Megger

Compact City

Single-Phase Test Van

USER GUIDE

Issue: C (07/2021) - EN
Article number: 85888

Consultation with Megger

The present system manual has been designed as an operating guide and for reference. It is meant to answer your questions and solve your problems in as fast and easy a way as possible. Please start with referring to this manual should any trouble occur.

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

Should any question remain unanswered or should you need the help of an authorized service station, please contact:

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Megger reject all further claims under warranty, in particular those from consequential damage. Each component and product replaced in accordance with this warranty becomes the property of Megger.

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

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Since some states do not allow the exclusion or limitation of an implied warranty or of consequential damage, the limitations of liability described above perhaps may not apply to you.

Contents

1 Safety Instructions

1.1 General Notes

Safety precautions

This manual contains basic instructions for the commissioning and operation of the device / system. For this reason, it is important to ensure that the manual is always available to the authorised and trained operator. He needs to read the manual thoroughly. The manufacturer is not liable for damage to material or humans due to non-observance of the instructions and safety advices provided by this manual.

Locally applying regulations have to be observed!

Labelling of safety instructions

The following signal words and symbols are used in this manual and on the product itself:

Signal word / symbol	Description
DANGER	Indicates a potential hazard which **will result** in death or serious injury if not avoided.
WARNING	Indicates a potential hazard which **may result** in death or serious injury if not avoided.
CAUTION	Indicates a potential hazard which may result in moderate or minor injury if not avoided.
NOTICE	Indicates a potential hazard which may result in material damage if not avoided.
	Serves to highlight warnings and safety instructions. As a warning label on the product it is used to draw attention to potential hazards which have to be avoided by reading the manual.
	Serves to highlight warnings and safety instructions that explicitly indicate the risk of an electric shock.
	Serves to highlight important information and useful tips on the operation of the device/system. Failure to observe may lead to unusable measurement results.

Working with products from Megger

It is important to observe the generally applicable electrical regulations of the country in which the device will be installed and operated, as well as the current national accident prevention regulations and internal company directives (work, operating and safety regulations).

After working on the system, it must be voltage-free and secured against reconnection as well as having been discharged, earthed and short-circuited.

Use genuine accessories to ensure system safety and reliable operation. The use of other parts is not permitted and invalidates the warranty.

Operating staff

The system may only be installed and operated by an authorised electrician. DIN VDE 0104 (EN 50191), DIN VDE 0105 (EN 50110) and the German accident prevention regulations (UVV) define an electrician as someone whose knowledge, experience and familiarity with the applicable regulations enables him to recognise potential hazards.

Anyone else 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. Given that living areas are sufficiently far away from the planned area of operation (industrial area), equipment in living areas will not be impaired.

1.2 General Safety Instructions and Warnings

Intended application

The operating safety is only guaranteed if the delivered system is used as intended (see page 10). Incorrect use may result in danger to the operator, to the system and the connected equipment.

The thresholds listed in the technical data may not be exceeded under any circumstances.

Operation in traffic environment

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

Five safety rules

The five safety rules must always be followed when working with HV (High Voltage):

1. De-energise
2. Protect against re-energising
3. Confirm absence of voltage
4. Earth and short-circuit
5. Cover up or bar-off neighbouring energised parts

Using cardiac pacemaker / defibrillator

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

Fire fighting in electrical installations

- According to regulations, carbon dioxide (CO_2) **is required to be used** as extinguishing agent for fighting fire in electrical installations.
- Carbon dioxide is electrically non conductive and does not leave residues. It is safe to be used in energized facilities as long as the minimum distances are maintained. A CO_2 fire extinguisher must be always available within electrical installations.
- If, contrary to the regulations, any other extinguishing agent is used for fire fighting, this may lead to damage at the electrical installation. Megger disclaims any liability for consequential damage. Furthermore, when using a powder extinguisher near high-voltage installations, there is a danger that the operator of the fire extinguisher will get an electrical shock from a voltage arc-over (due to the powder dust created).
- It is essential to observe the safety instruction on the extinguishing agent.
- Applicable is DIN VDE 0132.

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

Do not cover the air exit or leave any combustible material in close vicinity to the heater.

WARNING

Dangers when working with 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 test 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 Compact City generates a dangerous voltage of up to 45 kV during measurement operation. This is supplied to the test object via a high-voltage cable.
- The test system may not be operated without supervision.
- Never fail to use safety equipment or put it out of operation.
- Operation requires minimum two people whereas the second person must be able to activate the emergency switch in case of danger.
- To prevent dangerous charge accumulation, earth all metal parts in the vicinity of the high voltage equipment.

WARNING

Peripheral devices

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

2 Technical description

2.1 Description

Concept The Compact City is a compact and flexibly deployable test van system.

The safety module and its proven safety devices, combined with the central operating unit, make it possible for a wide range of Megger system components to be operated together in a test van and controlled safely from the operating room. Depending on the installed equipment, possible applications include cable fault detection (SPG, Teleflex, FLG, MFM), VLF testing (TDM) and diagnosis (partial discharge coupler, TanDelta sensor).

Depending on the operating mode, operation takes place either via a provided laptop, a removable reflectometer with a 10" touch display or the individual device itself. Switching between the different operating modes, signalling of problems in the safety circuit and HV control are all performed at the central operating unit of the test van.

