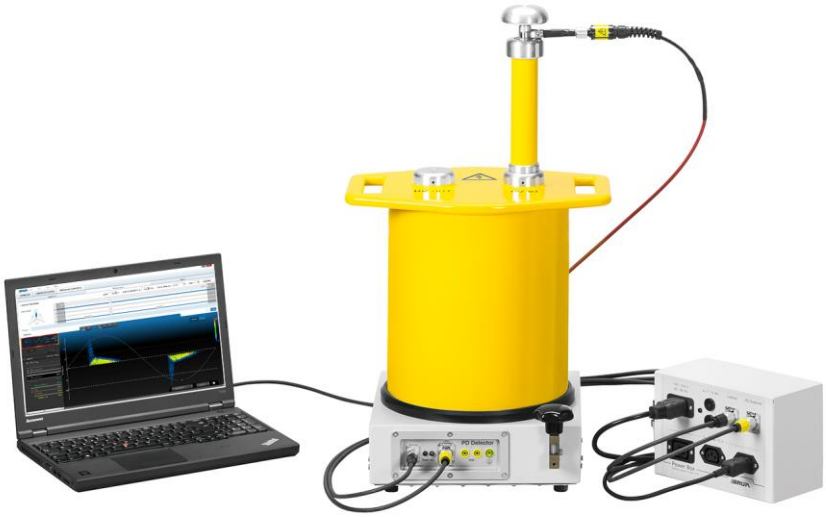
User manual

Portable PD diagnostics system

PD-TaD 62



The figure is illustrative

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1 ABOUT THIS MANUAL

1.1 Using this manual

This user manual contains all necessary information that is needed for the commissioning and operation of the described product.

- Read this user manual completely before operating the product for the first time.
- Consider this user manual to be a part of the product and store it in an easily accessible location.
- If this user manual is lost, please contact BAUR GmbH or your nearest BAUR representative.

1.2 Applicable documents

This user manual applies in conjunction with the following documents:

- User manual for the BAUR software 4
- User manual for the VLF HV generator used

1.3 Structure of safety instructions

The safety instructions in this user manual are presented as follows:

Danger symbol 	**SIGNAL WORD**
	Type of danger and its source Possible consequences of violation. ▸ Measure to prevent the danger.

If a dangerous situation could arise at a specific step, the safety instruction is displayed immediately before this dangerous step and is shown as follows:

SIGNAL WORD

Type of danger and its source. Possible consequences of violation.

1. Measure to prevent the danger.

Danger levels

Signal words in the safety instructions specify the danger levels.

DANGER	Will lead to severe injuries or death.
WARNING	May lead to severe injuries or death.
CAUTION	May lead to light to moderate injuries.
NOTICE	May lead to material damage.

Danger symbols

	**General danger**
	**Risk of electric shock**
	**Warning about arcing faults**

1.4 View Settings

Symbol	Meaning
▸	You are requested to perform an action.
1. 2. ...	Perform the actions in this sequence.
a. b. ...	If an operation consists of several operating steps, they are specified with "a, b, c". Perform the operating steps in this sequence.
1 2 ...	Numbering in the legend
▪	List
	Indicates further information on the topic.
	Indicates tools required for the subsequent tasks.
	Indicates spare parts required for the subsequent tasks.
	Indicates required cleaning agents.

1.5 Note on the screenshots and graphics used

The screenshots and graphics used are intended to illustrate the procedure and may differ from the actual state.

2 FOR YOUR SAFETY

All BAUR devices and systems are manufactured according to the state of the art and are safe to operate. The individual parts and the finished devices are subject to continuous testing by our qualified personnel as part of our quality assurance system. Each device and system is tested before delivery.

However, the operational safety and reliability in practice can be achieved only when all necessary measures have been taken. The responsible body[1] and operator[2] of the device or system are responsible for planning these measures and monitoring their implementation.

Make sure that the responsible body and persons working with the device or system have carefully read through and understood the user manual for the device or system, as well as the user manuals for all associated devices, before starting work.

The responsible body and operator of the device or system are responsible for any injuries or damage resulting from non-compliance with this user manual.

2.1 Intended use

The PD-TaD 62 portable PD diagnostics system is used in combination with a BAUR VLF HV generator for carrying out:

- Partial discharge testing and location
- Parallel partial discharge and dissipation factor measurement
- VLF cable testing with parallel partial discharge testing
- Full MWT: VLF cable testing with parallel partial discharge and dissipation factor measurement

For dissipation factor measurement and Full MWT, a VLF HV generator with a dissipation factor function is required.

If the system is not used in accordance with this stipulation, safe operation cannot be guaranteed. The user is liable for any damage to persons and property resulting from incorrect operation!

Proper use also includes

- compliance with all instructions in this user manual, and all other applicable documents,
- compliance with the technical data and connection requirements given on the rating plate and in the user manual and any other applicable documents,
- compliance with the inspection and maintenance instructions for the system and its components.

[1] Responsible body is the person or group that is responsible for the safe operation of the device and its maintenance (EN 61010-1, 3.5.12).

[2] Operator is the person who uses the device for its intended purpose (according to the definition of user in compliance with EN 61010-1, 3.5.11).

2.2 Instructions for the operator

The product may be operated only by authorised and trained electrical engineers. An electrical engineer is a person who, owing to his professional education (electrical engineering), knowledge, experience and familiarity with the applicable standards and regulations, can assess the tasks assigned to him and detect possible dangers.

In addition, the operator must have:

- Knowledge of the technical equipment and operation of the PD-TaD 62 and respective VLF HV generator
- Knowledge of the testing and measurement procedures
- Knowledge of plant engineering (cable types, switchgear, etc.).

2.3 Avoiding dangers, taking safety measures

- When installing the testing system and operating the PD-TaD 62 observe the following regulations and guidelines:
  - Accident prevention and environmental protection regulations applicable for your country
  - Safety instructions and regulations of the country where PD-TaD 62 is being used (according to the latest version)
  - EU/CENELEC countries: EN 50191 *Erection and operation of electrical test equipment*

    Other countries: The standard for erection and operation of electric test equipment applicable for your country
  - EU/CENELEC countries: EN 50110 *Operation of electrical installations*

    Other countries: The standards for operating electrical installations applicable in your country
  - If necessary, other national and international standards and guidelines in the latest applicable version
  - Local safety and accident prevention regulations
  - Employers' liability insurance association regulations (if any)

Only operate the system if it is in a technically safe condition.

Safety, function and availability depend on the proper condition of the system. Upgrades, modifications or alterations to the system are strictly prohibited.

- Operate the system only in a technical perfect condition.
- Only use the PD-TaD 62 for the intended VLF HV generators specified on the data sheet.

  Connecting the PD-TaD 62 to VLF HV generators with a higher output voltage can lead to flashovers.
- In the event of damage and malfunction, immediately stop the system, mark it accordingly and have the faults rectified by appropriately qualified and authorised personnel.
- Comply with the inspection and maintenance conditions.
- Use only accessories and original spare parts recommended by BAUR. The use of spare parts, accessories and special facilities that are not tested and approved by BAUR could adversely affect the safety, function and features of the product.

Do not dismantle the HV coupling unit

The housing of the HV coupling unit is sealed and gas-tight and may not be opened.

- Do not dismantle the HV coupling unit.
- Do not screw any components onto the HV coupling unit. Opening the housing can damage the device.

No operation with condensation

Condensation can form in devices and systems due to temperature fluctuations and high air humidity, which in some components can lead from leakage currents and flashovers up to short-circuit.

Maximum danger arises when relatively high air humidity and temperature fluctuations occur in a device consecutively, e.g. which is the case when storing the device in an unheated room or when placed outdoors. When the device is then exposed to a high ambient temperature, the cold device surfaces cool the air in the immediate vicinity, which leads to formation of condensation even inside the device.

In this process, two factors are crucial:

- The higher the relative air humidity, the faster the dew point is reached and water is condensed.
- The higher the temperature difference between the surfaces and the ambient air, the stronger the tendency for condensation.
- Always prevent condensation in devices. Temper the device and system before and during the measurements so that no condensation occurs.

No operation in areas with risk of explosion and fire

Measurements in direct contact with water, in environments with explosive gases and in areas with fire risks are not permitted. Possible danger zones are e.g. chemical factories, refineries, lacquer factories, paint shops, cleaning plants, mills and storage for milled products, tank and loading plants for combustible gases, liquids and solid matter.

Lifting and carrying the transport cases

- To transport the transport cases containing the PD-TaD and accessories, pull the wheeled cases along.
- The transport cases and their contents weigh approx. 38.0 kg or 22.5 kg.
  Lifting or carrying the transport cases requires two people.

2.3.1 Dangers when working with high voltage

When performing tests and measurements with the PD-TaD, a dangerous, and at times very high, voltage is generated that is fed to the test object via an HV connection cable.

Personnel need to pay special attention and must be very careful while working with high electric voltage.

Commissioning and working with PD-TaD is only permitted in compliance with EN 50110 and EN 50191 (EU/CENELEC countries) or the relevant standards applicable in your country.

Observe 5 safety rules

- Comply with the following safety rules before beginning tasks in and on the electrical plant:

1. Disconnect the test object.
2. Secure against re-connection.
3. Verify absence of operating voltage.
4. Earth and short all phases.
5. Provide protection against adjacent live parts.

DANGER

High electrical voltage

Danger to life or risk of injury due to electric shock.

- Before commencing work, the operator must assess the risks for the specific working conditions. Protective measures are based on the risk assessment and must be followed at the workplace.
- Connect the system as described in this user manual.
- Pay particular attention to ensuring the test object and system are earthed correctly.
- Observe the warning and safety signs on the system. Always check whether the warning signs are available and are legible.
- Never put the safety devices out of operation. It is forbidden to bypass the safety devices.
- Cordon off all metal parts in the area of the test object terminals (connection point and far end). Insulate and earth metal parts to avoid dangerous charges.

After a measurement or test - after switching off the device or system - the test object can still be live with dangerous voltage.

- Before removing the safety precautions, discharge, earth and short circuit all live parts.

DANGER

Arcing fault when establishing a connection

Risk of burn injuries and electro-ophthalmia due to arcing faults.

- Use suitable personal protective equipment to protect against arcing faults.
- Cover or cordon off adjacent live parts with insulating covering material.
- Use only undamaged connection cables.
- Secure the connection points and the far end of the test object.
- Use special locking devices to lock connection points.

2.3.2 Guaranteeing immediate measures in an emergency

The system may be operated only if a second person with visual and audio contact to the tester is present and is in the position to detect possible dangers and to act immediately and properly.

With an external emergency stop device (optional), it is possible to mount the trigger for the emergency stop outside the test installations so that it may be reached quickly in an emergency.

2.4 Special personal protective equipment

Personal protective equipment based on the risk assessment for the relevant working conditions is part of the safety concept of BAUR devices.

- Observe the internal operating instructions and the safety instructions applicable in your country.

The following state-of-the-art protective equipment may be necessary depending on the specific conditions in the workplace:

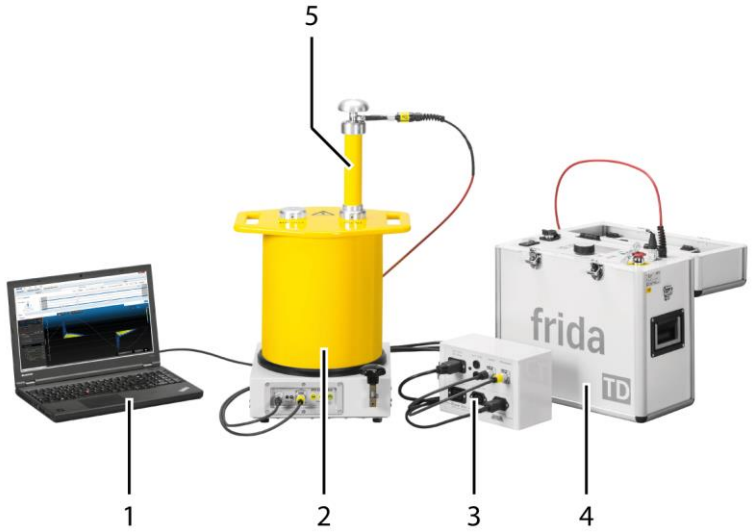
Protection against electrostatic charging, crushing, slipping and other accidents:	▪ Safety footwear
Protection against electric dangers (arcing fault):	▪ Tested safety clothing ▪ Insulating helmet with visor ▪ Insulating protective gloves ▪ NH fuse puller with cuff
Protection against noise:	▪ Ear protection
Protection against dangers from road traffic:	▪ High-visibility vest according to EN 471 (protection class 2) or according to the applicable standards in your country for high-visibility clothing for commercial applications. **Important:** No high-visibility vests while working with electric arc hazard!
Hand protection:	▪ Protective gloves

3 PRODUCT INFORMATION

Information on the following subjects is given in the chapter *Data sheet (on page 80):*

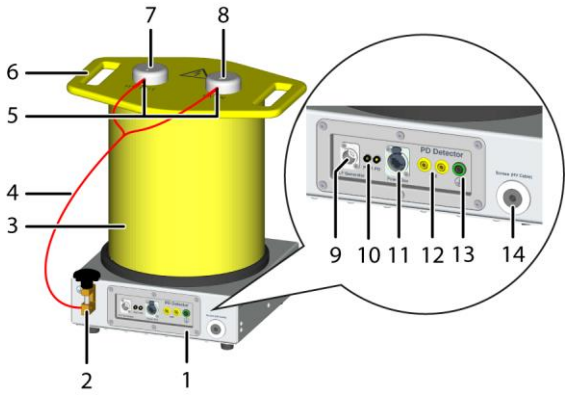
- Technical data
- Available methods
- Standard delivery
- Accessories and options

3.1 Full illustration of the PD-TaD and system components



No.	Element	Function
1	Laptop	The laptop with the BAUR software 4 installed on it forms the graphical interface for controlling the PD diagnostics system and evaluating the measurement results. The measurement results are displayed, analysed and archived in the BAUR software.
2	PD-TaD	The PD-TaD comprises: **HV coupling unit (with integrated measurement impedance)** Is used to couple out high-frequency PD pulses via a measurement impedance (in accordance with IEC 60270) and convert them into equivalent voltage signals **PD measuring unit** Is used to record and process the voltage signals from the HV coupling unit and measure partial discharges
3	Power Box	Is used for: ▪ Power supply for all system components ▪ Data transmission between the laptop and PD measuring unit
4	VLF HV generator	Is used as VLF voltage source for the measurements
5	HF filter	Is used to minimise external influences on the measurement results

