Megger

PDS 62-SIN

Partial discharge measuring system

User Guide

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Contents

1 Safety instructions

1.1 General Notes

Safety precautions

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

National standards and regulations must be observed.

Working with products from Megger

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

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

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

Operating personnel

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

Other persons must be kept away.

Signal words and symbols used

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

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

Declaration of Conformity (CE)

The product complies with the requirements of the following European directives:

Directive	Standard
2014/30/EU	**Electromagnetic Compatibility** **Electromagnetic Compatibility** EN 61000-6-2 EN 61000-6-4
2014/35/EU	**Low Voltage Directive** **Low Voltage Directive** EN 61010-1
2011/65/EU	**RoHS Directive** **Restriction of certain Hazardous Substances** EN 50581

Disposal

Depending on where the device is used, the end user may be obliged by law (e.g. the German Electrical and Electronic Equipment Act (ElektroG)) to dispose of it separately from household waste.

Megger Germany GmbH as the manufacturer of the device undertakes to accept and properly dispose of the old device when a comparable new device is purchased.

If the old device is to be returned directly upon delivery of the new device, Megger Germany GmbH must be informed in advance if possible. Batteries and rechargeable batteries that can be removed from the old device must be handed in separately. The end user is responsible for deleting personal data from the old device.

The above points apply to all electrical and electronic equipment labelled with the adjacent symbol.

1.2 General Safety Instructions and Warnings

Intended use

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

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

The PDS 62-SIN is used für measuring and localising partial discharges.

Reasonably foreseeable misuse

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

The supplied notebook is solely intended for measurements. The installation of additional software is not permitted.

The PDS 62-SIN is not suitable for depositing objects.

Behaviour in the event of faults during normal operation

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

Five safety rules

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

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

Fire fighting in the vicinity of electrical equipment

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

Behaviour in the event of electrical accidents

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

In the event of electrical accidents, proceed as follows:

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

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

2 Technical description

2.1 Abbreviations

In this manual the following abbreviations are used:

Abbreviation	Meaning
AKV	Ankoppelvierpol (Quadripole)
DAC	Sinusoidal, oscillating and damped AC voltage
MWT	Monitored Withstand Test
PDEV	Partial Discharge Extinction Voltage
PDIV	Partial Discharge Inception Voltage
TDR	Time Domain Reflectometry (or Time Domain Reflectometer)
PD	Partial discharge
VLF	0.1 Hz AC
VWD	Voltage Withstand Diagnosis

2.2 System description

Functional description

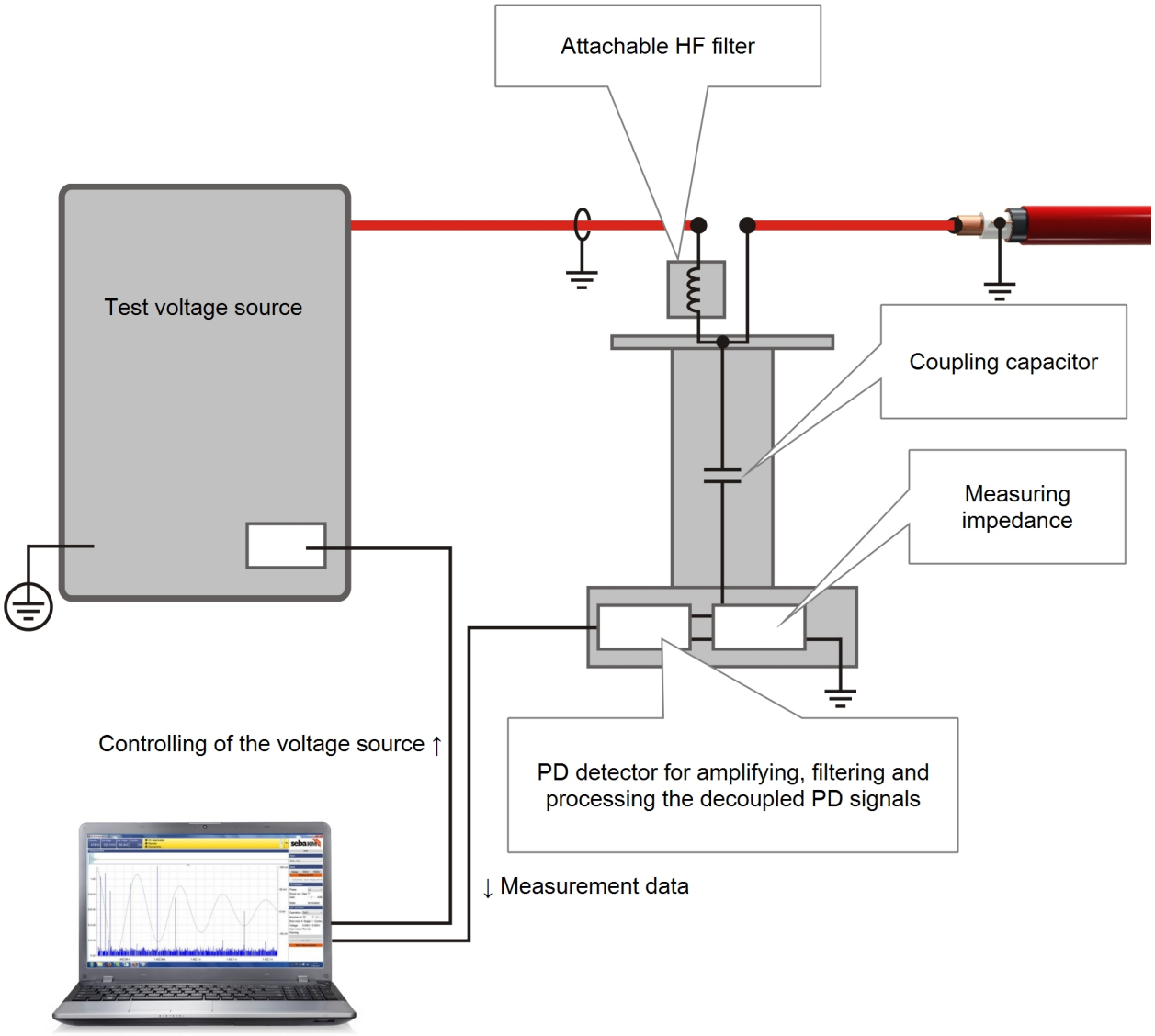
The PDS 62-SIN is a partial discharge coupler that - in combination with a VLF sine wave test voltage source - allows for the identification, classification and location of PD faults in the insulation and the accessories of all kinds of medium voltage cables.

Thanks to its versatile measurement software, it is suitable for pure PD diagnostics with VLF sinusoidal voltage as well as for a PD measurement during standard cable tests. This enables the user to perform highly accurate partial discharge measurements directly during a commissioning test or regularly performed testing with a VLF sinusoidal voltage, resulting in significant time savings and improved efficiency.

System configuration

The PDS 62-SIN acts as link between the voltage source and the test object and is responsible for the decoupling and capturing of the measurement signals. It consists of the components for the signal decoupling (coupling capacitor, measuring impedance, measurement amplifier) and the PD detector that is responsible for the signal processing.

Both, the control of the voltage source and the visualization and analysis of the measurement data are made through a notebook that is connected via a network interface. All operational actions that are required for measuring and locating partial discharges can be executed with the help of the preinstalled software. The analysis and management of the measurement data can be conducted either immediately after the measurement or later in the office.



Features

The system offers the following features and functions:

- Intuitive control and analysis software, suitable for the universal use with different systems
- Quick and fully automatic calibration in one step
- PD mapping and statistical evaluation in real time
- Fully automatic report generation directly after a measurement possible
- Cable database with individually adaptable segment templates

- Import of measurement data from other PD measurement systems, e.g. Oscillating Wave Test System (OWTS)

2.3 Scope of delivery

The scope of delivery of the system normally comprises the following components (it may deviate significantly in the case of test van installations):

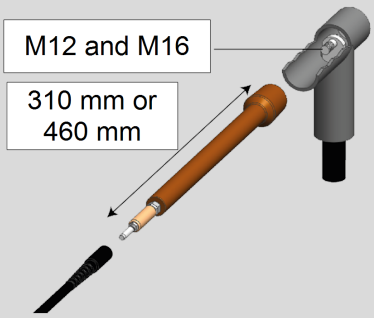
Component	Description		Article number	Quantity
Partial discharge measurement system PDS 62-SIN			1014867	1
Accessory bag			892480883	1
PD software licence	1 licence, 3 activations, 5-year term		1389	1
Notebook	With preinstalled software and case		language-dependent	1
PD calibrator CAL1	Conformity:	IEC 60270	2008807	1
	PD range:	100 pC ... 100 nC		
	Power supply:	9-volt battery		
Attachable filter	HF filter		2009631	1
Power supply			2009828	1
Mains supply line			region-dependent	1
HV connection cable	1.5 m		138316094	1
Operational earth connection cable	1.6 m		138316443	1
HV alligator clip	Red		810001055	1
Short-circuit line	0.5 m		138316442	1
Network cable			890020825 (5 m) 890023636 (3 m)	2
USB-to-Ethernet-adapter	For notebooks with only one network socket		90023850	1
Manual			85958	1

Check contents

Check the scope of delivery immediately after receipt for completeness and externally visible damage. In the case of visible damage, the device must under no circumstances be taken into operation. If something is missing or damaged, please contact your sales partner immediately.

Optional accessories

Should the following optional accessories not be part of the scope of delivery, these can be ordered from sales:

Accessory	Description	Article number
Longer network cable	50 m on cable drum	820023868
Additional PD software licence	1 additional licence, 1 activation, 5-year term	1390
PD SW package "Rating"	Enables the optional feature for rating of the cable systems, 1 licence, 3 activations, 5-year term	1391
Additiional PD SW package "Rating"	Enables the optional feature for rating of the cable systems, 1 licence, 1 activation, 5-year term	1392
PD SW licence extension	Valid for 1 licence, reactivation of the licence (all activated optional features included), 5-year term extension	1393
Longer HV connection cable	3 m	2005655
	5 m	890010915
	10 m	890023555
	15 m	890015603
Diagnostics connection set	Accessory set for PD-free connection to the test object	890017909
Cleaning kit		890010922
Transport case		90023948
PD PA-MC-UNI	PD-free connection adapter 	1013564 (460 mm) 1013563 (310 mm)

Suitable test voltage sources

In principle any Megger test voltage source with VLF sine wave output voltage is suitable to be the voltage source for the PDS 62-SIN.

If you have a VLF sine wave test voltage source from a different manufacturer, please contact the sales representative responsible for you to determine whether it can be used together with the PDS 62-SIN.

2.4 Technical data

Technical parameters

The partial discharge coupler and the included PD detector are specified by the following parameters :

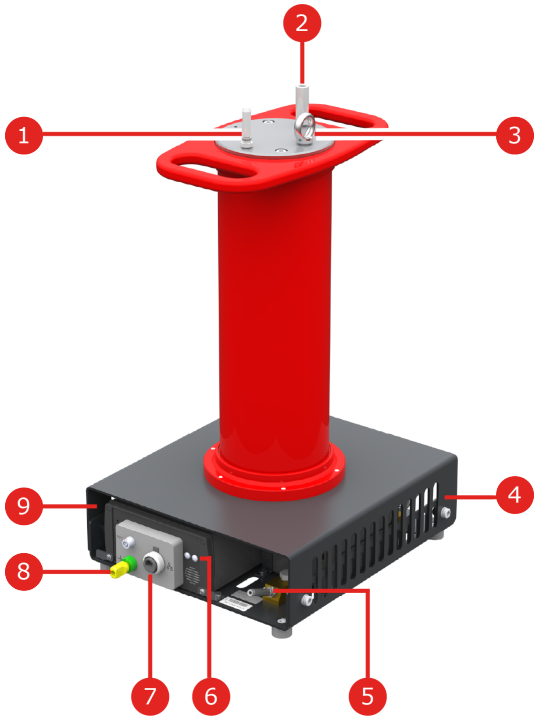
Parameter	Value
Voltage range	max. 62 kV kV_{PEAK}
Frequency range	0.01 Hz ... 0.1 Hz
Voltage form	VLF sine wave voltage
PD measuring range	2 pC ... >100 nC
System noise level	<2 pC
PD pulse repetition rate for charge evaluation	100 kHz
Charge evaluation	according to IEC 60270
PD localisation	
Measuring range	0 … 16.000 m / v/2 = 80 m/µs
Minimum cable length	75 m
Propagation velocity v/2	50 ... 120 m/µs
Sample rate	125 MHz (8 ns)
Bandwidth	3 / 20 MHz (switchable)
Accuracy	1% of cable length
Resolution	±1 pC / ±1 m
Filtering	Attachable HF milter (max. permissible current 1 A)
Power supply	via supplied power supply with input voltage range 90 … 264 VAC, 50/60 Hz
Weight	16 kg
Dimensions (W x D x H)	36 x 33 x 64 cm
Operating temperature	-20 °C … 55 °C
Storage temperature	-40 °C ... 70 °C
Relative humidity [1]	93% at 30 °C (non-condensing)

The technical parameters of the test voltage source can be found in the corresponding manual.

[1] A relative humidity above 80% may lead to increased intra-system interference.

2.5 Connection Elements and Status LEDs

The coupling unit has the following and connection elements and status LEDs:



Element	Description		
1	HV input (from test voltage source)		
2	HV output (to the test object)		
3	Eyelet for hooking the discharge rod		
4	Connection point for operational earth connection with test object		
5	Connection point for operational earth connection with test voltage source		
6	Status LEDs indicating the following states of the PD detector:		
		Left LED	**Right LED**
	Green	Measurement underway	Software and PD detector connected
	Orange	Measurement stopped and not yet restarted	Software and PD detector are connecting
	Red	System error ("Troubleshooting" on page 101)	
7	Network socket for communication with control notebook		

Element	Description
8	Protective earth connector
9	Mains socket

2.6 Technical Background

What is Partial Discharge and why test for it?

To be informed about the condition and residual life of their resources is increasingly important for network operators in order to be able to plan and optimise the investment and maintenance measures.

By the use of condition-based maintenance of medium voltage cable networks with the help of cable diagnosis and cable tests, it is possible to considerably reduce the costs for maintenance and renewal of the networks. Unnecessary repairs or renewals can be avoided and life expectancy can be maximized.

Moreover, the PD diagnosis also is an ideal method to verify the installation and assembly quality of a cable before commissioning.

The recognition, evaluation and location of PD faults has thereby been established as one of the most efficient and significant diagnostic methods. Partial discharge refers to the partial electrical breakdown of an insulation system in which only a limited area of the entire insulation section is bypassed. PD activity is an indication of incipient faults in the insulation and is widely regarded as one of the best indicators of potential weak spots in the accessories and insulation of medium and high voltage cables.

Inside cables, PD defects are generally ionisable, gas-filled voids, which were either developed during the production of the insulation or caused by one of the following events:

- Mechanical damage
- Incorrect installation of joints or terminations
- Thermal degradation processes inside joints due to improper conductor connections

Field of application

Depending on the test voltage source that is used, medium voltage cables with a rated voltage Uo/U of up to 25/45 kV can be diagnosed conforming to standards.

The measurable cable lengths depend greatly on the type of cable and on the number and the design of the sleeves. Faulty or poor quality sleeves and wet cable sections severely reduce the propagation of PD pulses and hinder or prevent their detection.

Cable lengths of 5 to 6 km can be easily measured (in some cases, even longer stretches) on new VPE cables that have sleeves of at least the required quality and if measurements can be made from both cable ends.

PD pulses are much more attenuated in mass-impregnated cables, so the maximum length is 2 to 3 km. If the cables are wet or have multiple sleeves (especially connector sleeves), the lengths that can be measured are often significantly shorter.

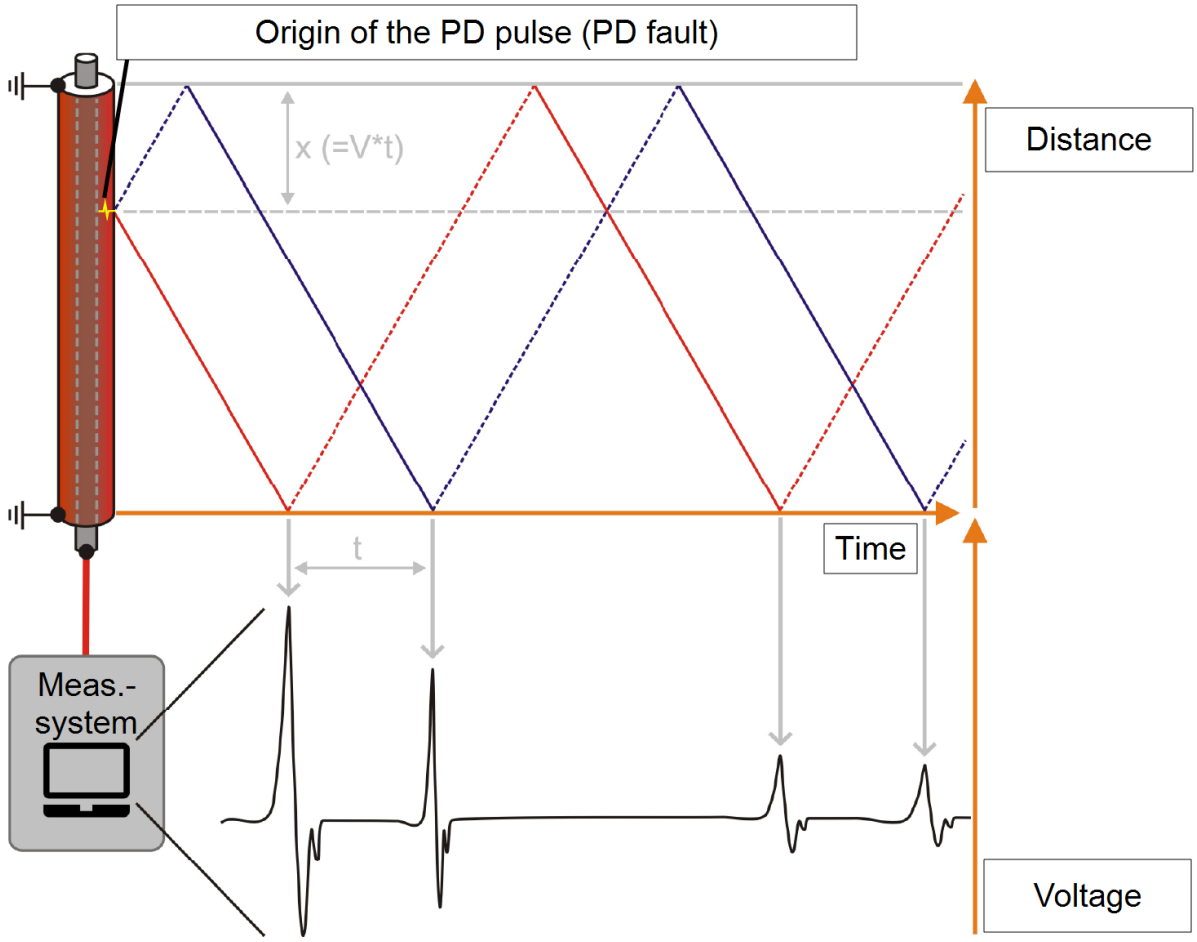
In locations where high interference voltages may obscure the measurement signal (e.g. in transformer stations), smaller PD levels are harder to identify. In these cases, a preferably short and direct earthing of the measurement system at the screen of the test object should be ensured.

How can partial discharges be measured and located?

In order to measure partial discharges, the test object is applied with the required voltage. The generated high-frequency PD signals are decoupled by means of a special AKV.

By gradually raising the voltage it is possible to detect at which voltage the PD ignites (PDIV) and how the PD level changes with increasing voltage. Conclusions regarding the type of PD fault can be drawn from the phase angle of the test voltage at the moment of the PD event. In a similar way, also the extinction voltage (PDEV) of an already activated PD can be determined during the decay of the DAC voltage.

The fact that generated high-frequency pulses in cables propagate in both directions is used to locate PD faults. During the measurement process, the measurement system records the incoming signals and, thanks to appropriate algorithms and filters, is able to identify both the directly incoming PD pulses and the respective reflections.



The position of the PD fault can then be calculated from the time difference between pulse and reflection and from the known or in the previous calibration determined pulse propagation velocity.

3 Commissioning

WARNING

General safety instructions for set-up and commissioning

- The guidelines for the implementation of occupational safety when operating a non-stationary test system often differ between different network operators and are frequently accompanied by national regulations (such as the German BGI 5191). Inform yourself about the guidelines applicable at the place of use before the measuring operation and carefully follow the rules set out therein for labour organisation and commissioning of the non-stationary test system.
- Choose a location for the system that meets the requirements of weight and dimensions and ensures a stable footing. The surface must be firm and level.
- Make sure that no other systems/system parts are impaired in their functionality when setting up or connecting the device. If changes have to be made to other systems/system parts, it must be ensured that these measures are reversed after the work has been completed. Always observe the special requirements of these systems/devices and only perform any work relating to them after prior consultation/approval from the person responsible for the work.
- In the event of vast temperature differences between the storage and installation location (cold to warm), condensation may form on the high-voltage components (condensation effect). To prevent voltage flashovers that could put persons and equipment at risk, the system must not be operated in this condition. Instead, it should remain in the new environment for about an hour to acclimatise before being put into operation.

3.1 Electrical connection

WARNING

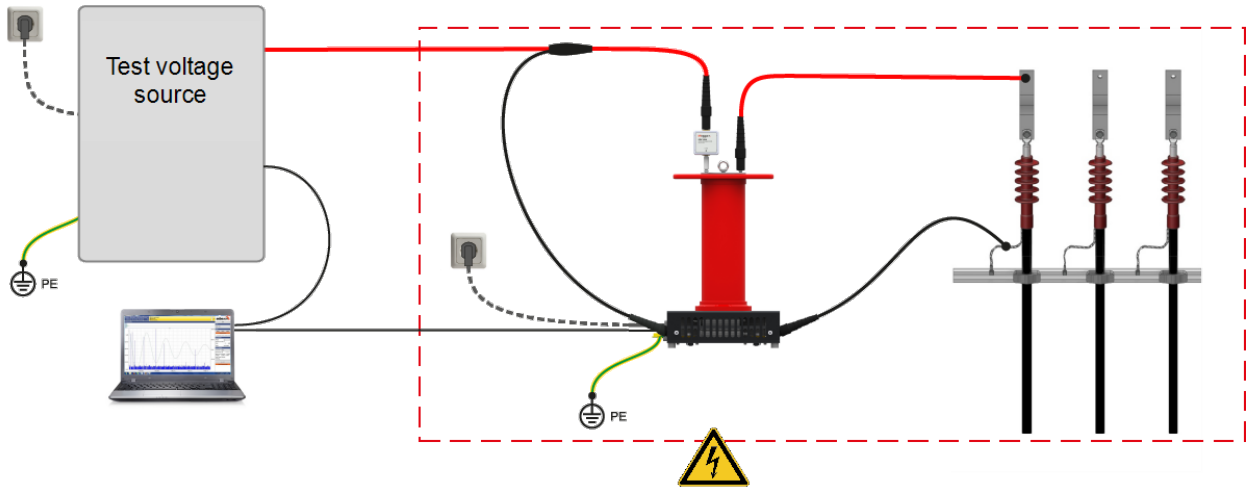
Safety instructions regarding the electrical connection

- The system may only be connected to **de-energised** equipment. The general safety instructions and, in particular, the five safety rules ("General Safety Instructions and Warnings" on page 9) must always be followed prior to connection to the test object.
- Follow the specified connection sequence.
- Because the voltage applied to the device under test can exhibit values that represent a shock hazard, all cable ends must be shielded in accordance with the legal requirements to prevent contact. It must be ensured that all branching points are considered.
- All cables at the measuring point that are out of service and at which no measurements are being taken must always be short-circuited and earthed.

3.2 When using a stand-alone test voltage source

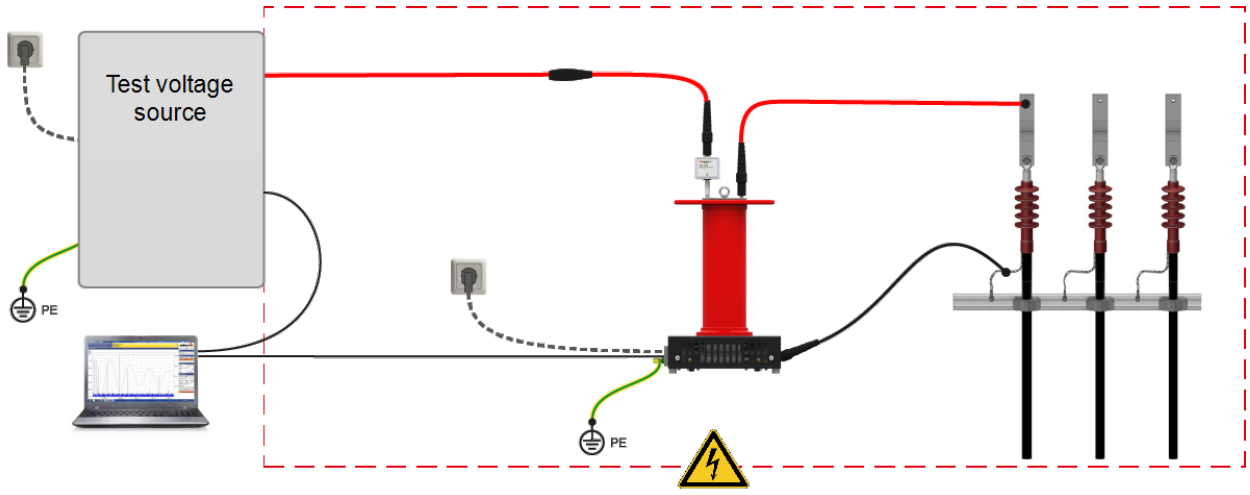
Connection diagram

The following simplified diagram shows the electrical connection with a test voltage source suitable for direct connection:



Prohibition zone and test area acc. to legal directives
(e.g. DIN EN 50191 (VDE 0104))

For test voltage sources **without outer shield connection** (e.g. VLF Sinus 62), the entire course of the HV connection cable is to be regarded as a prohibited zone as shown in the following figure:



Prohibition zone and test area acc. to legal directives
(e.g. DIN EN 50191 (VDE 0104))

WARNING

The measurement system including the unshielded connection cables are to be considered as live parts during the whole measurement. The dimensions of the prohibition zone and of the test area are determined by the test voltage in accordance to legal directives.

Procedure

Please perform the following steps for the electrical connection:

1. Earth the test voltage source and, if necessary, plug the corresponding HV connection cable into the HV output on its backside.

   For detailed information regarding the electrical connection of the test voltage source, read the corresponding manual.

