection-set and the screen-connection-set with the test object. Use the cable end on the outer side of the cable drum to plug it into the M 1 socket 15 of the device.
5. Repeat in order for the HV 1 plug (3) (socket 13), the M 2 plug (4) (socket 16) and the HV 2 plug (5) (socket 14).

3.2.1.4 Sheath testing

This connection method can be used for testing cables for sheath faults and for pinpointing pre-located sheath faults.

The BIFRÖST is connected as follows:



The far end of the cable must be open. The screens of the cable need to be disconnected from earth.

The cables necessary to connect the BIFRÖST with the test object are stored on a cable trolley.

Establishing the connection between BIFRÖST and the test object

In the following step-by-step instructions, the elements of the cable trolley are marked with black and white numbers, and the elements of the BIFRÖST are marked with red and white numbers. Proceed as follows to connect the device:

1. Connecting the earth cable (1): Unwind the cable as far as necessary and connect it to the protective earth connection 8. Clamp one of the contact sleeves attached to the cable at intervals of a few metres under the connecting clamp (6) on the backside of the trolley.
2. Connect the screen cables to earth.
3. To connect the M 1 plug (2): Unwind the cable as far as necessary and connect it with the test object. Use the cable end on the outer side of the cable drum to plug it into the M 1 socket 15 of the device.
4. Repeat in order for the HV 1 plug (3) (socket 13), the M 2 plug (4) (socket 16) and the HV 2 plug (5) (socket 14).

3.2.2 Optional: Operation of the motorised cable drum

[This chapter is only applicable when using a motorised cable drum.]

CAUTION

Risk of crushing

To prevent fingers and hands becoming crushed during the motorised winding of the HV connection cable, the wearing of suitable gloves and careful handling is recommended.

Unwinding the cable drum

Proceed as follows to unwind the cable drum:

1. Ensure that the HV sockets at both ends of the jumper cable are plugged into the screen ends, and that the inner end of the cable is completely inside the drum with the lid 17 closed.
2. Set the motor control switch 18 to ↓ and unwind the cable completely.
3. Open the lid and detach the jumper cable from the bracket 23.

Rewinding the cable drum

To rewind the cable drum, proceed as follows:

1. Ensure that the HV sockets at both ends of the jumper cable are plugged into the screen ends.
2. Open the lid 17 and attach a short part of the jumper cable (approx. 0.5 m) into the drum by fastening it into the bracket 23.
3. Close the lid.
4. Set the motor control switch 18 to ↑ and wind the cable up completely.

3.2.3 Connecting the jumper cable to the test object

Proceed as follows to establish a connection:

1. Ensure that the safety rules and security regulations are observed ("General safety instructions and warnings" on page 7)
2. Unwind the cable drum completely.
   [This chapter is only applicable when using a motorised cable drum.] The cable has to be detached from the bracket 23 on the inside of the cable drum.
3. Use the HV connection components (e.g. HV-connections set, HV clamp) to connect the HV socket of the jumper cable to the first termination pole of the cable to be tested.
4. Use the screen connection components (e.g. screen-connection set) to connect the screen plug to the earthing construction on site.
5. Repeat **steps 3 and 4** in to the auxiliary line.

3.3 Use of an external safety device (optional)

Purpose

With the aid of an external safety device, the current status of the system can be made clearly visible with coloured signal lamps (in accordance with EN 50191) and the generation of HV can be interrupted or locked with an EMERGENCY OFF switch and key switch.

Connection

To be able to connect the external safety device, first unscrew the device key from the socket 10 and then connect the connection cable of the external safety device to exactly this socket. The locking function of the device key ("Safety devices" on page 19) is now taken over by the "HV interlock" key switch on the external safety device.

Description

The following figure shows the optional external safety device:

Part	Description
1	**Green signal light** Lights up when the system is switched on but is not in high voltage operation.
2	**Red signal light** Lights up as soon as high voltage can be generated. All discharge and earthing devices are open and the test object must be treated as live.
3	**"HV interlock" key switch**  High voltage unlocked  High voltage locked In the locked state, the key can be removed and the system can thus be protected against unauthorised high voltage operation
4	**EMERGENCY OFF switch**

3.4 Switch on

Switch on

Switch on the device by briefly pressing the ON/OFF button 4. The software starts within a few seconds and pauses at the main menu after starting.

Indication of possible problems

Various safety and monitoring devices are activated from the moment of switching on. Problems detected in the safety circuit or the system components are indicated immediately on the user interface and prevent the operating mode from being started or the high voltage from being enabled, depending on the severity of the problem.

In order to close the dialogue and proceed with the actual measuring operation, all signalled problems must first be solved. The status of the respective elements can be read from the colour of the status icon:

Colour	Meaning
FOhm	The conditions of this safety circuit element are met and no action is required.
FOhm	For this safety circuit element, deviations from the conditions required for operation were detected. Use the information in the table below to solve the problem.
FOhm	A problem was signalled for this safety circuit element, but it no longer exists. Thanks to this special status, the operator can still identify the element triggering the safety message even if the problem only occurred briefly.

Depending on the problem description displayed, the following actions must be taken:

System reports...	Cause / remedy
actuated emergency off switch	One of the emergency stop switches (on the device itself or on the external safety device) has been activated and must first be reset.
actuated external emergency off switch	One of the following events has occurred: ■ Neither the lockout-tagout device key nor an external safety device is connected to the socket 10. ■ The emergency stop switch of the external safety device has been activated. ■ The "HV interlock" switch on the external safety device has been locked.
FΩ monitoring: ■ earth resistance too high ■ cable shield not connected	Impermissible earth resistances or voltage peaks were measured, which indicate poor earthing conditions. It must be checked that the following connections have been made correctly and provide good earth contact: ■ Earth cable ■ Reference earth connection ■ Cable shield of the HV connection cable  **WARNING** Safety devices must not be circumvented or put out of service.
high voltage connectors not connected correctly	The connector of the HV connection cable is not fixed firmly enough into the high voltage output. The connector must engage noticeably when it is inserted.
an internal communication error	An error occurred during communication between the modules within the BIFRÖST. The system should be restarted. If the error cannot be cleared or occurs repeatedly, an authorised service centre must be informed.

3.5 High voltage control

Release high voltage

Immediately after a measurement has been prepared and started by the operator, the green illuminated "HV ON" button 8 indicates the readiness for high voltage release. By pressing the button, the earthing at the HV output is cancelled. This state means: **High Voltage!**

Switch off high voltage

If certain events occur (e.g. voltage breakdown in the test object, expiry of the defined test duration), the high voltage is automatically deactivated by the system. This also occurs if a problem has been detected in the safety circuit (see above).