3.2 PD-TaD



No.	Element	Function
1	PD measuring unit	Is used for the measurement and location of partial discharges
2	⏚ port	Is used to connect the protective earthing
3	HV coupling unit with integrated measurement impedance	Is used to couple out high-frequency PD pulses via a measurement impedance (in accordance with IEC 60270) and convert them into equivalent voltage signals
4	Short-circuit cable	Is used to short-circuit the *HV IN* and *HV OUT* ports and the protective earthing (for the transportation and storage of the PD-TaD)
5	Port for the short-circuit cable	Is used to connect the short-circuit cable to the *HV IN* and *HV OUT* ports Two connection sockets are provided on each of the HV connections for the short-circuit cable: on the top and on the side.
6	Handles	
7	*HV OUT* port	Is used to connect the PD-TaD to the test object
8	*HV IN* port	Is used to connect the PD-TaD to the VLF HV generator
9	*VLF Generator* port	Is used to connect the PD-TaD to the VLF HV generator
10	*PWR* LED	▪ Does not light up: PD-TaD is not supplied with power. ▪ Is on continuously: PD-TaD is supplied with power.
	PD LED	▪ Does not light up: No measurement performed. ▪ Flashing: PD events are being received. The LED lights up for half a second if a PD event occurs.
11	*Power Box* port	Is used to connect the PD-TaD to the Power Box using a PoE cable (for power supply and data transmission)

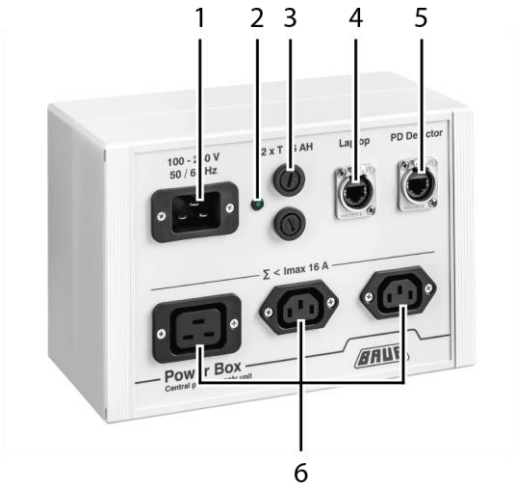
No.	Element	Function
12	*VSE* ports	Are used to connect the VSE cable for the dissipation factor measurement (to detect and account for leakage current)
13	⏚ port	Is not used
14	*Screen (HV Cable)* port	Is used to connect the screen of the HV connection cable

Note: The HV coupling unit is supplied in a sturdy transport case. The transport case is also used to protect the device against moisture and dirt during storage.

3.3 Power Box

The Power Box acts as the power supply for all system components:

- PD-TaD
- VLF HV generator
- Laptop

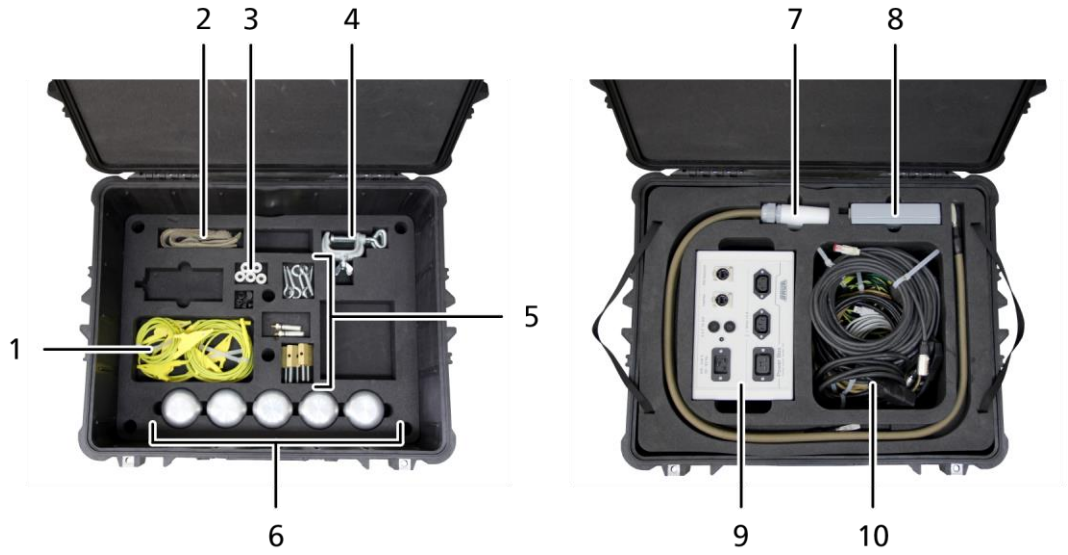


No.	Element	Function
1	Mains voltage connection	
2	LED	Lights up when the mains voltage is connected.
3	Device protection fuse	Is used to protect the Power Box and connected system components Type: T 16 AH
4	*Laptop* port	Is used to connect the laptop for data transmission to the Ethernet cable (standard delivery).
5	*PD Detector* port	Is used to connect the PD measuring unit of the PD-TaD to the PoE cable (standard delivery) for power supply to the PD-TaD and for data transmission.
6	Σ < Imax 16A ports	Is used to connect the system components to the connection cables (standard delivery) for power supply. Max. total current: 16 A

3.4 HF filter

The HF filter is used to minimise external influences on the measurement results. The HF filter is supplied in the PD-TaD transport case.

3.5 Connection set in transport case



No.	Element	Function
1	VSE cables	Are used for detecting leakage currents during a dissipation factor measurement
2	Guard rings (conductible Velcro strips)	Used for the measurement setup for the dissipation factor measurement for detecting leakage currents
3	Distance pieces	Are used for fitting anti-corona hoods
4	HV connection terminal	Is used to connect the HV connection cable to the test object
5	Various fixtures and fittings	Used to lay and secure the connection cables
6	Anti-corona hoods	Used to protect against corona discharges
7	HV connection cables, length 0.7 m and 1.2 m	Are used to connect the PD-TaD to the test object
8	Calibrator CAL1B/CAL1E	Is used to calibrate the PD test circuit
9	Power Box	Is used for: ▪ Power supply for the system components ▪ Data transmission between the PD-TaD and the laptop
10	Connection cables	Are used to connect the system components and the power supply, and for data transmission between the system components Further information: Chapter *Connection cables* (on page 21)

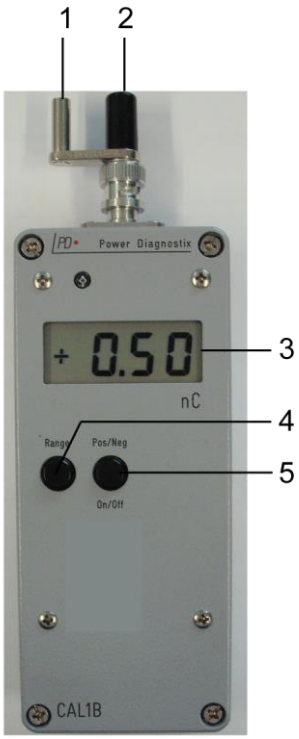
3.5.1 Calibrator

Before you can perform a partial discharge measurement, the test circuit must be calibrated to the following parameters:

- Charge (in nC)
- Cable length or speed of the PD pulses.

The delivered calibrator is connected to the test object for the calibration.

▸ For information on calibrating the PD measurement system, refer to the user manual for the BAUR software.



No.	Element	Function
1	Protective earthing port (metal port)	Is used to connect the protective earthing
2	Signal output (black port)	Is used for connection to the test object.
3	Display of selected charge in [nC]	
4	*Range*	Is used for setting the calibration charge Possible settings: ▪ CAL1B: 0.10, 0.20, 0.50, 1.00, 2.00, 5.00, 10.00 nC ▪ CAL1E: 0.50, 1.00, 2.00, 5.00, 10.00, 20.00, 50.00 nC

No.	Element	Function
5	*Pos/Neg*	▸ Press briefly to set the polarity of the signal.
	On/Off	▸ To switch on, press briefly. ▸ To switch off, press for approx. 3 seconds.

▸ Note that the calibrator must be removed from the test circuit before switching on the high voltage source.

Note: After some time, the calibrator automatically switches off to extend the battery life. If you have not yet completed the calibration, switch on the calibrator.

3.5.2 Connection cables

Figure	Cable	Length	Function
	Protective earthing cable Cross section: 16 mm²	1.5 m	Is used to connect the PD-TaD to the protective earthing
	HV connection cables (2 pcs)	0.7 m / 1.2 m	Are used to connect the PD-TaD to the test object
	Mains supply cord ▪ C19 – SCHUKO® ▪ C19 – N5/15 (USA)	2.5 m	Is used to connect the Power Box to the mains voltage (90 – 264 V, 47 – 63 Hz)
	Connection cable C5 – C14G	2.5 m	Is used for the power supply of the laptop via the Power Box
	Connection cable C13 – C14G	1.8 m	Is used for the power supply of the frida / frida TD via the Power Box
	Connection cable C19 – C20G	2.5 m	Is used for the power supply of the viola / viola TD via the Power Box

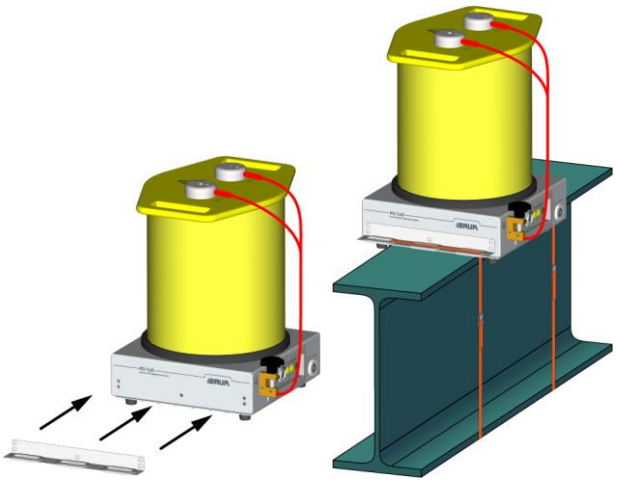
Figure	Cable	Length	Function
	PoE cable	10 m	Is used to supply power to the system and for data transmission
	Ethernet cable	3 m	Is used to transmit data between the PD-TaD and the laptop via the Power Box
	USB cable 3.0 Plug A on A	3 m	Is used to remotely control the VLF HV generator
For the PD testing:			
	Calibrator connection cables		Used to connect the calibrator to the PD test circuit
For the dissipation factor measurement:			
	TD cable	10 m	Is used for data transmission for dissipation factor and MWT measurements between the VLF HV generator and the PD-TaD
	VSE cables with 2 connection clips (2 pcs)	3 m	Are used to connect the PD-TaD for the dissipation factor measurement for detecting leakage currents ▪ Connection between far end of protective ring and adjoining de-energised phase as return line
	VSE cables with Ø 4 mm connector and a connection clip (2 pcs)	1.5 m	Are used to connect the PD-TaD for the dissipation factor measurement for detecting leakage currents ▪ Connection between PD-TaD and near end of protective ring ▪ Connection between PD-TaD and adjoining de-energised phase as return line at near end

Note: A mains supply cord for the laptop is supplied in the laptop bag.

- Only use this mains supply cord for charging the laptop and when working in the office. When taking measurements, attach the laptop to the power supply on the Power Box.

3.6 Mounting brackets

The mounting bracket is used to mount the PD-TaD on a cross beam or a similar supporting structure by means of tensioning straps. The mounting bracket is supplied in the PD-TaD transport case.



3.7 Power supply

The power supply for the entire system incl. the PD-TaD, laptop and VLF HV generator is centralised via the Power Box.

The Power Box is fitted with two fuses for max. current 16 A (T 16 AH).

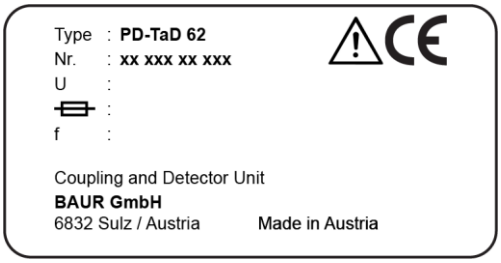
Device	Power supply
Power Box	90 – 264 V, 47 – 63 Hz
PD-TaD (PD measuring unit)	Via Power Box
VLF HV generator	Via Power Box
Laptop	Via Power Box

3.8 Markings on the PD-TaD

Safety markings

Location and type	Explanation
On the HV coupling unit: 	**Risk of electric shock** Once the measurements are complete, there may still be high voltage on the *HV IN* and *HV OUT* connectors, which could cause serious injury as a result of an electric shock if touched.

Rating plate



Element	Description
Type	System designation
Nr.	Serial number
U	Not applicable here
⎓	Not applicable here
f	Not applicable here
Coupling and Detector Unit	HV coupling unit with PD measuring unit
⚠	General warning sign Indicates that there is a potential risk of danger when using the product and hence the user manual must be observed
CE	CE mark Indicates that the device or system conforms to CE.
BAUR GmbH 6832 Sulz / Austria	Name and address of the manufacturer
Made in Austria	Indicates the country in which the device was manufactured. Austria: Austria

4 OPERATING THE PD-TAD

4.1 Switching off the system following faults or in emergencies

The system's emergency off button is located on the VLF HV generator.

- In the event of a fault or an emergency, immediately press the emergency off button.
  Pressing the emergency off button puts the system in the safe *Ready for operation* operating state.