2. Connect the protective earth connection 8 of the coupling unit with station earth or other suitable foundation earth electrode.
3. Plug the HF filter on the HV input 1 of the coupling unit.

4. Connect the inner conductor of the HV connection cable that comes from the test voltage source to the top of the HF filter.
5. Connect the shield of the HV connection cable coming from the test voltage source to the operational earth connection point 5.

   When using a test voltage source without outer shield connection, this step is omitted.
6. Make a connection between the operational earth connection point 4 and the shield of the cable that is to be tested by means of the supplied connection cable.

   The connection should be made directly at the cable shield and as close as possible to the point where the shield is fed out of the termination. This way, unnecessary high basic interference levels can be avoided.

7. Connect the HV output 2 with the phase conductor of the cable that is to be tested by means of the supplied HV connection cable.

> In order to ensure a PD-free connection, keep sufficient distance between the earthed parts of the system and the cable. If possible, use the connection adapters and field control electrodes from the diagnostic connection set ("Scope of delivery" on page 15) which is available as special accessory.

8. Connect a notebook with latest version of the measurement software to the network socket 7 of the coupling unit by means of the supplied network cable.
9. Connect the notebook also to the test voltage source using a network cable. Use the included USB to Ethernet adapter.

   If you are using a non-remotely controlled test voltage source with VLF sine wave output voltage, you don't need this connection, but need to make the voltage setting and enable the voltage directly at the source.
10. Connect the power supply socket 9 of the coupler with mains voltage (90 … 264 VAC, 50/60 Hz) via the included power supply unit.

3.3 Switching on

Switching on the test voltage source

After the electrical connection has been made as described, the test voltage source or the test van equipped with the test voltage source can be put into operation.

> For more details about commissioning and operating the test voltage source / the test van read the accompanying instructions.

Switching on the notebook / starting the software

The partial discharge measurement software runs either directly on the central control unit of the test van or on a provided notebook. While the software opens automatically on the control unit once a corresponding operating mode has been activated, it needs to be started manually on the notebook. Proceed as follows to do so:

1. Switch on the notebook.
2. Start the measurement software by double-clicking the  desktop icon.

> For information on how to install the software and configure the notebook, refer to the software booklet.

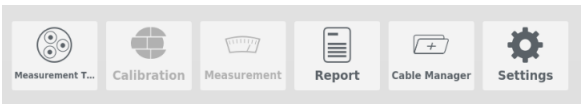
4 Basic operation of the software

4.1 Start screen

After the software has been opened, the main menu appears. This can be used to call up the individual modules of the software:

Main menu of the PC software

Main menu of the test van software



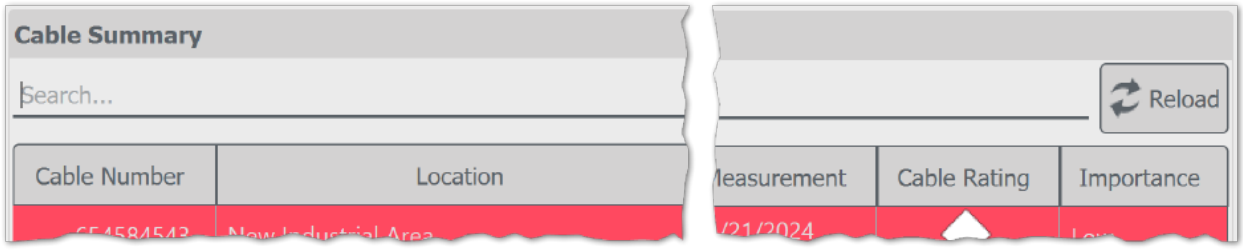
The following modules are available:

Module	Description
	Measurement task ("Starting or Resuming a Measurement Task" on page 60) Creating a new measurement task
	Calibration ("Calibrating the Partial Discharge Measuring Circuit" on page 62) Calibrating the partial discharge test circuit
	Measurement ("Measuring" on page 67) Parameterisation and conducting of the PD measurement
	Report ("Evaluating Measurement Results and Creating a Report" on page 85) Evaluating the measurement data and creating a report
	Cable manager ("Cable manager" on page 44) Administrating measurement and cable data sets
	Settings ("Adjusting the settings" on page 29) Adjusting the software settings

4.2 Useful Features of the Software

Search and sort functions

In order to make the search in extensive lists (e.g. cable lists) easier there is always a search form near the list in which any character string can be entered. While entering, the list is immediately filtered by entries that contain this character string.

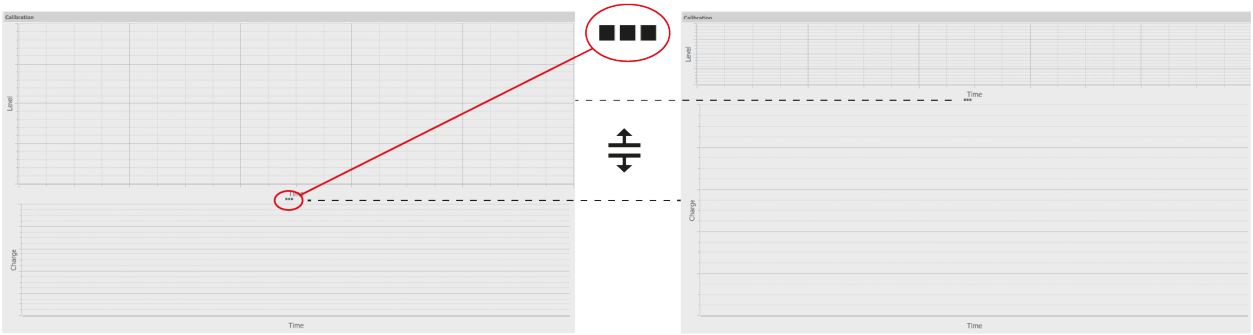


In order to cancel the filtering, either the character string needs to be deleted or, if available, the ⊗ button needs to be clicked.

When clicking on the title of a table column, the rows of the table are sorted according to the content of this column. Clicking again changes the direction of sorting. The column currently used for sorting is always indicated by a ^ or v (orientation depending on direction of sorting).

Adapting the screen layout

Where the symbol ■■■ appears, it indicates that the screen layout can be adjusted to the personal requirements depending on the situation. For this purpose, the symbol needs to be clicked and - with the mouse pressed - moved into the required position.



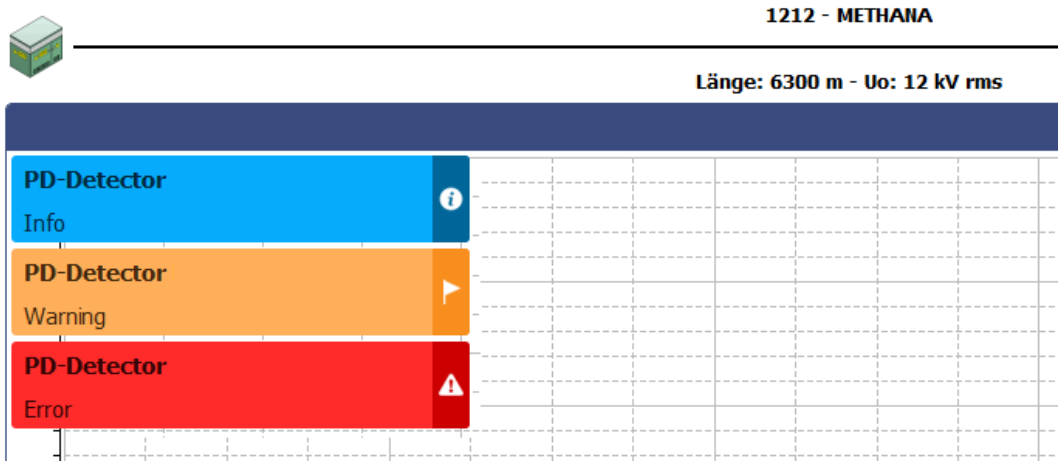
Administration of favourites

To guarantee quick access to frequently used cable templates, these can be added to the favourites (☆) list by clicking on the ★ symbol, or be removed from the list (☆) by clicking again.

The ☆ symbol which appears above the templates list allows you to toggle between the full view and the favourites view at any time.

Notifications

All notifications that are generated by the software or by the devices involved in the measurement appear in the display as an overlay for a few seconds.



The messages are divided into the following classes:

Class	Description
Info	Information about the status of the involved devices or necessary operational actions
Warning	Messages about problems that occurred in the course of the measurement, which do require user action ("Troubleshooting" on page 101)
Error	Problems (e.g. in the communication between the devices) that need to be resolved ("Troubleshooting" on page 101) before continuing the measurement

Warnings and errors are automatically stored in the notification list, which can be accessed using the menu item at the top right of the screen or by clicking on one of the error messages.

This ensures that the operator even takes note of short-term occuring problems.

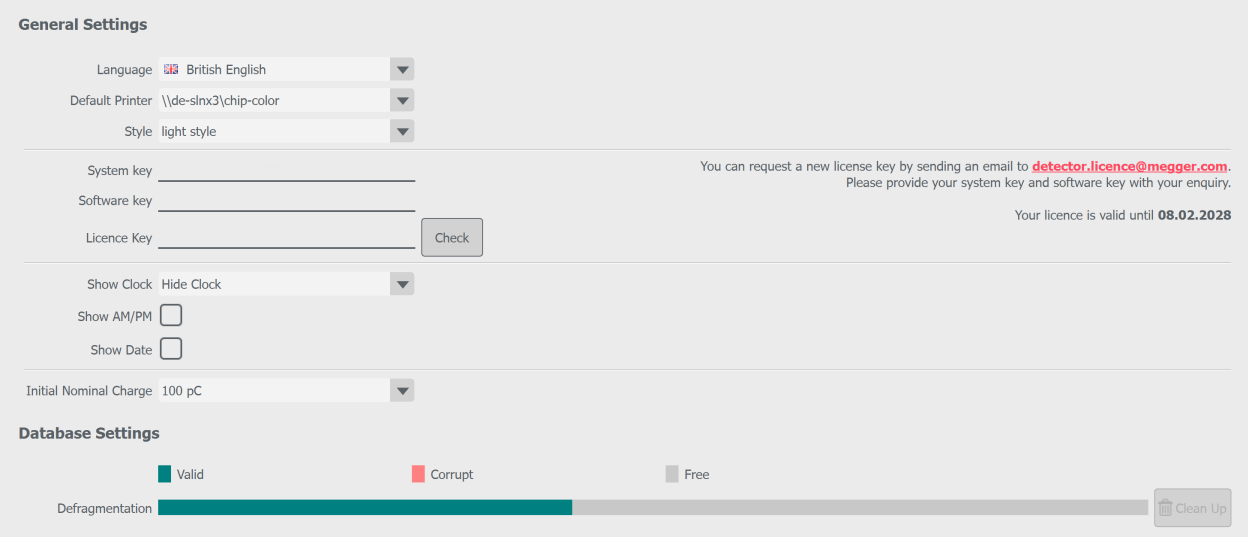
5 Adjusting the settings

In the software settings , adjustmends can be made within the following categories:

- General ("Category General" below)
- Report ("Category Report" on the next page)
- Printout ("Category Printout" on page 33)
- Devices ("Category Devices" on page 38)
- Phases ("Category Phases" on page 39)
- Localisation ("Category Localisation" on page 40)
- Test routine ("Category Test routine" on page 41)

5.1 Category General

This category contains the general software settings (language, default printer, appearance of the user interface), information about software and licences, presets for the nominal charge for the calibration mode and the database settings.



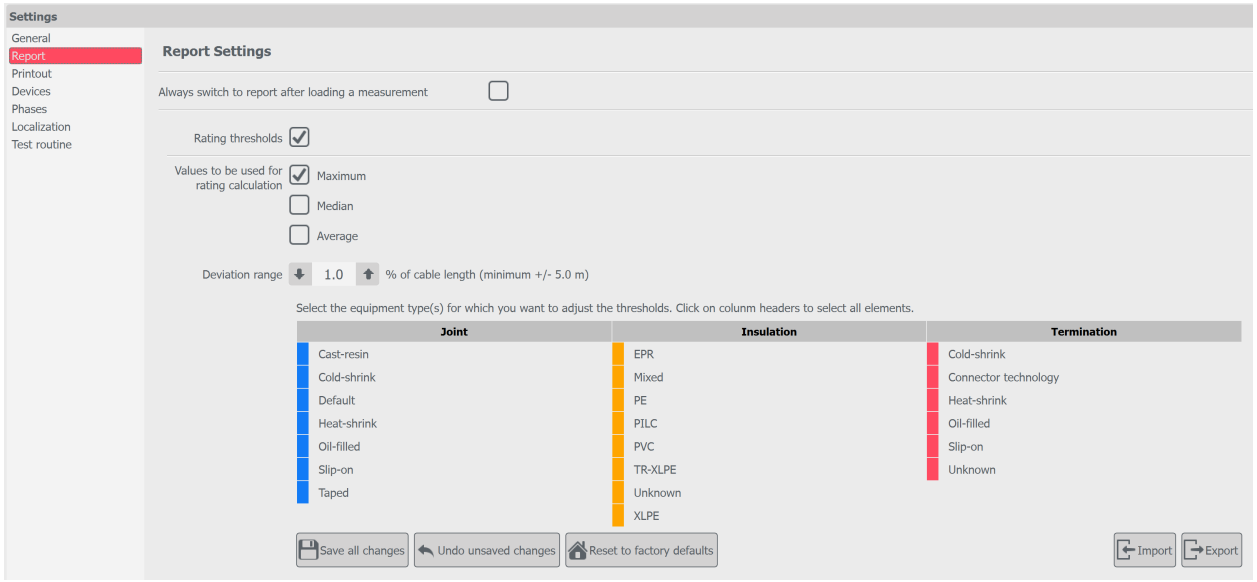
The following settings can be made in this category:

Field	Description
Language	Select the menu language. To ensure that all texts are displayed in the selected language, a restart is required after changing the language setting.
Default Printer	Printer that should print the created PDF reports.
Style	Select the colour scheme for the screen display.
Hardware key	Read-only access.

Field	Description
Software key	Display of the software key.
Licence key	Display of the licence key.
Show Clock **Show AM/PM** **Show Date**	These parameters can be used to specify whether and in what format the clock and date should be displayed on the upper right edge of the screen. This setting is especially important if the software is running in full-screen mode (as it is the case on a test van's IPC).
Initial Nominal Charge	Pre-selected charge level when entering calibration mode.
Database Settings	Overview of database memory usage. If the database contains corrupt data sets, it is recommended to clean the database using the **Cleanup** button. Data sets can become corrupted if, for example, cables have been deleted from the cable database via another application. If this happens, the measurement data for the cables remains in the database without being assigned and must be cleaned using this function.

5.2 Category Report

This category contains the setting to automatically switch to the associated report after loading a measurement. If the additional package PD SW package "Rating" is used, this contains also the settings to evaluate the cable systems.



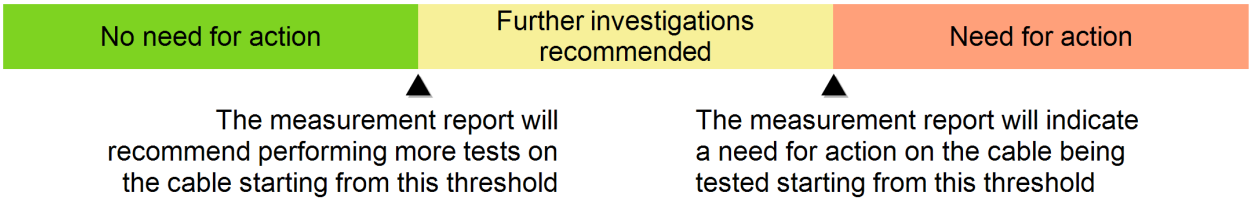
Any change of the evaluation criteria affects the rating of the diagnosed cable systems. Changes on these should only be made by experienced users to prevent the ratings becoming unusable.

The following settings can be made in this category:

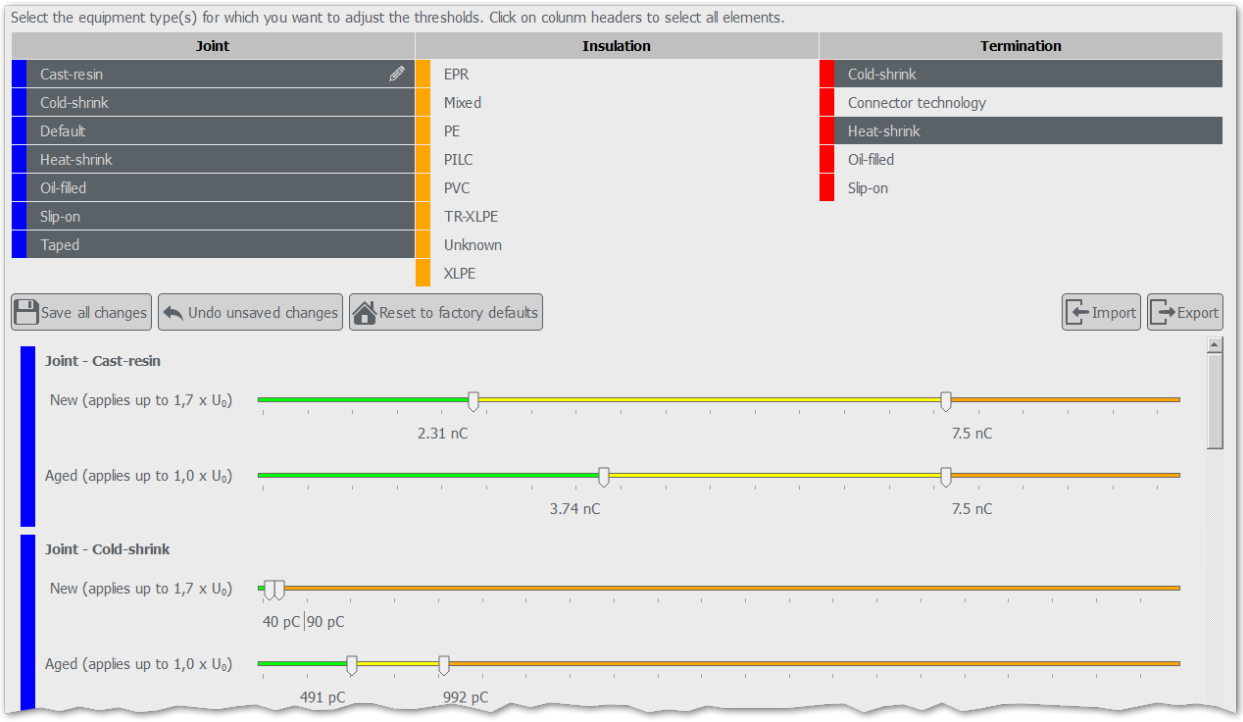
Field	Description	
Always switch to report after loading a measurement	This option automatically switches to the report after loading a measurement.	
Rating thresholds	[Only available with additional package PD SW package "Rating"] This option enables the rating of cables.	
Values to be used for rating calculation	[Only visible if Rating thresholds is selected] Selection of values used to determine the rating:	
	Maximum	This option uses the largest measured values as evaluation basis.
	Median	The median is the central value located exactly in the middle of a series of measured values (sorted by size). This option uses the median values as evaluation basis.
	Average	The average is the arithmetic mean of the available measured values. This option uses the arithmetic mean of the measured values as evaluation basis.
Deviation range	[Only visible if Rating thresholds is selected] Settings for determinating the rating:	
	Deviation range	The deviation range is indicated as a percentage of the cable length. In proximity to joints or terminations, partial discharges occuring within the deviation range are assigned to these and are included in the determination of the rating.
	Thresholds	It is possible to modify the evaluation thresholds for the various types of joints, insulations and terminations.

Modifying thresholds

The limits for the rating sections of the cable system elements are defined by setting the thresholds. The following recommended actions apply to these rating sections.



It's possible to select several elements simultaneous to change their thresholds. Selected elements are underlaid in colour. Their thresholds are displayed below the selection list. They can be adapted via sliders. A distinction is made here as to whether the elements are considered to be new or aged.



Unsaved changes are marked in the selection list with  .

As soon as the limit value on file is exceeded in a measurement, the software adopts the lower rating.

The following buttons are available to change the threshold values:

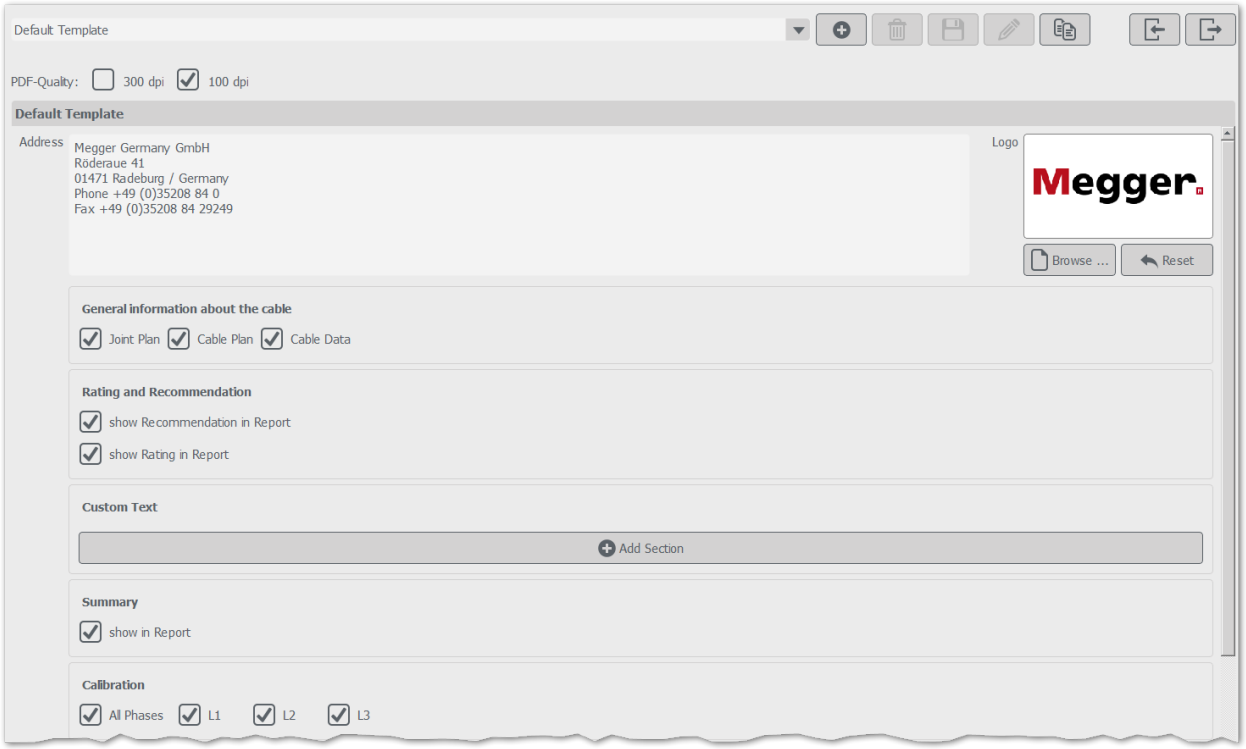
Button	Description
Save all changes	All changes to the thresholds are saved.

Button	Description
Undo unsaved changes	All unsaved changes are discarded. For selected elements, the saved thresholds are displayed.
Reset to factory defaults	All thresholds are set back to default settings and saved.
Import	Import thresholds in *.rat format from a local storage device.
Export	Currently saved threshold values are exported in *.rat format to a local storage device.

5.3 Category Printout

Within this category, it is possible to modify the content of the diagnostic report to your needs and to create any number of templates.

When the software is delivered, a template that satisfies the typical requirements for a diagnostics report is already included. However, this template cannot be modified or deleted.



Managing templates

Using the following buttons on the top of the screen, any number of individual templates can be created, edited, copied and also deleted:

Button	Description
	Creating a new template
	Rename currently selected template
	Delete currently selected template
	Save changes to currently selected template
	Duplicate currently selected template under new name
	Import templates in *.pddt format from a local storage device
	Export currently selected template in *.pddt format to a local storage device

Creating a new template

Proceed as follows to create a new template:

1. Use the button  to create a new template.
2. Customise the content that a report based on this template should include based on your needs.

   As soon as the template is modified, the icon  in the name field indicates unsaved changes.

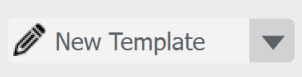
3. Save the changes using the  button.

Modifying the content of a template

Proceed as follows to modify the content of a template:

1. Using the pull-down menu, select the template that you want to modify.
2. Customise the content that a report based on this template should include based on your needs.

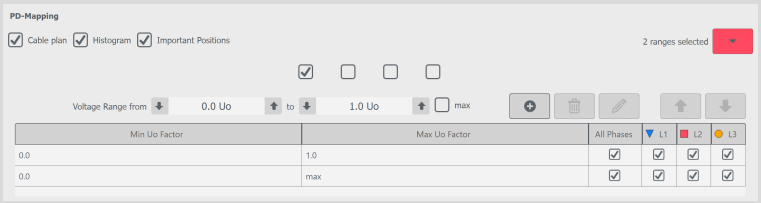
   As soon as the template is modified, the icon  in the name field indicates unsaved changes.

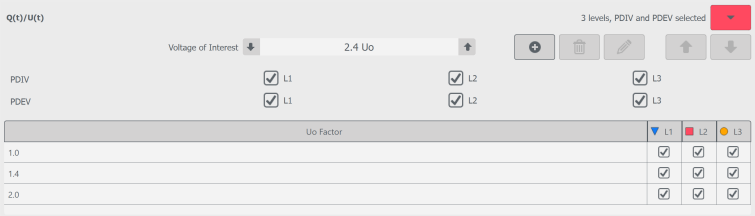


3. Save the changes using the button.

The following contents can be added to or removed from the report template based on your needs:

Category	Content
PDF-Quality:	Using these checkboxes it can be specified whether the PDF reports generated with this template should have a resolution of 100 DPI or 300 DPI.
Address / Logo	Address and logo that should appear in the header of the report.
General information about the cable	Data of the diagnosed cable. Cable data, cable plan and joint plan can be activated or deactivated individually.
Rating and Recommendation	[Only visible with the optional software package PD SW package "Rating"] Rating and recommendation for the diagnosed cable. Rating and recommendation can be activated or deactivated individually.
Custom Text	This segment can be used to add any number of custom text modules to the template. For example, this could be frequently used phrases, hints or recommendations, which are then activated or deactivated as needed in preparation for the actual report creation. The order of the modules can be adjusted using the and buttons. Clicking on the button deletes the text module.
Summary	Tabular overview of the key measurement data (for example, PDEV, PDIV and charge level at various voltage levels). The voltage levels to be included in this summary table can be set during the preparation of the report ("Preparing and Printing the Report" on page 95).
Calibration	The TDR images of the various phases recorded during calibration.

