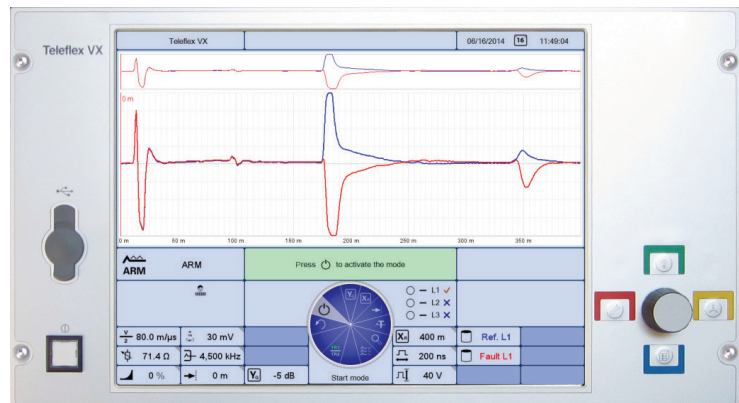


Operating manual Teleflex VX(-P) Touch



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.

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

Should any question remain unanswered, please contact:

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

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

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













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









To register a claim under the provisions of this warranty, the customer has to complain about the defect, in case of an immediately detectable fault within 10 days from the date of delivery.

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

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

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1 Cautions and Warnings

Safety precautions This manual contains basic advice for the installation and operation of the *Teleflex VX*. 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.

Setting up and operating the system may only be done by authorised and skilled personnel. According to DIN VDE 0104 (EN 50191) and DIN VDE 0105 (EN 50110) as well as the accident prevention regulation (Unfallverhütungsvorschrift UVV), skilled personnel is defined as a person who is qualified to work, judge and realize dangers due to his professional education, knowledge and experience and his knowledge of applicable regulations. 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 are labelled with one of the following symbols:

Symbol	Description
 WARNING	Serves to highlight warnings and safety instructions that explicitly indicate the risk of an electric shock.
 CAUTION	Serves to highlight warnings and safety instructions. As a warning label on the product it is used to draw attention to potential hazards which have to be avoided by reading the manual.
	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.

1.1 General Cautions and Warnings

Intended application Safe operation is only realised when using the equipment for its intended purpose (see chapter 3 *System Overview*). Using the equipment for other purposes may lead to human danger and damage of equipment of involved installations.

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.

Behaviour at malfunction of normal operation 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.

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



Fire fighting in electrical installations

- According to regulations, carbon dioxide (CO₂) is **required to be used** as extinguishing agent for fighting fire in electrical installations.
- Carbon dioxide is electrically non conductive and does not leave residues. It is safe to be used in energized facilities as long as the minimum distances are maintained. A CO₂ fire extinguisher must be always available within electrical installations.
- If, contrary to the regulations, any other extinguishing agent is used for 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.

2 Technical Data

Teleflex VX The *Teleflex VX* is specified by the following parameters:

Parameter	Value
Max. number of connected conductors	3
Ranges (at $v/2 = 80 \text{ m}/\mu\text{s}$)	20 m ... 1280 km 65,65 ft ... 4201,6 kft 250 ns ... 16 ms
Pulse width	20 ns, 30 ns, 50 ns, 100 ns, 200 ns, 500 ns, 1 μs , 2 μs , 5 μs , 10 μs
Pulse amplitude	30 V ... 160 V
Resolution	max. 0.1 m
Max. sampling rate	400 MHz
Update rate	approx. 10 pictures/s
$V_{1/2}$ ranges	10 ... 149,9 m/ μs 32,9 ... 491,8 ft/ μs
NVP range	0.067 ... 1 NVP
Dynamic Range	> 80 dB
Output impedance	50 Ω
Compensation	10 Ω ... ∞ , adjustable in steps
Dimensions (W x D x H)	483 x 295 x 258 mm (19" plug-in, 6 HU) 525 x 445 x 220 mm (<i>Teleflex VX P</i>)
Weight	5 kg (19" plug-in) 19 kg (<i>Teleflex VX P</i>)
Mains	100 ... 240 V, 50/60 Hz
Consumption	approx. 50 VA
Max. input voltage on test sockets of <i>Teleflex VX-P</i> (3 x BNC and 1 x LEMO)	
<ul style="list-style-type: none"> TDR and insulation measurement all other operating modes 	0 V 10 V (Peak-to-Peak)
Operation temperature	-10 ... 50 °C
Storage temperature	-20 ... +60 °C

Parameter	Value
Operating system	Embedded Linux (www.linux.com)
Database	PostgreSQL (www.postgresql.org)
Display	15" Touchscreen, 1024 x 768
Memory	Internal memory (8 GB) for more than 1000 saved measurements
Interfaces	USB interface for USB sticks and printers
Protection class (in accordance with IEC 61140 (DIN VDE 0140-1))	I
Ingress protection rating (in accordance with IEC 60529 (DIN VDE 0470-1))	IP54 IP65 with closed lid (<i>Teleflex VX-P</i>)

ISO module The ISO module contained in the portable *Teleflex VX-P* is specified by the following parameters:

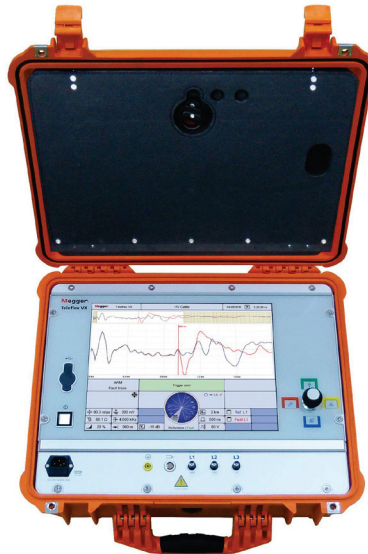
Parameter	Value
Measurement voltage	<6 V 500 V
Resistance measuring range	1 Ω ... 2 k Ω (at <6 V) 1 k Ω ... 2 G Ω (at 500 V)
Capacity measuring range (only with 500 V)	0 ... 20 μ F (resolution 0,1 μ F)
Measurement over time (only with 500 V)	up to 15 minutes

3 System Overview

3.1 Models and Features

Models The 19" **rack-mount version** of the *Teleflex VX* can be used as central control unit of most of the Megger test vans (e.g. *Centrix*, *Variant*, *R30*). The available fault location technologies for this models result from the configuration of the specific test van.

Furthermore, there is the **portable** *Teleflex VX-P* which can operate as stand-alone version or in combination with suitable HV equipment.



Unlike the rack-mount version, the *Teleflex VX-P* comes standard with the ISO module.

Features The *Teleflex VX* is a menu-driven and microprocessor-controlled reflectometer for cable fault prelocation on electricity networks.

The *Teleflex VX* can perform the following LV measurements without further equipment:

- Teleflex – three-phase TDR measurement
- Teleflex IFL (Intermittent Fault Locating)
- Insulation measurement (ISO module required)

Due to its variety of trigger modes, the device can be furthermore used for implementing the test procedures made available by additional test equipment such as

- ARM (Arc Reflection Method),
- Voltage Decay method,
- Impulse Current method and
- ARM burning

Mode of operation The *Teleflex VX* resembles a radar meter in that it makes use of the well known pulse echo technique. To this end, appropriately shaped test pulses are transmitted into the cable under test. The pulses travel along the cable at a speed specific for this cable. A fraction of the transmitter pulse is reflected from each place where the cable has changed its electrical characteristics and these reflected components are visualised on the screen. The mentioned changes in the electrical characteristics of a cable can be attributed to a possible fault in the cable or local particularities such as sleeves or the end of the cable. The type of fault and its distance can be evaluated from the shape and the delay time of the reflections. This way the screen of the *Teleflex VX* shows a clear and transparent image of the cable under test.

For measurements initiated by means of external HV equipment (e.g. ARM, Decay), the pulses are transmitted by the external equipment itself while the *Teleflex VX* (working in transient recorder mode) only records the reflected pulse fractions.

Scope of delivery of *Teleflex VX-P* The scope of delivery of the *Teleflex VX-P* includes the following:

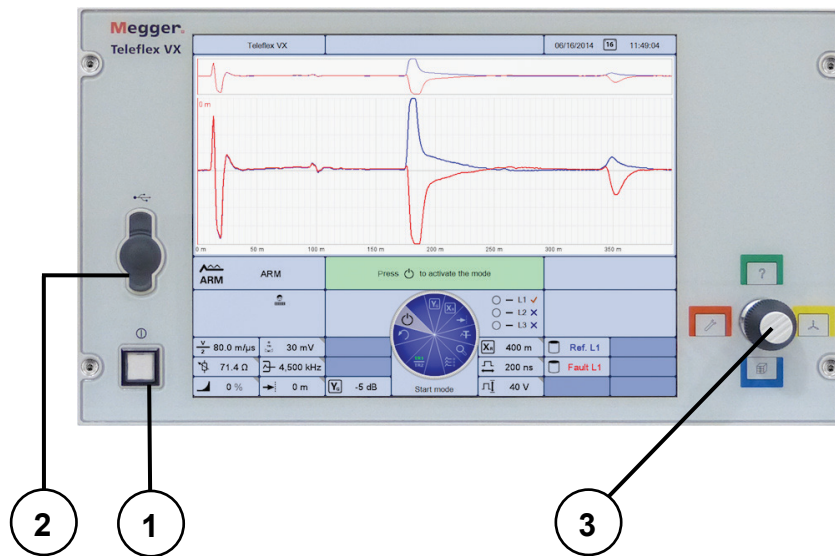
- Basic unit
- 1 x mains connection cable
- 1 x earthing cable (incl. alligator clip)
- 3 x BNC measuring cables (incl. alligator clips)
- 1 x K 208 connection and extension cable
- 1 x A 505 4-core measuring cable

Optional accessories If the following optional accessories do not form part of the scope of delivery, these can be ordered from sales:

Accessory	Description	Item number
HV connection set	Suitable for connection to outdoor HV cable terminations.	2004385 (5 m) 2005067 (12 m)
Separating filter TF VX	For connection to live low-voltage lines. Suitable for stand-alone devices and test van systems with LV cable (adapter cable VK 131 is included).	1010520
Separating filter TF VX-M	For connection to live low-voltage lines. This version is intended for test van systems without LV cable.	1010838

3.2 Front view

Front view The picture below shows the front view of the *Teleflex VX*:

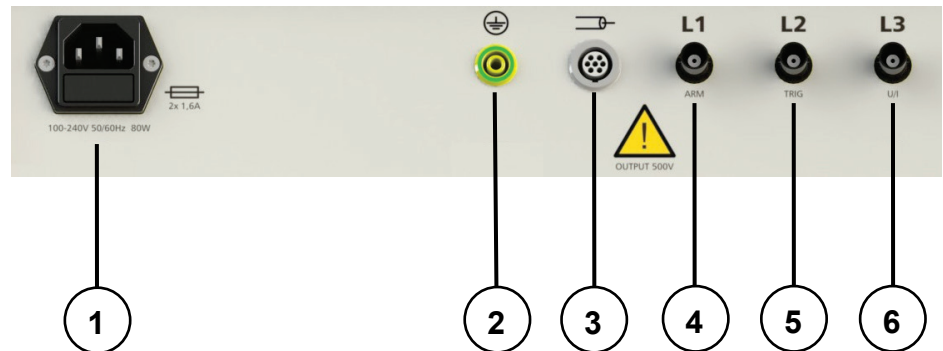


Control elements The *Teleflex VX* front view contains the following control elements:

Control element	Description
1	Mains on/off
2	USB interface The USB interface can be used to connect printers, keyboards or memory sticks. The printer must be able to communicate via Printer Command Language "PCL 3" or higher. Megger recommends the use of the HP Deskjet 460 or later model.
3	Jogdial The jogdial is used to navigate through the menu items, to activate menu items and to adjust certain values. By tilting the jogdial, the side menus can be opened.

3.1 Connection Elements (*Teleflex VX-P* only)

Connection panel The following connection elements are located on the front of the *Teleflex VX-P*:



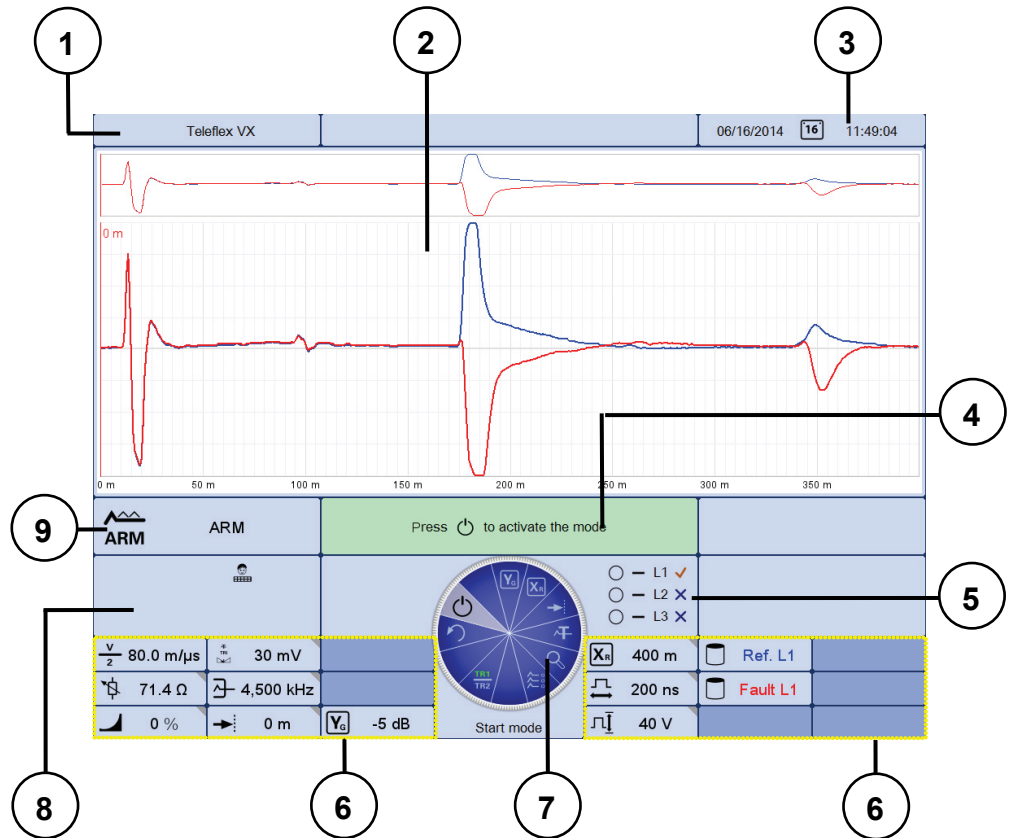
Connection element	Description
1	Power supply socket with fuses (2 x T 1,6A)
2	Protective earthing connection
3	LEMO connector Universal connector for three-phase connection to the cable under test (via connection cable A 505) or for connection to a HV device (via custom-made connection cable)
4	L1 / ARM BNC connector for connection to phase L1 of the cable under test or to the signal input (KLV) of the ARM filter.
5	L2 / TRIG BNC connector for connection to phase L2 of the cable under test or to the "Trigger" output of the ARM filter.
6	L3 / U/I BNC connector for connection to phase L3 of the cable under test or to the voltage or current coupler of a fault locating system.