4.2 Managing measurements

Measurements using the PD-TaD are configured and managed as follows:

Operating steps	Operating interface
Switching on, releasing and deactivating the high voltage	on the VLF HV generator
Configuring, starting and controlling the measurements	in the BAUR software on the laptop
Evaluating the measurement results	in the BAUR software on the laptop

5 CONNECTING THE SYSTEM

- Please consider the following provisions and guidelines when installing the testing system and operating the BAUR test and diagnostics systems:
  - Accident prevention and environmental protection regulations applicable for your country
  - Safety instructions and regulations of the country where the system is being used (according to the latest version)
  - EU/CENELEC countries: EN 50191 *Erection and operation of electrical test equipment*

    Other countries: The standard for erection and operation of electric test equipment applicable for your country
  - EU/CENELEC countries: EN 50110 *Operation of electrical installations*

    Other countries: The standards for operating electrical installations applicable in your country
  - If necessary, other national and international standards and guidelines in the latest applicable version
  - Local safety and accident prevention regulations
  - Employers' liability insurance association regulations (if any)
- Use the personal protective equipment for protection against electric shock and burning due to possible arcing faults in compliance with the local work safety and accident prevention regulations.

5.1 Specific safety instructions

⚠ WARNING

High electric voltage through potential increase

A fault can cause flashovers in the device. In this case, a potential increase of the housing is possible due to high short-circuit currents.

Danger due to the potential increase is reduced when a protective earthing is connected properly.

- Connect the protective earthing carefully. The protective earthing cable should be as short as possible and of low impedance.

⚠ WARNING

Danger due to electric voltage, flashovers at the connection point, or arcing fault on connection

Electric shock on touching live and active parts and due to residual charges and induction voltages;

Burns, electro-ophthalmia, and hearing damage.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Observe the isolating distances.
- Ensure that adjacent live parts are secured against accidental contact and flashovers with suitable covers (insulation mats, insulating safety plates).
- You may touch the parts that were under voltage only if they are visibly earthed and short-circuited.

5.2 Lifting and carrying the transport case

- To transport the transport cases containing the PD-TaD and accessories, pull the wheeled cases along.

  To extend the telescopic handle of the transport case, release the locking mechanism (1) and extend the telescopic handle (2).

- The transport cases and their contents weigh approx. 38.0 kg or 22.5 kg. Lifting or carrying the transport cases requires two people.

5.3 Checks to perform before commissioning

1. Check all system components and mechanical connections for damage.
2. Check electrical connections and connection cables for damage.

   Use only undamaged connection cables.

5.4 Ensuring there is no voltage at the work place

Before connecting the test object follow the 5 safety rules:

1. Disconnect the test object.
2. Secure against re-connection.
3. Verify absence of operating voltage.
4. Earth and short all phases.
5. Provide protection against adjacent live parts.

Note:

- If the **cable sheath is not earthed**, establish a short earth connection to the station earth. The station earth is the neutral point of the earth connections.
- The earthing conductor should be as short as possible and show low impedance. Use a copper **earthing conductor with a cross-section of min. 16 mm²**.

5.5 Preparing the test object terminals

The test object terminals are **the connection point and the far end** of the test object.

1. Disconnect all operating resources that are connected to the test object and are not designed for the stipulated test voltage.
2. Cordon off all metal parts, e.g. lighting masts at the test object terminals or insulate them with insulating safety plates.
3. Earth all metal parts at the terminals to avoid dangerous charging.
4. All cables that are used in danger zones can also carry high voltage potential outwards. Therefore, remove these cables from the danger zone or ensure low-resistive earthing and short-circuit.
5. Follow the cable route and ensure that no work is being carried out underground on gas lines and that there are no other danger points.

5.6 Setting up the system

- Place the PD-TaD as close to the test object as possible.
- Select the place of installation for the VLF HV generator in such a way that
  - a stable base is guaranteed,
  - the VLF HV generator is accessible for making connections and for operation, and
  - sufficient safety distances are maintained. You must comply with EN 50110 for the operation of electrical installations (EU/CENELEC countries) or the relevant standards applicable in your country.
- Set up the Power Box so that the PD-TaD, the VLF HV generator and the laptop can be connected to the Power Box.
- Set up the laptop so that you can work comfortably. You could place the laptop on a transport case, for example.

5.6.1 Securing the PD-TaD to the cross beam

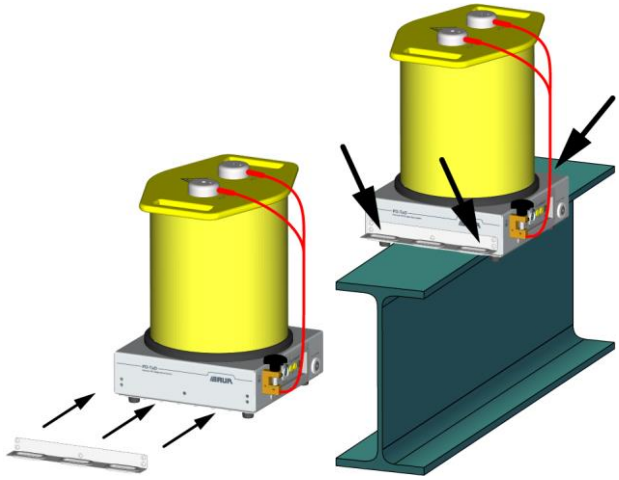
If the connection point is located on a pole, for example, it may be necessary to attach the PD-TaD to a cross beam or a comparable sub-structure.

Required equipment

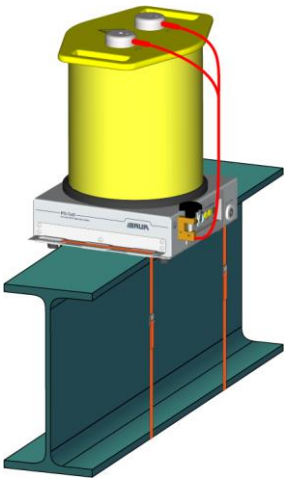
Offset screwdriver for Torx® screws, size TX 25 / 67 x 25 mm

Procedure

The following illustration shows an example for attaching the PD-TaD to a cross beam.



1. Loosen and remove the 5 screws on the underside of the PD-TaD.
2. Screw the mounting bracket to the PD-TaD using the 5 screws (see Fig.).
3. Repeat steps 1 to 2 on the opposite side of the PD-TaD.
4. Place the PD-TaD on the cross beam.
5. Guide the tension belts through the recesses in the mounting brackets and fasten the PD-TaD on both sides with the tension belts.
6. Tighten the tension belts and check the stability of the PD-TaD.
   Ensure that the tension lock is located below the device.



Note: The tension belts are not included in the standard delivery of the PD-TaD.

5.7 Points to note during connection

The following factors are crucial for precise measurement results:

- Short connections
- Protective earthing cable should be a flat copper strip (standard delivery)
- Keep the maximum possible distance between the connection cables and the adjacent parts that are not to be tested
- Keep the HV coupling unit of the PD-TaD and the terminations clean and dry
- No current loops in the power supply

5.8 Use of the anti-corona hoods

Corona discharges can arise at sharp edges of the test assembly. These can lead to a high noise level during the measurement. The anti-corona hoods protect sharp-edged parts, thereby eliminating the effect of corona discharges upon the measurement result. To achieve the most accurate measurement results possible, we recommend using the anti-corona hoods included in the standard delivery.

Example uses

Use of an anti-corona hood when connecting an HV connection cable with G-clamp to a spherical cable termination.

Use of two anti-corona hoods when connecting an HV connection cable with cable lug to a cable termination.

Direct connection of an HV connection cable with MC plug to a spherical cable termination without using anti-corona hoods.

5.9 Earth system

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

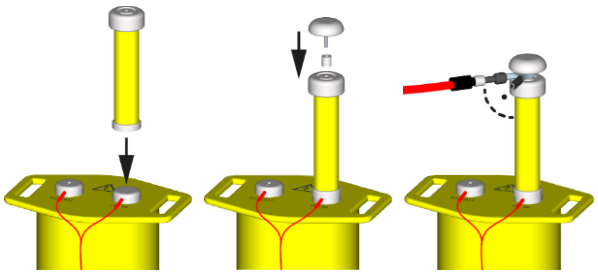
1. A 16 mm² protective earthing cable is included in the standard delivery of the PD-TaD. Use this cable to connect the protective earthing connection of the PD-TaD to the station earth (directly on the test object screen).

   Important: To keep the antenna effect to a minimum and thus prevent interference, the protective earthing cable must be a flat copper strip which is kept as short as possible.
2. Earth the VLF HV generator. Follow the user manual for the VLF HV generator in question.
3. A short-circuit cable is secured to the earth terminal on the PD-TaD. Connect this short-circuit cable to the *HV IN* and *HV OUT* ports.
4. If you are using a VLF HV generator with a 50 m long HV connection cable, connect the screen (operational earthing) of the HV connection cable to the *Screen (HV Cable)* port of the PD-TaD.

5.10 Connecting the HF filter to the PD-TaD

The HF filter is used to minimise external influences on the measurement results. We recommend using the HF filter for all PD tests.

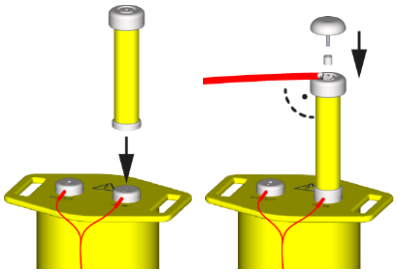
5.10.1 Connecting the HF filter und HV connection cable with connection clip



1. Screw the HF filter onto the *HV IN* port of the PD-TaD.
2. With a threaded bolt and distance piece, screw an anti-corona hood onto the HF filter.
3. Connect the HV connection cable from the VLF HV generator to the distance piece on the HF filter.

   Ensure that the HV connection cable leads away at a right angle to the HF filter.

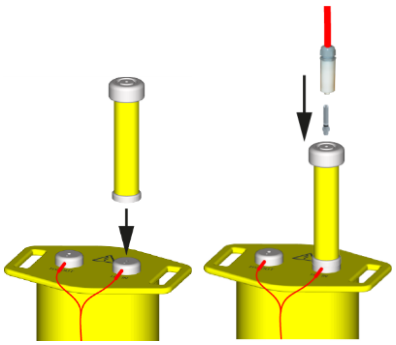
5.10.2 Connecting the HF filter und HV connection cable with cable lug



1. Screw the HF filter onto the *HV IN* port of the PD-TaD.
2. Remove the HV connection clip from the HV connection cable of the VLF HV generator.
3. Using a threaded bolt and distance piece, screw the cable lug of the HV connection cable and an anti-corona hood onto the HF filter.

   Ensure that the HV connection cable leads away at a right angle to the HF filter.

5.10.3 Connecting the HF filter und HV connection cable with MC plug



1. Screw the HF filter onto the *HV IN* port of the PD-TaD.
2. Screw the threaded pin (included in the standard delivery) to the HF filter.
3. Insert the MC plug-and-socket connection of the HV connection cable onto the threaded pin and screw it on tight.

5.11 Connecting the system for partial discharge testing

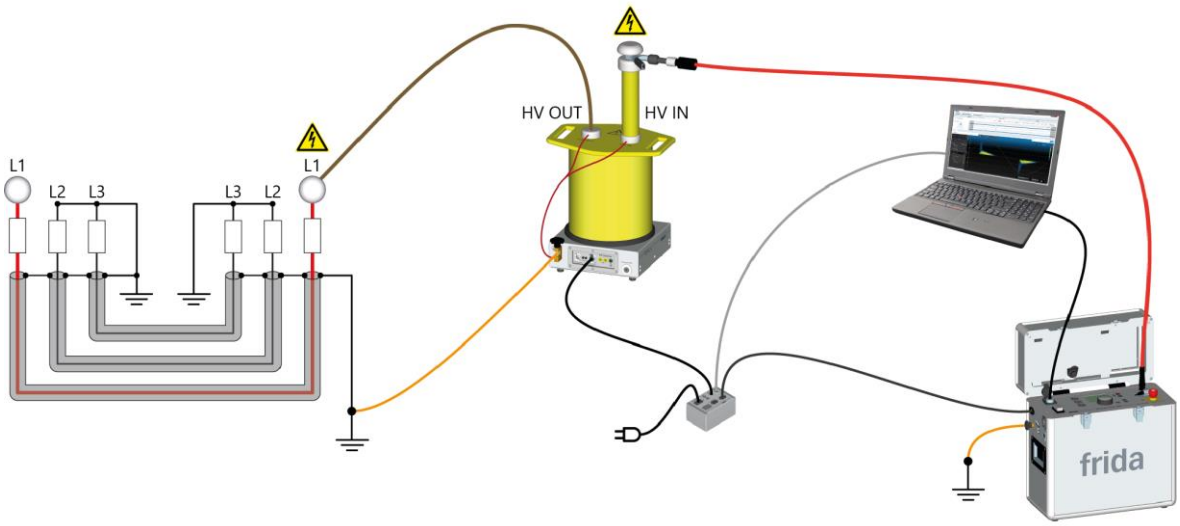
5.11.1 Connecting the system to the frida VLF HV generator

Required equipment

- PD-TaD incl. connection cables
- HF filter
- PoE cable
- Laptop incl. Ethernet and USB cable
- Anti-corona hoods

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

Procedure



Important:

- To keep the connection cable between the PD-TaD and the test object short, place the PD-TaD as close as possible to the test object.

  To avoid interference due to partial discharge at the connection point, make sure the PD-TaD is placed a sufficient distance away from metal and live parts.

  If the connection point is higher up, put the PD-TaD on a substructure. Further information: Chapter *Securing the PD-TaD to the cross beam* (on page 28)
- Keep all connections as short as possible.
- Lay out the connection cables in such a way that no loops are created.