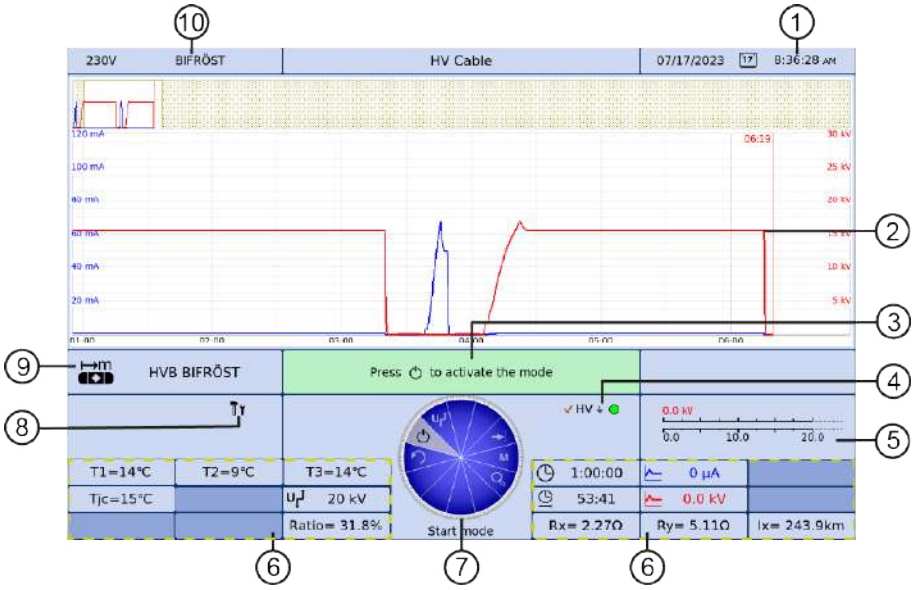
By pressing the red illuminated "HV OFF" button 7, HV operation can also be interrupted manually at any time.

The test object is discharged via the internal discharge unit both during automatic and manual shutdown.

4 Operation

4.1 Screen layout

The following figure shows the typical screen layout



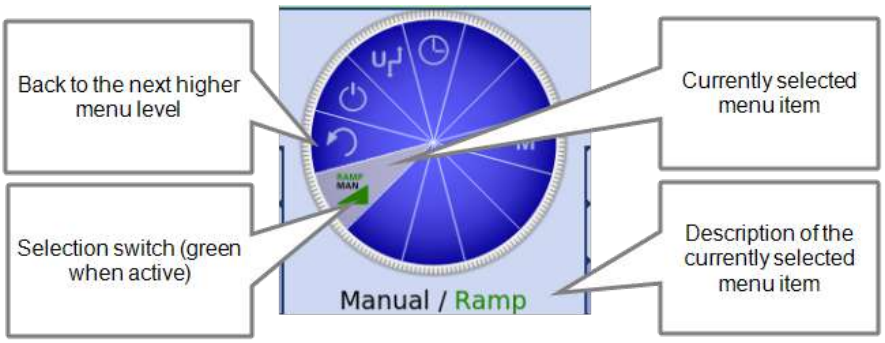
Segment	Description
1	Date and time
2	Curves of current measurement or loaded measurements. The display is split up into a general overview (top) and in an enlarged section (bottom).
3	Current status messages and information on the next step required in the test sequence.
4	Information on the states of the high voltage outputs. The symbols indicate the following states: ⏚ — High voltage generation is switched off and the HV output on the BIFRÖST is discharged and connected to earth through a resistor. ● — The resistor discharge is not effective. High voltage is active!
5	Voltage display bar graph Blue bar — Set value Red bar — Actual value

Segment	Description
6	The display elements arranged in the lower area of the screen may contain the following information: ■ Set measurement parameters ■ Current measurement values, which are continuously updated as the measurement progresses ■ Legend of traces currently shown in display ("History database" on page 39) Information (such as, e.g. measurement values) which apply for a particular trace only, is shown in the respective colour.
7	Selection menu ("Basics of control system" on the facing page)
8	Current system state — The system is currently in standby.  The user operating the system has successfully logged into the administration menu ("Administration menu (administration password required)" on page 48) and identified the user as administrator.
9	Current operating mode
10	Current input voltage

4.2 Basics of control system

Selection menu

Navigation within the menus is effected almost entirely from the circular selection menu:



Operation via rotary encoder

The system can be operated using the rotary encoder 6 as follows:

Rotating the encoder:

- Select the required menu item
- Increase or decrease the value of a variable parameter
- Select an option from a selection list

Pressing the encoder down:

- Call up the selected menu item
- Confirm the setting or the selection made

Tilting the encoder upwards:

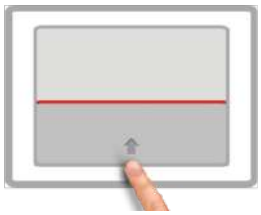
- History database ("History database" on page 39) 

Operation via touchscreen

As the device is equipped with a touch-sensitive display, the software can also be operated just by using your fingers.

Briefly tapping on the buttons in the various menus, and tapping and holding the buttons in isolated cases, allows the respective functions to be activated in the same way as the rotary encoder control.

The history database can also be opened with a swiping motion:



Whenever character strings need to be entered or changed, an on-screen keyboard appears at the lower edge of the display:

Dialog boxes

A few settings, which require values to be entered, are not made directly using the selection menu, but rather in a separate dialogue box.

By tilting the rotary encoder 6 to the side the user can switch back and forth between the individual buttons in a dialogue box. Each active button is then highlighted in white or it is surrounded by a red frame. Whenever the selected button requires letters or digits to be entered the screen keyboard automatically appears, and it can then be used to make the entries.

To close a dialogue box, the corresponding button must be selected and then the rotary encoder pressed.

4.3 History database

Purpose

Each conducted measurement is temporarily stored in the history database and it can be retrieved from there again. This enables the user to access old traces and to compare them with the current traces. The parameters under which the measurement was conducted are also shown.

