



## **VLF CR-60-HP**

### **VLF Test System**

## **USER GUIDE**

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## Consultation with Megger

The present system manual 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 manual should any trouble occur.

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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.

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## 1. Safety Advice

### 1.1 General Notes

**Safety precautions** This manual contains basic advice for the installation and operation of the *VLF Test System*. It is essential to make this manual accessible to the authorised and skilled operator. He needs to read this manual closely. The manufacturer is not liable for damage to material or humans due to non-observance of the instructions and safety advices provided by this manual.

Locally applying regulations have to be observed.

**Symbols used in this manual** Important instructions concerning the protection of staff and equipment as well as technical safety within this document are labelled with one of the following symbols:

| Symbol  | Description  |
|---|--|
| <br><b>WARNING</b> | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.                                    |
| <br><b>CAUTION</b> | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or material damage.                  |
|                  | Notes have important information and useful tips on the operation of your equipment. Non-observance may result in useless measurement results. |

**Working with equipment of Megger** All electrical regulations of the country where the system is operated have to be observed as well as national regulations for prevention of accidents and existing regulations for the safety and operation of equipment of the involved companies.

After working with the equipment, make sure to de-energise, protect against re-energising, discharge, ground and short-circuit the instrument and installations that have been worked on.

Original accessories ensure safe operation of the equipment. It is not allowed and the warranty is lost if other accessories than the original ones are used with the equipment.

**Operating personal** Only trained and/or instructed staff is permitted to deal with this system and its peripherals. Keep any other person away from it.

Only authorised persons with sufficient expertise are allowed to operate the device.

**Repair and maintenance** Repairs and service must only be done by Megger or authorised service departments of Megger. Megger recommends having the equipment serviced and checked once per year at a Megger service location.

Megger also offers direct on-site support. Please contact our service office for more information.

**Handling SF<sub>6</sub> greenhouse gas** This system / device contains the greenhouse gas SF<sub>6</sub> with a Global Warming Potential (GWP) of 22.200 which is listed in the Kyoto protocol. The mass of gas is indicated at the type label. SF<sub>6</sub> gas has to be recovered and must not be allowed to escape into the atmosphere. For detailed information please refer to IEC 62271-303 „Use and handling of sulphur hexafluoride (SF<sub>6</sub>)“.



## 1.2 General Cautions and Warnings

|  |   |
|--|---|
| Intended application                         | <p>Safe operation is only realised when using the equipment for its intended purpose. Using the equipment for other purposes may lead to human danger and damage of equipment of involved installations.</p> <p>The limits described under technical data may not be exceeded. Operating products of Megger in condensing environment may lead to flash-over, danger and damage. The instruments should only be operated under tempered conditions. It is not allowed to operate Megger products at direct contact with humidity, water or near aggressive chemicals nor explosive gases and fumes.</p> |
| Behaviour at malfunction of normal operation | <p>The equipment may only be used when working properly. When irregularities or malfunctions appear that cannot be solved consulting this manual, the equipment must immediately be put out of operation and marked as not functional. In this case inform the person in charge who should inform the Megger service to resolve the problem. The instrument may only be operated when the malfunction is resolved.</p>  |
| Operation in traffic environment             | <p>To ensure safety for operators and traffic, the country-specific regulations must be observed.</p>   |

### 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. Ground and short-circuit
5. Cover up or bar-off neighbouring energised parts



### Using cardiac pacemaker

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



### Wear Ear Protection

VLF operation can cause high noise levels. It is strongly recommended to wear hearing protection during surge operation. Keep in mind that this will limit the operators awareness for ambient dangers.



## Fire fighting in electrical installations

- According to regulations, carbon dioxide (CO<sub>2</sub>) 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 CO<sub>2</sub> fire extinguisher must be always available within electrical installations.
- If, contrary to the regulations, any other extinguishing agent is used for fire fighting, this may lead to damage at 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 arc-over (due to the powder dust created).
- It is essential to observe the safety instruction on the extinguishing agent.
- Applicable is DIN VDE 0132.



**WARNING**

## Dangers when operating with HV

Special attention and safety-conscious behaviour is needed when operating HV facilities and especially non-stationary equipment. The regulations VDE 0104 about setting up and operation of electric test equipment, i.e. the corresponding EN 50191 as well as country-specific regulations and standards must be observed.

- Safety installations may not be by-passed nor deactivated.
- Operation requires minimum two people whereas the second person must be able to activate the emergency switch in case of danger.
- To avoid hazardous electric charges of metallic parts in the vicinity, all metallic parts must be grounded.
- To avoid drawing dangerous arcs, switching should only be done in de-energized condition.
- HV test equipment and burn-down equipment is short-circuit proof. Hazardous voltage may be present if a short circuit is opened during operation. If measuring short-circuit current is necessary, it is advisable to connect an arrester in parallel with the measuring instrument (e.g. 90 V glow arrester).
- Adequate safety precautions must be met when using transient measuring techniques, using HV test instruments or surge generators.
- The equipment and all accessories must be connected according to applicable standards VDE, EN or DIN as well as country-specific regulations.
- Never place the test van on the route of the cable under test to avoid the danger of voltage cone at the location of the fault.
- Always connect all metal parts in the vicinity of a HV installation to earth in order to avoid dangerous charging. Particularly great attention should be paid to non-stationary (mobile) operation.



**WARNING**

## Peripheral devices

Please follow the safety instructions of the peripheral devices (e.g. heater) installed in the system environment. For all peripheral devices provided by Megger, the instructions manual is included in the scope of delivery. Megger is not liable for damage to material or humans due to misuse of these devices.

## 2. TECHNICAL DESCRIPTION

### 2.1 Technical Data

| Parameter  | Value  |
|--|--|
| Output voltage (DC)<br><i>60 kV HP</i>                                 | 5 ... ±60 kV   |
| Source output current<br><i>60 kV HP</i>                               | 17,1 mA  |
| Range of indication,<br>Leakage current measurement<br><i>60 kV HP</i> | 0 ... 17,1 mA  |
| Resolution of indication   | 10 µA  |
| Output voltage<br><i>60 kV HP</i>                                      | 5 ... 60 kV  |
| Test frequency   | 0.1 Hz   |
| Voltage wave shape   | Cosine rectangular   |
| Sheath fault location voltage  | 5 ... 10 kV  |
| Pulse rate for sheath fault location                                   | 4s 1:3, 4s 1:5, 6s 1:5, 6s 1:9   |
| Testable cable capacitance<br><i>60 kV HP</i>                          | max. 6.5 µF at 60 kV and -25 ... + 55 °C<br>max. 6.0 µF at 60 kV and +40 ... + 55 °C (derating)    |
| Discharge unit   | integrated, 17,5 µF at 60 kV   |
| Safety system  | FU<br>FΩ<br>Voltage-time area monitoring<br>Key interlock  |
| Power supply   | 230 V ±10 %, 50 ... 60 Hz or<br>115 V ±10 %, 50 ... 60 Hz<br>(K16A line safety switch in HV modul) |
| Power consumption  | max. 1900 VA   |

|  |                                   |
|--|-----------------------------------|
| Operating temperature range                              | -25 °C ... +55 °C                 |
| Operating humidity                                       | +30 °C, 70% relative humidity     |
| Storage temperature range                                | -40 °C ... +70 °C                 |
| Weight (without connection equipment)<br><i>60 kV HP</i> | 378 kg                            |
| Protection class   | I (according to DIN VDE 0140 T.1) |
| Type of protection                                       | IP 20 (according to EN 60529)     |

## 2.2 Description of the VLF Test System

Based on comprehensive scientific research, relevant DIN and VDE standards which we recommend to your attention, and more than 10 years of practical experience on more than 300 VLF Test Systems, we can today take it for granted that the 0.1 Hz VLF method for testing cables with plastics insulation outclasses any other test method using DC voltage or power-frequency AC voltage as used so far.

A 0.1 Hz VLF Test System is required to meet the following demands:

- The repetition rate has to be so slow, that the power set free in any partial discharge (PD) channel that may already exist is small enough not to cause further erosion and so increase gas pressure.
- The inversion of polarity, on the one hand, must be slow enough to exclude any transients caused by travelling waves. On the other, it must be fast enough that any space charge at the tip of a PD channel from where it grows in the direction of the opposite electrode is preserved.

A system that meets the requirements described above has to supply a 0.1 Hz oscillation with the inversion of polarity taking place within the time duration of a 50 Hz half-wave.

Every cycle starts with a charging phase in which the test object as well as the back-up capacitor switched in parallel are charged from a DC source until the desired test voltage is reached.

After a period of 5 seconds, the voltage source is disconnected from the system and discharged. Subsequently, polarity of the test voltage is changed from minus to plus. Depending on the capacitance of the connected test object, the ring-around process takes between 2 and 10 ms.

Fig 1 represents the generated characteristics of the test voltage.