No.	Cable	Step
1	–	Make sure that the connection point is de-energised. Further information: Chapter *Ensuring there is no voltage at the work place* (on page 28)
2	–	Make sure that the connection points and the far end are prepared for the measurement tasks. Further information: Chapter *Preparing the test object terminals* (on page 28)
3	–	Make sure that the HV coupling unit of the PD-TaD and the terminations of the test object are clean and dry. Further information: Chapter *Cleaning the PD-TaD and system components* (on page 66)
4	Protective earthing cable of the VLF HV generator	Earth the VLF HV generator. Further information: User manual for the respective VLF HV generator
5	Protective earthing cable of PD-TaD (flat copper strip)	Connect the PD-TaD to the station earth (close to the test object cable screen). Further information: Chapter *Earth system* (on page 31)
On the VLF HV generator:		
–	–	If present, connect the external emergency off unit to the VLF HV generator (⏻ port). If you are not using an external emergency off unit, ensure that a jumper plug is inserted into the ⏻ port on the VLF HV generator.
6	Connection cable C13 – C14G	Connect the VLF HV generator (mains supply) to the Power Box (port depends on the connection cable).
On the laptop:		
7	USB cable	For the remote control of the VLF HV generator: Use a USB cable to connect the laptop to the VLF HV generator.
8	Ethernet cable	Use the supplied Ethernet cable to connect the laptop to the Power Box (*Laptop* port).
–	–	If you do not want to run the laptop off its battery, connect the laptop to the Power Box to establish a power supply. To do so, use the connection cable with the C14G plug.
At the PD-TaD:		
9	PoE cable	Connect the PoE cable: ▪ to the Power Box (*PD Detector* port) and ▪ to PD-TaD (*Power Box* port) This is used for power supply and data transmission at the same time.
10	–	Connect the HF filter to the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)

No.	Cable	Step
11	HV connection cable of the VLF HV generator	Connect the HV connection cable to the HF filter at the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)
12	Short-circuit cable of PD-TaD	On the PD-TaD, remove the short-circuit cable from ports *HV IN* and *HV OUT*.
At the far end of the test object:		
13	–	Clean the cable termination of the phase to be tested carefully.
14	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
At the near end of the test object:		
15	–	Clean the cable termination of the phase to be tested carefully.
16	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
17	HV connection cable of PD-TaD	Connect the PD-TaD (*HV OUT* port) to the phase to be tested. To do this, select the shorter of the two supplied HV connection cables. Place the HV connection cable as far away as possible from the adjacent live and earthed parts.
At the near and far end of the test object:		
18	–	Remove the earthing and short-circuit connection from the phase to be tested. Make sure that the phases not being tested are earthed and short-circuited.

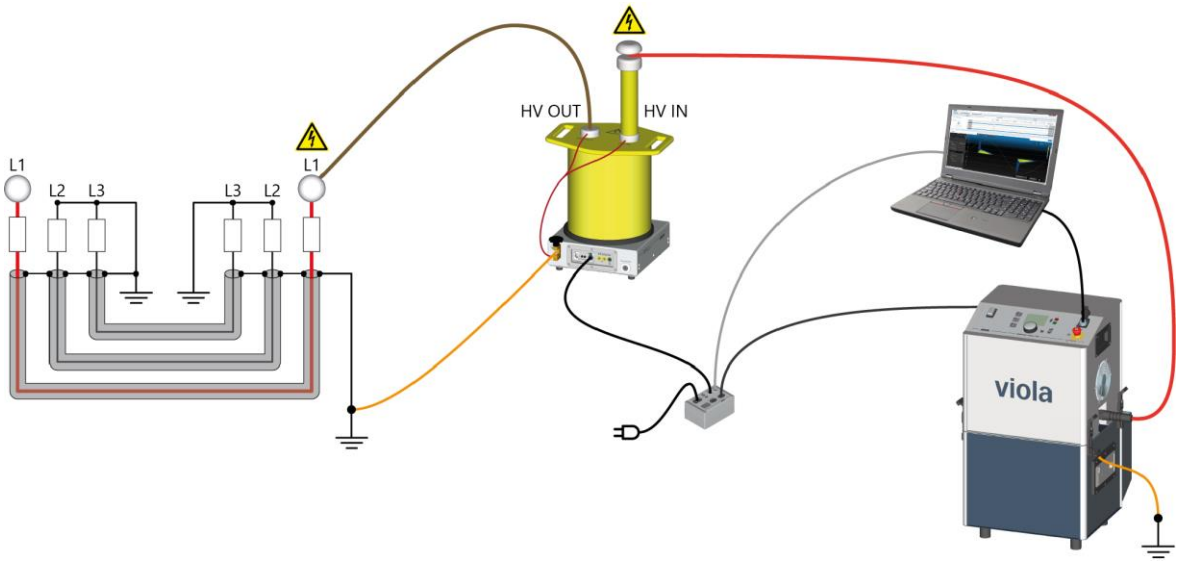
5.11.2 Connecting the system to the viola VLF HV generator

Required equipment

- PD-TaD incl. connection cables
- HF filter
- PoE cable
- Laptop incl. Ethernet and USB cable
- Anti-corona hoods

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

Procedure



Important:

- To keep the connection cable between the PD-TaD and the test object short, place the PD-TaD as close as possible to the test object.

  To avoid interference due to partial discharge at the connection point, make sure the PD-TaD is placed a sufficient distance away from metal and live parts.

  If the connection point is higher up, put the PD-TaD on a substructure. Further information: Chapter *Securing the PD-TaD to the cross beam* (on page 28)
- Keep all connections as short as possible.
- Lay out the connection cables in such a way that no loops are created.

No.	Cable	Step
1	–	Make sure that the connection point is de-energised. Further information: Chapter *Ensuring there is no voltage at the work place* (on page 28)
2	–	Make sure that the connection points and the far end are prepared for the measurement tasks. Further information: Chapter *Preparing the test object terminals* (on page 28)
3	–	Make sure that the HV coupling unit of the PD-TaD and the terminations of the test object are clean and dry. Further information: Chapter *Cleaning the PD-TaD and system components* (on page 66)
4	Protective earthing cable of the VLF HV generator	Earth the VLF HV generator. Further information: User manual for the respective VLF HV generator
5	Protective earthing cable of PD-TaD (flat copper strip)	Connect the PD-TaD to the station earth (close to the test object cable screen). Further information: Chapter *Earth system* (on page 31)
On the VLF HV generator:		
–	–	If present, connect the external emergency off unit to the VLF HV generator (⏚ port). If you are not using an external emergency off unit, ensure that a jumper plug is inserted into the ⏚ port on the VLF HV generator.
6	Connection cable C19 – C20G	Connect the VLF HV generator (mains supply) to the Power Box (port depends on the connection cable).
On the laptop:		
7	USB cable	For the remote control of the VLF HV generator: Use a USB cable to connect the laptop to the VLF HV generator.
8	Ethernet cable	Use the supplied Ethernet cable to connect the laptop to the Power Box (*Laptop* port).
–	–	If you do not want to run the laptop off its battery, connect the laptop to the Power Box to establish a power supply. To do so, use the connection cable with the C14G plug.
At the PD-TaD:		
9	PoE cable	Connect the PoE cable: ▪ to the Power Box (*PD Detector* port) and ▪ to PD-TaD (*Power Box* port) This is used for power supply and data transmission at the same time.
10	–	Connect the HF filter to the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)

No.	Cable	Step
11	HV connection cable of the VLF HV generator	Connect the HV connection cable to the HF filter at the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)
12	Short-circuit cable of PD-TaD	On the PD-TaD, remove the short-circuit cable from ports *HV IN* and *HV OUT*.
At the far end of the test object:		
13	–	Clean the cable termination of the phase to be tested carefully.
14	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
At the near end of the test object:		
15	–	Clean the cable termination of the phase to be tested carefully.
16	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
17	HV connection cable of PD-TaD	Connect the PD-TaD (*HV OUT* port) to the phase to be tested. To do this, select the shorter of the two supplied HV connection cables. Place the HV connection cable as far away as possible from the adjacent live and earthed parts.
At the near and far end of the test object:		
18	–	Remove the earthing and short-circuit connection from the phase to be tested. Make sure that the phases not being tested are earthed and short-circuited.

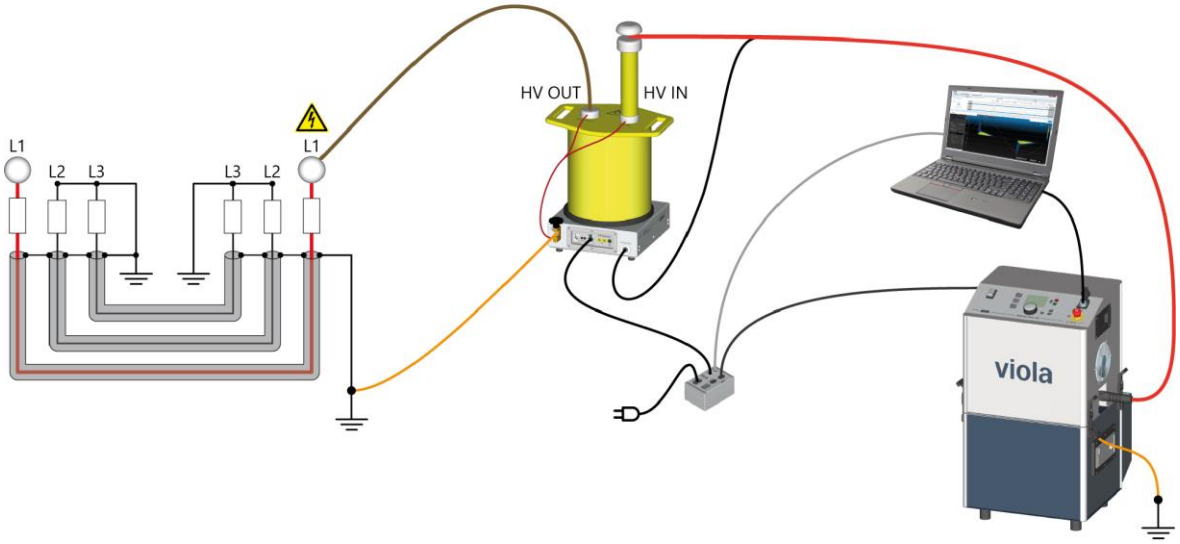
5.11.3 Connecting the system using an HV connection cable with operational earthing (option)

Required equipment

- PD-TaD incl. connection cables
- HF filter
- PoE cable
- Laptop incl. Ethernet and USB cable
- Anti-corona hoods

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

Procedure



Important:

- To keep the connection cable between the PD-TaD and the test object short, place the PD-TaD as close as possible to the test object.

  To avoid interference due to partial discharge at the connection point, make sure the PD-TaD is placed a sufficient distance away from metal and live parts.

  If the connection point is higher up, put the PD-TaD on a substructure. Further information: Chapter *Securing the PD-TaD to the cross beam* (on page 28)
- Keep all connections as short as possible.
- Lay out the connection cables in such a way that no loops are created.

No.	Cable	Step
1	–	Make sure that the connection point is de-energised. Further information: Chapter *Ensuring there is no voltage at the work place* (on page 28)
2	–	Make sure that the connection points and the far end are prepared for the measurement tasks. Further information: Chapter *Preparing the test object terminals* (on page 28)
3	–	Make sure that the HV coupling unit of the PD-TaD and the terminations of the test object are clean and dry. Further information: Chapter *Cleaning the PD-TaD and system components* (on page 66)
4	Protective earthing cable of the VLF HV generator	Earth the VLF HV generator. Further information: User manual for the respective VLF HV generator
5	Protective earthing cable of PD-TaD (flat copper strip)	Connect the PD-TaD to the station earth (close to the test object cable screen). Further information: Chapter *Earth system* (on page 31)
On the VLF HV generator:		
–	–	If present, connect the external emergency off unit to the VLF HV generator (⏚ port). If you are not using an external emergency off unit, ensure that a jumper plug is inserted into the ⏚ port on the VLF HV generator.
6	Connection cable C19 – C20G	Connect the VLF HV generator (mains supply) to the Power Box (port depends on the connection cable).
On the laptop:		
7	USB cable	For the remote control of the VLF HV generator: Use a USB cable to connect the laptop to the VLF HV generator.
8	Ethernet cable	Use the supplied Ethernet cable to connect the laptop to the Power Box (*Laptop* port).
–	–	If you do not want to run the laptop off its battery, connect the laptop to the Power Box to establish a power supply. To do so, use the connection cable with the C14G plug.
At the PD-TaD:		
9	PoE cable	Connect the PoE cable: ▪ to the Power Box (*PD Detector* port) and ▪ to PD-TaD (*Power Box* port) This is used for power supply and data transmission at the same time.
10	–	Connect the HF filter to the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)

No.	Cable	Step
11	HV connection cable of the VLF HV generator	Connect the screen of the HV connection cable to the *Screen (HV Cable)* port.
12	See above	Connect the HV connection cable to the HF filter at the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)
13	Short-circuit cable of PD-TaD	On the PD-TaD, remove the short-circuit cable from ports *HV IN* and *HV OUT*.
At the far end of the test object:		
14	–	Clean the cable termination of the phase to be tested carefully.
15	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
At the near end of the test object:		
16	–	Clean the cable termination of the phase to be tested carefully.
17	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
18	HV connection cable of PD-TaD	Connect the PD-TaD (*HV OUT* port) to the phase to be tested. To do this, select the shorter of the two supplied HV connection cables. Place the HV connection cable as far away as possible from the adjacent live and earthed parts.
At the near and far end of the test object:		
19	–	Remove the earthing and short-circuit connection from the phase to be tested. Make sure that the phases not being tested are earthed and short-circuited.

