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UHF PDD
UHF PD Detector

USER GUIDE

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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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Terms of Warranty

Megger accept responsibility for a claim under warranty brought forward by a customer for a product sold by Megger under the terms stated below.

Megger warrant that at the time of delivery Megger products are free from manufacturing or material defects which might considerably reduce their value or usability. This warranty does not apply to faults in the software supplied. During the period of warranty, Megger agree to repair faulty parts or replace them with new parts or parts as new (with the same usability and life as new parts) according to their choice.

This warranty does not cover wear parts, lamps, fuses, batteries and accumulators.

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.

Each measure to remedy a claim under warranty shall exclusively be carried out by Megger or an authorized service station.

This warranty does not apply to any fault or damage caused by exposing a product to conditions not in accordance with this specification, by storing, transporting, or using it improperly, or having it serviced or installed by a workshop not authorized by Megger. All responsibility is disclaimed for damage due to wear, will of God, or connection to foreign components.

For damage resulting from a violation of their duty to repair or re-supply items, Megger can be made liable only in case of severe negligence or intention. Any liability for slight negligence is disclaimed.

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   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 <u>**will result**</u> in death or serious injury if not avoided.
WARNING	Indicates a potential hazard which <u>**may result**</u> 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!

Declaration of Conformity (CE) The product meets the following security requirements of the European Council Directives:

- Radio Equipment Directive (RED 2014/53/EU)
- RoHS Directive (2011/65/EU)

Use of software of third parties This product contains protected software, which is licensed under the General Public License (GPL) and the Lesser General Public License (LGPL). This certifies your right to request the source code for these software components.

You can find detailed information on the GPL/LGPL licenses under www.gnu.org.

Intended application The operating safety is only guaranteed if the delivered system is used as intended (see page 8). 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.

Behaviour at malfunction of normal operation The equipment may only be used when working properly. When irregularities or malfunctions appear that cannot be solved consulting this manual, the equipment must immediately be put out of operation and marked as not functional. In this case inform the person in charge who should inform the Megger service to resolve the problem. The instrument may only be operated when the malfunction is resolved.

2 Technical description

2.1 System description

Intended use Defects on medium and high voltage accessories not only require costly repairs, but can also lead to failures of network sections with associated adverse consequences. It is therefore in the interest of all grid operators to be able to detect signs of imminent defects as early as possible so as to take suitable countermeasures promptly.

With the UHF PDD , Megger offers a lightweight, sturdy and portable measuring device with which various equipment can be quickly examined for partial discharge signals in ultra high frequency (UHF) ranges from 150 MHz up to 1000 MHz. The signal recording can optionally be performed via UHF antenna, UHF coupler or using both simultaneously. The device also additionally offers the option of displaying and analysing decoupled high frequency signals (in the cut-off frequencies of 100 kHz <= f <= 70 MHz) from HFCT and TEV sensors.

Used in combination with the UHF coupler UHF C-1, likewise developed by UHF PDD, the UHF PDD is especially suited for testing of live high voltage terminations, the failure of which is usually accompanied by the most devastating impacts on network operation. But also for regular and quick checks of extensive installations such as substations, the UHF PDD in combination with a UHF antenna makes the perfect tool.

Thanks to the two UHF signal inputs, the UHF PDD can be used for real-time comparison of the base noise level of the surroundings (caused by transmitter systems, for example) and the useful pulse-shaped signal on the sensor or the antenna. Of course, two sensor signals can also be easily compared to each other if needed.

Advantages of UHF measurement The UHF frequency band is ideal for selective and interference-resistant measurement of electromagnetic impulses caused by partial discharges, since disturbances output from, for example, transducers or transformers, are largely in frequencies <100 Mhz.

Measuring in the UHF frequency band also enables you to detect the differences between outer corona or sliding discharges as compared to the dangerous internal discharges.

Features The UHF PD Detector combines the following features in one device:
- Measurement of PD signals in the UHF range
- Measurement of spectrum, time and level on live equipment
- Real-time signal comparison thanks to two channels
- Simple operation via touchscreen or operating buttons
- High-performance internal rechargeable battery enables long operating time
- Built-in UHF pulse generator for functional testing and checking of sensor installations
- Synchronous network operation through internal or external sensors

Scope of delivery The delivery scope includes the following components:

Quantity	Component	Description	Item number
1	UHF PDD		1007234
1	Charger		1007523
1	UHF DIPOL-230	UHF reference antenna for the interference signal measurement in the surroundings	1008295
1	Synchronization sensor UHF MS5060	For network synchronization via socket tapping	1007235 (868 MHz / standard) 1008497 (913 MHz / US version)
1	Power supply	For synchronization sensor	country-specific
1	BNC cable	30 cm long	90019085
1	Transport case		90017139
1	Manual		---

Check contents Check the contents of the package for completeness and visible damage right after receipt. In the case of visible damage, the device must under no circumstances be taken into operation. If something is missing or damaged, please contact your local sales representative.

