

Operation and maintenance

Megger[®]

PRIMEON

Compact, single-phase test van system



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1 Safety and general information

1.1 General Notes

About this manual

This manual contains basic information about commissioning and operating the device / system. Therefore, it must be ensured that this manual is accessible to authorised and trained operating personnel at all times. The operating personnel must read the manual carefully.

The manufacturer will not accept liability for any damage to persons or materials caused by a failure to observe the safety instructions contained in this manual.

Keep this manual for future reference until the product is disposed of.

National standards and regulations must be observed.

Working with products from Megger

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

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

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

Operating personnel

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

Other persons must be kept away.

Electromagnetic radiation

This device is designed for industrial use. When used at home it could cause interference to other equipment, such as the radio or television.

The interference level from the line complies with the limit curve B (living area), the radiation level complies with the limit curve A (industrial area) according to EN 55011. Once the living area is sufficiently far away from the planned area of operation (industrial area), equipment there will not be impaired.

Signal words and symbols used

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

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

Terms used

The following terms are used in this manual in a way that differs from general usage:

Term	Description
EMERGENCY OFF	<p>In this manual, EMERGENCY OFF refers to an emergency shutdown. This means that any high-voltage operation is automatically interrupted and the measuring circuit is discharged. The power supply to the measuring system is also interrupted. However, the sockets in the control area are still live.</p> <p>To de-energise the entire test van, the connection to the mains connection system NAS 16-230-PRIMEON must be disconnected.</p> <hr/> <div style="display: flex; align-items: flex-start;">  <div> <p>WARNING</p> <p>Risk of electric shock</p> <p>When using a battery power kit or a generator, the test van remains energised even after disconnection from the mains connection system!</p> </div> </div> <hr/>

Disposal

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

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

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



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

Important information about disposing of damaged Li-ion batteries

Damaged Li-ion batteries must not be shipped or reused. They pose a safety risk and must therefore be disposed of properly and immediately. Please comply with applicable local disposal regulations and dispose of damaged batteries at a designated collection point or an authorised disposal company. Never dispose of batteries in normal household waste.

1.2 General Safety Instructions and Warnings

Intended use

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

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

Reasonably foreseeable misuse

Any use of the supplied cable test van and the associated devices outside the limits of use described in this and the associated manuals is considered misuse.

Sockets with control LED are only live when the measuring system is operational.

For test vans with the BPwrK-4 equipment option, it is strictly prohibited to place heat sources, such as fan heaters, near the battery power kit.

The Battery Power Kit housing must not be used to store objects or to be covered / blocked by them. The perforated side panels of the housing must be kept at least 50 mm away from other objects.

Operation in traffic environment

To ensure safety for operators and traffic, the country-specific regulations must be observed.

Behaviour in the event of faults during normal operation

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

Five safety rules

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

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



Persons with pacemakers/defibrillators

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



Fire fighting in the vicinity of electrical equipment

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



WARNING

Dangers when handling high voltage

Working on high voltage systems and equipment - especially in non-stationary operation - requires particular care and safety-conscious action on the part of operating personnel. VDE regulations 0104 on setting up and operating electrical test systems, as well as EN 50191 and national standards and regulations must be strictly adhered to.

- The PRIMEON generates a dangerous voltage up to 62 kV during the measuring operation. This is fed into the test object via the HV connection cable.
- The test system may not be operated without supervision.
- Safety devices must not be bypassed or disabled.
- Operation requires minimum two people whereas the second person must be able to activate the emergency switch in case of danger.
- To avoid dangerous charges, all metal parts in the vicinity of the high-voltage device must be earthed.



CAUTION

Danger by loose-fitting clothing and loose hair

Wear tight-fitting clothing and tied-back hair in the proximity of motorised cable drums! Avoid wearing clothing with strings, scarves or jewellery that could become caught in the cable drum.



Wear ear protection

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



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



Objects should not be placed on or lent against the heater, nor pushed between the heater and wall. Do not cover the air exit.

Do not leave any combustible material in close vicinity to the heater.



Peripheral devices

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



Lithium-ion batteries packed in equipment, Class 9

Lithium-ion batteries are used in test vans with the BPwrK-4 equipment option.

Behaviour in the event of electrical accidents

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

In the event of electrical accidents, proceed as follows:

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

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

2 Technical description

2.1 System description

The PRIMEON is a cable testing system intended for installation in a van, trailer or container, the basis of which is the STX 40 cable fault location system. The vehicle installation carried out by Megger itself or by following clear specifications enables rapid transportation, eliminating interference when time is of critical importance without having to unload the system from the vehicle at the deployment location. This is also ensured by the connection and safety technology integrated into the vehicle, which offers the user the familiar high degree of comfort and safety.

Optionally, the vehicle can also be equipped with powerful VLF testing technology and modern diagnostic systems that enable standard-compliant cable testing and partial discharge diagnostics.

The system is operated almost exclusively by a central control unit (with integrated TDR module), which is also responsible for the automatic storing and logging of test results. All system functions, measurement results, operating instructions and error messages are shown on a single display.



Features

The **basic configuration with STX 40** makes the system suitable for the following measuring tasks:

- DC test/trip detection up to 40 kV
- Insulation test up to 20 kV
- Fault detection with proven HV pre-locating methods such as
- Arc Reflection Measurement (ARM), voltage decoupling (DECAY) and
- Induced Current Elimination (ICE)
- Fault conversion by burning at the fault location with up to 850 mA
- Sheath test with up to 20 kV with automatic breakdown detection
- Pinpoint location of sheath faults according to the step voltage method with up to 20 kV
- Pinpoint fault location in surge mode with up to 2000 J

Depending on the add-on equipment, the following measurement and diagnostic applications are also available as **options**:

- VLF test with cosine rectangular and/or sinusoidal voltage
- Burning at the fault location with simultaneous fault detection (ARM burning)
- Line and fault detection by means of audio frequency signal
- TanDelta loss factor measurement
- Partial discharge diagnostics

In addition to the mentioned measurement and diagnostic technologies, the system offers the following features:

- Highest safety standards
- Intuitive operation via touch display
- Workflow-supported automation of typical measuring and testing processes
- High system stability thanks to the Linux® operating system
- Performance upgrade "TDR Unleashed" for higher pulse amplitudes, more pulse width, state-of-the-art interference and noise suppression technologies and "Signature Boost" for long ranges
- Self-powered (optional)
- Integrated protocol software with cable database for instant reporting (optional)
- Wireless communication interfaces (4G, WiFi, GPS) (optional)
- Remote control of important pinpointing and line location methods via app (optional)
- TeamViewer remote access for support and demonstration purposes (optional)

2.2 Equipment matrix

Basic equipment

The test van has the portable fault location device STX 40 as basic equipment. This makes it possible to use the following operating modes:

Mode	Symbol	Basic system	Optional
Test			
Insulation test		via HV cable, up to 20 kV, up to 650 MΩ	
DC voltage test		up to 40 kV, up to 1 A leakage current	
Sheath testing		up to 20 kV, up to 1 A leakage current	
Fault location			
Pulse reflection measurement		via HV cable	via LV cable
Pulse reflection measurement in the event of intermittent errors		via HV cable	via LV cable
ARM Multishot (arc reflection measurement)		up to 32 kV	
DECAY (Voltage decoupling method)		up to 40 kV	
ICE (Current decoupling method)		up to 32 kV	
Fault conversion			
Burning		up to 20 kV	
Fault pinpointing			
Surge pinpointing		8/16/32 kV @ 2000 J	4 kV with 1100 J
Sheath fault pinpointing		up to 20 kV	

Depending on the selected configuration, the system may include the following additional equipment options:

Packages for fault location

Package	Location methods	Characteristics
FL1: Utility location with tone generator	Audio frequency generator	250 W Available frequencies: 480 Hz, 491 Hz, 982 Hz, 8440 Hz, 9820 Hz Can be used in multi-frequency mode: 491 Hz, 982 Hz, 8440 HZ
FL2: Fault conversion with burning unit	ARM burning	Fault ignition up to 15 kV DC
	Burning	Burn-down current up to 25 A
FL3: Sheath integrity with sheath fault tester	Prelocation with voltage drop bridge	Sheath test up to 10 kV DC
	Pinpointing with voltage gradient method (step voltage method)	

Packages for VLF testing

Package	Available VLF tests	Characteristics
BASIC	VLF test with sine voltage	<ul style="list-style-type: none"> ■ 1 μF test capacitance ■ 44 kV_{RMS}, 62 kV_{PEAK}
AMBITION	VLF test with cosine-rectangular voltage	Version M: 25 kV cable 5 μ F test capacitance, 40 kV _{RMS}
		Version L: 35 kV cable 4.4 μ F test capacitance, 60 kV _{RMS}

Packages for testing and diagnostics

Package	Available tests and diagnostics	Characteristics
BASIC	<ul style="list-style-type: none"> ■ VLF testing ■ TanDelta ■ Sinusoidal 	44 kV _{RMS} , 62 kV _{PEAK}
ADVANCED	<ul style="list-style-type: none"> ■ VLF testing ■ PD testing ■ TanDelta ■ Sinusoidal 	44 kV _{RMS} , 62 kV _{PEAK}
DYNAMIC	<ul style="list-style-type: none"> ■ VLF testing ■ PD testing ■ Cosine rectangular ■ Slope ■ DAC 	<ul style="list-style-type: none"> ■ DYNAMIC; Version M: 25 kV cable ■ DYNAMIC; Version L: 35 kV cable
ULTIMATE	<ul style="list-style-type: none"> ■ VLF testing ■ PD testing ■ TanDelta ■ Sinusoidal ■ Cosine rectangular ■ Slope ■ DAC 	<ul style="list-style-type: none"> ■ ULTIMATE; Version M: 25 kV cable ■ ULTIMATE; Version L: 35 kV cable
COMFORT	Permanently installed PD detector for PD testing	available for the following packages: <ul style="list-style-type: none"> ■ DYNAMIC; Version M ■ DYNAMIC; Version L ■ ULTIMATE; Version M ■ ULTIMATE; Version L

Packages for battery power kit

Package	Description
BPwrS-INT	Battery Power Station Interface; Preparation for customer provision of a battery power kit
BPwrK-4	Battery Power Kit, 4 kWh Akku; Full integration of a Battery Power Kit with 4 kWh battery, control display, mountings in the measurement vehicle; can be used with up to 1 battery extension.
PXP-2	[Only usable in connection with BPwrK-4] Power Expansion Pack, 2 kWh Akku; Additional extension of the Battery Power Kit BPwrK-4 with a 2 kWh battery, including mounting bracket and wiring
BPwrK-PV	[Only usable in connection with BPwrK-4] Battery Power Kit, PV Expansion; PV module with 200 W for roof mounting on the measuring vehicle
BPwrK-ALT	[Only usable in connection with BPwrK-4] Battery Power Kit, Alternator Expansion; Charging the battery power kit via the alternator, BPwrK-4 connection is made to the vehicle battery
BPwr-XCS	Battery Power Kit, External Charging Socket; External socket for charging the battery power kit, including integration and charging cable (5 m), Schuko plug type; other lengths of charging cable and other plug types available on request.
Integration package 12 V car battery	Package for charging the car battery via the grid

Contact the sales department to retrofit packages for the battery power kit.

2.3 Technical data



Technical data for the additional measurement technology (e.g. PDS 60(-HP), Ferrolux receiver) and for the peripheral devices (e.g. generator system) available for the test van can be found in the respective operating instructions.