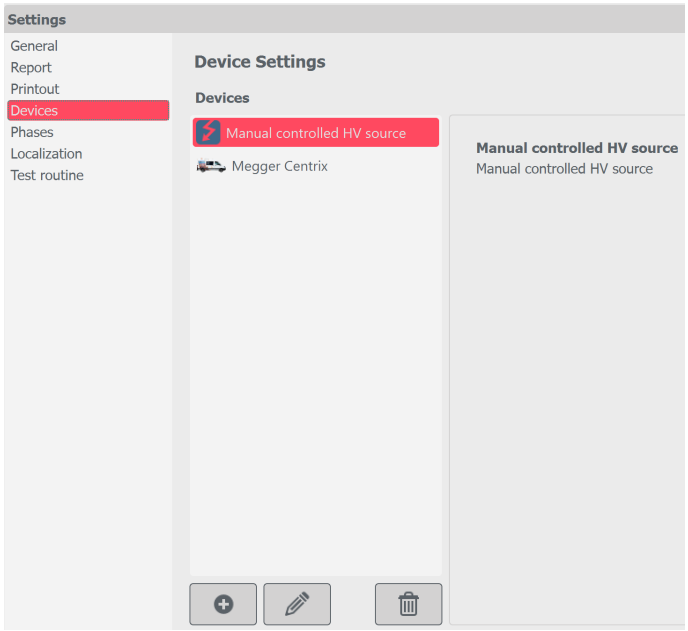
Category	Content
PD mapping	List of the PD mappings to be included in the report.  The checkboxes in the first line can be used to specify which information is to be displayed in each of the PD mappings contained in the report (cable plan, histogram, important positions, non-relevant PD events and non-localized PD events). The list of PD mappings contained in the report can be shown using the button. To add a PD mapping to the list, the voltage range must first be configured and then the button pressed. Double-clicking in the corresponding table cell is sufficient to change the parameters (voltage values, phases) of an existing entry. Using the and buttons, the order in which the PD mappings appear within the report can be changed. To delete a PD mapping from the list, first select it and then press . Using the and buttons, you can also specify whether the pulses classified as insignificant should also be displayed. This setting applies for all PD mappings included in the report.

Category	Content
Q(t)/U(t)	List of the Q(t)/U(t) diagrams to be included in the report.  The Q(t)/U(t) diagrams for the inception voltage (PDIV) and the extinction voltage (PDEV) are included by default (but can be disabled by unchecking the individual phases). To add another diagram to the list, the voltage level must first be selected and then the ⊕ button pressed. Double-clicking in the corresponding table cell is sufficient to change the parameters (voltage values, phases) of an existing entry. Using the ↓ and ↑ buttons, the order in which the diagrams appear within the report can be changed. To delete an entry from the list, first select it and then press 🗑.
PRPD	PRPD diagrams of the individual phases.
Localization Diagrams	The TDR diagrams which have been selected during the preparation of the report ("Preparing and Printing the Report" on page 95).
VWD Plots	The VWD diagrams which have been selected during the preparation of the report ("Preparing and Printing the Report" on page 95).

5.4 Category Devices

Within this category, all devices configured are listed. If one of the devices is selected, its settings are shown in the right section of the screen. In general, these settings (in particular the network and connection settings) should only be changed at the request of a service employee.

All changes that the user may make independently on the device configuration are described in the following sections.



Adding/removing devices

In general, the available devices are already added to the software in the factory. If, however, the software needs to be reinstalled or an additional device that can be used for the PD measurement is purchased, using the buttons directly under the device list the following changes can be made.

Button	Description
	Add new device to list. In addition to the device type, which must be set, a name or comment can also be added optionally. If the test voltage source is not in the list of supported devices (for example, because it is from another manufacturer), the option **Manual controlled HV source** should be selected.
	Change type, name or comment of the currently selected device.
	Delete currently selected device.

It is recommended that the device list is kept as small as possible and that devices are only added that are actually used regularly in combination with this software installation. In this way, device selection is made faster and easier at the start of a new measurement task. When the device list only contains one voltage source and one PD detector, this selection becomes unnecessary.

Updating the firmware of a PD detector

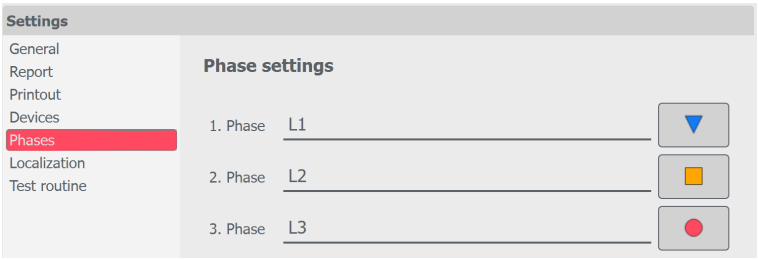
To be able to update the firmware of a PD detector, it must first be selected in the list of devices. Preferably, a firmware update should be performed prior or subsequent to a measurement when the system is properly erected and connected.

After a network connection to the PD detector has been established **Connect**, the firmware file (.pddfw) can be selected using the ••• button. Only after a suitable file has been selected can the update process be started by clicking on the **Update firmware** button.

The system must not be switched off during the entire update process!

5.5 Category Phases

To be able to distinguish the curves and PD events of the different phases, the colours and labels used for the display can be changed in this screen.



Changing the phase designation

By default the designations used are L1 for phase 1, L2 for phase 2 and L3 for phase 3.

To change the designations, the required identifier has to be entered into the field to the right of the repective phase.

The change is instantly adopted. It's also changed in each measurement task that is either newly created or reloaded. Reports already stored in *.pdf format remain unchanged. To get the changed designations adopted into those, the reports have to be newly created.

Changing the colour of the phase symbols

Use the button of the respective symbol to change the colour of a phase symbol. A window opens where the colour can be adjusted.

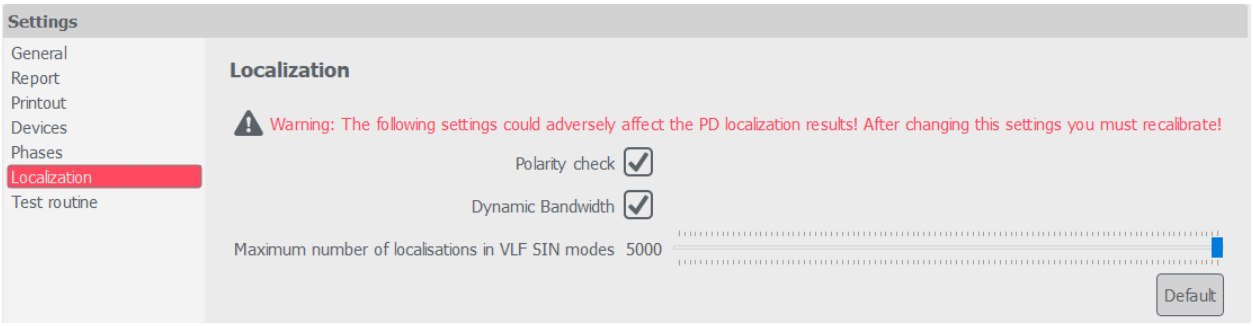
Preset default colours

The following colors are preset for the respective phase by default:

Phase	HTML colour code
Phase 1	#127bf6
Phase 2	#ffa500
Phase 3	#ff4960

5.6 Category Localisation

In this category, settings can be made that influence the localisation of partial discharges.



The following settings can be made in this category:

Field	Description
Polarity check	With the polarity check active, only those pulses for which the original pulse and the reflection have the same polarity are considered as possible partial discharge pulses. This procedure complies with the requirements of the normal partial discharge measurement, which is why the polarity check should not normally be disabled! For special applications, such as pinpointing partial discharges with a pulse generator, original pulse and reflection may have different polarities. In such cases, the polarity check must be disabled temporarily.
Dynamic Bandwidth	If this function is active, based on the cable length, the optimal bandwidth for the localisation is calculated and used. Otherwise, the localisation is always performed with the maximum bandwidth. Using dynamic bandwidth is recommended for measurements.
Maximum number of localisations in VLF SIN modes	In VLF sine wave modes, the amount of incoming and processed localization results can reach very high levels depending on the duration of the measurement. Though, a limitation of the maximum value is only necessary if the error message "**Processing Pipeline limit reached!**" is repeatedly displayed during measurement indicating that the processing power of the computer in use is not sufficient.

Changes to these settings can impact the results of the PD localisation in a negative way. It's necessary to redo the calibration after changing the settings!

5.7 Category Test routine

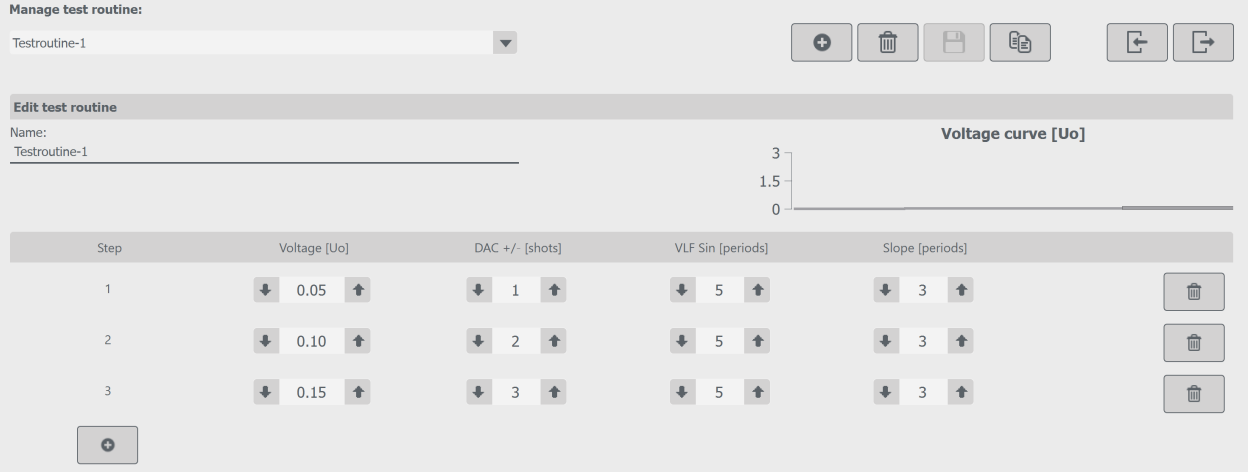
Within this category, it is possible to create and adjust test routines to your needs. They can be enabled oder disablled.

The following settings can be made in this category:

Field	Description
Enable test routine	Enable or disable the use of test routines
Manage test routine:	Dropdown menu for selecting the respective test routine
	Create new test routine Add step to test routine
	Delete currently selected test routine
	Save changes to currently selected test routine
	Duplicate currently selected test routine under new name
	Import test routines in *.trt format from a local storage device
	Export currently selected test routine in *.trt format to a local storage device
Name:	Free text field for changing the name

The editing of test routines is only possible while the field **Enable test routine** is enabled.

Editing test routines



When editing the individual steps, the following settings can be made:

Setting	Description
Step	It's possible to add new steps via the button ⊕
Voltage	Adjusting the test voltage with regard to Uo The selected test voltage is used for all measurements in this step.
DAC +/-	Shot quantity for this step in DAC mode
VLF Sin	Period quantity for this step in VLF Sinus mode
Slope	Period qunatity for this step in VLF CR Slope mode
🗑	Delete step from test routine

The settings for each individual step can be adjusted via the ↓ and ↑ buttons.

Creating a new routine

Proceed as follows to create a new test routine:

1. Use the button ⊕ to create a new test routine.
2. Customise the name of the test routine in the free text field **Name:**.
3. Add a step to the test routine using the button ⊕ in the column Step.
4. Customise this step to your requirements.
5. Repeat steps 3 and 4 until the test routine meets your requirements.
6. Save the changes using the 💾 button.

Editing an existing routine

Proceed as follows to edit an existing test routine:

1. Select a test routine from the drowdown menu Manage test routine:.
2. Customise the name of the test routine in the free text field **Name:**.
3. Adjust the already existing steps to meet your requirements.
4. If necessary, add a step to the test routine using the button  in the column Step.
5. Customise this step to your requirements.
6. Repeat steps 4 and 5 until the test routine meets your requirements.
7. If necessary, delete steps no longer needed via the button  .
8. Save the changes using the  button.

6 Cable manager

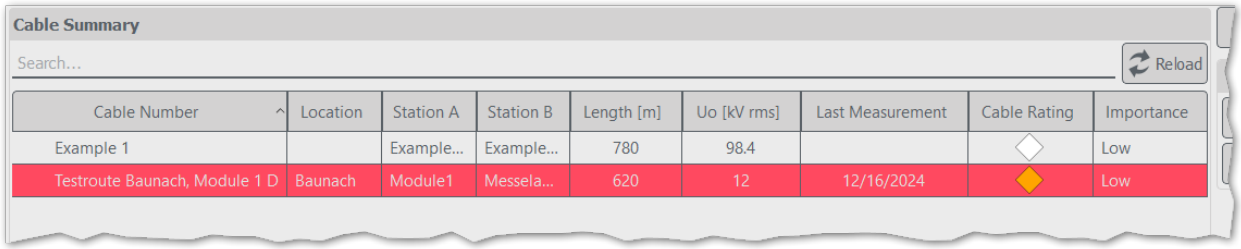
The cable manager serves for maintaining the cable data. These are stored in a local database, which is also used by the MeggerBook Cable protocol software (if also installed on the computer). This ensures that the cable data is consistent across all applications installed on the machine, i.e. any changes to the cable data will be effective in the other application as well.

In addition to the cable data, the cable manager also shows and manages all measurement tasks carried out on the respective cables.

6.1 Viewing Cable Data and Administrating Measurement Tasks

Selecting a cable

In order to be able to look at the technical details, the sections or the measurement tasks of one particular cable, this cable needs to be selected from the list of available cables first of all:

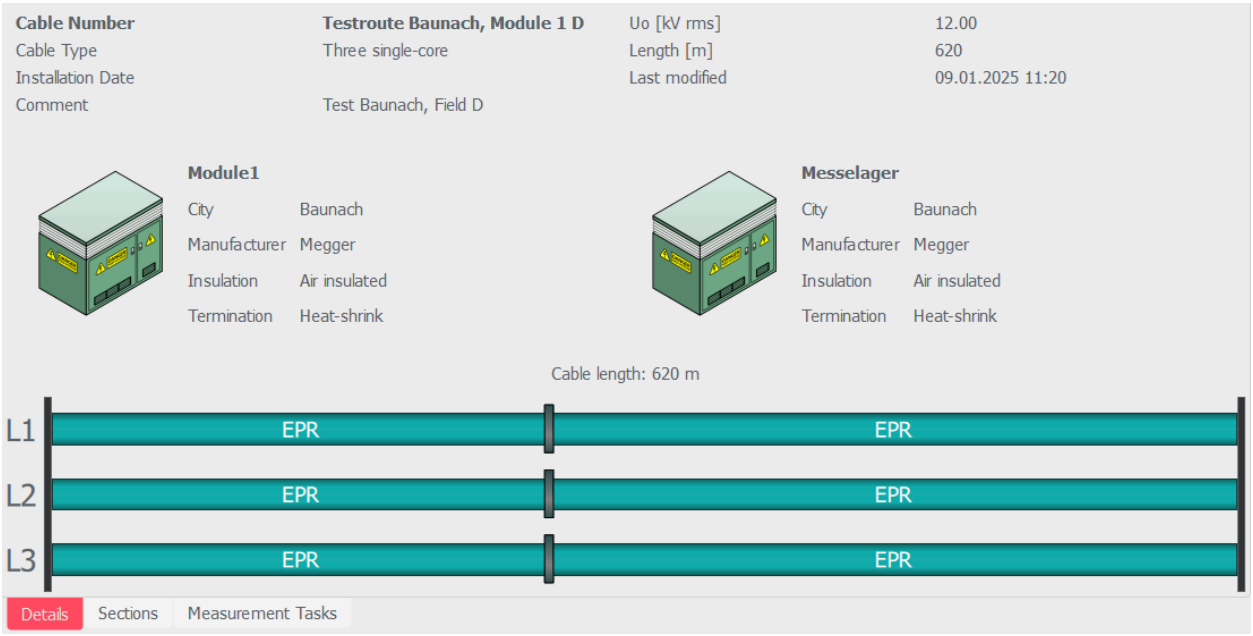


If changes were made to the cable data in the MeggerBook Cable protocol software during the current session, the cable list displayed should be reloaded using the **Reload** button.

In the event of an especially comprehensive cable list, the displayed cables can be filtered with the aid of the search function ("Useful Features of the Software" on page 27).

Details view

As soon as a cable has been selected, a table with the general cable data of the cable is displayed in the lower screen area (tab **Details**):



Cable sections

Under the **Sections** tab, detailed information on the individual cable segments can be viewed:

Measurement Tasks

The **Measurement Tasks** tab provides a list of all measurements conducted on this cable system. An active measurement task is marked in bold.

After an item of this list has been selected, the following functions can be called up:

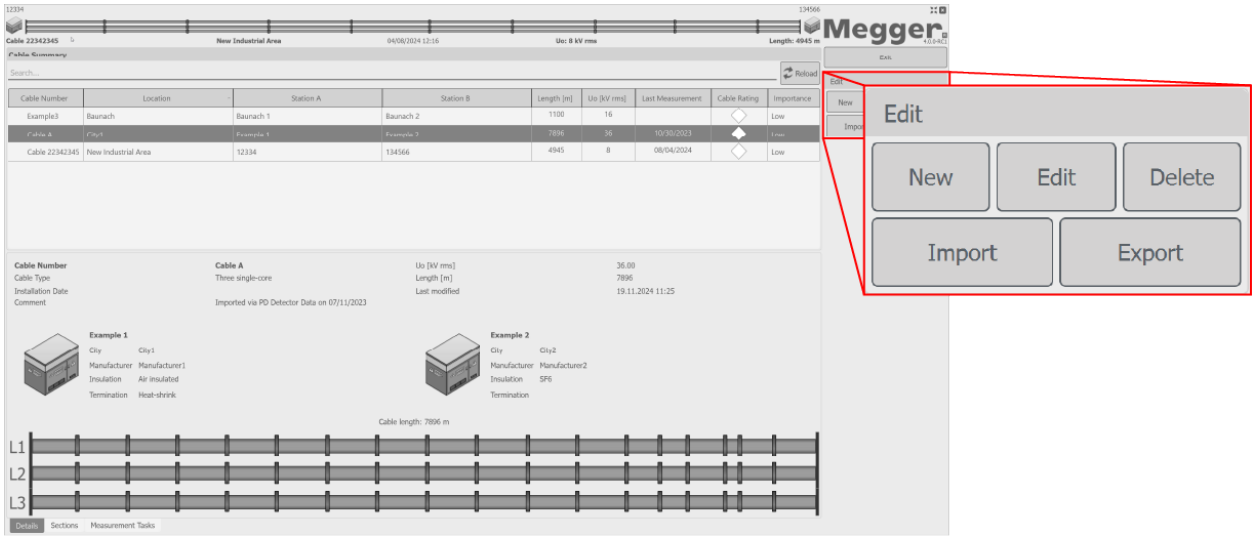
Button	Function
Load	The measurement data of the selected measurement task are loaded into the memory. After a previous measurement task has been loaded, the "Evaluating Measurement Results and Creating a Report" on page 85 menu point can be called up via the start screen and the measurement data can be once again evaluated ("Evaluating Measurement Results and Creating a Report" on page 85). If there is an active measurement task going on at that moment it will be closed. Therefore, current measurements should be finished before loading a previous measurement task.
Delete	The measurement task including all corresponding measurement data is deleted.
Cleanup	This menu item can be used to delete the measurement data of the selected measurement task. This function can be used if, due to many previous measurements, the memory space on the data carrier becomes limited and the measured data are no longer needed. After the cleanup, the last saved state of the report can still be opened and exported. Measurement tasks for which no report has yet been created cannot be cleared.
Show Report	The current report is displayed as PDF file. Prerequisite for thiis is that a report has already been generated for this measurement task.

Button	Function
Export Report	The PDF file of the current report can be saved in a target directory of your choice. Prerequisite for thiis is that a report has already been generated for this measurement task.
Resume Task	The measurement task is continued and further measurements can be added to the existing ones. This function is intended to resume interrupted measurements when e.g. the software was terminated unintentionally or a measurement must be completed on the following day.
Clone Task	A new measurement task with the exact same settings is started.

6.2 Managing cables

Functions

With the help of the buttons of the **Edit** menu block, existing cables can be managed and new cables can be created.



The following functions are available in this menu:

Button	Description
New	Create a new cable ("Entering/Changing General Cable Data" on the next page)
Edit	Edit the cable that is currently selected in the cable list ("Entering/Changing General Cable Data" on the next page)

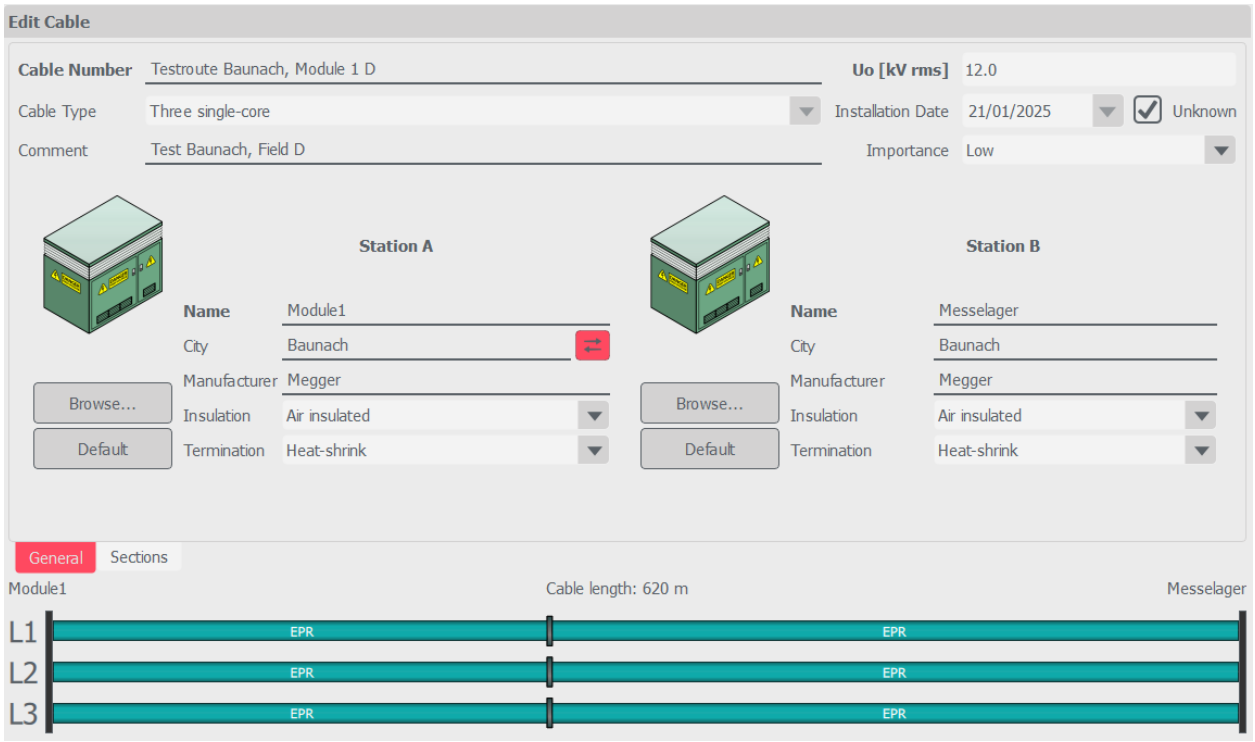
Button	Description
Delete	Delete the cable which is currently selected in the cable list When a cable is deleted, all measurement data of the cable is lost!
mport	Import cable and measurement data ("Importing Data" on page 57)
Export	Export cable and measurement data ("Exporting Data" on page 56)

6.2.1 Entering/Changing cable data

Directly after clicking the buttons **New** or **Edit**, a mask that allows entering/correcting of the cable data appears.

6.2.1.1 Entering/Changing General Cable Data

General cable data are entered in the **General**. Mandatory fields are marked by a coloured background.



The following entry forms allow entering the cable parameters:

Entry form	Description
Cable Number	Number/designation of the cable system The cable number has to be unique and must not be used twice!

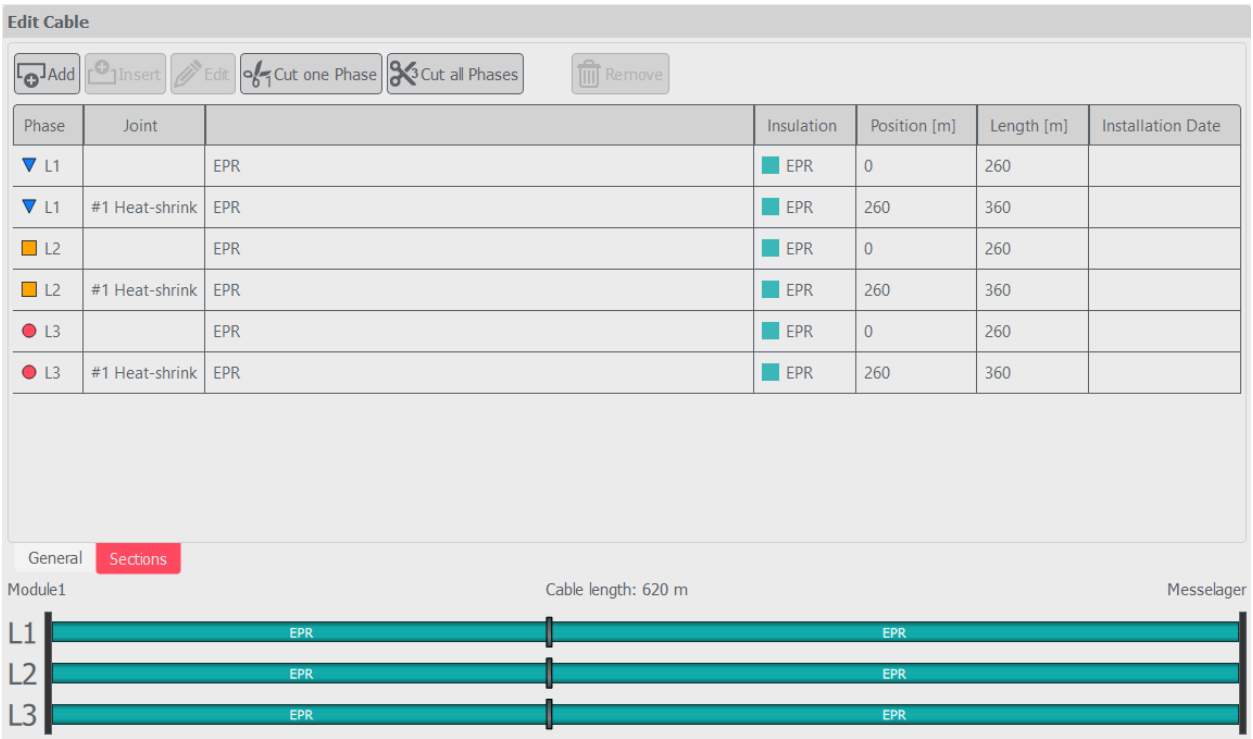
Entry form	Description
Uo [kV rms]	Nominal voltage U_0 of the cable (in kV_{rms})
Cable Type	Design of the cable system It is important to select the **Three single-core** option for cable systems which exhibit differences in the insulation type between the individual phases. Only then can this type of inhomogeneity actually be represented when entering the cable sections ("Specifying the sections of the cable" on the next page).
Installation Date	Date of the installation / initial operation
Comment	Helpful comments regarding the cable´s history

Beyond, with the help of the following buttons and entry forms, detailed information regarding the technical conditions on both ends of the cable can be entered.

