MT-HV

Operating Instructions

manuals

08.23

Table of contents

1. About these Operating Instructions

Original operating instructions

In these instructions, we have clearly structured the most important information so that you can use your **MT-HV** quickly and efficiently.

1.1. Notes about the Use of these Operating Instructions

These operating instructions contain important information relevant to operator safety.

Go to *www.hella-gutmann.com/manuals* to find all the manuals, instructions, references and lists about our diagnostic devices, tools and much more.

Please also visit our Hella Academy under *www.hella-academy.com* and expand your knowledge with various online tutorials and other training courses.

Please read the operating instructions entirely. Pay special attention to the first pages containing the safety instructions. They are provided solely to assure your safety when working with the product.

When working with the product, it is recommended to read the individual work steps in the manual again to prevent hazard of persons and equipment or operating errors.

The product shall be used exclusively by a qualified person. Information and knowledge included in this training is not explained in these operating instructions.

The manufacturer reserves the right to modify these instructions and the product itself without prior notice. We therefore recommend checking it for any updates. These operating instructions must accompany the product in case of sale or any other transfer.

These operating instructions shall be kept for the entire service life of the product and shall be accessible at any time.

2. Symbols Used

2.1. Marking of Text Parts

DANGER

Text parts marked in this way indicate an imminent dangerous situation, which will lead to death or severe injuries if not avoided.

WARNING

Text parts marked in this way indicate a possibly dangerous situation, which may lead to death or severe injuries if not avoided.

CAUTION!

Text parts marked in this way indicate a possibly dangerous situation, which may lead to minor or slight injuries if not avoided.

These symbols indicate rotating parts.

This symbol indicates dangerous electric voltage/high voltage.

This symbol indicates the risk of crushing limbs.

This symbol indicates a potential injury of the hand.

IMPORTANT

All texts labeled **IMPORTANT** refer to a hazard in the diagnostic device or environment. The advices or rather instructions stated here must therefore be observed by all means.

NOTICE

Texts marked with **NOTICE** contain important and helpful information. It is recommended to observe these texts.

Struck-through waste bin

This marking indicates that the product must not be discarded as domestic waste.

The bar underneath the waste bin indicates whether the product was "placed on the market" after 13 August 2005.

Refer to manual

This marking indicates that the user manual must always be read and always be available.

2.2. Symbols on the Product

DANGER

Text parts marked in this way indicate an imminent dangerous situation, which will lead to death or severe injuries if not avoided.

WARNING

Text parts marked in this way indicate a possibly dangerous situation, which may lead to death or severe injuries if not avoided.

CAUTION!

Text parts marked in this way indicate a possibly dangerous situation, which may lead to minor or slight injuries if not avoided.

Refer to manual

This marking indicates that the user manual must always be read and always be available.

Direct current voltage

This symbol indicates direct current voltage.

Direct current voltage means that the electrical voltage does not change throughout a longer period of time.

Polarity

This symbol indicates a plus connection of a voltage source.

Ground connection

This symbol indicates a ground connection of a voltage source.

3. User Information

3.1. Safety precautions

3.1.1. General Safety Precautions

- The MT-HV is exclusively intended for use on a vehicle. It is a precondition for the use of the MT-HV that the user has knowledge of automotive technology and is therefore aware of the sources of danger and risks in the workshop and on motor vehicles.
- An additional country-specific qualification is mandatory for performing high-voltage measurements.
- Please read the entire operating instructions thoroughly and, where necessary, the mega macs X user manual before using the MT-HV.
- All notes apply which are given in the individual sections of the MT-HV operating instructions and in the user documentation of the mega macs X. All the symbols on the MT-HV and the following measures and safety precautions shall also be observed.
- Furthermore, pay attention to all general instructions from labour inspectorates, trade associations and vehicle manufacturers as well as all laws, legal ordinances and instructions which have to be commonly obeyed by a repair shop.

3.1.2. Safety Precautions for the MT-HV

Observe the following to avoid incorrect handling and injury to the user or destruction of the MT-HV arising from this:

- Protect the MT-HV and all connecting cables from hot parts.
- Protect the MT-HV and all connecting cables from rotating parts.
- Regularly check all connecting cables/accessory parts for damage (destruction of the MT-HV due to short circuit).
- Only use approved test prods and high-voltage test leads.
- Regularly and prior to every application, check the test prods and high-voltage test leads for damage (visual inspection).
- Do not remove the protective cap from the test prods during high-voltage measurements.
- Do not exceed the allowed operating and ambient temperatures.
- Keep the MT-HV away from fluids such as water, oil or gasoline. The MT-HV is not waterproof.

- Protect the MT-HV from strong impacts and do not drop it.
- If the MT-HV shows signs of malfunction, immediately contact Hella Gutmann or a Hella Gutmann trading partner.

3.1.3. Safety Precautions for High Voltage/Line Voltage

It is a precondition for performing high-voltage measurements that the user has knowledge of automotive technology and is therefore aware of the sources of danger and risks in the workshop and on motor vehicles. An additional country-specific qualification is mandatory.

Very high voltages occur in electrical systems. Due to voltage flashover on damaged components, such as marten damage or touching live components, the risk of electric shock is likely. Voltage flashover can occur e.g. on the primary and secondary side of the ignition system, the connection to the vehicle, the lighting systems or the wiring harness with plug connections. Therefore regard the following:

- Only use power supply cables with grounding contact.
- Only use a checked or the attached power cord.
- Always use the original cable set.
- Do not exceed the voltage limits indicated on the connecting cables.
- The voltage values to be measured must be shielded extra or even twice from dangerous line voltage. The voltage limits printed on the test leads must not be exceeded. Pay attention that the allowed measuring range is not exceeded when measuring positive and negative voltage at the same time.
- Regularly check cables and adapters for damage.
- Perform any assembly work such as the connection of the MT-HV to the vehicle or the replacement of components only when ignition is switched off.
- Do not touch live components when the ignition is on.

3.1.4. Safety Precautions – Chemical Burns

In case of improper use electrolyte may escape from the battery and may cause chemical burn of eyes, respiratory system and skin. Therefore regard the following:

- Wear personal protective equipment when working on the battery.
- If acid comes in contact with parts of the body or clothing, immediately rinse the parts concerned with plenty of water and consult a doctor.
- Instantly consult a doctor if you have aspirated acid vapor.