General data of the vehicle's technical equipment

Parameter	Value
Mains voltage	230 V, 50 Hz or 120 V, 60 Hz Optional: Connection via isolation transformer (minimum 3.6 kVA)
Generator / Battery	12 V battery with 12 Ah (e.g. for interior lighting and cable drum motor) Generator system (e.g. optionally BPwrK-4 with 3.6 kVA)
Connection power	3.6 kVA

Parameter	Value
Connection equipment	
HV connection cable	50 or 80 m
Power cord	50 m (incl. power supply system NAS 16-230-PRIMEON)
Earth cable	50 m or 80 m
Reference earth connection cable	15 m
External safety device connection cable	15 or 50 m
Three-phase LV connection cable (optional)	25 or 50 m
Safety	
Electrical safety	according to DIN EN (IEC) 61010-1
Safety and protective equipment	<p>The following conditions are monitored during operation:</p> <ul style="list-style-type: none"> ■ Earth loop monitoring (F-ohm) ■ Monitoring for dangerous potential increases (F-U) ■ Monitoring for rapid voltage rises ■ Rear door switch ■ Safety key switches ■ Emergency off switch internal/external (EN 50191)
Discharge	Safe discharge even in the event of an emergency shutdown or power failure by the discharge equipment of the respective individual device.
Supply voltage	Overvoltage cut-off, undervoltage cut-off, residual current circuit breaker
Wireless data communication via optional 4G/GPS router [(only available for CU 15.6 FLPD control unit)]	Mobile data (GPRS / EDGE / 3G / 4G), Wi-Fi, GPS

Parameter	Value
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Temperature ¹



NOTE

When using Battery Power Kits, especially those supplied by the user, the permissible operating and storage temperature limits can be greatly reduced. The permissible temperatures can be found in the corresponding manuals.

It is strongly recommended that these limits are adhered to in order not to shorten the service life of the batteries used.

Operating temperature	-10 °C ... +50 °C
Storage temperature	-20 °C ... +60 °C
Operating humidity	93% at 30 °C (non-condensing)
Operating altitude	<p>Depending on the operating altitude, the following limit values must be considered when setting the voltage:</p> <p><5000 m → 0,6 U_{max}</p> <p><4000 m → 0,7 U_{max}</p> <p><3000 m → 0,8 U_{max}</p> <p><2000 m → U_{max}</p> <p>U_{max} refers to the maximum voltage of the respective voltage source.</p>

¹The permissible operating and storage temperature may vary depending on the actual equipment of the test van.

Technical data of the available control units

Parameter	CU 10.1 FL	CU 15.6 FL	CU 15.6 FLPD
Processor	NXP i.MX6Q QuadCore 996MHz	NXP i.MX6Q QuadCore 996MHz	Intel®Core i5-7300U
RAM	1 GB DDR3	1 GB DDR3	8 GB DDR4
Memory	4 GB NAND Flash	4 GB NAND Flash	256 GB SSD
Display	10.1 inch 1280 x 800 WXGA	15.6 inch 1920 x 1080 Full HD	15.6 inch 1920 x 1080 Full HD
Design	Integrated or remote	Remote	Remote
USB	USB 2.0	USB 2.0	USB 3.0
Operating system	Linux®	Linux®	Linux®
Suitable for PD diagnostics?	No	No	Yes

Technical data of the STX 40 fault location system

Parameter	Value
Insulation test	
Measurement voltage	1 ... 20 kV (adjustable in 0.1 kV increments)
Measuring range	100 Ω ... 650 MΩ
DC voltage test	
Test voltage	1 ... 40 kV ±1.5% (adjustable in 0.1 kV increments)
Leakage current measurement	0 ... 100 μA ±2% 0 ... 10 mA ±2% 0 ... 1 A ±2%
TDR module (time range reflectometer)	
Distance range (at $v/2 = 80 \text{ m}/\mu\text{s}$)	20 m ... 320 km (standard) 20 m ... 1280 km ("TDR Unleashed")
Pulse width	20 ns ... 10 μs (standard) 20 ns ... 30 μs ("TDR Unleashed")
Pulse amplitude	100 V (standard) 250 V ("TDR Unleashed")
Resolution	0.1 m at $v/2 = 80 \text{ m}/\mu\text{s}$

Parameter	Value
Accuracy	0.1 %
Timebase accuracy	<50 ppm
Data rate	533 MHz
Runtime setting	As v/2 or NVP value 10 ... 149,9 m/μs or 33 ... 492 ft/μs
Dynamic range	115 dB
Output impedance	50 Ω
Distance dependant de attenuation (ProRange)	+40 dB, adjustable
Surging	
Surge levels ¹	0 ... 8 / 16 / 32 kV with 2000 J 0 ... 4 kV with 1100 J (optional)
Surge sequence	Every 3 seconds at 32 kV Adjustable between 3 ... 10 seconds or single surge
Prelocating methods	
ARM Multishot	Reflectance measurement in an arc caused by a fault; 32 consecutive error patterns per measurement
ICE	Current decoupling from a travelling wave caused by a fault
DECAY	Voltage decoupling from a travelling wave caused by a fault
Burning with internal high voltage source	Max. 850 mA in the 5 kV range Max. 400 mA in the 10 kV range Max. 200 mA in the 20 kV range Max. 100 mA in the 40 kV range
Burning with 15 kV burn unit	See the enclosed operating manual
Sheath testing	
Output voltage	1 ... 20 kV ±1.5% (adjustable in 0.1 kV increments)

¹If the system is supplied with 120 V AC input voltage, the output power is limited to 1,600 W (in accordance with ANSI/NEMA 5)

Parameter	Value
Leakage current measurement	0 ... 100 μ A \pm 2% 0 ... 10 mA \pm 2% 0 ... 1 A \pm 2%
Sheath fault pinpointing	
Output voltage	1 ... 20 kV \pm 1.5% (adjustable in 0.1 kV increments)
Timing	0.5:1, 1:3, 1:4, 1:6

Technical data of the FLG 250 audio frequency generator (optional)

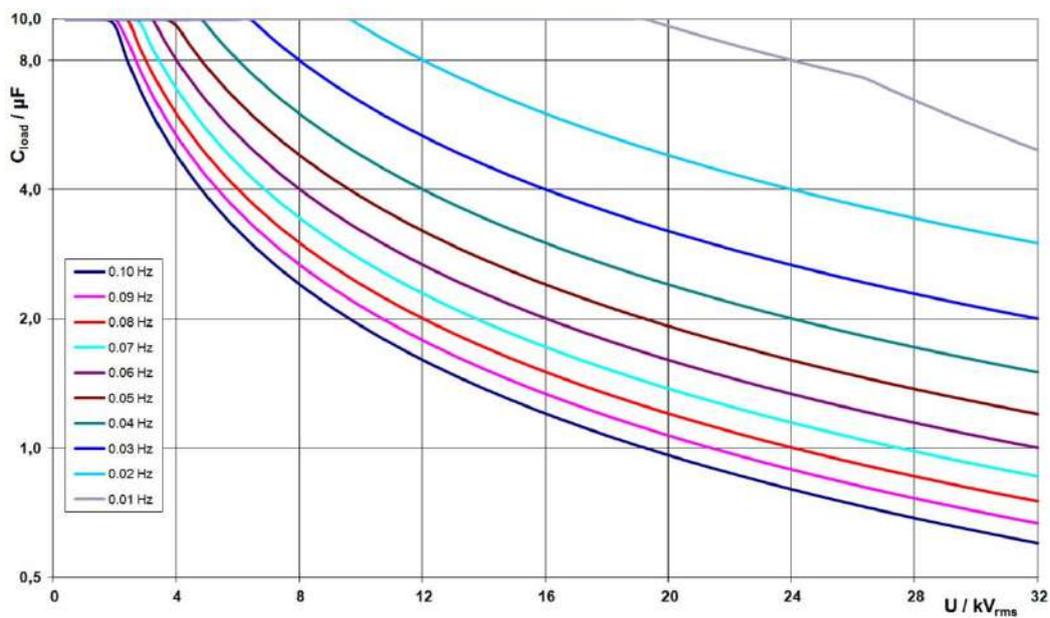
Parameter	Value
Frequencies	0.491 kHz, 0.982 kHz, 8.440 kHz (customer-specific frequencies are possible)
Output power	250 W

Technical data of the TDM 45 / TDM 4540 test and diagnostic module (optional)

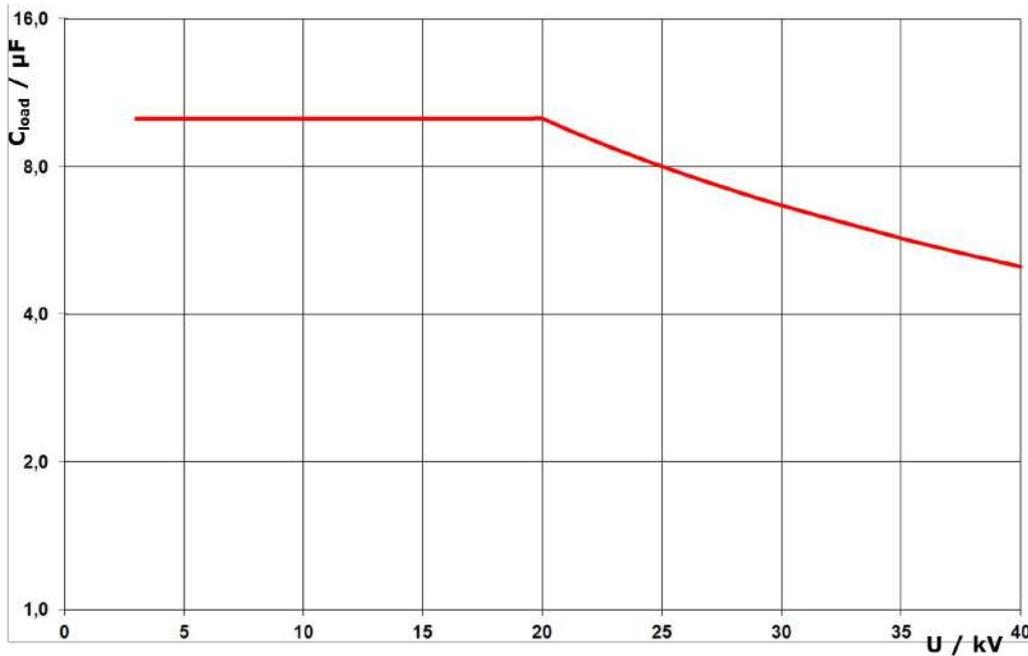
Parameter	Value
Output voltage	
Sinusoidal	2 ... 32 kV _{RMS} / 45 kV _{PEAK}
Rectangular	\pm 2 ... \pm 45 kV
Cosine rectangular (TDM 4540 only)	\pm 3 ... \pm 40 kV
DAC (Damped AC) (TDM 4540 only)	\pm 3 ... \pm 40 kV
Max. output current source	12 mA _{RMS} (at rated voltage)
Leakage current measurement	(Rectangular, VLF-CR and DC operation)
Display range	0 ... 20 mA
Resolution	10 μ A
Frequency	
Sinusoidal/rectangular voltage	0.01 Hz ... 0.1 Hz
Cosine rectangular voltage (TDM 4540 only)	0.1 Hz
DAC voltage (TDM 4540 only)	20 Hz ... 500 Hz
Testable load capacitance	(See also the following diagrams)
Sinusoidal voltage	0.6 μ F at 45 kV / 0.1 Hz
Rectangular voltage	0.6 μ F at 45 kV / 0.1 Hz

Parameter	Value
Cosine rectangular voltage/DAC voltage (TDM 4540 only)	4.8 μF at 40 kV
Maximum load capacity	10 μF at reduced voltages and frequencies
TanDelta measurement (optional)	
Measuring range	10^{-3} to 10^0
Accuracy (at a load capacity >20 nF)	1×10^{-3} or 1%
Resolution	1×10^{-4}

The following graph **applies to tests with sinusoidal voltage** and illustrates the dependence of the test frequency on the capacity of the connected load and the set test voltage. If a test frequency cannot be applied due to the capacity limits specified here, an automatic adjustment is made and the user is informed about this condition.