Entry forms / Buttons	Description
Name	Name of the respective switchgear/substation
City	Location of the respective switchgear/substation Synchronising: If the ⇄ button is activated, the entries for the field **City** for switchgears/substations A and B are synchronised.
Manufacturer	Type/manufacturer of the switchgear
Insulation	Insulation of the switchgear
Termination	Type of the cable termination
Browse	With this button, a meaningful picture of the switchgear can be imported into the software and can be saved with the cable data.
Default	With this button the picture of the switchgear is reset.

6.2.1.2 Specifying the sections of the cable

Via the tab **Sections** you get to the second entry form in which all cable types and joints of all cable sections have to be specified.



Specifying the cable sections

The following functions are available in this menu:

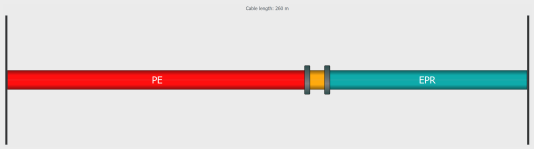
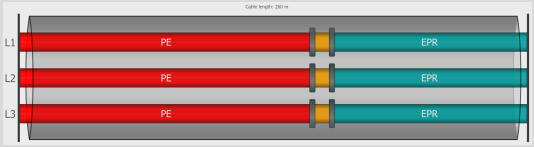
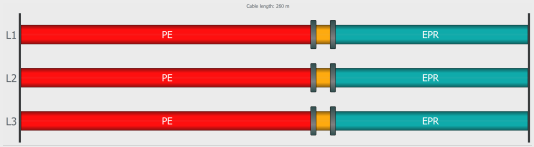
Button	Description
Add	Adds a section at the far end of the cable.
Insert	Inserts a section to the left of the currently selected section.
Edit	Enables changing of the characteristics of the selected section.
Cut one Phase	Enables cutting of one phase of the selected section.
Cut all Phases	Enables cutting of alll phases of the selected section.
Remove	Removes the currently selected section.

General notes

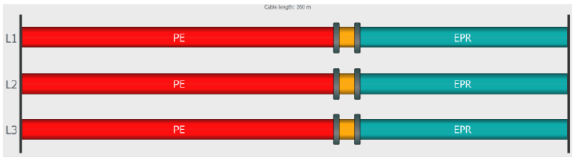
In case of homogeneous cable systems without joints exactly one section with the total cable length needs to be specified. The individual sections of cables with several sections must be entered step-by-step (starting with the cable end defined as **Station A**). The individual section lengths and the respective insulation types must be specified as exactly as possible. This makes it easier to identify relationships between PD faults and joint positions following the measurement, and incorrect conclusions can be avoided.

Depiction of the different cable types

The different cable types are depicted as follows:

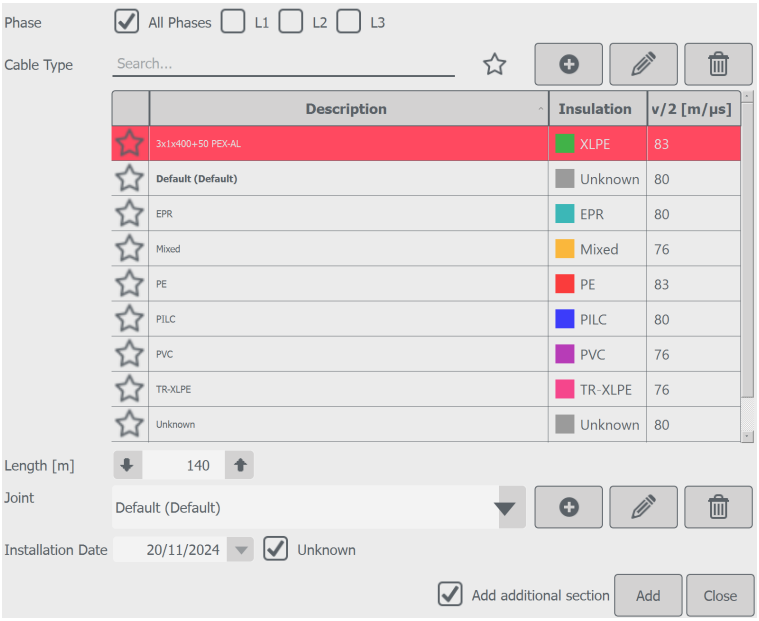
Cable Type	Depiction
Single-core	
Three-core	
Three single-core	

For three phase cable systems, it is possible to enter cable sections for all three phases at once as well as for each phase individually. However, after completing entry, it must be ensured that all three phases exhibit the same total length:



Adding/Editing a section

After pressing one of these buttons (Add, Insert, Edit), a new window for entering/editing the section data opens.



The following properties can be defined:

Parameter	Description
Phase	Phase(s) of the cable system to which the changes should be applied (only available for cable types Three single-core or Three-core).
Cable Type	Cable type of the section The type can be selected from all the cable templates created. When delivered, a number of typical cable types are already stored in the database. When required, the buttons can be used to add any number of templates of your own and to administrate existing templates ("Managing Segment Templates" on page 54). When there are a large number of cable templates, the Search and Favourites functions ("Useful Features of the Software" on page 27) can be used to help filter the templates displayed.
Length [m]	The length of the cable section in metres When adding a new cable section before the marked section, an additional tickbox is made available in this line. If this box is ticked, the length of the new section is subtracted from the length of the marked section (which is equivalent to cutting the marked section). If this box is not ticked, the marked section retains its original length and the total length of the cable is extended by the length of the new section (which is equivalent to the actual insertion of a new piece of cable).

Parameter	Description
Joint	Type of joint connecting the current cable section with the previous cable section. Accordingly, no selection need be made for the first section of a cable. The joint type can be selected from all the templates created. When delivered, a number of typical joint types are already stored in the database. When required, the buttons can be used to add any number of joint templates of your own and to administrate existing templates ("Managing Segment Templates" on the next page).
Installation Date	Date of the installation of the cable section

Editing is completed using the **Add**, **Insert** or **Edit** buttons, and the section is added. The editing window is closed using the **Close** or **Cancel** buttons.

When adding new sections to the cable end, it is possible to continue adding another section directly if the **Add additional section** checkbox has been activated and the button **Add** has been used.

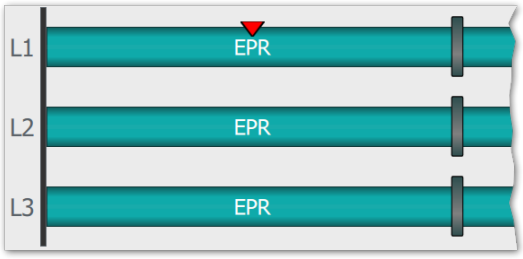
Cutting cable sections

If a cable was cut and a joint inserted during maintenance work, this change can also be made to the digital image of the cable using the buttons **Cut one Phase** and **Cut all Phases**.

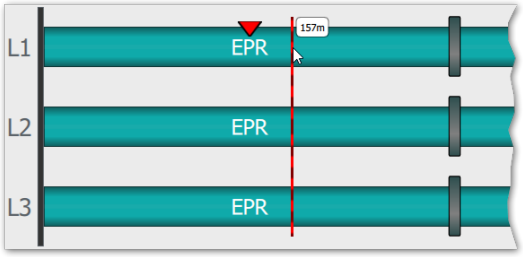
Proceed as follows to do so:

1. Select the cable section to be cut from the list or directly in the cable plan.

   The selected section is marked with a red triangle.



2. Using the buttons placed above the list, activate the desired cutting mode.
3. Select the position where the cut was made by hovering the mouse over the respective section/phase in the cable plan. Using the mouse wheel, the position can be finely adjusted.



4. Click to make the cut.

6.2.1.3 Saving Cable Data

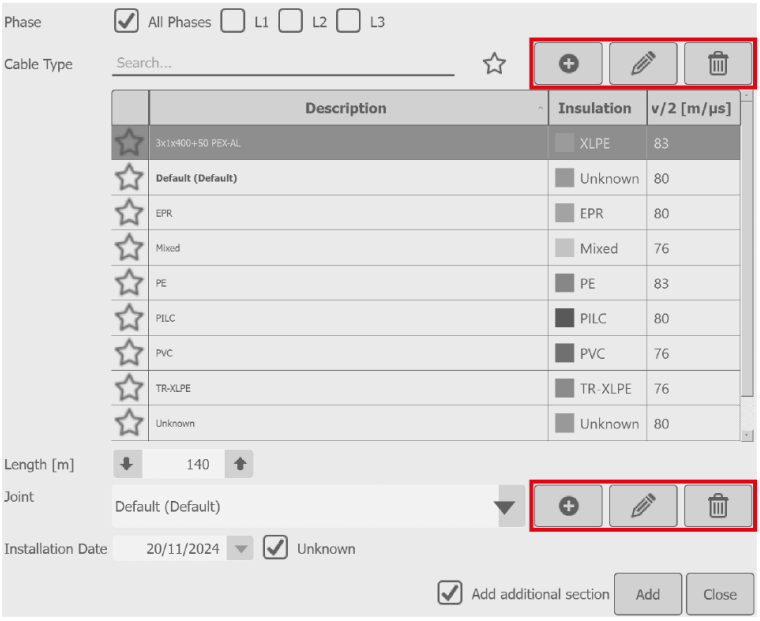
After the cable data have been entered as completely as possible, the new or edited cable can be saved via the button **Adjust to Target** at the right bottom side of the screen.

With the button **Cancel** the entry form will be closed without saving and all performed changes are discarded.

6.2.1.4 Managing Segment Templates

Introduction

To be able to specify the cable and joint types in a cable section explicitly, the corresponding templates must be filed in the database. A number of typical datasets are already stored in the database upon delivery. You can add/manage your own templates directly while editing a cable section ("Specifying the sections of the cable" on page 50) by using the buttons provided for this:



Creating/editing a cable template

A new cable template can be created, and the cable template currently selected can be edited, using the buttons. After clicking the button, a new window opens in which the following properties can be defined for the template:

Parameter	Description
Insulation	Insulation of the cable type
v/2	Signal propagation velocity of the cable type as a v/2 value
Description	Unique designation for the cable template

Parameter	Description
Favorite	The template can be added to the favourites list (★) or be removed from the list (☆) by clicking on the respective symbol ("Useful Features of the Software" on page 27).

Creating/editing a joint template

A new joint template can be created, and the joint template currently selected can be edited, using the ⊕ ✎ buttons. After clicking the button, a new window opens in which the following properties can be defined for the template:

Parameter	Description
Description	Type or unique designation for the joint template
Default	When this checkbox has been activated, the template is specified as default template for new cable sections

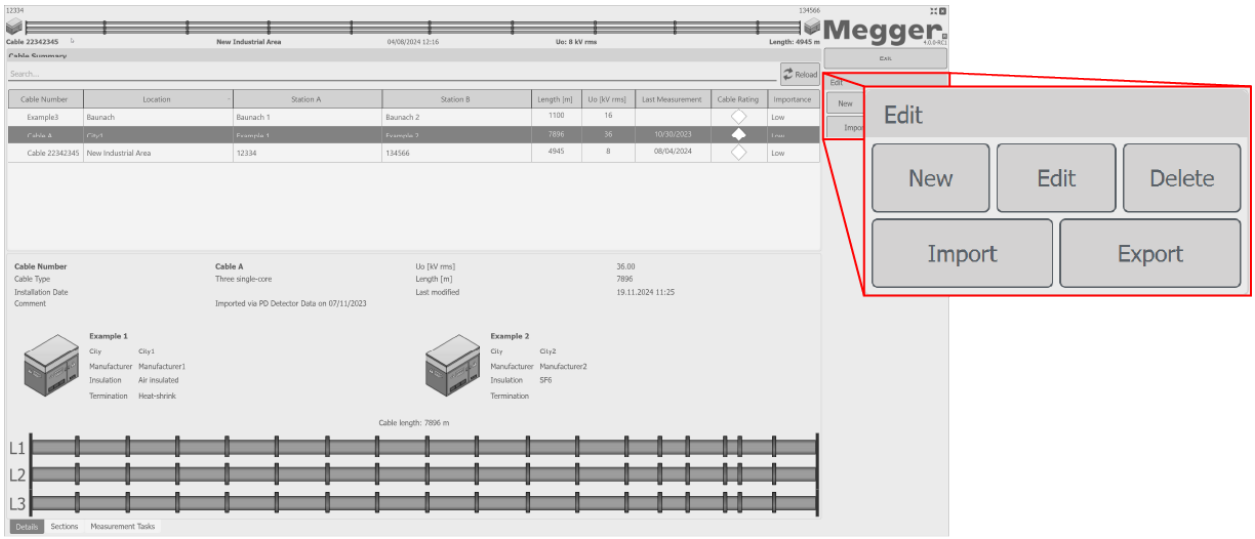
Deleting a template

To delete an existing segment template, this template must be selected first, after which the 🗑 button is clicked.

6.2.2 Managing Measuring and Cable Data

With the aid of the import and export assistants, measuring and cable data can be exchanged between the databases of various TE detector software installations. There is also the possibility of importing the measuring and cable data of an OWTS PD diagnostic system.

The assistants for the importing and exporting of data can be accessed via the **mport** and **Export** buttons in the **Edit** menu block.



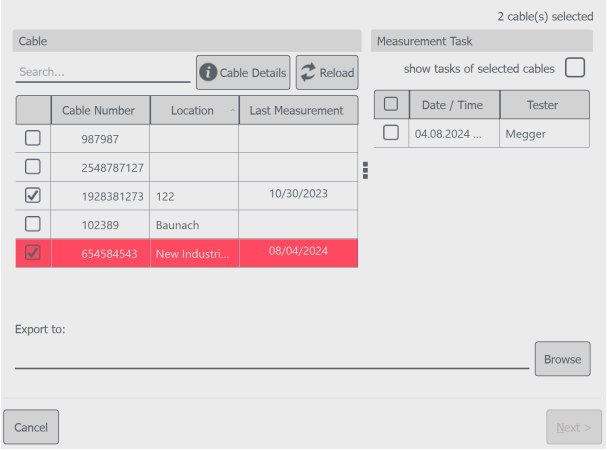
When importing and exporting measurement data, very large amounts of data are copied. If an external storage device is used for export/import, it should be connected to the fastest USB interface (usually USB 3.0 or higher).

6.2.2.1 Exporting Data

Proceed as follows to export cable and measuring data from the local database to a data carrier of your choice:

1. Click on the **Edit** in the **Export** menu block.

   Result: The export assistant is opened in a new window.



2. In the left part of the window, select the cables to be exported.

   In the event of an especially comprehensive cable list, the displayed cables can be filtered with the aid of the search function ("Useful Features of the Software" on page 27).

3. In the right part of the window, select the measurement tasks for the cables that are to be exported.

   If **show tasks of selected cables** is enabled, the measurment tasks of all selected cables are displayed. If the checkbox is disabled, only the measurment tasks of the currently selected cable are displayed.

4. Use the **Browse** button to select an **empty** directory into which the data should be exported.

5. Click on **Next** and then on **Conclusion** to export the selected data.

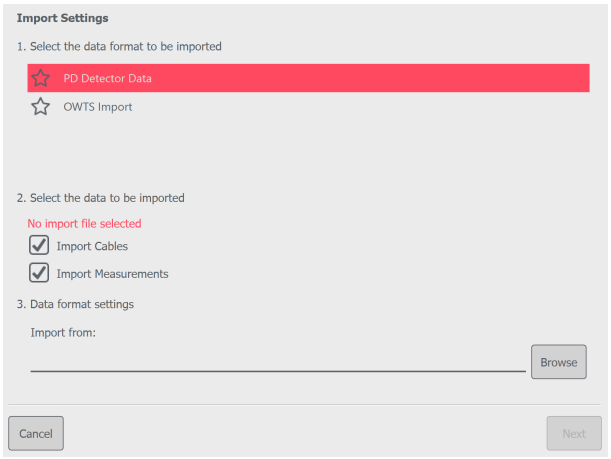
   Result: The export is performed. In addition to the exported files and the import file (*.pddd), a file in CSV format is created in the export folder. This contains a short summary of the exported cables and measurement tasks. This makes it possible to recognise which cable data is in the export directory, which enables a precise import of cable data.

6.2.2.2 Importing Data

Proceed as folows to import cable and measurement data:

1. Click on the **Edit** in the **mport** menu block.

   Result: The import assistant is opened in a new window.



2. Select the data format to import:

PD Detector data:	Measuring and cable data from another TE detector software installation
OWTS:	Measuring and cable data from a OWTS PD diagnostic system

3. Tick the data types (cable data, measuring data) that you would like to import.

   If the local database does not yet contain any cable data, the cables must be imported.

4. Use the **Browse** button to select the file to be imported. Depending on the file type, the following file should be selected:

PD Detector data:	Import file with the extension *.pddd (which was automatically created during data export)
OWTS:	Import file StartMask.dat (which was automatically created during data export from the OWTS software)

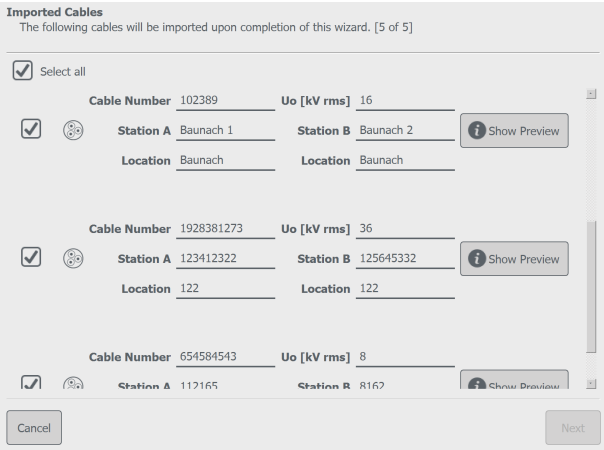
5. [This setting is only required when OWTS data is to be imported]

   Under **Language coding of import data**, select the language that is set in the source system.

   This setting is required so the date information can be imported correctly.

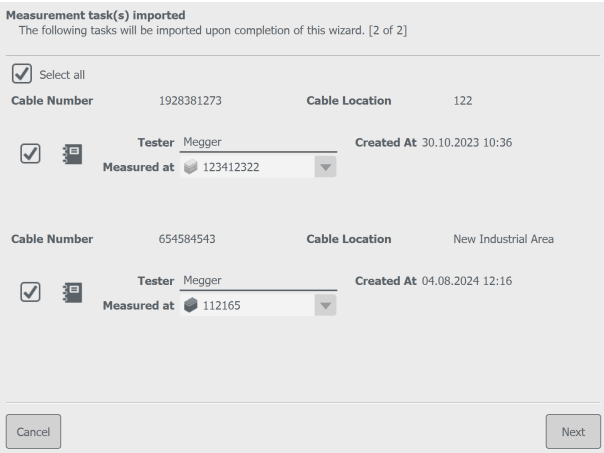
6. Click on **Next**.

7. If the import of cable data is activated in the import settings, an overview of the identified cables appears. If required, the basic cable data can be adapted and cables can also be completely excluded from the import.



Using the **Next** button, the next page of the import assistant can then be accessed.

8. If the import of measuring data is activated in the import settings, an overview appears of the identified measuring tasks that can be excluded from the import if required.

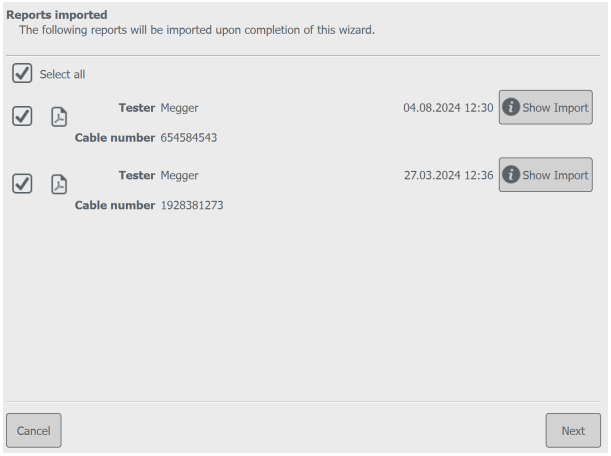


Measuring tasks that are imported without the associated cable data and cannot be automatically assigned to an existing cable are initially excluded from the import.

To be able to import these measurement tasks, the right cable must first be sought in the local database using the **Browse** button and selected by double clicking.

After selecting the measurement tasks intended for import, the next page of the import assistant can then be accessed by using the **Next** button.

9. If the import of measuring data is activated in the import settings, an overview appears of the identified reports that can be excluded from the import if required.



   After selecting the reports intended for import, the next page of the import assistant can then be accessed by using the **Next** button.

10. The data are imported into the local database immediately after the selection of the data to be imported is completed. A summary of the import process is displayed. By clicking on the **Conclusion** button, the displayed changes can be confirmed and the import completed.

    Using the **Cancel** button, the import can also still be cancelled at this time. The displayed changes are discarded in this case.

6.2.2.3 Backing Up Data

To prevent loss of data (e.g. in the event of a hard drive defect), it is recommended to regularly perform a backup of the measuring and cable data.

The following data must be saved:

Cable data:	File *%installation folder%\Megger.mcb*
Measuring data:	Directory *%installation folder%\data*

A suitable backup strategy should be developed by the responsible system administrator.

7 Starting or Resuming a Measurement Task

Before starting the actual measurement, a measurement task must be created or opened in the first step, under which all recorded measurement data are stored until either the software is closed or a new measurement job is started.

You can either:

- continue a previous measurement task ("Viewing Cable Data and Administrating Measurement Tasks" on page 44) which had to be suspended due to lack of time or other reasons,
- clone a previous measurement task ("Viewing Cable Data and Administrating Measurement Tasks" on page 44), if e.g. a repeat measurement has to be performed on a cable already diagnosed (in this case the settings from the previous task are adopted and preset).
- start a new measurement task.

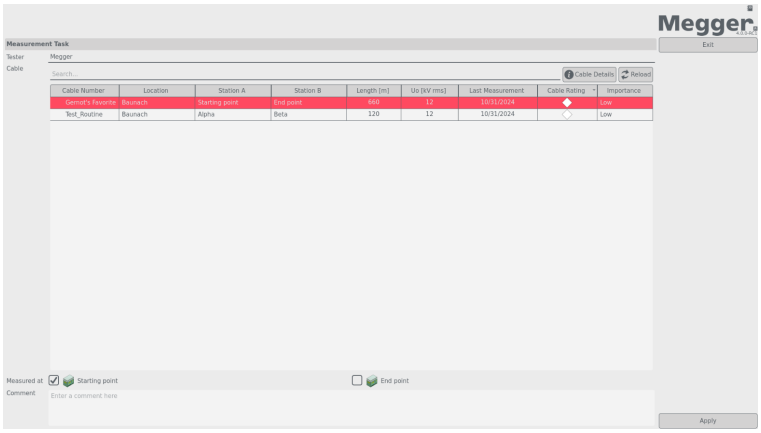
Creating a new measuring task.

Before starting a new measurement task, ensure that the measurement data recording has been completed for the measurement task currently in progress!

Proceed as follows to create a new measuring task:

1. Call up the menu point from the main menu of the measurement software.

   Result: The following input mask opens.



2. Enter the name of the responsible measurement technician into the input field **Tester**.
3. Select the appropriate entry from the list of the defined cable systems for the measurement task. If needed, use the search and sort functions ("Useful Features of the Software" on page 27).

   Should the cable system not yet be stored in the system, it has to be created before the start of the measurement task ("Entering/Changing cable data" on page 48).
4. Select the cable end at which the current measurement is conducted under **Measured at**.

5. If required, select the HV source used for the measurement from the **HV source** drop down list.

   The drop down list is only available if more than one HV source is configured in the software.

   If a suitable test voltage source from another manufacturer is used or if the source cannot be remote-controlled for other reasons, the option **Manual controlled HV source** is to be selected here. However, this option must have been activated ("Category Devices" on page 38) beforehand in the software settings.
6. If required, select the version of the PD Detector in use from the **PD detector** drop down list.

   Information on the version of the PD Detector can be found on the type plate.

   The drop down list is only available if more than one PD detector is configured in the software.
7. If required, enter a few useful details on the measurement task in the **Comment** text field.
8. Click on **Apply** in order to confirm the selection.

   Result: The software jumps back to the start screen. The measurement task initialises. The menu point Calibration is available.

9. Proceed with the calibration ("Calibrating the Partial Discharge Measuring Circuit" on the next page).

8 Calibrating the Partial Discharge Measuring Circuit

Requirements

In order to be able to conduct a calibration , a new measurement task must have been started beforehand ("Starting or Resuming a Measurement Task" on page 60). Otherwise the menu point in the start screen is greyed out.

It is recommended to use the supplied calibrator. In principle though, any other calibrator that is in accordance with the requirements of the IEC 60270 can be used.