Features The system provides the following features:

- Compact design suitable for portable vans
- Individually equipped
- The highest safety standards
- Internal power supply (optional)
- Signalling of the current patch panel activation on the operating unit

2.2 Technical data

Technical data of the test van

The test van itself is defined by the following parameters:

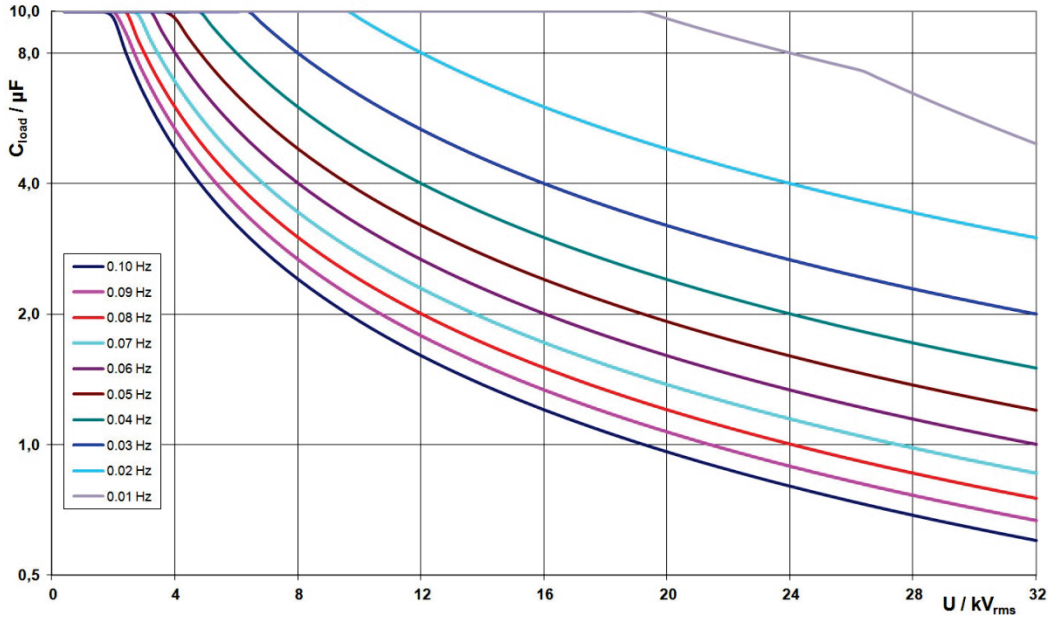
Parameter	Value
Mains voltage	230 V, 50 Hz or 110 V, 60 Hz Connection via isolating transformer (3.6 kVA)
Generator system	Voltstar genarator up to 8 kV (optional)
Connection power	3.6 kVA (optional up to 8 kV)
Connection equipment	
• HV output cable	50 m (motorised or manual)
• Power cable	50 m (including appropriate isolating transformer and power supply system NAS 16-2)
• Earth cable	50 m
• Auxiliary earth connection cable (FU)	10 m
• External safety device connection cable (optional)	5, 15 or 50 m
• LV coaxial connection cable (optional)	25 or 50 m
Safety	
• Electric safety	in accordance with DIN EN (IEC) 61010-1
• Safety and protection equipment	The following conditions are monitored during operation: • Loop resistance: System earth to station earth, auxiliary earth to station earth • Step voltage: Earth to vehicle chassis • Fast ramp voltages • Rear door switch • Safety key switch • Internal/external emergency switch (EN 50191)
• Discharge	Safe forced discharge in case of emergency shutdown or mains failure
• Supply voltage	Overvoltage protection, undervoltage protection, residual current circuit breaker
Operating temperature	-10 °C to +50 °C
Storage temperature	-20 °C to +70 °C
Operating humidity	93% at 30 °C (non-condensing)

Technical data of the TDM 45 test attachment (optional)

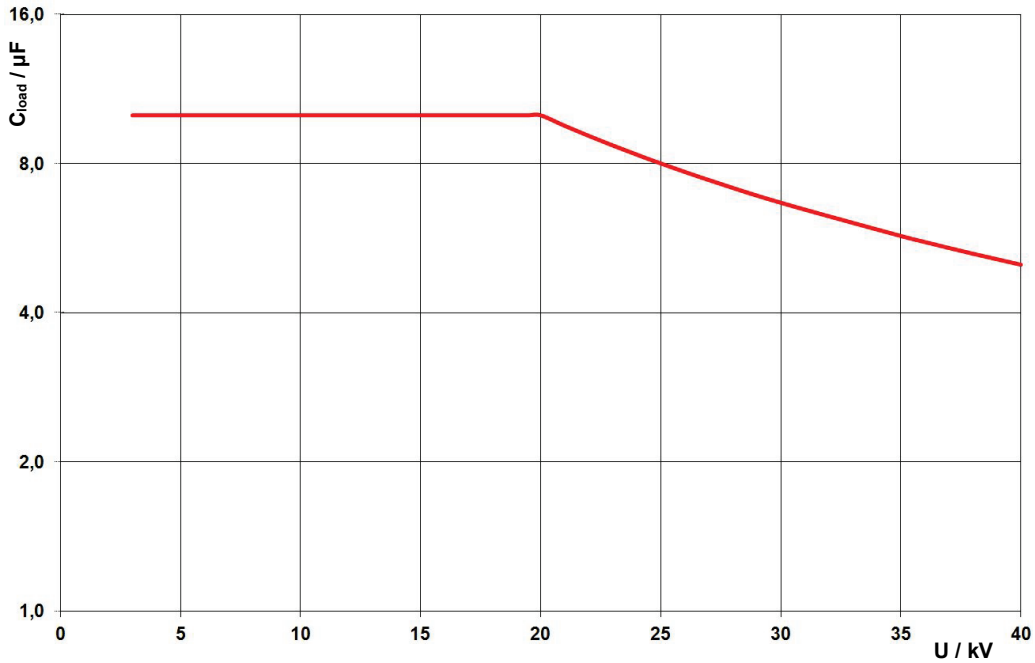
The optional test and diagnosis module TDM 45 is defined by the following parameters:

Parameter	Value
Output voltage	
• Sine wave	2 … 32 kV_{RMS} / 45 kV_{PEAK}
• DC	±2 … ±45 kV
• Rectangle	±2 … ±45 kV
• Cosine rectangular (optional)	±3 … ±40 kV
• DAC (Damped AC) (optional)	±3 … ±40 kV
Max. source output current	12 mA_{RMS} (at nominal voltage)
Leakage current measurement	(Rectangular, VLF-CR and DC operation)
• Display area	0 … 20 mA
• Resolution	10 µA
Frequency	
• Sine wave/rectangular voltage	0.01 Hz - 0.1 Hz
• Cosine rectangular voltage	0.1 Hz
• DAC voltage	20 Hz - 500 Hz
Testable load capacitance	
• Sine wave voltage	0.6 µF at 45 kV / 0.1 Hz
• Rectangular voltage	0.6 µF at 45 kV / 0.1 Hz
• DC voltage	5 µF at 45 kV
• Cosine square voltage / DAC voltage	4.8 µF at 40 kV
• Maximum load capacitance	10 µF at reduced voltages and frequencies
Internal tan delta (optional)	
• Measurement range	10^{-3} to 10^{0}
• Accuracy (at a load capacity >20 nF)	1 x 10^{-3} or 1%
• Resolution	1 x 10^{-4}
Pulsing for sheath fault pinpointing (in seconds)	0.5:1 / 1:2 / 1:3 / 1:4 / 1.5:0.5

The following diagram **applies to tests with a sine wave voltage** and illustrates the dependency of the test frequency on the capacity of the load connected and the test voltage set. If a test frequency cannot be used due to the capacity limitations specified here, the frequency is automatically adapted and the user is informed of this.



In **cosine rectangular or DAC operation** (optional), the following load diagram applies analogously[1]:



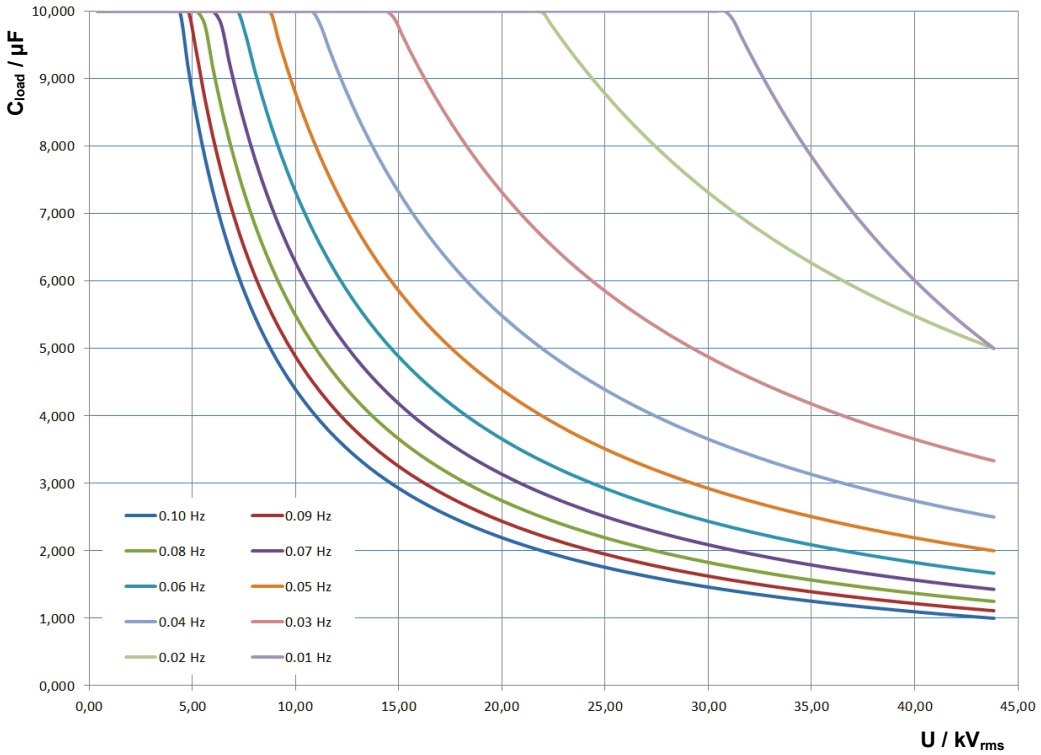
[1] Only applies between -25 and 45 °C. In the temperature range from 45 °C to 55 °C, at 40 kV the power is reduced to 80%.

Technical data of the TDM 62 test attachment (optional)