3.1.5. Safety Precautions – Risk of Injury

When working on the vehicle, there is a risk of injury through rotating parts or rolling of the vehicle. Therefore regard the following:

- Protect vehicle against rolling away.
- Additionally place gear selector lever of AT vehicles to park position.
- Deactivate the start/stop system to avoid an inadvertent engine startup.
- Only connect the the MT-HV to the vehicle when the ignition is switched off.
- Do not reach into rotating parts while the engine is running.
- Do not run cables near rotating parts.
- Check the high-voltage parts for damage.

3.1.6. Safety Precautions for Hybrid/Electric Vehicles

Any work on high-voltage systems is allowed only when wearing the corresponding personal protective equipment.

Very high tensions occur on hybrid and electric vehicles. Due to voltage flashover on damaged components, such as marten damage or touching live components, the risk of electric shock is likely. High voltage at or in the vehicle can lead to death in case of inattention. Therefore regard the following:

- Only the following qualified employees are allowed to de-energize the high-voltage system:
  - High-voltage technician
  - Skilled electrician for predetermined operations – Hybrid or rather electric vehicles
  - Skilled electrician

- Place and attach warning signs and barriers.
- Check the high-voltage system and the high-voltage lines for damage (visual inspection!).
- De-energizing the high-voltage system:
  - Regard the manufacturer- and vehicle-specific regulations.
- Regard the vehicle manufacturer's instructions.
- Securing the high-voltage system against re-activation:
  - Withdraw the ignition key and keep it safe.
  - Keep the service disconnect plug in a safe place or secure the battery master switch against re-activation.
  - Insulate the battery master switch, the plug connections etc. with dummy plugs, covering caps or insulating tape with the corresponding warning notice.
- With the MT-HV or another approved measuring tool, test for absence of voltage. Even when the high-voltage system is disconnected, residual voltage may still be present.
- Ground and short-circuit the high-voltage system (necessary only if voltage is higher than 1000 V).
- Voltage below 1000 V: Cover the parts which are close to the system or which are energized e.g. with insulating cloth, hoses or plastic coverings. Voltage higher than 1000 V: Cover the parts with insulating plates/protective panels specially developed for this purpose so that sufficient protection against contact to adjacent parts is ensured.
- Regard the following before re-energizing the high-voltage system:
  - All tools and utilities are removed from the hybrid/electric vehicle.
  - Remove the grounding and short circuit of the high-voltage system. Do not touch any of the cables now.
  - Attach the protective paneling that has been removed before.
  - Remove the protective measures at the switching system.

3.2. Disclaimer of liability

3.2.1. Burden of Proof on the User

The burden of proof is on the user of the product, that he has paid attention to technical explanations, notes on operation, equipment care as well as maintenance and safety without exception.

3.2.2. Documentation

The listed notes describe the most common causes of errors. However, there are often further causes of existing faults which cannot be listed here, or there are further sources of error which as yet are unknown. The Hella Gutmann Solutions GmbH does not accept any liability for failed, unnecessary or incorrectly performed repair work.

Hella Gutmann Solutions GmbH does not accept any liability for the use of data and information that is found to be incorrect or that was incorrectly displayed, or for errors that occurred inadvertently during the compilation of the data.

The Hella Gutmann Solutions GmbH will not take any liability arising from the errors and misuse mentioned before and further losses of profit or company value thereof.

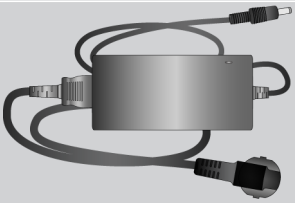
The Hella Gutmann Solutions GmbH does not accept any liability for damages or operational disruptions resulting from failure to observe the operating instructions and the special safety precautions.

The burden of proof is on the user of the product, that he has paid attention to technical explanations, notes on operation, equipment care as well as maintenance and safety without exception.

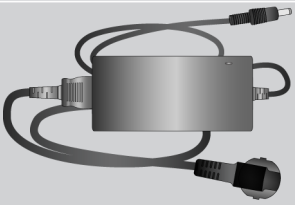
4. Device description

4.1. Delivery Contents

4.1.1. Basic

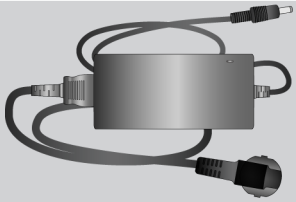
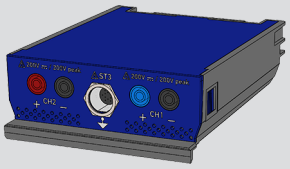
Quantity	Name	
1	**MT-HV**	
1	Power adapter and power cord	
1	USB cable (type C - type C)	
1	Operating instructions	

4.1.2. Positive

Quantity	Name	
1	**MT-HV**	
1	Power adapter and power cord	
1	USB cable (type C - type C)	

Quantity	Name	
1	High-voltage test lead black/red	
1	Operating instructions	

4.1.3. Pro

Quantity	Name	
1	**MT-HV**	
1	Power adapter and power cord	
1	USB cable (type C - type C)	
1	High-voltage test lead black/red	
1	MT 77	
1	Black/blue test lead	
1	Red/black test lead	
1	Operating instructions	

4.1.4. Checking Delivery Contents

Please check the delivery contents upon receiving your device so that complaints can be issued immediately regarding any potential damage.

Proceed as follows to check the delivery contents:

1. Open the delivery package and check for completeness based on the delivery slip. If the package shows signs of external damage, open it in the presence of the delivery service and examine the **MT-HV** for hidden damage. Any damage to the delivery package or damage to the **MT-HV** during transport must be documented by the delivery service in a damage report.
2. Take the **MT-HV** out of the packaging.

⚠ CAUTION!

Danger of short circuit due to loose parts in or at the MT-HV

Danger of destruction of the MT-HV and/or the automotive electronics

Never put the MT-HV into operation if you suspect that there are loose parts in or on the module. If this is case, contact the Hella Gutmann repair service or a Hella Gutmann trading partner immediately.

3. Check the **MT-HV** for mechanical damage and shake slightly to ensure that there are no loose parts inside.

4.2. Intended Use

The **MT-HV** is a mobile measurement module with which you can measure voltage, current, resistance and pressure.

You can use the **MT-HV** both for measuring high voltages and low voltages. Use the installed high-voltage measurement module for high-voltage measurements. You can insert another measurement module into the **MT-HV** for low-voltage measurements.