5.12 Connecting the system for parallel dissipation factor and partial discharge measurement or Full MWT

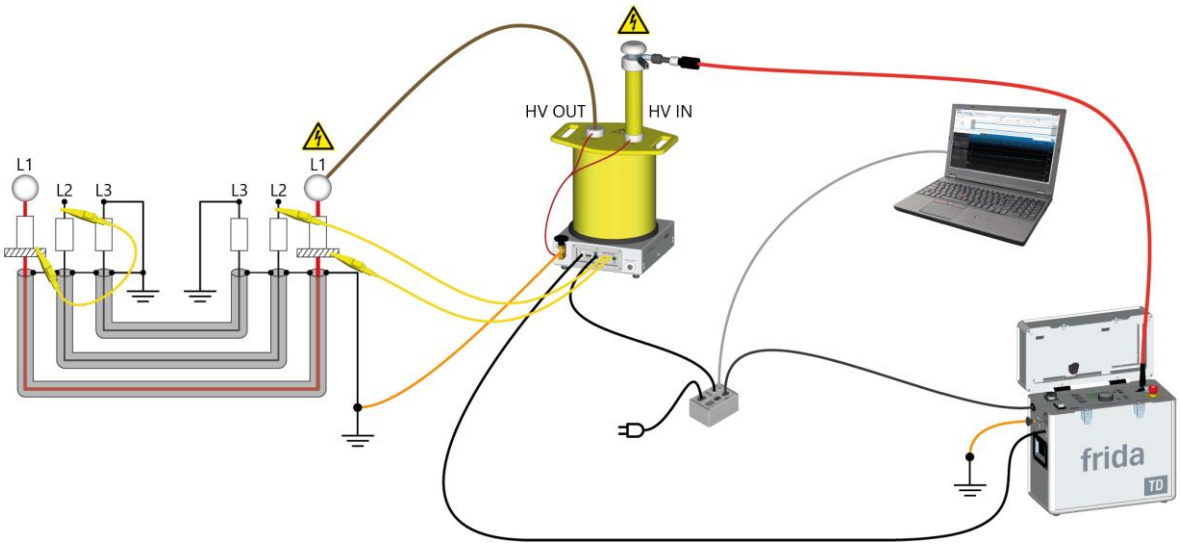
5.12.1 Connecting the system to the frida TD VLF HV generator

Required equipment

- PD-TaD incl. connection cables
- HF filter
- PoE cable
- TD cable
- VSE cable
- Protective rings (conductive hook and loop fastener tape)
- Laptop incl. Ethernet and USB cable
- Anti-corona hoods

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

Procedure



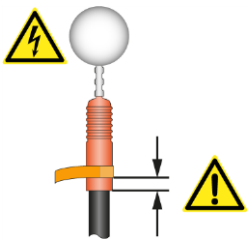
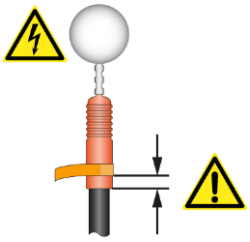
Important:

- To keep the connection cable between the PD-TaD and the test object short, place the PD-TaD as close as possible to the test object.

  To avoid interference due to partial discharge at the connection point, make sure the PD-TaD is placed a sufficient distance away from metal and live parts.

  If the connection point is higher up, put the PD-TaD on a substructure. Further information: Chapter *Securing the PD-TaD to the cross beam* (on page 28)
- Keep all connections as short as possible.
- Lay out the connection cables in such a way that no loops are created.

No.	Cable	Step
1	–	Make sure that the connection point is de-energised. Further information: Chapter *Ensuring there is no voltage at the work place* (on page 28)
2	–	Make sure that the connection points and the far end are prepared for the measurement tasks. Further information: Chapter *Preparing the test object terminals* (on page 28)
3	–	Make sure that the HV coupling unit of the PD-TaD and the terminations of the test object are clean and dry. Further information: Chapter *Cleaning the PD-TaD and system components* (on page 66)
4	Protective earthing cable of the VLF HV generator	Earth the VLF HV generator. Further information: User manual for the respective VLF HV generator
5	Protective earthing cable of PD-TaD (flat copper strip)	Connect the PD-TaD to the station earth (close to the test object cable screen). Further information: Chapter *Earth system* (on page 31)
On the VLF HV generator:		
–	–	If present, connect the external emergency off unit to the VLF HV generator (⏚ port). If you are not using an external emergency off unit, ensure that a jumper plug is inserted into the ⏚ port on the VLF HV generator.
6	Connection cable C13 – C14G	Connect the VLF HV generator (mains supply) to the Power Box (port depends on the connection cable).
On the laptop:		
7	Ethernet cable	Use the supplied Ethernet cable to connect the laptop to the Power Box (*Laptop* port).
–	–	If you do not want to run the laptop off its battery, connect the laptop to the Power Box to establish a power supply. To do so, use the connection cable with the C14G plug.
At the PD-TaD:		
8	PoE cable	Connect the PoE cable: ▪ to the Power Box (*PD Detector* port) and ▪ to PD-TaD (*Power Box* port) This is used for power supply and data transmission at the same time.
9	TD cable	Connect the TD cable: ▪ to the VLF HV generator (*PD Detector* port) and ▪ to PD-TaD (*VLF Generator* port).
10	–	Connect the HF filter to the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)

No.	Cable	Step
11	HV connection cable of the VLF HV generator	Connect the HV connection cable to the HF filter at the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)
12	Short-circuit cable of PD-TaD	On the PD-TaD, remove the short-circuit cable from ports *HV IN* and *HV OUT*.
At the far end of the test object:		
13	–	Clean the cable termination of the phase to be tested carefully.
14	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
15	Protective ring (conductive hook and loop fastener tape)	Attach a protective ring to the cable termination of the phase to be tested – directly over the screen. **Important:** Ensure that the protective ring does not come into contact with the screen. 
16	VSE cables with 2 connection clips (yellow)	Use the VSE cable to short-circuit the protective ring to a de-energised phase on which no measurement is to be taken. The de-energised phase is used as a return circuit for leakage currents from the far end.
At the near end of the test object:		
17	–	Clean the cable termination of the phase to be tested carefully.
18	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
19	Protective ring (conductive hook and loop fastener tape)	Attach a protective ring to the cable termination of the phase to be tested – directly over the screen. **Important:** Ensure that the protective ring does not come into contact with the screen. 

No.	Cable	Step
20	VSE cables with Ø 4 mm connector and a connection clip (yellow, 2x)	Connect a VSE cable to each of the *VSE* ports on the PD-TaD. From the *VSE* ports connect a VSE cable to: ▪ the protective ring of the phase to be tested. ▪ the de-energised phase that is used as a return circuit for leakage currents from the far end.
21	HV connection cable of PD-TaD	Connect the PD-TaD (*HV OUT* port) to the phase to be tested. To do this, select the shorter of the two supplied HV connection cables. Place the HV connection cable as far away as possible from the adjacent live and earthed parts.
At the near and far end of the test object:		
22	–	Remove the earthing and the short-circuit connection: ▪ on the phase to be tested. ▪ on the de-energised phase that is used as a return circuit for leakage currents from the far end Ensure that the phases that are not used for the measurement are earthed and shorted.

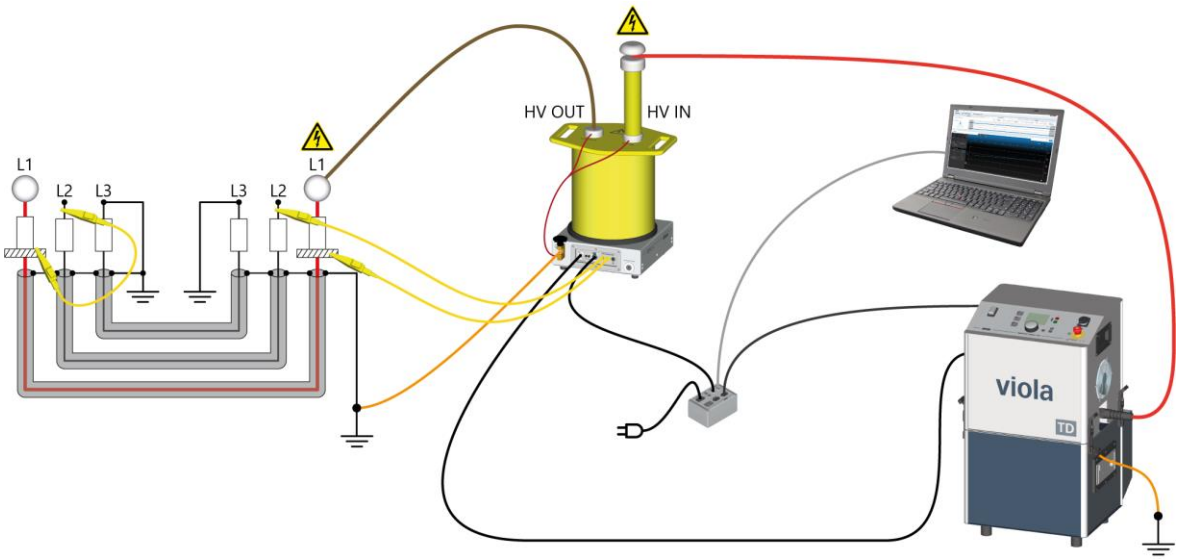
5.12.2 Connecting the system to the viola TD VLF HV generator

Required equipment

- PD-TaD incl. connection cables
- HF filter
- PoE cable
- TD cable
- VSE cable
- Protective rings (conductive hook and loop fastener tape)
- Laptop incl. Ethernet and USB cable
- Anti-corona hoods

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

Procedure



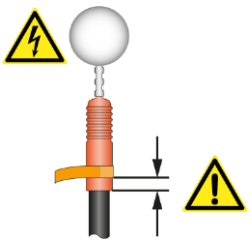
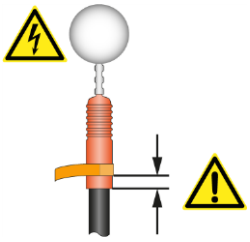
Important:

- To keep the connection cable between the PD-TaD and the test object short, place the PD-TaD as close as possible to the test object.

  To avoid interference due to partial discharge at the connection point, make sure the PD-TaD is placed a sufficient distance away from metal and live parts.

  If the connection point is higher up, put the PD-TaD on a substructure. Further information: Chapter *Securing the PD-TaD to the cross beam* (on page 28)
- Keep all connections as short as possible.
- Lay out the connection cables in such a way that no loops are created.

No.	Cable	Step
1	–	Make sure that the connection point is de-energised. Further information: Chapter *Ensuring there is no voltage at the work place* (on page 28)
2	–	Make sure that the connection points and the far end are prepared for the measurement tasks. Further information: Chapter *Preparing the test object terminals* (on page 28)
3	–	Make sure that the HV coupling unit of the PD-TaD and the terminations of the test object are clean and dry. Further information: Chapter *Cleaning the PD-TaD and system components* (on page 66)
4	Protective earthing cable of the VLF HV generator	Earth the VLF HV generator. Further information: User manual for the respective VLF HV generator
5	Protective earthing cable of PD-TaD (flat copper strip)	Connect the PD-TaD to the station earth (close to the test object cable screen). Further information: Chapter *Earth system* (on page 31)
On the VLF HV generator:		
–	–	If present, connect the external emergency off unit to the VLF HV generator (⏚ port). If you are not using an external emergency off unit, ensure that a jumper plug is inserted into the ⏚ port on the VLF HV generator.
6	Connection cable C13 – C14G	Connect the VLF HV generator (mains supply) to the Power Box (port depends on the connection cable).
On the laptop:		
7	Ethernet cable	Use the supplied Ethernet cable to connect the laptop to the Power Box (*Laptop* port).
–	–	If you do not want to run the laptop off its battery, connect the laptop to the Power Box to establish a power supply. To do so, use the connection cable with the C14G plug.
At the PD-TaD:		
8	PoE cable	Connect the PoE cable: ▪ to the Power Box (*PD Detector* port) and ▪ to PD-TaD (*Power Box* port) This is used for power supply and data transmission at the same time.
9	TD cable	Connect the TD cable: ▪ to the VLF HV generator (*PD Detector* port) and ▪ to PD-TaD (*VLF Generator* port).
10	–	Connect the HF filter to the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)

No.	Cable	Step
11	HV connection cable of the VLF HV generator	Connect the HV connection cable to the HF filter at the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)
12	Short-circuit cable of PD-TaD	On the PD-TaD, remove the short-circuit cable from ports *HV IN* and *HV OUT*.
At the far end of the test object:		
13	–	Clean the cable termination of the phase to be tested carefully.
14	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
15	Protective ring (conductive hook and loop fastener tape)	Attach a protective ring to the cable termination of the phase to be tested – directly over the screen. **Important:** Ensure that the protective ring does not come into contact with the screen. 
16	VSE cables with 2 connection clips (yellow)	Use the VSE cable to short-circuit the protective ring to a de-energised phase on which no measurement is to be taken. The de-energised phase is used as a return circuit for leakage currents from the far end.
At the near end of the test object:		
17	–	Clean the cable termination of the phase to be tested carefully.
18	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
19	Protective ring (conductive hook and loop fastener tape)	Attach a protective ring to the cable termination of the phase to be tested – directly over the screen. **Important:** Ensure that the protective ring does not come into contact with the screen. 

No.	Cable	Step
20	VSE cables with Ø 4 mm connector and a connection clip (yellow, 2x)	Connect a VSE cable to each of the *VSE* ports on the PD-TaD. From the *VSE* ports connect a VSE cable to: ▪ the protective ring of the phase to be tested. ▪ the de-energised phase that is used as a return circuit for leakage currents from the far end.
21	HV connection cable of PD-TaD	Connect the PD-TaD (*HV OUT* port) to the phase to be tested. To do this, select the shorter of the two supplied HV connection cables. Place the HV connection cable as far away as possible from the adjacent live and earthed parts.
At the near and far end of the test object:		
22	–	Remove the earthing and the short-circuit connection: ▪ on the phase to be tested. ▪ on the de-energised phase that is used as a return circuit for leakage currents from the far end Ensure that the phases that are not used for the measurement are earthed and shorted.