During insulation testing hazardous voltages up to 500 V may be present at the test sockets ③ to ⑥.










3.2 Display

Display layout The picture below shows the display of the *Teleflex VX*:



Display segments The *Teleflex VX* display is structured into the following sub-segments:

Display segment	Description
1	System information This segment shows the version number of the Teleflex software.
2	Traces This segment shows the traces recorded by the active or loaded measurement. It is divided into an overall view (upper part) and a section view (lower part).
3	Date and time This segment shows the current date and time.
4	Next step This segment shows a short message which suggests the step to proceed with.  Even though this step is usually the next step, it is just a suggestion. In some cases, it might be advisable to proceed with other steps (e.g. trace adjustments).

Display segment	Description
5	<p>Phases status This segment shows which of the three phases are currently grounded and which are enabled for testing.</p> <ul style="list-style-type: none">  measurement active, ground is lifted  status of phase unknown  phase is selected for testing  phase is disabled for testing <p>For more information how to enable/disable phases for measurement, see section 5.4.2 <i>Phase Selection Menu</i>.</p>
6	<p>Measurement parameters / Legend of displayed traces The segments left and right of the selection menu display all relevant measurement parameters. Some of these measurement parameters are continuously updated during a measurement in progress.</p> <p>In addition, colour-coded relevant information (e.g. phase, measured value, unit) is shown for all traces displayed on the screen.</p>
7	<p>Selection menu This segment shows all available menu items and is controlled with the jogdial.</p> <p>The name of the selected menu item is shown below the selection menu.</p>
8	<p>Status display This segment shows the current system status and in some cases the progress of switching operations and measuring procedures undertaken through the system.</p> <p>The following symbols represent various system states:</p> <ul style="list-style-type: none">  Standby: The system is currently in “sleep” mode  Active: measurement is in progress  Freeze: measurement is paused  Ready for trigger: Measurement is started and the system waits for a reflection pulse to take place  Administrator mode: The user operating the system has successfully logged into the administration menu (see section 5.3.3) and identified himself as administrator
9	<p>Operation mode This segment shows the active measurement method.</p>

4 Getting started



If you are operating with a *Teleflex VX* assembled in a test van, make sure that the cables of the safety equipment and the HV cable are properly connected.
How to connect the cables properly depends on your test van and should be described in the respective user manual.

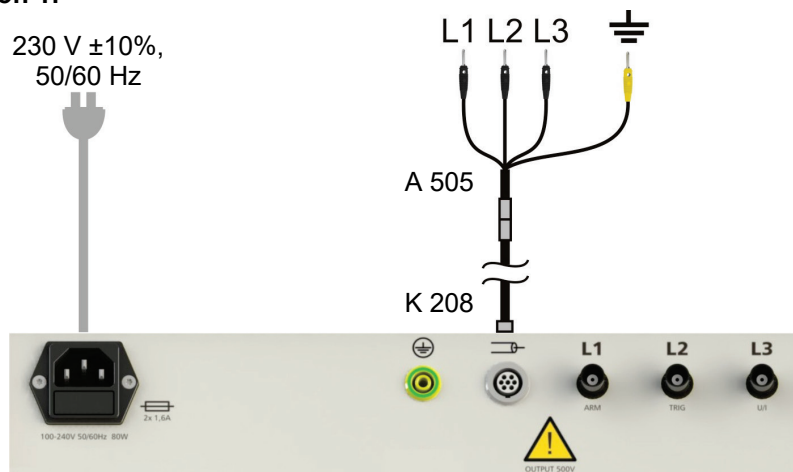
4.1 Electrical Connection

Introduction For a *Teleflex VX* assembled in a test van, the connections to the HV equipment of the test van are already established. Generally, no further connections are needed.

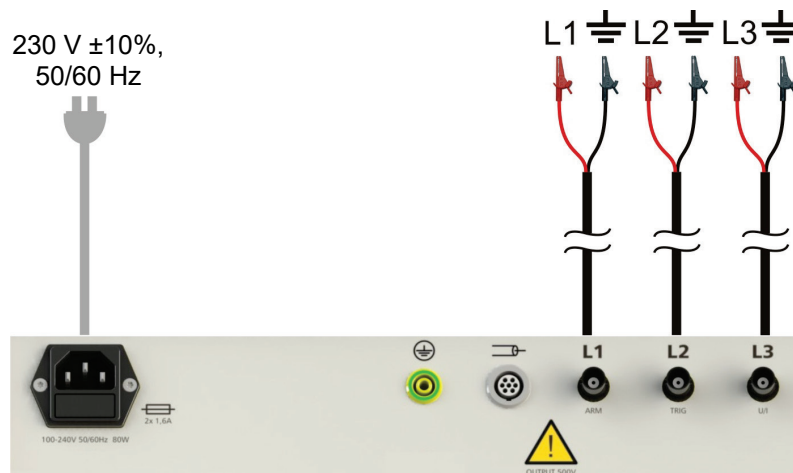
For the portable *Teleflex VX-P*, the electrical connection has to be carried out manually as described below.

LV measurement Direct connection to the cable under test (for LV pulse reflection measurements and insulation measurements) can be carried out in one of the following ways (do not use both methods at the same time!):

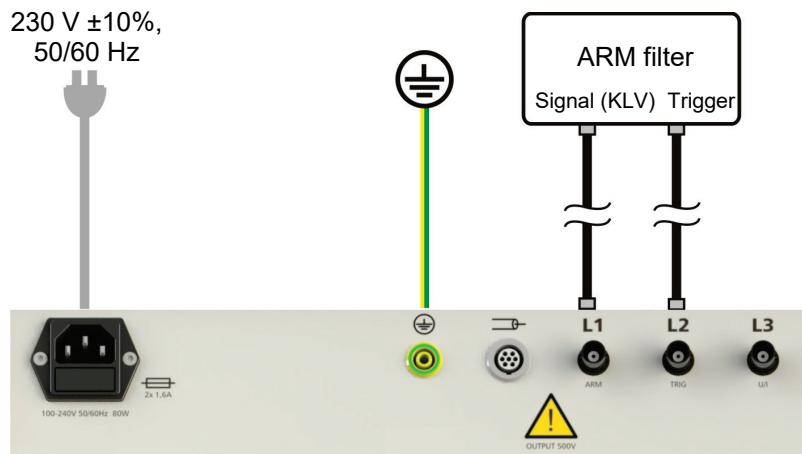
Option 1:



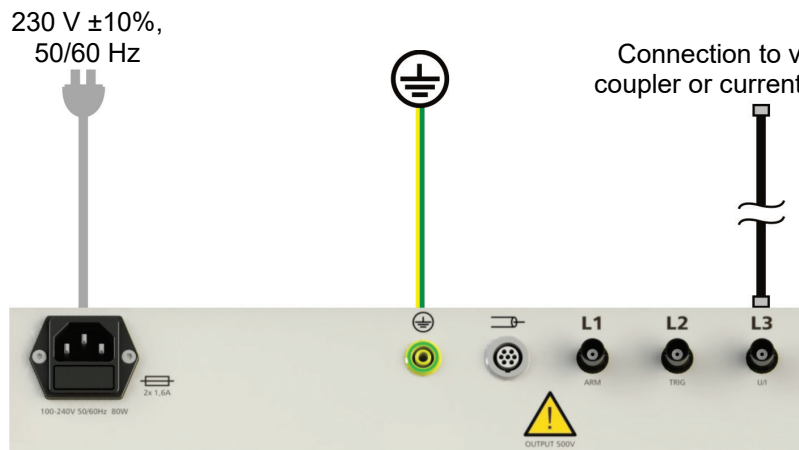
Option 2:



Connection to ARM filter In order to perform an arc reflection measurement (ARM) with the *Teleflex VX-P*, the device has to be connected to an ARM filter as shown below:



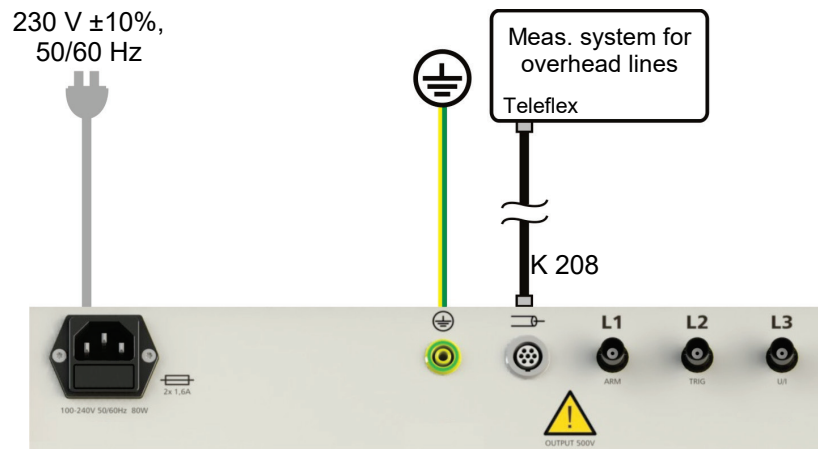
Connection to current or voltage coupler In order to prepare the *Teleflex VX-P* for transient prelocation methods, it has to be connected to the voltage coupler (Decay method) or current coupler (ICE method) of a fault locating system (or surge wave generator) as shown below:



The respective connectors may be labeled SYK (current coupler) and SYU (voltage coupler).

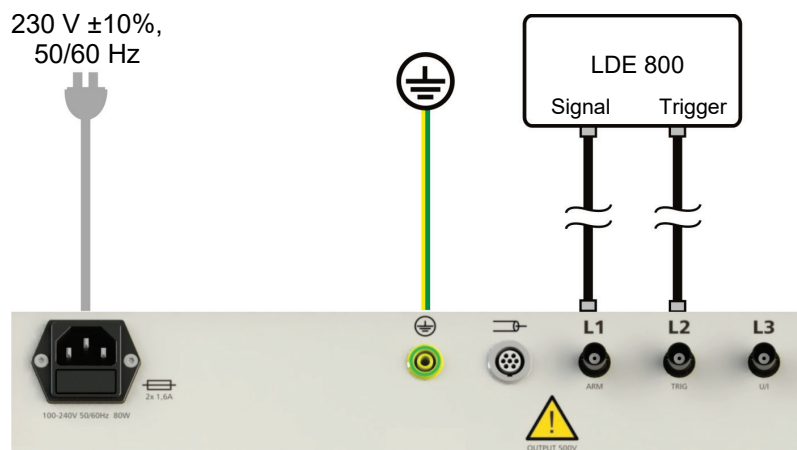
Connection to measuring system for overhead lines

Connection between the *Teleflex VX-P* and the measuring system for overhead power lines has to be carried out as shown below:



Connection to LDE 800

Connection between the *Teleflex VX-P* and the LDE 800 has to be carried out as shown below:



Connection to live low-voltage lines

By using the optional separation filter TF VX (or TF VX-M), the Teleflex VX can be connected to low-voltage lines with a voltage of up to 400 V.

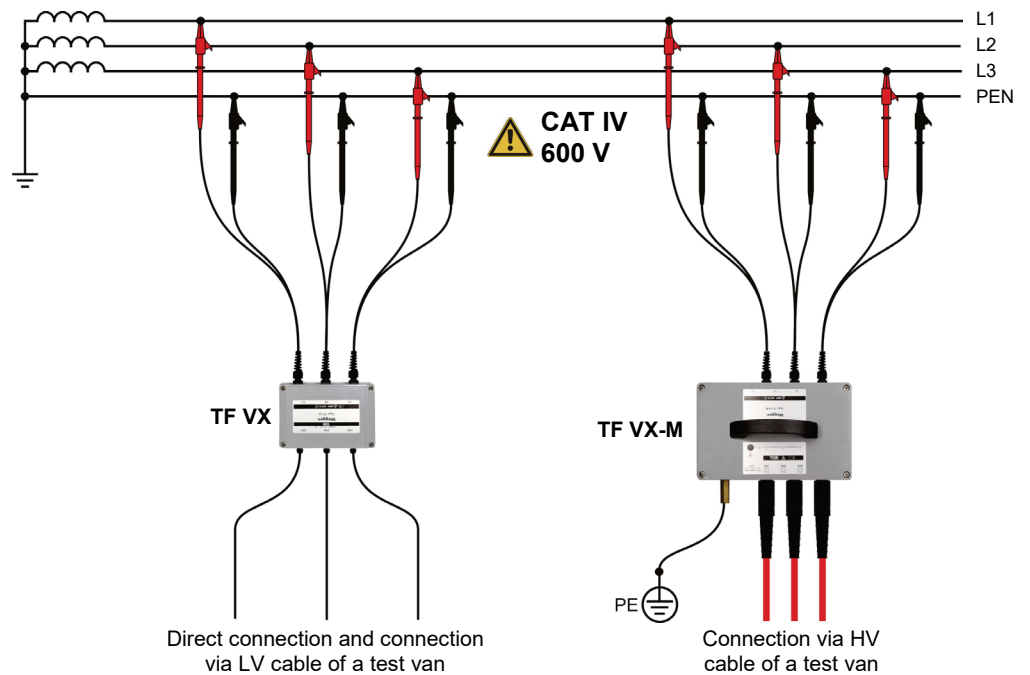


WARNING

Danger from electrical shock!

When connecting to live parts, the applicable safety regulations for live-line working must be observed!

The connection can be made between two phases or, as shown in the following example, between phase and earth.



When connecting via the separation filter, an additional virtual cable length of approx. 4 m (at $v/2 = 80 \text{ m}/\mu\text{s}$) must be taken into account when evaluating the located distance!

4.2 Starting the System

Switching on/off the
Teleflex VX

The *Teleflex VX* can be switched on/off using the mains switch on the left side of the control panel.

During the boot process, which takes approximately 60 seconds, the following startup screen, containing the license hints for the embedded software components, is shown on the display:



After successful startup, the *Teleflex VX* switches to the main menu (see section 5.2 *Main Menu*) and waits for further user interaction.

The system configuration (language, printer etc.) after startup corresponds to the stored settings from last usage.