The **MT-HV** can be operated only in connection with the **mega macs X** of **Hella Gutmann**. The communication between the **mega macs X** and the **MT-HV** is realized via Bluetooth®. Diagnostic devices from other manufacturers will not be supported. The **MT-HV** is *not* suitable for the following repair work/voltage measurements:

- Electric appliances and devices
- Home electrics
- Power supply systems/line voltage

If the **MT-HV** is used in a way not authorized by **Hella Gutmann**, the protection of the **MT-HV** and the **mega macs X** may be influenced.

4.3. Using the Bluetooth® Function

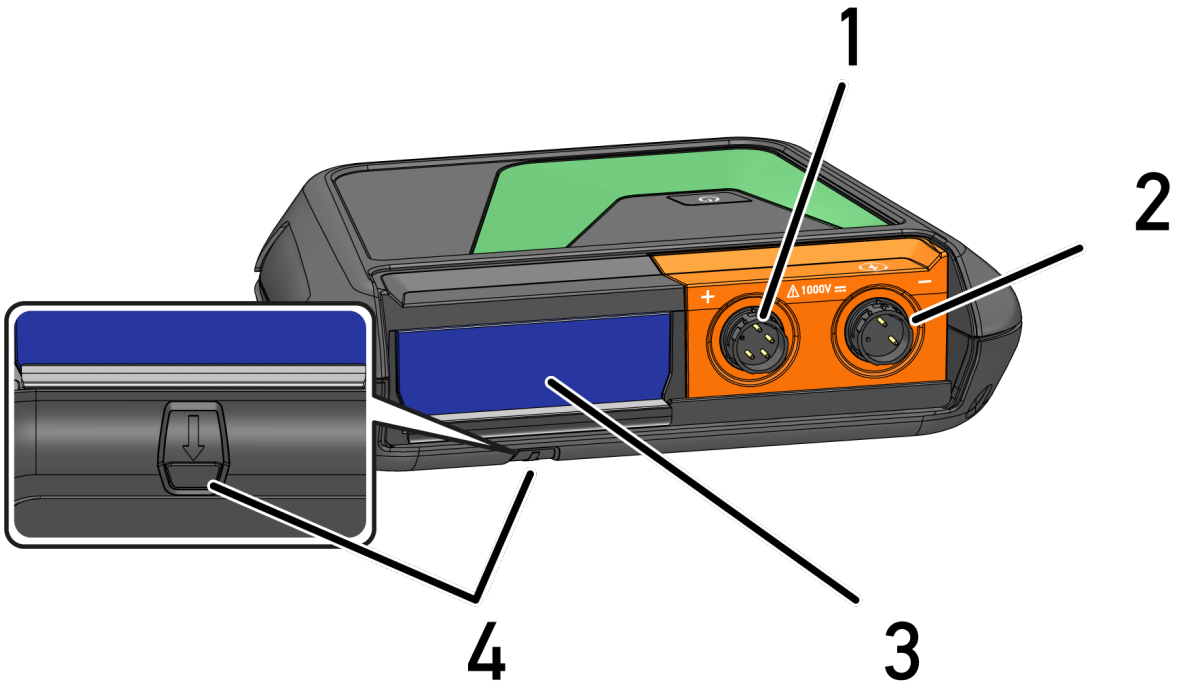
NOTICE

Alternatively, you can also operate the MT-HV with USB cable connected to the mega macs X.

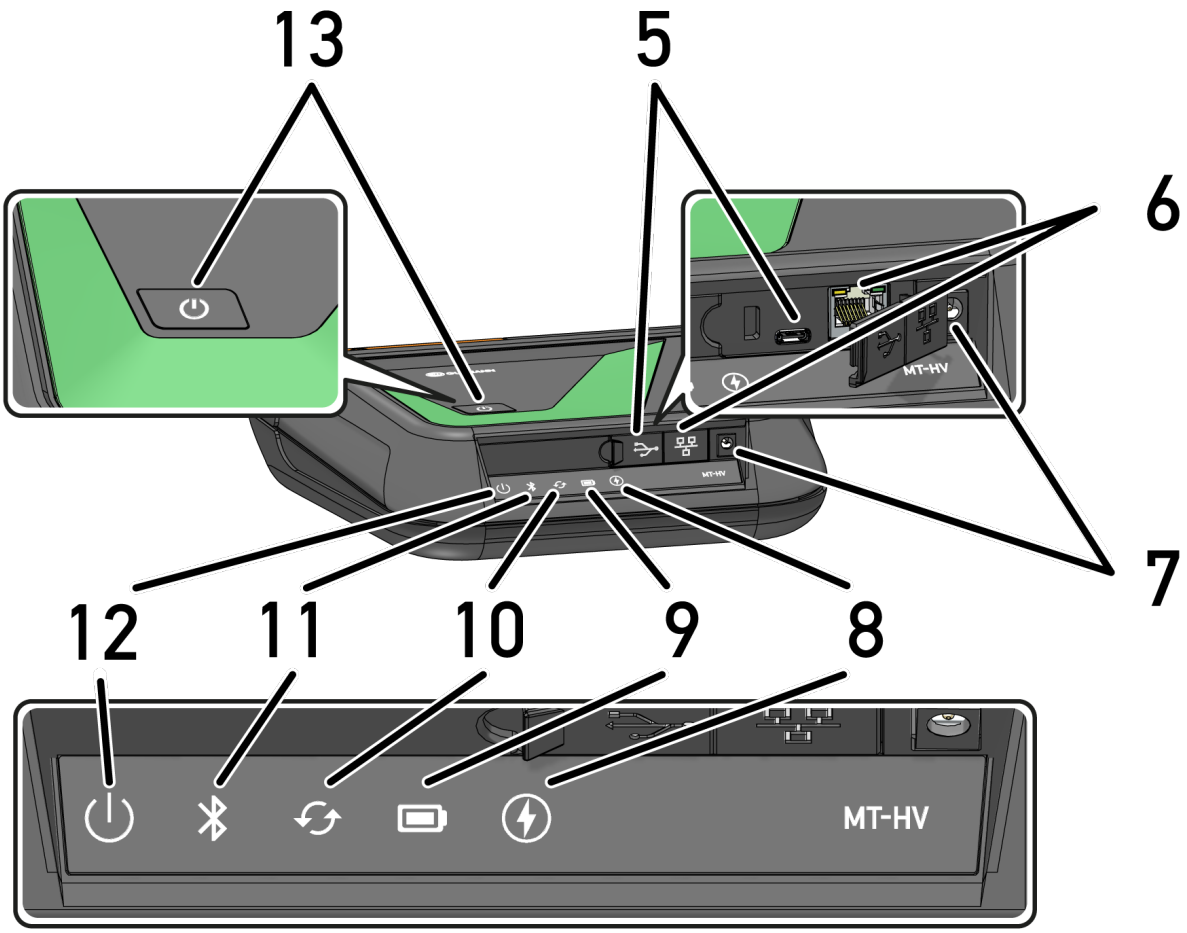
The terms of use of the Bluetooth® function may be restricted or prohibited through law or corresponding legal regulations in certain countries.