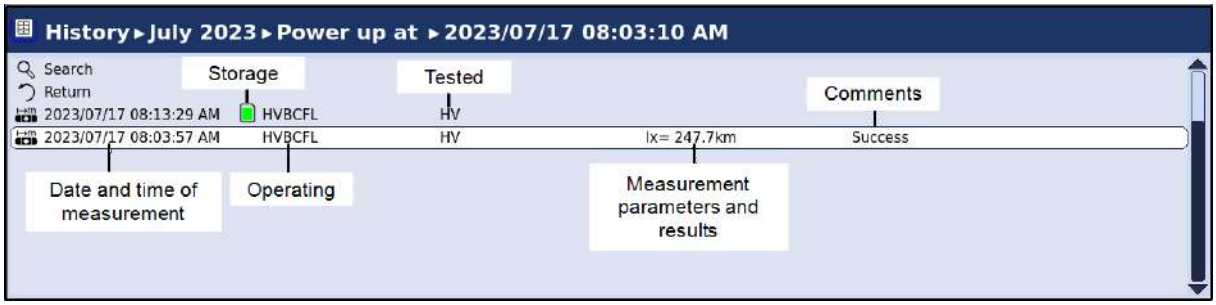
In addition to the individual measurements, the measurement logs created using the log function are also archived in the history database.

Searching in the History database -

Tilting the rotary encoder downwards enables the database to be opened at any given time.

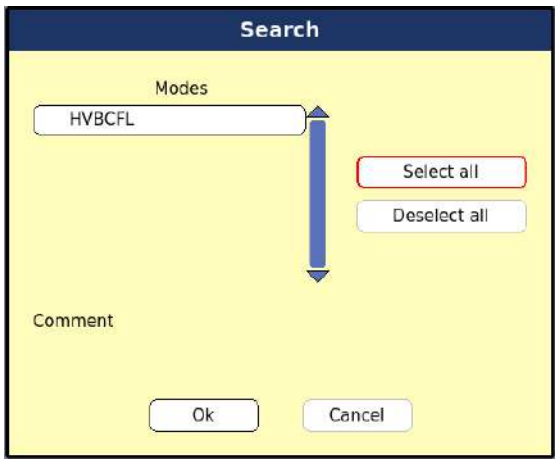
The measurement data records are organised by date in sub-directories.

After the desired month and then the desired day have been selected, the measurement data records registered on this days can be searched through and retrieved.



Via the ↶ list entry you can always return to the next directory level up.

Via the list entry you can reach the search mask using which you can search for particular operating modes and comment entries through the data records of the current directory and all sub-directories.



If you are searching for both an operating mode and comment entry at the same time, only those results which fulfil both criteria will be displayed. Holding down the button will cause the search criteria to be discarded and all the data records to be displayed again.

Storage period

The default setting stores the measurement data for 90 days in the history database. The following symbol indicates how long a measurement has already been stored:

Symbol	Description
No symbol	The data record has been conducted within the last 85 days. An automatic deletion is not imminent.
	The data record is at least 86 days old and will be automatically deleted during the next few days.
	The data record is either imported or permanently stored ("Standard functions" on page 52). There will be no automatic deletion.

It is recommended to save data records in order to be able to use them after the storage period expired, if the measurements and tests are taken at longer intervals.

Managing data records

In order to delete / export a data record or a complete folder it needs to be selected with the rotary encoder first. Afterwards, the rotary encoder needs to be tilted to the right or the left until the appropriate marking is shown.

Symbol	Description
	The data record or the folder (incl. all data records in it) is marked for deletion.
	The data record or the folder (incl. all data records in it) is marked for export.
	Several data records within the folder have been marked for deletion.
	Several data records within the folder have been marked for export.
	The folder contains both data records marked for deletion and data records marked for export.

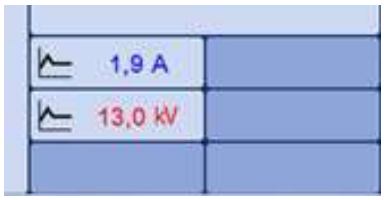
After selection of the measurements the data deletion or export process must be initiated in the data menu ("Data menu" on page 45). Otherwise the markings will expire the next time the device is started up.

Accessing measurement data from the history database

To access curves and data from old measurements, first access the history database and then use the rotary encoder to select the respective measurement from the directory structure. **Briefly pressing** the rotary encoder enables all the curves and measured data for this measurement to be loaded. To this end, the software proceeds as follows:

- If the operating mode currently selected is the same operating mode in which the loaded measurement was recorded in, the accessed curves are shown together with the currently recorded curves. This enables the results of different measuring operations to be easily compared.
- If the current and the loaded measurement are not of the same operating mode, the current measurement is automatically ended and only the loaded measurement is displayed.
- If there are not enough free slots to display the loaded curves, the currently recorded curves are overwritten. To avoid this, it is advisable to select curves from the History database one by one (see below) so that you can assign them individually to slots that are free or no longer needed.

The colour-coded legend on the bottom right edge of the screen provides information relating to the measured values of the curves currently displayed.



Current and loaded curves can be differentiated between using the symbols in front of them.

Symbol	Description
	Curves which were recorded during the measurement in progress.
	Curves which have been accessed from the history database.

By **Holding down** the rotary encoder a context menu can be opened from which the following special functions can be accessed:

- Add / edit a comment for the measurement
- Access special measurement data or only individual traces of this measurement (possible in certain modes only)

4.4 Main menu

After starting the system, the main menu is available:

This menu contains the following menu items:

Item	Description
	"Insulation test" on page 52
	"DC voltage test / breakdown detection" on page 55
	"Sheath test" on page 56
	"HVB BIFRÖST" on page 58
	"Sheath Pinpointing" on page 62
	"Burning" on page 64
	"System menu" on the facing page

4.5 System menu

The system menu can be accessed directly from the menu item in the main menu. It contains the following menu items:

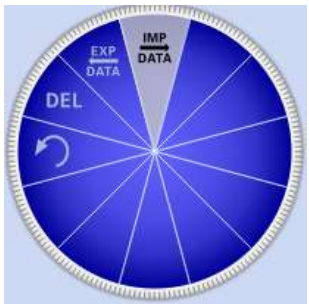
Menu item	Description
	Default Values: Menu for default values ("Default values menu" on the next page).
	Setup: Menu for basic system settings.
	Date and Time: Opens a window to set the current date and time.
	Language: Opens a window to select an available language.
	Return to the next higher menu level.
	Keyboard: Opens a window to select an available keyboard layout.
	Information: Menu for important system information.
	System log: Enables messages stored in the system log to be displayed and exported to an inserted USB flash drive (System log directory).
	Software Info: Information on software version.
	Hardware Info: Information on system hardware and the current IP address.
	Return to the next higher menu level.
	Data: Menu for managing the measurement data ("Data menu" on page 45).
	Return to the next higher menu level.
	Administration: This menu enables a user with the appropriate permissions to access extended system functions ("Administration menu (administration password required)" on page 48).
	Service: The service menu can only be accessed by a service technician.