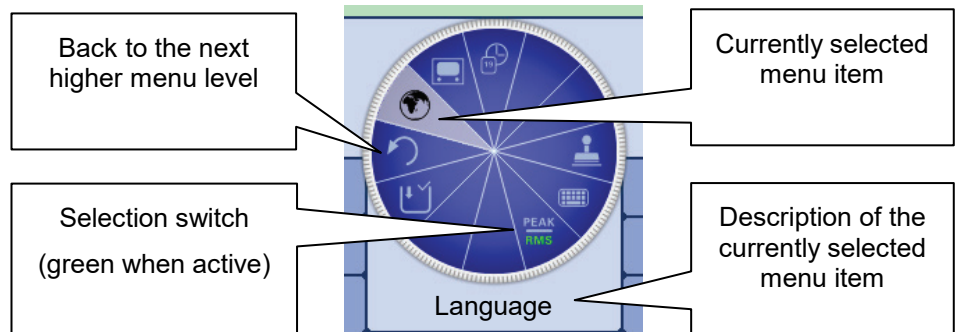
5 Menus

5.1 Navigating Through the menus

Introduction Operator control of the *Teleflex VX* is by means of menus which can be accessed using the jogdial. These menus are arranged in a flat menu structure which leads to short navigation paths.

In addition, there are four attendant menus which can be permanently accessed via separate buttons.

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



Operation with jogdial The system can be operated using the jogdial as follows:

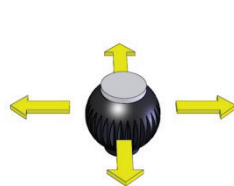






- Select the required menu item
- Increase or decrease the value of a variable parameter
- Select an option from a selection list



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

The four side menus are called by tilting the jogdial:

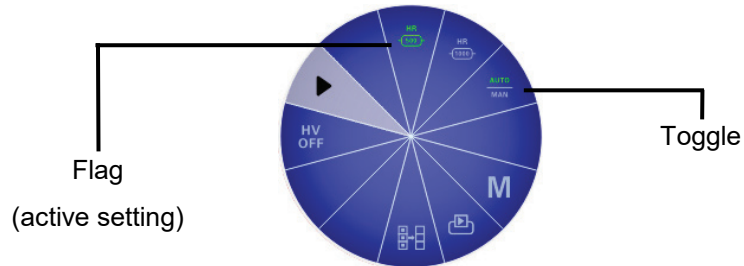


-  Quick selection of operating modes
-  On-line help
-  Phase selection (see section 5.4.2)
-  History database (see section 5.4.3)

Enabling/disabling settings

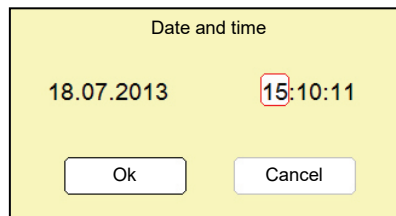
Some menu items serve as flags indicating whether a certain setting is enabled or disabled. In these cases, a menu icon which represents an enabled setting is shown in green colour.

Furthermore, there are menu items which serve as toggle between two available settings. The respective menu icons are divided into two parts and only the part of the active setting is shown in green colour.



Dialog boxes

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



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

To close a dialog box, the corresponding button must be selected and then the jogdial pressed.

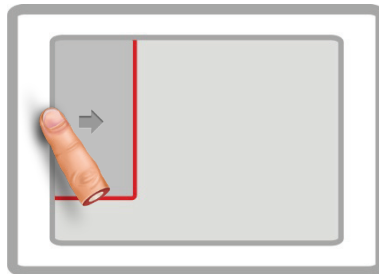
Operation using the touchscreen

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

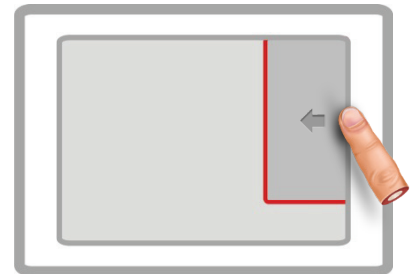
Briefly tapping on the buttons in the various menus, and tapping and holding the buttons in isolated cases, allows the respective functions to be activated in the same way as the jogdial control.



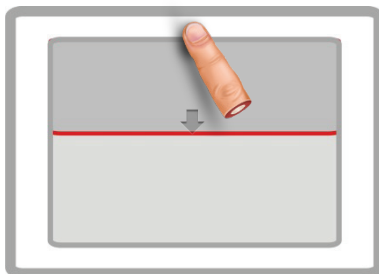
The four menus at the side can be opened by a swiping motion.



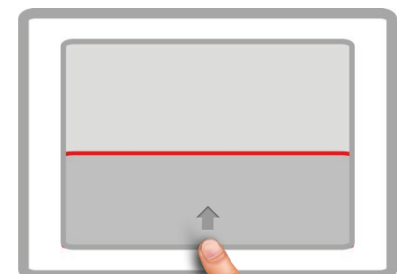
Quick selection of operating modes



Phase selection (see section 5.4.2)

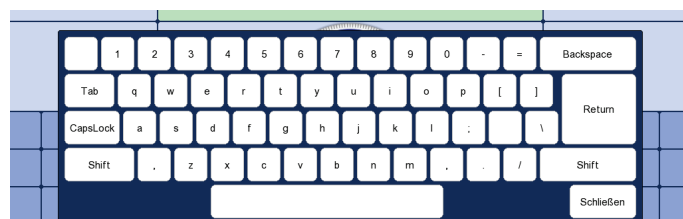


Online help




History database (see section 5.4.3)

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


















5.2 Main Menu

Purpose The main menu is the central menu presented after startup. It offers direct access to the measurement methods and to the system configuration.

 Depending on the configuration of your system, some of the operation modes listed below may not be available.

Menu items The main menu contains the following menu items:

Menu item	Description
	System Submenu for system configuration and data handling, see section 5.3.
	Insulation test Menu item to initiate an insulation test, see section 6.3.
	Teleflex Menu item to initiate a Teleflex measurement, see section 6.4.
	IFL Menu item to initiate an IFL measurement, see section 6.5.
	ARM Menu item to initiate an ARM measurement, see section 6.6.
	Decay Menu item to initiate a Decay measurement, see section 6.7.
	ICE Menu item to initiate an ICE measurement, see section 6.8.
	ICE 3PH Menu item to initiate a three-phase ICE measurement, see section 6.9.
	ARM Burning Menu item to initiate ARM burning, see section 6.10.
	Overhead line (overhead line measuring set required) This operating mode is specially designed for reflection measurements at overhead lines. The connection to the overhead line must be made through the special connection box of the overhead line measuring set. <hr/>  Detailed information on the electrical connection and the operation can be found in the operating manual of the overhead line measuring set. <hr/>
	Protocol Main menu item to access the protocol function. The protocol function does not start logging measuring data until it is accessed at least once after system start. (see section 5.5 <i>Protocol Function</i> - ).

If installed in a test van, the Teleflex VX is also used to control the available test and diagnosis attachments. In such a case, the respective test and diagnosis operating modes can be found in the  and  submenus.

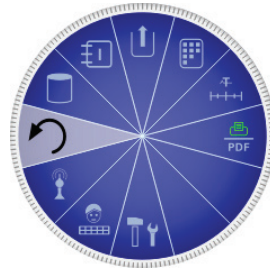


Detailed information on the operating modes can be found in the operating manual of the respective test and diagnosis attachment.











5.3 System Menu -








Purpose The system menu offers the possibility to configure the system settings, to import, export and delete measurement data and to obtain system information.











Menu layout The following picture shows the screen view of the system menu:



Menu items The system menu contains the following menu items:

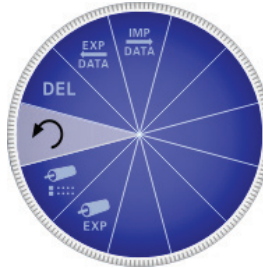
Menu item	Description
	Data Submenu for data handling, see section 5.3.1 <i>Data Menu</i> .
	Information Submenu for system information containing the following menu items: <ul style="list-style-type: none"> <li data-bbox="639 1003 1444 1041"> This menu item provides information about the software version. <li data-bbox="639 1070 1500 1137"> This menu item provides information about the system hardware and the IP address of the system. <li data-bbox="639 1167 1481 1272"> Menu item to view the system log which contains the error messages of the system. Furthermore, the system log can be exported to the USB stick using this menu item. <li data-bbox="639 1301 1412 1339"> Menu item to export the system information to the USB stick. <li data-bbox="639 1368 1497 1435"> Menu item to obtain information about the actual key mapping of the connected keyboard.
	Setup Submenu for general system settings, see section 5.3.2 <i>Setup Menu</i> .
	Print to printer / PDF Menu item to select whether measurement data (e.g. traces) is printed or saved as a PDF file. <ul style="list-style-type: none"> <li data-bbox="639 1653 1465 1711"> In order to select the 'Print to printer' option, it is necessary to define a printer in the setup menu, see section 5.3.2 <i>Setup Menu</i>.

Menu item	Description
	<p>Default values</p> <p>You can adjust the default values for nearly all the system settings. When the user administration is activated (see section 5.3.3.2), any user can set and save his own defaults. These defaults are then loaded each time the system starts or a user logs in.</p> <p>This submenu contains the following items:</p> <p> Using this menu item you can save the current settings as default settings. Only these settings will be overwritten which have been changed during the ongoing session. There are defaults for the following settings:</p> <ul style="list-style-type: none"> • All parameters that can be set within the operation modes, such as voltages, pulse width etc. (except phase selection) • The names entered in the protocol function for the Tester and Owner <p> When saving the default values, note that all values that have been changed since the last system start are saved, which means that you might inadvertently save some changes that you do not want. To be on the safe side, you can first reload the current defaults (see below), make the required settings and then save them.</p> <p> Using this menu item, the current user can reload his saved default values.</p> <p> Menu item to restore the factory defaults.</p> <p> You can use this menu item to export the current user's defaults as XML file in the <i>DefaultValues</i> folder of the USB stick that is plugged in.</p> <p> This menu item can be used to import default values which are stored on an inserted USB stick into the system. The imported default values then become immediately applicable. When the user administration is active (see section 5.3.3.2), the imported defaults are only applied for the user who is currently logged in.</p>

Menu item	Description
	<p>Teleflex units</p> <p>This submenu offers the possibility to specify in which way the pulse runtime is indicated and which parameter is used to convert runtime values to length values.</p> <p>The unit of all length values can be chosen by toggling the following menu item:</p> <p> - meter (m)</p> <p> - feet (ft)</p> <p>The unit of the X-axis can be chosen separately by toggling the following menu item:</p> <p> unit is set to seconds (s) - runtime</p> <p> unit is set to either feet or meter depending on the selection (see above) - distance</p> <p>If a distance unit (m or ft) is set, an additional menu item  is available to select in which way the signal propagation velocity is specified:</p> <p> Nominal Velocity of Propagation Specifies the ratio of signal propagation velocity to the velocity of light, e.g. NVP 0.53 = 0.53 x c (adjustable via the NVP menu item).</p> <p> $v/2$ - Specifies the signal propagation velocity in term of half the actual velocity (adjustable via the $\frac{v}{2}$ menu item).</p>
	<p>Service</p> <p>This menu item is only accessible by service personnel.</p>
	<p>Administration</p> <p>A user with the appropriate permissions can call up advanced system functions using the administration menu (see section 5.3.3).</p>

5.3.1 Data Menu -

- Purpose** The data menu provides the possibility to import, export and delete stored measurements.
- Prerequisites** Prior to a data export/deletion, the respective measurements have to be selected in the history menu. For more information, see to section 5.4.3 *History Menu*.
In order to import/export data, it is necessary to insert a memory stick into the USB port.
- Menu layout** The following picture shows the screen view of the data menu:



Menu items The data menu contains the following menu items:

Menu item	Description
DEL	Delete Measurements Menu item to delete selected measurements from history. For information how to select a measurement for deletion, please refer to section 5.4.3 <i>History Menu</i> .
	Export to Winkis Menu item to export selected measurements. The measurements are stored under the <i>Winkis</i> folder on the USB stick. For information how to select a measurement for export, please refer to section 5.4.3 <i>History Menu</i> .
	Import from Winkis Menu item to import measurements from a USB stick. A browser window is opened which enables the operator to navigate through the folders on the USB stick.
	Cable Menu item to add a cable with specific characteristics to the system database in order to create a comprehensive list of common cable types. This list can be accessed via the protocol function which enables the user to quickly assign the actual cable type to a specific cable section in the current measurement protocol. Two filters (cable type and cable insulation) can be specified in order to view only a particular selection of the available cable types. Stored cable types can only be modified or deleted by the system administrator (see section 5.3.3).
	Export cables The cable database (see above) is imported as an XML file to the Cables-folder on the USB stick that is plugged in.















5.3.2 Setup Menu - [↑]


Purpose The setup menu provides the possibility to change global system settings like language, printer etc.









Menu layout The following picture shows the screen view of the setup menu:



Menu items The setup menu contains the following menu items:

Menu item	Description
	Language Menu item to select the system language.
	Display  Menu item to choose between a given number of display layouts.  Menu item to adjust the line width of the curves to suite your taste.  For systems with a touch sensitive display, this menu item can be used to enable / disable touch functionality.  Menu item to show/hide the mouse cursor which is required to operate the software via a connected mouse.  Menu item to enable / disable the on-screen keyboard.
	Date and time Menu item to set the date and time of the system.
	Printer setup Menu item to select the connected printer from a given number of known printers.
	Print formulars Menu item to select the set of print formular templates.
	Options Submenu for activating and deactivating various support functions (see table below).
	Logo This menu option can be used to change the logo in the header of the printed form (for printouts of measurement data and logs). Corresponding image files in the <i>PNG</i> format can be imported by the administrator (see section 5.5.2).
	Keyboard Menu item to select the adequate layout for the connected keyboard from an available set of keyboard layouts.
	Change user Menu item to switch the user. After a new user is selected, his personal default values are loaded. This menu item is only accessible, if there is at least one user account available in the system database. User accounts can be managed by the system administrator in the administration menu (see section 5.3.3).

Support functions The following functions assist the user during the measurement by automating various processes. Each of these functions can be activated or deactivated using the  submenu.





Function	Description
	Activates / deactivates the selection of all phases when a TDR mode is selected.
	Activates / deactivates the selection of all phases when Ω mode is selected.
	Activates / deactivates the option of selecting multiple phases in ARM mode.
NVP / $\frac{V}{2}$	Activates / deactivates automatic adoption of the signal propagation velocity from the cable type currently selected in the protocol function (see also section 5.5) at the start of a reflection measurement.
	Activates / deactivates automatic scaling adjustment of the X axis as soon as a curve is drawn.
	Activates / deactivates automatic gain adjustment of the Y axis as soon as a curve is drawn.
	Activates / deactivates automatic positioning of the marker on the suspected fault location as soon as a trace is recorded.
	<p>Activates / deactivates the monitoring of the HV device (e.g. surge wave generator) involved in the ongoing measurement (<i>Teleflex VX-P</i> only).</p> <p>If monitoring is enabled, the operator is prompted to activate the respective HV device during measurement. Only after the device indicates readiness for operation, the measurement can be continued.</p> <p> This function must not be enabled, if there is no signaling between the <i>Teleflex VX-P</i> and the HV device.</p>

5.3.3 Administration Menu -

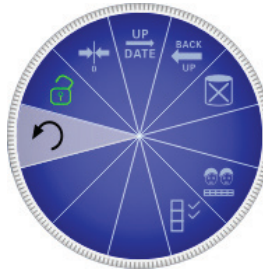
Purpose The administration menu is password-protected and provides access to advanced system settings such as the user administration, as well as update and backup functions.