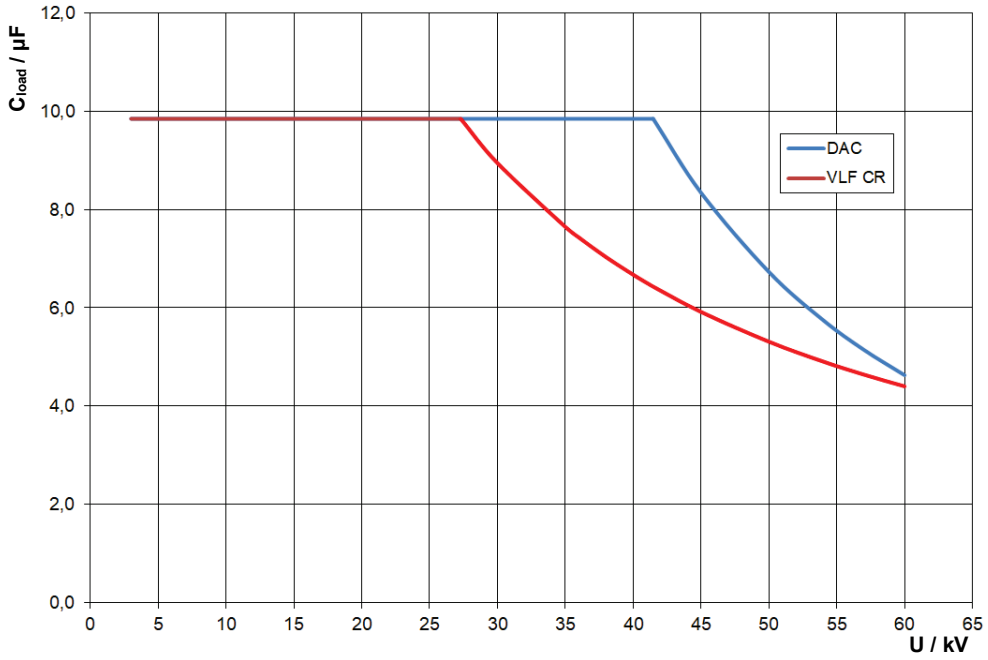
The optional TDM 62 test attachment is defined by the following parameters:

Parameter	Value
Output voltage	
• Sine wave	2 … 44 kV_{RMS} / 62 kV_{PEAK}
• DC	±2 … ±62 kV
• Square wave	±2 … ±62 kV
• Cosine rectangular (optional)	±3 … ±60 kV
• DAC (Damped AC) (optional)	±3 … ±60 kV
Max. source output current	23 mA_{RMS} (at nominal voltage)
Leakage current measurement	(Rectangular and DC operation)
• Display area	0 … 20 mA
• Resolution	10 µA
Frequency	
• Sine wave / square wave voltage	0.01 Hz to 0.1 Hz
Testable load capacitance	(see also diagram below)
• Sine wave voltage	1.0 µF at 62 kV / 0.1 Hz
• Square wave voltage	1.0 µF at 62 kV / 0.1 Hz
• DC voltage	5 µF at 62 kV
• Cosine rectangular voltage	4.45 µF at 60 kV
• DAC voltage	4.75 µF at 60 kV
• Maximum load capacitance	10 µF at reduced voltages and frequencies
Internal tan delta (optional)	
• Measurement range	10^{-4} … 10^{0}
• Accuracy (at a load capacity >20 nF)	1 x 10^{-4}
• Resolution	1 x 10^{-5}
Pulse rate in sheath pinpointing mode (in seconds)	0.5:1 / 1:2 / 1:3 / 1:4 / 1.5:0.5

The following diagram **applies to tests with a sine wave voltage** and illustrates the dependency of the test frequency on the capacity of the load connected and the test voltage set. If a test frequency cannot be used due to the capacity limitations specified here, the frequency is automatically adapted and the user is informed of this.



In **cosine rectangular or DAC operation** (optional), the following load diagram applies analogously[2]:



[2] Only applies between -25 and 45 °C. In the temperature range from 45 °C to 55 °C, at 60 kV the power is reduced to 80%.

Technical data of other measurement equipment / peripherals

The technical data of additional measurement equipment (for example, SPG, digiPhone+, PDS, tan delta test attachment) and peripherals (for example, generator system) contained in the test van can be found in the operating instructions.

2.3 Operating unit

Operating unit

The central operating unit of the test van has the following display and control elements:

Element	Description
1	LEDs for signalling of existing security problems and current connection configuration (see page 28)
2	HV interlock key switch  High voltage unlocked  High voltage locked In the locked state, the key can be removed and the system can thus be protected against unauthorised high-voltage operation.
3	Operating mode selection switch
4	Emergency stop switch Pressing the emergency stop switch will shut off the high voltage immediately and discharge the measurement circuit. The plug sockets in the control room will still be live.
5	“HV Off” button
6	“HV On” button

3 Putting the test van into operation

Applicable guidelines

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.

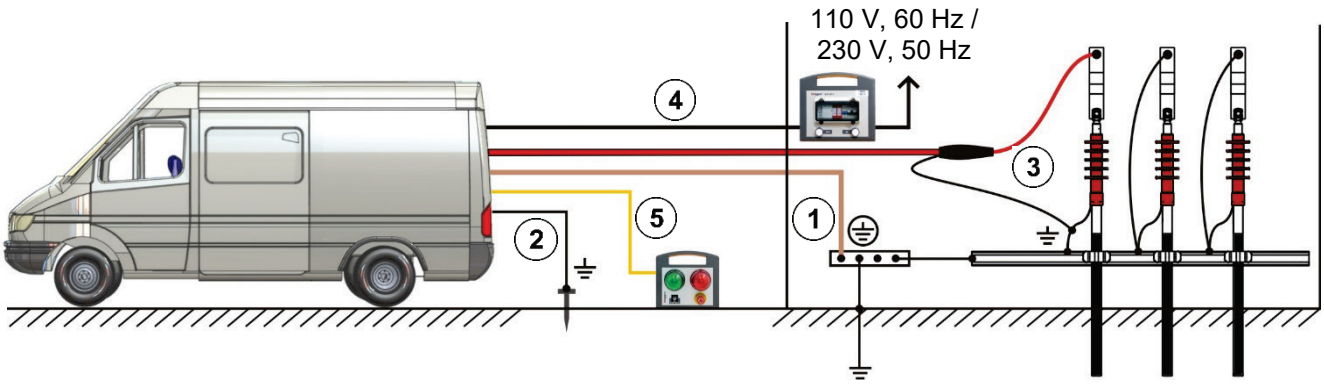
3.1 Securing the area

The following steps must be taken to adequately secure the area and the test van:

Step	Action
1	Place the test van so that it is level (slope <10%) and near the access to the test object, taking into consideration its load and external dimensions. Verify that the test van is in a stable position.  **WARNING** Never place the test van directly over the route of the cable to be tested!
2	Use the parking brake to secure the test van from rolling away and place stop blocks on the wheels if required.
3	Secure the area according to regional regulations using barricades, warning signs and cable bridges.