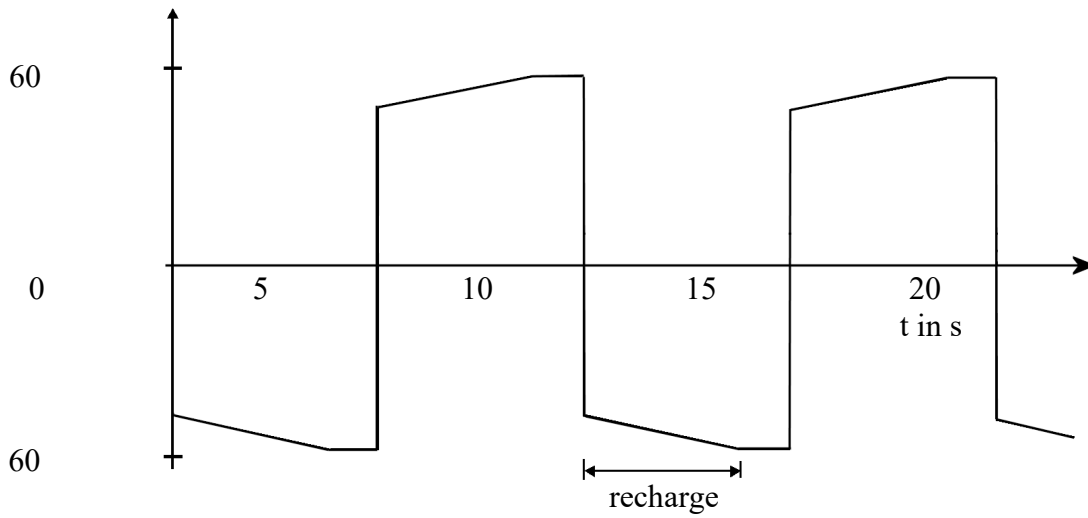


Fig : 1: Representation of the test voltage characteristics

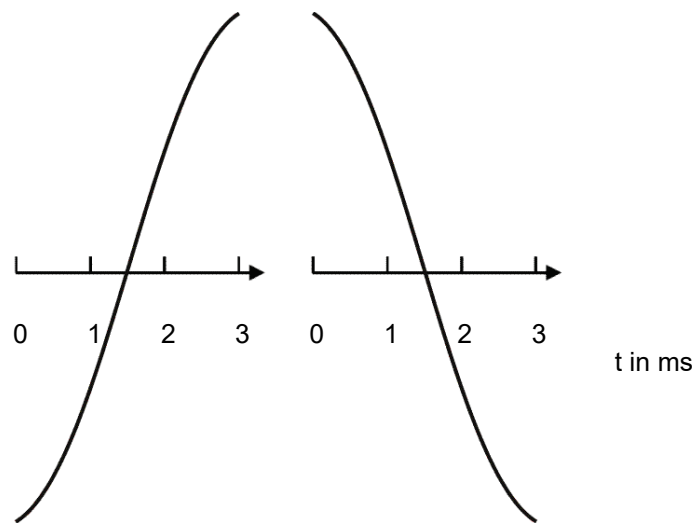
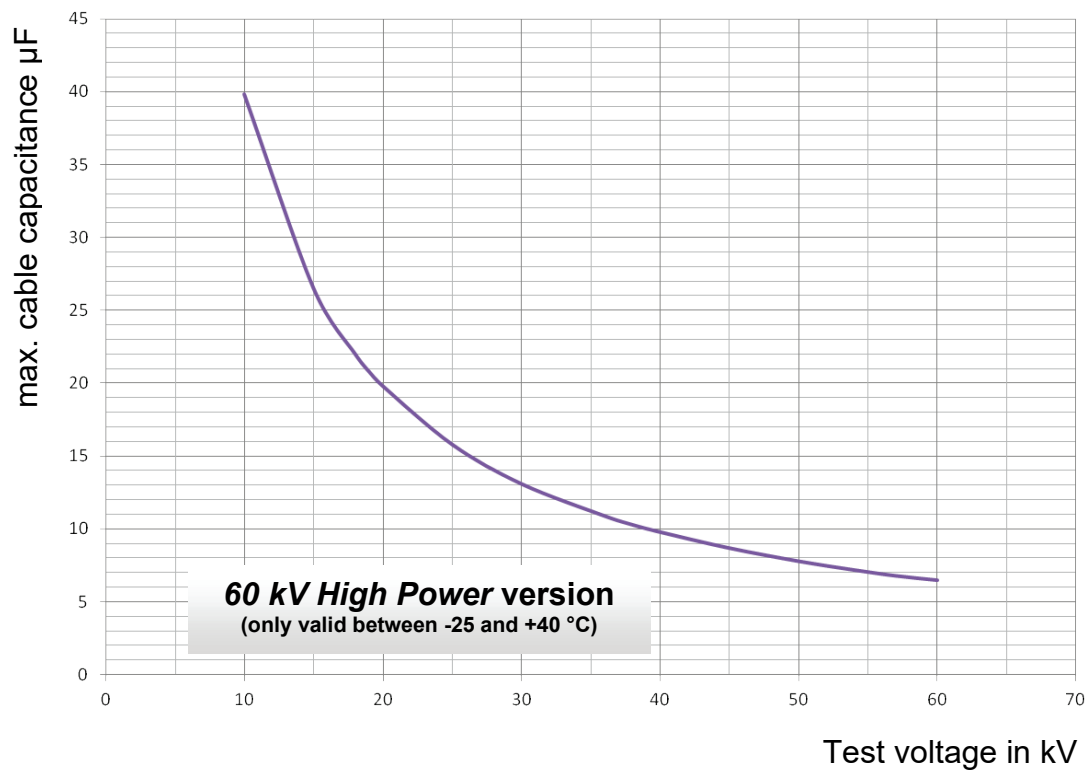


Fig : 2 Voltage waveform during polarity inversion

The course of the following graph shows maximum testable cable capacitance against the test voltage:



## 2.3 Description of components of the VLF Test System

### 2.3.1 Operating module

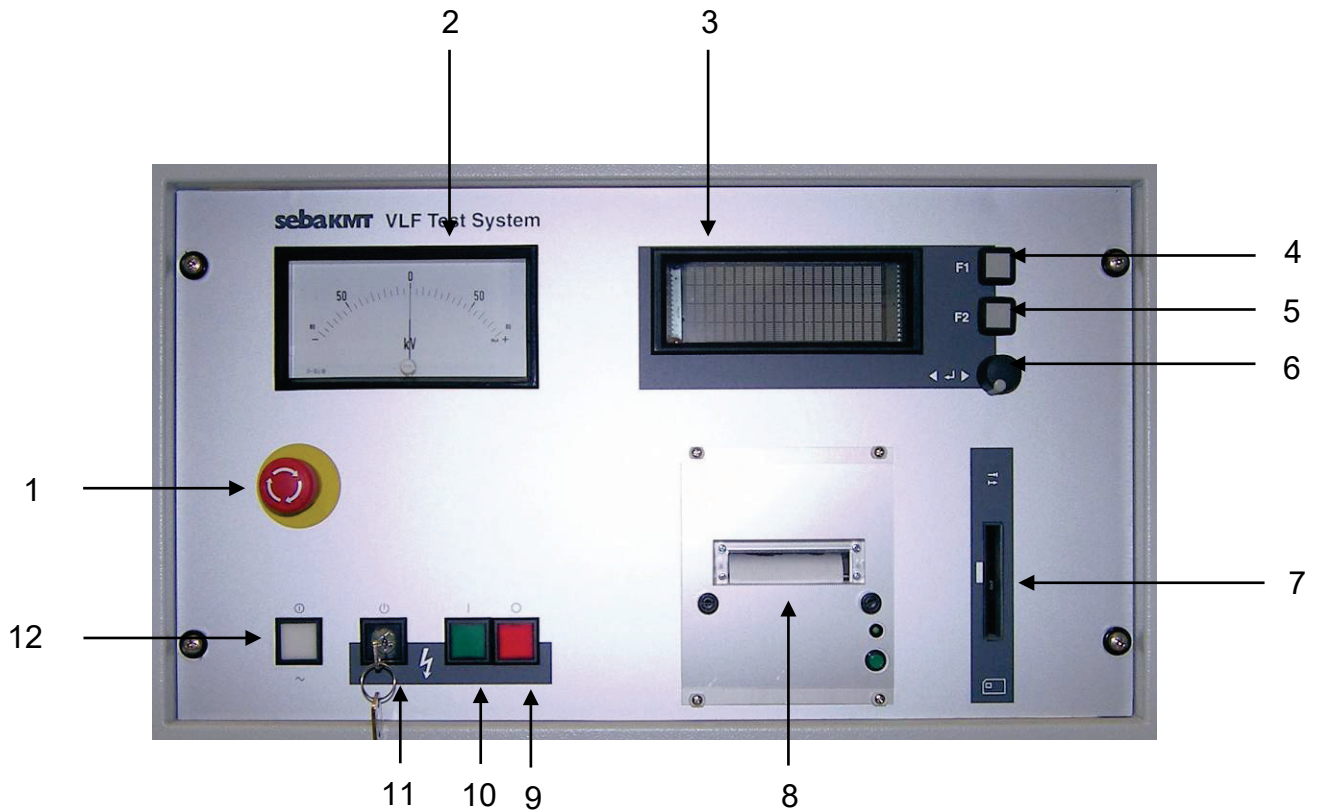


Fig : 3 Operating module, Front View

- 1 Key "Emergency Off"
- 2 Analogue indication instrument test voltage (kV)
- 3 Display
- 4 Menu key F1
- 5 Menu key F2
- 6 Knob / push-button
- 7 Intake slot for the System Card (optional)
- 8 Protocol printer (optional)
- 9 Key "HV Off" (red)
- 10 Key "HV On" (green)
- 11 Key-operated switch "Interlock"
- 12 Key "Mains On" (white)



### 2.3.2 Display of the Operating module

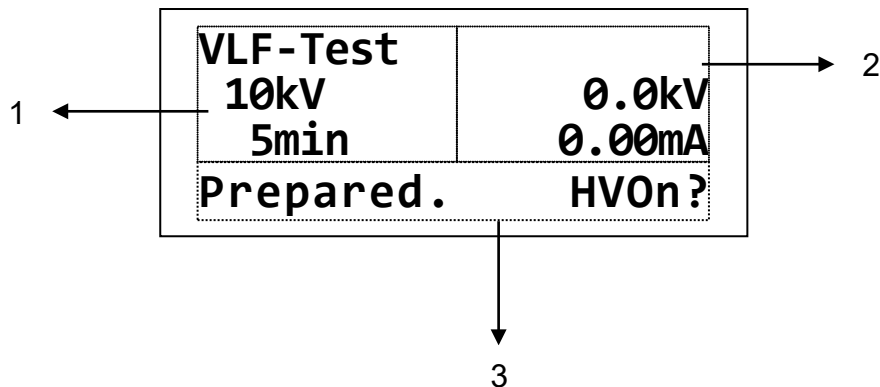


Fig : 4: Display of the Operating module (View of the standard operating mode)

- 1 Representation of parameters with value and content resp.
- 2 Representation of residual time and/or measuring values
- 3 Representation of operator guidance / status display

The representation of the residual time / measuring values (Fig 4; number 2) takes place according to following pattern:

- **Residual time**                    **31:45** or after calling by the menu key F1 (Fig 3; item 4) e. g.
- **HV-Set value**                    **!10.0 kV!** (Return after residual time by the menu key F1) e. g.
  
- **Measuring voltage**            **-10.4 kV** or independent to e. g.
- VLf final voltage**            **[-11.0 kV]** (change back by the menu key F2) e. g. or
- Storage voltage**                **(-11.8 kV)** (after breakdown in the cable) e. g.
  
- **Measuring current**            **-0.14 mA** or independent to e. g.
- VLf final current**            **[-0.16 mA]** (change back by the menu key F2) e. g. or
- Storage current**                **(-0.21 mA)** (after breakdown in the cable) e. g.

Following signals are indicated in the line of operator guidance / status display (Fig 4, item 3):

- **Operator guidance**    „Select mode    OK?“ e. g.
- **Status display**            „Running.    HVOff?“ e. g.
- **Switching condition**    „HV interlock“ e. g.
- **Cause for shutdown**    „Breakdown in cable“ e. g.
- **Warning**                    „34: No printer data“ e. g.
- **Failure message**        „19: Coil overload“ e. g.

## 2.3.3 VLF Test System as a whole

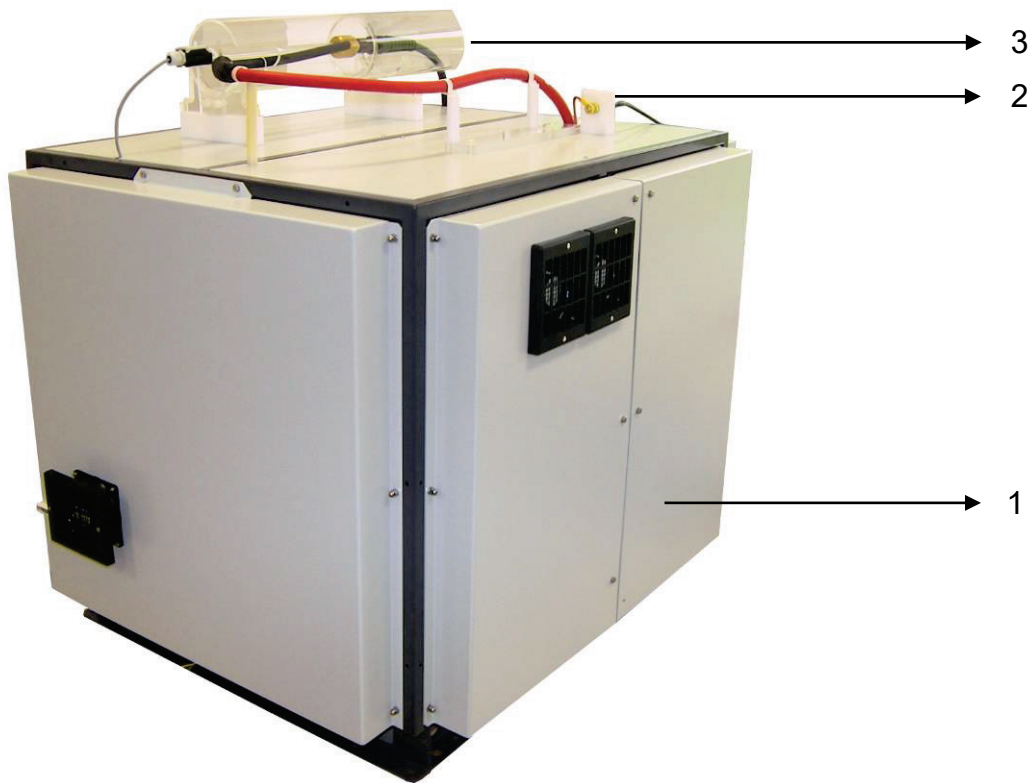


Fig : 5: HV modul

- 1 HV modul
- 2 Operational earth connector
- 3 HV connector

### **3. DESCRIPTION OF THE TEST METHOD**


Because of the space charges formed in the dielectric of the cable, DC test methods prove to be dangerous when applied to PE and VPE cables and should therefore never be used on such types of cables.

VLF testing is an alternative test method. It is based on the classical method of AC testing but is carried out at a very low frequency (VLF).

Meaningful test results can be obtained by using a rectangular test voltage with a cosine-type alternation of polarity at a frequency of 0.1 Hz.

Its mode of operation has been described in section 2.2.