In **cosine rectangular or DAC mode** ((TDM 4540 only)), the following load graph¹ also applies:



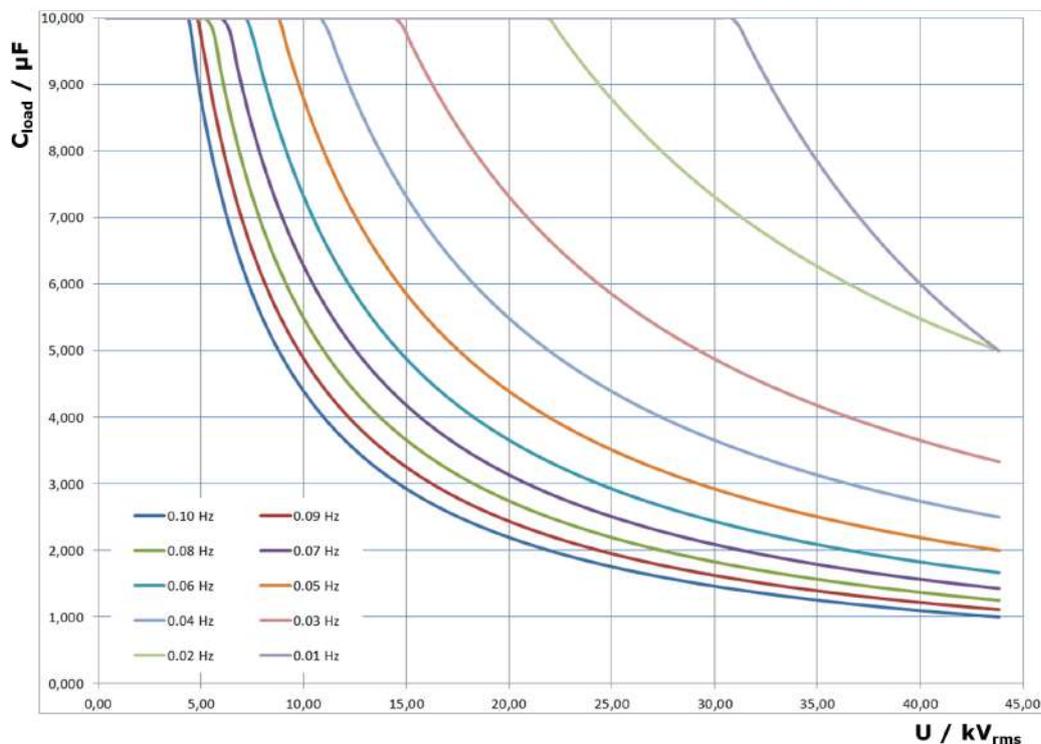
Technical data of the TDM 62 / TDM 6260 test and diagnostic module (optional)

Parameter	Value
Output voltage	
Sinusoidal	2 ... 44 kV _{RMS} / 62 kV _{PEAK}
Rectangular	±2 ... ±62 kV
DC (optional)	±3 ... ±62 kV
Cosine rectangular (TDM 6260 only)	±3 ... ±60 kV
DAC (Damped AC) (TDM 6260 only)	±3 ... ±60 kV
Max. output current source	23 mA _{RMS} (at rated voltage)
Leakage current measurement	(Rectangular, VLF-CR and DC operation)
Display range	0 ... 20 mA
Resolution	10 µA
Frequency	
Sinusoidal/rectangular voltage	0.01 Hz ... 0.1 Hz
Cosine rectangular voltage (TDM 6260 only)	0.1 Hz

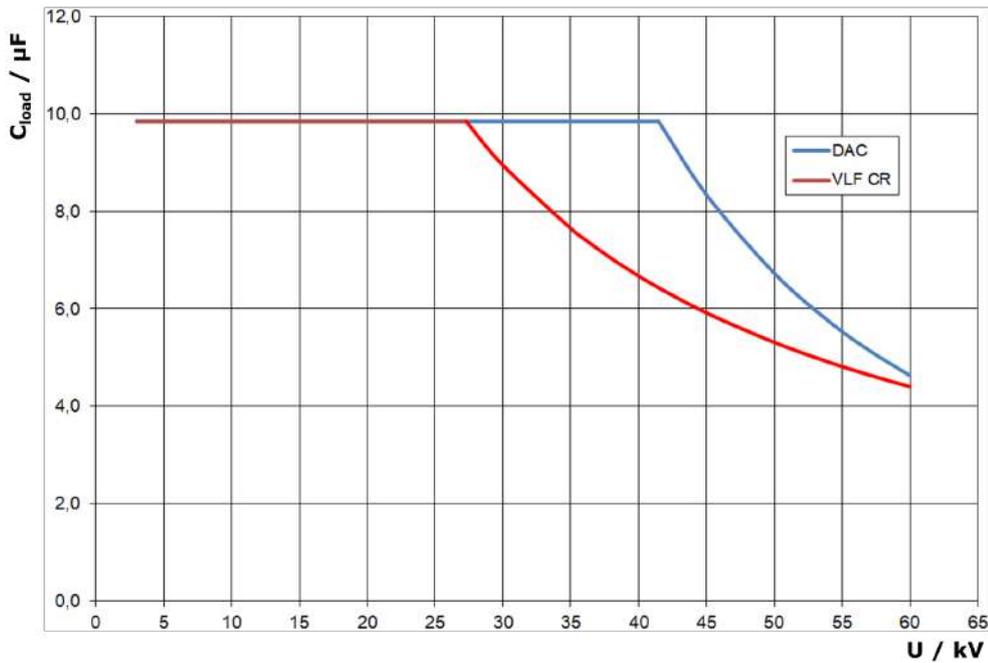
¹Only valid between -25 and 45 °C. In the temperature range from 45 °C to 55 °C, the power is reduced to 80% at 40 kV.

Parameter	Value
DAC voltage (TDM 6260 only)	20 Hz ... 500 Hz
Testable load capacitance	(See also the following diagrams)
Sinusoidal voltage	1.0 μ F at 62 kV / 0.1 Hz
Rectangular voltage	1.0 μ F at 62 kV / 0.1 Hz
Cosine rectangular voltage (TDM 6260 only)	4.4 μ F at 60 kV
DAC voltage (TDM 6260 only)	4.8 μ F at 60 kV
Maximum load capacity	10 μ F at reduced voltages and frequencies
TanDelta measurement (optional)	
Measuring range	10^{-4} to 10^0
Accuracy (at a load capacity >20 nF)	1×10^{-4} or 1%
Resolution	1×10^{-5}

The following graph **applies to tests with sinusoidal voltage** and illustrates the dependence of the test frequency on the capacity of the connected load and the set test voltage. If a test frequency cannot be applied due to the capacity limits specified here, an automatic adjustment is made and the user is informed about this condition.



In **cosine rectangular or DAC mode** ((TDM 6260 only)), the following load graph¹ also applies:



Technical data of the battery power kit BPwrK-4 (optional)

Parameter	Value
Battery power kit console:	
Display	
Touch control	supported
Size	154.2 mm x 85.9 mm
Resolution	1024 x 600
Input / Output	
DC Input / RJ45	12 V / 1 A, 12 W maximum
DC Input / USB-C	5 V / 2 A, 10 W maximum
DC Output / USB-A	5 V / 1 A, 5 W maximum
Dimensions (L x W x H)	205 mm x 114 mm x 23 mm
Weight	450 g
Operating and storage temperature range	-20 °C to +50 °C (optimum temperature range: +15 °C to +25 °C)

¹Only valid between -25 and 45 °C. In the temperature range from 45 °C to 55 °C, the power is reduced to 80% at 40 kV.

Parameter	Value
Battery power kit:	
Input	220 ... 240 V AC, 50 Hz, 16 A
Output	230 V AC, 50 Hz 4 kWh (capacity) 3.6 kVA



Further information and specifications can be found in the enclosed operating instructions for the battery power kit.

Technical data of the Battery Power Station Interface¹ BPwrS-INT (optional)

Parameter	Value
Mains input for generator	230 V / 16 A / 50 Hz
Fuse generator AC-OUT	Fuse type C16A
Mains output for charging (generator AC-IN)²	230 V / 16 A / 50 Hz

Technical data of the battery power kit solar modules BPwrK-PV (optional)

The BPwrK-PV package includes 2 solar modules with the following parameters per module:

Parameter	Value
Rated power	100 W (±5 W)
Maximum operating current	5.9 A
Maximum operating voltage	17.1 V
Conversion rate	23%
Cell type	Monocrystalline silicone
Output port	Plug type MC4
Weight	6.2 kg
Dimensions (L x W x H)	980 mm x 586 mm x 30 mm
IP rating (according to IEC 60529 [DIN VDE 0470-1])	68

¹In the network distribution of the cable test van, a TN-C-S network is created from the IT network of a generator, provided that the grounding of the test van is connected!

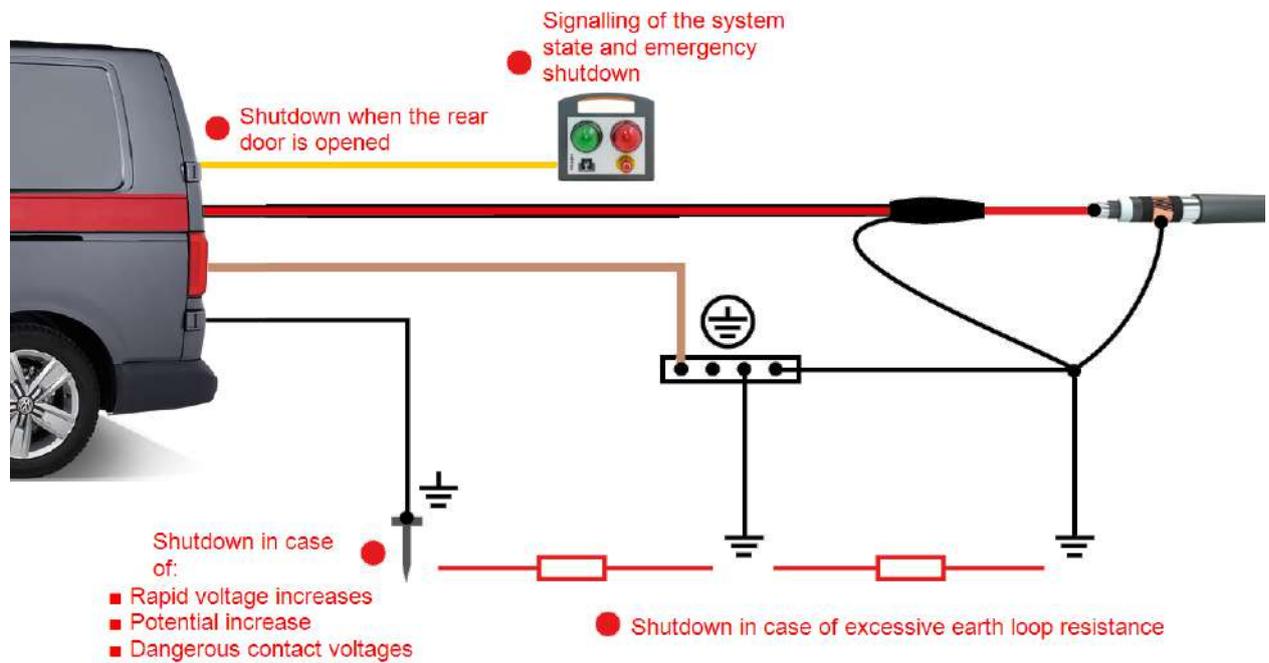
²Charging function for AC charging of the battery storage system / power generator not available when AC-Out is active on the generator.

Technical data for the Battery Power Kit outdoor socket BPwr-XCS (optional)

Parameter	Value
Mains voltage	230 V, 50 Hz, 16 A
Voltage	250 V
Current	16 A
Length	5 m
Plug	Schuko, other plug types available on request
IP rating (according to IEC 60529 [DIN VDE 0470-1])	IP44

3 Safety devices

The safety of the operator and the operational readiness of the system are ensured by a variety of intelligent and proven safety devices, which serve to comply with the applicable occupational health and safety guidelines.



Monitoring devices



WARNING

Risk of electric shock

Safety devices must not be bridged or neutralised!

Proper functioning of the protective devices described below requires that all earth connections (earth cable, F-U cable and cable shield of the connection cable) have been connected to the respective earthing points in accordance with the instructions in this manual.