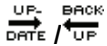





As well as this, when you have administrator rights you can see certain menu items that are otherwise hidden. These functions, which are only rarely used during day-to-day operation of the test van, are described in detail in the course of the manual.

Access To open the administration menu, you must first enter the password. This is how to do it:

Step	Action
1	Select the  menu item to enter the system settings and then select  .
2	Select the  menu item to enter the password. Result: The password entry dialogue appears in the display.
3	Use the jogdial to select the first character of the password and then use  to jump to the next character. Enter all the characters of your password in this way. If you have a keyboard, you can type in the password directly.
4	Press the jogdial to confirm your entry. Result: If you entered the password correctly, the menu items of the administration menu appear (see below). If your entry is incorrect, you must repeat the procedure from step 2 .

Menu layout The following picture shows the screen view of the administration menu:



Menu item	Description
	<p>Backup / update You can use these menu items to back up and update the individual software components (see 5.3.3.1).</p>
	<p>Reset database You can use this menu item to completely empty the database, which means all measurements, users, cable types and system logs are deleted. However, calibration and configuration data is retained. After you select this function, the system is restarted. After the restart, you must once again confirm that you want to reset the database. Always make a backup (see 5.3.3.1) before resetting the database.</p>
	<p>User management Administration of the users of the system (see 5.3.3.2).</p>
	<p>Module activation You can use this menu item to enable software modes and functions that were not previously activated. To enable a function, you need the correct unlock key. Please contact your Megger sales partner for more information on activating a function or mode.</p>
	<p>Calibrate end of connection lead Menu item to activate/deactivate the connection lead calibration mode (see section 5.3.3.3).</p>
	<p>Password Use this menu item to withdraw administrator rights and protect the administrations menu with a password again.</p>

5.3.3.1 Backing Up and Updating - $\frac{UP}{DATE}$ / $\frac{BACK}{UP}$

Backup You can use the $\frac{BACK}{UP}$ menu option to back up all the files that are needed to restore the system.

Before making the backup, plug a USB stick into one of the USB slots provided. During the backup, first of all a new folder (the serial number followed by consecutive number) is created on the USB- stick, in which the following files are saved:

File	Description
<i>application_<version>.tar</i>	The application file itself
<i>printforms.tar</i>	All print templates, protocol templates and logos
<i>Languages*.tar</i>	The language file, which contains all the available menu languages
<i>Megger.cfg.xml</i>	The configuration file
<i>backupDB.sql</i>	A backup of the database, containing the saved measurements, cable database, user database and default values
<i>ProtocolDefinitions.xml</i>	The names and sequence of the protocol parameters (see also 5.5)

Because the *backupDB.sql* file contains the complete database and therefore can only be loaded again in its entirety, the following data can also be exported separately using specific menus so that they can be transferred separately (e.g. to another system):

- Measured data (see section 5.3.1)
- User account data (see section 5.3.3.2)
- Default values (see section 5.3)
- Cable data (see section 5.3.1)

Loading software modules You can use the $\frac{UP}{DATE}$ menu item to load individual modules of the software (see above) to the system. This way, you can restore or update modules, or transfer them to another system.

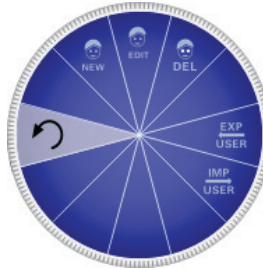
When you open the function, a file browser appears to help you navigate through the files on the inserted USB stick. Only the files which the system identifies as software modules and which the user is authorised to load are displayed.

This means that the application itself, the database and the configuration file can only be loaded by users with enhanced administrator rights. If you do not have these rights, contact your Megger sales partner.

5.3.3.2 User Management -

Purpose The user management allows you to set up various user accounts on the system, so that each user can adjust the default values and the way the system behaves according to his own preferences.

Menu layout The following picture shows the screen view of the user management menu:






Menu item	Description
	<p>Add User To add a new user you must first enter a user name. You can also limit the maximum voltage that the user can adjust and protect the account with a password.</p> <p>If you do not specify a password, the user does not need to enter a password when logging in, which makes the procedure quicker.</p> <p>The default values for the new user are the same as the factory settings. If necessary, you can import the default values from another user account (or even another system) (see section 5.3).</p>
	<p>Edit User Using this menu item, you can edit the user's name, voltage range and password.</p>
	<p>Delete User Using this menu item, you can delete individual users from the user database. If you delete the last user, the user management is deactivated and there is no longer a login procedure when the system is started.</p> <p> You can only delete the last user by interrupting the login. When you delete a user, his default values are lost. Therefore – particularly for the last user – you should export them first (see section 5.3).</p>
	<p>Export User All user profiles are exported along with their default values as an XML file to the <i>User</i> folder on the USB stick that is plugged in.</p>
	<p>Import User You can use this menu item to import user profiles that are stored on a USB stick to the system. This does not affect existing users. If two user names are the same, the system asks whether you want to overwrite or keep the existing user in the system.</p>

5.3.3.3 Connection Cable Calibration -

Purpose A properly calibrated connection cable ensures the accuracy of all operating modes which function according to the TDR principle (Teleflex, IFL, ARM and ARM burning). The length of the connection cable is not only automatically hidden from the visible diagram area, but also automatically subtracted from the calculated distance specifications.


As a principle, a calibration was already performed using the connection cables supplied during the final test. A repeat calibration should only be performed when one of the connection cables was replaced with a cable with a different length. In this case, an individual calibration must be performed for all respective operating modes and phases with a signal path which is affected by the cable replacement.

Procedure To calibrate a pre-measuring cable, proceed as follows:

Step	Action
1	Activate calibration mode using the menu item  in the administration menu.
2	Start the operating mode for which you wish to perform the calibration.
3	Select the phase for which you wish to perform the calibration.
4	Perform a measurement with the end of the connection cable open.
5	Exit the operating mode and then open it again immediately. Select the same phase as in Step 3 .
6	Open the trace recorded in the history database beforehand (see section 5.4.3).
7	Short circuit the connection cable at its end, and perform another measurement.
8	Select the menu item  and move the red cursor exactly to the point at which both traces diverge. Then press the jog dial and keep pressing it until the new zero position is applied.
9	Repeat the procedure, if necessary, for other phases and operating modes.
10	Deactivate calibration mode using the menu item  in the administration menu.

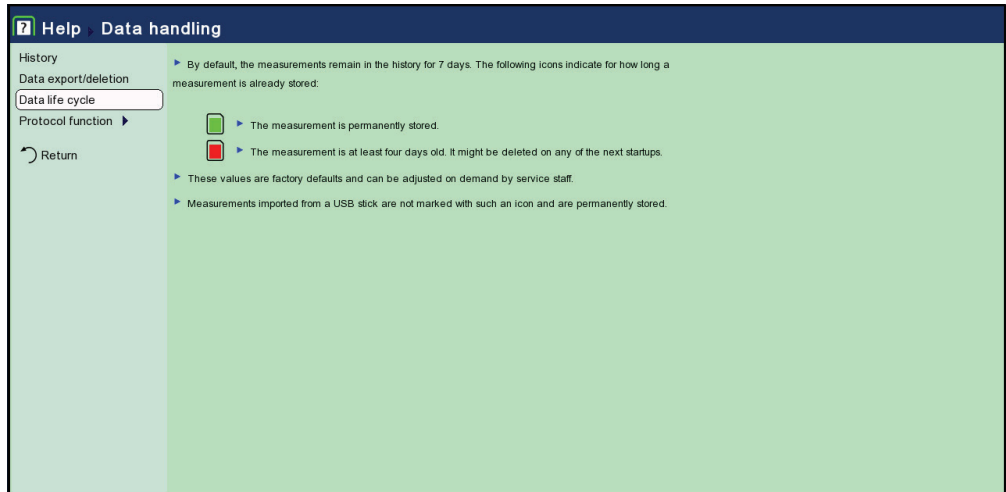
5.4 Side Menus

5.4.1 Online help -

Accessibility Tilting the rotary encoder towards the symbol  opens / closes the help ages.

Menu layout The online help is divided into a navigation window and the actual help window. The operator can use the jogdial to scroll through the available help pages.


The following picture shows the screen view of the online help:




5.4.2 Phase Selection Menu -

Purpose The phase selection menu provides the possibility to select the phases of the test conductor which should be tested.

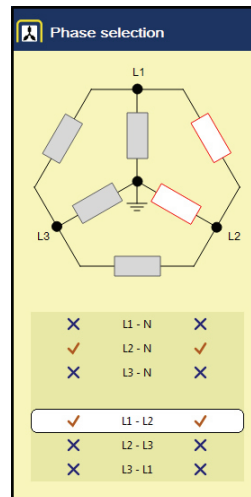
Measurements can be performed between phases and earth (e.g. L1 – N) and between two phases (e.g. L1 – L2).

Accessibility Tilting the rotary encoder towards the symbol  opens / closes the phase selection menu.


Furthermore, the phase selection menu automatically opens immediately after activating an operating mode.


 If the *Teleflex VX* is part of a vehicle-mounted fault locating system, it may be the case that phase selection is to be done on the system's control panel. If so, the selection cannot be changed via the phase selection menu. For detailed information, please refer to the test van's operating manual.

Menu layout The following picture shows an example of a phase selection menu where the options 'L2 – N' and 'L1 – L2' are enabled:



Menu navigation The operator can scroll through the available options using the jogdial. An option can be enabled/disabled by pressing the jogdial.

 selected for testing

 disabled from testing

Depending on the measurement method, either multiple options or only on option can be enabled.

The changes can take effect only after the phase selection menu is closed.

Specifics for test van assembly

If the Teleflex VX is used as central reflectometer in a test van, the phase selection is performed either by using the Teleflex VX or by using the power switching panel of the test van. Depending on the technical equipment of the test van, the procedure to be followed may vary between the operation modes. The Teleflex VX behaves as follows:

- **If the phase selection can only be viewed but not changed**, the selection has to be made at the power switching panel of the test van. The selection is automatically adopted by the Teleflex VX. If the phase selection menu is opened, an appropriate system message (“**Phases are externally forced!**”) is displayed.
- If the phase selection menu automatically pops up after a operation mode has been accessed, the selection has to be made at the Teleflex VX. Make sure the switch settings at the power switching panel correspond to the operation mode and the phases selected at the Teleflex VX.




CAUTION

Make sure that the phase selection corresponds to the actual connection of your test conductor. Otherwise, the measurement data is stored under a wrong phase label which can lead to serious mistakes.

5.4.3 History Menu -

Purpose Measurements and their data are automatically stored in the database and the history menu offers access to this data. By accessing a measurement from the history menu, the operator can retrieve the traces of the measurement and is able to repeat the measurement with the same settings.


A history entry may be either an individual measurement or a complete protocol created using the protocol function.


Accessibility The history menu can be accessed/left by pressing the jogdial in the direction of the  symbol.

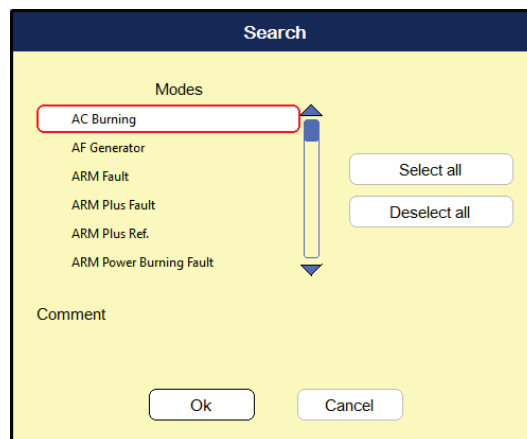
Menu navigation The measurement data records and the logs are organised by date in sub-directories.




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

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

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



If you are searching for both an operating mode and comment entry at the same time, only those results which fulfil both criteria will be displayed.

Holding down the  button will cause the search criteria to be discarded and all the data records to be displayed again.

Menu layout The following picture shows the screen view of the history menu:

Measurement method	Date	life cycle status		Tested phase		Comment
	2013/06/18 02:31:29 PM		ARM Plus Ref.	L2	1.059 kn	
	2013/06/18 02:29:36 PM		ARM Fault	L2	2.118 kn	comment
	2013/06/18 02:27:41 PM		ARM Ref.	L2	2.118 kn	
	2013/06/18 02:17:47 PM		Teleflex HV	L1,L2,L3	1 kn	comment
	2013/06/18 02:14:32 PM		DC Test	L3	Range=16 kV, t=00:50	
	2013/06/18 02:13:14 PM		DC Test	L2	Breakdown U=12.32 kV	
	2013/06/18 02:11:36 PM		DC Test	L1	Range=16 kV, t=01:04	

Labels below the table:






- date and time of measurement
- Specific type of measurement
- Fault characteristics


Data life cycle status By default, the measurements remain in the history for 7 days. The following icons indicate how long a measurement is already stored:

Icon	Description
No symbol	The data record has been conducted within the last four days. An automatic deletion is not imminent.
	The data record is either imported or permanently stored.
	The data record is at least 4 days old and may be deleted on any of the next startups.

In order to retain very important or useful measured data long-term in the history, the data record must be loaded to the measuring screen (see next page) and permanently saved using the **M** menu item (see section 5.6.1).

Managing data records If a data record or an entire folder is to be exported or deleted, it has to be selected first using the jogdial. Afterwards, the jogdial needs to be tilted to the right or the left until the appropriate marking is shown.

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

 After selection, the export/deletion has to be initiated via the data menu, see section 5.3.1 Data Menu. If the export/deletion is not initiated, all markings are lost during the next startup.

Selecting measurements from the history log

To call up traces and data from older measurements, first access the history menu and then use the jog dial to select the respective measurement from the directory tree. **By pressing the jog dial briefly**, you can call up all traces and data for this measurement.

By holding the jog dial pressed, you can open a context menu from which various special functions can be accessed, depending on operating mode:

- Add / edit a comment for the measurement
- Access special measurement data or individual traces of this measurement (only possible in certain modes)
- Add relevant measured values (such as failure distance and insulation resistance) from this measured data record to the current protocol. In this way, you can also fill a protocol with measured data from previous sessions (this is useful if you forgot to make a protocol for a past session).