4.5.1 Default values menu

Default values can be adapted for nearly all the system settings. The menu contains the following items:

Menu item	Description
IMP DEFS	**Import Default Values**: Can be used to import default values stored on an inserted USB flash drive into the system. The imported values become immediately applicable.
EXP DEFS	**Export Default Values**: This menu item enables the default values for the current user to be exported as XML files to the Default Values directory of an inserted USB flash drive.
	Reset: Restores the factory settings.
	Load: This menu item can be used by the current user to reload the stored default values.
	Save: The current settings can be stored as default values. Naturally, only the changes made during this session are taken into consideration. When saving the default values, note that all values that have been changed since the last system start are saved, which means that you might inadvertently save some changes that you do not want. To be on the safe side, you can first reload the current defaults (see below), make the required settings and then save them.
	Return to the next higher menu level.

4.5.2 Data menu



The Data menu enables stored measurement data to be imported, exported or deleted as well as managing and exporting cable data. It contains the following menu items:

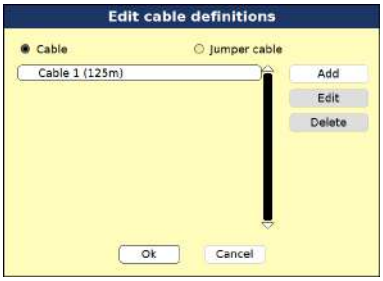
Menu item	Description
EXP DATA	**Export Measurements**: Enables measurement data records from the History database to be exported to an inserted USB flash drive (Winkis directory). The data records to be exported must be marked beforehand ("History database" on page 39).
IMP DATA	**Import Measurements**: Enables measurement data records / logs to be imported. To do so, a window is opened in which the user can navigate through the directories on the plugged-in USB flash drive.
DEL	**Delete Measurements**: Enables measurement data records to be deleted from the History database. The measurements to be deleted must be marked beforehand ("History database" on page 39).
	Return to the next higher menu level.
	Cable:Enables cable data to be added, edited and deleted.
EXP	**Export cables**: Enables cable data to be exported to an inserted USB flash drive.

Changing cable data

To change cable data, proceed as follows:

1. In the main menu, call up the menu item .
2. In the system menu, call up the menu item .
3. In the data menu, call up the menu item .

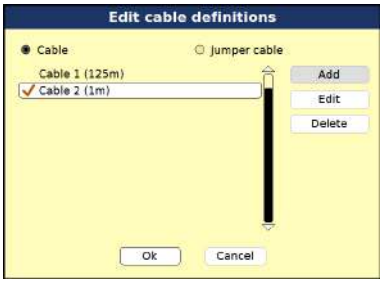
   Result: The cable editor opens in a new window.



   The cables are divided into 2 categories: Cable and Jumper cable.

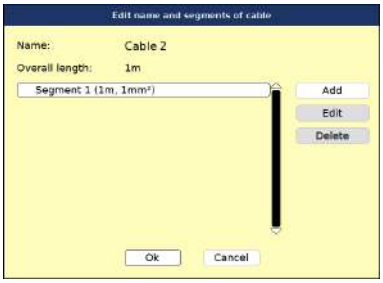
4. Select the cable category by setting the radio button.
5. If you want to add a new cable, use the button **Add**.
6. To edit a cable, you need to first select it.

   Result: The selected cable has a red tick left to its name:



7. To edit a cable, use the button **Edit**.

   Result: The cable data can now be edited.



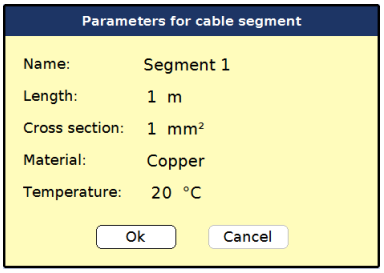
   For cables, the name and the segments can be edited. One cable can consist of 1 to 10 segments, each of those can be edited individually according to the physical characteristics.

   For jumper cables, only the name and the physical characteristics are editable. It is not possible to divide the jumper cable into different segments.

8. Adjust the cable name.

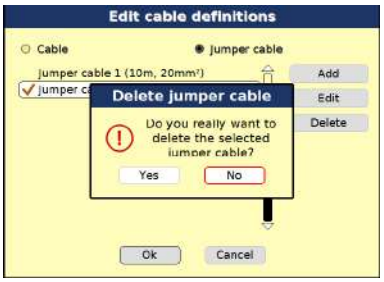
9. To edit the physical characteristics, select the cable segment / the Jumper cable and use the button **Edit**.

   Result: The characteristics window opens.



10. Adjust the characteristics as needed.
11. Confirm the adjustment by using the button **Ok**.

    Result: The editor returns to the state shown in step 7.
12. If necessary, repeat the steps 9 to 11 for each cable and cable segment.
13. To delete cables or cable segments, the cable (segment) needs to be selected. Use the button Delete and confirm the pop-up window:



14. Use the button **Ok** two times to confirm the set cable data and exit the cable menu.

4.5.3 Administration menu (administration password required)

Purpose

The administration menu is password-protected and provides access to advanced system settings such as the user administration, as well as update and backup functions.

The software's menu structure has concealed menu items added to it when administration rights are issued. These enabled functions, which are only rarely used during day-to-day operation of the device, are described in greater detail throughout the course of the manual.

Access

To open the administration menu, you must first enter the password. Proceed as follows:

1. In the main menu, call up the menu item .
2. In the system menu, call up the menu item .
3. Select menu item to enter the password.
   Result: The password entry dialogue appears in the display.
4. Enter the password and confirm your entry with **Ok**.
   Result: If you entered the password correctly the menu items of the administration menu appear.
   If your entry is incorrect, you must repeat the procedure from step 2 onward.

Menu items

The Administration menu offers the following menu items:

Menu item	Description
UP DATE	**Update**: Used to update the software
BACK UP	**Backup**: Various system data (such as the log file and the configuration file) can be exported to the inserted USB flash drive via this menu item. The directory name consists of the system serial number and a sequential number. These data can provide important information about the cause of the problem when servicing and should be made available to service personnel on request.
	Reset database: The database can be completely emptied via this menu item, i.e. all measurement results, users, cable types and system logs are deleted. However, calibration and configuration data are retained. Once the function has been called up, the system must be switched off and then on again. After the restart, the database reset must be confirmed once again.
	Password: This menu item is used to disable the administrator rights and to relock the access to the administration menu.
	Return to the next higher menu level.