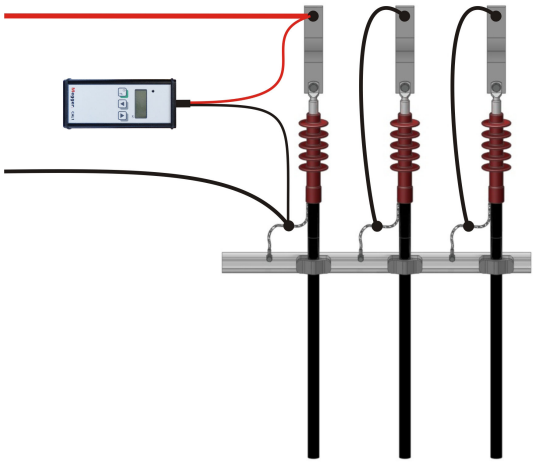
Necessity

After the measurement system has been set up and connected to the test object, the partial discharge measuring circuit needs to be calibrated by measuring current pulses of known charge. Only this way, a reproducible measurement and a reliable evaluation on the basis of comparable measurement data can be ensured.

8.1 Connecting the Calibrator

Connection diagram

The following figure shows the simplified connection diagram:



Procedure

Proceed as follows to connect the calibrator:

1. Connect the black connection line of the calibrator to the screen of the cable that is to be tested.

   The connection should be made directly at the cable shield and as close as possible to the point where the shield is fed out of the termination. This way, unnecessary high basic interference levels can be avoided.

2. Connect the red connection line of the calibrator to the phase conductor of the cable that is to be tested.
3. Switch the calibrator on by shortly pressing the button.

   With the help of the ▲ and ▼ buttons the calibration pulse level can be adapted if required. In most cases, however, the calibration can be completed successfully with the preset calibration value of 1 nC.
4. Cancel the earthing and short circuiting measures on both ends of the cable that is to be tested.

   Since the supplied calibrator automatically switches off approx. 2 minutes after the last operational action, the actual calibration should be conducted directly after connecting the calibrator.

8.2 Conducting the Calibration

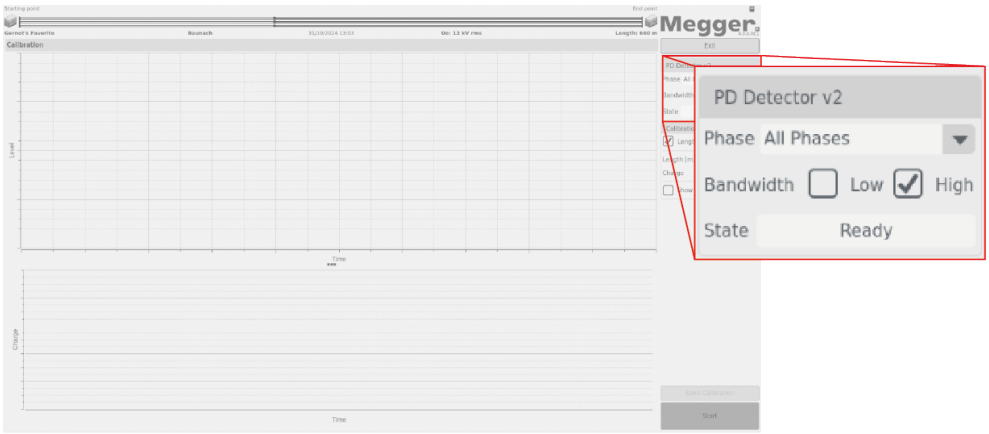
Preparing and starting the calibration

In order to calibrate the partial discharge measuring circuit proceed with the following steps:

1. Call up the menu point from the main menu of the measurement software.

   Result: The connection to the PD detector is being established (the HV source must be switched on). As soon as there is a connection, the **Start** button is activated (green). Otherwise, the cause for the failed connection needs to be determined.

2. Adjust the PD detector settings:

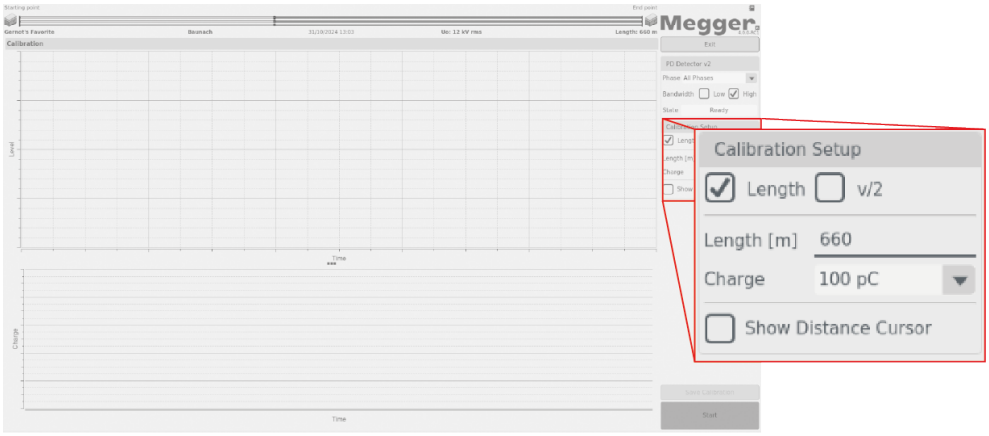


Select from the dropdown menu **Phase** either the phase of the test object that is currently connected to the measuring system or the option **All Phases**.

> For 3-core cable systems it is generally sufficient to calibrate the circuit only once and apply the data for all phases. Only if you expect differences between the single phases you should calibrate each phase individually prior to the measurement.

The optimum **Bandwidth** setting is determined by the length of the cable. While a high bandwidth is recommended for short cables (up to 1 km), measuring with a low bandwidth is preferable for longer cables with higher attenuation.

3. Adjust the calibration settings:



The value in the input field **Length** has been adopted automatically from the cable data and normally does not have to be corrected.

Should the length value be uncertain and the exact pulse propagation velocity be known, then the velocity needs to be provided instead. To do so, check the radio box **v/2** and enter the v/2 of the cable into the input field **v/2** (in m/µs).

Select the calibration value that is set at the calibrator from the dropdown list **Charge**.

4. Click the **Start** button in order to start measuring the pulses.

   Result: The PD detector measures the incoming pulses and tries to identify the calibration pulses the respective reflections from the far cable end.

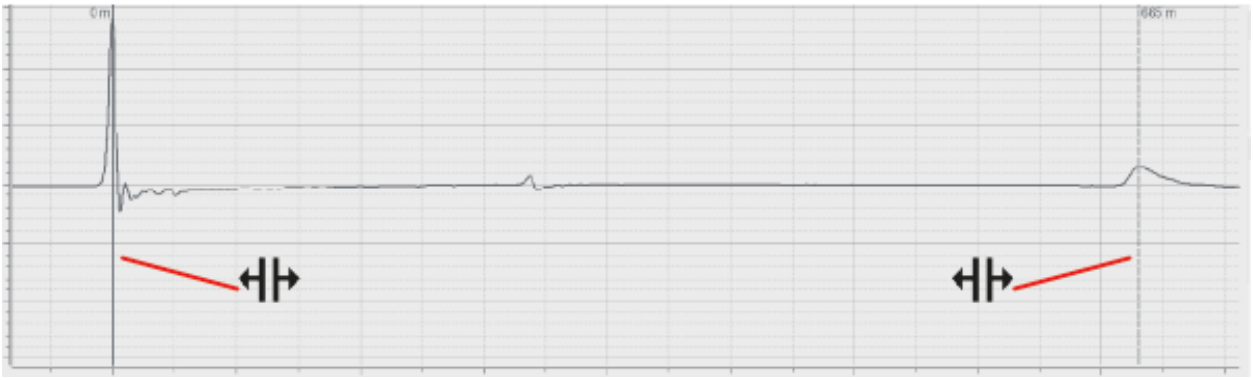
   If the pulses are successfully measured, a TDR trace and a charge diagram are displayed in the left area of the window. The calibration process finishes automatically after roughly 15 to 30 seconds, it may also be stopped manually ahead of time using the **Stop** button, provided the pulses and charge level have been successfully calibrated and the markers placed.

   If no pulses could be measured, the message **Calibration failed. Using default parameters!** appears in the message list. Check the troubleshooting section for possible causes ("Troubleshooting" on page 101).

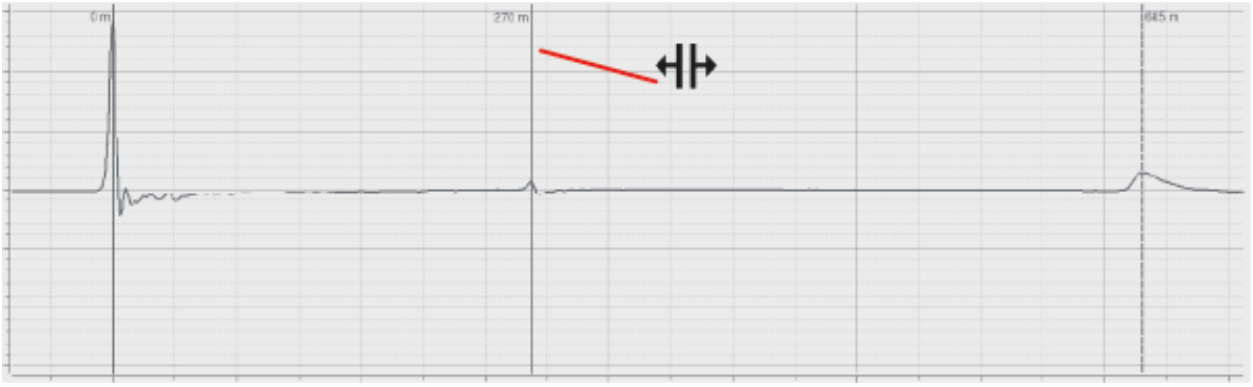
Checking the markers

The quality of the subsequent measurement results depends on various factors, particularly the accuracy of calibration. It is therefore advisable to check the automatic positioning of the markers and correct them if necessary before applying the calibration data.

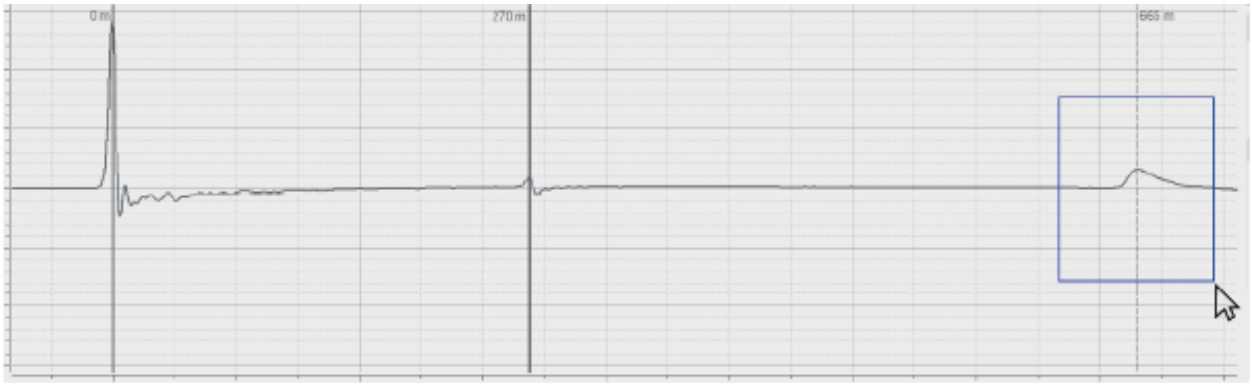
The propagation velocity or the length of the connected cable can be calibrated by means of the TDR trace. For this purpose, the peaks of both the original calibration pulse and the reflection need to be marked.



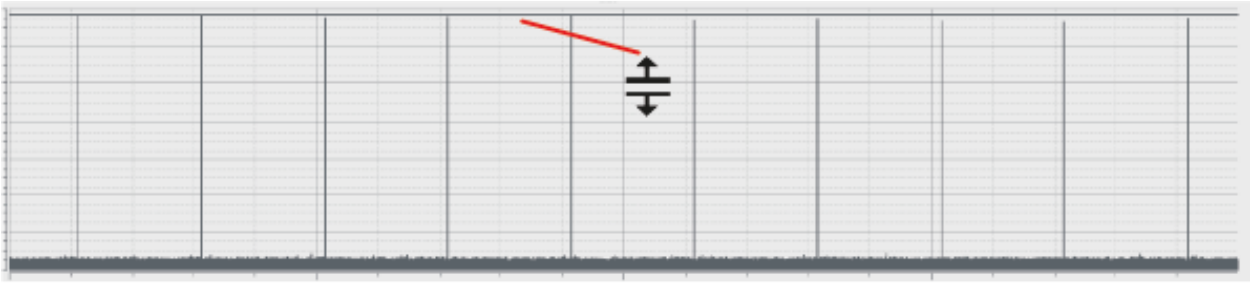
The **Show Distance Cursor** tickbox can be used to display an additional marker and move it along the curve. This allows, for example, the positions of joints to be measured and later entered manually into the cable plan.



If need be, the mouse can be used to drag a box across a specific area, allowing the user to zoom into this range.



In the charge diagram, the line should mark roughly the average value of the periodically measured calibration pulses.



If a correction has to be made, the respective mark has to be clicked once with the left mouse button. As a result, the line width of the marker increases and the mouse pointer changes into the ⟛ or ⟛ symbol. By clicking and holding the left mouse button again, the marker can be freely moved. As soon as the mouse button is released, the marker locks in the current position.

Applying the calibration data

After the markers have been checked and if required corrected, the calibration data can be applied by clicking on the **Save Calibration** button.

8.3 Disconnecting the Calibrator

Prior to the actual measurement, the calibrator has to be disconnected from the cable under test.

WARNING

Follow the five safety rules ("General Safety Instructions and Warnings" on page 9) before disconnecting the calibrator.

Afterwards, cancel the earthing and short circuiting measures on both ends of the cable that is to be tested. in order to be ready for the measurement.

9 Measuring

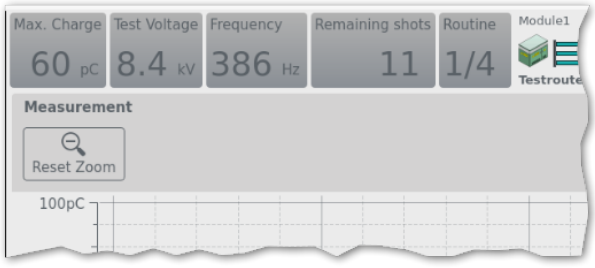
Requirements

In order to conduct the measurement , a new measurement task must have been started ("Starting or Resuming a Measurement Task" on page 60) beforehand and the partial discharge measuring circuit must have been calibrated ("Calibrating the Partial Discharge Measuring Circuit" on page 62). Otherwise the menu point in the start screen is greyed out.

9.1 Basic Information Regarding the Measurement Screen

Measurement data display

In the course of the measurement all relevant measurement data / measurement parameters are displayed at the top left screen:

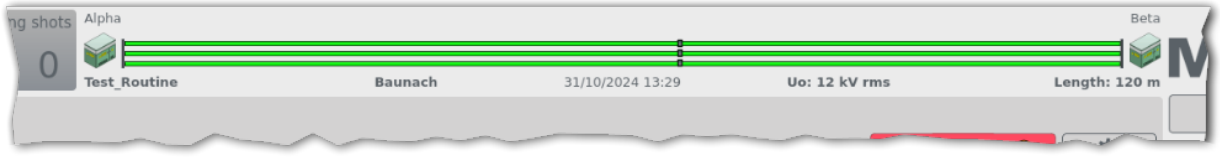


Depending on the set test parameters, a selection of the following values is displayed:

Measurement value	Description
Max. Charge	Maximum charge value that has been measured during the last period
Test voltage	Test voltage as peak value
Frequency	Frequency of the VLF polarity reversal
Remaining time	Remaining duration of the ongoing VLF test
Routine	Current step of the test routine / total number of steps of the test routine

Cable plan

At the top side of the screen all relevant data regarding the currently connected cable are displayed.

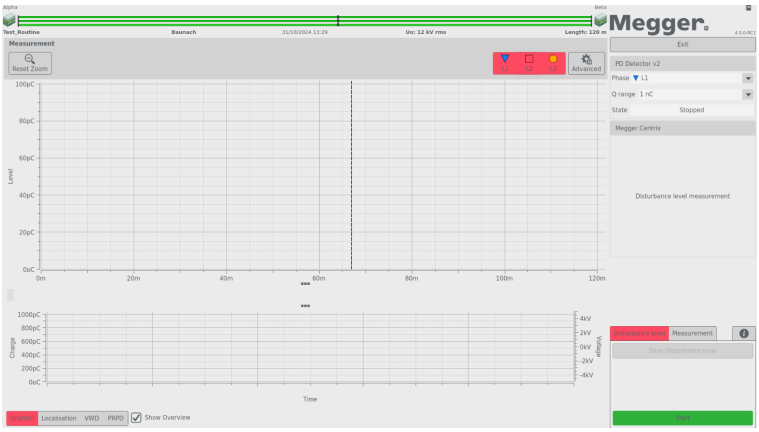


The cable end to which the measurement system is connected is shown on the left side.

9.2 Available diagram types

Introduction

The measurement screen provides access to various diagrams during the measurement.

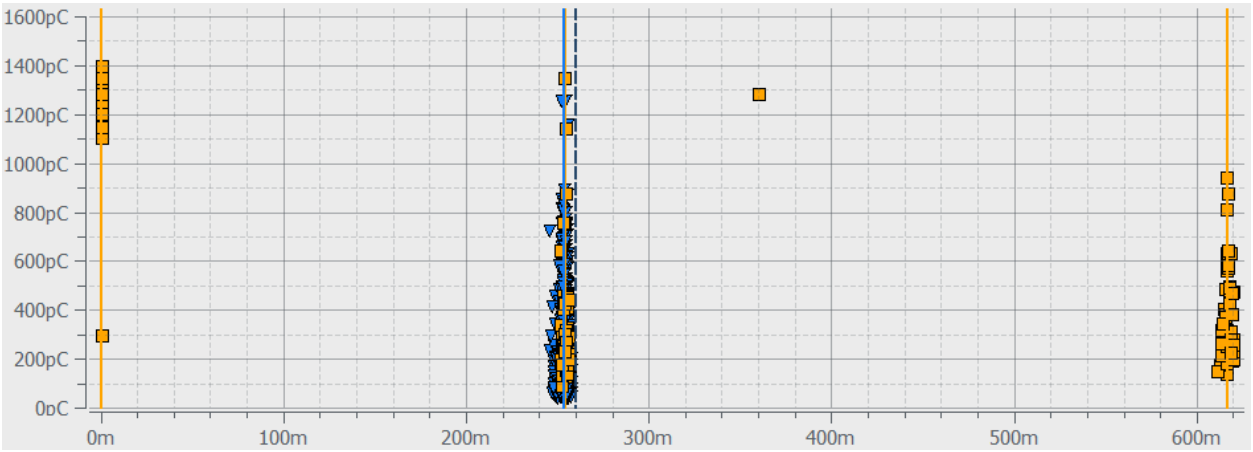


In the upper part of the screen, PD mapping with the previously recorded PD events is displayed by default. The diagram type directly below can be changed during measurements using the tabs at the bottom.

Using the ▪▪▪ buttons between the diagrams, the proportions of the displayed diagrams can be adapted ("Useful Features of the Software" on page 27) according to the own preferences.

PD mapping

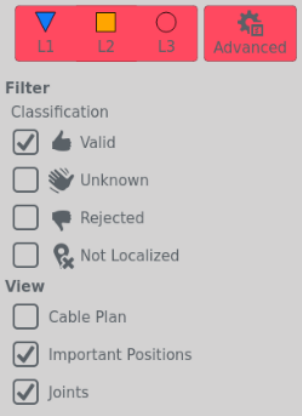
The PD mapping displays the measured partial discharge level in a location-resolved way over the length of the cable.



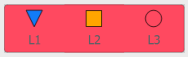
A localised cluster of PD events indicates actual PD faults. These events are shown with the colour and symbol of the respective phase. One-off events, which are most likely not the result of a PD fault, are shown in grey (or not displayed at all depending on the setting).

PD mapping displays the PD events of all measurements performed and saved during the measurement job. If a measurement is intentionally not saved, the corresponding events are removed from the PD mapping at the start of the next measurement.

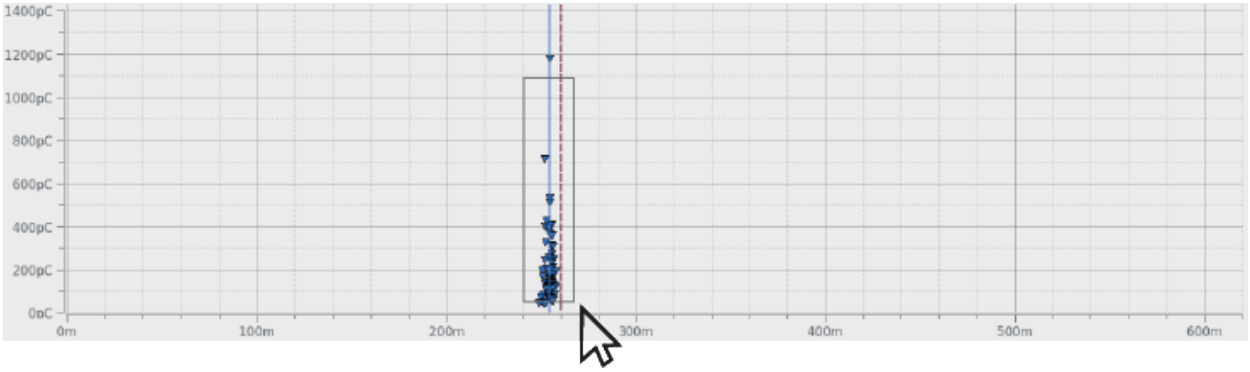
Using the **Advanced** menu item, you can display the advanced view filters and the pulses in the PD mapping can be filtered as you wish to provide a better overview:



The following buttons are available for this purpose:

Button	Description	
	Filter view according to phase.	
Classification	Show/hide pulses that were not identified (or not definitely identified) as PD.	
		All pulses classified as partial discharge.
		All pulses classified as **possible partial discharges** (pale colours) are shown or hidden, respectively.
		All pulses classified as **negligible** (grey) are shown or hidden, respectively.
		Pulses for which no reflection could be determined. These pulses are placed at the beginning of the cable by default.
View	With the aid of these checkboxes, the individual auxiliary indicators (joint markers, cluster markers, cable plan) can be shown or hidden respectively.	

In order to enlarge a certain area of the PD mapping, simply draw a frame around the area while holding the mouse button.



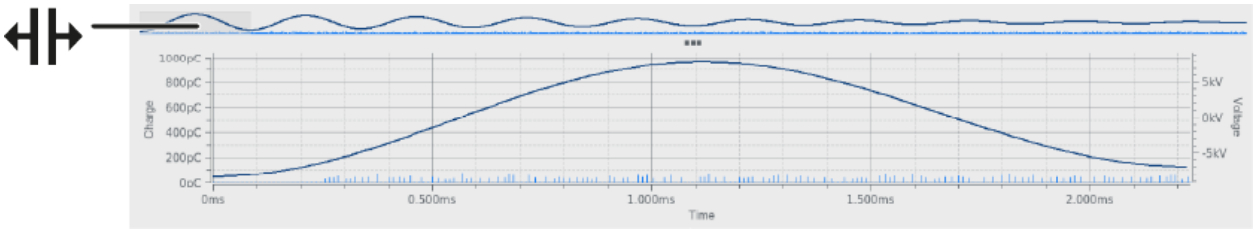
Clicking **Reset Zoom** removes the magnification.

Q(t)/U(t)

The **Q(t)/U(t)** view displays the temporal profile of the measured charge level (the partial discharge pattern) and the excitation voltage.

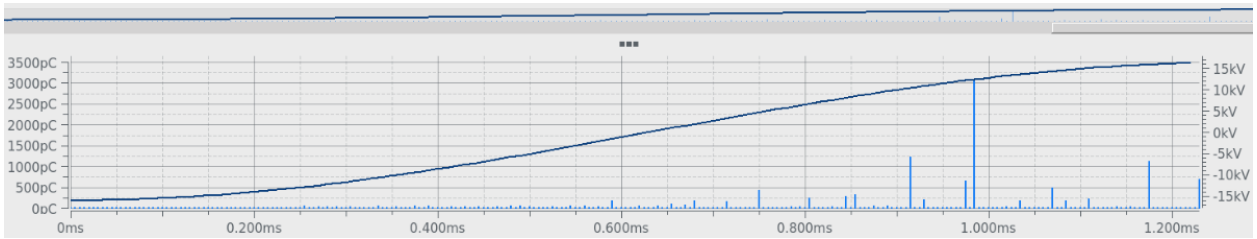
This type of diagram is particularly suited to detecting partial discharge events and distinguishing them from periodic interference.

In **DAC operation**, a low-resolution overview of the first 7 to 10 intervals (depending on the frequency) is shown above the actual diagram, which shows only one voltage period.



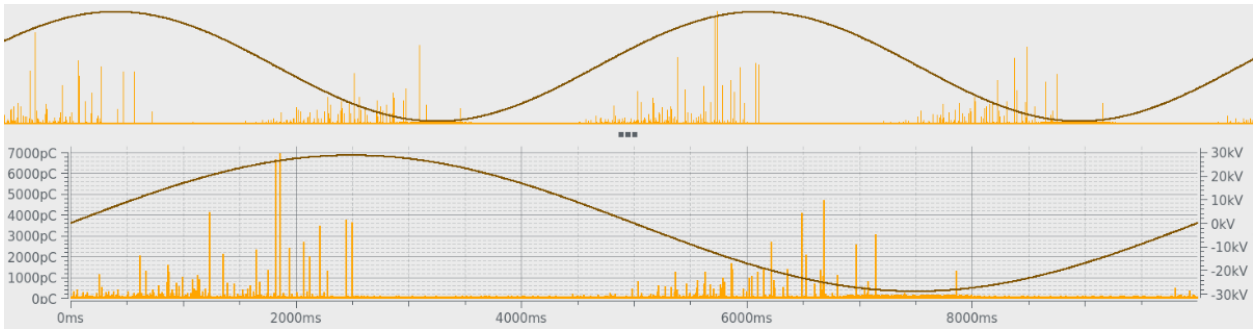
The section with the coloured background can be moved ( ) with the aid of the mouse to any point along the overview for zooming in on a particular time frame. The scroll bar below the overview can be used to scroll through the individual shots of the measurement.

In **VLF-CR operation** measurements are conducted during the time span of the polarity reversal only and accordingly only the period of the last polarity reversal is displayed in the diagram.



If after about 5 seconds the next polarity reversal is performed, the diagram is updated accordingly. Using the scroll bar below the overview the previous measurement cycles can also be selected.