Once you have opened one or more traces from the history, they are shown on the display according to the following conditions:

- If the operating mode currently selected is the same one which the history measurement was recorded in, the selected traces are shown together with the currently recorded traces. In this way, you can easily compare the results of different measuring sessions.
- The traces accessed from the history log are always scaled to the display parameters used for the current measurement.
- If there are not enough free slots to display the traces from a history log entry, currently recorded traces are overwritten. In this case it is advisable to select traces from the history log one by one so that you can assign them individually to slots that are free or no longer needed.
- If the current operating mode is not the same as the one the history measurements were recorded in, the system switches to that mode and overwrites the currently recorded curves with the ones from the history log

Trace legend The legend on the bottom right of the screen shows all the information for the traces currently displayed. The numerical and coloured assignment is as follows:

Slot 1	Slot 4
Slot 2	Slot 5
Slot 3	Slot 6

The symbol in front of the trace name indicates its status:

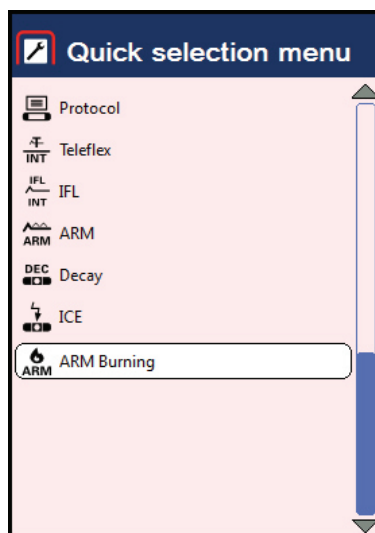
Symbol	Description
	Curves which were recorded during the measurement in progress.
	Curves which were recorded during the current measurement but not with the currently set measuring parameters (such as compensation and gain).
	Curves selected from the history log whose parameters are the same as those of the measurement in progress.
	Curves selected from the history log whose parameters are different to those of the measurement in progress.

5.4.4 Quick Selection Menu -

Purpose The quick selection menu offers the possibility to directly access each available measurement method, regardless of the current position within the menu structure.

Accessibility The quick selection menu can be accessed/left by pressing the jogdial in the direction of the symbol.

Menu layout The following picture shows the screen view of the quick selection menu:



5.5 Protocol Function -

Purpose The protocol function can be used for the automatic or manual entry of various data from a measuring process (such as local conditions, cable information, measuring results) and to collate them in a formatted protocol which can be printed out.

For the entry of data, it is recommended to use a USB keyboard with the system. Entry using a jogdial is also possible.

Accessibility The protocol function can be accessed via the main menu using the menu item.

Protocols are also stored in the history along with the individual measurements. The same data life cycle used for the individual measurements applies for the protocols too (see 5.4.3 *History Menu* -). The data menu can be used to import, export (as an Excel spreadsheet) or delete protocols (see 5.3.1 *Data Menu* -).

Menu items The protocol function contains the following menu items.



Menu item	Description
	Clicking on this menu item calls up the general data on the measuring deployment (such as cable parameters, local conditions) on the left side. This data can then be selected and edited.
	Clicking on this menu item calls up the log data (such as measuring results, fault descriptions) on the left side. This data can then be selected and edited.
	This menu item is used to load alternative printing templates stored in the system.
	This menu item is used to print out the active protocol in the format of the currently selected printing template.
	This menu item is used to start a new protocol during ongoing operation (for example, if the measurement is being continued on a different cable). By default, a new protocol is created when the system is restarted. The previous protocol is always stored in the history.
	The protocol function can be left using this menu item. The values entered so far are kept. The fields are automatically populated with these values when the protocol function is accessed again (if no system restart took place meanwhile).



Automatic entries Protocol parameters, which are indicated by a small triangle, are filled automatically with measurement data once a certain measuring procedure has been concluded. These parameters can also be edited manually. If the corresponding measuring procedure is conducted afresh, the existing data is automatically overwritten.

Fault position	
Fault distance	
External damage	

5.5.1 Protocols from Previous Measuring Sessions


If a protocol is accessed from the history, the stored values are visible but cannot be changed. The following additional menu items are available for this type of protocols:

Menu item	Description
	Using this menu item you can start a new protocol based on one that you load. Only the general information (such as cable data) is taken over. The measured values of the archived protocol are not adopted. Adopting protocol data can save a lot of time, if, for example, a second measurement is taken on a known cable that has already been tested.
	This menu item is used to permanently save a protocol in the history, meaning that it is no longer subject to the normal data life cycle.



 Protocols called from the history are indicated with this  symbol. The protocol of the current session remains active in the background and can be accessed again via the protocol function as soon as the protocol from the history is closed.




5.5.2 Modifying Protocol Templates


Prerequisites To modify the print templates and parameters of the protocol function, you must first **log in as an administrator** (see section 5.3.3).

After that, you can go to the Protocol function and select **Settings** () , which is enabled if you have administrator rights.

Modifying protocol parameters The parameters of the currently active category are shown on the left side of the settings screen.


Use the menu items  and  to switch between the categories. You can adjust the currently selected parameter as follows:


Action	Description
Activating and deactivating parameters	Briefly press the jogdial to activate () or deactivate () the selected parameter.
Renaming parameters	You can rename any parameter using the  menu item. However, note that especially with parameters that are automatically filled or provided with certain options, that the actual meaning is retained. To add new parameters, you can rename the three parameters named Free at the end of the list.
Adjusting the order of parameters	To change the position of the selected parameter in the list, you must press the jogdial for 2 seconds. You can then move the parameter up and down the list by turning the jogdial. Confirm the new position by briefly pressing the jogdial.

 The selection, order and names of the log parameters are the same for all user accounts.


Modifying protocol print templates



You can modify the layout of printed protocols according to the company's requirements.

To create a print template, you must open the  menu item in the settings screen. The print template editor opens, in which you can rearrange the log parameters (see previous page) on the print template as you like.


You can add () the selected parameter to the print template by briefly pressing the jog dial or remove it by holding down the jog dial for 2 seconds. Parameters you have added to the print template are immediately displayed on the print template where you can position them as you like.


Because creating a print template with the jogdial is very time-consuming, it is advisable to create the print template in the demo software on a desktop PC using the keyboard and mouse and import it to the system later (see next page). If you do not have a demo version of the system software, contact your Megger sales partner.

You can use the  menu item to modify texts and the logo in the header separately. If not yet done, the logo has to be imported into the system first (see below).

Once you have modified the print template as required, you should save it using the  menu item. In this way, you can save several print templates in the system and switch to them as necessary using the  menu item.

Importing and exporting protocol templates and logos

Using the  menu item you can export the modified protocol parameter set (see previous page) and the protocol print templates you have created yourself (see above) to a USB stick. In this way you can back up the changes you make and transfer them to another system if necessary.

To import a protocol parameter set (*ProtocolDefinitions.xml*) or print templates (*<Name of print template>_Protocol.xml*) from a USB stick to the system, you must open the file browser using the  menu item.

In the same way, you can also import your own logos to the system as portable network graphics (*.png) and use them later in protocol print templates (see above) or the normal print templates (see section 5.3.2).

5.6 Generic Measurement Submenus







5.6.1 Teleflex Menu - $\overline{\text{T}}$




- Purpose** The Teleflex menu offers the possibility to adjust measurement settings such as, e.g., cursor position and zoom factor. Furthermore, it can be used to store and print measurement results.
- Accessibility** The Teleflex menu is available as submenu during measurements. It can be accessed using the $\overline{\text{T}}$ menu item.
- Menu layout** The following picture shows the screen view of the Teleflex menu:




Menu items The Teleflex menu contains the following menu items:


Menu item	Description
$\overline{\text{T}}$ TRI	<p>Trigger Menu item to adjust the trigger threshold for the measurement.</p> <p>In general, the trigger threshold is automatically adjusted to an applicable value. If the measurement is interfered by low voltage reflections not caused by the measurement pulse, it is recommended to increase the trigger threshold. Whereas it may be helpful to decrease the threshold, if no reflections can be recorded during measurement.</p> <p>Only available for Decay and ICE measurements.</p>
$\overline{\text{C}}$	<p>Compensation Menu item to adjust the built-in compensation for suppressing the display of the transmitter pulse. The value should correspond to the actual compensation of the cable.</p> <p>In practice, the compensation should be configured in the smallest measuring range so that the start reflections (one positive followed by one negative) at the beginning of the reflectogram are equal in size and as small as possible.</p> <p>Only available for Teleflex, IFL and ARM measurements.</p>
$\overline{\text{Y}}$ Y _G	<p>Y-gain Menu item to adjust the gain of the Y-axis.</p>
$\overline{\text{X}}$ X _R	<p>X-range Menu item to adjust the range of the X-axis.</p> <p>If the range of the X-axis is changed, the filter value, the pulse width and the pulse amplitude are automatically adjusted.</p>

Menu item	Description
	<p>Cursor Menu item to change the position of the cursor on the X-axis.</p>
	<p>Zoom Menu item to increase/decrease the zoom of the X-axis corresponding to the position of the cursor.</p>
M	<p>Memory This menu item provides the possibilities</p> <ul style="list-style-type: none"> • to access all permanently saved measurements of the active measurement method (no temporarily saved history measurements), • to save a measurement retrieved from the history permanently and • to save the current measurement permanently.
	<p>Print Menu item to print the active measurement. It depends on the system configuration whether the measurement is printed or saved as a PDF file, see section 5.3 <i>System Menu</i>.</p>
	<p>Filter Menu item to adjust the band-pass filter which specifies the frequency range to be measured. Interfering signals out of this frequency range are suppressed.</p> <p>The filter setting is automatically reset to its default value when one of the following operations is carried out:</p> <ul style="list-style-type: none"> • Measurement method is changed. • Pulse width is changed during Teleflex measurement. • X-axis range is changed during HV measurement.
$\frac{V}{2} / \text{NVP}$	<p>$V_{1/2}$ or NVP Menu item to adjust either $V_{1/2}$ or NVP depending on the system configuration, see section 5.3 <i>System Menu</i>.</p> <p>After the menu item has been accessed you can either adjust the $V_{1/2}$ manually or press the jogdial for at least 2 seconds to access the cable list (see section 5.3.1 <i>Data Menu</i> - .</p> <p>By selecting a cable type from the list, the $V_{1/2}$ specified for this type is automatically adopted.</p>
	<p>Delete trace Menu item to erase individual traces which are not required any longer from the display. This may improve display clarity.</p>

Menu item	Description
	<p>Pulse width Menu item to adjust the pulse width of the output signal (50 ns ... 5 μs). Only available for Teleflex and ARM measurements For information how to select the optimal pulse width, please refer to section 6.1 <i>General Information</i>.</p>
	<p>De-attenuation By means of the de-attenuation function the damping which affects the electrical pulse during its run through the cable can be compensated. This is achieved by a gain of the input signal which increases as the runtime increases, i.e. the more distant the origin of the reflection, the higher the gain. In the process, the gain rises exponentially up to a fixed maximum value.</p>
	<p>Pulse amplitude Menu item to manually adjust the pulse amplitude if need be. For fault positions in close range, it can be advantageous to play around with smaller pulse amplitudes. Conversely, higher pulse amplitudes should be used when measuring at very long cables. When changing the X-axis range, the pulse amplitude is automatically adjusted to an adequate value.</p>









 Some of these menu items (e.g. zoom, cursor) are also available in the main measurement menus in order to reduce the necessary navigation steps for frequently used functions.





5.6.2 Trace Functions Menu -


- Purpose** The trace functions menu offers the possibility to shift the position of the traces vertically and horizontally.
- Accessibility** The trace functions menu is only available as submenu during Teleflex and ARM measurements. It can be accessed using the  menu item.
- Menu layout** The following picture shows the screen view of the trace functions menu:



Menu items The trace functions menu contains the following menu items:


Menu item	Description
	<p>Y-pos trace 1 Menu item to shift the first trace (according to the order shown in the trace legend) along the Y-axis.</p> <p>Only available for Teleflex measurements at two or three phases or ARM measurements with reference trace and fault trace.</p>
	<p>Y-pos trace 2 Menu item to shift the second trace (according to the order shown in the trace legend) along the Y-axis.</p> <p>Only available for Teleflex measurements at two or three phases or ARM measurements with reference trace and fault trace.</p>
	<p>Y-pos trace 3 Menu item to shift the third trace (according to the order shown in the trace legend) along the Y-axis.</p> <p>Only available for Teleflex measurements at three phases.</p>
	<p>Y-pos all traces Menu item to shift all traces along the Y-axis.</p>
	<p>Union / separate Menu item to separate/superimpose multiple traces along the Y-axis.</p> <p> The Y positions of the traces are shifted by 50 pixels against each other.</p> <p> The traces are shifted back to the origin position on top of each other.</p>
	<p>X shift Menu item to shift all traces along the X-axis.</p>

Menu item	Description
	<p>Trace 1 / 1-2 Menu item to display a trace illustrating the difference between trace 1 and trace 2 (according to the order shown in the trace legend). All other traces are hidden.</p> <p>Only available for Teleflex measurements at two or three phases or ARM measurements with reference trace and fault trace.</p>
	<p>Trace 2 / 2-3 Menu item to display a trace illustrating the difference between trace 2 and trace 3 (according to the order shown in the trace legend). All other traces are hidden.</p> <p>Only available for Teleflex measurements at two or three phases or ARM measurements with reference trace and fault trace.</p>
	<p>Trace 3 / 3-1 Menu item to display a trace illustrating the difference between trace 3 and trace 1 (according to the order shown in the trace legend). All other traces are hidden.</p> <p>Only available for Teleflex measurements at three phases.</p>
	<p>X shift 2 Menu item to shift one of two traces along the X-axis.</p>

 Functions which can only be applied to traces 1 to 3 are only available when the respective slots are actually assigned (see page 5-44).

Loading a trace from the History database into one of these slots has to be done by calling up the individual trace (see page 5-43) instead of the complete measurement data record.

6 Performing Test Measurements

 Depending on the configuration of your system, some of the operation modes described in this chapter may not be available.

6.1 General Information


Optimal pulse width Due the attenuation and dispersion characteristics of the cable which depend on frequency, every signal is changed in amplitude and shape. This applies to the transmitter pulse and each reflection too.

As a result, narrow transmitter pulses which have a greater proportion of high frequencies than longer pulses will be deformed more heavily.

This fact has to be taken into account when selecting a combination of pulse width and range of measurement. It means that short pulses are only suited for tests at short distance. On the one hand, they provide for a very good local resolution, but at long distances they are heavily attenuated and widened, on the other. Long pulses are attenuated much less, clear echoes can so be received even over long distances. At short distance, however, they are inferior to shorter pulses due to their limited local resolution.