Observe the provisions in force in the respective country before using the Bluetooth® function.

4.4. MT-HV

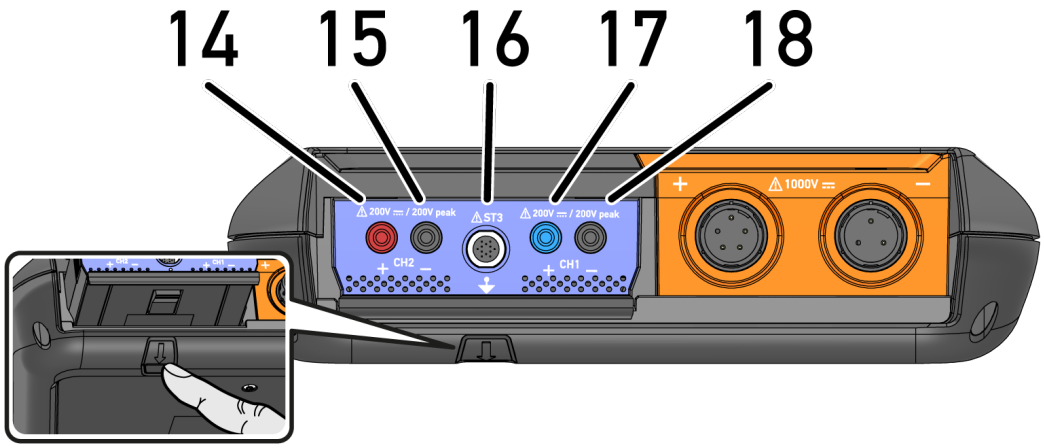


	Name
1	**Connecting the high-voltage test leads** Connect the red high-voltage test lead.
2	**Connecting the high-voltage test leads** Connect the black high-voltage test lead.
3	**Module slot** Insert another module (e.g. MT 77) into the module slot.
4	**Unlocking button** • Use the unlocking button to unlock and remove the MT-HV. • Use the unlocking button to check if the inserted module is properly inserted.



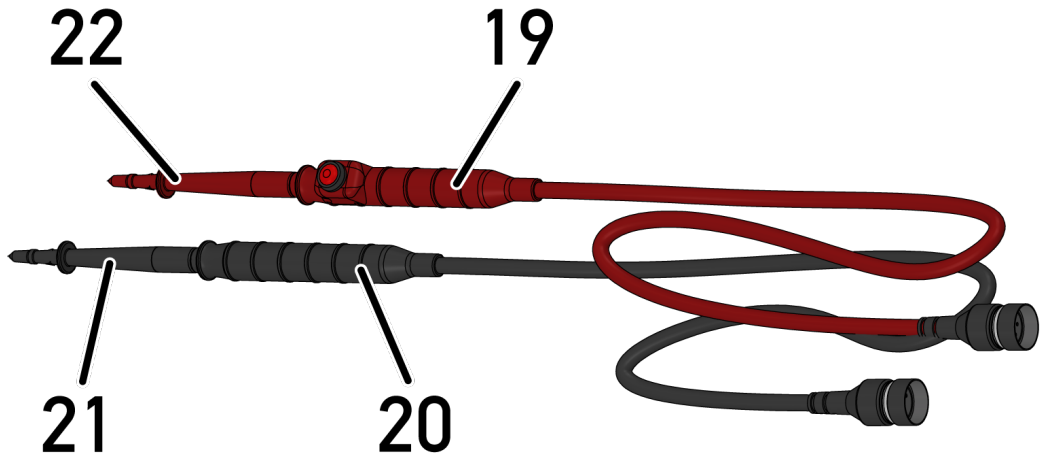
	Name
5	**USB-C interface**
6	**Ethernet interface**
7	**Power supply socket** Connect a power adapter to the power supply socket to supply the MT-HV with voltage and to charge the internal battery.
8	**High-voltage** This LED indicates if e.g. a high-voltage measurement process is active or if high voltage is applied to the test prods (e.g. in case of insulation resistance measurement). The different status indications are explained in the section User Communication [▶ 18].
9	**Battery status** This LED indicates the various battery charging states. The different battery status display are explained in the section User Communication [▶ 18].
10	**Update** This LED indicates that an update is in progress.
11	**Bluetooth®** This LED indicates that the MT-HV is connected via Bluetooth®.

	Name
12	**MT-HV status** This LED indicates e.g. if the MT-HV is active or ready for operation. The different status indications are explained in the section User Communication [▶ 18].
13	**ON/OFF button** Switch the MT-HV on and off with the ON/OFF button.



	Name
14 / 15	**Ports Scope 2 (CH2)** Connect the test leads to Scope 2 (CH2) here. • red = signal + • black = signal -
16	**ST3 connector** Connect the blue and the green clamp meter here.
17 / 18	**Ports Scope 1 (CH1)** Connect the test leads to Scope 1 (CH1) here. • blue = signal + • black = signal -

4.5. High-voltage test lead



	Name
19	**High-voltage test lead (red)** • 4-mm-test connection (safety connector) for manufacturer-specific test adapters • incl. function button to start or to confirm measurements
20	**High-voltage test lead (black)** 4-mm-test connection (safety connector) for manufacturer-specific test adapters
21	**Attachable test prod (black)**
22	**Attachable test prod (red)**

4.6. User Communication

Meaning of the LEDs with different interactions:

Interaction	LED
When the MT-HV is switched off and you briefly push ON/OFF, the yellow LED will light up until the start procedure is completed.	
• After the start procedure is completed, the LED is permanently green and the MT-HV is ready for operation. • When the MT-HV is switched on and you briefly push ON/OFF, the green LED will flash several times until the MT-HV is shut down entirely.	
If the connection is inactive or if there is no connection in battery mode, the MT-HV will switch off after 2 minutes. Before that the red LED will light red for 60 seconds.	
If an update is in progress, the LED will flash several times green until the update is finished.	