Updating the software

Proceed as follows to update the software:

1. Download the latest software from the Megger website.
2. Unpack the update package into the root directory of an USB flash drive.
3. Insert the USB flash drive into the USB port 1.
4. Call up the UP DATE menu item in the administration menu.

   Result: A selection dialogue appears.
5. Select the option **System Software (RPM/DEBIAN package)**.

   The option **Single file (file selection)** enables the import of individual files, but should only be used in the event of an error and after consultation with a service employee.
6. Start the update via **Ok** and confirm the following message.

   Result: The system / unit switches off.
7. Switch the system / unit on again.

   Result: During the boot process, the update package on the inserted USB flash drive is recognised and automatically installed.

   Do not switch off the system / device during the update!

5 Performing measurements

Basic procedure for identifying and locating faults

To identify and locate faults, proceed as follows:

1. To identify the faulty cable, connect the BIFRÖST accordingly ("Identifying and burning of faulty cables" on page 24). Ensure that the screens are grounded.
2. Start a DC test ("DC voltage test / breakdown detection" on page 55).

   Result: If the cable cannot be charged to the set nominal voltage, overcurrent is detected during the test or a voltage breakdown occurs, the test is automatically aborted, the cause of the shutdown or breakdown voltage is displayed and the high voltage is switched of.
3. If the test was not aborted, start an insulation test ("Insulation test" on the next page).

   Result: A resistance value of **>650 MΩ** is shown for healthy cables as well as for interrupted cables. Other resistance values indicate cable faults.
4. In the case of high-impedance faults, an attempt can be made to convert the fault by burning into a low-impedance fault that can be located ("Burning" on page 64).
5. Repeat the **steps 1 to 4** for each available phase / pole of the cable to identify all faulty phases / poles.
6. To proceed with identifying and locating the fault, the BIFRÖST needs to be connected to the faulty cable depending on the number of available auxiliary conductors.

For further measurements on **HV cables**, use the connection method with one auxiliary conductor ("Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25).

7. Start a test in the mode HVB BIFRÖST to pre-locate the fault ("HVB BIFRÖST" on page 58).

For further measurements on **MV cables**, use the connection method according to the next test.

7. Depending on the results of the preceding tests, start a sheath test ("Sheath test" on page 56).
8. Start a test in the mode HVB BIFRÖST to pre-locate the fault ("HVB BIFRÖST" on page 58).
9. If the sheath test revealed a sheath fault, start the sheath pinpointing ("Sheath Pinpointing" on page 62).

5.1 Standard functions

Generally available functions

For all operating modes in which measured data are recorded and displayed, the following standard functions are available in the respective measurement menu:

Menu item	Description
M	This menu item can be used to access a list of all data records stored in the History database which match the currently active operating mode. Only the permanently stored data records are taken into account here. Using the rotary encoder enables a data record in the list to be selected and then accessed. This way, e.g. a reference trace previously recorded on the same cable can be quickly located and compared with the current trace. Furthermore, the menu item  can be used to store the current measurement permanently in the History database.
	This menu item can be used to increase or reduce the visual range on the X-axis. The section aligns itself with the current cursor position here. It is displayed after a measurement was performed (Not available for the insulation test).
	This menu item can be used to move the cursor along the X axis. The current, voltage, time or distance values of the currently marked position are displayed in the bottom part of the screen. It is displayed after a measurement was performed (Not available for the insulation test).

5.2 Insulation test

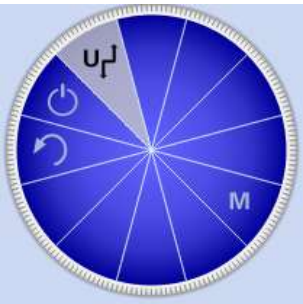
Introduction

A basic fault classification can often be carried out in advance by measuring the ohmic insulation resistance. For example, low- and medium-resistance cable faults can be directly detected and appropriate follow-up measurements can be undertaken.

Even in the event of high-impedance cable faults, conclusions can be drawn about the affected poles based on resistance deviations between both poles.

It can also be helpful to repeat resistance measurements after fault conversion methods (burning) and to compare the measurement results with those stored in the database.

Available menu items:



The following menu items are available in the insulation menu:

Menu item	Description
U	**Range**: Voltage range, available from 5 ... 20 kV. While it is set upon opening the test menu, the voltage range can be changed again before the test gets started.
⏻	**Start mode**: Starts the test.
↩	**Return** to the next higher menu level.
M	**Memory**: Previous test results which are stored in the history database can be opened in the Memory sub-menu.

Procedure

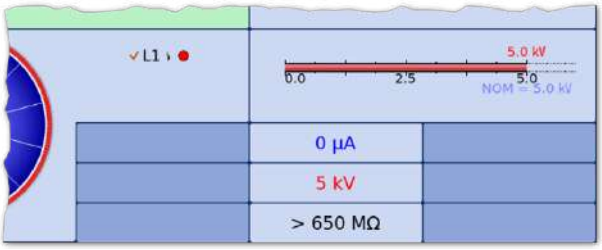
The BIFRÖST can be connected to the cable using these methods:

- Identifying the faulty cable ("Identifying and burning of faulty cables" on page 24
- Pre-locating / Testing on HV cables ("Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25)
- Pre-locating / Testing on MV cables ("Pre-locating / Testing on MV cables (using two auxiliary conductors)" on page 25)

To conduct an insulation test, perform the following steps:

1. In the main menu, call up the menu item Ω.
2. Set the voltage range that limits the maximum selectable voltage during the test.
3. Use the menu item ⏻ to start the test.
4. Release the high voltage via the "HV ON" button.

   Result: The insulation test starts with the voltage conditioning. After the resistance value is taken, the high voltage has to be manually switched off by using the "HV OFF" button or the menu item HV Off.

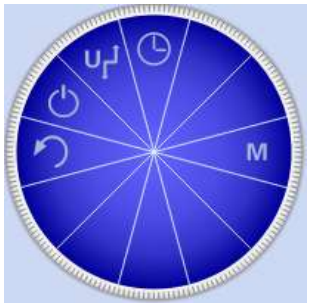


5.3 DC voltage test / breakdown detection

Introduction

A DC voltage test not only allows the dielectric strength of the connected test object to be checked, but also the breakdown voltage of the fault location to be reliably determined in the event of insulation problems.