The following ranges of measurement are allocated to the pulse widths that can be selected:

Pulse width	Time measuring range	Distance measuring range (at $V_{1/2} = 80 \text{ m}/\mu\text{s}$ or $\text{NVP} = 0.533$)
... 50 ns	... 12.5 μs	... 1000 m
100 ns	3.125 μs ... 25 μs	250 m ... 2 km
200 ns	6.25 μs ... 50 μs	500 m ... 4 km
500 ns	12.5 μs ... 125 μs	1 km ... 10 km
1 μs	62.5 μs ... 625 μs	5 km ... 50 km
2 μs	250 μs ... 1250 μs	20 km ... 100 km
5 μs	625 μs ... 1875 μs	50 km ... 150 km
10 μs	1250 μs	100 km ...

 Since high pulse widths make it hard to distinguish closely spaced events, it is recommended, even for long test cables, to start the measurement with a small pulse.

Determining $V_{1/2}$ / NVP from a known cable If the length of a cable is exactly known, the *Teleflex VX* can be used to determine the $V_{1/2}$ / NVP value specific for the cable by means of the cursor. In order to do this, a reflection measurement has to be performed (see section 6.4 *Teleflex Measurement*) and the cursor has to be moved to the end-of-cable reflection. Afterwards, the $V_{1/2}$ / NVP value has to be adjusted until the cursor position matches the actual length of the cable.

6.2 Before You Start

Before you start any measurement on a cable you should initialise a new protocol. This is automatically done when accessing the protocol function (see section 5.5) for the first time.

If you know the parameters of the cable connected to the test van, it may be helpful to specify the cable in the protocol first.

In order to do so, you have to specify the number of cable sections first. Afterwards, cable type (from the cable list; see section 5.3.1) and length has to be specified for each section.

If the cable has been sufficiently specified in the protocol data, the system can automatically adopt the resulting $v_{/2}$ for runtime measurements (e.g. TDR, ARM). This is particularly useful for mixed cables where you normally would have to calculate the $v_{/2}$ laboriously.

The automatic adoption of the $v_{/2}$ from the protocol data can be enabled / disabled in the system setting (see section 5.3.2).

Moreover, if a cable with several sections has been specified in the protocol, the joint positions are indicated along the X-axis of any runtime traces.

6.3 Insulation test - Ω

The insulation test operating mode is accessed directly from the main menu through the menu option Ω .

6.3.1 Measurement of insulation resistance and test object capacitance

Introduction Based on a measurement of the ohmic insulation resistance, a basic error classification can often be made in advance.

Thus, low- and medium-resistance cable faults can, for example, be directly detected and appropriate follow-up measurements (e.g. Teleflex measurements) can be undertaken.

In the case of high-resistance cable faults, the deviations in resistance within a cable system can be used to draw conclusions about the affected phases.

It can also be helpful to repeat resistance measurements after application of certain prelocation methods (e.g. ARM, ICE) or fault conversion methods (burning) and to compare the measurement results with those from the history database.

With the Centrix-integrated test module, the complete measuring range from 1 Ω to 2 G Ω can, thanks to the selectable test voltages, be measured with high resolution.






The integrated resistance-dependent automatic switching of the test voltage can also be deactivated as needs require.


Test voltage	Measuring range
500 V / 1000 V	Insulation resistance: 1 k Ω ... 2 G Ω Cable capacitance: 0.1 μ F ... 19.9 μ F
Low voltage (<6 V)	Insulation resistance: 1 Ω ... 1 k Ω

Phase selection After calling up the operating mode, the phase selection menu (see section 5.4.2) automatically appears on the screen. Activate the phase(s) you want to measure and close the phase selection menu.

Up to the actual start of the measurement, you can call up the phase selection menu again to correct the entered phase selections if necessary.

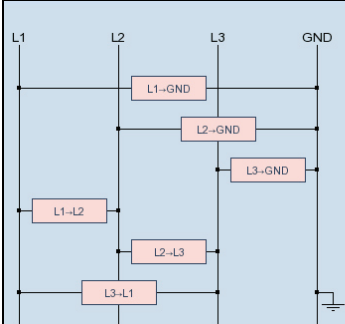
Setting parameters For the measurement of the insulation resistance and test object capacitance, the following settings can be adjusted:

Menu item	Description
	<p>This menu item is used to select between an automatic or manual mode.</p> <p>In automatic mode, both, resistance and capacitance are measured. A selection must only be made between the upper test voltages of 500 V and 1000 V. The system automatically switches to low voltage when determining a low-ohm resistance, since the resistance values in this measuring range can only be measured with low voltage.</p> <p>In manual mode, you may only determine either the resistance or the capacitance during a test. The three test voltages of 500 V, 1000 V and low voltage (<6 V) are available for selection. No automatic switching between the voltages occurs during the measurement.</p>
	<p>This menu item is used to specify a test voltage of 1000 V (not supported by <i>Teleflex VX-P</i>).</p>
	<p>This menu item is used to specify a test voltage of 500 V.</p>
	<p><i>only available with manual mode activated</i></p> <p>This menu option is used to specify a low test voltage (<6 V).</p>
	<p><i>only available with manual mode activated</i></p> <p>This menu item is used to specify whether resistance or capacitance values are to be measured.</p>

Measurement procedure After the measurement parameters have been set as described above, the measurement can be started via the menu item .

Depending on the set mode, the system measures the resistance and/or capacitance values for each selected phase combination.


The results are shown in a table:



	R iso 6 V 18.12.2008 11:40:04	C 18.12.2008 11:32:39	C 18.12.2008 11:12:41	R iso 1 kV 18.12.2008 11:11:59	R iso 500 V 18.12.2008 11:11:32	R iso 18.12.2008 11:09:38
L1-GND	≥1 kΩ	2.3 μF	2.3 μF	305 MΩ	318 MΩ	312 MΩ
L2-GND	≥1 kΩ	0.0 μF				≥2 GΩ
L3-GND	≥1 kΩ	0.0 μF				≥2 GΩ
L1-L2	≥1 kΩ					≥2 GΩ
L2-L3	≥1 kΩ					≥2 GΩ
L3-L1	≥1 kΩ					≥2 GΩ

The measured parameter, date and time of measurement as well as the test voltage used can be read from the table header for each measurement (column).

A new column is created for every measurement begun. The columns start on the left with the most current measured values and end on the right with the oldest measured values. A maximum of six columns can be adjacently shown. For each additional measurement, the column with the oldest measurement results is deleted.

The user can also manually delete the column with the respectively oldest measurement results via the menu option .

6.3.2 Time-dependent resistance test -


Introduction Through a resistance measurement over time, the chronological change of the absorption characteristics and thus the degree of moisture and dirt in an insulation can be tested.

A continual rise of the recorded resistance indicates an intact insulation. A flat or downward sloping curve on the other hand can indicate a dirty, moist or damaged insulation.

To obtain comparable measurement results, the chronological progress can be used to calculate the coefficients PI (Polarization Index) and DAR (Dielectric Absorption Ratio).

For the DAR coefficient, the value measured after one minute is divided by the measured value after 30 seconds. This coefficient should therefore be used primarily for evaluation of newer insulating materials, which exhibit a faster decline of dielectric absorption currents.






For other insulation materials, with absorption characteristics that normalise more slowly, the PI coefficients should be determined. For these, the value measured after 10 minutes is divided by the measured value after one minute.


In order to perform a time-dependent resistance test, the submenu option  must be selected.

Phase selection After calling up the operating mode, the phase selection menu (see section 5.4.2) automatically appears on the screen. Activate the phase(s) you want to test and then close the phase selection menu.

Up to the actual start of the measurement, you can call up the phase selection menu again to correct the entered phase selections if necessary.

Setting parameters For the measurement of the insulation resistance over time, the following settings can be adjusted:

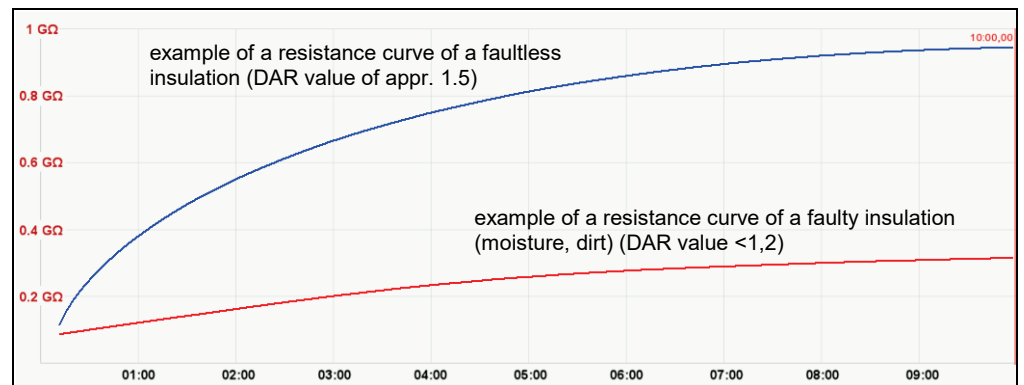
Menu item	Description
	Activates/deactivates the function for determining the DAR coefficient.
	Activates/deactivates the function for determining the PI coefficient.
	This menu item is used to specify a test voltage of 500 V.
	This menu item is used to specify a test voltage of 1000 V (As far as possible, resistance measurement over time should be performed with a test voltage of 1000 V).
	This menu item is used to specify a maximum test time of up to 15 minutes. The minimum test time is automatically set to 1 minute (when determining the DAR coefficient) or 10 minutes (when determining the PI coefficient).

Measurement procedure After the measurement parameters have been set as described above, the measurement can be started via the menu item .

The determined resistance values are shown on the screen during the course of the measurement as a curve over time.

With the completion of the measurement, the coefficients that have been determined (DAR and / or PI) are shown in a dialog box.


Evaluation of the measurement results The course of the curve itself as well as the determined coefficients can provide information on the state of the insulation.



The following table provides generally accepted guideline values which may be used for evaluating the measurement results:

PI value	DAR value	Condition of insulation
<1	<1	poor
1 ... 2	1 ... 1.3	questionable
2 ... 4	1.3 ... 1.6	good
>4	>1.6	excellent

A comparison with intact cables of identical construction or with previous measurements should also be taken into account.

To do so, previous measurements can be called up from the history database (see section 5.4.3) and the resistance curves can be compared. By selecting the  menu item, the determined DAR and/or PI coefficients can also be displayed for comparison.


6.4 Teleflex Measurement -

Introduction Low resistive cable faults are located using the proven and very widely used pulse reflection method. This method works according to the radar principle. It is based on the fact that cable points with a deviation in their essentially constant wave resistance cause part of the transmission energy to be reflected when pulses are transmitted into the cable. The size of the reflection depends on the size of the deviation in the wave resistance, the number of individual reflections, the length of the cable and the distance to the fault point.


The recorded trace shows every deviation of the cable. This way not only the fault to be detected is displayed but also every other impedance change, e.g. sleeves. These points may give additional assistance in pinpointing the exact location of the fault.

Notes on the phase selection in TDR modes

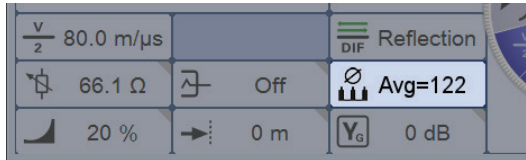
When selecting an individual phase (e.g. **L1 – N**), the reflection measurement is performed between this phase and the cable screen. This way, not only the fault to be detected is displayed but, for example, also joints and branches. These points may give additional assistance in identifying the exact location of the fault. For the purposes of comparison, several individual phases can be activated simultaneously (only if the optional three-phase Teleflex cable is used).

As soon as one of the „L – L“ options (e.g. **L1 – L2**) has been activated (only if the optional three-phase Teleflex cable is used), the  menu item can be used to switch between the following two measuring methods:






Setting	Description
Reflection	<p>In this setting, a reflection measurement is taken between the two conductors (e.g. to detect conductor-to-conductor faults).</p> <p>When searching the history database, measurements conducted in this mode can be identified by the arrow between the phases (e.g. L2 → L3).</p>
Difference	<p>In this setting, a differential measurement is taken between the two conductors.</p> <p>The reflections of both inputs are combined to form a single trace. However, the reflections received at the second input have their polarity reversed through a differential transformer. Consequently, the differential trace generated here then shows genuine differences only. Faults of identical magnitude, breaks on all conductors and cable inhomogeneities such as joints will not be visible because a difference does not exist.</p> <p>When searching the history database, measurements conducted in this mode can be identified by the hyphen between the phases (e.g. L2 – L3).</p>

Averaging The averaging function can be activated or deactivated using the menu item . When averaging is active, the trace shown on the display presents the average of all previously recorded measurements. A maximum of 256 measurements are taken into consideration here. After reaching this figure, the recording stops automatically.

The number of measurements the currently displayed average trace is composed of is shown at the bottom area of the display and is continuously updated.



Measurement procedure Perform the following steps to initiate a Teleflex measurement:






Step	Action
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .
2	Select Teleflex measurement from the <i>Teleflex VX</i> main menu using the  menu item, see section 5.2 <i>Main Menu</i> .
	Result: The phase selection menu pops up.
3	Select the phases to be tested (see previous page) and close the phase selection menu, see section 5.4.2 <i>Phase Selection Menu</i> .
	Result: The <i>Teleflex VX</i> displays the following prompt: Press  to activate the mode
4	Adjust $V_{1/2}$ / NVP, pulse width, compensation and filter according to the parameters of your test cable (see section 5.6.1 and section 6.1) and, if required, activate the averaging function (see above).
5	Start the measurement using the  menu item.
	Result: The pulse is continuously transmitted. Depending on the phase selection, one or more traces are shown on the display and refreshed with each reflected pulse.
6	Stop the measurement using the  menu item.
	Result: The measurement is stopped and the traces are frozen. It can be restarted using the  menu item.
7	The system automatically sets a marker at the supposed fault position. If necessary, adjust the position of the fault manually using the cursor. If the traces provide no applicable result, try the following adjustments: <ul style="list-style-type: none"> adjust the resolution and position of the traces using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>). adjust the measurement settings using the Teleflex menu (see section 5.6.1 <i>Teleflex Menu</i>) Check whether the cabling of the test cable corresponds with the active phase selection.

6.5 IFL Measurement -

Introduction The IFL measurement is a Teleflex measurement method which is used to distinguish intermittent (time-varying) low resistive cable faults by catching any quick change of the cable characteristics, e.g. caused by traffic vibrations etc.

Therefor, an envelope trace of all recorded measurements is composed. The difference between the most deflecting traces is distinguished as coloured area.