## 4. SETTING-UP OPERATION

|   |  |
|---|--|
|  <p><b>WARNING</b></p> | <p><b>Safety Precautions</b></p> <ul style="list-style-type: none"><li>• Whenever the VLF Test System is operated, a second person must be present within viewing and hearing distance who can recognise possible hazards and press the Emergency Off key.</li><li>• In order to avoid dangerous charging, connect all metal parts in the vicinity of the VLF Test System to earth.</li><li>• As a matter of principle, all unused cables not needed for the test have to be shorted and connected to earth.</li><li>• Safety installations may not be by-passed nor deactivated.</li><li>• To avoid drawing dangerous arcs, switching should only be done in de energized condition.</li><li>• In the event of larger 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 arc-overs, the system must not be operated when in this condition. It should instead be left in the new environment for roughly one hour to acclimatise before it is then put into operation.</li></ul> |
|---|--|

### 4.1 Preparing the Site

- Place the test van in an adequate and plane position next to the test cable access point (but not on the test cable route) with regard to its dimensions and its load-carrying capacity. Check whether the system stands in stable position.
- Secure the test van against rolling by pulling the hand brake and, if required, by placing wedges at the wheels.
- Protect the site according to regulations using appropriate barriers, warning signs and cable bridges.

## 4.2 Electrical Connection of the VLF Test System

### 4.2.1 General Rules for Making Connections

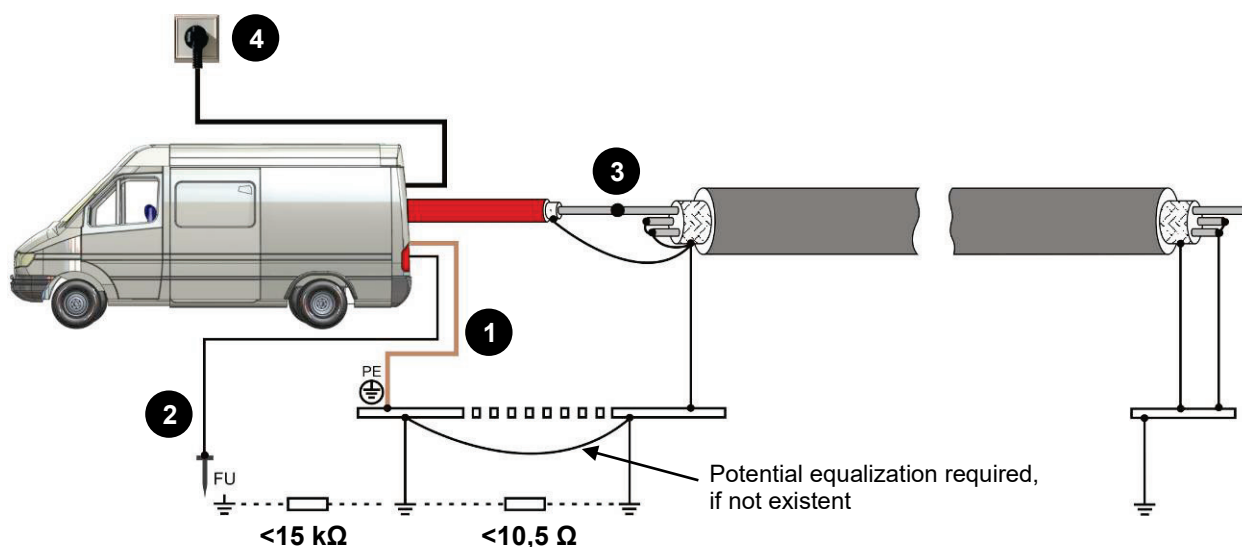


Fig : 6: Electrical Connection of the VLF Test System



**WARNING**

#### Follow the given order

The preparing tasks must be performed in the order they are described within this chapter. It is indispensable to properly connect the safety equipment and the HV cable prior to the mains connection.

- 1 Connecting system earth (see section 4.2.3)
- 2 Connecting FU earth (see section 4.2.4)
- 3 Connecting the test object (see section 4.2.5)
- 4 Connecting the mains cable (see section 4.2.6)



**WARNING**

Never operate a test van unless the earthing cable is connected. The earthing cable connects the test van with protective earth and, thus, guarantees safety against accidental contact for the entire system.

Protective earth (earthing cable) and operational earth (shield of the HV cable) shall be connected that no inadmissible voltage difference may arise between protective earth (PE) and neutral conductor (N).

## 4.2.2 Connection Equipment

The arrangement of the connection equipment may differ depending on the type of vehicle and the system configuration. In general the connection equipment consists of the following components:

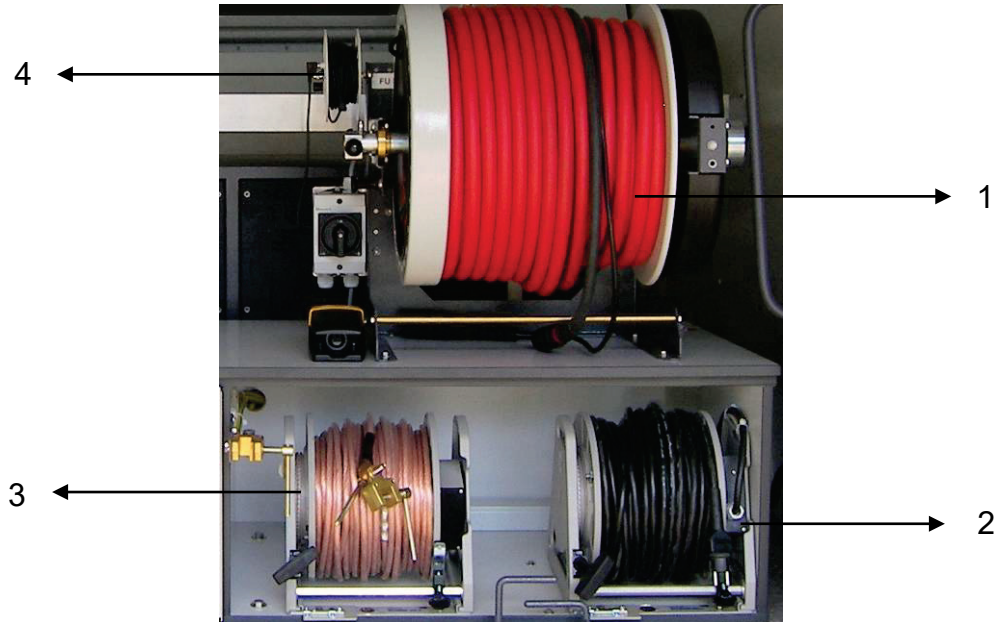


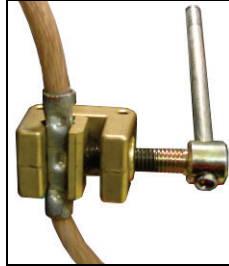
Fig : 7: connection equipment

- 1 HV cable drum
- 2 Mains cable drum
- 3 Earthing cable drum
- 4 FU cable

### 4.2.3 Connecting System Earth

Perform the following steps to connect the system earth:

- Release the brake of the earthing cable drum (Fig 7; item 3).
- Unreel the cable and connect it to the station earth.
- Tuck one of the contact bushes, mounted in 5 m intervals, under the clamp of the earthing cable drum.



- Fix the brake of the cable drum.

## 4.2.4 Connecting FU Protective Equipment

Perform the following steps to connect the FU protective equipment:

- Unreel the FU cable (Fig 7; item 4).
- Drive the earth spike into the ground close to the test van and connect the FU cable.



In offshore operation on a ship or platform where an earth spike cannot be used, the FU cable must be connected to metal deck as close as possible to the VLF system.

---


---

- Connect the other end of the FU cable to the connector of the FU cable drum.





#### 4.2.5 Connecting the Test Object

|   |   |
|---|---|
| <br><b>WARNING</b> | <p><b>Follow the five safety rules</b></p> <p>The five safety rules as described in section 1.2 must always be followed before connecting the test van to a test cable.</p> |
|---|---|

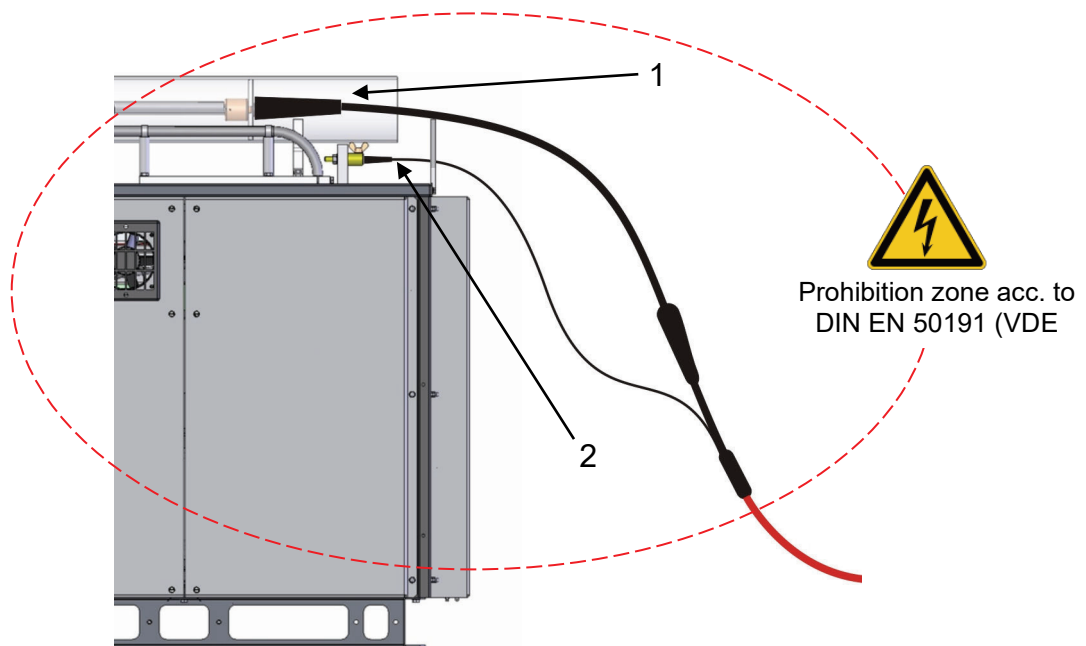



Fig : 8: HV connectors of the HV module

Perform the following steps to connect the test object:

- Release the brake of the HV cable drum (Fig 7; item 1).
- Unreel the HV cable.
- Connect the shield of the HV cable (operational earth) to the shield of the cable under test.
- Connect the HV cable to the test object using the supplied clamps or other adequate equipment.
- Fix the brake of the cable drum.
- Take the connecting end of the HV cable out of its support on the cable drum and connect it to the high-voltage output (Fig 8; item 1) and to the operational earth (Fig 8; item 2) of the VLF Test system. The inner conductor of the HV connection cable must be routed through the notch in the support and must be kept in a distance of at least 25 cm to the casing of the HV module and neighbouring metallic parts.

|   |   |
|---|---|
| <br><b>WARNING</b> | <p>Conductors of the test object which are not needed for the test must be connected to system earth.</p> |
|---|---|

## 4.2.6 Connecting the Mains Cable

Perform the following steps to connect the test system to mains voltage:

- Release the brake of the mains cable drum (Fig 7; item 2).
- Completely unreel the cable.
- Plug the cable into a mains outlet.
- Fix the brake of the cable drum.



**WARNING**

Connections to some special types of mains outlets or direct connections to mains conductors have to be done using certified adapters only (according to VDE or corresponding national standards).




**WARNING**

When the cable under test and the power supply system are connected to different earthing systems not linked with one another, a connection between the two earthing systems must be established for potential equalization using a cable with a cross-sectional area of at least 16 mm<sup>2</sup>.

Proper earthing conditions are of highest importance!

## 5. EXECUTION OF TESTS

### 5.1 VLF / DC Test

|   |   |
|---|---|
| <br><b>CAUTION</b> | <p><b>Checking the humidity</b></p> <p>Prior to putting the system into service, read off the hygrometer mounted at the workspace to check the relative humidity. If the value exceeds 70%, the system must not be operated with HV. Instead, the humidity has to be decreased to a value within the tolerance limits by dehumidifying the air using the internal air condition. These conditions have to be maintained for at least 30 minutes. It is recommended to operate the system with a nominal voltage of 0 kV during the dehumidification period in order to keep the system fans in operation.</p> |
|---|---|

For high voltage tests by using the VLF Test System to be carried out, all electrical connections must have been established as described in sections before.