Available menu items:



The following menu items are available in the DC voltage test menu:

Menu item	Description
	Test time: Counted in minutes, can be set and changed as required.
	Range: Voltage range, available from 5 ... 20 kV. While it is set upon opening the test menu, the voltage range can be changed again before the test gets started.
	Start mode: Starts the test.
	Return to the next higher menu level.
M	**Memory**: Previous test results which are stored in the history database can be opened in the Memory sub-menu.

Procedure

The BIFRÖST can be connected to the cable using these methods:

- Identifying the faulty cable ("Identifying and burning of faulty cables" on page 24
- Pre-locating / Testing on HV cables ("Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25"Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25
- Pre-locating / Testing on MV cables ("Pre-locating / Testing on MV cables (using two auxiliary conductors)" on page 25)

To conduct a DC voltage test, perform the following steps:

1. In the main menu, call up the menu item DC.
2. Set the voltage range that limits the maximum selectable voltage during the test.
3. Use the menu item to set the test time required.
4. Use the menu item to start the test.
5. Release the high voltage via the "HV ON" button.
6. Use the rotary encoder to increase the voltage to the required test voltage and confirm the value by pressing the encoder.

   For safety reasons, the voltage setting dialogue closes automatically after a few seconds, but can be called up again via the $U_{\lceil}^{\rceil}$ menu item.

   Result: The high-voltage source automatically starts charging the cable to the set voltage. Voltage and current run are shown in the display.

   If the cable cannot be charged to the set nominal voltage, overcurrent is detected during the test or a voltage breakdown occurs, the test is automatically aborted, the cause of the shutdown or breakdown voltage is displayed and the high voltage is switched off.

   After the test time has expired and the test has been successfully completed, the high voltage is also switched off.

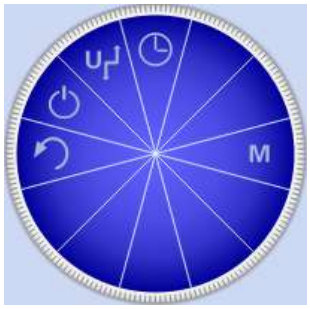
5.4 Sheath test

Introduction

For power cables, an undamaged cable sheath is an exceptionally important prerequisite to avoid serious cable faults, which would influence the quality of supply. The conservation of the value of a cable is also determined by the attention paid to the condition of the sheath. Irrespective of the tests and diagnoses of the core insulation, the early recognition and elimination of sheath faults has a stabilising effect on the operational quality of a cable system.

Testing for sheath faults can be performed with a DC voltage of up to 20 kV.

Available menu items



The following menu items are available in the sheath test menu:

Menu item	Description
	**Test time**: Counted in minutes, can be set and changed as required.
	**Range**: Voltage range, available from 5 ... 20 kV. While it is set upon opening the test menu, the voltage range can be changed again before the test gets started.
	**Start mode**: Starts the test.
	**Return** to the next higher menu level.
M	**Memory**: Previous test results which are stored in the history database can be opened in the Memory sub-menu.

Procedure

Connect the BIFRÖST accordingly ("Sheath testing" on page 29).

To conduct a sheath test, perform the following steps:

1. In the main menu, call up the menu item  .
2. Set the voltage range that limits the maximum selectable voltage during the test.
3. Use the menu item  to set the test time required.
4. Use the menu item  to start the test.
5. Release the high voltage via the "HV ON" button.

   Result: The sheath test runs for the selected time. The test duration can also be adjusted later when the test is running via the menu item  or reset via the menu item  .

   During the test, the display area shows the voltage curve and the measured leakage current. In addition to the current and voltage values, the remaining test duration  and the set test duration  are displayed at the bottom of the screen.

   The high voltage is automatically switched off after the set test time has elapsed. A manual switch-off can be performed at any time using the "HV OFF" button or the menu item  .

   During both automatic and manual shut-off, the high voltage output is earthed and the test object discharged via the internal discharge resistor. The measurement data recorded until shutdown are written to the History database.

5.5 HVB BIFRÖST

Introduction

In order to substantially reduce the time required for pinpointing, the pinpointing of the location of the fault is preceded by a pre-location. This reduces the risk of the fault location unintentionally “drying up” during the course of a lengthy pinpointing.

Due to thermo-electric or galvanic effects, there can be offset voltages on top of the actual measured voltage during the measurement.

The cable needs to be entered into the cable database before the pre-location can be started ("Data menu" on page 45).

As ambient temperatures are influencing the results of the high voltage bridge, it is recommended to adjust the temperatures for the different segments of the cables.

The more accurate the temperatures, the more accurate the measurement results!

It is strongly recommended to adjust the temperatures for each segment as accurate as possible, to improve the results and enable a pre-location as accurately as possible.

Setting the voltage

Pre-locations are always carried out bipolar and fully automatic by the device. The amount of the voltage can be set within the range of 5 kV to 20 kV. The voltage should be set to the value at which the fault occurred during the previous test.

In the event that the pre-location is to be performed immediately after a test, the device software suggests an appropriate voltage value for the pre-location, which can be manually changed at any time.

Available menu items:

The following menu items are available in the HVB BIFRÖST menu:

Menu item	Description
	**Settings**: Opens the menu for adjusting the temperature settings of the cables used for measurement. This menu item is only available after the settings 1 Aux / 2 Aux and  have been made.
	**Range**: Voltage range, available from 5 ... 20 kV. While it is set upon opening the test menu, the voltage range can be changed again before the test gets started.
	**Start mode**: Starts the test.
	**Return** to the next higher menu level.
1 Aux / 2 Aux	**1 Aux / 2 Aux**: This sets the use to one or two auxiliary cables. The selected mode is displayed in green colour.
	**Cable**: Opens the menu for selecting the cables and jumper cables used for measurement.
M	**Memory**: Previous test results which are stored in the history database can be opened in the Memory sub-menu.