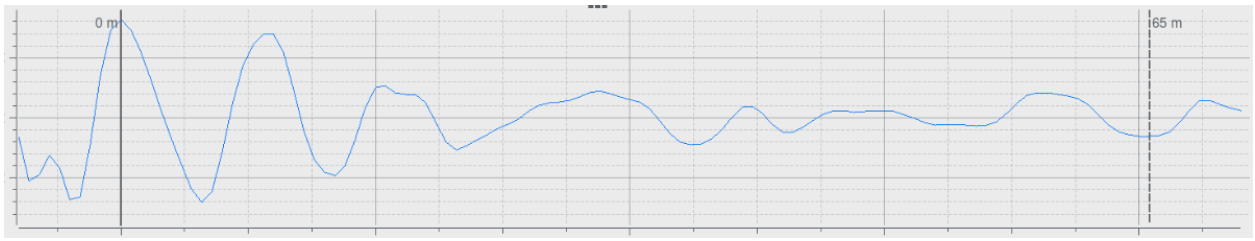
In **VLF sine wave operation**, measurement is performed continuously and accordingly the Q(t)/U(t) diagram is also constantly updated.



The overview diagram can be shown or hidden using the checkbox **Show Overview**.

Localisation

Once a PD event is recorded during a measurement, the software automatically switches to the **Localisation** view, in which the associated reflection image (TDR image) is shown. The TDR image is updated accordingly whenever another PD event is detected.



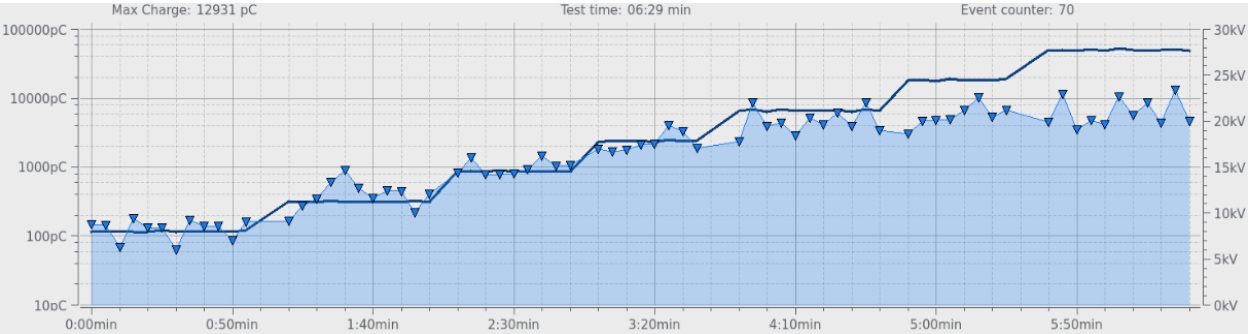
In the upper section of the display, the overview of the recorded measured data is shown. In it, all pulses identified as locatable PD events are marked with black lines. Using the ⬅ and ➡ buttons it is possible to switch back and forth between these positions. In the actual diagram, the associated curve is displayed. The displayed time range corresponds to about four times the cable length.

With the scrollbar, depending on the voltage waveform, you can switch back and forth between the recorded measurement windows (the individual shots for DAC, the polarity reversals for VLF-CR or the triggered PD pulses for VLF-SIN).

The checkbox **Switch to this view on any new event** can be used to determine whether the software automatically switches to the localisation diagram with each recorded PD event.

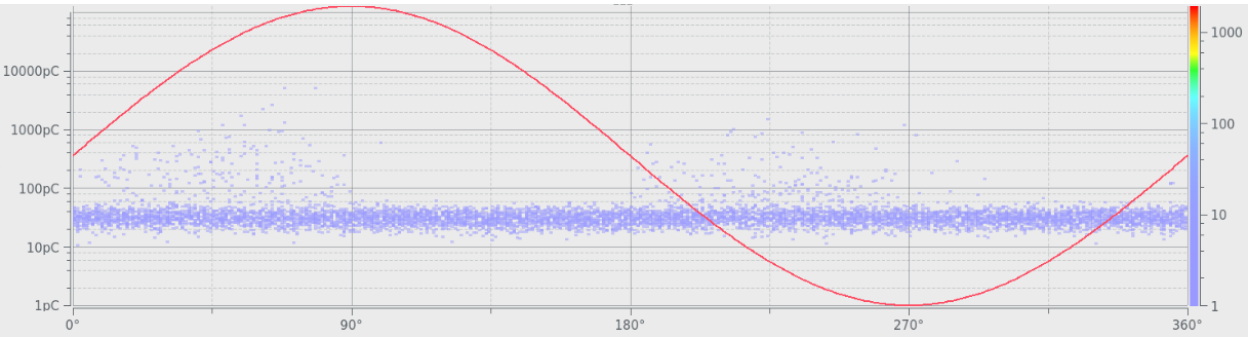
VWD diagram

The diagram, which can be called up via the **VWD** tab, shows the trend of the measured maximum charge levels over the course of the measurement. This makes it possible to draw conclusions about a possible change/conditioning of PD faults, in particular if the cable under test is subjected to prolonged voltage stress.



Phase-resolved diagram

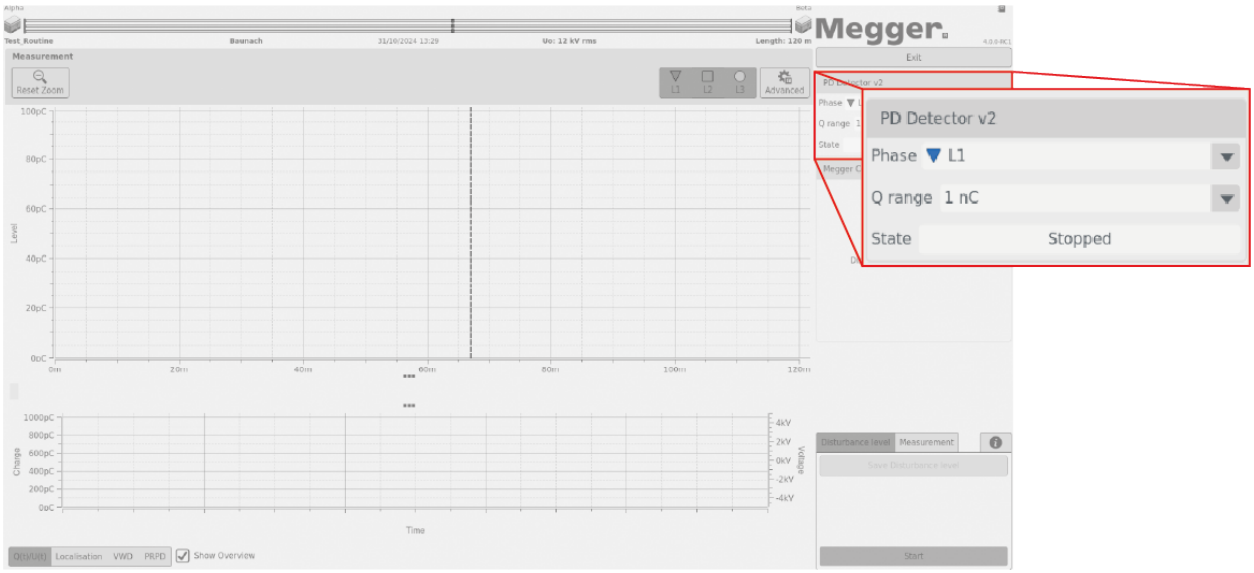
Using the **PRPD** tab, the PRPD diagram (Phase Resolved Partial Discharge) can be displayed, showing the distribution of the charge pulses relative to the phasing of the excitation voltage.



9.3 Setting the Measurement Parameters

Configuring the PD detector

The configuration of the PD detector must be performed through the menu block specially provided for this purpose:

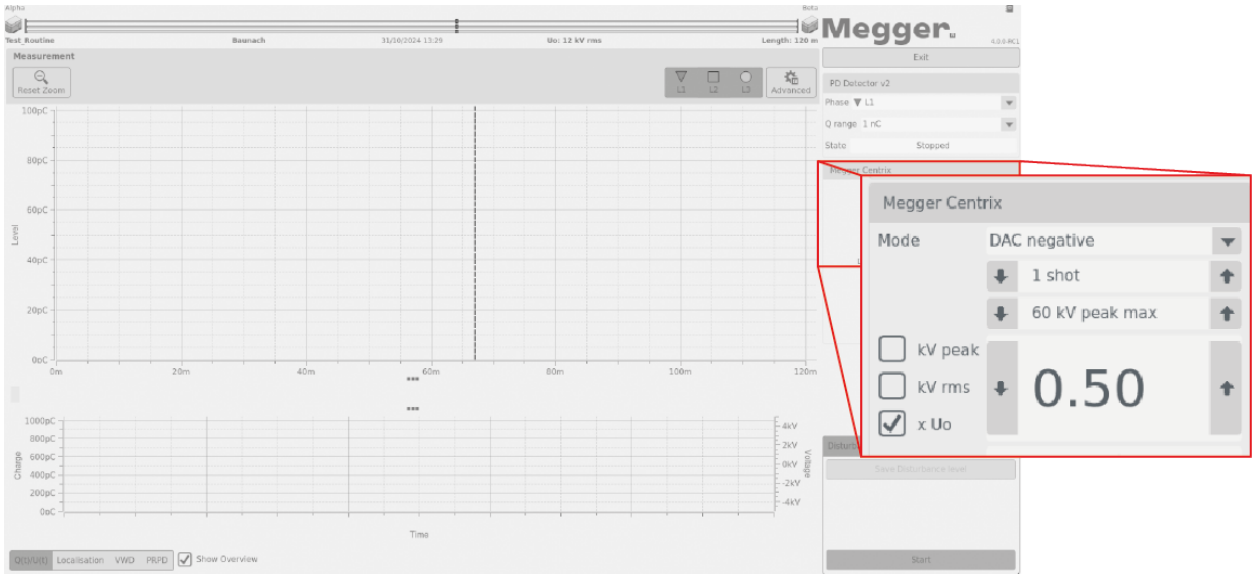


The following settings are possible:

Parameter	Description
Phase	Phase of the cable system currently being measured.
Q range	An optimally set measuring range is critical for ensuring the accuracy of the measured charge values. Before beginning the first measurement, a relatively low measuring range should initially be selected. If the PD level exceeds the set measuring range during the measurement, the message **Overflow** appears in the message list ("Useful Features of the Software" on page 27). In this case, the measuring range should be increased incrementally and further test measurements performed until the message no longer appears. Each further increase would unnecessarily reduce the sensitivity.
Localisation level	**Only configurable in the VLF sine wave operating modes** The localisation threshold identifies the charge threshold at which localisation data (TDR traces) for the measured charge pulses are recorded and saved. Due to the permanent measurement data acquisition in sine wave mode, depending on the duration of the test, a large amount of data to be stored may be generated. To prevent too much data from being generated, in particular for long tests, the localisation level should be set so that a localisation is only triggered and saved using TDR starting from a size that is of interest for the user.

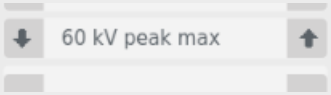
Configuring the test voltage source

The configuration of the test voltage source must be performed through the menu block specially provided for this purpose:



The following settings are possible:

Parameter	Description
Operating mode	Selection of the desired operating mode :
VLF Sinus	PD diagnosis with VLF-SIN voltage and the possibility to adjust the test voltage while the measurement is running.
VLF Sinus Withstand	Standard-compliant monitored withstand test with VLF SIN voltage and simultaneous measurement of the PD level. The duration of the measurement is specified in minutes and the voltage **cannot** be adjusted during the running measurement.
	NOTE **Danger of damage to the partial discharge coupler** Even if, depending on the connected source, other operating modes are offered, only the operating modes specified above may be used in combination with the partial discharge coupler!
Test duration	**Only configurable in test operating modes** Test duration in minutes

Parameter	Description
Maximum required test voltage	**Only configurable in diagnosis operating modes** When it comes to the partial discharge diagnosis the initial measurements are usually conducted at very low voltage levels. However, in order to ensure from the start that the test voltage supply can charge the connected test object using the necessary maximum test voltage (usually 1.7Uo), this must be specified before starting the measurement.  The test voltage supply will carry out a load detection right after the start of the measurement, taking into account the indicated maximum voltage, and will suspend the measurement with an error message if the capacity of the test object does not allow for such a high voltage.
Voltage	Specification of the test voltage. The test voltage can be entered as peak value (kV_{peak}), RMS value (kV_{rms}) or multiple of Uo (x Uo). The actual test voltage (peak value) resulting from these settings is displayed at the bottom of the menu block.

If the test voltage source used cannot be controlled remotely (for example, in the case of devices from another manufacturer), the settings regarding the voltage level and duration must not be made in the software but instead directly at the test voltage source. If this was also specified accordingly when the measurement job was started, the following information is displayed in place of the control elements in the software:

NOTE

Danger of damage to the partial discharge coupler

In order to avoid damage to the coupler and to obtain usable measuring results, a manually controlled source may only be used with sinusoidal VLF voltage, while also taking into account the maximum permissible voltage for the coupler!

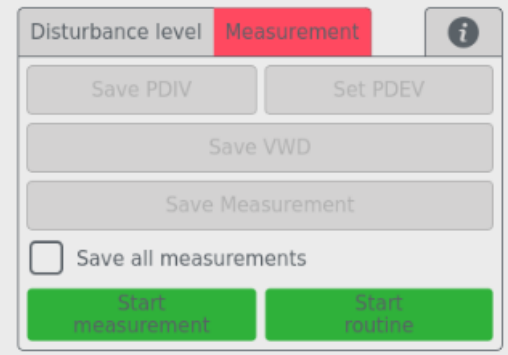
9.4 Performing a measurement

Starting the measurement

Directly from entering the measurement screen, the connection with all devices involved in the measurement is permanently checked. Deactivated buttons and the symbol indicate connection problems, which have to be solved before the test is started ("Troubleshooting" on page 101).

Since a series of measurements should always be started with a disturbance level measurement ("zero shot"), the buttons to control the test voltage are not available when entering the measurement screen. They will, however, automatically show up as soon as the noise measurement has been conducted and saved or has manually been skipped by clicking on the **Measurement** tab ("Saving test data" on the facing page).

As soon as the system is ready for measurement, the buttons for starting a measurment or test routine light up green and a single measurement or test routinecan be started by clicking this buttons.



Activating the high-voltage generator

If high voltage has not already been released during a previous measurement, it needs to be done right after a measurement (except of the noise measurement) has been started. Any deviations from the high voltage switching requirements are displayed in the Message list ("Useful Features of the Software" on page 27) and the user must then eliminate them.

For more details about the high voltage switching requirements of the test voltage source, read the accompanying operating manual.

If all high voltage switching requirements are met, the following symbol appears in the menu block:

Ten seconds remain in which to enable the high voltage using the green illuminated "HV ON" push-button. Normally, this button is located directly on the front plate of the testing system. For fixed components, the high voltage may need to be enabled through a button of equal priority on an external safety device or on the system control panel of the test van.

Directly after being activated, the button goes out and the red "HV OFF" push-button lights up. Load detection is performed automatically. If the capacitance of the connected cable is too high or too low, the measurement is ended directly and a corresponding error message ("Troubleshooting" on page 101) is displayed.

If a non-remotely controllable test voltage source is used, the high-voltage release is not monitored by the software. The setting and release of the high voltage must be carried out by the user at the voltage source itself.

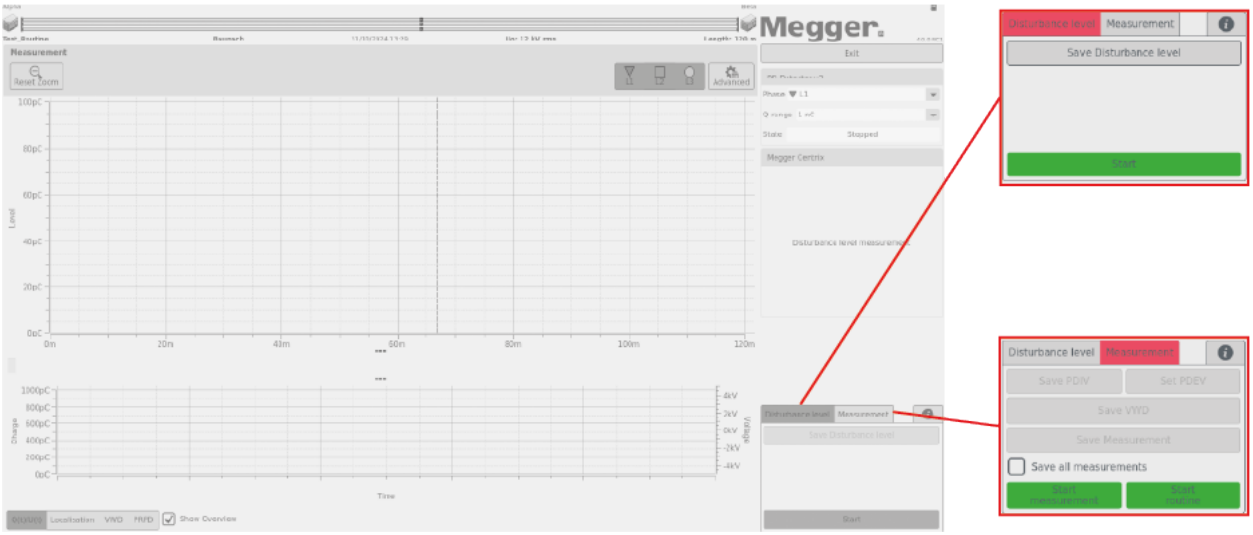
WARNING

The red illuminated "HV OFF" push-button signals high voltage! The entire measuring circuit should be considered as "live" from this point onward.

In modes with VLF sine wave voltage, an automatic load detection is performed immediately after high voltage clearance. Should an adjustment of the test frequency be necessary due to a too high load capacity, this will be communicated by system message in the software.

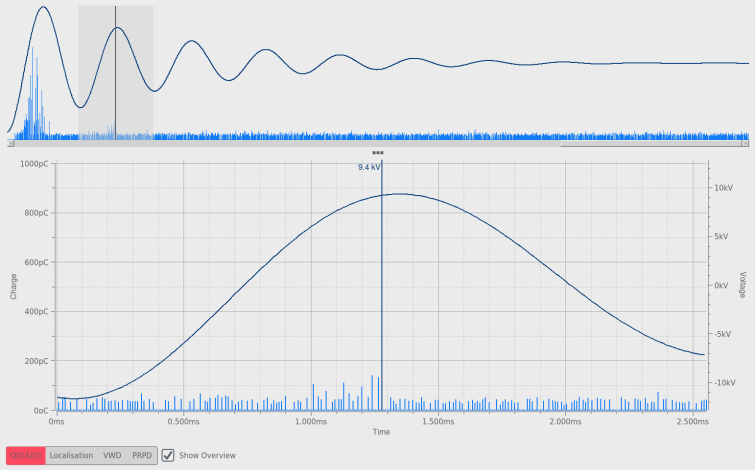
Saving test data

The saving of test data is initiated exclusively with the buttons of the menu block specially provided for this purpose.

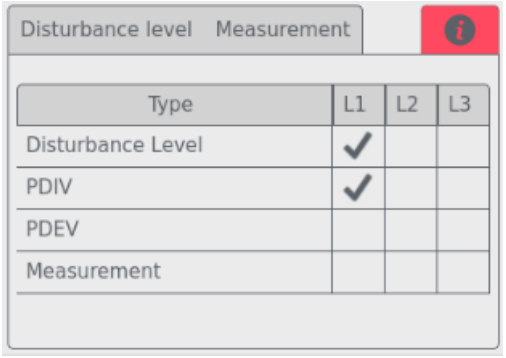


By default, each completed individual measurement must be saved manually. **Otherwise, the data are discarded when the next individual measurement is started!** Certain defined parameters, such as PDIV and PDEV, are to be saved using specially dedicated buttons. These are accordingly labelled in the test data and output separately in the report. For this purpose, the following buttons are to be used:

Button	Description
Save Disturbance level	This button must be clicked after the obligatory noise measurement ("zero shot") has been completed. Afterwards, the software automatically switches to the **Measurement** tab and by doing so activates the actual measurement mode.
Save Measurement	Any meaningful measurement, with the exception of the noise, PDIV and PDEV measurements (which are saved through separate buttons), needs to be saved by clicking on this button.
Save all measurements	If this checkbox is checked, any completed individual measurement is automatically saved with no confirmation required. This increases the volume of test data, but also prevents the loss of relevant data due to negligence in saving. In order to save the PDIV or PDEV, the checkbox needs to be unchecked at least for this particular measurement.
Save PDIV	This button must be clicked if, during the previous measurement, initially critical PD of a defined strength were detected (PD inception). The voltage set prior to starting the measurement is saved as PDIV.

Button	Description
Set PDEV	This button for saving the PDEV should be clicked, if both the inception and the extinction of the PD can be clearly distinguished from the PD pattern of the previous measurement. Directly after clicking the button, the software automatically switches to the **Q(t)/U(t)** view and places a marker on the last detectable PD pulse.  If further evident PD pulses can be identified to the right of the selected pulse, the position of the marker needs to be manually corrected. By clicking on the **Save PDEV** button, the positioning is concluded and the marked voltage value is saved as the PDEV.
Save VWD	If a meaningful VWD diagram has been recorded during a measurement, the respective measurement should be saved by clicking this button. Basically, exactly the same information are saved as if the **Save Measurement** button is clicked. The only difference is that the VWD diagram of this measurement is automatically included in the report (but can be manually removed, if required).

Between the individual measurements, a summary of all data that has been saved as yet can be accessed by clicking on the ℹ button.



9.4.1 Typical Procedure for PD Diagnosis with VLF Voltage

The following described procedure is a recommended, but by no means binding approach to PD diagnosis and **can deviate from parts of the applicable company-internal guidelines or country-specific standards:**

1. Start the **Disturbance level** measurement to determine the disturbance level of the PD measuring circuit and save the result with the **Save Disturbance level** button.
2. Start the test at a low voltage level (e.g. 0.5 Uo) in **VLF Sinus** mode.
3. While the test is running, increase the voltage in increments of 0.2 Uo to 1.7 Uo
4. If PD activity sets in during the increase in voltage, stop the test immediately. Save the voltage level as PDIV with the **Save PDIV** button.

   The test should be paused at selected voltage levels (in particular at Uo) in order to save the respective data with the **Save Measurement** button.
5. Resume the test with the **Start** button and increase the voltage to 1.7 Uo.
6. Finish the test after some voltage periods at 1.7 Uo. Save the measurement data with the **Save Measurement** button.
7. In the event that PD activity was detected during the previous measurements, the extinction voltage should also be determined in the course of a further measurement.

   Start the measurement at a high voltage level with PD activity (for example, 1.7 Uo) and slowly reduce the voltage during the measurement until the partial discharges cease.
8. Stop the measurement at this voltage level, click on the **Set PDEV** button, mark the last pulse in the diagram ("Performing a measurement" on page 76) and save the measurement using the **Save PDEV** button.

9.4.2 Typical Procedure for Monitored Withstand Testing

Proceed as follows to perform a withstand test:

1. Start the **Disturbance level** measurement to determine the disturbance level of the PD measuring circuit and save the result with the **Save Disturbance level** button.
2. Switch to **VLF Sinus Withstand** operating mode and set the voltage and duration of the test.

   The requirements for a meaningful cable test are found in the harmonisation documents HD 620 S1 and HD 621 S1 and often in company-internal testing guidelines as well. These documents recommend, depending on the type of test, the following settings:

Application	Test voltage	Test duration in minutes
Start-up test	3 Uo	15 to 60
Testing of aged cables	1.7 to 3 Uo	60

It is recommended to set the **Q range** parameter to **1 nC** or **10 nC** to make sure that the test must not be interrupted due to overflow.

3. Start the test with the **Start** button.

   Result: The standard-compliant test starts and the test parameters can no longer be modified. Parallel to testing, the partial discharges are measured.

   In the case of a breakdown, the test is immediately aborted and the test voltage source is earthed.
4. After the test is concluded, save the results with the **Save Measurement** button.

9.4.3 Procedure for measurements with test routine

Test routines make it possible to automate frequently required measurement sequences. The individual steps of the test routine are carried out one after the other with the preset measurement parameters. The consistent use of test routines for measurement operation ensures that the measurement results of individual cables can be compared with each other regardless of the measurement date.

After a test routine has been run, the software offers to carry out a PDIV measurement to determine the inception voltage and, depending on the operating mode, a PDEV measurement to determine the interruption voltage.

Requirements

To be able to carry out the measurement with test routines, the appropriate test routine must be created in advance and the use of test routines must be activated ("Category Test routine" on page 41).

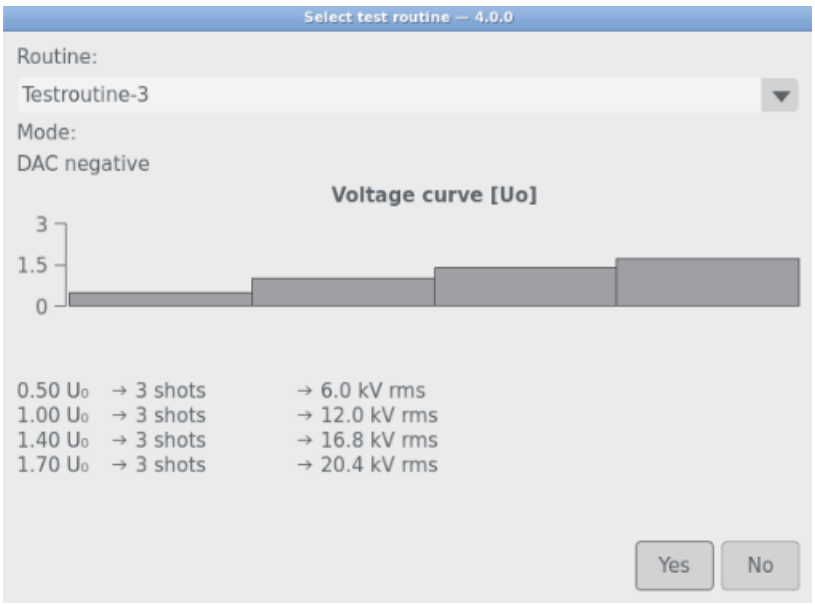
Performing measurements with test routines

Proceed as follows to carry out a measurement using a test routine:

1. Start the **Disturbance level** measurement to determine the disturbance level of the PD measuring circuit and save the result with the **Save Disturbance level** button.
2. Select the desired operation mode.

3. Start the test with the **Start Routine** button.

   Result: A new window opens. The button **Yes** can be used after 10 seconds.