In high-voltage operation, the following conditions and measured values are continuously monitored by the integrated protective devices (F-Ohm, F-U, door contact switch) to ensure a sufficiently good earthing and to protect against hazardous voltages:

- The voltage difference between the test van and the surrounding earth (reference earth) must not exceed 33 V AC or 40 V DC
- The measured voltage-time area must not exceed 50 V / 20 ms
- The transfer resistance between the earth spike and the station earth must not exceed 150 k Ω
- The earth loop resistance between the cable shield of the HV connection cable and the protective earth must not exceed 6 Ω
- The rear door must be closed

In the event of a deviation, any high-voltage operation is immediately automatically interrupted and the measuring circuit is discharged. It is only possible to switch on the high voltage again after the rear door has been closed or the earthing conditions have been improved and the measured values are within the tolerance levels.



Safety trigger thresholds are tested during the final test and can be found in the test report.

Emergency shutdown

In the event that an immediate emergency shutdown is required in measuring mode, one of the available emergency off switches must be activated.

These are located on the control unit ("[Operating unit](#)" on page 47), on the external safety device ("[Connection of the external safety device](#)" on page 44) and optionally at other quickly accessible positions in the vehicle.

In the event of a shutdown, any high-voltage operation is automatically interrupted immediately and the measuring circuit is discharged. In addition, the power supply to the measuring system is interrupted. However, the sockets in the control area are still live.

Safety key switches

For reasons of liability, it must be ensured that measuring systems that emit a hazardous voltage can be secured against unauthorised access. This is made possible by the safety key switches on the remote control unit ("[Operating unit](#)" on page 47) and the external safety device ("[Connection of the external safety device](#)" on page 44).

4 Setting up and connecting the test van

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

4.1 Setting up and securing the test van



WARNING

Risk of electric shock

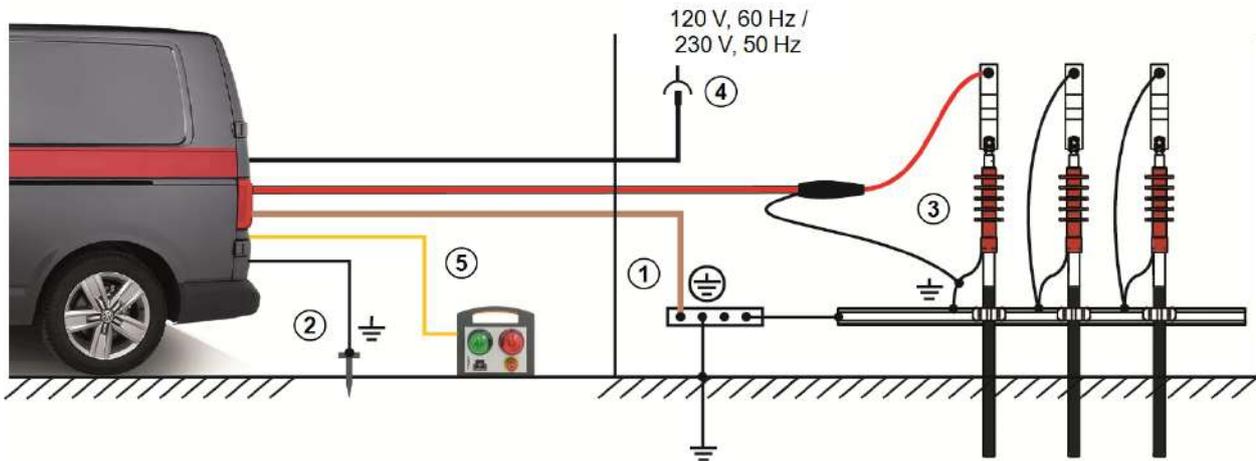
- The test van must never be placed directly over the route of the cable to be tested!
- To ensure that the integrated gravity switches function correctly, the test van must never be operated on inclines that exceed 10%.
- The test van must not show any visible damage, e.g. accident damage, as long as this has not yet been classified as harmless by a Megger service center!
- If the height at the job site exceeds 2000 m, the maximum voltage limit values defined in the technical data must be complied with due to the reduced dielectric strength of the air gaps.
- In the event of vast temperature differences between the storage and installation location (cold to warm), condensation may form on the high-voltage components (condensation effect). To avoid any risk of damage to people and devices caused by voltage flash-overs, the system must not be operated in this condition. It should rather be left in the new environment to acclimatise for approximately one hour before putting it into operation.

The following steps must be carried out to adequately secure the test van and the surrounding area:

1. Place the test van on level ground (inclination <10%) and close to the access to the test object, taking into account its load and external dimensions. Check that the test van is in a stable position.
2. Secure the test van against rolling away by applying the handbrake and positioning chocks against the wheels if necessary.
3. Secure the site in accordance with local regulations using barriers, warning signs and cable bridges.

4.2 Electrical connection

The following figure shows the simplified connection diagram:



WARNING

Risk of electric shock

The electrical connection must be carried out in the sequence shown in the image. The ground cable must be connected first and the mains connection is made last!

To disconnect, follow the sequence in reverse order.

Follow the specified connection sequence:

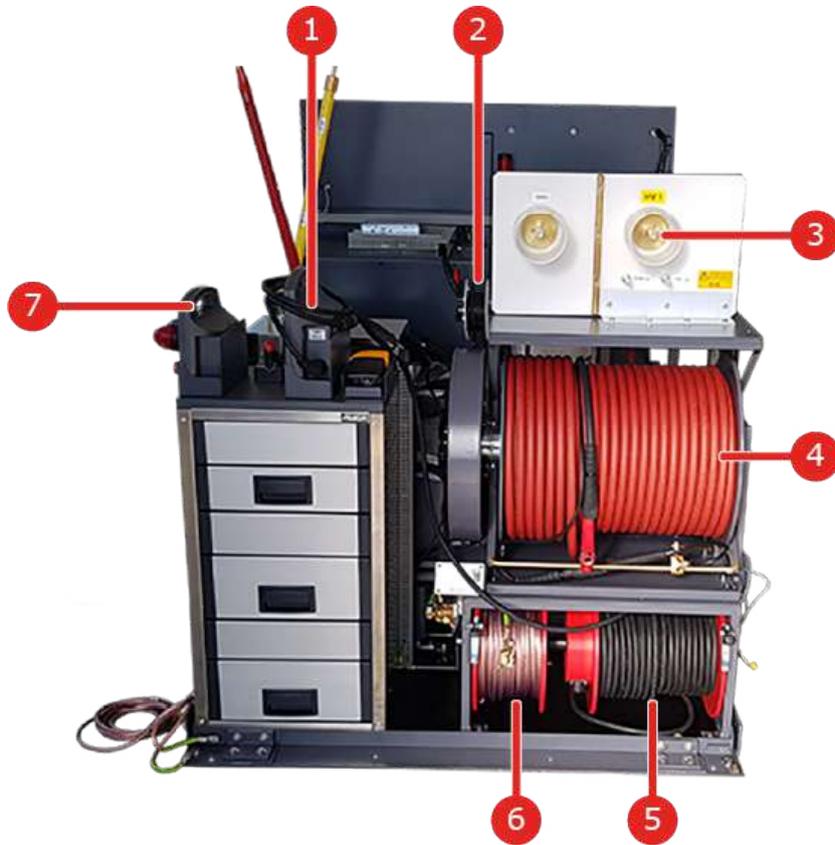
1. Connection of the earth cable ("Connection of the earth cable" on page 34)
2. Connection of the F-U monitoring (reference earth) ("Connecting the reference earth (F-U monitoring)" on page 35)
3. Connection to the test object ("Connection to the test object" on page 36)
4. Mains connection ("Establishing the mains supply" on page 41)
5. Connection of the external safety device ("Connection of the external safety device" on page 44)

4.2.1 Connection equipment



The arrangement and equipment of the connection system may differ depending on the vehicle type and equipment variant.

Example configuration



Number	Description
1	NAS 16-230-PRIMEON
2	Reference earth cable (F-U monitoring)
3	HV output of the system; Systems with Test and Diagnostics Module (TDM) have an additional HV output and are accordingly equipped with a remote connection panel.
4	HV connection cable
5	Power cord
6	Earth cable
7	External safety device ("Connection of the external safety device" on page 44)

4.2.2 Connection of the earth cable



WARNING

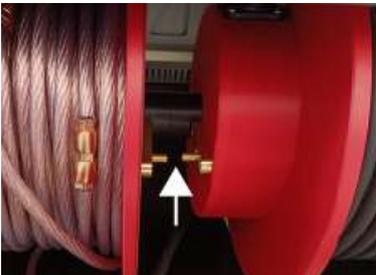
Risk of electric shock

- The test van must never be operated without a connected earth cable. The earth cable provides the connection between the system and the protective earth and ensures that the entire system is safe to touch.
- The test van may only be connected to earth systems or single earth conductors with transition resistors $<2 \Omega$.
- Protective earth (earth cable) and system earth (shield of the HV cable) must be connected in such a way that no impermissible voltage difference can arise between protective earth (PE) and neutral conductor (N).
- For TT networks, there is no connection between the neutral conductor (N) and protective earth (PE) in the station. To ensure the protective function of the RCD in the NAS, the TT network must be converted into a TN network by the customer using suitable measures.

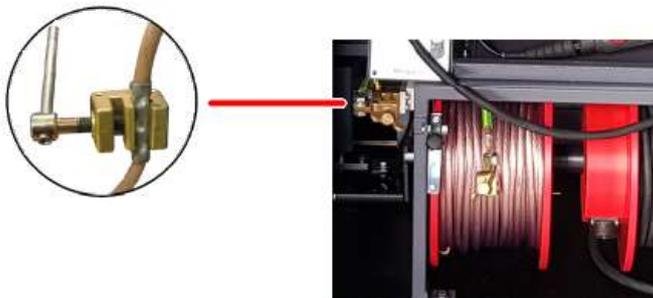
To connect the earth cable, proceed as follows:

1. Release the brake on the earth cable drum.
2. Release the anti-roll latch on the inside of the cable drum housing by pushing the metal pin inward.

To lock the anti-roll latch before winding the drum back up and reestablish the connection to the rewinding device, pull the metal pin outward.



3. Unwind the cable as far as necessary and connect it to the station earth or another suitable foundation earth.
4. Clamp one of the contact sleeves attached to the cable at 5 metre intervals under the connecting clamp next to the cable drum.



5. Secure the cable drum brake again.

4.2.3 Connecting the reference earth (F-U monitoring)

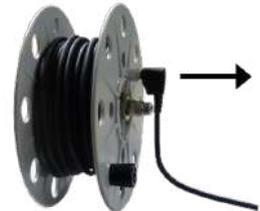


The direct connection between the measuring system and the surrounding earth (reference earth) is essential for functioning earth monitoring (F-U) and a safe measuring operation ("Safety devices" on page 29). Even in heavily built-up areas where it is difficult to insert the earth spike this protective device must not be bridged and neutralised! The following measures can help to establish a sufficiently low-impedance earth connection:

- Try inserting the earth spike in other locations that provide better ground contact. In heavily built-up areas, joints between concrete slabs may be used for example.
- Moisten the place where the earth spike was inserted with water.
- Attach the reference earth to a foundation earth (e.g. a lightning protection system). However, do not use the same foundation earth to which you have already connected the main earth cable.

Proceed as follows to establish the reference earth connection for monitoring the voltage-time area and the fault voltage:

1. Disconnect the system's connection cable from the F-U cable drum.



2. Place the supplied earth spike into the ground in the immediate vicinity of the test van and attach the end of the F-U cable to it.



3. Reconnect the system's connection cable to the F-U cable drum.



4.2.4 Connection to the test object



WARNING

Risk of electric shock

- Before connection to the test object, the five safety rules ("[General Safety Instructions and Warnings](#)" on page 8) must be applied.
 - All phases of the test object which are not being tested must always be short-circuited and earthed.
 - Protective devices (guard rails, chains, bars etc.) must be installed on the test object as a barrier to prevent contact with active parts and to ensure that the danger zone cannot be accessed.
 - Since the voltage applied to the test object can assume hazardous values, all cable ends must be isolated to prevent contact. It must be ensured that all branching points are considered. It must be ensured that all branching points are considered.
-

4.2.4.1 Using the HV connection cable

Instructions for operating the cable drum



CAUTION

Before using the motor drive, always connect the earth cable of the test van to protective earth first.