Now the test system can be put into operation. After activation of the "Mains On" pushbutton (Fig 3, item 12) the system can be operated using the knob / push-button (Fig 3, item 6) and the display (Fig 3, item 3).

The following start menu is represented on the display (Fig 3, item 3) after start-up:

|                 |                 |
|-----------------|-----------------|
| <b>VLF mode</b> |                 |
| <b>10kV</b>     | <b>F1:Print</b> |
| <b>5min</b>     | <b>F2:Setup</b> |
| <b>Ready</b>    | <b>OK:Start</b> |

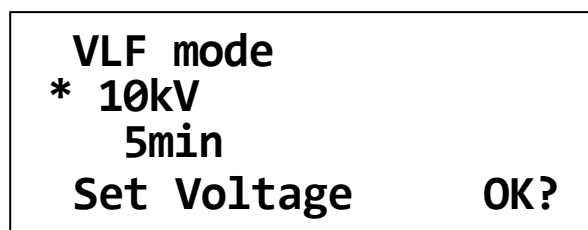
Fig : 9: Start menu

A singular pressure on the knob / push-button (Fig 3, item 6) will enable the operation mode to be selected:

|                    |            |
|--------------------|------------|
| <b>*VLF mode</b>   |            |
| <b>10kV</b>        |            |
| <b>5min</b>        |            |
| <b>Select Mode</b> | <b>OK?</b> |

Fig : 10: Selection of the operation mode

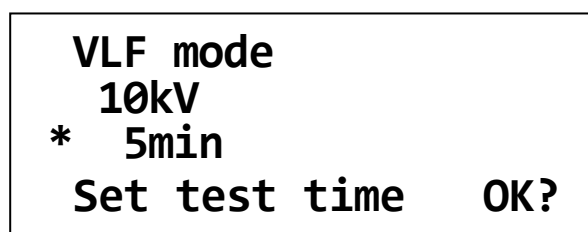
Now the user is able to choose the operation mode out of VLF, DC– and DC+ (only available on systems with two voltage sources) by turning the knob / push-button (Fig 3, item 6). The selection has to be confirmed by a singular pressure on the knob / push-button (Fig 3, item 6). Now it is possible to select the test voltage level:



The screenshot shows a rectangular box with a black border containing the following text:  
**VLF mode**  
**\* 10kV**  
**5min**  
**Set Voltage                      OK?**

Fig : 11:            Selection of the test voltage

The test voltage level can be adjusted in steps of 1 kV up to the maximum test voltage of the system by turning the knob / push-button (Fig 3, item 6). The adjusted test voltage level has to be confirmed by pressure on the knob / push-button (Fig 3, item 6). Now it is possible to adjust the test time:



The screenshot shows a rectangular box with a black border containing the following text:  
**VLF mode**  
**10kV**  
**\* 5min**  
**Set test time                    OK?**

Fig : 12:            Selection of the test time

The test time can be adjusted in steps of 1 min from 5 min up to 45 min and in steps of 5 min from 45 min up to 90 min test duration at maximum by turning the knob / push-button (Fig 3, item 6). The adjusted test time has to be confirmed by pressure on the knob / push-button (Fig 3, item 6).

Use the information given in DIN VDE 0276 - 620 and 0276 - 621 as a guideline to start from. These standards recommend a test level of 3 x U<sub>0</sub> and a test duration of 30 or 60 minutes, respectively

When you follow these guidelines, the test level is near the peak voltage of a 50-Hz test (2 x U<sub>0</sub> rms).

For sheath tests with DC voltage, the test voltage should not exceed 3 kV for PVC cables or 5 kV for PE cables respectively.

## 5.2 Sheath Fault Location

Following a failed sheath test with DC voltage fault location based on the step voltage method can be immediately performed at the cable under test with the VLF test system serving as voltage source.

The test current coming from the pulsed DC source is flowing into the ground at the point of fault and results in a maximum step voltage at the fault. This peak is located with an earth fault locator (e.g. ESG 80-2). When approaching the fault position, the step voltage increases and decreases after the fault with a change in polarity.

The **SFL** operation mode can be selected by turning the knob / push-button (Fig 3, item 6). Afterwards, the voltage level (max. 10 kV) and the pulse rate can be selected as described in the section before.

By changing the pulse rate you can vary the cycle period too (between 4 or 6 seconds). E.g. the setting **4s 1:3** enables 4 seconds cycles where 1 second of high voltage is followed by a 3 seconds dropout.

|                    |            |
|--------------------|------------|
| <b>SFL mode</b>    |            |
| <b>10kV</b>        |            |
| <b>*4s 1:3</b>     |            |
| <b>Set pulsing</b> | <b>OK?</b> |

Fig 13: Selection of the pulse rate

## 5.3 Starting the Test / Location

After the system has carried out all necessary settings which takes a short period of time, the high voltage can be enabled.

|                 |               |
|-----------------|---------------|
| <b>VLF mode</b> |               |
| <b>10kV</b>     | <b>0.0kV</b>  |
| <b>5min</b>     | <b>0.00mA</b> |
| <b>Prepared</b> | <b>HVOn?</b>  |

Fig : 14: HV on

It depends on the following conditions whether or not HV can be switched on using the respective pushbutton (Fig 3, item 10):

- All "Emergency Off" switches have to be released
- The transition resistance between the earth spike and the protective earth must not exceed  $15\text{ k}\Omega \pm 2\text{ k}\Omega$ .
- The fault voltage between test van chassis and earth spike must not exceed 40 V.
- The backdoor of the test van must be closed.
- The HV interlock (Fig 3; item 11) must be unlocked.
- The resistance between system earth and protective earth must not exceed  $10.5\ \Omega \pm 2\ \Omega$ .
- The voltage time area is less than 1Vs. This control mechanism is used to avoid dangerous voltage peaks.

If these conditions have been fulfilled, the "HV On" key (green) (Fig 3, item 10) lights up for about 10 s and can be activated during this time. Afterwards, the "HV Off" key (red) (Fig 3, item 9) lights up. Under maintaining of the predetermined charging parameters the test voltage will be regulated to the adjusted test voltage level.

At the analogue indication instrument (Fig 3, item 2) and on the display (Fig 3, item 3) the level and the polarity of the test voltage are represented. In addition, the leakage current of the test object is indicated on the display (Fig 3, item 3).

|                 |               |
|-----------------|---------------|
| <b>VLF mode</b> | <b>11:42</b>  |
| <b>20kV</b>     | <b>20.1kV</b> |
| <b>15min</b>    | <b>0.13mA</b> |
| <b>Running.</b> | <b>HVOff?</b> |

Fig 15: Cable test

During normal operation, the voltage source is / can be switched off

- by pressing the "HV Off" key (red) (Fig 3, item 9)
- automatically after the lapse of the test time
- automatically after a voltage breakdown in the cable under test or a short circuit has been detected

In these cases the predefined discharging of the (voltage source), back-up capacitor and test object follows.

|                       |                 |
|-----------------------|-----------------|
| <b>VLF mode</b>       |                 |
| <b>20kV</b>           | <b>F1:Print</b> |
| <b>15min</b>          | <b>F2:Setup</b> |
| <b>Test time over</b> |                 |

Fig 16: Start menu after the test has been finished

In addition, the voltage source is / can be switched off

- by activating the “Emergency Off” switch (Fig 3; item 1),
- by turning HV interlock key switch (Fig 3; item 11),
- by removing a system card which has been inserted prior to the test (see section 7.4)
- after drop out of the operating voltage
- after detection of an internal failure (see section 8.4)

In these cases the predefined discharging of the voltage source, back-up capacitor and test object follows too.

**Attention!** The test object has to be connected to earth and shorted after termination of the test.

You are not excused from this duty even the complete discharge by the internal discharging unit and the zero positioning of the residual voltage (Fig 3, item 2) have been performed.

In the case of an incomplete discharge of the test object the complete discharging must be carried out by a suitable discharge rod.

After the test session has been finished, the test system has to be switched off. Afterwards, it must be disconnected from the cable under test which has been grounded and shorted before. Finally, the earth cable has to be disconnected.

## 6. ADDITIONAL FUNCTIONS

### 6.1 Adjustment of Language

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the "User setup" menu can be accessed. Here the language on the display and in the protocol printing of the VLF Test System can be adjusted. Any new setting will be saved after pressing of the knob / push-button (Fig 3, item 6).

```
User setup
*Lang.:  English
Level:   Standard
Select user language
```

Fig : 17: User Setup: Language

### 6.2 Viewing the System Information

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the "System info" menu can be accessed. When accessing this menu, the software versions of several system components and the system ID, you should have on-hand when calling a service centre, are shown on the display. In some cases the system ID is also required for the subsequent activation of optional system features. A short instruction how to enable optional system features is handed out with the certificate you get when buying one or more options.

```
*System info
ID:12345678
1.21-1  1.21-1  1.21
USER    PROT    CTRL
```

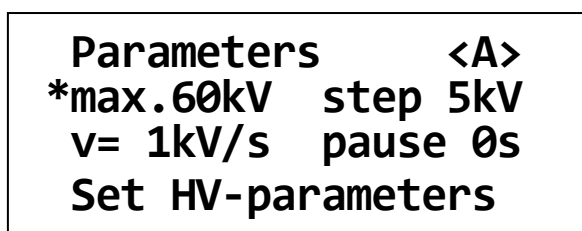
Fig 18: Setup: System Informationen



### 6.3 Viewing / Setting the System Parameters

Certain test parameters are permanently stored as system parameters and secured against unauthorized changes. As a standard user you can only view these parameters. In order to adjust these parameters you have to gain administrator rights by entering the administrator password first (see section 6.4).

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the "Parameters" menu can be accessed. Provided you own administrator rights (see section 6.4), the following parameters can be adjusted:



```
Parameters      <A>
*max.60kV  step 5kV
v= 1kV/s   pause 0s
Set HV-parameters
```

Fig : 19: Setup: Parameters

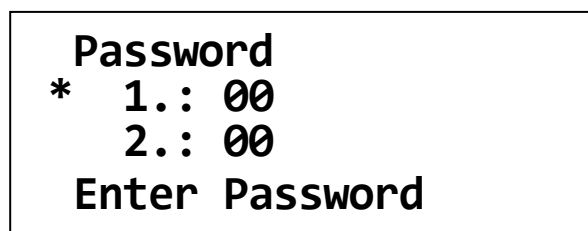
- Adjustment of the **maximum test voltage in kV**: By this adjustment the maximum output voltage of the system can be permanently restricted in the space of its standard data. Any re-setting can be only carried out by the administrator. The standard maximum voltage of the test system represents the default setting.
- Adjustment of the **rate of the test voltage increase v in kV/s**: By this means the rate of increase of the test voltage during the charging phase can be adjusted. Any re-setting can be only carried out by the administrator. The default setting is 1 kV/s.
- Adjustment **Step in kV**: By this means the increment at stepwise increasing of the test voltage during the charging phase can be adjusted. Any re-setting can be only carried out by the administrator. The default setting is 5 kV.
- Adjustment **Pause** (rest period) **in s**: Here the duration of the rest period at stepwise increasing of the test voltage during the charging phase can be adjusted. Any re-setting can be only carried out by the administrator. The default setting is 0 s.

## 6.4 Entering / Changing the Administrator Password

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the "Password" menu can be accessed. When entering this menu, you have to enter the administrator password in order to gain the administrator rights enabling you to adjust the test parameters accessible via the "Parameters" menu (see section 6.3).

The factory-provided default password for any VLF test system is **2345**.

The first two digits of the password (**23**) have to be entered under 1. and the last two digits (**45**) have to be entered under 2. Any entered number sequence has to be confirmed by pressing the knob / push-button (Fig 3, item 6).



```

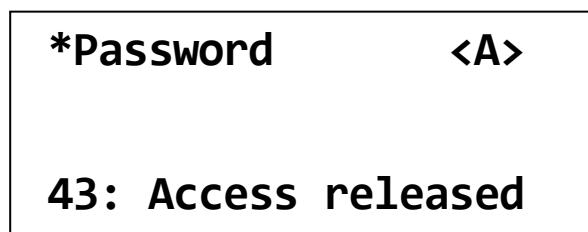
Password
* 1.: 00
   2.: 00
Enter Password

```

Fig : 20: Setup: Enter password

The access will be gained, if the correct password has been entered. The respective system message has to be confirmed by pressing the knob / push-button (Fig 3, item 6).