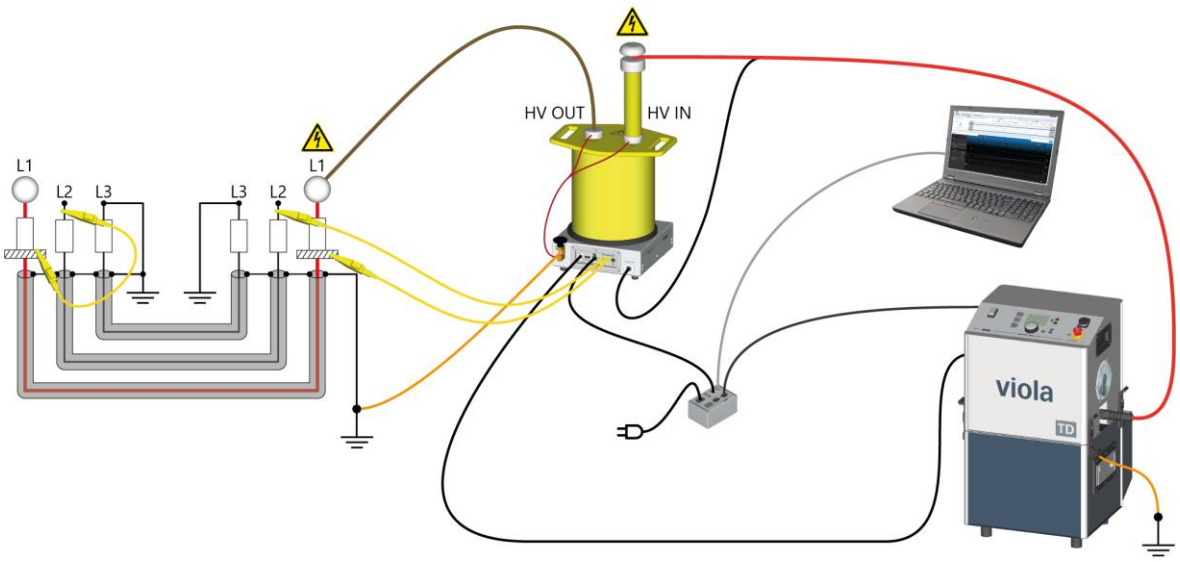
5.12.3 Connecting the system using an HV connection cable with operational earthing (option)

Required equipment

- PD-TaD incl. connection cables
- HF filter
- PoE cable
- TD cable
- VSE cable
- Protective rings (conductive hook and loop fastener tape)
- Laptop incl. Ethernet and USB cable
- Anti-corona hoods

Note: All the necessary connection cables and connecting elements are included in the standard delivery.

Procedure



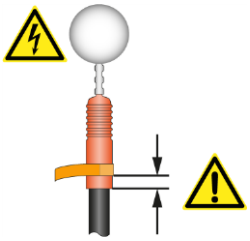
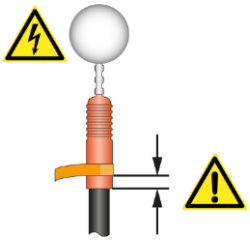
Important:

- To keep the connection cable between the PD-TaD and the test object short, place the PD-TaD as close as possible to the test object.

  To avoid interference due to partial discharge at the connection point, make sure the PD-TaD is placed a sufficient distance away from metal and live parts.

  If the connection point is higher up, put the PD-TaD on a substructure. Further information: Chapter *Securing the PD-TaD to the cross beam* (on page 28)
- Keep all connections as short as possible.
- Lay out the connection cables in such a way that no loops are created.

No.	Cable	Step
1	–	Make sure that the connection point is de-energised. Further information: Chapter *Ensuring there is no voltage at the work place* (on page 28)
2	–	Make sure that the connection points and the far end are prepared for the measurement tasks. Further information: Chapter *Preparing the test object terminals* (on page 28)
3	–	Make sure that the HV coupling unit of the PD-TaD and the terminations of the test object are clean and dry. Further information: Chapter *Cleaning the PD-TaD and system components* (on page 66)
4	Protective earthing cable of the VLF HV generator	Earth the VLF HV generator. Further information: User manual for the respective VLF HV generator
5	Protective earthing cable of PD-TaD (flat copper strip)	Connect the PD-TaD to the station earth (close to the test object cable screen). Further information: Chapter *Earth system* (on page 31)
On the VLF HV generator:		
–	–	If present, connect the external emergency off unit to the VLF HV generator (⏚ port). If you are not using an external emergency off unit, ensure that a jumper plug is inserted into the ⏚ port on the VLF HV generator.
6	Connection cable C13 – C14G	Connect the VLF HV generator (mains supply) to the Power Box (port depends on the connection cable).
On the laptop:		
7	Ethernet cable	Use the supplied Ethernet cable to connect the laptop to the Power Box (*Laptop* port).
–	–	If you do not want to run the laptop off its battery, connect the laptop to the Power Box to establish a power supply. To do so, use the connection cable with the C14G plug.
At the PD-TaD:		
8	PoE cable	Connect the PoE cable: ▪ to the Power Box (*PD Detector* port) and ▪ to PD-TaD (*Power Box* port) This is used for power supply and data transmission at the same time.
9	TD cable	Connect the TD cable: ▪ to the VLF HV generator (*PD Detector* port) and ▪ to PD-TaD (*VLF Generator* port).
10	–	Connect the HF filter to the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)

No.	Cable	Step
11	HV connection cable of the VLF HV generator	Connect the screen of the HV connection cable to the *Screen (HV Cable)* port.
12	See above	Connect the HV connection cable to the HF filter at the *HV IN* port. Further information: Chapter *Connecting the HF filter to the PD-TaD* (on page 31)
13	Short-circuit cable of PD-TaD	On the PD-TaD, remove the short-circuit cable from ports *HV IN* and *HV OUT*.
At the far end of the test object:		
14	–	Clean the cable termination of the phase to be tested carefully.
15	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
16	Protective ring (conductive hook and loop fastener tape)	Attach a protective ring to the cable termination of the phase to be tested – directly over the screen. **Important:** Ensure that the protective ring does not come into contact with the screen. 
17	VSE cables with 2 connection clips (yellow)	Use the VSE cable to short-circuit the protective ring to a de-energised phase on which no measurement is to be taken. The de-energised phase is used as a return circuit for leakage currents from the far end.
At the near end of the test object:		
18	–	Clean the cable termination of the phase to be tested carefully.
19	–	Attach the anti-corona hood to the termination of the phase to be tested. Further information: Chapter *Use of the anti-corona hoods* (on page 30)
20	Protective ring (conductive hook and loop fastener tape)	Attach a protective ring to the cable termination of the phase to be tested – directly over the screen. **Important:** Ensure that the protective ring does not come into contact with the screen. 

No.	Cable	Step
21	VSE cables with Ø 4 mm connector and a connection clip (yellow, 2x)	Connect a VSE cable to each of the *VSE* ports on the PD-TaD. From the *VSE* ports connect a VSE cable to: ▪ the protective ring of the phase to be tested. ▪ the de-energised phase that is used as a return circuit for leakage currents from the far end.
22	HV connection cable of PD-TaD	Connect the PD-TaD (*HV OUT* port) to the phase to be tested. To do this, select the shorter of the two supplied HV connection cables. Place the HV connection cable as far away as possible from the adjacent live and earthed parts.
At the near and far end of the test object:		
23	–	Remove the earthing and the short-circuit connection: ▪ on the phase to be tested. ▪ on the de-energised phase that is used as a return circuit for leakage currents from the far end Ensure that the phases that are not used for the measurement are earthed and shorted.

5.13 Connecting the system to the supply voltage

NOTICE

Too high or too low mains voltage

A low mains voltage adversely affects the function of the system, a high mains voltage can cause damage.

▸ Ensure that the supply voltage matches the specifications on the rating plate.

1. Measure the mains voltage with a voltmeter.
2. Compare the mains voltage with the specifications on the rating plate.
3. Make sure that the mains supply earth is not isolated from the station earth.

   ⚠ **CAUTION**

   High electric voltage through potential increase. Risk of personal injury due to electric shock. Damage to property due to potential differences from mains input to the housing.
4. Check whether the PD-TaD, VLF HV generator and, if the case may be, the laptop are connected to the Power Box to receive a power supply.
5. Connect the Power Box to the mains voltage.

   The green LED on the Power Box and the LEDs *PWR* and *PD* on the PD-TaD light up.

5.14 Securing the test area

1. Mark out the path for pedestrians.
2. Protect the test lead (connection cable), e.g. with cable bridges or rubber mats. The cables must be protected against damage and there must be no danger of people tripping.
3. If the connection creates a hazard for the testing personnel and pedestrians, mark them.
4. The area around the test assembly (test area) must be demarcated from workplaces and traffic in such a way that
   - *except for the tester, no other person can remain in the test area,*
   - *except for the tester, no other person can access the test area,*
   - *persons standing outside the boundary cannot reach the operating elements of the test installations located inside the boundary.* (EN 50191)

   The minimum height of individual boundaries must be 1 m.
5. If the system is cordoned off from general areas only with ropes, chains or bars, the entire test assembly must be monitored during the test in compliance with EN 50191. If the test assembly includes several local test areas, security guards must be appointed for each test area. But it is important that the testing personnel and the security guards understand each other well.
6. Mark the test area and terminals clearly. It must be very obvious that a cable test is in progress.
7. Make sure that unauthorised persons cannot access the local mains stations.

6 SWITCHING THE SYSTEM ON

1. Switch on the VLF HV generator with the main switch.
   The VLF HV generator switches to the *Ready for operation* operating state.
2. The PD measuring unit of the PD-TaD will be switched on automatically when supplied with power via the Power Box. Wait until all the LEDs on the PD-TaD display the ready for operation status.
   - *PWR* – green
   - *PD* – orange

3. Start the BAUR software 4 on the laptop.
   The Dashboard opens.
4. Hand over the control of the VLF HV generator to the BAUR Software 4.

▸ For information on commissioning and the operating states the VLF HV generator, refer to the user manual for the respective VLF HV generator.

7 CARRYING OUT THE MEASUREMENT

7.1 Performing partial discharge measurement

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Use ear protection.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.

- For information on operating the VLF HV generator, refer to the user manual for the VLF HV generator.
- For information on implementing the diagnostic methods, refer to the user manual for the BAUR Software 4.

1. Connect the system properly.
   Further information: Chapter *Connecting the system for partial discharge testing* (on page 33)
2. Secure the test area.
   Further information: Chapter *Securing the test area* (on page 54)
3. Switch on the system.
   Further information: Chapter *Switching the system on* (on page 55)
4. Carry out the partial discharge measurement in the BAUR Software 4.

7.2 Carrying out a parallel dissipation factor and partial discharge measurement

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Use ear protection.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.

- For information on operating the VLF HV generator, refer to the user manual for the VLF HV generator.
- For information on implementing the diagnostic methods, refer to the user manual for the BAUR Software 4.

1. Connect the system properly.
   Further information: Chapter *Connecting the system for parallel dissipation factor and partial discharge measurement or Full MWT* (on page 42)
2. Secure the test area.
   Further information: Chapter *Securing the test area* (on page 54)
3. Switch on the system.
   Further information: Chapter *Switching the system on* (on page 55)
4. Carry out the parallel dissipation factor and partial discharge measurement in the BAUR Software 4.

7.3 VLF cable testing with parallel partial discharge testing

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Use ear protection.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.

- For information on operating the VLF HV generator, refer to the user manual for the VLF HV generator.
- For information on implementing the diagnostic methods, refer to the user manual for the BAUR Software 4.
- For information on configuring and performing VLF cable tests with partial discharge measurement, contact your BAUR representative.

1. Connect the system properly.
   Further information: Chapter *Connecting the system for parallel dissipation factor and partial discharge measurement or Full MWT* (on page 42)
2. Secure the test area.
   Further information: Chapter *Securing the test area* (on page 54)
3. Switch on the system.
   Further information: Chapter *Switching the system on* (on page 55)
4. Carry out the VLF cable testing with partial discharge measurement in the BAUR Software 4.

7.4 Performing a Full MWT measurement

⚠ WARNING

Risk of arcing faults and noise that can damage hearing as a result of cable breakdown during testing.

Danger to life as a result of electric shock, burns, electro-ophthalmia, hearing damage.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Use ear protection.
- Keep a safe distance from the connection point of the test object according to the nominal voltage of the network.

- For information on operating the VLF HV generator, refer to the user manual for the VLF HV generator.
- For information on implementing the diagnostic methods, refer to the user manual for the BAUR Software 4.
- For information on configuring and performing full MWT measurements, contact your BAUR representative.

1. Connect the system properly.
   Further information: Chapter *Connecting the system for parallel dissipation factor and partial discharge measurement or Full MWT* (on page 42)
2. Secure the test area.
   Further information: Chapter *Securing the test area* (on page 54)
3. Switch on the system.
   Further information: Chapter *Switching the system on* (on page 55)
4. Carry out the full MWT measurement in the BAUR Software 4.

8 MEASUREMENT ON ANOTHER PHASE

DANGER

Dangerous voltage at test object and other live plant parts.

Danger to life or risk of injury due to electric shock.

- Before touching the test object, discharge, earth and short it: at the connection point and at the far end.
- You may touch the plant parts that were under voltage only if they are visibly earthed and short-circuited.

- For information on implementing the diagnostic methods, refer to the user manual for the BAUR Software 4.
- For information on the operation and operating states of the VLF HV generator, refer to the user manual for the respective VLF HV generator.

1. Make sure that the measurement is completed in the BAUR Software 4 and the VLF HV generator is in operating state *Ready to switch on*.
2. Deactivate the high voltage release on the VLF HV generator.
   The VLF HV generator switches to the *Ready for operation* operating state.
3. Discharge and earth the test object.
   Further information: Chapter *Discharging and earthing the test object* (on page 62)
4. Discharge and earth the *HV IN* and *HV OUT* ports of the PD-TaD using the discharge rod of the VLF HV generator (standard delivery of VLF HV generator).
5. Disconnect the phase that is connected to the system.
6. Connect the required phase to the system.
   Further information:
   - Chapter *Connecting the system for parallel dissipation factor and partial discharge measurement or Full MWT (on page 42)*
   - Chapter *Connecting the system for partial discharge testing* (on page 33)
7. Hand over the control of the VLF HV generator to the BAUR Software 4.
8. Carry out the measurement in the BAUR Software 4.

9 EVALUATING THE MEASUREMENT

- For information on evaluating the measurement, refer to the user manual for the BAUR Software 4.

10 DISCHARGING AND EARTHING THE TEST OBJECT

On completion of cable testing or measurement the test object still carries a dangerous voltage.

DANGER

Dangerous voltage in test object.

Danger of electric shock or risk of injury

- **Before touching, discharge, earth and short-circuit:** The test object at the connection point and at the far end.
- You may touch the plant parts that were under voltage only if they are visibly earthed and short-circuited.
- Connect the discharge and earth rod correctly to the station earth.
- Only use the discharge and earth rod if its surface is clean and dry.
- Hold the discharge and earth rod only at the handles!
- Observe the minimum discharge period in accordance with the capacitance of the test object.