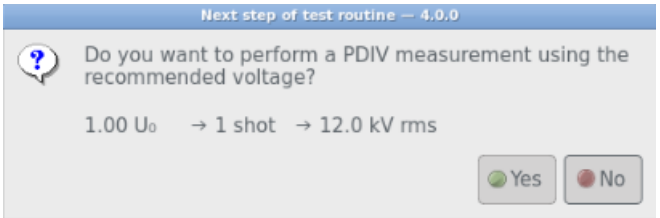


4. Select the appropriate test routine from the drop-down list.
5. Confirm the selection with the **Yes** button.

   Result: The window closes. The Symbol for HV release appears in the menu block.
6. Release the high voltage.

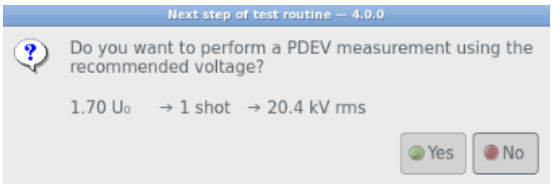
> If the high voltage is not released within 10 seconds, the test routine has to be restarted.

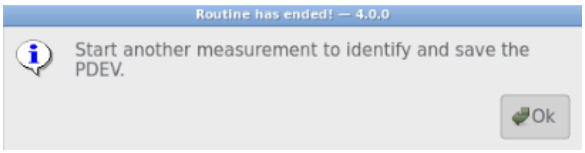
Result: The test routine is performed and the measurements are saved. Once all steps have been completed, a new window for PDIV measurement opens.



7. To perform the PDIV measurement, start the measurement with the **Yes** button.

   Result: The PDIV measurement is performed and saved. A new window for PDEV measurement then opens, depending on the selected operating mode.





The PDEV measurement can be carried out with the displayed parameters via the test routine.	The PDEV measurement must be started outside the test routine as an independent measurement.
The button **No** ends the test routine without performing the PDEV measurement.	The test routine is complete.

8. To perform the PDEV measurement, start the measurement with the **Yes** button.

   Result: The PDEV measurement is performed. A new window opens with a list of the steps required to successfully complete the PDEV measurement:

9. Close the window with the **OK** button.
10. Ensure that the last pulse in the diagram is marked ("Performing a measurement" on page 76) and save the measurement via **Save PDEV**.

9.5 Stopping / Finishing a Measurement

Stopping a measurement

Each measurement is always ended automatically after the specified test cycles have run. In this case, the system lingers in the operating state of "Ready for switching on" after the measurement, which is indicated by the red illuminated "HV OFF" button. Additional measurements can be started directly without renewed enabling of the high voltage.

A measurement in progress can be interrupted both through the software (**Stop** and HV OFF buttons) as well as through the available switching elements ("HV OFF" push-button, EMERGENCY OFF switch, key switch). In the event of such a manual interruption, the high voltage is always immediately deactivated. This also occurs if the **HV Off** button is clicked after conclusion of a measurement.

Switching off the high-voltage generator

If no further measurements need to be conducted at this phase, HV switch-off is to be initiated by pressing the "HV OFF" push-button or clicking on the **HV Off** button.

For test voltage sources that cannot be remotely controlled by the software, the high voltage must be manually deactivated after completion of the measurement.

After high voltage has been switched off, the following safety measures must be taken:

WARNING

- Earth and short-circuit the cable under test in accordance to the five safety rules ("General Safety Instructions and Warnings" on page 9).
- The system components that were under voltage should only be touched once they have been earthed and short-circuited using a suitable earthing device. This applies in particular for the PDS 62-SIN itself!

Resuming a measurement job at another phase

After the measurement has been completed at the current phase and the high voltage has been switched off, the measurement job can be resumed at another phase of the same cable system. The electrical connection ("Commissioning" on page 22) has to be adopted accordingly. If no differences between the individual phases are expected, the measurement can be directly continued at the new phase with the existing calibration data. Otherwise, a new calibration of the PD measuring circuit should be performed ("Calibrating the Partial Discharge Measuring Circuit" on page 62).

It is essential to adapt the phase selection before starting the measurement/calibration in order to avoid unintentional falsifying of existing measurements.

Finishing the measurement

After the measurement has been completed at all phases to be tested, the measurement screen can be closed with the **Exit** button.

To dismantle, use the same method as for connecting ("Electrical connection" on page 22) but in reverse order. Directly after the reduction, the short-circuit line / short-circuit device must be installed ("Storage" on page 99).

The evaluation of the test results and the creation of a report ("Evaluating Measurement Results and Creating a Report" on the facing page) can be done either directly afterwards or at a later time ("Viewing Cable Data and Administrating Measurement Tasks" on page 44).

10 Evaluating Measurement Results and Creating a Report

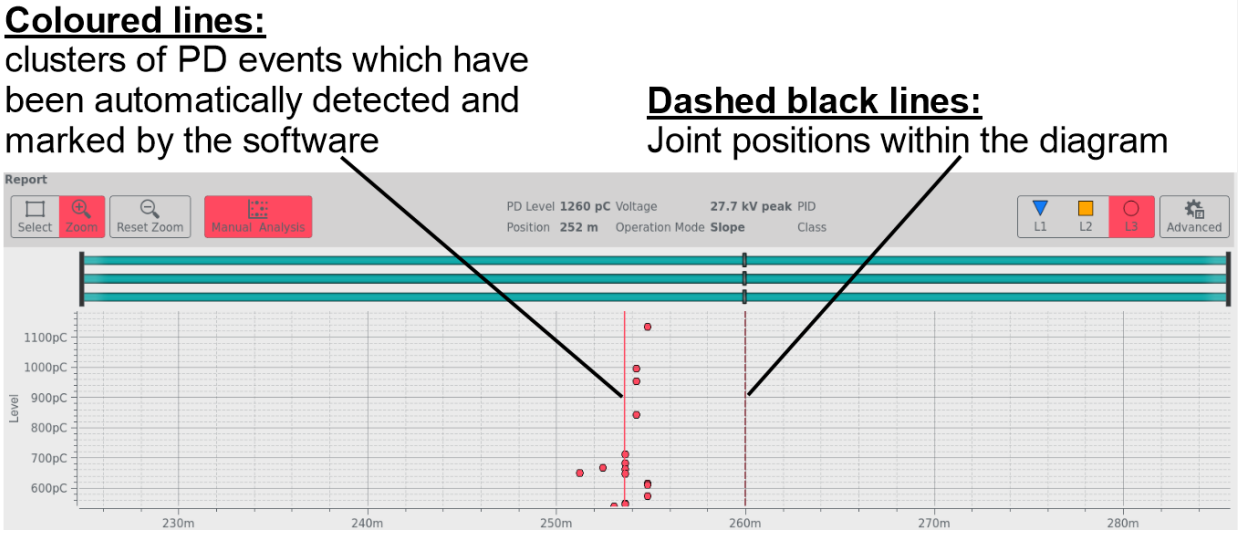
Opening the evaluation screen

If the evaluation of the measurement results will be performed directly after the measurement, you can directly call up the menu item **Report** in the start screen.

However, if the software was closed in the meantime, the data of the measurement job being evaluated must first be loaded ("Viewing Cable Data and Administrating Measurement Tasks" on page 44) into memory before you can call up the menu item.

PD mapping

The already familiar PD mapping from the measurement screen ("Available diagram types" on page 68) forms the central element of the analysis screen. It provides the user with a location-resolved overview of the partial discharges identified by the PD evaluation algorithm.



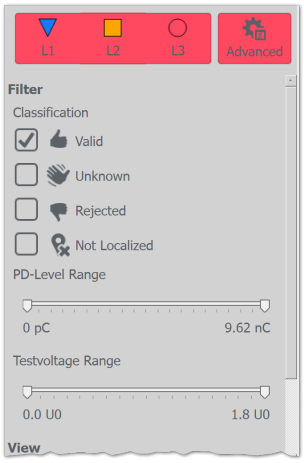
To generate the PD mapping, the software applies suitable algorithms and filters while the measurement is in progress for an automated analysis of the measured charge pulses. In doing so, it not only considers the level, but also other characteristics of the pulse, such as the phasing and edges. In the evaluation results, the majority of interference has largely already been identified and thrown out.

Based on the time difference between the arrival of the actual pulse and its reflection from the cable end, the remaining pulse can then be correlated ("Technical Background" on page 20) with a concrete position along the cable to a very high degree of accuracy. The now spatially resolved imaging is examined for localised clusters of PD events and colour-coded as follows:

Colour	Description
Saturated colours	Pulses which were classified as a **partial discharge**. The clustering of PD pulses at this position points to a PD fault. These positions are additionally labelled in the PD mapping with a coloured marker matching the respective phase.
Pale colours	Pulses which were classified as a **possible partial discharge**. These pulses occur either at positions with a smaller pulse cluster or near larger clusters. Partial discharge cannot be excluded as the cause.
Grey	Pulses which were classified as **negligible** and are with considerable certainty not caused by a PD fault.

View filter

Using the **Advanced** menu item, you can display the advanced view filters and the pulses in the PD mapping can be filtered as you wish to provide a better overview:



The following buttons are available for this purpose:

Button	Description
	Filter view according to phase.

Button	Description	
Classification	Show/hide pulses that were not identified (or not definitely identified) as PD.	
		All pulses classified as **partial discharge**
		All pulses classified as **possible partial discharges** (pale colours) are shown or hidden, respectively.
		All pulses classified as **negligible** (grey) are shown or hidden, respectively.
		Pulses for which no reflection could be determined. These pulses are placed at the beginning of the cable by default.
PD-Level Range	With the aid of charge limiting, the display can be restricted to the pulses that appear in a particular charge range.	
Testvoltage Range	With the aid of voltage limiting, the display can be restricted to the pulses that appear in a particular voltage range.	
View	With the aid of these checkboxes, the individual auxiliary indicators (joint markers, cluster markers, cable plan) can be shown or hidden respectively.	

The settings made with the aid of the functions described above have no effect on the PD pulses displayed in the report.

10.1 Manual classification of partial discharges

Necessity

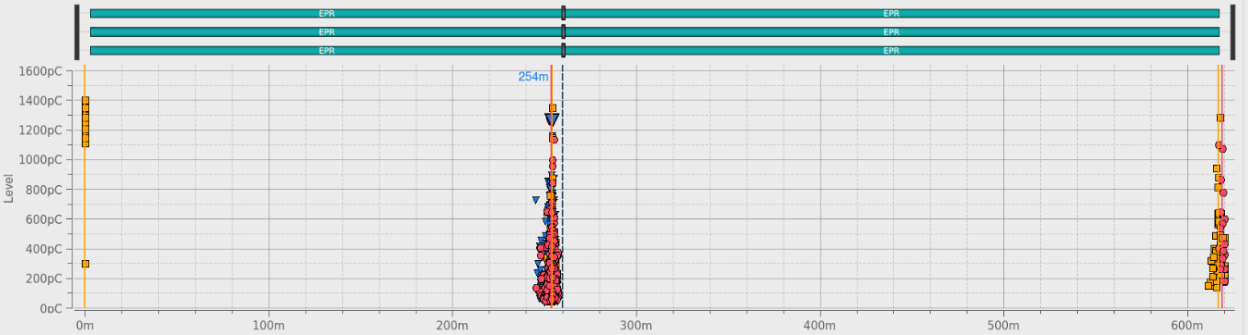
Generally, the automatic detection and location of partial discharges by the PD evaluation algorithm is very accurate. In most cases, a time-consuming post-processing of the measurement data is not needed and the report can be directly created ("Preparing and Printing the Report" on page 95).

However, if there are reasonable doubts as to the position or “realness” of identified PD faults, the functions described in this section enable experienced users to manually analyze and correct the localization data.

10.1.1 Determining Possible Sources of PD Faults

Cable plan

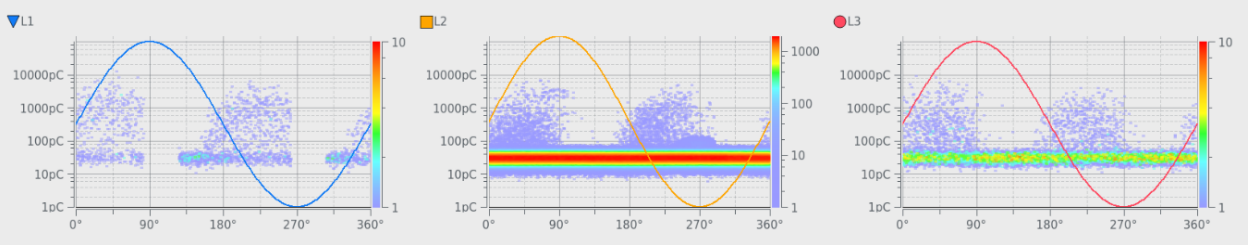
If it has not been manually deactivated via the view filter, the layout of the diagnosed cable is displayed, true-to-scale and with the correct orientation, over the PD mapping.



This view is ideally suited to identify any relations between the diagnosed PD faults certain characteristics (e.g. insulation types, joints) of the cable. A slight offset between the position of the accessory and the PD fault can often be attributed to an inaccurate cable plan or signal propagation velocity.

Phase-resolved diagrams

Using the **PRPD** tab at the bottom of the screen, the PRPD diagrams (Phase Resolved Partial Discharge) can be displayed under the PD mapping.



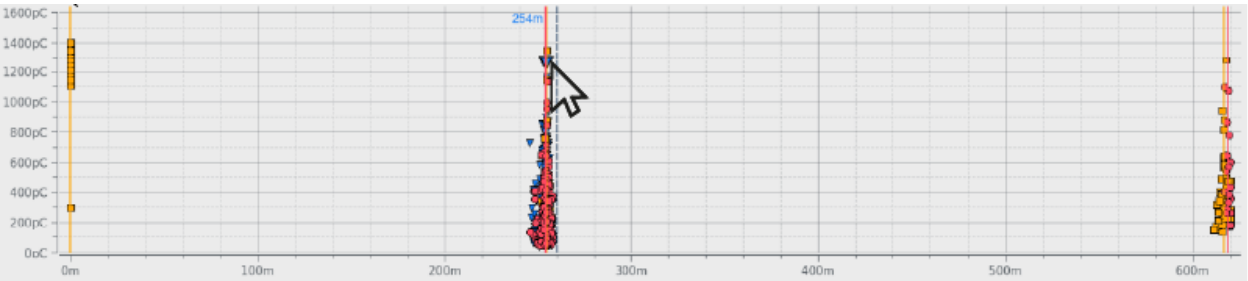
Using these diagrams, which display the distribution of charge pulses relative to the phasing, it is often possible to develop sound information about the characteristics and cause of a PD fault. The significance of the representation, however, depends greatly on the quantity of the recorded data.

To improve readability, phases can be shown or hidden as needed using the view filter. In addition, the quantity of the PD events used for the diagram can also be restricted ("Analysing Individual PD Events" on the facing page).

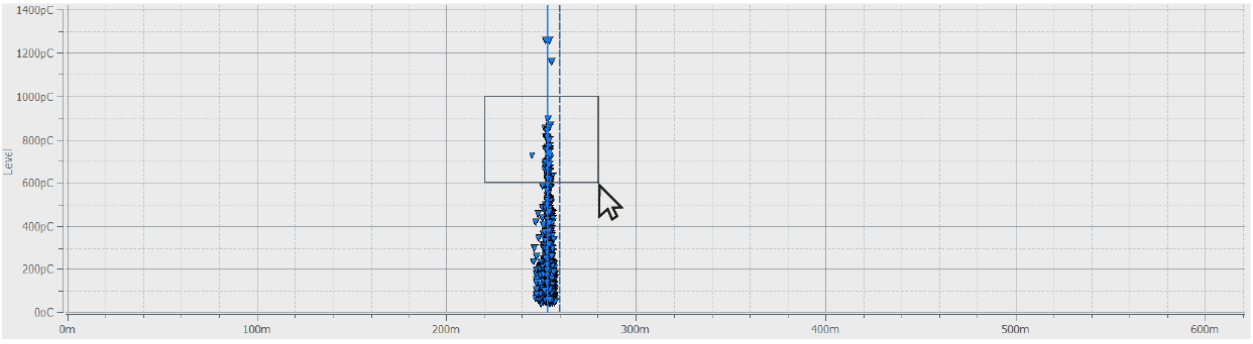
10.1.2 Analysing Individual PD Events

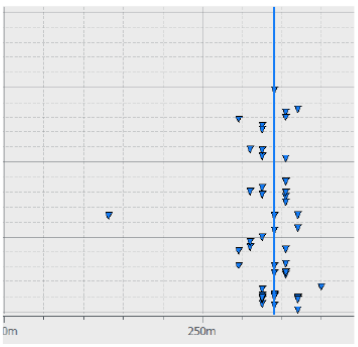
Selecting a PD event

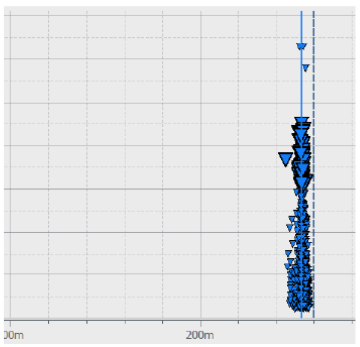
Each measured and automatically (via the software) classified pulse can be manually evaluated by the user and given a different classification, if necessary. In order to carry out a manual evaluation, the pulse must first be selected with a left mouse click.



The selection box on the top left of the PD mapping determines whether dragging a frame zooms in the marked area or selects the PD events within the marked area.







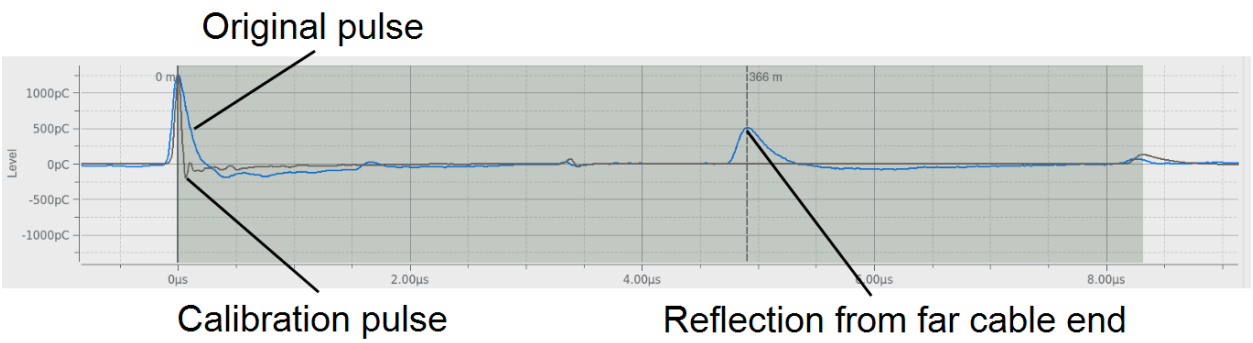
The **Zoom function** makes it easier to find and click on pulses in areas of dense accumulations. By clicking on the **Reset Zoom** button, the zoom can be canceled at any time.

After a number of PD events has been selected using the **Select function**, only these events are considered for the phase-resolved diagram (PRPD).

Manual analysis

Directly after a PD event has been selected, it can be analysed more precisely using the diagrams available under the PD mapping and can be classified differently if necessary.

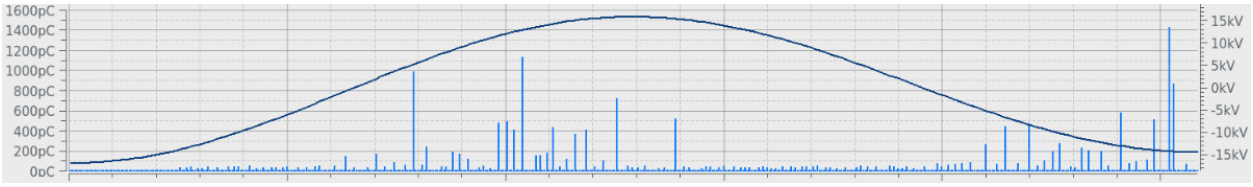
The **Localisation** tab can for example be used to call up the TDR image, which shows both the directly incoming pulse and its reflection at the far end of the cable.



The calibration pulse, shown in parallel with the PD pulse, serves particularly in uncovering system-inherent reflections (e.g. an impedance jump between high voltage connection cable and test object). It can be regarded as an undistorted reference pulse which was injected at the beginning of the cable and was not subjected to appreciable damping or dispersion. If, in comparison, the original PD pulse is visibly widened or damped, the PD certainly originates from within the cable. The calibration curve can be shown / hidden via the **Show Calibration Curve** checkbox.

For particularly experienced users, the software offers the option of checking the markings for the original pulse and its reflection which were automatically placed according to the algorithms so that corrections, if necessary, can be made. Should this be the case, the marker in question must be clicked briefly once with the left mouse button. The line thickness of the marker is thereby increased and the ⇤⫴⇥ symbol is displayed instead of the mouse pointer. By clicking again and holding the mouse button depressed, you can now freely drag the marker along the X-axis. As soon as the mouse button is released, the marker locks in the current position.

Furthermore, the time segment of exciter voltage during which the PD pulse was measured can be viewed under the **Q(t)/U(t)** tab.



Manual classification

If a more detailed analysis of PD events reveals doubts about the automatically performed classification and it needs to be corrected manually, an additional toolbar can be displayed below the PD mapping using the **Manual analysis** button.

Using the buttons in the toolbar, the events can be classified manually or even deleted. **The change is applied to all currently selected events.** Thus, for example, a group of PD events can be marked and in one step assigned the same classification.

The following functions are available:

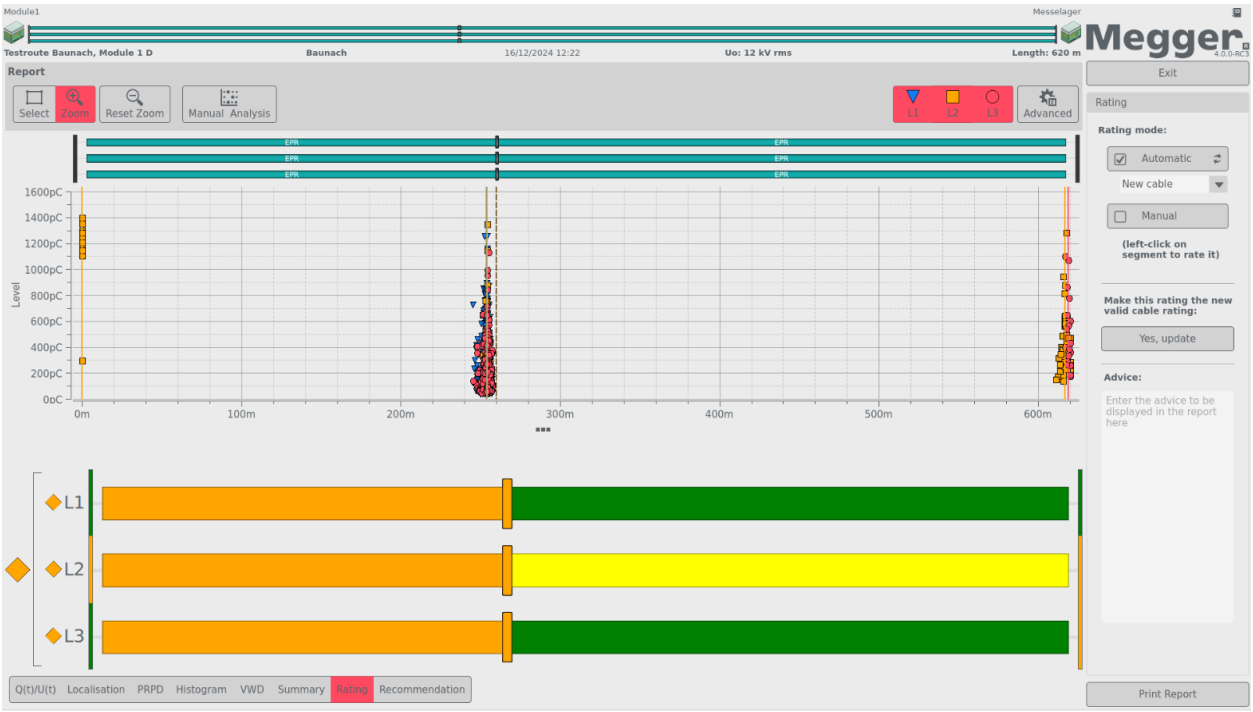
Button	Description
	Jump to the event with the next highest pulse amplitude.
	Jump to the event with the next lowest pulse amplitude
	Classify pulse as **partial discharge**.
	Classify pulse as **possible partial discharge**.
	Classify pulse as **negligible**.
	If a pulse appears very close to the near or far end of the cable, this button - in case of reasonable suspicion - can be used to "move" the pulse to the opposite cable end. The resulting change in position is immediately visible in the PD mapping.
	Discard pulse. This action cannot be reversed.

10.2 Assessing the measurement results

Introduction

In each measurement data set, a rating of the measurement results can be made within an evaluation system. This rating can then also be applied to the cable under test.

The rating of the measurement results enables quick and convenient filtering for conspicuous measurements and cables, which in turn facilitates the planning of repair measures. Of course, this requires the evaluations to be updated promptly and reliably following abnormal measurements, failures, or repairs.



Requirements

To evaluate cable systems, the additional package PD SW package "Rating" is required. Furthermore, the option **Settings** in the category **Report** of the **Rating thresholds** menu needs to be enabled.

Rating sections

The following rating sections are used:

Colour	Rating	Recommended action
white	Not rated	Evaluate measurement result
green	Inconspicuous	No need for action
yellow	Conspicuous	Carry out further tests
orange	Needs repair	Carry out repairs
red	Defective	Carry out repairs

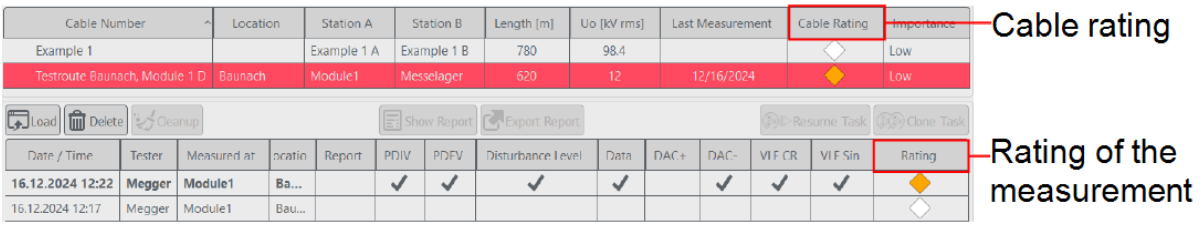
The rating "**Not rated**" is the initial state which is automatically assigned to each new cable/segment. The rating "**Inconspicuous**" should be assigned to cables/segments that do not show any abnormalities and are in good condition. If problems have been found with a cable/segment, this should be assigned with the ratings "**Conspicuous**", "**Needs repair**" or "**Defective**" in accordance to the criticality of the problem.