CAUTION

Risk of crushing

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

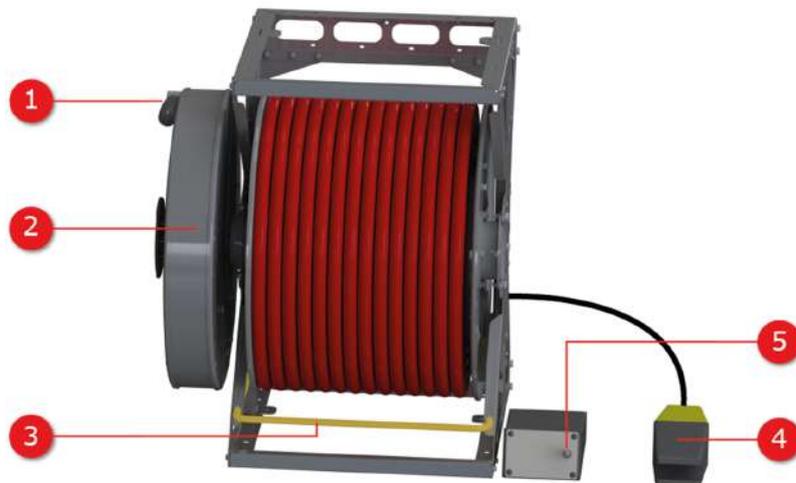


CAUTION

Danger due to automatic start-up of motorised cable drum

Cable drums that are interrupted during motorised winding may start up automatically as soon as the interruption is cancelled!

To prevent crushing and injury, the coverage area of the cable drum must be kept clear when interruptions (EMERGENCY OFF, overload protection) are cancelled.



Number	Description
1	Hand crank to manually wind and unwind the drum (only available with manual version)
2	 <p>Storage space for the system-side end of the HV connection cable. The cable end must always be properly stowed in the drum body before the HV connection cable can be unwound or wound.</p>
3	Earth rail for short circuit and earthing of the cable ends when the HV connection cable is not in use.
4	Foot pedal for motor-assisted winding of the drum (only available on motorised version). The drum is manually unwound by pulling the cable.
5	 <p>Circuit breaker (only available on motorised version) that trips when the drum motor is overloaded and disconnects the control unit from the power supply. After tripping, ensure that the cable runs freely and push the circuit breaker back in. Then continue the drum operation.</p>

Basic procedure

The electrical connection between the HV connection panel and the test object is established as follows:

1. Ensure that the system-side end of the HV connection cable, which protrudes from the side of the cable drum, is not connected to the HV connection panel and is properly stowed in the drum body.
2. Release the brake on the cable drum.
3. Manually unwind the HV connection cable as far as necessary.
4. Connect the HV connection cable to the test object using suitable terminals. When doing so, observe the notes and sketches on the following pages.



If the connection to the test object is made using additional measuring accessories (e.g. a partial discharge measuring system), the instructions for connecting the devices can be found in the respective operating instructions.

5. Connect the system-side end of the HV cable to the HV connection panel. When doing so, observe the notes and sketches on the following pages.
6. Secure the cable drum brake again.

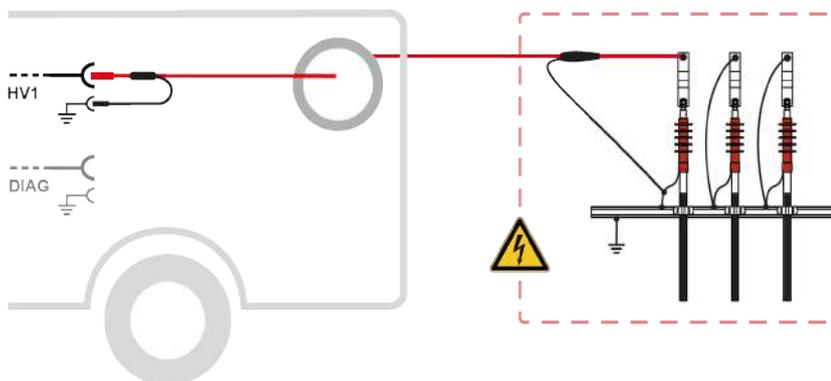
Typical connection scenarios



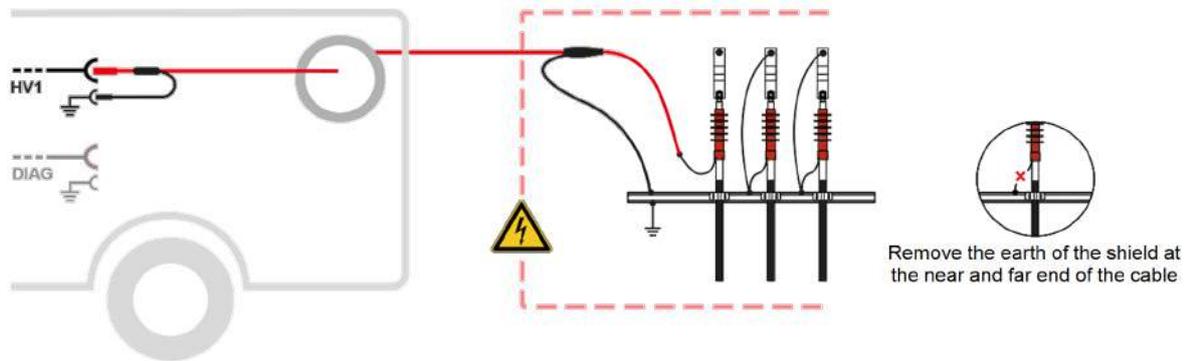
If your system is a tailored solution with an individual connection panel and/or different connection accessories, please refer to the signs on the inside of the rear door for the details of the electrical connection to the test object.

Depending on the equipment of the test van and the desired operating mode, the connection between the HV connection panel and the test object must be made as follows:

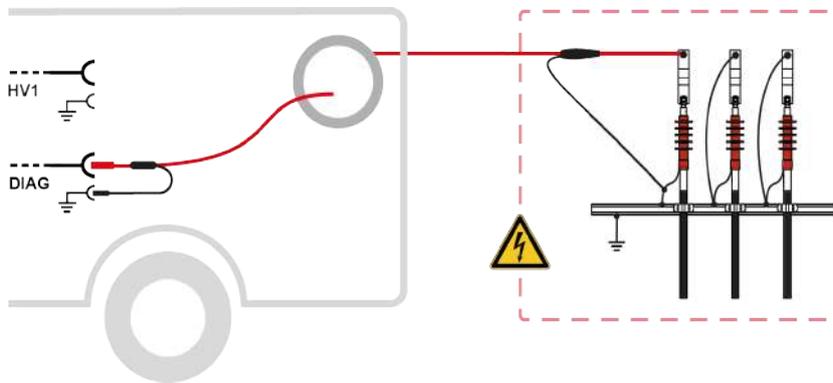
Fault location, DC test



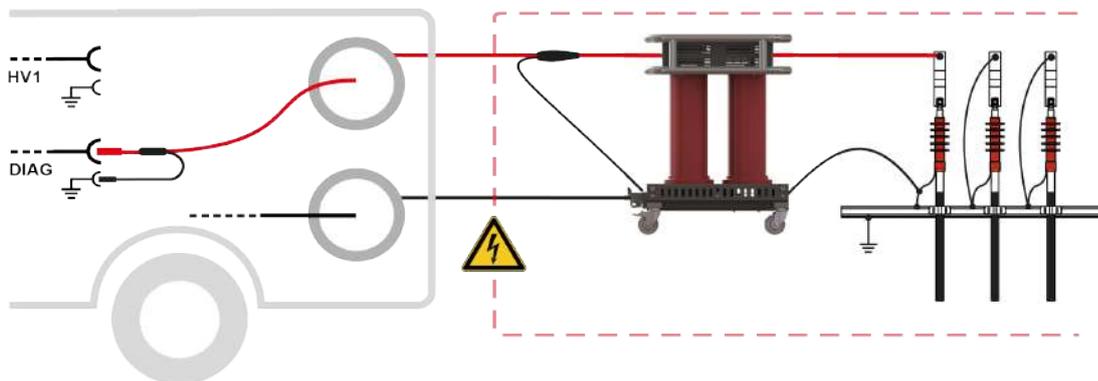
Sheath test and sheath fault location



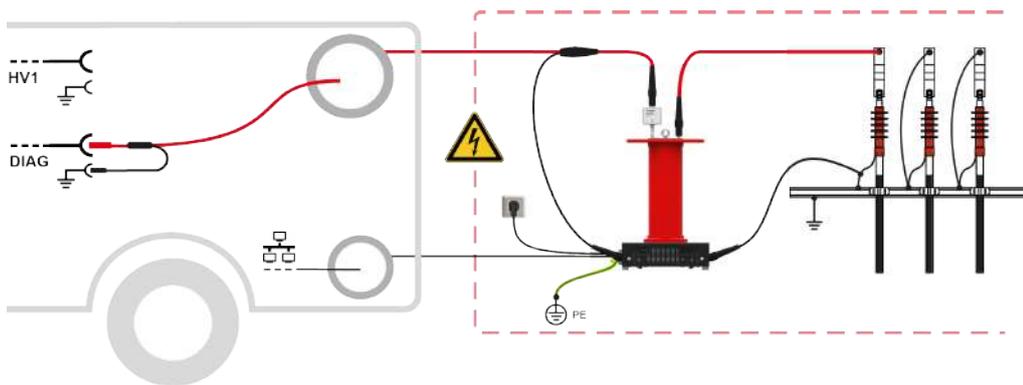
VLF tests using TDM



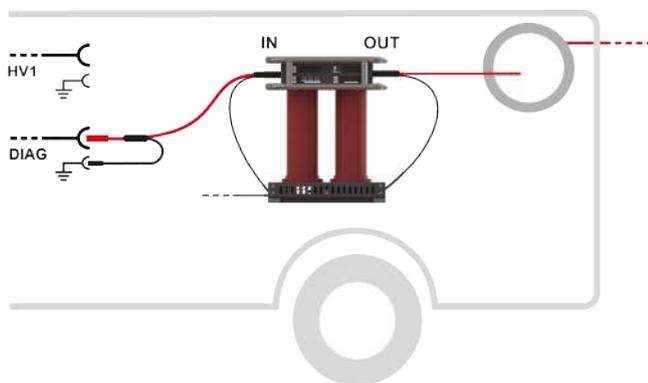
PD diagnostics with external partial discharge coupler PDS 60(-HP)



PD diagnostics with external partial discharge coupler PDS 62-SIN



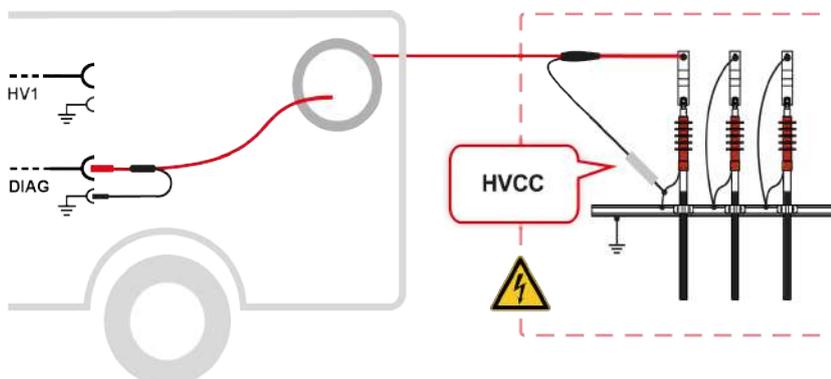
PD diagnostics with internal partial discharge coupler PDS 60(-HP)



TanDelta measurement (step test or MWT)



The cable shield on the HV connection cable must be connected to the shield of the test object using the HVCC adapter supplied. A system-side connection of the adapter to the connection panel is not permitted!