Interaction	LED
The green LED is permanently on if the high-voltage measurement is active.	
The yellow LED is permanently on if high voltage is switched to the test prods.	
The blue LED is permanently on if the MT-HV has Bluetooth® connection.	
Explanation of the battery status display:  **more than 40 % of entire charge** • The battery status indicator flashes green if the battery is being charged. • The status indicator is permanently green if the battery is fully charged.  **20 % to 40 % of entire charge**  **20 % or less (charging required!)** • The battery status indicator flashes red if battery charge is less than 10 %.	  

5. Installation

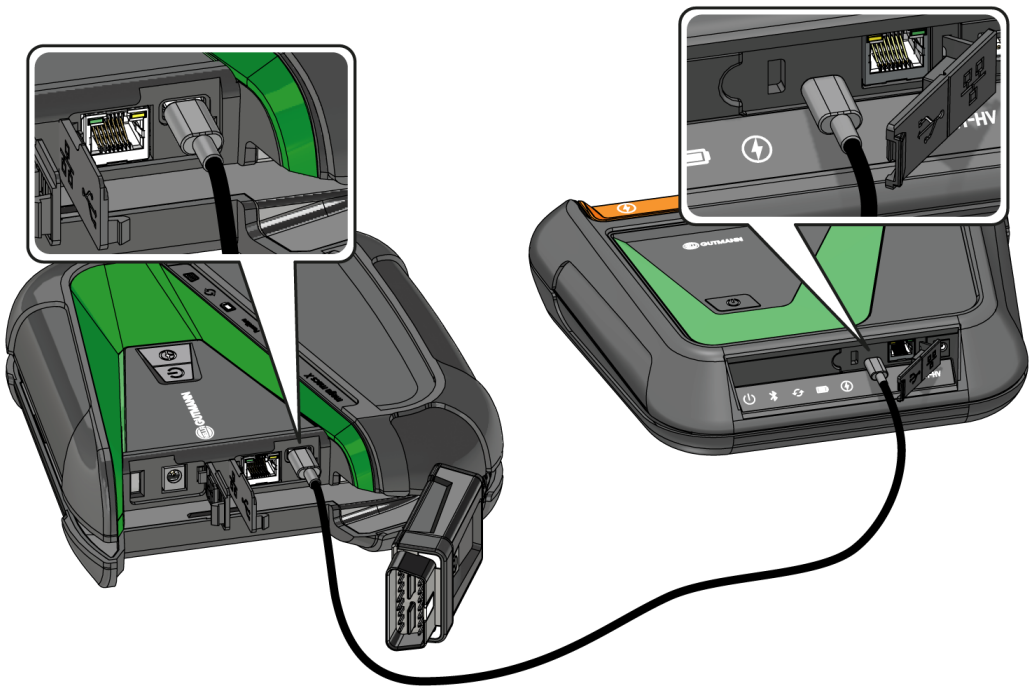
This section describes how to connect the MT-HV with the mega macs X.

5.1. Connecting the MT-HV with the mega macs X

Initial setup:

Proceed as follows to connect the MT-HV with the mega macs X for the first time:

1. Connect the MT-HV with the supplied USB-C cable to the mega macs X.



⇨ The mega macs X is recognizing the MT-HV automatically and is starting the pairing process.

2. Remove the USB-C cable.

⇨ Now the MT-HV is connected with the mega macs X.

NOTICE

Continuous operation:

The MT-HV is connected via Bluetooth® with the mega macs X.

There is a Wi-Fi connection between the display device (tablet etc.) and the mega macs X.

6. Low-Voltage Measurements

NOTICE

You can alternatively use the measurement module MT 56 for measuring voltage, current and resistance.

This section describes how to perform a low-voltage measurement in connection with the MT 77 measurement module. The following pictures illustrate the exact proceeding.

⚠ CAUTION!

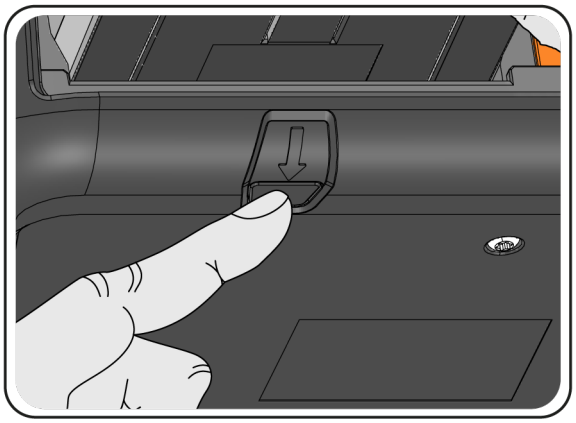
Danger of electric shock / Danger of destruction of the device

Ensure that the power supply is disconnected and that all high-voltage condensers are discharged before you perform measurements regarding resistance, continuity, diodes or capacity.

6.1. Inserting the MT 77 into the MT–HV

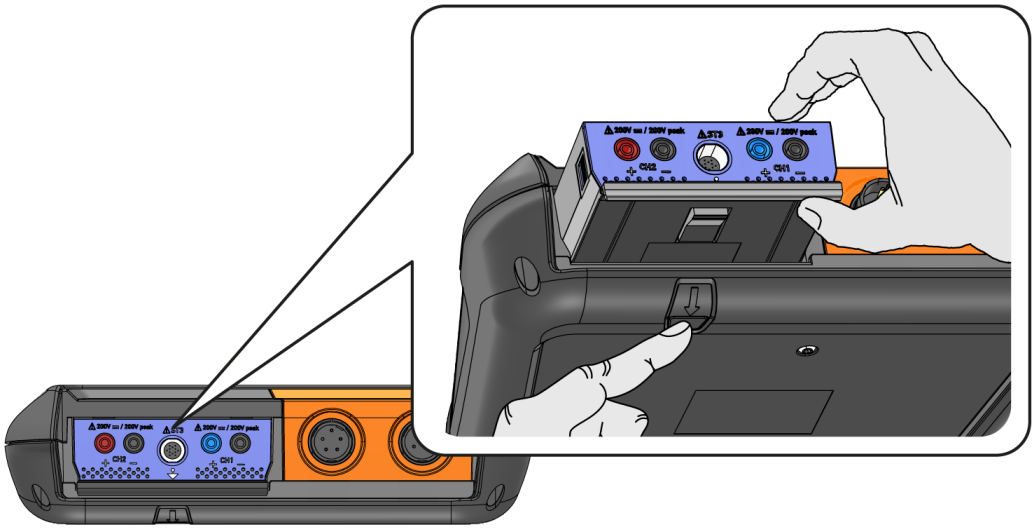
Proceed as follows to insert the MT 77 into the MT-HV:

1. Press the unlocking button of the MT-HV.



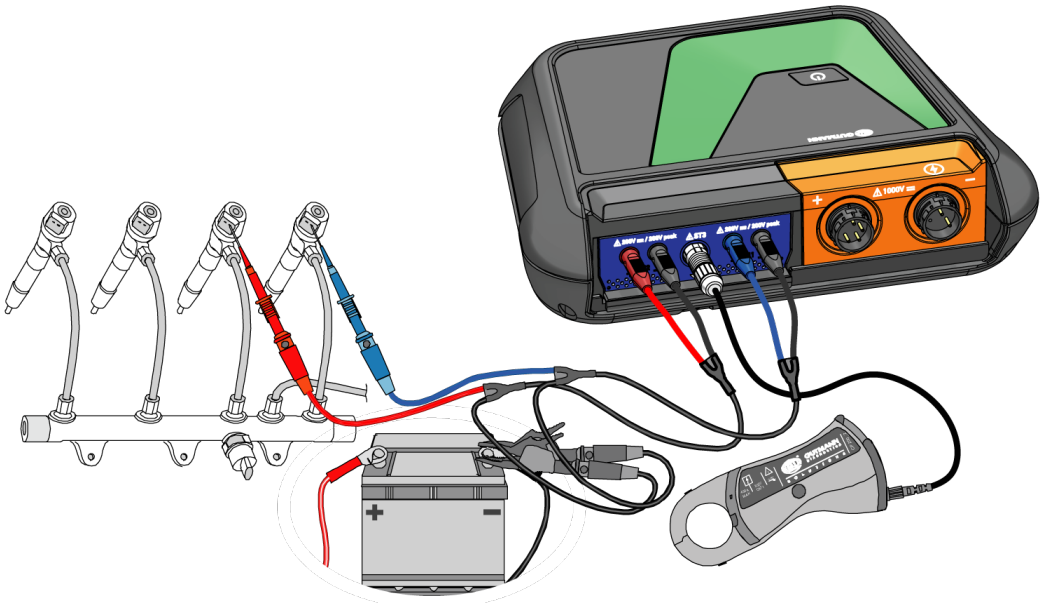
⇨ The module releases from the module slot.

2. Draw the module out of the module slot.
3. Insert the MT 77 into the free module slot, pay attention that it locks into place.



⇨ Now the MT 77 is instered in the module slot of the MT-HV.

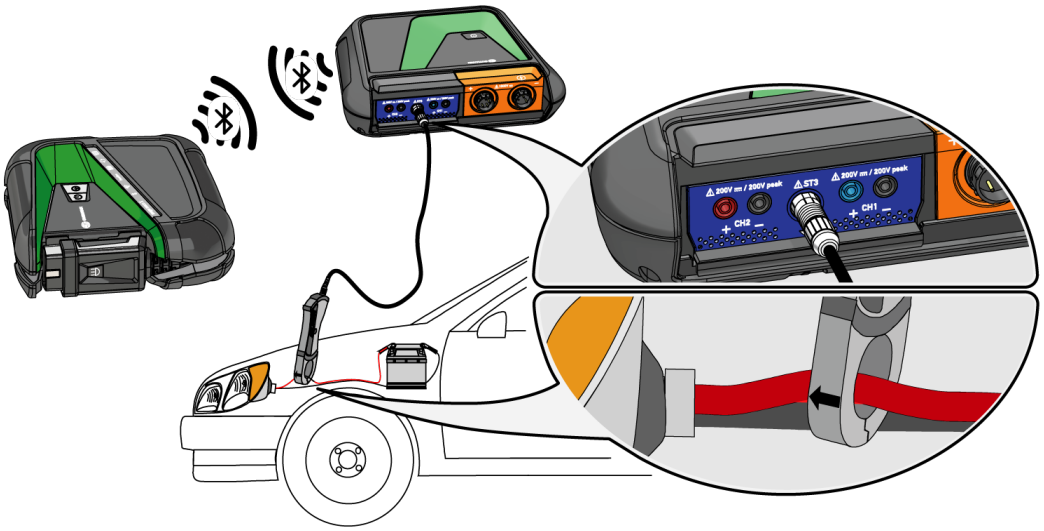
6.2. Connecting the Test Lead to the MT 77



6.3. Connecting the Current Clamp to Vehicle and MT 77

NOTICE

The clamp meters are parts of the optional accessory parts.


CH2
CH1

7. High-Voltage Measurement

This section describes how to perform a high-voltage measurement. The following pictures illustrate the exact proceeding.

7.1. Connecting the high-voltage test lead to the MT-HV

⚠ DANGER

Danger to life due to electric voltage

It is a precondition for performing high-voltage measurements that the user has knowledge of automotive technology and is therefore aware of the sources of danger and risks in the workshop and on motor vehicles. An additional country-specific qualification is mandatory.

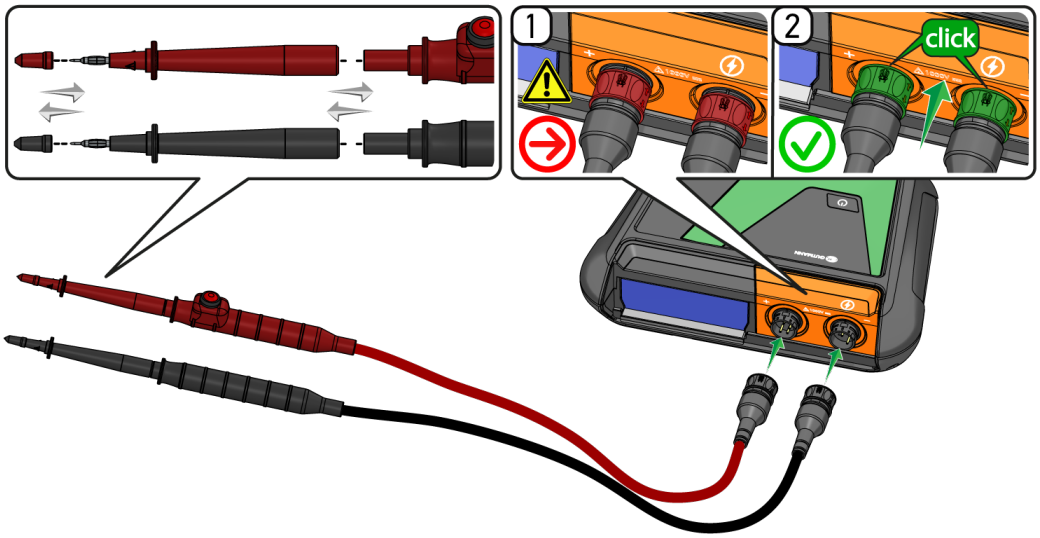
⚠ CAUTION!