You are now authorised as an administrator which is indicated by the characteristic **<A>** in the top right of the display.



```

*Password           <A>

43: Access released

```

Fig : 21: Setup: Entered password ok

After the password has been entered and accepted, it can be changed.

In order to change the password, you have to access the “Passw. Set” menu right after you gained administrator rights. The new password has to be entered the same way as the current password has been entered (see previous page).

```
Passw. Set      <A>
*  1.: 00
    2.: 00
Change password
```

Fig : 22: Setup: Enter new password

```
*Passw. Set    <A>

55: Password stored
```

Fig : 23: Setup: New password stored

## 6.5 Returning to the start menu

In order to return to the start menu you have to access either the “Return” or the “Escape” menu item.

If you leave the setup via “Return” (fully to the left), you lose the administrator rights.

If you leave the setup via “Escape” (fully to the right), you keep the administrator rights.

```
*Return        <A>

Your selection ?
```

Fig 24: Setup: Return to start menu

## 7. Optional Features

### 7.1 Detection of Breakdown and Short Circuit

For systems equipped with the optional breakdown and short circuit detection, the test voltage will be immediately switched off in any case of a breakdown in the cable under test. The status message "Cable break down" is indicated on the display.

The level of the break down voltage is indicated on the display. That value is represented as storage voltage (i.e. in parentheses).

In case of a short circuit (test voltage < 5% of rated voltage), the test voltage will be switched off. The status message "Cable cannot be charged" is indicated on the display.

|                           |                 |
|---------------------------|-----------------|
| <b>VLF mode</b>           | <b>6:32</b>     |
| <b>20kV</b>               | <b>(20.1kV)</b> |
| <b>15min</b>              | <b>(0.19mA)</b> |
| <b>Breakdown in cable</b> |                 |

Fig 25: Breakdown detection

### 7.2 Measurement of Leakage Current

If a system is equipped with the optional Leakage Current measurement, the leakage currents of the test object are indicated on the display during the test.

During charging period, the instantaneous measurement values are indicated on the display. Afterwards, the VLF final values are indicated on the display. The final values (test voltage and leakage current) are represented in brackets. Change-over to the representation of the instantaneous measurement values (values without parentheses or brackets) and back can be carried out by activating the F2 key.

If the VLF Test System has been additionally equipped with the logging option or protocol printout option, these measurement values can be additionally filed and printed out respectively.

### 7.3 Internal Protocol Printout

If the VLF Test System is equipped with an internal protocol printer (Fig 3, item 8), data logged during a cable test can be printed out on this printer.

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the "Protocol" menu can be accessed. Here you can change the behaviour of the printer by adjusting the "Print" parameter. The value of the parameter can be changed by rotating the knob / push-button (Fig 3, item 6) and can be accepted / saved by pressing it.

```
Protocol
Prot.: Extended
*Print: Off
Set print mode
```

Fig : 26: Setup: Protocol Printout Off

```
Protocol
Prot.: Extended
*Print: Standard
Set print mode
```

Fig : 27: Setup: Protocol Printout Standard

After a cable test has been finished, the protocol printout can be triggered from the start menu (Fig. 9) by pressing the F1 key once or repeatedly.

Depending on the print settings (see above), the following information are included in the printout:

- Printout "**Standard**":
  - Header (extended by the header from the SystemCard (if specified))
  - System type and version
  - Mode of operation, test voltage, test time
  - Date / Time of test start
  - Result of the test
  - Measured data (time, test voltage in kV, leakage current in mA) of the test phase (affected by the "print time points" set on the SystemCard (if specified))
  - Footer (extended by the footer from the SystemCard (if specified))
  - Date / Time of the printout

- Printout "**Extended**":
  - All information listed under "**Standard**"
  - Maximum test voltage, test voltage increase, step increment, rest period of the ramp (ramp pause)
  - Settings for logging and printing
  - User profile, service / administrator mode (if applicable)
  - Measured data (time, test voltage, current) of the charging period
- Printout „**Detailed**“:
  - All information listed under "**Extended**"
  - A bunch of measuring data logged right before the end of the test

For systems equipped with the logging option (see section 7.4), up to 4 header lines and 4 footer lines (e.g. the company name or a field for the signature of the operator) can be specified.

This so called individual "**print templates**" can be imported into the system using a SystemCard (see section 7.4.2). It depends on the settings of the SystemCard whether these print templates are permanently stored in the test system configuration or are only valid for the period of the cable test under way.

In order to test the layout of the individual header lines and footer lines you can initiate a test printout even if no cable test has been performed before. For this purpose, you have to change the print settings to "Text" or "System" first. Afterwards, you can initiate the test printout from the start menu by pressing F1.

Depending on the print settings, the following information are included in the printout:

- Printout "**Text**":
  - Header (extended by the header from the SystemCard (if specified))
  - System type and version
  - Footer (extended by the footer from the SystemCard (if specified))
  - Date / Time of the printout
- Printout „**System**“:
  - All information listed under "**Text**"
  - All information about the system configuration (options, software versions)

**Attention:** When initiating a test printout ("Text" or "System"), any set of measuring data that may have been logged during a previous cable test will be deleted.

**Attention:** Immediately change the print settings back to your normal protocol printout mode after you performed a test printout.

**Note:** If a SystemCard is used with the system (see section 7.4), make sure that when parametrizing the SystemCard under "WinkisVFL", the "**Settings: Protocol printout**" parameter has been set to **[set on device]**. Otherwise, the print settings are automatically adopted from the SystemCard and cannot be changed manually.

## 7.4 Using a SystemCard

### 7.4.1 Purpose of a SystemCard

If the VLF Test System has been equipped with the logging option, the measured data can be written to a so-called **SystemCard** which has the dimensions of a conventional credit card.

The SystemCard can be used to store and transfer logged data (see section 7.4.3) and to hand over predefined test parameters to the system (see section 7.4.2).

In order to format and, if required, parametrize a SystemCard and to analyze / archive the logged measuring data, the software *WinkisVLF* has to be used. For detailed information about the *WinkisVLF* software, please refer to its online help.

In general, a SystemCard can be used for the following purposes:

- A SystemCard can be prepared for storing measured data only (**Protocol card**). No test parameters are handed over to the system. The card may also contain header lines and footer lines for printouts (see section 7.3) which, however, are only valid for the cable test under way.
- A SystemCard can be prepared for parametrizing the system (**Parameter card**). In this case, the SystemCard changes the settings of the system as specified under *WinkisVLF* before. The card may also contain header lines and footer lines for printouts (see section 7.3). Both, the parameters handed over by the SystemCard and the print templates are not permanently stored on the system and only valid for the cable test under way.
- A SystemCard can be prepared for both **parametrizing the system** and **storing the measured data**. The parameters handed over by such a SystemCard are not permanently stored on the system and only valid for the cable test under way. The card may also contain header lines and footer lines for printouts as well as “print time points” (see section 7.3).
- A SystemCard can be prepared for parametrizing the system in a way that the parameters handed over by the SystemCard **change the device settings permanently**. The card may also contain header lines and footer lines for printouts (see section 7.3) which are also permanently stored on the system.  
**Attention:** This type of card cannot be used for storing measured data.

## 7.4.2 Preparing a SystemCard

Using a SystemCard appropriately parametrized under *WinkisVLF* will enable you to make volatile (only for the cable test under way) or permanent changes to your device settings. Depending on how the card has been parametrized, either all or only certain test parameters are affected.

That way, cable tests can be planned and prepared in the office using *WinkisVLF*. Later, on-site, you only have to plug the SystemCard into the system in order to change the system settings the way it has been planned.

Furthermore, this will allow you to prepare volatile print templates (individual header lines and footer lines for the ongoing cable test) or non-volatile print templates (as default protocol template for permanent use) (see section 7.3).

By defining “print time points” using *WinkisVLF* you can also schedule the logging timeline. These “print time points” are only valid for the cable test under way and cannot be stored permanently.

For detailed information about the *WinkisVLF* software, please refer to its online help.

The parameters stored on a SystemCard are automatically adopted by the test system right after the card has been plugged into the respective slot on the control unit (see section 7.4.4).



### 7.4.3 Logging to SystemCard

By activating the logging function, measuring data logged during a cable test can be written to a SystemCard. These data may consist of system information, system / test settings, information about the course of the cable test, the measured data (test voltage, leakage current) and the test result.

Back in the office, the logged data can be transmitted from the card to a PC where it can be analyzed and archived using the *WinkisVLF* software.

For detailed information about the *WinkisVLF* software, please refer to its online help.

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the menu "Protocol" can be accessed. Here the logging mode ("Prot.") of the VLF test system can be adjusted by rotating the knob / push-button and saved by pressing it.

```
Protocol
*Prot.: Off
Print: Standard
Set protocol mode
```

Fig : 28: Setup: Protocol Off

```
Protocol
*Prot.: Extended
Print: Standard
Set protocol mode
```

Fig : 29: Setup: Protocol Extended

Depending on the logging mode, the following data is written to the SystemCard:

- Protocol **“Off”**:  
If the protocol mode is set to “Off”, **no** measured data is written to the SystemCard.
- Protocol **“Standard”**:
  - System type and version
  - Test settings relevant for analysis
  - Date / time of test start
  - Result of the test and remaining test time
  - Measured data (time, test voltage in kV, leakage current in mA) of the test phase
- Protocol **“Extended”**:
  - All information listed under **“Standard”**
  - Measured data (time, test voltage, current) of the charging period

**Hint:** Setting the protocol mode to "Standard" or "Extended" requires a SystemCard to be plugged in.

**Hint:** After a test run has been finished, the system card has to remain in the slot until the system is completely discharged (status message appears). Otherwise, data may be lost.

#### 7.4.4 Operating the Test System with a SystemCard

In order to use a SystemCard for parametrizing the test system or storing the logged data, the card has to be plugged into the respective slot (Fig 3; item 7) of the control unit prior to the start of the cable test (while the start menu is visible).

If it is a valid card, the parameters and other relevant information are read out from the card. The operator has to identify the card as “Porper Card ?“ while the test parameters obtained from the card are shown on the display.

After the card has been acknowledged by pressing the knob / push-button, the system performs some more checks of the system card (e.g. available logging memory on the SystemCard) whereupon the start menu should look as follows:

|                 |                 |
|-----------------|-----------------|
| <b>VLF mode</b> |                 |
| <b>20kV</b>     | <b>F1:Print</b> |
| <b>15min</b>    | <b>F2:Setup</b> |
| <b>By card.</b> | <b>OK:Start</b> |

Fig 30: Start menu with SystemCard inserted

From now on, only the test parameters which have been specified as **[set on device]** under *WinkisVLF* can be manually changed. This does also apply for the parameters accessible via the setup menu (F2 key).

If the card is removed from the slot, the settings are undone and the standard start menu appears on the display.

A cable test can be started as described in section 5.1.

**Attention!** If the SystemCard is removed during an ongoing cable test, the test is interrupted!

For the **special case** of a SystemCard intended to change the settings of the test system permanently (see section 7.4.1), the settings (test parameter, print templates etc.) are handed over and stored in the system right after the card has been identified as a “Proper Card ?”. Afterwards, the start menu looks as follows and the card has to be removed from the slot.

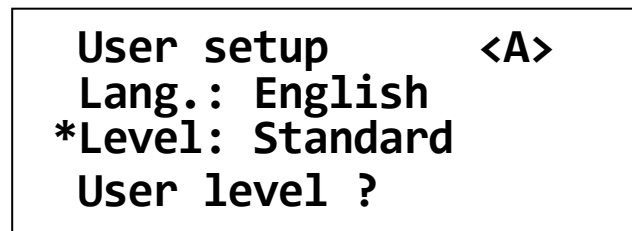
|                         |                 |
|-------------------------|-----------------|
| <b>VLF mode</b>         |                 |
| <b>25kV</b>             | <b>F1:Print</b> |
| <b>30min</b>            | <b>F2:Setup</b> |
| <b>Card data stored</b> |                 |

Fig 31: Start menu after new system settings have been stored

## 7.5 Function User Setup / User Level

By pressing the F2 key (Fig 3, item 5) and turning the knob / push-button (Fig 3, item 6) the menu "User Setup" can be accessed.