3.2 Electrical connection

The following figure shows the simplified connection diagram:



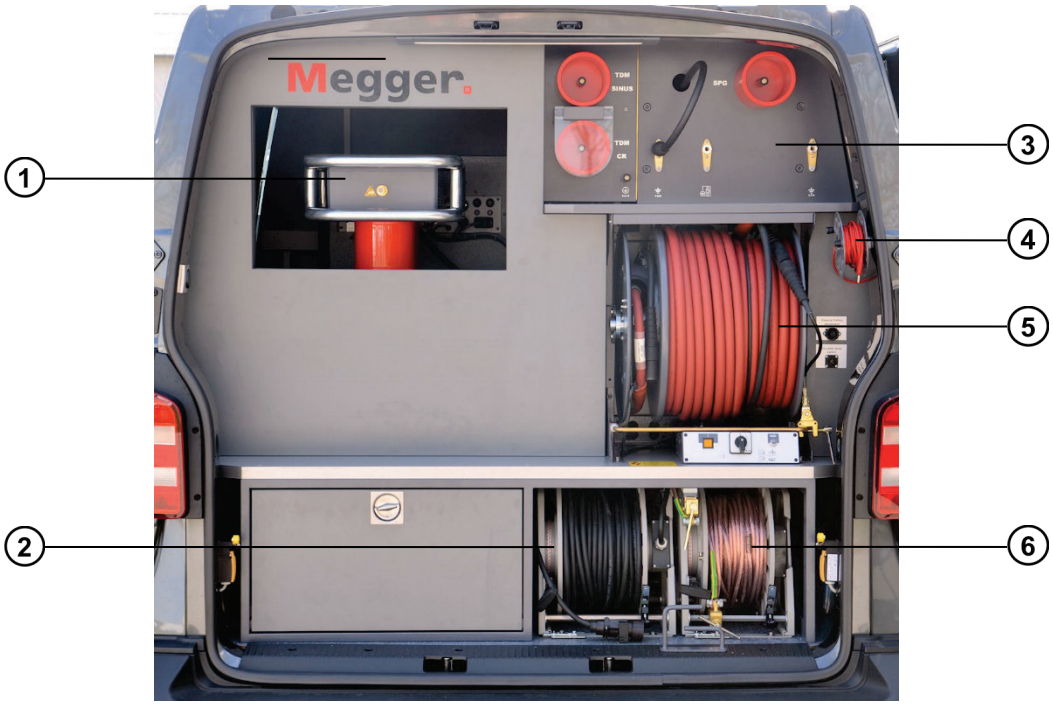
WARNING	**Follow the specified connection sequence.** The electrical connection must be carried out in the sequence shown in the figure. Connection to the mains occurs last. Taking down the setup is to proceed in reverse order.

1. Connection of the earth cable (see page 21)
2. Connection of the FU cable (auxiliary earth) (see page 22)
3. Connection to the test object (see page 23)
4. Connection to the mains (see page 27)
5. Connection of the external safety device (optional) (see page 25)

3.2.1 Connection equipment

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

Typically, the test van in the HV room is equipped with the following components[3]:



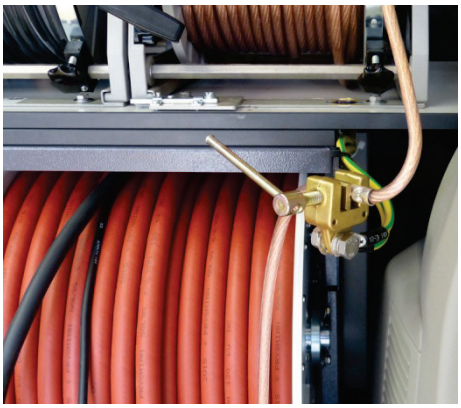
Part	Description
1	Coupling unit for partial discharge measurement (optional)
2	Power cable reel
3	High voltage patch panel
4	Cable reel of FU cable
5	Cable reel for high-voltage cable
6	Cable reel of earth cable

[3] Not shown in the figure: External safety device, LV cable drum (optional), MFM cable drum (optional)

3.2.2 Connection of the earth cable

WARNING	• The test van should never be operated without the earth cable being connected. The earth cable establishes the connection between the system and the protective earth and ensures that the entire system is touch-proof. • The test van should be operated only on earthing systems or single earth electrodes with transition resistances <2 Ω. • The protective earth (earth cable) and system earth (screen of the HV cable) must be connected so that no unacceptable voltage difference may arise between the 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. This connection must be created for the measurement with a suitable cable.

Proceed as follows to connect the earth cable:

Step	Action
1	Release the brake of the earth cable reel.
2	Unwind the cable and connect it to the station earth or other suitable foundation earth.
3	Clamp one of the contact sleeves attached to the cable at intervals of 5 m under the earthing terminal next to the cable reel. 
4	Secure the cable reel brake again.