Procedure

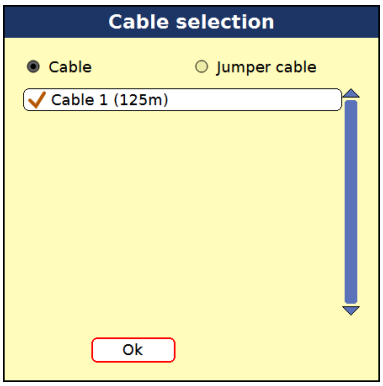
The BIFRÖST can be connected to the cable using these methods:

- Pre-locating / Testing on HV cables ("Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25
- Pre-locating / Testing on MV cables ("Pre-locating / Testing on MV cables (using two auxiliary conductors)" on page 25)

To conduct a pre-location, perform the following steps:

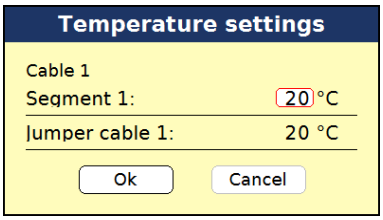
1. In the main menu, call up the menu item .
2. Set the voltage range that limits the maximum selectable voltage during the test.
3. Use the menu item 1 Aux / 2 Aux to switch between the use of one or two auxiliary cables. The selected mode is displayed in green colour.
4. Use the menu item to select the cables and jumper cables used for measurement.

   Result: A selection window opens:



5. Use the menu item to adjust the ambient temperatures for the different cables.

   Result: A selection window opens:



6. Use the menu item to start the test.
7. Press the "HV ON" push-button.

   Result: The device runs through the automatic fault location algorithm. Readings are taken from the near and far ends of the cable, respectively, with both voltage polarities and the fault distance determined, using the voltage drop method.

> If the "HV OFF" push-button is pressed during the automatic pre-location, operation may not be stopped and high voltage may not be turned off until the current sub-step is finished. Accordingly, in emergencies the emergency off button must always be used, as the high voltage is then immediately switched off and the cable discharged.

On completion of the measurement, the high voltage is switched off and the cable discharged.

Multiple sheath faults

Multiple sheath faults at the same cable can lead to measurement errors and false distance data as the displayed distance is an average of the individual fault distances.

However, there are signs which indicate multiple faults and consequently should be taken into consideration during location. Highly scattered distance values at changing test voltages can potentially indicate the presence of multiple faults, as the faults probably have different ignition voltages.

At the same time, these different ignition voltages offer an approach which allows location to be carried out even on sheaths with multiple faults. The most ignitable fault can be measured first by carefully increasing the test voltage. After it has been located and repaired, a further location can be carried out.

5.6 Sheath Pinpointing

Introduction

During sheath fault pinpointing, the BIFRÖST transmits direct current pulses into the shield affected by the earth fault.

With each coupled pulse, the current flowing into the ground forms voltage gradients in the area around the fault, the centre of which can be located precisely with the assistance of a sheath fault locator.

Available menu items

The following menu items are available in the sheath pinpoint menu:

Function / Menu item	Description
I_{MAX}	**Current Limit**: Sets the current within the defined limits. If the set value is exceeded, the pinpointing process is automatically stopped.
	Repetition rate: Sets the repetition mode for the pulse. Only available for the pulse mode Interval.
	Interval / Continuous: Sets the pulse mode for the pinpointing process. The selected mode is displayed in green colour.
	Range: Voltage range, available from 5 ... 20 kV. While it is set upon opening the Sheath Pinpointing menu, the voltage range can be changed again before the process gets started.
	Start mode: starts the pinpointing process.
	Return to the next higher menu level.

Procedure

Connect the BIFRÖST accordingly ("Sheath testing" on page 29).

To conduct a sheath pinpointing, perform the following steps:

1. In the main menu, call up the menu item .
2. Set the voltage range that limits the maximum selectable current during the test.
3. Use the menu item to set the pulse mode.
4. When using the pulse mode **Interval**, use the menu item to set the repetition rate for the pulse.
5. Use the menu item I_{MAX} to set the current for the pulse.
6. Use the menu item to start the test.
7. Release the high voltage via the "HV ON" button.

   Result: The sheath pinpointing starts. It continues until the high voltage is manually switched off by using the "HV OFF" button or the menu item HV Off.

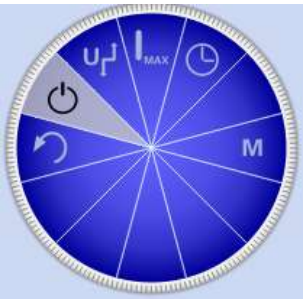
5.7 Burning

Introduction

The process known as "burning" enables the ongoing conversion of high-impedance faults into low-impedance shunts right up to saturated short-circuits. To this end, the fault is first caused to breakdown by charging the test object and then continuously fed a high current, which keeps the arc burning. Ideally, this causes the burned insulating material to form a conductive carbon bridge, thus reducing the resistance of the fault (the fault then becomes locatable) or the moisture that penetrated into the cable evaporates.

Thanks to steady improvement in pre-location methods, this material-stressing method must be used only very rarely with difficult faults, such as moist sleeves.

Available menu items



The following menu items are available in the burning menu:

Function / Menu item	Description
I_{MAX}	**Current Limit**: Sets the current within the defined limits. If the set value is exceeded, the burning process is automatically stopped.
U	**Range**: Voltage range, available from 5 ... 20 kV. While it is set upon opening the Burning menu, the voltage range can be changed again before the process gets started.
◷	**Burning time**: Counted in minutes, can be set and changed as required. On completion of the time set, the high voltage is switched off automatically.
⏻	**Start mode**: starts the burning process.
↶	**Return** to the next higher menu level.
M	**Memory**: Previous test results which are stored in the history database can be opened in the Memory sub-menu.

Procedure

The BIFRÖST can be connected to the cable using these methods:

- Identifying the faulty cable ("Identifying and burning of faulty cables" on page 24
- Pre-locating / Testing on HV cables ("Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25"Pre-locating / Testing on HV cables (using one auxiliary conductor)" on page 25
- Pre-locating / Testing on MV cables ("Pre-locating / Testing on MV cables (using two auxiliary conductors)" on page 25)

To conduct a burning process, perform the following steps:

1. In the main menu, call up the menu item .
2. Set the voltage range that limits the available current during the burning process.
3. Use the menu item I_{MAX} to set the current for the burning process.
4. Use the menu item to set the time required.
5. Start the burning process via the menu item .
6. Release the high voltage via the "HV ON" button.
7. Set the nominal voltage.

   Result: The burning process runs for the selected time. The process duration can also be adjusted later when the time is running via the menu item or reset via the menu item .

   The voltage is raised directly to the set value even without prior confirmation. For safety reasons, the voltage setting dialogue closes automatically after a few seconds, but can be called up again via the menu item .