After administrator rights have been gained as described in section 6.4, the "User Setup" menu can be used to change the user level. That function is of importance when logging to SystemCard (see section 7.4.3) or parametrizing the system using a SystemCard (see section 7.4.2).



```
User setup      <A>
Lang.: English
*Level: Standard
User level ?
```

Fig 32: Setup: User Profile

By setting the user level to "**Single**", the system can only be operated with a parametrized SystemCard. That way, the users operating the system on-site are not allowed to change test parameters not specified as **[set on device]**.

By setting the user level to "**Standard**", the system can be operated with or without SystemCard.

**Attention!** Only the user level "**Standard**" allows the system to be operated without SystemCard.

## 7.6 Re-Setting the System Settings / Deleting the Print Templates

The user interface of the VLF Test System allows you to reset the non-volatile system settings back to the default factory settings and to delete permanently stored print templates.

After administrator rights have been gained as described in section 6.4, the “Memory” menu can be accessed via the “Setup” menu. The functions of this menu can be activated by pressing the F1 key or F2 key respectively. By pressing the knob / push-button the menu can be left without triggering a function.

|   |
|---|
| <p><b>Memory</b><br/><b>F1: Reload setup</b><br/><b>F2: Delete texts</b><br/><b>F1/F2?                    else OK</b></p> |
|---|

Fig 33: Setup, Memory

“**F1: Reload setup**” resets all parameters and system settings to the default factory settings. The administrator password is not affected (see section 6.4).

“**F2: Delete Texts**” resets all print templates (individual header lines and footer lines) stored on the system (see section 7.3).

**Hint:**            These functions are not accessible, if a System Card inserted.

## 7.7 Adjustment of the System Timer

If the test system is equipped with at least one of the system options "Logging" or "Protocol printout", the system contains a battery-operated and crystal-controlled clock (see section 8.2).

After activating of the Menu key F2 (Fig 3, item 5) and by turning the knob / push-button (Fig 3, item 6) the menu "Date / Time" can be accessed. Here the date and the clock time of the system timer (VLF Test System) can be adjusted. By turning the knob / push-button, the value of the selected segment is changed. You can toggle through the segments by pressing the knob / push-button.

After all segments have been set, the date and time can be stored by pressing the F1 key. By pressing the knob / push-button again, the changes are discarded.

```
Date/Time  
Mo 19.06.08 10:27:13  
  
F1= set!      else OK
```

Fig : 34: Setup Date / Time

```
Date/Time  
Mo 19.06.08 10:27:13  
*  
Set date & time
```

Fig : 35: Setup Date / Time: adjusting the day of the week

```
Date/Time  
Mo 19.06.08 10:27:13  
          *  
Set date & time
```

Fig : 36: Setup Date / Time: adjusting the minutes

```
Date/Time  
Mo 19.06.08 10:27:13  
          *  
F1= Set!      else OK
```

Fig : 37: Setup Date / Time: Saving by F1

## 8. Maintenance and Troubleshooting

### 8.1 How to Exchange the Paper Roll or Ink Ribbon of the Printer

The optional built-in printer is housed in a robust metal case with removable front cover.

To exchange the paper roll or the ink-ribbon cartridge, first remove the front cover from the printer.

#### a) How to remove the front cover

Turn either knurled screws anti-clockwise (Fig 38) until the front cover comes off the printer (Fig 39).



Fig 38: Unscrewing the printer front cover

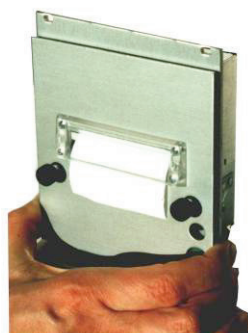


Fig 39: Removing the front cover

#### b) How to exchange the ribbon

To exchange the ribbon, press down the left edge of the ink ribbon cartridge marked "Push" and "Eject" (Fig 40). The cartridge will come off on the right-hand side and can now be removed. Tighten the ribbon of the new cartridge by turning the small wheel on the right-hand side, following the direction of the arrow. After that, guide the ribbon cartridge over the paper. See to it that the paper is between the textile ribbon and the plastic bridge (Fig 41). Let the ink cartridge engage distinctly. If you encounter blurred or unbalanced printing, improper engagement of the ink cartridge is very likely to be the cause.

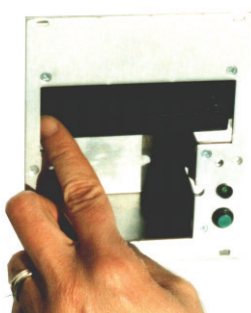


Fig 40: Removing the ribbon cartridge

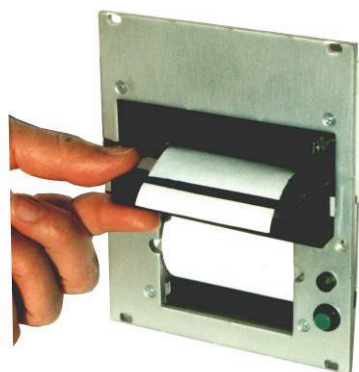


Fig 41: Inserting the ribbon cartridge

## c) How to exchange the paper roll

The container can hold paper rolls with up to 50 mm diameter.

First follow step 2 and remove the ribbon cartridge. Remove the spindle from the core of the empty roll and insert it into the core of the new paper roll.

If necessary, cut the front edge of the paper strip in a straight line. Hold the paper roll in your hand and thread the front end of the paper from below into the slot of the printer unit intended to this purpose (see Fig 42) until you sense some resistance. To lead the paper past the print head, press the paper feed button (Fig 43) until approx 5 cm (2 inches) of paper stand out of the printer unit.

Insert the new paper roll with the spindle into the paper container und tension the paper. After that, again insert the ribbon cartridge into the printer unit, as described in step 2.

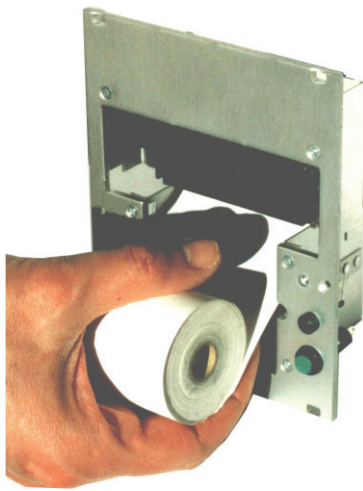


Fig 42: Inserting the paper roll into the printer

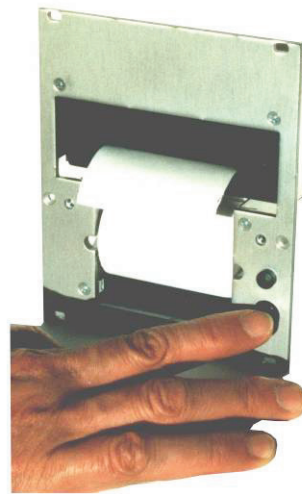


Fig 43: Paper feed button

## d) How to attach the front cover

Lead the paper from the rear through the front cover and again screw the front cover onto the printer.

## 8.2 Replacing the Battery of the System Clock

If the test system is equipped with at least one of the system options “Logging” or “Protocol printout”, the system contains a crystal-controlled clock. The built in lithium cell is capable of powering the clock for several years.

If this battery needs to be changed, please contact the next service centre.



## 8.3 Connecting Cables, HV Couplings

Maintenance and troubleshooting include regularly checking the connecting cables such as earth cables, mains cables and test cables for being in good repair. In addition to that we recommend that the HV couplings at the Operating module and HV module should be checked with respect to mechanical integrity and cleanness.

Make absolutely sure that after use the HV plug of the test voltage cable is again covered with the included protective sleeve.

## 8.4 Operational and Error Messages

### 8.4.1 Classification of Messages

Operational and error messages occurring during operation of the "VLF Test System" are classified as follows:

| Symbol | Class   | Response | What to do                    |
|--------|---|----------|-------------------------------|
| U      | Operational message about state of system     |          | refer to instruction manual   |
| C      | Operational message about switching condition |          | confirm - continue operation  |
| F      | Error of type "fatal"                         | HV Off   | confirm - restart system      |
| T      | Error of type "trans"                         | HV Off   | confirm - repetition possible |
| N      | Error of type "normal"                        | HV Off   | confirm - repetition possible |
| W      | Warning                                       | none     | confirm - continue operation  |

For detailed information about the messages, please refer to the following paragraphs.

## 8.4.2 Operational Messages about State of System

The following operational messages inform the operator about the current state of the system.

You need not confirm any of them. The system, however, expects the operator to make one of the entries listed in the table.

| Code | Cl. | Operational message | Description  | Input                |
|------|-----|---------------------|--|----------------------|
| -    | -   | [ Start-up screen]  | System is starting up.                                   | none                 |
| -    | U   | Connecting...       | System is connecting Master and Slave processors.        | none                 |
| -    | U   | Initiating system   | System is initializing parameters etc.                   | none                 |
| -    | U   | Remove any card !   | No card must be plugged in during start-up.              | none pull out card ! |
| -    | U   | Ready. OK:Start     | System is ready for starting a test.                     | OK (or to Setup)     |
| -    | U   | By card. OK:Start   | System is ready for starting a test.                     | OK (or to Setup)     |
| -    | U   | Stopped. OK:Start   | System is ready for starting a test.                     | OK (or to Setup)     |
| -    | U   | Select mode OK?     | System is waiting for input of mode.                     | rotary knob + OK     |
| -    | U   | Set voltage OK?     | System is waiting for input of test voltage.             | rotary knob + OK     |
| -    | U   | Set test time OK?   | System is waiting for input of test time.                | rotary knob + OK     |
| -    | U   | Set pulsing OK?     | System is waiting for input of pulsing rate.             | rotary knob + OK     |
| -    | U   | Insert SystemCard   | System is waiting for a system card to be inserted.      | none insert card !   |
| -    | U   | Without card only   | Operation mode can only be performed without system card | none pull out card ! |
| -    | U   | Card is invalid !   | System card not readable or invalid.                     | none pull out card ! |
| -    | U   | Card is full !      | System card is full.                                     | none pull out card ! |

| Code | Cl. | Operational message | Description                                       | Input                 |
|------|-----|---------------------|---|-----------------------|
| -    | U   | Card is faulty !    | Content of system card is faulty.                 | none pull out card !  |
| -    | U   | Really this card ?  | System is waiting for confirmation of card.       | OK                    |
| -    | U   | Reading card...     | System is reading data from the system card.      | none                  |
| -    |     | Checking...         | System is checking the read data                  | none                  |
| -    | U   | Card data stored    | Non-volatile storage of data                      | none pull out card !  |
| -    | U   | Preparing...        | System is setting up parameters.                  | none                  |
| -    | U   | Prepared. HVOn?     | System is waiting for "HVon".                     | HVon or OK (abortion) |
| -    | U   | Turning on...       | System is starting up after "HVon".               | none                  |
| -    | U   | Running. HVOff?     | System is preparing high voltage.                 | HVoff or OK           |
| -    | U   | Holding. HVOff?     | System is preparing high voltage.                 | HVoff or OK           |
| -    | U   | Discharging...      | System is discharging and earthing after "HVoff". | none                  |
| -    | U   | F1=retry F2=reboot  | System is waiting for a decision after error.     | F1 or F2              |
| -    | U   | Press F2 to reboot  | System is waiting for reboot after fatal error.   | F2                    |
| -    | U   | Rebooting...        | System is going to reboot .                       | none                  |
| -    | U   | Printing...         | Device-internal protocol printing under way.      | none                  |
| -    | U   | Your selection ?    | In Setup: Prompting to select from menu.          | rotary knob + OK      |
| -    | U   | Set HV-parameters   | In Setup: Prompting to make entry                 | rotary knob + OK      |
| -    | U   | Set protocol mode   | In Setup: Prompting to make entry                 | rotary knob + OK      |
| -    | U   | Set print mode      | In Setup: Prompting to make entry                 | rotary knob + OK      |
| -    | U   | Set user language   | In Setup: Prompting to make entry                 | rotary knob + OK      |

| Code | Cl. | Operational message | Description   | Input  |
|------|-----|---------------------|---|--|
| -    | U   | Set user level      | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | F1= set! else OK    | In Setup: query for setting the clock                         | F1: set or OK (abortion)                           |
| -    | U   | Set date & time     | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | Enter code number   | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | Enter password      | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | Change password     | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | F1/F2 ? else OK     | In Setup: query of "Memory"                                   | F1 or F2 or OK (abortion)                          |
| -    | U   | F1/F2 ? else OK     | In Setup: query of "Calibration"                              | F1 or F2 or OK (abortion)                          |
| -    | U   | Set service mode    | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | Set configuration   | In Setup: Prompting to make entry                             | rotary knob + OK                                   |
| -    | U   | System is locked.   | In Setup: no access authorization                             | Config. code needed to obtain access.              |
| -    | U   | Values are fixed.   | In Setup: no access authorization.                            | Password needed to obtain access.                  |
| -    | U   | Unknown message     | A user message has been called that is unknown to the system. | Software trouble - must not occur during operation |