The rating section "**Defective**" is not assigned automatically. To declare a segment as defective, it must be manually evaluated.

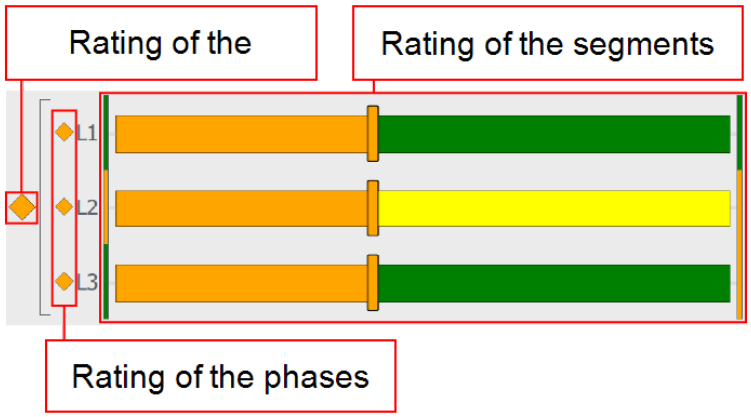
Evaluating the complete cable or a segment of the cable

Measurement results can be evaluated in the **Rating** tab. The evaluation can be performed both for the entire cable and for individual segments of the cable (joints, terminations, and cable sections). In this context, a higher-order element is automatically classified with at least the same level of criticality as a lower-order segment with the most critical classification. For example, when a joint is classified as in need of repair, both the phase and the measurement result of the cable are also classified as at least in need of repair. The rating of the measurement result can then be adopted as cable rating.

The rating of the measurements as well as the cable ratings are displayed in the **Cable manager** section.



In the section **Report**, the rating of the individual segments as well es the resulting rating of the pases and measurement can be found in the tab **Rating**:



It is possible to evaluate the measurement results automatically by the software or manually.

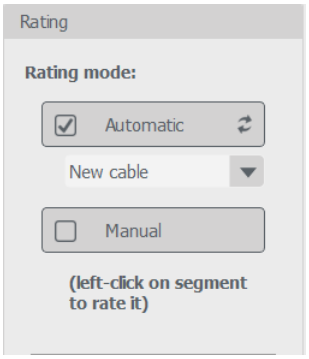
The automatic evaluation distinguishes between new and aged cable systems. For this, the thresholds set in the settings are used.

With manual evaluation, it is possible to rate the individual segments of a cable system independently of thresholds. This makes it possible to cater to special circumstances or requirements of individual cable systems.

Procedure for automatic evaluation

Proceed as follows to conduct an automatic evaluation of the cable system:

1. Ensure, that the button **Automatic** in the area "**Rating mode:**" is enabled.



2. Choose between the options **New Cable** and **Aged Cable** from the drowdown menu located below.

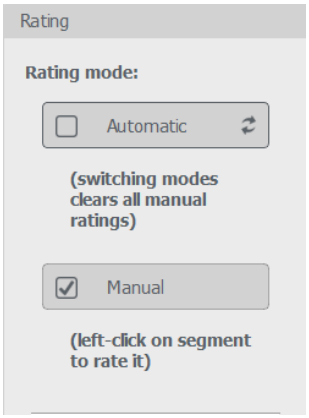
   Result: The evaluation is conducted automatically with the settings on file. The colours of the affected elements change with the amendment of the rating.

If the evaluation settings are modified, it's possible to evaluate already rated cable systems again with the new settings via the button **Automatic**.

Procedure for manual evaluation

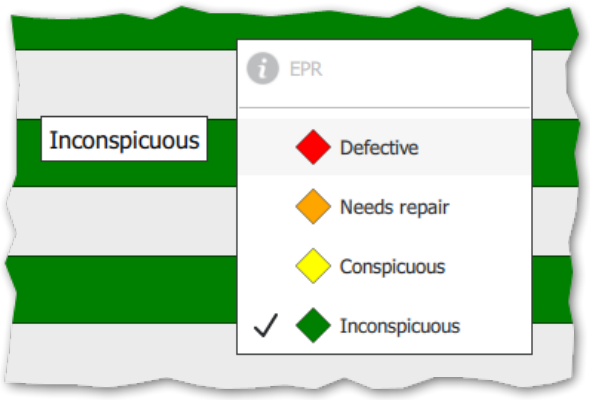
Proceed as follows to conduct a manual evaluation of the cable system:

1. Ensure, that the button **Manual** in the area "**Rating mode:**" is enabled.



2. Select an element whose rating you want to adjust.

   Result: A window displaying the available rating categories opens:



3. Select the appropriate rating for the element.
4. Repeat the steps **2** and **3** for all elements that have to be adjusted.

By switching to automatic rating mode all manual adjusted ratings are overwritten.

Adopting a rating as current cable rating

If the measurement results provide information about the condition of a cable, the rating of this measurement can be adopted as cable rating. The cable rating is not updated automatically, but must be done manually. For cable ratings to remain meaningful, they need to be updated reliably and in a timely manner to the measurements.

Use the button **Yes, update** to adopt the rating of a measurement as cable rating. The rating of the selected measurement is accepted as new cable rating. The new cable rating is displayed in the cable manager.

Text field Advice:

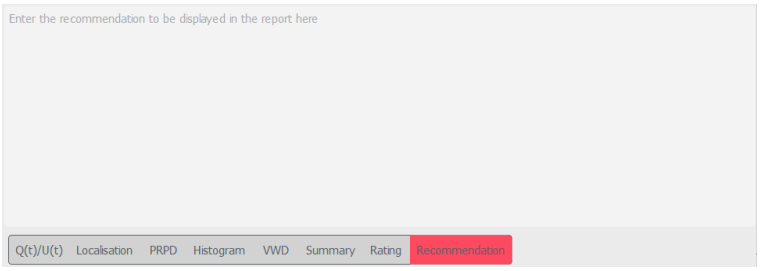
Advice, comments and notes to ratings made can be entered into the text field. These are reproduced in the report.

10.3 Preparing and Printing the Report

Risk assessment/recommendation

The risk assessment for reliable network operation must be performed taking into account the respective isolating systems, the type of faults as well as the measured PD.

A recommendation on how to proceed based on the risk assessment can be entered in the text field available through the **Recommendation** tab.

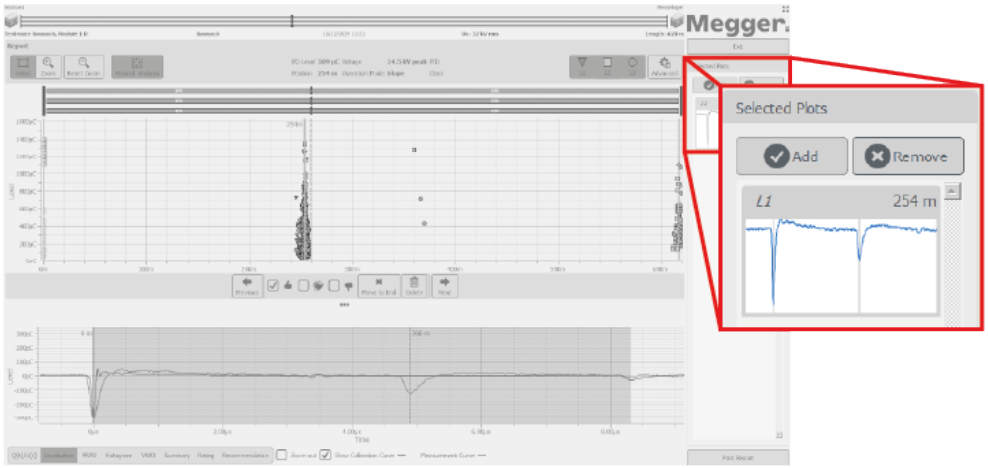


The recommendation could, for example, suggest a repeat measurement for trend analysis or even the replacement of an affected cable section/accessory. The text of this recommendation is also contained in the printed report.

Selecting additional diagrams to be included in the report

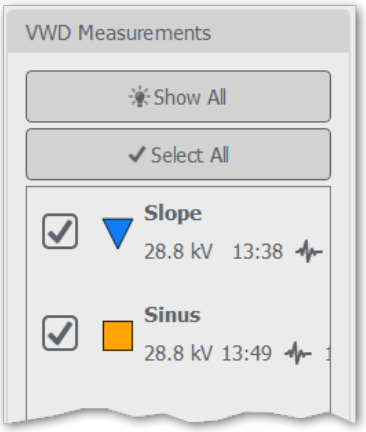
Depending on the selected template the report may already contain the cable plan, relevant PD mappings, the calibration curve, a tabular overview of the key measurement values and the recommendation.

In addition, individual TDR images may also be included in the report as required, e.g. if the original PD pulse and its reflection can be particularly well recognized in one of the reflectograms and, accordingly, a clear localization of the partial discharge fault can be made. To do so, you must first mark the respective pulse in the PD mapping and then click the **Add** button in the **Selected Diagrams** menu block. A miniature view of the pulse appears directly superimposed in the menu window.



The pulses contained in the selection can be selected and brought to the display by clicking on them. Clicking the **Remove** button will remove them from the selection.

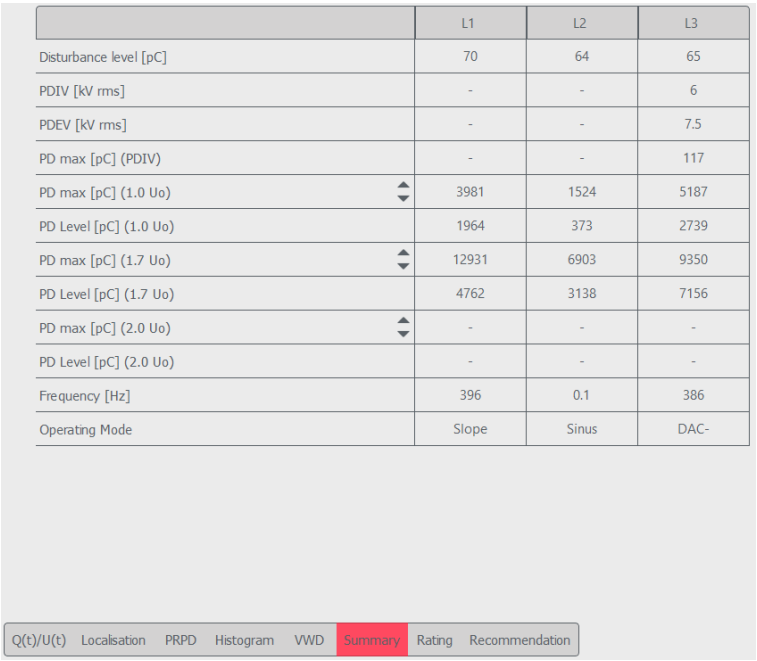
It's possible to add meaningful VWD diagrams to the report during the measurement by using the button **Save VWD**. Of course diagrams can be added to or removed from the report during report creation. As soon as the **VWD** view is opened, the diagrams which are already included in the report are displayed in the **VWD Measurements** menu block on the right.



The **Show All** button can also be used to show and view all other available VWD diagrams. To include one of the VWD diagrams that has not yet been added to the report, tick the corresponding box.

Preparing the summary table

By clicking on the **Summary** tab, a table can be called up which, depending on the template used, will also be included in the report (exactly as it is shown here) and shows the most important data of the measurement task.



	L1	L2	L3
Disturbance level [pC]	70	64	65
PDIV [kV rms]	-	-	6
PDEV [kV rms]	-	-	7.5
PD max [pC] (PDIV)	-	-	117
PD max [pC] (1.0 Uo)	3981	1524	5187
PD Level [pC] (1.0 Uo)	1964	373	2739
PD max [pC] (1.7 Uo)	12931	6903	9350
PD Level [pC] (1.7 Uo)	4762	3138	7156
PD max [pC] (2.0 Uo)	-	-	-
PD Level [pC] (2.0 Uo)	-	-	-
Frequency [Hz]	396	0.1	386
Operating Mode	Slope	Sinus	DAC-

The buttons ▲ and ▼ in the first column of the table can be used to set the test voltage levels for which the measured PD values are to be displayed in the table. The setting is automatically applied to the generated report as well (if the summary table is included in the selected report template at all).

Printing/exporting a report

After completion of the analysis and risk assessment, using the **Print Report** button on the lower right, template management can be opened and the desired report template selected (the most recently used template is preselected). If the results of the measurement require it, the content of the template can still be changed at this time by enabling or disabling certain content elements ("Category Printout" on page 33).

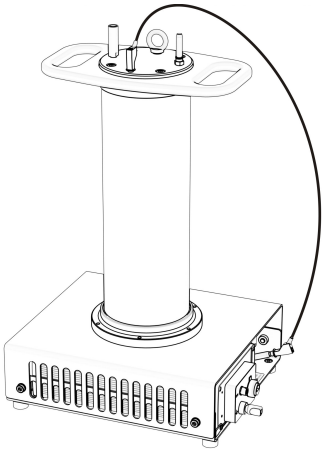
When the **Print PDF** button is pressed, a PDF report is generated based on the selected template. Depending on the size, this can take several minutes. The report is then displayed in a PDF viewer, where it can be saved or printed on the selected printer ("Category General" on page 29). If a full version of the Megger Book Cable protocol software is installed on the same computer, the generated PDF report is automatically added to the list of previous measurement activities on the selected cable.

The report data can alternatively be exported in the CSV (comma-separated values) file format. To do so, select the **Export CSV** template, which can also be modified before the export but cannot be saved. The actual export is then initiated using the **Save CSV** button.

11 Storage

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

To prevent charging of the capacitor, the short-circuit line has to be installed as shown in the following picture both during storage and during transportation of the system:



12 Maintenance and care

Repair and maintenance

Repairs and maintenance work may only be carried out by Megger itself or by authorised service partners using original spare parts. Megger recommends having the system tested and maintained at a Megger service centre once a year.

Megger also offers on-site service to its customers. If necessary, please contact your local service centre.

Cleaning

In order to be able to guarantee a consistently high measuring precision at the same time as the lowest possible system-related partial discharge, the housing (in particular the surfaces painted red) and the connection cables of the PDS 62-SIN should be cleaned regularly.

No aggressive solvents or cleaning agents may be used for cleaning. Megger instead recommends using the cleaning set ("Scope of delivery" on page 15) specifically intended for this purpose. In principle, cleaning can also be carried out with a soft, lint-free cloth and ethanol.

13 Troubleshooting

Independent troubleshooting

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

Problem / Error message	Cause / Remedy
Connection to test voltage source or PD detector cannot be established	▪ Restart the affected device ▪ Restart notebook and measurement software ▪ Check cabling ▪ Make sure that the device is supplied with power and, if possible, measure the supply voltage
The system of the PD detector apparently crashed (LEDs light up red)	Briefly disconnect the PD detector from power to initiate a restart.
Software is very slow; delayed response to user actions	The processor is heavily utilized by other processes or running at reduced clock speed. ▪ Close all other applications ▪ Deactivate the virus scanner ▪ Deactivate the power-saving mode
The software is slow to start and takes up a lot of space on the hard drive.	Large volumes of data may accumulate in the installation directory due to the amount of measurement data recorded. This depends on how long and how intensively the software is used and may also delay software start-up. ▪ Cleaning measurement data ("Viewing Cable Data and Administrating Measurement Tasks" on page 44) ▪ Cleaning up the database ("Category General" on page 29)
When the software is opened for the first time, no new measurement job can be started	No devices have been configured ("Category Devices" on page 38) in the software.
"Overflow"	Measured data exceeds the input data range. Increase the measuring range (Q range) in the software.

Problem / Error message	Cause / Remedy
"Processing Pipeline limit reached!"	The computing power of the computer used is not sufficient to process the amount of incoming measurement data. This problem can be counteracted by decreasing the maximum number of localizations during VLF sine wave voltage measurements ("Category Localisation" on page 40).
"Calibration failed. Using default parameters!"	The start and / or end reflection could not be unambiguously identified by the software. ▪ Try again with low bandwidth setting ▪ Check the electrical connection of the calibrator and whether it is still switched on ▪ Make sure the cable under test is not earthed / short circuited ▪ Try to manually position the markers
"PD Detector protocol not supported!" **"PD Detector software not supported!"** **"PD Detector firmware not supported!"**	The wrong PD Detector version may have been selected when the measurement task was started ("Starting or Resuming a Measurement Task" on page 60). Otherwise, a firmware upgrade ("Category Devices" on page 38) might solve the problem.

Behaviour at persistent malfunction

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, notify the relevant supervisor. Inform the Megger service to resolve the problem. The system must not be put back into operation until the fault has been rectified.

14 Information on PD Detector Software

This chapter only refers to the Windows version of the software and contains information on system requirements, installation and licensing of the software. This chapter is not relevant for the test van version of the software, as the control unit of the test van is already preconfigured and licenced.

14.1 System requirements

The measuring software is normally pre-installed on a notebook included in the scope of delivery, so that measurements can be started directly.

The configuration of the supplied notebook (the network settings and the power options in particular) should only be changed follwing consultation with Megger. You are also strongly discouraged to install any third-party software, as this may negatively affect the performance of the notebook and hence the functionality of the PD Detector Software. Repair costs which are due to a change in the system configuration or the installation of third-party software will be charged to the customer.

System requirements

Provided that the licences required are available, the software can also be installed on other computers without any difficulty. These computers should meet the following system requirements:

- Processor: Intel i5 or higher
- RAM: min. 4 GB
- Display: min. 1920 x 1080 pixels
- Interfaces: Gigabit Ethernet, USB 2.0
- Operating system: 64 Bit, Windows 7 or newer

Ethernet interfaces

The Ethernet interfaces need to be configured as follow:

Ethernet interface	Configuration
Primary Ethernet interface:	
IP address:	192.168.220.1
Subnet mask:	255.255.0.0
Secondary Ethernet interface:[1]	
IP address:	192.168.220.2
Subnet mask:	255.255.0.0

[1] Only required, if both voltage source and PD coupler need to be separately connected to the notebook (as it is the case when working with a stand-alone voltage source and the PDS 62-SIN).

14.2 Installing the software

Installing the software requires administration rights! Proceed as follows to install the software:

1. Insert/plug the data medium with the software into your computer and double-click the **setup-p-%version_number%.exe** setup file.
2. Click **Next** and then select the location where you would like to install the software. To confirm, click on **Next**.
3. Select the additional components you want to install. If the **CodeMeter Runtime** application is not yet installed on the system, then it must be selected. To confirm, click on **Next**.
4. Select whether or not a desktop icon should be created. To confirm, click on **Next**.
5. Start tthe installation by clicking **Install**.

14.3 At first start of the software

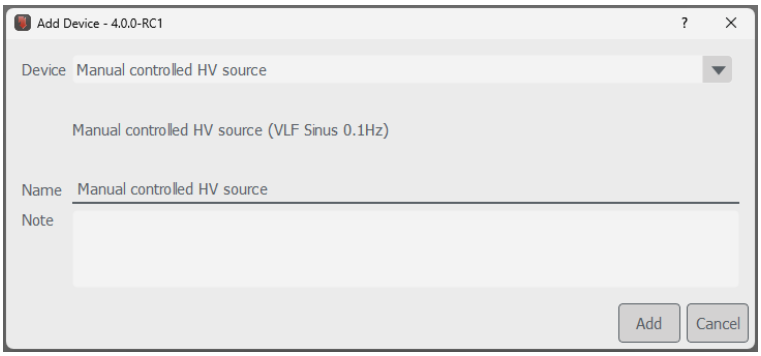
If the software has already been installed at the factory and configured for the hardware being used, no further configuration steps are required. The first measurements can be taken straight away. However, if the software has been installed on the PC for the first time or a new piece of measuring hardware has been purchased, the device configuration must be carried out after the software is launched for the first time.

Configuring the device

Proceed as follows to configure the device:

1. In the main menu, select the menu item ⚙.
2. Select the category **Devices**.
3. Press the ⊕ button to add another device.

   Result: the following input mask opens:

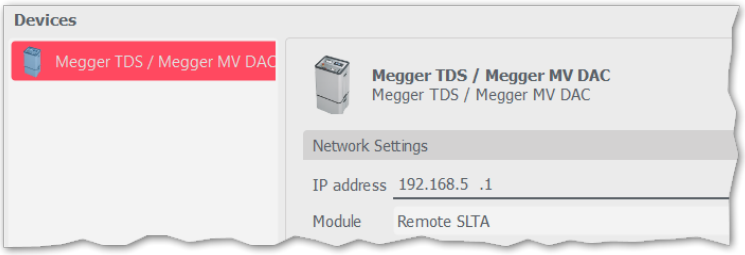


4. In the **Device** dropdown list, select the device you wish to add.

   You can change the suggested name if required and add a brief description.

5. Next, click on **Add** to enter the device.

   Result: The device now appears in the device list and is ready to perform measurements. Click the device in the list to adjust its settings.



Available device types

The following device types can be added in this way:

Device	Device type		Default setting[1]
PD Detector v1	PD Detector	PD Detector of version 1	IP: 192.168.220.100
PD Detector v2[2]		PD Detector of version 2	IP: 192.168.220.100
Megger Centrix	HV source	TDM in Centrix test van	IP: 192.168.150.1
Megger HV DAC		HV DAC 200 / 300	IP: 192.168.220.99 LON module: Remote SLTA
Megger TDS / Megger MV DAC		TDS 40/60 / MV DAC 30	IP: 192.168.5.1 LON module: Remote SLTA
VLF Sinus		VLF Sinus test system	IP: 192.168.4.1 (VLF Sinus 28/34/54) IP: 192.168.4.4 (VLF Sinus 45/62)
Manual controlled HV source		Any other test voltage source	

As a matter of principle, at least one PD detector and one HV source must be added at all times. If multiple devices of the same type are configured, the device that is actually connected must be selected when creating a new measurement task.

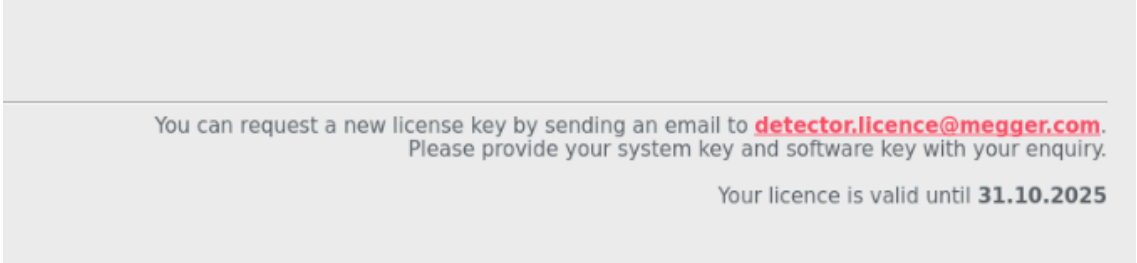
[1] Do not change without explicit instruction
[2] The version can be read off the type plate

14.4 Software licences

Licence model

The licences of the PD Detector software are based on the subscription model. This means that the licences are activated for a defined period and have to be renewed/extended after that time has expired.

The expiration date is displayed in the category **General** in the area **Settings**:



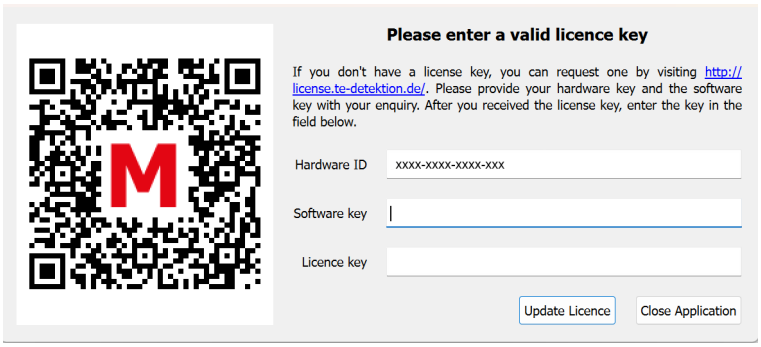
Activating the licence

After reinstalling the software, changing the software package used or replacing hardware, it is necessary to (re)activate the licence. This requires Internet access and access to the licence documents provided (Software key).

Proceed as follows to generate a new licence key:

1. Start the software.

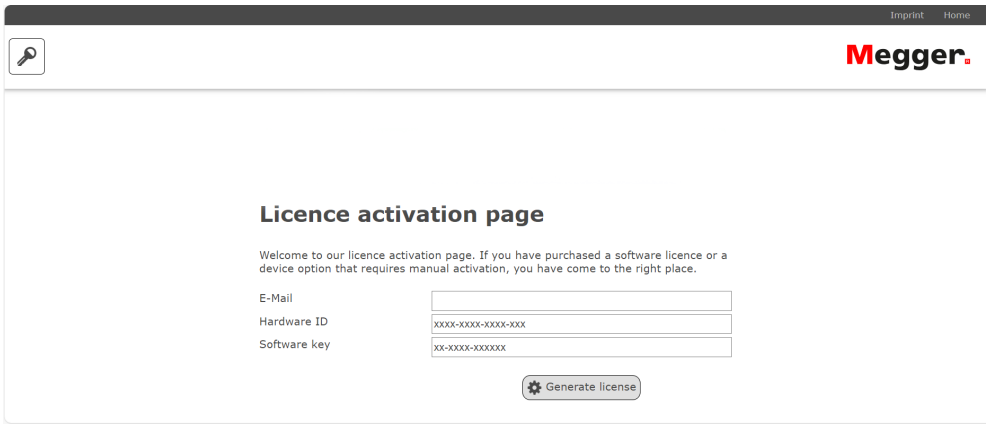
   Result: A new window opens in which the field **Hardware ID** is already filled in:



2. Type the software key into the field **Software key**.

3. Use the link or the QR code displayed in the window.

   Result: A window opens in the browser. The values for the entered keys for hardware and software are adopted.



4. Enter your e-mail address.
5. Generate the licence by using the button ⚙.

   Result: The licence key and the number of actications left are displayed.

> If all activations of the licence have been used up, no licence key can be generated. In this case, contact your sales partner.

6. In the PD Detector Software, copy the licence key into the field **Licence key**.
7. Save the licence key via the button **Update Licence** into the software.

   Result: The PD Detector software opens.

Licence keys are only valid in combination with the associated system and software keys. This means that a new licence key needs to be generated after exchanging the hardware.

Activation of further software options

It is possible to activate additional software packages at any time. This is necessary if you have purchased additional software options that are not yet included in the current licence. Internet access and the new licence documents are required for activation.

Proceed as follows to switch the software package:

1. Ensure, that the PD Detector softwae is closed.
2. Open the installation folder of the software.

3. Delete the file *licence.lic* from the folder.
4. Follow the instructions for activating a licence key ("Activating the licence" on page 106).

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