3.2.3 Connection of the FU cable (auxiliary earth)

Proceed as follows to connect the FU cable (auxiliary earth) to monitor the voltage-time integral and fault voltage:

Step	Action
1	Unwind the FU cable.
2	Place the earth spike into the ground in the immediate vicinity of the test van and attach the FU cable to it. 
3	Connect the other end of the cable to the connector on the FU cable reel. 

If despite the connected auxiliary earth, the high-voltage clearance is not given after activation due to poor earthing conditions, the following measures may help:

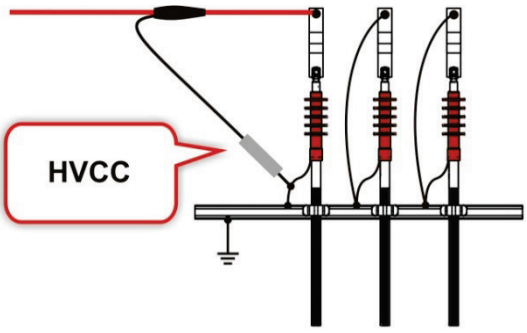
- Try inserting the earthing rod in other locations that provide better earth contact. In heavily built-up areas, the gaps between the concrete slabs can be used, for example.
- Use water to moisten the location where the earthing rod has been inserted.
- Attach the auxiliary earth to a foundation earth (e.g. a lightning protection system). Do not use the same foundation earth to which you have already connected the main earthing cable.

3.2.4 Connection to the test object

WARNING	• Before connecting to the test object, the five safety rules (see page 8) must be applied. • All test object phases which are not being tested must be short-circuited and earthed. • Install protective equipment (such as railings, chains or bars) to block access to the hazard zone and prevent the risk of touching live parts. • Since the voltage applied to the test object can assume values that pose a risk of incidental contact, all cable ends must be shielded in accordance with VDE 0104 to avoid this. Make sure that all cable branches are taken into account.

3.2.4.1 Using the HV connection cable

Basic procedure The electrical connection between the HV patch panel and the test object is to be performed as follows:

Step	Action
1	Make sure that the system-side end of the HV connection cable protruding from the side of the cable reel is not connected with the high-voltage patch panel.
2	Unwind the HV connection cable.
3	Connect the HV connection cable to the test object using suitable connection clamps. When conducting a Tan Delta measurement using the internal sensor of the integrated test and diagnosis module (TDM), connection to the shield of the cable under test needs to be made via the supplies HVCC adapter as shown below: 
4	Connect the system-side end of the HV connection cable to the HV patch panel. The connection to the HV patch panel must be made according to the desired operating mode. You can find the switch-on rules on the inside of the rear door.

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

Application If the specimen is connected via the LV connection cable, unless you remove the the reflectometer from the operating room, it is only possible to perform pulse reflection measurements with the reflectometer.

Procedure Perform the following steps to connect the LV cable to the test object:

Step	Action
1	If the connection cable coming from the system needs to be connected to the socket of the cable reel body, this connection must be disconnected before the cable can be unwound.
2	Unwind the LV cable.
3	Use the included adapter cables (BNC to crocodile clips) to connect the individual leads of the LV cable to the desired phases of the specimen (black crocodile clips) and the earthed shield of the specimen (red clip). When connecting, make sure that the cores are run as uniformly as possible to each other (ideally twisted) and are not separated from each other until just before the actual connection point. This ensures that both phases have equal impedance ratios. When connecting, pay attention to the marking of the phases in order to correctly assign the results to the respective phases.
4	Reconnect the system coming from the reflectometer with the socket on the cable reel.

3.2.5 Connection of the external safety device

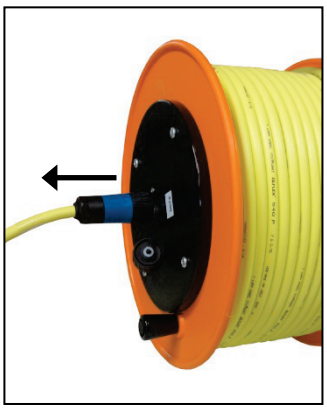
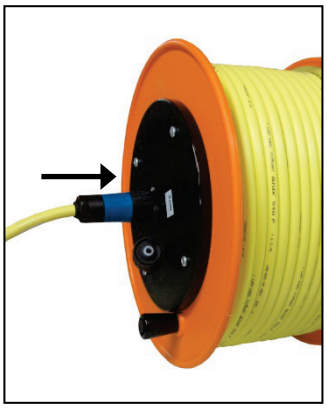
Purpose Using the external safety device, the status of the system can be indicated outside the test van and the HV processing can be interrupted or blocked using the EMERGENCY OFF switch and key switch.

Description The following figure shows the external safety device:

Part	Description
1	**Green signal light** Lights up when the system is switched on but not in high-voltage operation.
2	**Red signal light** Lights up as soon as high voltage can be generated. All discharge and earthing devices are open and the test object must be treated as live.
3	**HV interlock key switch**  High voltage unlocked  High voltage locked In the locked state, the key can be removed and the system can thus be protected against unauthorised high-voltage operation.
4	**Emergency stop switch**

Connection of the external safety device

Proceed as follows to connect the external safety device:

Step	Action
1	If the connection cable (yellow) coming from the system control panel needs to be connected to the socket of the cable reel body, this connection must be disconnected before the cable can be unwound. 
2	Unroll the connection cable.
3	Place the external safety device so that it is accessible and visible near the test van, and connect the connection cable to the appropriate socket. If the connection cable has not been connected to the external safety device, the high-voltage clearance is denied during operation!
4	Reconnect the system control panel coming from the reflectometer with the socket on the cable reel. 