Danger of destruction of the MT-HV and/or the automotive electronics

Only use approved test prods and high-voltage test leads.

Do not remove the protective cap from the test prods during high-voltage measurements.

Prior to every application, check the test prods and high-voltage test leads for damage (visual inspection).



7.2. Performing High-Voltage Measurements

⚠ DANGER

Danger to life due to electric voltage on vehicles with high-voltage systems

It is a precondition for performing high-voltage measurements that the user has knowledge of automotive technology and is therefore aware of the sources of danger and risks in the workshop and on motor vehicles. An additional country-specific qualification is mandatory.

Ensure, that the component to be evaluated is de-energized.

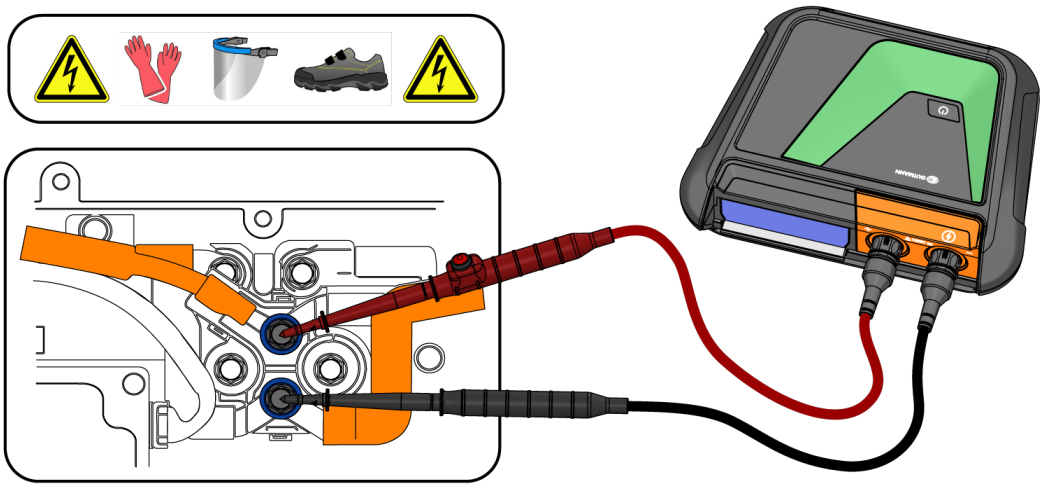
Ensure that you or other persons do not touch any sockets or connecting cables of the high-voltage battery module.

Pay attention not to touch energized components.

Do not remove the protective cap from the test prods during high-voltage measurements.

NOTICE

The following image is an example.



8. General information

8.1. Care and maintenance

Regard the following notes for care and maintenance of the **MT-HV**:

- Do not use cleaning agents.
- Only use a dry cloth.
- Replace damaged cables/accessories immediately.
- Only use original spare parts. You can order these parts via the Order Center of the Hella Gutmann GmbH.

  Note: The battery is available separately. Unscrew and remove the back cover of the housing to be able to exchange the battery:

⚠ DANGER

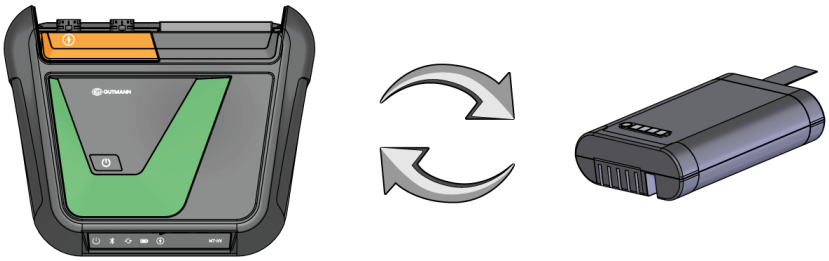
Danger to life due to electric voltage on vehicles with high-voltage systems

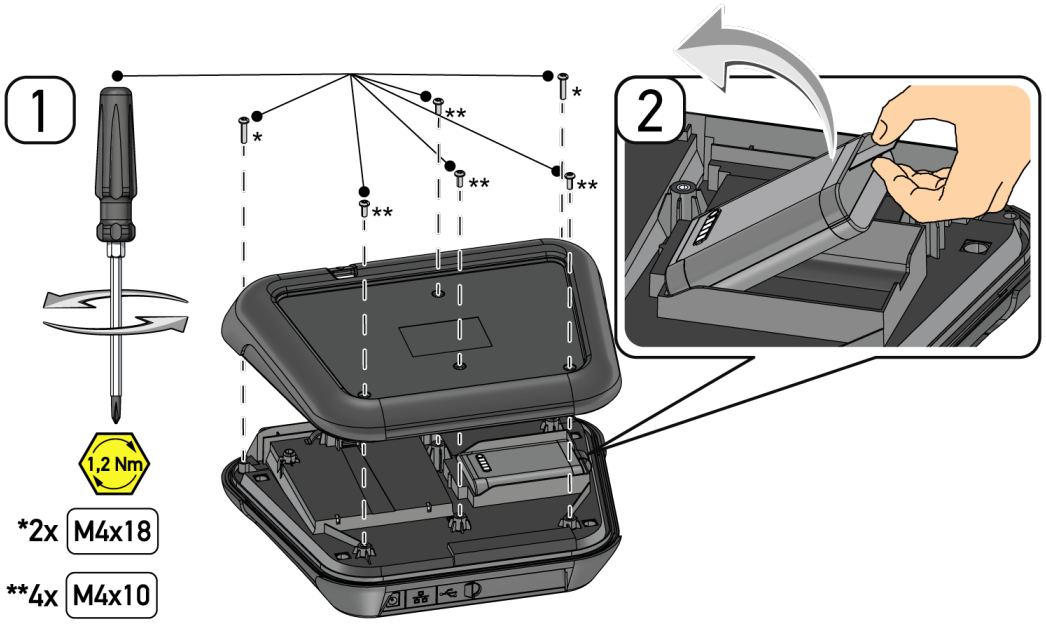
Make sure that the test prods and the high-voltage test leads are not connected to any components during the procedure.