Measurement procedure Perform the following steps to initiate an IFL measurement:

Step	Action
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .
2	Select IFL measurement from the <i>Teleflex VX</i> main menu using the  menu item, see section 5.2 <i>Main Menu</i> . Result: The phase selection menu pops up.
3	Select the phase to be tested (see also page 6-61) and close the phase selection menu, see section 5.4.2 <i>Phase Selection Menu</i> . Result: The <i>Teleflex VX</i> displays the following prompt: Press  to activate the mode
4	Adjust $V_{1/2}$ / NVP, pulse width, compensation and filter according to the parameters of your test cable, see section 5.6.1 <i>Teleflex Menu</i> and section 6.1 <i>General Information</i> .
5	Start the measurement using the  menu item. Result: The pulse is continuously transmitted. An envelope trace is shown on the display. If possible, a second technician or the operator himself may purposely check the cable and try to trigger the problem by hand.
6	Stop the measurement using the  menu item. Result: The measurement is stopped and the traces are frozen. It can be restarted using the  menu item.
7	The system automatically sets a marker at the supposed fault position. If necessary, adjust the position of the fault manually using the cursor. If the trace provides no applicable result, try the following adjustments: <ul style="list-style-type: none"> • adjust the resolution and position of the traces using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>). • adjust the measurement settings using the Teleflex menu (see section 5.6.1 <i>Teleflex Menu</i>) • Check whether the cabling of the test cable corresponds with the active phase selection.


6.6 ARM -


Introduction The ARM measurement method is used to locate high resistive faults and intermittent faults.

Locating faults using ARM requires that a reference trace and a fault trace have to be recorded and, thereafter, are compared with one another. The fault trace is initiated by a capacitive discharge (surge) causing a momentary fault flash-over (arc) at the fault location followed by a measuring impulse causing a reflection at the momentary low-resistive fault.

Depending on the system configuration up to 15 TDR measuring impulses are transmitted at the moment of the fault flash-over one after another into the arc that stands at the fault position. The operator can afterwards view the 15 resulting fault traces and select the most suitable.

This way the chance to record a more accurate fault trace or to draw helpful conclusions from comparing the recognizable changes between the traces is vastly increased.

	<p>The ARM measurement method requires a HV surge discharge which causes a fault flash-over. In order to avoid permanent damage to the cable, the appropriate voltage value has to be determined prior to the ARM measurement by performing a DC voltage test. The cable must not be operated with a surge voltage higher than permitted by the cable parameters and not higher than 4/3 of the breakdown voltage determined during the DC test.</p>
---	--

Adjusting the trigger delay time If you are registered as administrator (see section 5.3.3), an additional menu item () is available in this operation mode. Via this menu item the delay time between the reception of the trigger signal (exceeding of the set trigger threshold) and the actual start of the TDR measuring can be adjusted.

This is intended to give the ignition process at the fault location more time to form a stable arc.


In principle the delay time is already set optimally to suit your system configurations at the factory and should only need to be adjusted in exceptional cases (for very special measurement setups) and then only by experienced users.

An improper adjustment of the delay time harbours the following risks:

Delay time is too short: The arc is not yet stable and the fault trace is not reliable or distorted.

Delay time is too long: With an increasing delay time the danger is that it becomes more likely that the measurement is taken exactly at the point of zero passage of the oscillation curve. The re-ignition processes that occur at this time can distort the reflectogram. At an extremely increased delay time there is even the danger of the arc already having become extinguished altogether.

Delay between the TDR measuring impulses

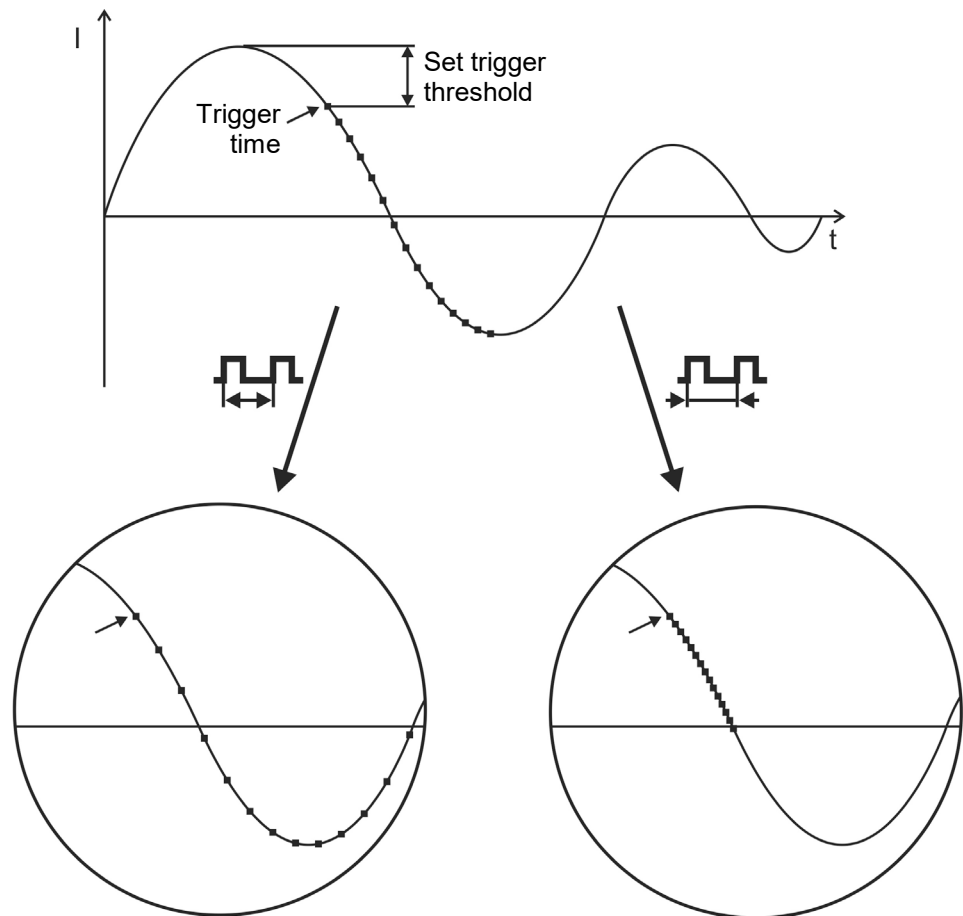
Prior to the recording of the fault trace the operator can set the delay between two successive impulses via the menu item  manually. However, this delay time should not be confused with the trigger delay time (see page 6-64), which specifies the delay prior to the first TDR impulse.

In principle it is advisable to record the first series of fault traces with the default delay of 256 μ s.

If required, the delay may be varied between 0 μ s and 3.84 ms and a new fault flash-over be forced.

When set to 0 μ s, impulses are triggered in the fastest possible sequence.






The effect of a delay adjustment can be demonstrated most clearly using the current flow after a flash-over:









■ Triggering a measuring impulse

As can be clearly seen in this diagram, by increasing the delay a “broader time span” can be projected, in which the arc may occasionally already be extinguished and ignites again.

Measurement procedure Perform the following steps to initiate an ARM measurement:

Step	Action	
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .	
2	Select ARM measurement from the <i>Teleflex VX</i> main menu using the  menu item (see section 5.2 <i>Main Menu</i>) and select the phase to be tested (see section 5.4.2 <i>Phase Selection Menu</i>).	
3	Activate the surge unit of the test van and adjust the high voltage to the value causing a fault flash-over.	
	<p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Press  to activate the mode</p>	
4	Adjust $V_{1/2}$ / NVP, pulse width, compensation and filter according to the parameters of your test cable, see section 5.6.1 <i>Teleflex Menu</i> and section 6.1 <i>General Information</i> .	
5	Start the reference measurement using the  menu item.	
	<p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Automatic adjustment</p> <p>This indicates that the measurement is in progress and no user interaction is required. After the measurement is finished, a trace is displayed and the following prompt is shown:</p> <p style="text-align: center;">Switch to fault trace </p>	
6	If the trace is ...	
	... applicable	... not applicable
	Proceed with step 7 .	repeat the reference measurement using the  menu item.





Step	Action
7	Start the fault measurement using the  menu item.
	<p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Trigger shoot</p>
8	If required, adjust the delay time (see previous page) via the  menu item.
9	Activate the HV shoot at the control panel of the HV equipment.
	<p>Result: The fault traces are recorded and the following prompt is shown:</p> <p style="text-align: center;">Select trace</p>
10	<p>Scroll through the available fault traces by rotating the jogdial and select the most appropriate one.</p> <p> You can change your selection via the  menu item only until you switch HV off (step 11).</p> <p>Afterwards, only the trace selected last remains in the memory and is stored in the history database.</p>
11	<p>Switch off the HV using the  menu item.</p> <p> It is important to perform this step prior to the HV path deactivation at the surge unit control panel in order to avoid a subsequent trace displacement.</p>
12	Switch off the HV path of the surge unit.
13	<p>The system automatically sets a marker at the supposed fault position. If necessary, adjust the position of the fault manually using the cursor.</p> <p>If the traces provide no applicable result, try the following adjustments:</p> <ul style="list-style-type: none"> • adjust the resolution and position of the traces using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>). • adjust the measurement settings using the Teleflex menu (see section 5.6.1 <i>Teleflex Menu</i>) and repeat the measurement starting with step 5. • Check whether the cabling of the test cable corresponds with the active phase selection.

6.7 Decay Measurement -

Introduction The Decay measurement method is used to locate high resistive faults and intermittent faults on chargeable cables.

The faulty cable is charged by HV up to the level of the breakdown which creates a transient wave travelling between the fault position and the HV generator. The delay of this wave is used to calculate the distance of the fault.

Measurement procedure Perform the following steps to initiate a Decay measurement:

Step	Action
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .
2	Select Decay measurement from the <i>Teleflex VX</i> main menu using the  menu item (see section 5.2 <i>Main Menu</i>) and select the phase to be tested (see section 5.4.2 <i>Phase Selection Menu</i>).
3	Activate the HV test unit. Result: The <i>Teleflex VX</i> displays the following prompt: Press  to activate the mode
4	Adjust $V_{1/2}$ / NVP, trigger threshold and filter, see section 5.6.1 <i>Teleflex Menu</i> and section 6.1 <i>General Information</i> .
5	Activate the measurement using the  menu item. Result: The <i>Teleflex VX</i> displays the following prompt: Initiate breakdown
6	Raise the HV until a breakdown happens. Result: A trace is displayed and the following prompt is shown: Switch HV Off
7	Switch off the HV using the  menu item.
8	Switch off the HV test unit.
9	Determine the position of the fault as described on page 6-69. If the measurement provides no applicable result, try the following adjustments: <ul style="list-style-type: none"> adjust the resolution and position of the trace using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>). adjust the measurement settings using the <i>Teleflex</i> menu (see section 5.6.1 <i>Teleflex Menu</i>) and repeat the measurement starting with step 5. Check whether the cabling of the test cable corresponds with the active phase selection.

Fault distance In general, a typical trace representing an oscillating wave should look as follows:



Since a complete period represents two times the distance between the HV generator and the fault, the following equation applies for the distance between the test cable connection and the fault:

Fault distance = full period distance / 2 – (test lead length + effective internal cabling)

Whereas the test lead length and the effective internal cabling depend on the configuration of the test van and should be determined with an appropriate test measurement, the distance value of a half period can be determined using cursors or the shift method as described below.

Distance determination using cursors


After measurement, the recorded trace is automatically analyzed and a complete period is marked by two cursors. If the cursors are not exactly defining a full period, it is necessary to adjust them manually as described below:

Step	Action
1	Activate the cursors using the menu item.
2	Place the red cursor on a significant point of the trace (e.g. peak or zero position) using the jogdial.
3	Press the jogdial for two seconds. Result: The blue cursor is shifted to the position of the red one.
4	Shift the red cursor about one period forward or backward. Result: The <u>half</u> distance of a period is shown next to the cursor and in the lower left corner of the display. <div data-bbox="726 1505 1260 1664" data-label="Image"> </div>
5	Subtract the length of the connection cable and the internal wiring of the test van from this value. In the case of a standard 50-metre cable drum this equates to a total of approx. 65 metres. The calculated value roughly corresponds to the distance between the connection point and the fault position. For technical reasons, this method has a slightly higher tolerance than, for example, pre-location using the ARM method.




6.8 ICE Measurement -


Introduction The ICE measurement method is used to locate high resistive faults and intermittent faults.

The ICE measurement is initiated by a capacitive discharge of an impulse current causing a fault flash-over lasting for a few milliseconds. Thereby, an inward propagating wave is reflected at the fault position and is travelling between this position and the HV generator.

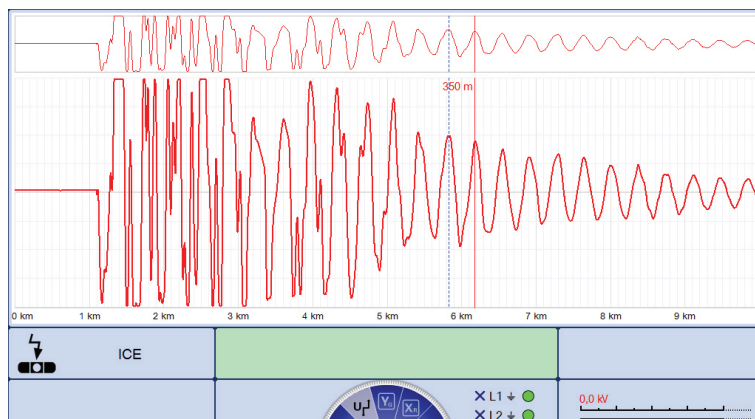
 CAUTION	<p>The ICE measurement method requires a HV surge discharge which causes a fault flash-over. In order to avoid permanent damage to the cable, the appropriate voltage value has to be determined prior to the ICE measurement by performing a DC voltage test. The cable must not be operated with a voltage higher than permitted by the cable parameters and not higher than 4/3 of the breakdown voltage determined during the DC test.</p>
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Measurement procedure Perform the following steps to initiate a ICE measurement:

Step	Action
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .
2	Select ICE measurement from the <i>Teleflex VX</i> main menu using the  menu item (see section 5.2 <i>Main Menu</i>) and select the phase to be tested (see section 5.4.2 <i>Phase Selection Menu</i>).
3	<p>Activate the surge unit of the test van and adjust the high voltage to the value causing a fault flash-over.</p> <p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Press  to activate the mode</p>
4	Adjust $V_{1/2}$ / NVP, trigger threshold and filter, see section 5.6.1 <i>Teleflex Menu</i> and section 6.1 <i>General Information</i> .
5	<p>Activate the measurement using the  menu item.</p> <p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Trigger shoot</p>
6	<p>Activate the HV shoot at the control panel of the HV equipment.</p> <p>Result: A trace is displayed and the following prompt is shown:</p> <p style="text-align: center;">Measurement Finished Switch HV Off</p>

Step	Action
7	Switch off the HV using the  menu item.
8	Switch off the HV path of the surge unit.
9	Determine the position of the fault as described later in this section. If the trace provides no applicable result, try the following adjustments: <ul style="list-style-type: none"> • adjust the resolution and position of the trace using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>). • adjust the measurement settings using the Teleflex menu (see section 5.6.1 <i>Teleflex Menu</i>) and repeat the measurement starting with step 5. • Check whether the cabling of the test cable corresponds with the active phase selection.