   The voltage and current curves are shown on the display. When the fault location is ignited, the voltage drops abruptly while the burning current rises sharply. A few minutes are usually enough to convert the fault resistance so that it may be localised using an HV pre-location method.

   The high voltage is automatically switched off after the set time has elapsed. A manual switch-off can be performed at any time using the "HV OFF" button or the menu item HV Off.

   During both automatic and manual shut-off, the high voltage output is earthed and the test object discharged via the internal discharge resistor. The measurement data recorded until shutdown are written to the History database.

6 Completing the work

Exporting and processing measurement data

After the actual measurement job, the recorded measurement data can be conveniently analysed, archived and summarised in a report on a Windows PC.

To do this, the desired data must first be marked for export in the History database ("History database" on page 39) and then exported to an inserted USB flash drive via the data menu ("Data menu" on page 45). On the Windows PC, the data can then be imported into the protocol software and processed further.

Switching off the system and disconnecting from the test object

After the measurements have been completed, the BIFRÖST can be switched off by pressing the ON/OFF button 3.

When disconnecting the test system, proceed in reverse sequence to the manner in which the connection ("Electrical Connection" on page 22) was made. The following safety instructions must be strictly adhered to.

WARNING

- Follow the five safety rules ("General safety instructions and warnings" on page 7)
- Even if switched off properly and discharged using the discharge unit, 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.
- When the HV socket and the screen plug are disconnected from the tested cable, they need to be secured ("Connecting the cables" on page 23).

Rewinding the jumper cable

When the jumper cable is disconnected and secured, rewind it. ("Optional: Operation of the motorised cable drum" on page 30)

7 Transportation, storage and care

Transportation

The vertical position of the rear handle can be adjusted to allow an ergonomic stance when pushing or pulling the device. To do this, simply loosen the locking screws slightly on both sides and tighten again after adjusting the height.

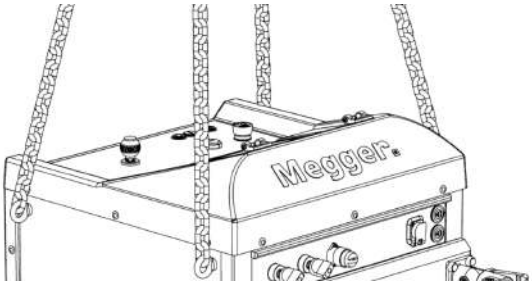
The device can be transported over long distances (e.g. in vehicles) in either a vertical (standing) or horizontal position.

The four eyelets on the top of the device can be used to load the device onto a vehicle via lifting equipment.

NOTE

Risk of damage

The bearing capacity of the eyelets can only be guaranteed as sufficient if the lifting equipment is secured to all four eyelets, as this allows the weight to be distributed evenly.



The eyelets can also be used to secure the device when transporting it in a vehicle.

[This chapter is only applicable when using a motorised cable drum.]

For safe transportation, the cable needs to be completely wound up on the cable drum. Additionally, the sockets of the HV end of the cable needs to be plugged into the plug on the screen end for both ends of the cable.

Remove the fuse 20 for the duration of the transport

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.

NOTE

To store the jumper cable, connect the HV socket with the screen plug when the drum is wound up completely ("Connecting the cables" on page 23).

This causes a short circuit for safety reasons when the HV connection cable is not in use.

Care of the display

Do not clean the display with harsh cleaning agents such as solvents or gasoline.

Instead, lukewarm water with some washing-up liquid should be used and applied to the display using a microfibre cloth.

8 Troubleshooting and maintenance

8.1 Troubleshooting and maintenance measures to be carried out by the operator

Maintenance

In order to identify potential problems at an early stage and to maintain the system in good condition, it is essential that you carry out the following tasks yourself and at appropriate intervals, depending on the usage behaviour:

Maintenance tasks	Period
Remove dust and dirt	If needed
Unwind the cable drum and check all cables for breaks / visible damage	Before use
Check the connection cables and modules of the high voltage components for secure hold	Before use
Charge the rechargeable battery 21 in the motorized cable drum. The battery charger 22 is connected with the battery. To charge the battery, the charger needs to be plugged into a mains socket.	Every three months
After a long period of non-use, it is recommended to clean the clamps to avoid oxidation, which would distort the test results. To improve the electrical connectivity, the use of contact grease can be beneficial.	Once per year

Troubleshooting: replacing fuses

If the system cannot be switched on even though the mains supply is connected, proceed as follows:

1. Check the two fuses next to the mains socket 11. To do this, the fuse holder must be pulled out.
2. If the fuses are defective, they must be replaced with suitable fuses (T16A 250V, type SPT 6,3x32mm).
3. If the fuses continue to trip, contact an authorised service centre to have the fault rectified.

[For the motorised cable drum only:]

1. Check the fuse 20 next to the rechargeable battery 21 .
2. If the fuse is defective, it must be replaced with suitable fuses (FKS2, 15 A, 32 V).
3. If the fuse continues to trip, contact an authorised service centre to have the fault rectified.

If you notice any defects during maintenance or troubleshooting, promptly inform the responsible service centre.

8.2 Required maintenance by maintenance personnel

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 once a year.

Please contact the responsible service centre for maintenance appointments or repairs.

[This page was intentionally left blank.]

Sales contact

Megger Limited
Archcliffe Road
Dover
Kent
CT17 9EN
England
T. +44 (0)1 304 502 101
F. +44 (0)1 304 207 342
E. uksales@megger.com

Production sites

Megger Limited
Archcliffe Road
Dover, Kent CT17 9EN
United Kingdom
T. +44 (0)1 304 502101
E. uksales@megger.com

Megger Germany GmbH
Dr.-Herbert-Iann-Strasse 6
96148 Baunach
Germany
T. +49 (0) 9544 68 - 0
E. team.dach@megger.com

Megger Germany GmbH
Röderaue 41
01471 Radeburg
Germany
T. +49 (0) 35208 84 – 0
E. team.dach@megger.com

Megger Sweden AB
Rinkebyvägen 19
182 36 Danderyd
Sweden
T. +46 8 510 195 00
E. seinfo@megger.com

Megger Baker Instruments
4812 McMurry Ave., Suite 100
Fort Collins, CO 80525
United States
T. +1 970-282-1200
E. baker.sales@megger.com

Megger
4545 West Davis Street
Dallas, TX 75211
United States
T. +1 800-723-2861 ext. 6000
E. usasales@megger.com

4 251821 442395

www.megger.com