⚠ CAUTION!

Danger of destruction of the MT-HV and/or the automotive electronics

Disconnect the MT-HV from the voltage supply during that.





8.2. Disposal

NOTICE

The guidelines listed here are exclusively valid within the European Union.

In compliance with Directive 2012/19/EU of the European Parliament and Council of 4 July 2012 relating to Waste Electrical and Electronic Equipment (WEEE), and the German national statute governing the distribution, return and environmental disposal of electrical and electronic equipment (Electrical and Electronic Equipment Act – ElektroG) of 20 October 2015 in its current version, we are obliged to take back this device, distributed by us after 13 August 2005, at the end of its service life free of charge and to dispose of it in accordance with the above-mentioned directives. Juli 2012 über Elektro- und Elektronik-Altgeräte sowie dem nationalen Gesetz über das Inverkehrbringen, die Rücknahme und die umweltverträgliche Entsorgung von Elektro- und Elektronikgeräten (Elektro- und Elektronikgerätegesetz – ElektroG) vom 20.10.2015 in der aktuell gültigen Fassung, verpflichten wir uns dieses, von uns nach dem 13.08.2005 in Verkehr gebrachte Gerät nach Beendigung der Nutzungsdauer unentgeltlich zurückzunehmen und es den o.g.

Since, in the case of the present device, this relates to exclusively commercially used equipment (B2B), it shall not be handed over to a public disposal facility.

The device can be disposed of at the following address (specifying the date of purchase and the device numbers):

Hella Gutmann Solutions GmbH

Am Krebsbach 2

79241 Ihringen

GERMANY

WEEE reg. no.: DE 25419042

Phone: +49 7668 9900-0

Fax: +49 7668 9900-3999

E-mail: info@hella-gutmann.com

8.3. Technical data MT-HV

Supply voltage	12...32 V ⎓
Power input	10...40 W
Current draw	max. 1 A
Battery type	RRC2040
Ambient temperature	Recommended: 10 to 35 °C Working range: 0 to 45 °C Storage temperature: -10 to 60 °C
Suitable for humid environment?	no
Use at high altitude	max. 2,000 m above NHN (normal height null)
Relative air humidity	approx. 10 to 90 % (not condensating)
Continuous operation	ja
Weight	approx. 1.7 kg
Dimensions	300 x 360 x 80 mm (L x W x H)
IP degree of protection	IP20
Overload protection	max. 1 kV
Measuring channels	1 (galvanically isolated)
Measured variables of HV modules	• High-voltage measurement up to 1 kV • Potential equalization measurement • Insulation resistance measurement • Resistance measurement (service disconnect plug)
Interfaces	• USB-C • Bluetooth® • RJ45
Ranges	
Voltage	• **Measuring range:** ± 1000 V DC • **Resolution:** 0.1 V • **Precision:** ± (1 % of reading + 2 digits)

Ranges	
Insulation resistance measurement	• **Measuring range:** 10k...10 GΩ • **Test voltage:** variably adjustable to 1000 V DC in steps of 10 V • **Resolution:** 0.1 • **Precision:** ± (3 % of reading + 3 digits)
Resistance (service disconnect plug)	• **Measuring range:** 0...10 Ω • **Resolution:** 0,01 Ω • **Measuring current:** 200 mA • **Precision:** ± (2.5 % of reading + 4 digits)
Potential equalization measurement	• **Measuring range:** 0...10 Ω • **Resolution:** 0,01 Ω • **Measuring current:** 200 mA • **Precision:** ± (2.5 % of reading + 4 digits)

High-voltage test lead	
Red	• Length: 1500 mm • Handpiece with function button • With 4 mm test connection for manufacturer-specific test adapters • incl. removable test probe
black	• Length: 1500 mm • Handpiece • With 4 mm test connection for manufacturer-specific test adapters • incl. removable test probe

8.4. Technical Data of the MT 77

Supply voltage	5 V ⎓ (through module interface)
Power input	0 W
Current draw	max. 2 A
Ambient temperature	Recommended: 10 to 35 °C Working range: 0 to 45 °C Storage temperature: -10 to 60 °C
Suitable for humid environment?	no
Use at high altitude	max. 2,000 m above NHN (normal height null)
Relative air humidity	approx. 10 to 90 % (not condensating)

Continuous operation	ja
Weight	approx. 270 g
Dimensions	43 x 110 x 136 mm (H x W x D)
IP degree of protection	IP20
Bandwidth	max. 10 MHz
Sampling rate	64 MSa/s
Memory depth	64 kB
Amplitude resolution	14 bit
Overload protection	max. 200 V
Measuring channels	2 (galvanically isolated)
Measured variables	• Voltage • Current (external clamp meter) • Resistance • Pressure (external LPD kit)
Measuring accuracy	+/- 2.5 %
Interfaces	• 4x safety socket 4 mm (2 per measuring channel) • 1x ST3 (12-pin) • 1x module interface (USB) ST3 connections • 6x communication • 1x voltage inlet 10-15 V • 1x voltage outlet +17 V • 2x scope (+/-) • 1x hardware detection (coding) • 1x ground
Ranges	
Voltage	• **Range:** 10 positions, 0,01-20 V/Div • **Measurable Voltage:** max. 200 V
Current	• **Blue clamp (CP 700):** – Measuring range: ± 700 A – Current load: max. 25 mA • **Green clamp (CP 40):** – Measurable current: -10 to 40 A – Current load: max. 25 mA

Ranges	
Resistance	• **Range:** 6 positions, 1 Ohm/Div to 100 kOhm/Div • **Current output:** 1 to 10 Ohm/250 µA, 10 to 100 Ohm/2.5 mA, 100 kOhm/25 µA, 1 MOhm/2.5 µA • **Measurable resistance:** approx. 1 MOhm
Pressure (with LPD kit)	• **Range:** 4 positions, 0.2 to 2 bar/Div • **Measurable pressure:** max. 60 bar

8.5. FCC Compliance Statement

Compliance statement (part 15.19)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Warning (part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Information to the User (Part 15.105 (b))

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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