3.2.6 Connecting the power cable

If the measurement object and the supplied network are connected to different, unconnected earthing systems during operation of the test van, then establish potential equalisation using a connection cable with a cross section of at least 16 mm² Cu. Good earthing conditions are extremely important.

When connecting to mains sockets which do not fit with the preassembled plugs, or when establishing a direct connection to the low voltage line, only approved (VDE/IEC or equivalent national regulations) interconnections are to be used.

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

Step	Action
1	Release the brake of the mains cable reel.
2	Unroll the mains cable.
3	Connect the cable with a mains voltage.
4	Secure the cable reel brake again.

Generator power (optional) If you have no way to tap mains power in the immediate vicinity of the deployment location and your system is equipped with a generator system such as the *Voltstar* used by Megger, the system can also be supplied on this generator.

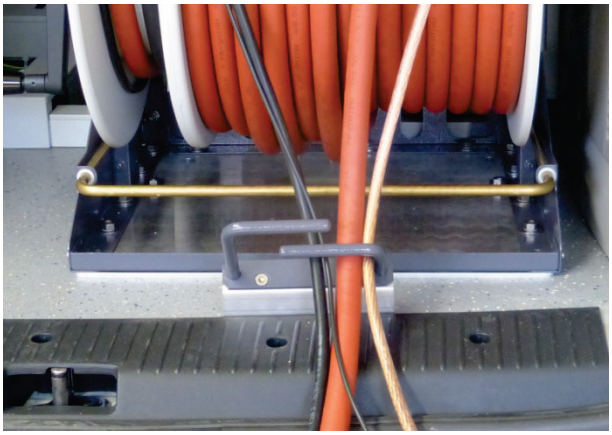
For information on setting up and operating the generator, please see the associated operating manual.

When the generator is operating, the system automatically obtains its operating voltage from the generator. This is also the case if the mains power supply and generator are active at the same time.

3.3 Setting up switch-on standby

Closing the HV room

After the test van has been connected or a change made to the test object activation, the connection cables must be led through the cable guide to the outside, as shown in the following figure, and then the rear door closed:



Rectifying safety problems

Safety problems that prevent high-voltage clearance are indicated by the LEDs ❶ on the operating unit and must be rectified before starting the work. The following problems are indicated by the corresponding LED:

LED	Cause / remedy
	The earthing cable needs to be connected with the earthing terminal on the cable drum (see page 21).
	The resistance between the protective earth and system earth is too high. Check whether the shield of the HV connection cable and the earthing cable are connected correctly and the connection points provide good metallic contact.
	The auxiliary earth has either not been connected or does not provide good earth contact (see page 22).
	The emergency stop switches on the operating unit or the external safety device has been activated and needs to be reset again first.
	One of the emergency stop switches (for example, on the operating unit) has been activated and needs to be reset again first.
	The rear door must be closed.

3.4 Operation

Switching the test van on

After the electrical connection has been conducted as described in the previous sections, the test van can be switched on by turning the mains switch located in the operating room to **1** position.

Switching on the notebook and starting the software

If the system is equipped with a notebook to carry out the test and diagnosis operating modes, the notebook must be switched on and the required measurement software started. Afterwards, the "**TDM Initialization**" button in the control room must be pressed for at least 2 seconds to initialize the network communication between the notebook and the TDM.

Selecting the operating mode

After readiness of switching on has been established, use the selector switch ❸ to select the desired operating mode. The selection of available operating modes depends on the equipment of the test van.

When making your selection, make sure that the connection situation in the HV room, which is indicated by the HV VLF CR and VLF SIN LEDs, corresponds to the required operating mode. If this is not the case, the electrical connection must be adapted.

Depending on the configuration of the test van, the following operating modes can be selected:

Required operating mode	Suitable position of the selector switch ❸	Correct LED signalling
• Test with sine wave voltage • Test with DC voltage • Sheath test • Sheath fault location	**TDM Sinus**	VLF SIN

Required operating mode	Suitable position of the selector switch ❸	Correct LED signalling
Test with cosine rectangular voltage	**TDM CR**	
Tan Delta measurements and step tests	**TDM tanD**	
Partial discharge diagnosis with cosine rectangular voltage (Slope) or damped AC voltage (DAC)	**TDM CR**	
Partial discharge diagnosis with sine wave voltage	**TDM Sinus**	
Operating modes of the SPG 40	**SPG**	

Switching high voltage on

If the selected device is a device with no remote access to internal safety circuit (for example, SPG 32), the green “HV ON” button ❻ must be pressed immediately after the operating mode has been selected. However, this does not enable high voltage conditioning, it only makes it possible to switch the device on. The actual high voltage clearance then takes place using the buttons on the device itself in the course of the normal device operation (according to the corresponding operating instructions).

The situation is different for ‘intelligent’ devices with remote access to internal safety circuit (for example, SPG 40, TDM), where the “HV ON” button ❻ only turns green during the course of operation, and with actuation of the button the actual high voltage is enabled. This switching state means: **High voltage**!

Operation

Depending on the device involved, actual operation is performed either using a laptop, the reflectometer or the individual device itself.

For information about operating the individual devices, refer to their respective operating manuals.

High voltage clearance

When certain events occur (for example, voltage breakdown in the test object, expiration of the defined test duration), the high voltage is automatically deactivated by the system. This also happens when a problem has been identified in the safety circuit (see above).

HV operation can also be terminated manually at any time by pressing the red illuminated HV OFF button ❺.

Irrespective of whether the high voltage is switched off automatically or manually, the measurement circuit is discharged by means of an internal discharge-resistor of the individual device used.