10.1 Discharging

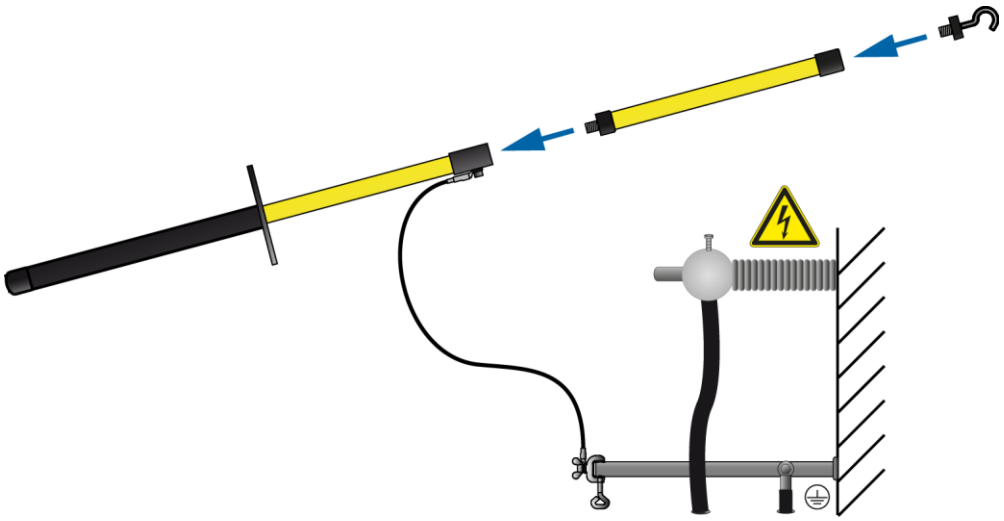
DANGER

Dangerous voltage in test object

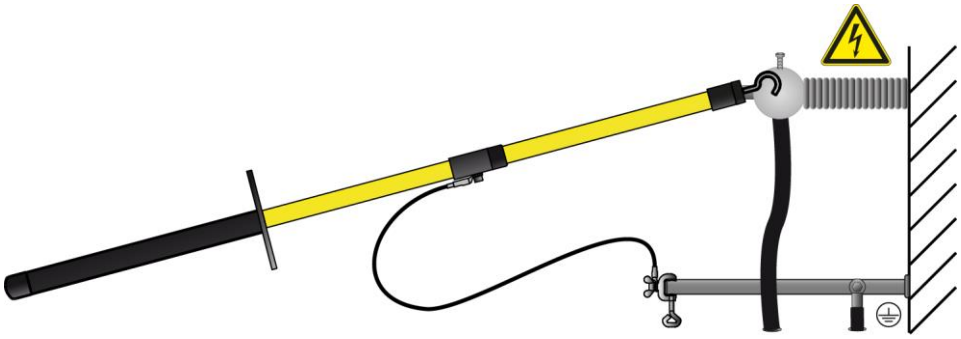
Danger to life or risk of injury due to electric shock or electric arcs.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Keep a distance of at least 50 cm from the protective earthing cable of the discharge and earth rod.

1. If not yet connected, connect the earth cable of the protective earthing cable of the discharge and earth rod to the station earth.
2. Assemble the discharge rod:
   a. Screw the hook onto the discharge part.
   b. Screw the discharge part onto the handle.



3. Use the black handle to hold the discharge and earth rod and make contact with the test object by touching it with the tip of the discharge and earth rod.



4. Observe the minimum discharge period in accordance with the capacitance of the test object.

10.2 Earthing

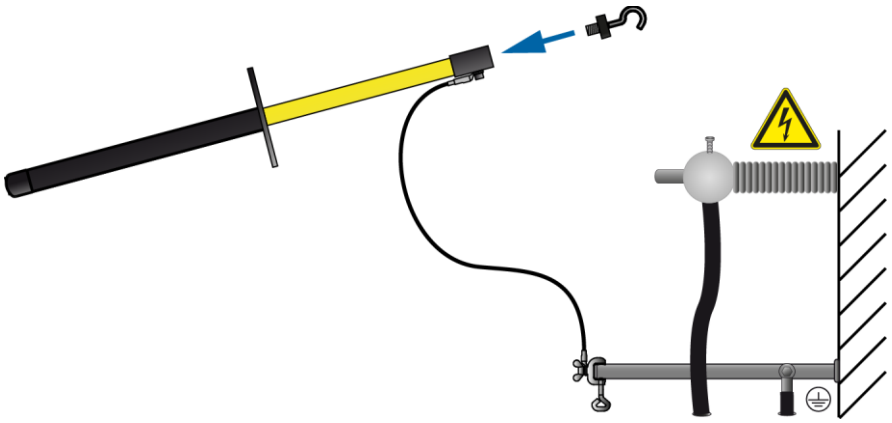
DANGER

Dangerous voltage in test object

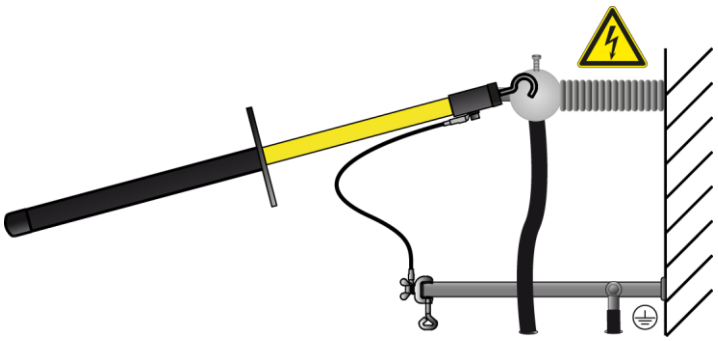
Danger to life or risk of injury due to electric shock or electric arcs.

- Use suitable personal protective equipment against electric shocks and arcing faults.
- Keep a distance of at least 50 cm from the protective earthing cable of the discharge and earth rod.

1. If not yet connected, connect the earth cable of the protective earthing cable of the discharge and earth rod to the station earth.
2. Assemble the earth rod: Screw the hook into the handle.



3. Contact the test object with the tip of the earth rod.



4. Immediately after earthing, connect the earthing and short-circuit equipment to the test object.

11 DECOMMISSIONING THE TEST INSTALLATIONS

⚠ WARNING

High electrical voltage

Electric shock on touching live and active parts and due to residual charges if earthing is removed too early

- Disconnect the earth connections as the last connection of the test assembly.
- Never disconnect the earth connections as long as power and other periphery connections are still connected.

NOTICE

Damage to devices due to improper use.

- Do not switch off the system under load.
- Before switching off, put the VLF HV generator in the *Ready for operation* operating state.

- For information on decommissioning and the operating states of the VLF HV generator, refer to the user manual for the respective VLF HV generator.

1. Switch off the VLF HV generator.
2. Disconnect the system completely from the mains voltage.
3. Disconnect the HV connection cables.
4. Establish a short-circuit connection on the PD-TaD between the HV connections *HV IN* and *HV OUT* and the protective earthing connection. Insert the short-circuit cable into the side sockets on the HV connections *HV IN* and *HV OUT* so that the short-circuit cable plugs are not pulled out during transportation.
5. Finally, disconnect the earth cable last.
6. If the cables are dirty, clean them and store them in the designated place.
7. If necessary, remove the cordoning.
8. Remove the earthing and the short-circuit on the test object only if no subsequent work is required and if the test object is to be put back into operation.
9. Remove the barriers and marking of the test area.

12 MAINTENANCE

12.1 Special maintenance instructions

NOTICE
Damage to device due to improper handling The user is liable for damages caused due to improper maintenance or care. ▸ Never take apart the device. This can lead to device damages. Inside the device there are no components that could be serviced or repaired by the user. ▸ Maintenance tasks must be carried out only by personnel trained and authorised by BAUR

NOTICE
The housing of the HV coupling unit is locked gas-proof and may not be opened. ▸ Do not dismantle the HV coupling unit. ▸ Do not screw any components onto the HV coupling unit. Opening the housing can damage the device.

▸

12.2 Cleaning the PD-TaD and system components

NOTICE
Damage to the device may be caused by using the wrong cleaning agents ▸ Do not use any abrasive, corrosive cleaning agents or strong solvents. ▸ Ensure material compatibility. ▸ Do not clean the product with acetone or thinner. ▸ Never clean electrical devices with water.

- Mild detergent for cleaning the surfaces of the device
- Lint-free cleaning cloth

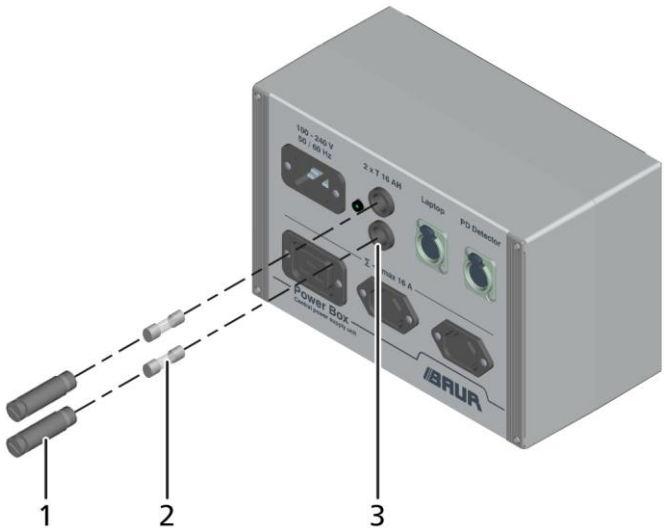
▸ Keep the ports and the surface of the HV coupling unit (PD-TaD) clean and dry.
Dirt and moisture will have a negative effect on the measurement results.
▸ Clean the device surfaces with mild detergent and a lint-free cloth on a regular basis.
▸ Clean the connection cables and terminations with mild detergent and a lint-free cloth.

12.3 Replacing the device protection fuses in the Power Box

Required equipment

- Flat-blade screwdriver 1.2 x 6.5 mm
- Device protection fuses: 2 x T 16 AH (250 V / 16 A time lag), rated breaking capacity 1500 A (H)

Procedure



1	Fuse cartridge
2	Fuse
3	Groove

1. Unscrew the fuse cartridge (1) from the groove (3).
2. Replace the fuse (2).
3. Screw the fuse cartridge (1) back into the groove (3).

12.4 Replacing the calibrator battery

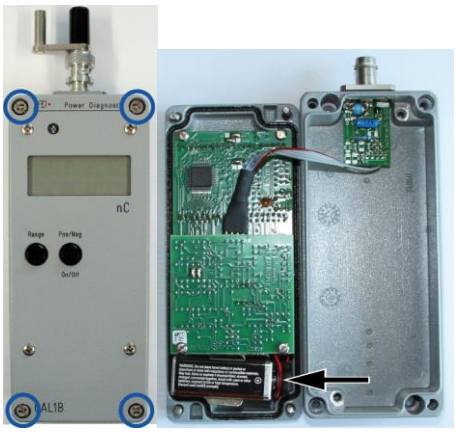
NOTICE
Material damage may be caused by the wrong polarity of the battery Wrong polarity of the battery can damage the electronics. ▸ When inserting batteries, pay attention to the polarity of the battery.

Required equipment

- Phillips screwdriver (size 2)
- Battery type: 9 V block battery, DIN/IEC 6F22

Procedure

1. Switch off the calibrator with the On/Off switch.
2. Loosen the screws in the corners on the front side of the housing and open the calibrator housing.



3. Remove the old batteries.
4. Insert new batteries.
5. Close the calibrator housing and screw it tight.
6. Dispose of the old batteries in compliance with the local regulations.

12.5 Accessories and spare parts

- Only use accessories and original spare parts recommended by BAUR.
- Only use the supplied connection cables or cable of the same specification.
  PoE cable: If it is necessary to replace the PoE cable for connecting the Power Box and the PD-TaD, use a standard commercially available Ethernet cable of category 5.
- Order accessories and spare parts from your nearest BAUR representative (http://www.baur.eu/baur-worldwide).

13 FAULTS AND CORRECTIVE MEASURES

NOTICE
Damage to device due to improper handling The user is liable for damages caused due to repairs. ▸ Never take apart the device. This can lead to device damages. Inside the device there are no components that could be serviced or repaired by the user. ▸ Repairs must be carried out only by personnel trained and authorised by BAUR

13.1 Malfunction and error messages

When a fault or an error message occurs on the VLF HV generator or the BAUR Software 4, proceed as follows:

1. Check the supply voltage, the connection cables and earth cable.
2. Check that the fuses in the Power Box are OK.
   Further information: Chapter *Power Box* (on page 18)
3. Check whether the PD-TaD or the VLF HV generator are in the required operating state.
4. Restart the laptop.
   Start the BAUR Software 4 and check whether the fault persists.
5. If the fault occurs again, write down the error text and the procedure that caused the error to occur.
6. Put the system out of operation and mark it accordingly.
7. Contact your nearest BAUR representative (http://www.baur.eu/baur-worldwide).

Further information on the error messages and operating states of the VLF HV generator and BAUR Software 4 can be found:

- in the user manual for the respective VLF HV generator
- in the user manual for the BAUR Software 4

14 TRANSPORTATION AND STORAGE

14.1 Transportation

During transportation, or if you send PD-TaD system components to BAUR GmbH, a BAUR representative or the Technical Service department for repair or for any other reason, please follow the instructions below:

NOTICE! Damage to device due to improper transportation.

- When transporting the PD-TaD system components, always use the transport cases provided for this purpose.
- During transportation, comply with the ambient conditions specified in the technical data of the product.

  Further information: Chapter *Data sheet* (on page 80)
- To prevent the short-circuit cable plug from being pulled out during transportation, ensure that the short-circuit cable is inserted into the HV connections *HV IN* and *HV OUT* in the side.
- Protect all PD-TaD system components against strong vibrations.
- Protect all PD-TaD system components against moisture.
- To transport the transport cases containing the PD-TaD and accessories, pull the wheeled cases along.

  To extend the telescopic handle of the transport case, release the locking mechanism (1) and extend the telescopic handle (2).

- The transport cases and their contents weigh approx. 38.0 kg or 22.5 kg.

  Lifting or carrying the transport cases requires two people.

14.2 Storage

- Only store the system components in the intended transport cases with closed lids.
- During storage, comply with the ambient conditions specified in the technical data of the product.

  Further information: Chapter *Data sheet* (on page 80)
- Protect the system and components from moisture.
- Protect the system against unauthorised access.