### 8.4.3 Operational Messages about Switching Conditions

The following operational messages inform the user about the switching conditions prior to "HVon" and about the cause of shut-down after "HVoff". These messages need to be confirmed by the operator with "OK" unless they disappear on their own accord after having set a switching condition.

| Code | Cl. | Operational message | Description   | Input   |
|------|-----|---------------------|---|---|
| -    | C   | Checking...         | After the parameters have been set, the switching conditions are being queried. | No action required, only information                                      |
| -    | C   | HV interlock        | Detachable key switch is switched off.  | Switch detachable key switch on   |
| -    | C   | Emergency switch    | Internal emergency switch has tripped.  | Switch emergency switch on  |
| -    | C   | Ext. safety loop    | External safety loop is open.   | Close emergency loop  |
| -    | C   | Door contact(s)     | At least one door contact is open.  | Close doors of vehicle  |
| -    | C   | Module coupling     | Connection between modules is interrupted..                                     | Connect modules   |
| -    | C   | SF6 pressure        | SF6 gas pressure in HV switching system is below rated value.                   | Gas pressure monitor at present not functional, check signal on module    |
| -    | C   | Humidity sensor     | Degree of dew condensation on system is above permissible limit.                | Dew monitor at present not functional, check signal on module, if need be |
| -    | C   | HV connector        | The HV cable is not properly connected at the HV connector                      | Connect the HV cable  |
| -    | C   | Ground monitor      | Earth monitoring is reporting inadequate protective earth connection.           | Check the electrical connections / grounding conditions                   |
| -    | C   | Cable shield        | Earth monitoring is reporting inadequate operational earth connection.          | Check the electrical connections / grounding conditions                   |
| -    | C   | Breakdown in cable  | High voltage has been switched off by system after breakdown in cable.          | Possible result of a cable test   |

| <b>Code</b> | <b>Cl.</b> | <b>Operational message</b> | <b>Description</b>  | <b>Input</b>                                       |
|-------------|------------|----------------------------|---|--|
| -           | C          | Cannot be charged          | High voltage has been switched off by system due to breakdown of voltage. | Possible result of a cable test                    |
| -           | C          | Test time over             | High voltage has been switched off by system after test time has elapsed. | No action required                                 |
| -           | C          | HVoff by OWTS-M            | HV is switched off via the connected OWTS system                          | No action required                                 |
| -           | C          | HVoff by system            | High voltage has been switched off by system after a fault has occurred.  | No action required, refer to error list            |
| -           | C          | Unknown message            | A condition message has been called up that is unknown to the system.     | Software trouble - must not occur during operation |

#### 8.4.4 Error Messages and Warnings

With the exception of operating errors, every error, once it has occurred, is reported by way of a two-digit error code. Each of these messages needs to be confirmed by the operator with "OK", further procedures are determined by the system.

| Code | Cl. | Operational message | Description  | Input  |
|------|-----|---------------------|--|--|
| 00   | F   | Unknown error       | An error message has been called that is unknown to the system.                              | Software trouble - must not occur during operation   |
| 01   | F   | Event overflow      | The software buffer of events in the master has overflowed.                                  | Software trouble - may occur during operation only if there is an unusual accumulation of errors |
| 02   | F   | Slave not found     | The master has not received any acknowledgement of receipt from the slave via LON.           | LON Bus / wiring / power supply  |
| 03   | F   | Slave not ready     | The master has not received any confirmation from the slave on its request.                  | LON Bus / wiring / power supply  |
| 04   | F   | Unknown slave       | The software version of the slave is not compatible with the software version of the master. | Insert Slave PROM with suitable software version   |
| 05   | F   | Master timeout      | Communication between master and slave is interrupted (slave does not respond).              | LON Bus / wiring / power supply  |
| 06   | F   | P-node missing      | A protocol node registered in Setup does not answer to the network.                          | Check protocol node and its linkage as well as power supply                                      |
| 07   | F   | Config. restart     | The system needs to be rebooted after the device configuration has been changed.             | Initiate restart by confirmation of error message  |
| 08   | F   | State mismatch      | The slave is unable to carry out the requested transition of condition.                      | Software trouble - must not occur during operation   |

| Code | Cl. | Operational message | Description   | Input  |
|------|-----|---------------------|---|--|
| 09   | F   | Unknown master      | The software version of the master is not compatible with the software version of the slave.          | Insert Master Flash with appropriate software version                                      |
| 10   | F   | Slave timeout       | Communication between master and slave is interrupted (master does not respond any more).             | LON Bus / wiring / power supply  |
| 11   | F   | Slave is locked     | The slave does not perform a task requested by the master owing to preceding errors.                  | Software trouble - must not occur during operation   |
| 12   | F   | VOK malfunction     | The so-called operation stand-by of module "Control node VLF..." has broken down.                     | Check hardware signal VOK on module, check cable between LON and module                    |
| 13   | F   | SPI data error      | In the slave the exchange of data between LON node and module "Control" is interrupted.               | Hardware damage / EMC trouble in module, check cable between LON and module                |
| 14   | T   | Parameter error     | The slave does not perform any parameter setting because the set of parameters is faulty.             | Software trouble - must not occur during operation   |
| 15   | T   | Turn on failed      | Error when opening the discharge unit and/or when switching the HV source(s) on.                      | Check return and control lines to discharge unit and HV sources                            |
| 16   | T   | NOT DISCHARGED      | Danger ! The system cannot ensure proper discharging after "HVoff".                                   | Manually discharge by external means, check return and control lines to discharge switches |
| 17   | T   | Turn off failed     | Error when closing the earthing switch and/or when switching the HV source(s) off.                    | Check return message and control lines to discharge switches and HV sources                |
| 18   | N   | HVon line error     | In the slave the so-called HV contactor (module: K2) is reported switched on in spite of being locked | Check control line of relay K2 as well as hardware signal KISON on module                  |



| Code | Cl. | Operational message | Description  | Input  |
|------|-----|---------------------|--|--|
| 19   | N   | Jumper changed      | Jumper coding of module "Control node VLF..." has been changed during operation.     | Undo changes or make changes only when system is switched off                              |
| 20   | N   | Module coupling     | The connection between the modules of the system has been interrupted.               | Restore connection, check hardware signal COUPL on module                                  |
| 21   | N   | SF6 pressure        | The SF6 gas pressure in the HV switching system is below limit.                      | Gas pressure monitor at present not functional, check hardware signal PRESS on module      |
| 22   | N   | GND SWITCH OPEN     | Danger! The system cannot ensure proper earth protection.                            | Manually discharge by external means, check return and control lines to discharge switches |
| 23   | N   | Feed switch on      | At least one of either charge switches has not opened.                               | Check control of either charge switches and hardware signal XXXn on module                 |
| 24   | N   | Dischg. switch      | The discharge switch has not opened.   | Check control of discharge switch and hardware signal XXXn on module                       |
| 25   | N   | HV source on        | Return message from a switched-off HV source reports source switched on.             | Check HV sources, their mains lines as well as hardware signals N/PISON on module          |
| 26   | N   | HV source(s) !      | The return messages expected from either HV sources have broken down or are wrong.   | Check HV sources, their mains fuses and hardware signals N/PISON on module                 |
| 27   | N   | Coil overload       | Current monitor in slave reports overcurrent through the VLF ring-around coil.       | Reduce load at HV output of system or magnitude of high voltage                            |
| 28   | N   | HV polarity +       | Polarity monitor in slave reports wrong (positive) polarity at HV measuring divider. | Check operation of HV thyristors (ring-around may have not taken place)                    |
| 29   | N   | HV polarity -       | Polarity monitor in slave reports wrong (negative) polarity at HV measuring divider. | Check operation of HV thyristors (ring-around may have not taken place)                    |

| Code | Cl. | Operational message | Description   | Input  |
|------|-----|---------------------|---|--|
| 30   | N   | VOLTAGE FOUND       | Danger! Voltage monitor in reports residual voltage at HV measuring divider.                  | Eliminate possible residual voltage manually. Check discharge switches and voltage monitoring. |
| 31   | N   | Overvoltage         | Voltage monitor in slave reports overvoltage at HV measuring divider.                         | Check voltage control of HV sources, check measuring divider                                   |
| 32   | N   | Meas. Overflow      | Voltage monitor in slave reports overflow of voltage divider.                                 | Hardware damage / EMC trouble on module, check HV measuring divider                            |
| 33   | N   | Card removed        | The system card has been removed during a cable test.   | Remove the system card only after the cable test has been finished!                            |
| 34   | N   | Card is full        | The system card is full prior to or during the cable test.                                    | The required memory space on the card can only be guessed before testing.                      |
| 35   | N   | Bad card format     | There is a formatting error on the system card.   | Card/Device/Command Header erroneous, print text line too long, Data Page not empty            |
| 36   | N   | No card access      | Some error has occurred when reading from or writing on system card.                          | Access to card is via I <sup>2</sup> C-Bus in protocol node. Contacts of card clean ?          |
| 37   | N   | Protocol error      | There has been an error in the timing of measuring data and their recording in the protocol.  | The protocol node checks the measuring data received from contro node with time stamp.         |
| 38   | W   | Config. changed     | The jumper encoding of module "Control node VLF..." is found changed during start-up.         | Any change to the encoding is reserved to the Customer Service and manufacturer!               |
| 39   | W   | Memory written      | Non-volatile device settings have been reset to their default values at the time of delivery. | This is a receipt message after "Reload setup" or "Delete texts".                              |
| 40   | W   | Bad card param.     | Erroneous parameters found on the system card have been reset to default values.              | Call parameters up to display (also in Setup) and check their usability.                       |

| Code | Cl. | Operational message | Description   | Input   |
|------|-----|---------------------|---|---|
| 41   | W   | Setup is faulty     | System of conditions on master inhibits start of HV operation if user level is inappropriate.       | Software trouble - must not occur during operation  |
| 42   | W   | Access denied       | Entered password is wrong and will be rejected.   | To administrator, customer service und manufacturer: Enter correct password!                                  |
| 43   | W   | Access released     | Entered password is right and will be accepted.   | To administrator, customer service und manufacturer: Access to extended Setup is granted.                     |
| 44   | W   | Not accepted        | Entered password is illegal and will be rejected.   | To administrator, customer service und manufacturer: Enter approved password!                                 |
| 45   | W   | Relaxed mode on     | The slave is operating in Relaxed mode after the respective adjustment has been made in Setup.      | Must not occur during operation - Relaxed mode is reserved for customer service!                              |
| 46   | W   | DEMO MODE ON        | The system has been set to demo mode via the setup menu.  | Should not appear during regular operation. Demo mode is only for service purposes.                           |
| 47   | W   | C-values stored     | Calibration data have been changed by entry and stored on slave in non-volatile mode.               | Any change of calibration data is reserved for customer service and manufacturer !                            |
| 48   | W   | Not calibrated      | System has not been calibrated / calibration data in slave have been lost (possibly only in parts). | Perform initial calibration / Call customer service, as initial calibration is reserved for customer service! |
| 49   | W   | No print data       | No data are available for built-in protocol printing.   | Record protocol, data will be available till next "HVon".   |
| 50   | W   | Printer error       | The built-in protocol printer is not ready for operation.   | Check protocol printer and its linkage as well as power supply  |
| 51   | W   | IIC-Bus error       | Some error has occurred when reading from or writing on the real-time clock.                        | Access to the real-time clock is via I <sup>2</sup> C Bus in protocol node. System card involved?             |