4.2.4.2 Using the three-phase LV connection cable (optional)

As an alternative to the HV connection cable, the optional LV coaxial cable can also be used for a TDR measurement, which enables a three-phase measurement.

To connect the LV cable to the test object, proceed as follows:

1. If the connection cable coming from the system is connected to the socket of the cable drum body, this connection must be disconnected before the cable can be unwound.



2. Unwind the LV cable.
3. Connect the pre-assembled four-wire adapter cable intended for the test object connection to the unwound LV cable.



When connecting, make sure that the four wires run as uniformly as possible to each other (ideally twisted) and that they are not separated from each other until just before the actual connection point. This ensures the same impedance ratios for all three phases.

The identification of the phases must be considered during connection to be able to correctly assign the measurement results to the respective phases.

4. Using suitable connection accessories, connect the individual phases of the LV cable to the phases of the test object and the operating earth (red terminal) to the earthed shield of the test object.
5. Reconnect the connection cable coming from the system to the socket on the cable drum.



4.2.5 Establishing the mains supply

4.2.5.1 Connection to mains supply



WARNING

Risk of electric shock

If the object to be measured and the mains power supply are connected to different earth systems that are not interconnected, the potential equalisation must be established using a connection cable with a cross-section of at least 16 mm² Cu while the test van is in operation. Good earthing conditions are of utmost importance here!

Proceed as follows to connect the test van to a mains power supply:

1. Release the brake on the mains cable drum.



2. Release the anti-roll latch on the inside of the cable drum housing by pushing the metal pin inward.

To lock the anti-roll latch before winding the drum back up and reestablish the connection to the rewinding device, pull the metal pin outward.



3. Unwind the mains supply cable.



CAUTION

The mains cable drum must be unwound at least 5 to 10 m to use in operation mode.

4. Connect the cable to a mains power outlet.



CAUTION

Only approved (VDE/IEC or corresponding national regulations) intermediate connections are to be used for the connection to mains sockets that do not fit the pre-assembled plug or for direct connection to the low-voltage cable!

Result: The two signal lamps **IN** and **OUT** on the mains connection system NAS 16-230-PRIMEON should now light up, indicating that the input voltage is within the permissible range. If this is not the case, check the mains supply and the fuses in the NAS 16-230-PRIMEON ("[Checking the fuses](#)" on page 61).



5. Secure the cable drum brake again.

4.2.5.2 Operation via generator (optional)

If there is no possibility to tap mains power in the immediate vicinity of the deployment location, the measuring system can also be operated via an adequately dimensioned generator system.

The generator systems provided by Megger are typically vehicle engine driven systems, which must be commissioned manually if necessary. To do this, the vehicle must be put into neutral, the generator switched on and, if necessary, the engine speed must be regulated. The exact procedure differs depending on the generator and vehicle model.

When the generator is in operation, the system automatically draws its operating voltage from the generator. This also applies if the test van is connected to the mains power supply.



For detailed information on the handling, specification and safety of the systems provided, refer to the manufacturer's product information.

4.2.5.3 Operation via battery power kit (optional)

If there is no possibility to tap mains power in the immediate vicinity of the deployment location, the measuring system can also be operated via a battery power kit.

Customer provided battery power kit (package BPwrS-INT)

With the option "BPwrS-INT" a battery power kit is provided by the customer. The test van is prepared by Megger for the provision, so that dedicated fuses, sockets and connection points are available in the test van.



CAUTION

Danger due to unsecured load

The operating personnel are responsible for securing the load of the battery power kit provided during transport.

The conditions for transport according to the manual of the respective battery power kit supplied apply. The customer (provider of the battery power kit) is responsible for compliance with these conditions and the associated further measures (labelling, hazardous goods, special transport positions, etc.).

In the mains distribution system PRIMEON, a connection is established between N and PE for the integration of the battery power kit provided, so that the function of the RCD is guaranteed in generator operation. This is established between N and PE in the mains distribution series X1 terminal 3.

Integrated Battery Power Kit (package BPwrK-4)

With the "BPwrK-4" option, there is a permanently installed battery power kit in the test van. There are separate fuses and sockets, which are supplied via the battery power kit, for this.

4.2.5.4 Charging via auxiliary charging socket (optional)

The BPwr-XCS option provides users with an extra mains socket, which can be used to charge an integrated battery-powered generator.

To do this, connect the extra mains connection socket on the measuring trolley to a mains power supply with RCD protection using the specific mains cable. The power generator is charged via the extra mains socket when the mains switch is in position **0** ("Other operating and connecting elements in the control area" on page 51).

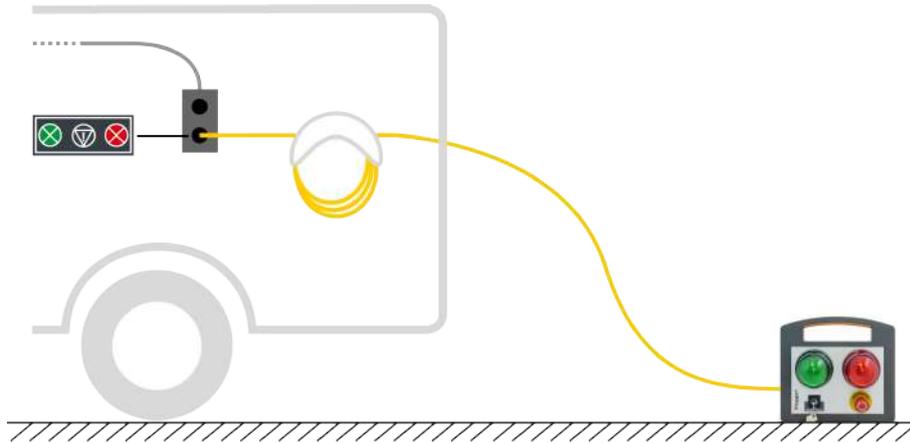
4.2.6 Connection of the external safety device

The external safety device can be used to signal the status of the system outside the test van and to interrupt or disable the HV preparation via the emergency off switch and key switch.



Number	Description
1	Signal lamps for the widely visible signalling of the switching state according to EN 50191. If the green light is active, the system has been powered on but has not yet been put into high voltage operation. The red light lights up as soon as high voltage can be generated. All discharge and earth devices are open and the test object is to be considered "live".
2	Emergency off switch ("Safety devices" on page 29)
3	Safety key switch for locking the high-voltage preparation
	<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>The key switch is unlocked and high-voltage preparation is possible, provided that all other safety conditions are also met.</p> </div> </div>
	<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>The key switch is locked and high-voltage preparation is not possible. When locked, the key can be removed and the system secured against unauthorised high-voltage operation.</p> </div> </div>

The external safety device must be placed in an accessible and clearly visible position in the vicinity of the test van and connected to the designated socket of the connection box via the connection cable provided.

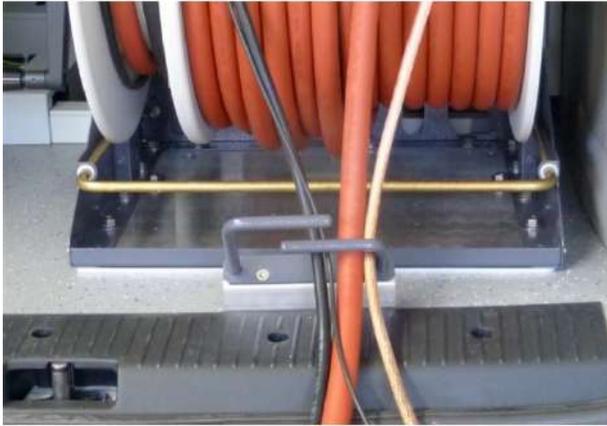


For systems with a cable drum, the connection cable from the system side must be disconnected from the cable drum for the unwinding and rewinding process.



4.3 Switching on the test van

After the test van has been connected or a change has been made to the test object connection, the connection cables should be pulled out of the vehicle in such a way that the rear door can be closed without squeezing or kinking the cables. Most test vans are equipped with a cable guide and a movable door flap for this purpose.



After the rear doors of the test van have been closed, it is ready to be switched on. Provided that the connection has been correctly implemented and good earthing conditions have been observed, the conditions of the safety circuit are also fulfilled.

5 Operation of the test van

5.1 Operating unit

Depending on the space available in the vehicle and the performance requirements of the installed software, different control units are used.

Especially when installed in very small vehicles or trailers without a separate operating area, the measuring system can be operated directly via the integrated control unit of the STX 40. It has a 10.1-inch display and is suitable for cable fault detection and VLF testing.



In vehicles that have sufficient space for a spatial separation between the system components and the operator's workplace, a remote control unit is used. It has all the necessary controls and is optionally equipped with a 10.1 inch display (model 10.1 FL) or a 15.6 inch display (model 15.6 FL or 15.6 FLPD). Each version of this remote control unit is suitable for cable fault detection and VLF testing.



A special, more powerful version of the 15.6 inch control unit with x86 processor also enables the execution of partial discharge measurements and the use of the protocol software.



Regardless of the type of control unit used, it offers the following display, operating and connection elements:



Number	Description
1	Touch display
2	Emergency off switch ("Safety devices" on page 29)
3	USB 2.0 port for connecting input and output devices and storage media ("Use of USB accessories" on page 58) CU 15.6 FLPD control units have two additional USB 3.0 ports on the rear of the housing.
4	ON/OFF button
5	Green "HV On" button for enabling the high-voltage preparation
6	Red "HV Off" button for manual shutdown of the high voltage
7	Rotary encoder with tilt function for operating the software
8	Safety key switch [(only on remote control unit)] When locked, the key can be removed and the system secured against unauthorised high-voltage operation. If operation is carried out directly on the control unit of the STX 40, the safety key switch of the external safety device must be used for this purpose ("Connection of the external safety device" on page 44).

5.2 Elements in the control area

5.2.1 Control Unit of the battery power kit (optional)

When using the package BPwrK-4, the control unit of the battery power kit is also located in the operating area:



Element	Description
1	USB-C port
2	USB-A port
3	Touch screen
4	On/Off button
	press short Switch between Standby mode and Active mode
	press long (3s) Switch between Deep Sleep mode and Active mode
5	RJ45 CAN Bus port



Further information and specifications can be found in the enclosed manual.

Switch on the control unit

Current state	The control unit gets switched on, when....
Standby	<ul style="list-style-type: none"> ■ the charging process of the battery power kit is initiated ■ the touch screen gets swiped ■ the On/Off button is pressed
Deep Sleep	<ul style="list-style-type: none"> ■ the charging process of the battery power kit is initiated ■ the On/Off button is pressed (3 s)

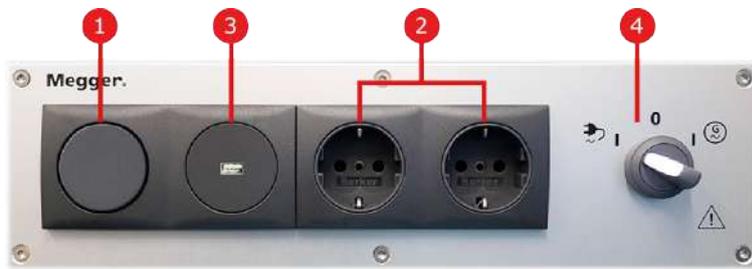
Default settings of the control unit

The following settings are preset on delivery, depending on the actual equipment of the test van:

Name	Value / Switch position	Description	Higher level menu
DC Output Voltage	12 V	Limiting the output voltage <hr/>  NOTE Risk of damage to property Do not change! Changes to these settings can lead to damage to the cable test van and connected systems / devices! <hr/>	Output
AC Input Current	10 A	Limiting the maximum load current	Input
Solar 2	Enabled	Enables parallel charging during mains operation	Input
Solar 3	Enabled	Enables charging via PV modules	Input
Alternator 1	Enabled	Enables charging via the alternator	Input
Idle Vehicle Charging	Enabled	Enables charging via the alternator, even when the engine is idling	Input; Alternator 1
Alternator Input Current	≥ 45 A	Must be adapted to the permissible charging current of the alternator <hr/>  If the charging current limits are not observed, the internal line fuse may trip. <hr/>	Input; Alternator 1

5.2.2 Other operating and connecting elements in the control area

Systems that have been installed in a vehicle by Megger itself are equipped with a number of additional control and connection elements, **depending on the equipment** in the control area:



Number	Description
1	Switch for interior lighting
2	Sockets with an output voltage and design suitable for the region of application
	 <p>WARNING Risk of electric shock Sockets are not de-energized when the emergency off switch is used!</p>
3	USB charging socket (not used for data transmission), only active when the main power switch is in the position  or  .
4	Main power switch for switching on/off the mains or generator voltage

When using a battery power kit

If the packages BPwrK-4 or BPwrS-INT are used, there are additional switchable sockets with LED indicators in the control room. The various sockets are in operation depending on the position of the main power switch **4** :

Type	Operation in position	Special feature
Socket without control LED	 	These sockets do not carry mains voltage when set to position 0 .
Socket with control LED	0	 <p>NOTE:</p> <p>These sockets are only active when no measurement operation can take place in order to prevent possible damage to devices during measurement operations.</p> <p>These sockets are suitable for charging own devices remaining in the test van.</p>



All consumers that are supplied via the battery power kit affect the operating time of the battery power kit - in some cases considerably. It is recommended to monitor the consumption and thus the remaining runtime of the battery power kit accordingly.