4 Disconnecting/adapting electrical connections

WARNING

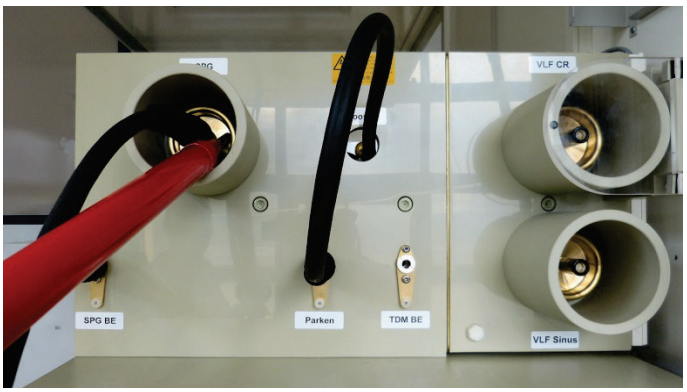
Risk of electric shock

In case of necessary corrections to the HV activation and for the final disconnection of the electrical connections, the following information must be complied with:

- Follow the five safety rules (see page 8).
- Even if switched off properly and discharged using the discharge device, the system components that were under voltage should only be touched once they have been discharged using a suitable discharge rod as well as having been earthed and short-circuited.
- Only undo the earthing and short-circuiting measures when the test object is to be operated again.

If the test van is equipped with the test and diagnosis module TDM 62, the analogue residual voltage meter in the operating room has to be checked to confirm the absence of residual voltage before taking any actions in the HV room. For up to 10 seconds after switch-off, there may still be residual voltage at the HV output and the patch panel.

After the rear door of the test van has been opened following a measurement/test, the connected contacts of the HV patch panel must first be tapped with the earthing rod of the test van and checked for residual voltage.



Only after the lack of voltage has been established beyond any doubt may electrical connections be disconnected or modified.

When disconnecting the test system, proceed in reverse sequence to the manner in which the connection was made (see page 19).

5 Troubleshooting

Independent fault clearance

If one of the following faults occurs, the first step is to perform the described interference suppression measures:

Fault	Possible remedy
None of the LEDs on the operating unit are on, even though the test van is connected to the mains voltage.	Check the fuses and the residual current circuit breaker in the mains connection box (yellow or grey box at the end of the power cord) and in the optional fuse box (see next page).
Reflectometer cannot be switched on	The F13 fuse (type: 5A) in the power distribution (for the position refer to test van documentation) may be defective and must be replaced if necessary.
Lighting in the operating room cannot be switched on	The F12 fuse (type: 5A) in the power distribution (for the position refer to test van documentation) may be defective and must be replaced if necessary.
Although none of the safety LEDs are illuminated, the high voltage cannot be enabled	The external safety device might not be connected to the respective connection cable. Please also check the position of the key switch on the operating unit and the external safety device.
The measuring software on the provided test and diagnosis notebook (optional) does not work anymore	The software versions which were up-to-date at the time of delivery can be found on the supplied USB flash drive and be re-installed on the notebook or copied to its hard disk, if need be.
The measurement software running on the notebook shows the fault message „**VLF Booster not ready**“ or „**Safety circuit is open**“.	No network connection could be established between the TDM and the notebook. Press the "**TDM Initialization**" button in the control room for at least 2 seconds to initialize the network communication.

Depending on the system's equipment there may be an additional fuse box installed under the tabletop in the control room which contains the following safety and display elements:

Element	Value	Function
H0	---	(only if a Voltstar generator system is installed) Generator overload! The generator is active, but currently does not supply 230 V supply voltage. The indicator also lights up for about 3 to 5 seconds when the generator is turned on.
F0	C32A / 0,03A	Residual current circuit breaker / miniature circuit breaker
F1	C16A	Circuit breaker for the Compact City system
F2	C16A	Circuit breaker for the air conditioning system
F3	C25A	Circuit breaker for the device with a power consumption > 3,6 kVA

CAUTION	If a circuit breaker or fuse is tripped repeatedly, it must be assumed that there is a permanent fault in the affected circuit. To prevent additional damage, further operation of the test van is not allowed.

What to do in case of permanent faults

In the event of damage, irregularities or faults that cannot be resolved with the assistance of this manual, the device/system must be shut down immediately and labelled accordingly. In such an event, the relevant management must be informed. Please contact Megger Service immediately to eliminate the malfunction. The device/system may only be started up again once the malfunction has been eliminated.

6 Maintenance and care

6.1 Required maintenance by a service workshop

A measurement system of the technical complexity of the Compact City needs regular maintenance to maintain its functionality. For this reason it is **imperative** to perform a maintenance upon occurrence of one of the following conditions:

- Once a year (check the HV components, safety devices, the insulating gas and the individual devices / accessory parts)
- In case of malfunctions

Upon occurrence of any of these conditions, promptly contact the responsible service workshop to make an appointment for maintenance.

If the maintenance requirements described above are not fulfilled, the manufacturer releases itself from the warranty on defects shown to be due to inadequate maintenance.

6.2 Independent testing and maintenance measures

To identify potential problems at an early stage and keep the system in good condition, it is essential for the following tasks to be carried out independently and at appropriate intervals depending on the amount of use:

- Remove dust and dirt
- Check the function of door and EMERGENCY OFF switches
- Unwind the cable and inspect for cracks and damage
- Check connecting cables and modules in the HV room for secure hold

For information on do-it-yourself maintenance and care of peripheral devices, read the corresponding sections in the relevant operating manuals. This especially applies to battery-powered devices.

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