Fault distance In general, a typical trace should look as follows:





Since a complete period represents the distance between the HV generator and the fault, the following formula applies for the distance between the test cable connection and the fault:

$$\text{Fault distance} = \text{full period distance} - (\text{test lead length} + \text{effective internal cabling})$$

Whereas the test lead length and the effective internal cabling depend on the configuration of the test van and should be determined with an appropriate test measurement, the distance value of a full period can be determined using cursors.


Distance determination using cursors


After measurement, the system tries to analyse the recorded trace and to mark a complete period using two cursors. If the cursors are not exactly defining a full period, it is necessary to adjust them manually as described below:

Step	Action
1	Activate the cursors using the  menu item.
2	Place the red cursor on a significant point of the trace (e.g. peak or null position) using the jogdial.
3	Press the jogdial for two seconds. Result: The blue cursor is shifted to the position of the red one.
4	Shift the red cursor about one period forward or backward. Result: The full distance between the two cursors is shown in the lower left corner of the display. 
5	Subtract the length of the connection cable from this value and the internal wiring of the test van. This equates to a total of approx. 65 metres in the case of a standard 50-metre cable drum. The calculated value roughly corresponds to the distance between the connection point and the fault. For technical reasons, this method has a slightly higher tolerance than, for example, pre-location using the ARM method.

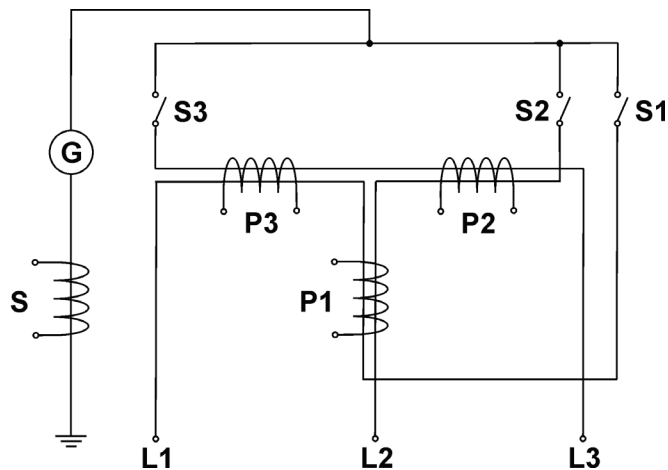
6.9 Three-phase ICE Measurement -

Introduction The three-phase ICE measurement method is used to locate high resistive faults and intermittent faults in **branched** cables.

 This measurement method should only be performed by experienced personnel, since the evaluation of the recorded traces requires very profound knowledge of the method.

 <p>CAUTION</p>	<p>The three-phase ICE measurement method requires a HV surge discharge which causes a fault flash-over. In order to avoid permanent damage to the cable, the appropriate voltage value has to be determined prior to the measurement by performing a DC voltage test. The cable must not be operated with a voltage higher than permitted by the cable parameters and not higher than 4/3 of the breakdown voltage determined during the DC test.</p>
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Phase selection For three-phase ICE measurement, the phase selection results from the following circuit diagram:



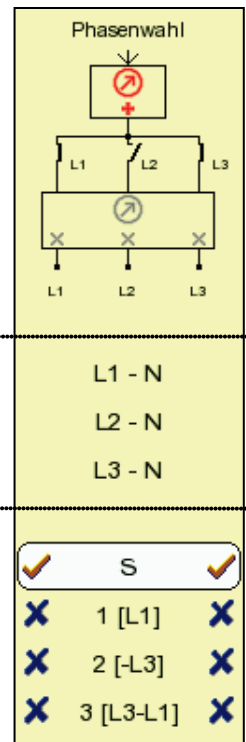
A maximum of two phases can be activated for simultaneous measurement at the test van control panel. If three phases are activated, the measurement cannot be started and an appropriate message is displayed.

In opposition to the other measurement methods, the reflection is not measured at the phase itself but at one out of four selectable measuring coils (P1, P2, P3, S) which enables the operator to measure the sum and the difference of two phases. Thus, it depends on the selected measuring coil, which phases and which phase polarity is measured:

Active phases	Sum coil (S)	Phase coil 1 (P1)	Phase coil 2 (P2)	Phase coil 3 (P3)
L1	L1	L1	-	L1
L2	L2	L2	L2	-
L3	L3	-	L3	L3
L1, L2	L1+L2	L1-L2	L2	-L1
L1, L3	L1+L3	L1	-L3	L3-L1
L2, L3	L2+L3	-L2	L2-L3	L3





Phase selection menu The specific phase selection menu for the three-phase ICE measurement looks as follows:


Simplified block diagram showing the currently activated phases (closed switch) (in this case L1 and L3).



Menu to select the measuring coil applicable for measurement (in this case S). The phases measured by the respective coil and their polarity are shown in parentheses (corresponding to the active phase selection).

Measurement procedure Perform the following steps to initiate an three-phased ICE measurement measurement:

Step	Action
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .
2	<p>Select the  menu item from the <i>Teleflex VX</i> main menu (see section 5.2 <i>Main Menu</i>), the phases to be tested (see section 5.4.2 <i>Phase Selection Menu</i>) and the measuring coil.</p> <p> Typically, the measurement is carried out on the defective phase and one healthy phase. The coil to be selected depends on the method used for evaluation of the measurement.</p>
3	<p>Activate the surge unit and adjust the high voltage to the value causing a fault flash-over.</p> <p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Press  to activate the mode</p>
4	Adjust $V_{1/2}$ / NVP, pulse width, compensation and filter according to the attributes of your test cable, see section 5.6.1 <i>Teleflex Menu</i> and section 6.1 <i>General Information</i> .
5	<p>Start the measurement using the  menu item.</p> <p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">trigger shoot</p>
6	<p>Activate the HV shoot at the control panel of the HV equipment.</p> <p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Switch to trace 2 $\frac{TR1}{TR2}$</p>
7	<p>Start a second measurement for comparison purposes using the $\frac{TR1}{TR2}$ menu item.</p> <p>A system message pops up requesting the operator to deactivate the HV path of the test van and to connect a loop between the active test phases at the far end of the cable under test.</p>
8	Switch off the HV path of the surge unit and connect the loop.
9	<p>Switch on the HV path of your test van again.</p> <p>Result: The <i>Teleflex VX</i> displays the following prompt:</p> <p style="text-align: center;">Initiate shoot</p>
10	<p>Activate the HV shoot at the control panel of the HV equipment.</p> <p>Result: A second trace is displayed and the following prompt is shown:</p> <p style="text-align: center;">Measurement Finished</p> <p style="text-align: center;">Switch HV Off</p>

Step	Action
11	Switch off the HV using the  menu item.
12	Switch off the HV path of the surge unit.
13	<p>Attempt to evaluate the two recorded traces according to the applied method and determine the distance to fault.</p> <p>If the results indicate that the fault is located in a branch, the measurement must be repeated. This time, the bridge has to be installed at the end of the branch.</p> <p>If the traces provide no applicable result, try the following adjustments:</p> <ul style="list-style-type: none">• adjust the resolution and position of the traces using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>).• adjust the measurement settings using the Teleflex menu (see section 5.6.1 <i>Teleflex Menu</i>) and repeat the measurement starting with step 5.• Check whether the cabling of the test cable corresponds with the active phase selection.


6.10 ARM Burning -

Introduction ARM burning is used to locate high resistive faults. For this purpose, TDR pulses are transmitted into a burning Arc.

The resulting fault trace is compared to a previously recorded reference trace in order to distinguish the fault position.










In order to avoid permanent damage to the cable, it must not be operated with a voltage higher than permitted by the cable parameters and not higher than 4/3 of the breakdown voltage.

Automatic Trigger The automatic trigger can be enabled / disabled using the  menu item:

Auto Trigger	Description
On	The burning process stops as soon as the system recognizes a significant fault conversion.
Off	The burning process stops after the selected burning time has expired.

Measurement procedure Perform the following steps to initiate an ARM burning:

Step	Action	
1	Switch on the <i>Teleflex VX</i> , see chapter 4 <i>Getting started</i> .	
2	Activate the burning unit.	
3	Select the  menu item from the <i>Teleflex VX</i> main menu (see section 5.2 <i>Main Menu</i>) and the phase to be tested (see section 5.4.2 <i>Phase Selection Menu</i>).	
4	Adjust $V_{1/2}$ / NVP, pulse width, compensation and filter according to the attributes of your test cable, see section 5.6.1 <i>Teleflex Menu</i> and section 6.1 <i>General Information</i> .	
5	Enable or disable the Auto Trigger using the  menu item.	
6	<p>Start the reference measurement using the  menu item.</p> <p>Result: The measurement is prepared and, afterwards, the following prompt is displayed:</p> <p style="text-align: center;">Automatic adjustment</p> <p>This indicates that the measurement is in progress and no user interaction is required. After the measurement is finished, the reference trace is displayed and the following prompt is shown:</p> <p style="text-align: center;">Switch to fault trace </p>	
7	If the trace is applicable ...	If the trace is not applicable ...
	Proceed with step 8 .	Repeat the reference measurement using the  menu item.

Step	Action
8	Start the fault measurement using the $\frac{REF}{FAU}$ menu item.
9	<p>Activate the HV path of the burning unit and raise the voltage until a voltage breakdown takes place.</p> <p>Result: The burning process starts as soon as the Arc is ignited. The fault trace is recorded and the following prompt is shown:</p> <p style="text-align: center;">Measurement finished</p> <p>If, for any reason (e.g. cable not chargeable), no voltage breakdown takes place, the fault trace cannot be recorded and an appropriate error message is displayed.</p>
10	Switch HV off using the  menu item.
11	Deactivate the HV path of the burning unit.
12	<p>The system automatically sets a marker at the supposed fault position. If necessary, adjust the position of the fault manually using the cursor.</p> <p>If the measurement provides no applicable result, try the following adjustments:</p> <ul style="list-style-type: none"> • Adjust the burning time using the  menu item. If automatic trigger is enabled, the burning process stops automatically as soon as a significant fault conversion is recognized even if a longer burning time is selected. • adjust the resolution and position of the traces using the trace functions menu (see section 5.6.2 <i>Trace Functions Menu</i>). • adjust the measurement settings using the Teleflex menu (see section 5.6.1 <i>Teleflex Menu</i>) and repeat the measurement. • Check whether the cabling of the test cable corresponds with the active phase selection.



6.11 Control of a VLF Sinus Test System

Within a modular fault locating system (like a *Variant* test van) the Teleflex VX can also be used to control a VLF Sinus test system.

In this case, the operating modes supported by the respective test system (cable and sheath testing, sheath fault pinpointing and possibly TanDelta step test) are seamlessly integrated into the menu structure of the *Teleflex VX*.

For detailed operating instructions, please refer to the “Software for remote control of VLF Sinus test system” operating manual.

7 Closing Operations

- Printing test results If a measurement or test procedure generates a meaningful trace, the operator can print this trace and the effective measurement settings on the selected printer (see section 5.3.2 *Setup Menu*) using the  menu item.
- If no printer is available, the data can be saved as PDF file. For this purpose, the respective system setting has to be enabled (see section 5.3 *System Menu*).
- Data export/deletion The operator has the possibility to select measurement results stored in the history for export/deletion (see section 5.4.3 *History Menu*). The export/deletion has to be initiated via the data menu (see section 5.3.1 *Data Menu* - ).
- If this is not done before you shut down the system, the markings in the history are lost.
- Completing the protocol At the latest after finishing the measurements you should open the protocol function (see section 5.5) and enter the general information for the measuring session. The measuring parameters are automatically filled with the results of the measurements already carried out.
- You can then print out the protocol or export it (see section 5.4.3).

8 Repair and Maintenance

General maintenance instructions Repair and maintenance work may only be performed by Megger or authorised service partners.

To ensure the high measuring accuracy over a long period of time, the unit should periodically (a two-year cycle is recommended) be sent in to the manufacturer for calibration.

Problem solving If problems occur, these can - under certain circumstances - be diagnosed and solved using the following table:

Problem	Possible cause	Remedy
The system time has to be set again after every restart.	Spent BIOS battery	The battery is to be replaced by an authorised service centre.
The Teleflex VX-P cannot be switched on, even though it is connected to the mains power supply.	Blown fuse	Both fuses below the power supply socket need to be checked. The fuse holder must be pulled out to do so. If the fuses are defective, they must be replaced with suitable microfuses (5 x 20 mm) of the type T 1.6A.
While being connected through the separating filter TF VX or TF VX-M, no signal can be measured on one or more phases.	Blown fuse	The fuses in the alligator clips (F 1.25A 500V; 6.3 x 32mm) and in the separating filter housing (F 1.6A 250V TR5) need to be checked. und bei Defekt gegen Sicherungen des gleichen Typs zu ersetzen.



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.



Selle sümbooliga tähistatud toodet ei tohi käidelda tavalise olmejäätmena. Kuna tegemist on B2B-klassi kuuluva tootega, siis ei tohi seda viia kohaliku jäätmeäitluspunkti. 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 yhteyttä 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 tsli seo a dhiúscairt sa chóras fuoil teaghlaigh. Os rud é gur táirgeadh ghnó le ghnó (B2B) é, ní féidir é a dhiúscairt ach oiread in ionaid dhiúscairthe phobail. Más mian leat an táirgeadh seo a dhiúscairt, déan é a thógáil ag eagraíocht gar duit a sainfheidhmiú in ndiúscairt sean-fhearas leictreach.



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 απορρίματα. 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 elektronikus berendezések begyűjtésével foglalkozó hulladékkezelő 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 zjme noráda, ka izstrádajumu, uz kura tá atrodas, nedrīkst izmest kopā ar parastiem mājāsaimniecības atkritumiem. Tā kā tas ir izstrādājums, ko cits citam pārdod un lieto tikai uzņēmumi, tad to nedrīkst arī izmest atkritumos tādās izgāztuvēs un atkritumu savāktnēs, 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 elektrisko 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 ji arčiau jūsų esančiai specializuotai senos elektrinės įrangos utilizavimo organizacijai.



Dan is-simbolu jindika li l-prodott li huwa mmarkat b'dan il-mod m'ghandux jintrema bhāl 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 tispicjalizza 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 să 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 výrobok 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 gospodinjske odpadke. Ker je to izdelek, namenjen za druge proizvajalce, ga ni dovoljeno odlagati v centrih za civilno odlaganje odpadkov. Če želite izdelek zavreči, prosimo, 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 señalizado 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 avfallshandling av förbrukad elektrisk utrustning i ert närområde.