| Code | Cl. | Operational message | Description   | Input   |
|------|-----|---------------------|---|---|
| 52   | N   | Check sum error     | Some check-sum error has occurred when reading from the system card.                      | Data are stored on card in an EEPROM. Life time expired?  |
| 53   | W   | Unlocked system     | Only in test lab: Automatic configuration interlock is blocked.                           | Only in test lab: Enable configuration interlock manually!  |
| 54   | W   | Code accepted       | Entered configuration code has been accepted by the respective device.                    | Configuration authority has been granted, access to configuration setup is open.  |
| 55   | W   | Password stored     | Entered administrator password has been stored and is accepted.                           | Help can be given quickly should you have forgotten your password (specify Device-ID).  |
| 56   | N   | Incompat. card      | The system card contains a wrong Device-ID or Command-ID.                                 | Check your version of "WinkisVLF" and perform an update if necessary.   |
| 57   | N   | OWTS version        | the software version of the interface node is not compatible with the VLF system.         | Update the interface node to a supported software version.  |
| 58   | N   | OWTS timeout        | The communication between the OWTS interface node and the VLF test system is interrupted. | Check the connections to the OWTS system. Switch the OWTS on, if it is not already running.   |
| 59   | N   | OWTS sync error     | The communication within the OWTS system (between interface node and PC) is interrupted.  | Check the interface node and its connection to the RS232 interface of the PC. Check the version and functionality of the OWTS software. |
| 60   | N   | OWTS comm error     |   |   |
| 61   | N   | OWTS data error     |   |   |
| 62   | W   | OWTS line test      | Test reports successful communication between OWTS and VLF system.                        | Two-stage test, see OWTS manual for details.  |
| 63   | W   | OWTS ignored        | The OWTS system is not configured in the VLF test system.                                 | Enable the "OWTS-System" option in the system configuration of the VLF test system.   |
| 64   | F   | Illegal config.     | Configuration data of master and slave differ.  | Software problem. Must not appear during regular operation.   |

| <b>Code</b> | <b>Cl.</b> | <b>Operational message</b> | <b>Description</b>   | <b>Input</b>   |
|-------------|------------|----------------------------|--|--|
| 65          | N          | NOT GROUNDED               | Danger! The system cannot ensure proper discharging after "HVoff". | Manually discharge by external means, check return and control lines to discharge switches |
| 66          | N          | Cal. by DC only            | The system cannot be calibrated in the active operation mode.      | Only for service:<br>Choose DC mode  |





Tento symbol indikuje, že výrobek nesoucí takovéto označení nelze likvidovat společně s běžným domovním odpadem. Jelikož se jedná o produkt obchodovaný mezi podnikatelskými subjekty (B2B), nelze jej likvidovat ani ve veřejných sběrných dvorech. Pokud se potřebujete tohoto výrobku zbavit, obraťte se na organizaci specializující se na likvidaci starých elektrických spotřebičů v blízkosti svého působiště.



Dit symbool duidt aan dat het product met dit symbool niet verwijderd mag worden als gewoon huishoudelijk afval. Dit is een product voor industrieel gebruik, wat betekent dat het ook niet afgeleverd mag worden aan afvalcentra voor huishoudelijk afval. Als u dit product wilt verwijderen, gelieve dit op de juiste manier te doen en het naar een nabij gelegen organisatie te brengen gespecialiseerd in de verwijdering van oud elektrisch materiaal.



This symbol indicates that the product which is marked in this way should not be disposed of as normal household waste. As it is a B2B product, it may also not be disposed of at civic disposal centres. If you wish to dispose of this product, please do so properly by taking it to an organisation specialising in the disposal of old electrical equipment near you.



Този знак означава, че продуктът, обозначен по този начин, не трябва да се изхвърля като битов отпадък. Тъй като е B2B продукт, не бива да се изхвърля и в градски пунктове за отпадъци. Ако желаете да изхвърлите продукта, го занесете в пункт, специализиран в изхвърлянето на старо електрическо оборудване.



Dette symbol viser, at det produkt, der er markeret på denne måde, ikke må kasseres som almindeligt husholdningsaffald. Eftersom det er et B2B produkt, må det heller ikke bortskaffes på offentlige genbrugsstationer. Skal dette produkt kasseres, skal det gøres ordentligt ved at bringe det til en nærliggende organisation, der er specialiseret i at bortskaffe gammelt el-udstyr.



Sellise sümboliga tähistatud tooted ei tohi käidelda tavalise olmejäätmena. Kuna tegemist on B2B-klassi kuuluva tootega, siis ei tohi seda viia kohalikku jäätmekäitluspunkti. Kui soovite selle toote ära visata, siis viige see lähimasse vanade elektriseadmete käitlemisele spetsialiseerunud ettevõttesse.



Tällä merkinnällä ilmoitetaan, että kyseisellä merkinnällä varustettua tuotetta ei saa hävittää tavallisen kotitalousjätteen seassa. Koska kyseessä on yritysten välisen kaupan tuote, sitä ei saa myöskään viedä kuluttajien käyttöön tarkoitettuihin keräyspisteisiin. Jos haluatte hävittää tämän tuotteen, ottakaa yhteys lähimpään vanhojen sähkölaitteiden hävittämiseen erikoistuneeseen organisaatioon.



Ce symbole indique que le produit sur lequel il figure ne peut pas être éliminé comme un déchet ménager ordinaire. Comme il s'agit d'un produit B2B, il ne peut pas non plus être déposé dans une déchetterie municipale. Pour éliminer ce produit, amenez-le à l'organisation spécialisée dans l'élimination d'anciens équipements électriques la plus proche de chez vous.



Cuireann an siombail seo in iúl nár cheart an táirgeadh atá marcáilte sa tsíol seo a dhíúscairt sa chóras fuíoll teaghlaigh. Os rud é gur táirgeadh ghnó le gnó (B2B) é, ní féidir é a dhíúscairt ach oiread in ionaid dhíúscairthe phobail. Más mian leat an táirgeadh seo a dhíúscairt, déan é a thógáil ag eagraíocht gar duit a sainfheidhmíonn i ndíúscairt sean-fhearas leictrigh.



Dieses Symbol zeigt an, dass das damit gekennzeichnete Produkt nicht als normaler Haushaltsabfall entsorgt werden soll. Da es sich um ein B2B-Gerät handelt, darf es auch nicht bei kommunalen Wertstoffhöfen abgegeben werden. Wenn Sie dieses Gerät entsorgen möchten, bringen Sie es bitte sachgemäß zu einem Entsorger für Elektroaltgeräte in Ihrer Nähe.



Αυτό το σύμβολο υποδεικνύει ότι το προϊόν που φέρει τη σήμανση αυτή δεν πρέπει να απορρίπτεται μαζί με τα οικιακά απορρίμματα. Καθώς πρόκειται για προϊόν B2B, δεν πρέπει να απορρίπτεται σε δημοτικά σημεία απόρριψης. Εάν θέλετε να απορρίψετε το προϊόν αυτό, παρακαλούμε όπως να το παραδώσετε σε μία υπηρεσία συλλογής ηλεκτρικού εξοπλισμού της περιοχής σας.



Ez a jelzés azt jelenti, hogy az ilyen jelzéssel ellátott terméket tilos a háztartási hulladékokkal együtt kidobni. Mivel ez vállalati felhasználású termék, tilos a lakosság számára fenntartott hulladékgyűjtőbe dobni. Ha a terméket ki szeretné dobni, akkor vigye azt el a lakóhelyéhez közel működő, elhasznált elektromos berendezések begyűjtésével foglalkozó hulladékezelő központhoz.



Questo simbolo indica che il prodotto non deve essere smaltito come un normale rifiuto domestico. In quanto prodotto B2B, può anche non essere smaltito in centri di smaltimento cittadino. Se si desidera smaltire il prodotto, consegnarlo a un organismo specializzato in smaltimento di apparecchiature elettriche vecchie.



Št zīme norāda, ka izstrādājumu, uz kura tā atrodas, nedrīkst izmest kopā ar parastiem mājaiemniecības atkritumiem. Tā kā tas ir izstrādājums, ko cits citam pārdod un lieto tikai uzņēmumi, tad to nedrīkst arī izmest atkritumos tādās izgāztuvēs un atkritumu savāktuvēs, kas paredzētas vietējiem iedzīvotājiem. Ja būs vajadzīgs šo izstrādājumu izmest atkritumos, tad rīkojieties pēc noteikumiem un nogādājiet to tuvākajā vietā, kur īpaši nodarbojas ar vecu elektrisku ierīču savākšanu.



Šis simbolis rodo, kad juo paženklinto gaminio negalima išmesti kaip paprastų buitinių atliekų. Kadangi tai B2B (verslas verslui) produktas, jo negalima atiduoti ir buitinių atliekų tvarkymo įmonėms. Jei norite išmesti šį gaminį, atlikite tai tinkamai, atiduodami jį arti jūsu esančiai specializuotai senos elektrinės įrangos utilizavimo organizacijai.



Dan is-simbolu jindika li l-prodott li huwa mmarkat b'dan il-mod m'ghandux jintrema b'hal skart normali tad-djar. Minhabba li huwa prodott B2B , ma jistax jintrema wkoll f'centri civici ghar-rimi ta' l-iskart. Jekk tkun tixtieq tarmi dan il-prodott, jekk joghgbok ghamel dan kif suppost billi tiehdu ghand organizzazzjoni fil-qrib li tispejcalizza fir-rimi ta' taghmir qadim ta' l-eletriku.



Dette symbolet indikerer at produktet som er merket på denne måten ikke skal kastes som vanlig husholdningsavfall. Siden dette er et bedriftsprodukt, kan det heller ikke kastes ved en vanlig miljøstasjon. Hvis du ønsker å kaste dette produktet, er den riktige måten å gi det til en organisasjon i nærheten som spesialiserer seg på kassering av gammelt elektrisk utstyr.



Ten symbol oznacza, że produktu nim opatrzonego nie należy usuwać z typowymi odpadami z gospodarstwa domowego. Jest to produkt typu B2B, nie należy go więc przekazywać na komunalne składowiska odpadów. Aby we właściwy sposób usunąć ten produkt, należy przekazać go do najbliższej placówki specjalizującej się w usuwaniu starych urządzeń elektrycznych.



Este símbolo indica que o produto com esta marcação não deve ser deixado fora juntamente com o lixo doméstico normal. Como se trata de um produto B2B, também não pode ser deixado fora em centros cívicos de recolha de lixo. Se quiser desfazer-se deste produto, faça-o correctamente entregando-o a uma organização especializada na eliminação de equipamento eléctrico antigo, próxima de si.



Acest simbol indică faptul că produsul marcat în acest fel nu trebuie aruncat ca și un gunoi menajer obișnuit. Deoarece acesta este un produs B2B, el nu trebuie aruncat nici la centrele de colectare urbane. Dacă vreți să aruncați acest produs, vă rugăm s-o faceți într-un mod adecvat, ducând-ul la cea mai apropiată firmă specializată în colectarea echipamentelor electrice uzate.



Tento symbol znamená, že takto označený výrobek sa nesmie likvidovať ako bežný komunálny odpad. Keďže sa jedná o výrobek triedy B2B, nesmie sa likvidovať ani na mestských skládkach odpadu. Ak chcete tento výrobek likvidovať, odneste ho do najbližšej organizácie, ktorá sa špecializuje na likvidáciu starých elektrických zariadení.



Ta simbol pomeni, da izdelka, ki je z njim označen, ne smete zavreči kot običajne gospodinjске odpadke. Ker je to izdelek, namenjen za druge proizvajalce, ga ni dovoljeno odlagati v centrih za civilno odlaganje odpadkov. Če želite izdelek zavreči, prosimo, j da to storite v skladu s predpisi, tako da ga odpeljete v bližnjo organizacijo, ki je specializirana za odlaganje stare električne opreme.



Este símbolo indica que el producto así señalado no debe desecharse como los residuos domésticos normales. Dado que es un producto de consumo profesional, tampoco debe llevarse a centros de recogida selectiva municipales. Si desea desechar este producto, hágalo debidamente acudiendo a una organización de su zona que esté especializada en el tratamiento de residuos de aparatos eléctricos usados.



Den här symbolen indikerar att produkten inte får blandas med normalt hushållsavfall då den är förbrukad. Eftersom produkten är en så kallad B2B-produkt är den inte avsedd för privata konsumenter, den får således inte avfallshanteras på allmänna miljö- eller återvinningsstationer då den är förbrukad. Om ni vill avfallshandera den här produkten på rätt sätt, ska ni lämna den till myndighet eller företag, specialiserad på avfallshandtering av förbrukad elektrisk utrustning i ert närområde.



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