5.3 Switching on



NOTE

When operating the measuring system in an electric vehicle, charging the vehicle during the measurement is not permitted! Failure to do so may result in damage to the charging unit of the electric vehicle.

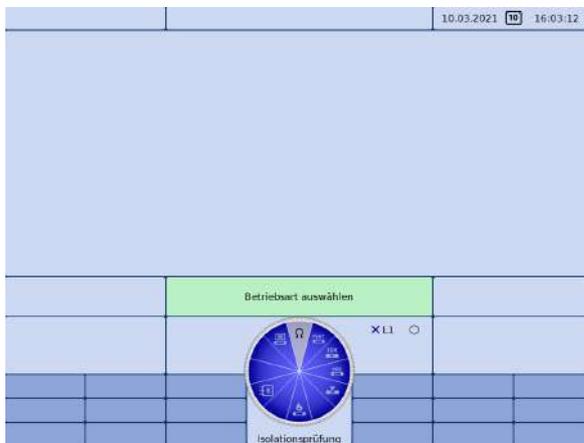


The parallel charging of the battery power kit during measurement operation is only possible if the BPwrK-4 package is used.

After the test van has been set up and connected according to the instructions in the previous chapter, the measuring system can be switched on as follows:

1. Use the main power switch "[Other operating and connecting elements in the control area](#)" on page 51 located near the control unit to supply voltage to the measuring system.
Set it to position , if the system is connected to mains voltage. If the system is operated via generator or battery power supply (optional), set the switch to position  instead.
2. Press the illuminated on/off button  on the control unit to switch on the measuring system.
If the button is not lit, this indicates problems with the mains supply ("[Establishing the mains supply](#)" on page 41).

Result: The measuring system starts. When the boot process is complete, the start screen of the operating software appears.



If problems are detected during start-up of the measuring system that would prevent a safe measuring operation, these are signalled in a separate dialogue and must be eliminated ("[Resolving signaled problems](#)" on page 55).

Operating the test van with battery power kit present

Using the BPwrK-4 package, the measuring system can be operated with the following positions of the main power switch:

Main power switch	Measuring system available
	yes
0	no
	Yes, if AC-OUT is activated in the control unit of the Battery Power Kit.



When using a customer provided battery power kit, there may be other/further requirements for the use of the measuring system.

Follow the instructions of the manual of the battery power kit to operate the measuring system with that respective battery power kit.

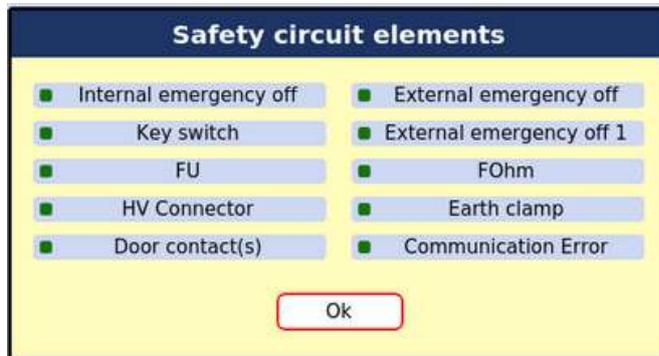
Default settings of the battery power kit

Using the BPwrK-4 package, the following default settings are available in the output segment of the battery power kit:

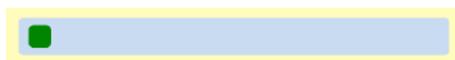
Menu item in the output segment	Default setting
AC OUT	enabled
DC OUT	enabled The DC output is required for the interior lighting and the motorised cable drum.

5.4 Resolving signaled problems

If safety problems are detected during start-up of the measuring system, the following dialogue opens after the boot process has been completed, which signals the status of the individual safety circuit elements:



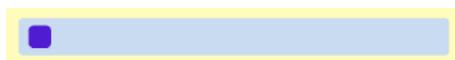
Before the dialogue can be acknowledged and the actual measuring mode can be started, all signaled problems must first be eliminated. The status of the respective elements can be read by the colour of the status icon:



The conditions of this safety circuit element are met and no action is required.



Deviations from the conditions required for operation were found in this safety circuit element. The problems should be corrected using the information in the table below.



A problem has been signalled for this safety circuit element, but no longer exists. Thanks to this special status, the operator can still identify the element triggering the safety message even if the problem occurred only briefly.

Depending on the problem signaled, the following actions must be taken:

Message	Possible cause / remedy
Internal emergency off	The emergency off switch on the control unit has been actuated and must first be reset.
FU	The F-U monitoring device ("Safety devices" on page 29) has detected a dangerous deviation in the monitored parameters. It must be checked that the following connections have been made correctly and provide good earth contact: <ul style="list-style-type: none"> ■ Earth cable ■ Reference earth connection (e.g. lack of earth contact of the earth spike, connection between cable drum and system not established)
HV Connector	The HV power cable connector is not fixed firmly enough into the high voltage output of the STX 40. If necessary, the union nut must be tightened.

Message	Possible cause / remedy
Key switch	The safety key switch on the control unit (" Operating unit " on page 47) is not in the correct position.
Door contact(s)	The rear door of the measuring vehicle is not closed or not properly closed.
Communication Error	An error occurred during communication between the modules within the measuring system. The system should be restarted. If the problem occurs repeatedly, contact an authorised service workshop.
External emergency off	Either the emergency off switch has been pressed or the safety key switch has been locked on the external safety device (" Connection of the external safety device " on page 44). If this is not the case, check the connection of the external safety device to the system.
External emergency off 1	The emergency off switch (optional) installed inside the vehicle has been actuated and must be reset first.
FOhm	The F-Ohm monitoring device (" Safety devices " on page 29) has detected a dangerous deviation in the monitored parameters. It must be checked that the following connections have been made correctly and provide good contact: <ul style="list-style-type: none"> ■ Earth cable ■ Cable shield of the HV connection cable (test object and system-side) ■ Reference earth connection (e.g. lack of earth contact of the earth spike, no connection between cable drum and system)
Earth clamp	The earth wire is not connected to the earth terminal on the cable drum (" Connection of the earth cable " on page 34).

5.5 Operation

The software can be operated using the touch display, the rotary encoder with tilt function or USB mouse. An USB keyboard can also be connected to the CU 15.6 FLPD control unit.



Detailed information on the operation of the software and the measuring procedures as well as on the high-voltage release can be found in the accompanying software manual.

6 Work after completion of the measurement job

Before opening the rear doors of the test van and making adjustments to the electrical connection, the following measures must be taken:

- Press the red "HV Off" button to switch off the high voltage and initiate discharge.
- Ensure that there is a short circuit and earthing for the test object at the connection point.



WARNING

Risk of electric shock

- The five safety rules ("General Safety Instructions and Warnings" on page 8) must be applied when disconnecting the connection between the test van and the test object.
- Even if properly switched off and discharged with the discharging device, system components that have been energised should only be touched if they have been discharged with a suitable discharging rod, as well as earthed and short-circuited.
- Do not remove the earthing and short circuit until the test object is to be put back into operation.

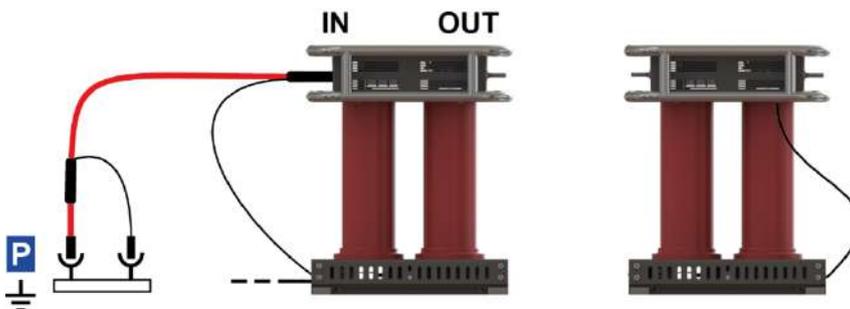
When the measurements are complete, follow these steps to turn off the test van and disconnect the electrical connections:

1. Complete the work with the measurement and logging software and ensure that you have either exported or uploaded all the records required for later follow-up to the cloud database.



For detailed information on operating the software, refer to the accompanying software manual.

2. Press the illuminated on/off button **I** on the control unit to switch off the measuring system.
3. Set the main power switch to position **0** to interrupt the voltage supply to the measuring system. The main power switch is always located near the operator station.
4. Disconnect the electrical connections. To dismantle, use the same method as for connecting ("Electrical connection" on page 32) but in reverse order.
5. If the test van is equipped with a partial discharge coupler (e.g. PDS 60(-HP)), it must be short-circuited using a short-circuit cable (external coupler) or the HV connection cable connected to the input "IN" (internal coupler) to avoid charging the integrated capacitor.



7 IT accessories and connectivity

7.1 Use of USB accessories



CAUTION

Risk of damage due to vibration and interference

To prevent malfunction or even damage to the control unit, observe the following instructions:

- Remove longer USB sticks from the USB port after the work has been completed.
- Do not use extension cables when connecting USB accessories.
- In HV operation, no loose USB connection cables may be inserted into the USB ports of the control unit.

Depending on the model, the control unit ("[Operating unit](#)" on page 47) has at least one USB port to which the following accessories can be connected:

Class	Description
Input devices	<p>A USB mouse can be connected to all available control units and allows full operation of the software by mouse.</p> <p>Operating units of the type CU 15.6 FLPD additionally allow the connection of a USB keyboard for convenient data input.</p> <p>It is also possible to connect a wireless keyboard and/or mouse with a suitable USB dongle.</p>
USB mass storage	<p>USB mass storage devices (such as USB sticks and external hard disks) can be connected for importing and exporting measurement data and reports.</p> <p>CU 15.6 FLPD control units have two additional USB 3.0 ports on the rear of the housing for fast transfer of larger amounts of data.</p>
Printer	<p>A printer can be connected to the USB port on CU 15.6 FLPD control units for direct printing of measurement data and reports. However, the selection of compatible printers is limited by the drivers installed on the system.</p> <p>Before purchasing a printer, please contact your Megger sales representative for a list of supported devices.</p>

7.2 Internet and GPS connectivity (optional)

Requirements

To connect to the internet and receive GPS signals, the system must be equipped with the optional 4G/GPS router and the CU 15.6 FLPD control units. In most cases, the router is located on the vehicle's partition or side walls and is easily accessible. With the exception of the software configuration of the router and the replacement of the SIM card, no unauthorised adjustments may be made to the router and its wiring.