15 WARRANTY AND AFTER SALES

Warranty

For warranty claims, please contact BAUR GmbH or your local BAUR representative.
Warranty is cancelled in case of misuse.

After Sales

For questions contact BAUR GmbH or your BAUR representative.

BAUR GmbH

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16 DISPOSAL

The final decommissioning and disposal of the system must be carried out only in compliance with country-specific laws, regulations and standards.

System components do not belong in the domestic waste.

- Dispose of electrical system components in accordance with the applicable national regulations.
- Dispose of the various system components in an environmentally friendly manner and in accordance with the applicable national regulations.

17 DECLARATION OF CONFORMITY

We

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https://www.baur.eu

declare, under our sole responsibility, that the BAUR product

BAUR Portable PD diagnostics system PD-TaD 62 with Power Box

to which this declaration refers, conforms to the following standards or standard documents:

- Low Voltage Directive 2014/35/EC
  EN 61010-1:2010
  EN 61010-2-030:2010
  EN 50191:2010
- EMC Directive 2014/30/EU
  EN 55011:2009 + A1:2010
  EN 61000-3-2:2014
  EN 61000-4-2:2009
  EN 61000-4-4:2012
  EN 61000-4-5:2014
  EN 61000-4-11:2004
- Environmental testing
  EN 60068-2-ff

Signed: Dr. Markus Baur, CEO

Sulz, 19/06/2018

18 GLOSSARY

Anti-corona hoods

Anti-corona hoods are used to protect against corona discharges at the terminations.

Connection point (near end)

The connection point or the near end represents the end point of the test object to which the PD-TaD is connected.

Dissipation factor, dielectric dissipation factor

Abbreviation: tan δ

Tangent of the dissipation angle - amount of the ratio between the ideal capacitive current and the real total current. The difference between these two values is determined by the ohmic dissipation current and various different polarisation mechanisms.

The greater the dissipation angle is, the higher the dielectric dissipation is.

Far end

The far end represents the end point of the test object opposite the connection point.

Full MWT

Full MWT is a combination of VLF cable testing, PD and dissipation factor measurement.

While cable testing shows whether a cable system can withstand a load over a specified test time, the PD test identifies and locates the PD activities in the cable insulation. The dissipation factor measurement evaluates the condition of the cable and allows conclusions as to ageing or any latent damage.

It is also easier to detect hidden faults (e.g. moist joints) through conditioning of weak points and simultaneously monitor dissipation factor values and PD activities.

The cable is not damaged due to the reduced measuring time thanks to the combination of various methods.

Near end (connection point)

The connection point or the near end represents the end point of the test object to which the PD-TaD is connected.

Parallel PD and dissipation factor measurement

This method combines the statements of a PD test and a dissipation factor measurement.

While the PD test identifies and pinpoints PD activities in the cable insulation, the dissipation factor measurement evaluates the condition of the cable and allows conclusions as to ageing or any latent damage.

It is also easier to detect hidden faults (e.g. moist joints) by conditioning weak points and simultaneously monitoring dissipation factor measurement values and PD activities.

The cable is not damaged due to the simultaneous PD and dissipation factor measurement and thus the reduced test time.

Partial discharge (PD)

Electrical discharge that only partially bridges the insulation between conductors (see International Electrical Dictionary of IEC).

Partial discharge measurement

The PD test identifies and pinpoints PD activities in the cable insulation.

Power over Ethernet (PoE)

Power over Ethernet (PoE) is a process by which network-enabled devices can be supplied with power via the Ethernet cable.

System

All of the technical components that are connected to one another and related to one another and which are regarded as a single unit with regard to their function.

VLF cable testing with parallel PD test

This method combines the statements of a PD test and VLF cable testing.

While the cable test shows whether a cable can withstand a load (e.g. 2x Uo) over a specified test time, the PD test identifies and locates the PD activities in the cable insulation.

The simultaneous performance of VLF cable testing and the PD test reduces the test time for cables that are in good condition.

19 INDEX

W

PD-TaD 62, PD-TaD 80

BAUR portable PD diagnostics system

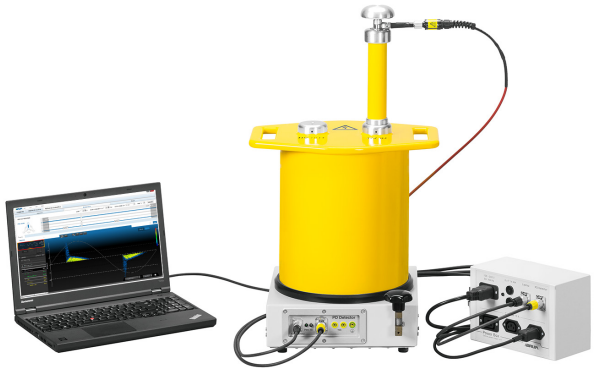

Figure: PD-TaD 62 with laptop and Power Box

A new dimension in cable condition evaluation

- Better decisions based on a comprehensive condition evaluation of the cable network
- Saves time on site thanks to automated sequences and report generation
- Suitable for mobile use or system integration

The PD-TaD portable PD diagnostics system is used in combination with a BAUR VLF HV generator to perform partial discharge measurement and location.

When the VLF HV generator is equipped with a dissipation factor measurement function, two effective and proven methods for evaluating the ageing condition of medium-voltage cables and cable accessories, namely PD measurement and dissipation factor measurement, can be combined. The result is a one-step cable analysis with early detection and location of weak points through PD measurement, in addition to the assessment of dielectric ageing based on the dissipation factor values.

The ability to perform PD and dissipation factor measurements simultaneously saves a lot of time and leads to increased efficiency during inspection of the entire cable network. The simultaneous analysis of dissipation factor values and PD activities also helps detect hidden fault locations (e.g. moist joints).

Light, robust, and portable: the PD-TaD 62 is ideal for mobile use in the field. The PD-TaD 80 is particularly suitable for integration in cable test vans.

- **PD measurements up to 44 kV_{rms} or 57 kV_{rms}**
- **Excellent precision thanks to high coupling capacitance and sensitivity (≤ 1 pC)**
- **Light and compact**

Functions

- PD measurement and calibration of the PD measuring system according to IEC 60270
- Location of PD activities in cable insulation, joints, and terminations
- Measurement of
  - PD level and frequency
  - PD inception and extinction voltages
  - PD phase resolving for classification of PD fault locations
- Parallel dissipation factor and PD measurement*
- Cable testing with parallel PD measurement
- Cable testing with parallel dissipation factor measurement*
- Full Monitored Withstand Test*

Features

- Coupling capacitor incl. measurement impedance and PD measuring unit in one device
- Integrated filter for suppressing noise signals
- Stable data transmission and power supply via Power over Ethernet (PoE); no batteries needed
- Excellent noise suppression due to
  - compact design
  - galvanic isolation between PD measuring unit and laptop
  - central power supply
- Easy test assembly: identical test assembly for PD and dissipation factor measurement
- Integrated device for detecting leakage currents for dissipation factor measurement
- Intuitive user interface in multiple languages adapted to the work flow

* A VLF HV generator with dissipation factor measurement function is required

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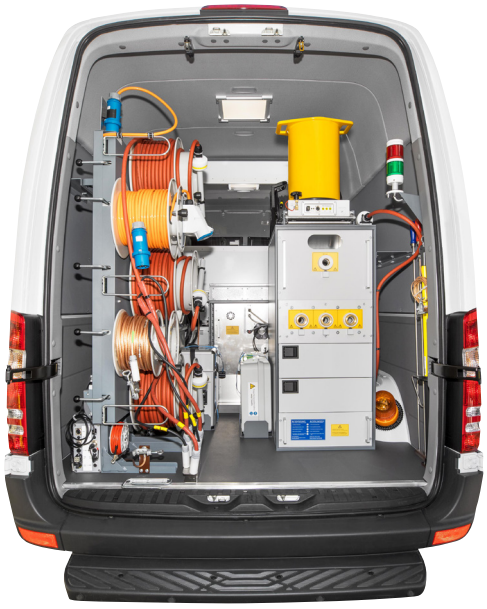
PD-TaD 62, PD-TaD 80

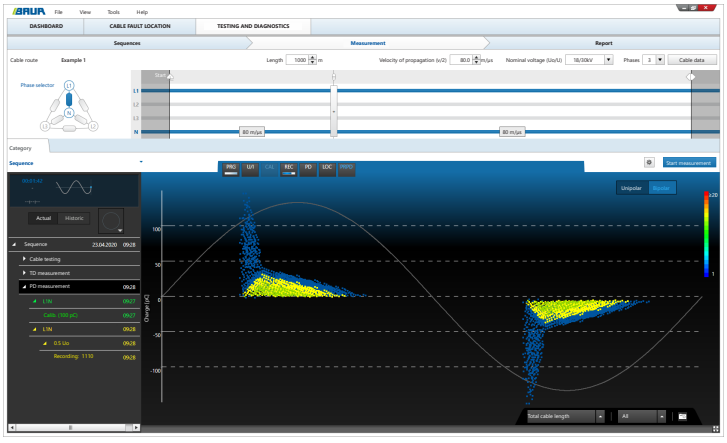
Available methods and combinations of methods

Method	Significance and benefits	Additional equipment
PD measurement	▪ Diagnostics of local weak points ▪ Location of faults in the cable insulation	BAUR VLF HV generator
Parallel dissipation factor and PD measurement	▪ Combination of statements of a dissipation factor measurement and PD measurement ▪ Shorter measuring time with simultaneous dissipation factor and PD measurement ▪ Better detection of hidden fault locations (e.g. moist joints) and simultaneous analysis of dissipation factor values and PD activities	BAUR VLF HV generator with dissipation factor measurement function
Cable testing with parallel PD measurement	▪ Intelligent cable testing ▪ Diagnostics of local weak points ▪ Location of faults in the cable insulation	BAUR VLF HV generator
Cable testing with parallel dissipation factor measurement	▪ Intelligent cable testing ▪ Assessment of the dielectric condition of the insulation ▪ Indication of PD, water trees, moisture in joints, etc.	BAUR VLF HV generator with dissipation factor measurement function
Full MWT	▪ Combination of statements of a dissipation factor measurement and PD measurement ▪ Shorter measuring time with simultaneous dissipation factor and PD measurement ▪ Intelligent cable testing ▪ Better detection of hidden fault locations (e.g. moist joints) and simultaneous analysis of dissipation factor values and PD activities	BAUR VLF HV generator with dissipation factor measurement function

Prerequisite: Availability of the corresponding software functions of the BAUR Software 4.



Example of integration in a cable test van



Example: PD measurement – phase-resolved PD presentation (PRPD)

Technical data

Partial discharge location	
Theoretical measurement range	10 – 12,800 m (at v/2 = 80 m/µs)
Velocity of propagation	50 – 120 m/µs
Sampling rate	100 MSamples/s (10 ns)
PD measurement range	1 pC – 100 nC
Accuracy	Approx. 1% of cable length
Resolution	0.1 pC / 0.1 m
Calibrator	
Electrical charge (pulses)	
CAL1B	0.1 / 0.2 / 0.5 / 1 / 2 / 5 / 10 nC
CAL1E	0.5 / 1 / 2 / 5 / 10 / 20 / 50 nC
Power supply	9 V block battery, DIN/IEC 6F22

Power Box	
Input voltage	90 – 264 V, 47 – 63 Hz
Power consumption	Max. 3500 VA
Max. current	16 A
PD-TaD interface	Ethernet (PoE)
Dimensions (W x H x D)	160 x 120 x 240 mm
Weight	Approx. 1.7 kg
BAUR Software 4	
Information about the BAUR Software 4 and the system requirements can be found in the data sheet for BAUR Software 4 cable testing and diagnostics.	

General	PD-TaD 62	PD-TaD 80
HV coupling unit:		
Input voltage	44 kV_{rms} / 62 kV_{peak}	57 kV_{rms} / 80 kV_{peak}
Capacitance of coupling capacitor	10 nF	8 nF
PD measuring unit:		
Power supply and data transmission	Via Power Box (Power over Ethernet)	Via Power Box (Power over Ethernet)
Signal gain	0 – 75 dB	0 – 75 dB
Ambient temperature (operational)	-10°C to +50°C	-10°C to +50°C
Storage temperature	-20°C to +60°C	-20°C to +60°C
Rel. humidity	Non-condensing	Non-condensing
Dimensions (W x H x D)	410 x 463 x 369 mm	410 x 593 x 369 mm
Incl. HF filter	410 x 668 x 369 mm	410 x 798 x 369 mm
Transport case 1	800 x 581 x 482 mm	800 x 581 x 482 mm
Transport case 2 (accessories)	627 x 497 x 303 mm	627 x 497 x 303 mm
Weight	Approx. 17 kg	Approx. 21 kg
Incl. HF filter	Approx. 17.5 kg	Approx. 21.5 kg
Transport case 1	Approx. 38 kg	Approx. 42 kg
Transport case 2 (accessories)	Approx. 22.5 kg	Approx. 22.5 kg
Degree of protection	IP54	IP54
Safety and EMC	CE-compliant in accordance with Low Voltage Directive (2014/35/EU), EMC Directive (2014/30/EU), EN 60068-2-ff Environmental testing	

Standard delivery

PD-TaD 62 or PD-TaD 80 portable PD diagnostics system

- Transport case 1
  - HV coupling unit with integrated PD measuring unit
  - HF filter
  - Mounting brackets
- Transport case 2
  - Power Box
  - CAL1B or CAL1E calibrator
  - HV connection set incl. adapters
  - Connection cable set
  - User manuals
- Laptop incl.
  - pre-installed Windows operating system
  - pre-installed BAUR Software 4 (cable testing, PD measurement)
  - Carrying bag

Accessories and options

- CAL1B calibrator
- CAL1E calibrator
- BAUR Software 4 for office PC (office installation)

Optional software functions

- Mapping (available countries on request)
- GIS interface
- TD measurement (dissipation factor measurement)
- TD || PD measurement (parallel dissipation factor and partial discharge measurement)

A VLF HV generator with dissipation factor measurement function is required for dissipation factor measurements.

Information on individual functions and the required system configuration can be obtained from your BAUR representative.

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