Purpose

Internet and GPS connectivity are required for the availability of the following software features:

- Access to online maps
- Remote control of important location and line location methods via app
- TeamViewer remote access for support and demonstration purposes
- Location indicator in the map view

Inserting/swapping the SIM card

To establish a mobile data connection, there must be at least one SIM card in the router. There may also be a second slot for inserting a second SIM card available. The SIM cards must meet the following requirements:

- Format: Mini SIM
- Enabled for internet use using GPRS, EDGE, 3G or 4G (a data-only plan is sufficient)
- Providers with good network coverage



It is recommended that contracts be concluded with a fixed upper cost limit to always keep control of the costs incurred, even in the case of high data consumption!

To replace the currently installed SIM card or insert a SIM card for the first time, proceed as follows:



After the new SIM card is inserted in the orientation shown, the holder must be pushed back into the slot until it clicks into place. Following the installation of a new SIM card, the PIN of the SIM card must be stored and the configuration of the access point (APN) adjusted.



For detailed information on the software configuration of the router and the data connection, refer to the accompanying software manual or the online help of the software.

If there is a SIM card in both slots **SIM1** and **SIM2**, the data connection of the SIM card in slot **SIM1** is used until one of the following conditions occurs:

- The data volume of the SIM card in slot **SIM1** is used up.
- A data connection via the network provider of the SIM card in slot **SIM1** cannot be established.

Troubleshooting connection problems

If you experience connection problems while using the test van, the LEDs on the router may help you determine the cause of the problems. The following states are signalled:

LED	Status	Description
PWR	Off	No mains voltage available
	On	Mains voltage available
2G 3G 4G	Off	No connection could be established to the respective network.
	All LEDs are flashing at the same rate	No SIM card found or there are problems with the SIM cards. This may be due to the access point (APN) or SIM PIN not having been configured yet or not having been configured correctly.
	Permanently lit or flashing a single colour	A connection to the respective network exists. When there is data traffic, the LED flashes very quickly.
📶		Signal strength
SIM1 SIM2	Off	No data connection could be established via the SIM card.
	On	There is an active data connection via this SIM card.

8 Troubleshooting

8.1 Behaviour in the event of faults during normal operation

8.1.1 Checking the fuses

If a fault occurs, the various circuit breakers and fuses of the measuring system should be checked first.



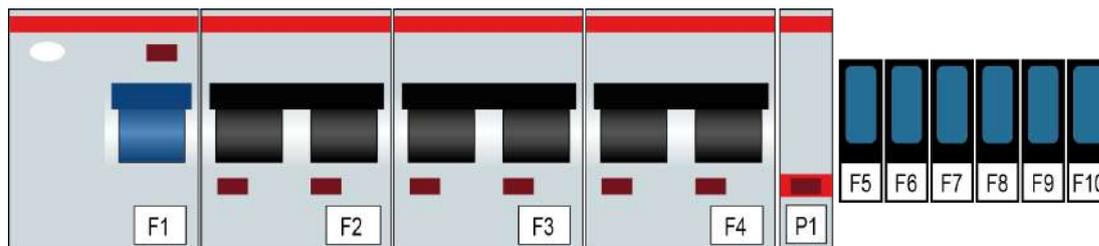
NOTE

Risk of damage to the measuring devices

If a circuit breaker or a fuse is repeatedly triggered, it must be assumed that there is a permanent fault in the affected circuit. To avoid consequential damage, further operation of the measuring system is not permitted.

Fuses of the measuring system:

In case of problems with the mains supply, the fuses of the measuring system should be checked first. Depending on the type of installation, the fuse strip for the power distribution is located either in the control room or near the connection equipment.



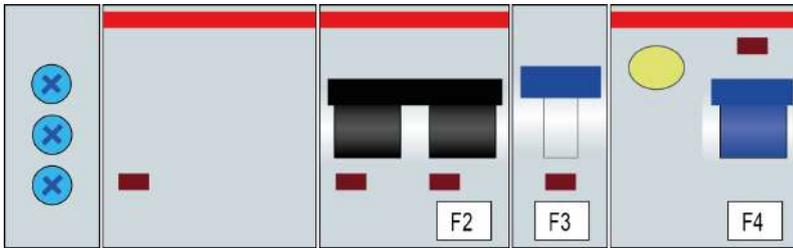
Number	Value	Function
F1	F202A-40/0.03	FI circuit breaker (RCD)
F2	C 16	Electrical outlets
F3	C 16	Electrical outlets/air conditioning (optional)
F4	C25	Supplied large unit (optional)
P1 ¹	LED	Signalling in case of overload of the internal generator (optional)
F5 / F6	4A	Mains switch
F7 / F8	4A	Generator switch
F9	6A	12 V distribution
F10 ²	6A	24 V distribution (optional)

¹Not available for versions M and L with the Battery Power Kit power distribution system.

²Available for version L

Fuses in the mains supply system NAS 16-230-PRIMEON

Especially in the case of power supply problems, the fuses in the mains supply system should also be checked. This is located at the end of the mains cable.



Number	Value	Function
F2	K16A	Main fuse power supply
F3	C2	Voltage monitoring Overvoltage protection
F4	40A, 2p, 30mA	RCD
F5 / F6 ¹	T1A	Indicator lights on the NAS

Fuse on the 12 V battery

In case of problems with the interior lighting and the cable drum motor, the 20 A flat plug fuse on the 12 V battery should be checked. In most cases, the battery is located in the rear part of the vehicle behind the connection equipment.



Number	Value	Function
Flat plug fuse	20A	Interior lighting and cable drum motor

¹Inside the housing

Battery Power Kit fuses

The DC output is secured with its own fuse. This is located below the top cover. Another fuse is on the battery module of the battery power kit (bottom module):

Fuse DC output:



Fuse DC output:



Fuse battery module:



Fuse battery module:



When equipped with the package BPwrK-ALT, an additional fuse is located directly on the vehicle battery.

Number	Value	Function
Flat plug fuse	25A	DC output
High-current fuse	70VDC/150A	Protection against external short circuit
High-current fuse ¹	32VDC/50A (Typ MidiVAL, Mini-ANL, ANS)	Line fuse for the alternator connection



NOTE

Risk of damage to property

The fuse in the battery module may only be replaced by Megger service personnel!

¹Only in connection with the BPwrK-ALT package

8.1.2 Other possible fault causes

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

Problem	Possible cause / remedy
<p>VLF test not possible</p> <p>When a VLF test is started, it indicates that the connected cable cannot be charged.</p>	<p>It must be checked whether all voltage converters have been disconnected from the test object.</p> <p>It is possible that a fault in the test object may also be the cause of this problem.</p>
<p>Very high PD interference levels</p> <p>In preparation for a partial discharge measurement, a very high basic interference level (>500 pC) is measured.</p>	<p>It must be checked that all earth connections are clean, have no corrosion and provide good metallic contact.</p> <p>If these measures do not achieve the desired success, a measurement from the other side is recommended.</p>
<p>Decreasing TanDelta measured values</p> <p>During a TanDelta measurement, significantly decreasing TanDelta measured values are detected as the voltage increases</p>	<p>This may indicate moisture in the cable or at the end caps (especially if humidity >85%).</p> <p>It is recommended to dry the end caps and clean them with a suitable cleaning agent.</p> <p>If these measures do not achieve the desired success due to climatic conditions, the measurement should be repeated when conditions have improved.</p>
<p>High PD level at the beginning of the cable</p> <p>During a partial discharge measurement, noticeably high partial discharges are measured directly at the start of the test object</p>	<p>These partial discharges could be caused by an improper type of connection.</p> <p>It is recommended to maximise the distance from earthed parts. The use of insulating mats must be avoided.</p> <p>In particular, in the case of partial discharge measurements with VLF sinusoidal voltage, corona discharges can also be the reason. This can be counteracted by appropriate field control measures such as corona rings.</p>
<p>Cable drum motor / interior lighting does not work</p>	<p>If the fuse on the 12V battery is intact ("Checking the fuses" on page 61), it can be assumed that the battery is completely discharged.</p> <p>Connect the system to mains power for an extended period of time to recharge the battery.</p> <p>If this does not help, a replacement of the battery has to be arranged with an authorized service workshop.</p> <p>When using the battery power kit included in the BPwrK-4 package, it must be checked that the output DC out is enabled ("Switching on" on page 53).</p>

Problem	Possible cause / remedy
Battery power kit is not charging	<p>It must be checked that the required charging options in the input segment of the control unit are enabled and that the mains switch of the test van is set to position 0.</p> <p>When charging via NAS 16-230-PRIMEON or outdoor socket, the cable connections and their associated fuses must be checked.</p> <p>When charging via solar panels, it must be checked whether the panels are dirty or (partially) covered.</p> <p>When charging via alternator, the associated fuses of the vehicles must be checked.</p> <p>If this does not help, contact Service.</p>

8.2 Behaviour in the event of continuous faults

In the event of damage, irregularities or malfunctions that cannot be rectified using the information in the operating instructions, the following steps must be carried out immediately:

1. Switch off the measuring system.
2. Insert a USB stick into the USB port of the operating unit.
3. If still possible, turn on the system and import the error memory to the inserted USB stick.



For detailed information on operating the software, refer to the accompanying software manual.

4. Take the measuring system out of operation and mark it accordingly as not functional.
5. Inform a service workshop authorised by Megger of the fault and provide the service personnel with the log file read out.

9 Care and maintenance

9.1 Testing and maintenance measures to be carried out by the operator

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

- Remove dust and dirt
- Check the function of the door and emergency off switches
- Unwind the cables and check for breaks and damage
- Check the connection cables and modules of the high-voltage components for secure hold



Refer to the relevant sections in the respective operating manual for information on maintenance and care of the peripheral devices to be carried out by the operator. This especially applies to battery-powered devices.



If you notice any defects during the test, please promptly inform a service workshop authorised by Megger.

9.2 Required maintenance by a service workshop

A measuring system of the technical complexity of PRIMEON requires regular maintenance in order to maintain its functionality. Megger recommends that the system be checked and serviced once every two years at a Megger service centre.

In addition, necessary measures such as usage-dependent maintenance of the shock switch are announced by system messages in the software. If such a system message occurs, a maintenance appointment must be arranged with the responsible service workshop immediately!



If the maintenance requirements are not fulfilled, the manufacturer is released from the warranty for defects shown to be due to inadequate maintenance.

9.3 Charging, Maintenance and Care of the battery power kit (optional)

Charging process

In general, charging the battery power kit is possible when the main switch ("Other operating and connecting elements in the control area" on page 51) is set to position **0**.

Proceed as follows to charge the battery power kit included in the BPwrK-4 package:

1. Make sure, that the main switch is set to position **0**.
2. Make sure, that the required charging options in the input segment of the battery power kit control unit are enabled:

Charging options	Description
Alternator 1	Must be activated for charging via the test van's alternator.
Solar 2	For parallel charging in mains operation via NAS. The mains cable drum does not need to be unrolled. It is recommended to always leave this option activated!
Solar 3	Must be activated for charging via PV.
AC Input Current	Must be activated for charging via outdoor socket. The input current for this must be limited to 6 A in the settings.

3. To charge the battery power kit via the mains voltage or the outdoor socket, connect the corresponding cable to the mains voltage.

Charging via the alternator or solar panel is automatic.

Connecting the charging cable to the external charging socket



WARNING

Risk of electric shock

The external charging cable does not have its own fuse. Therefore, it may only be used with a fused socket.

Always connect the charging cable to the vehicle first before connecting it to the mains voltage.

Maintenance and care

When using the PV modules:

Action	Period
Clean the glass surfaces of the PV modules with water and a soft cloth / sponge. Persistent dirt can be removed with a mild detergent. It is recommended that cleaning is only carried out in weak sunlight.	If needed
Visual inspection of electrical and mechanical components for soiling, damage and fastening	every 6 months
Removing leaves and other objects from the surface of the solar panels	As required

When using the external socket with the corresponding charging cable:

Action	Period
Visual inspection of the charging cable for damage	before use
Visual inspection of the external socket outlet for damage	before use
Spray silicone spray for electrical contacts onto the contact pins	before and after the winter season

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