Optional accessories The following optional accessories can also be ordered from the sales department if required:

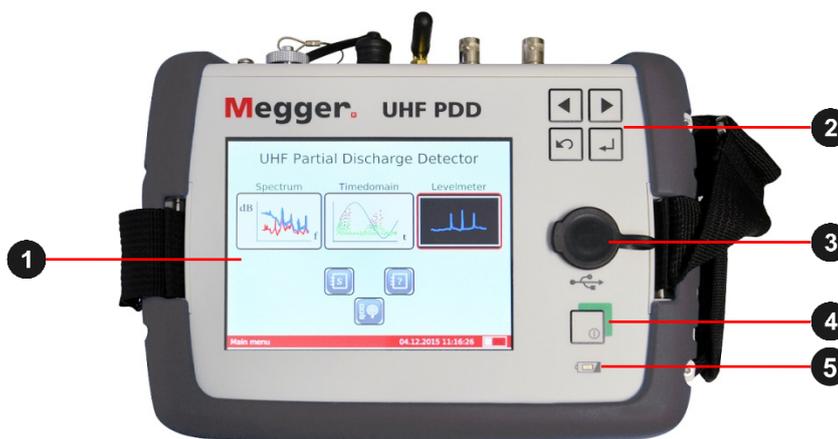| Accessory	Description	Item number
Stereo headphones	For acoustic analysis of the demodulated useful signal	810002087
Synchronization sensor UHF ES5060	For network synchronization based on the electrical or magnetic field	1007236
BNC rod antenna	25 - 1900 MHz	90017365
Partial discharge coupler UHC C-1	Request installation material and connection cable	138315730
Ground wire coupler ESC 40	For quick and temporary installation on the cable shield	128309485
HFCT sensor	For permanent installation; 20 mm diameter	1006296
BNC cable	5 m long	502020108

2.2   Technical data

The UHF PD Detector is defined by the following parameters:

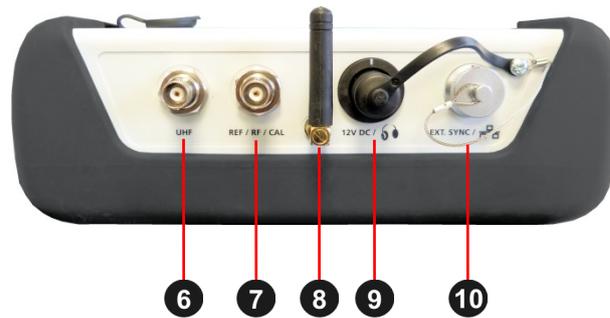| Parameter	Value
UHF frequency range	150 MHz - 1000 MHz
RF frequency range	100 kHz - 70 MHz
Withstand voltage of the measurement inputs (BNC)	4.5 V_{PEAK}
Sensitivity	-90 dBm
Input-voltage range	100 V - 240 V, 50 / 60 Hz (through supplied charger)
Internal rechargeable battery	Li-ion rechargeable battery, 7.4 V / 12.25 Ah;
Battery operating time	10 hours
Display	6" touch display, 640 x 480 pixels
Internal memory	about 10 GB
Wireless connection	868 MHz (standard version) 913 MHz (US version)
Data interface	USB 2.0 (Host)
Operating temperature	-20 °C to 50 °C
Storage temperature	-30 °C to 70 °C
Operating humidity	93% at 30 °C
Weight	2100 g
Dimensions (L x W x H)	250 x 190 x 100 mm
IP protection class (in accordance with IEC 60529 (DIN VDE 0470-1))	IP65

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2.3 Connections, controls and display

Control module   The UHF PD Detector has the following connection, display and control elements:

Element	Description
1	**Touchscreen**
2	**Operating buttons**
3	**USB port** For data export and firmware updates
4	**On/Off button** (brief activation)
5	**Charging indicator light**

The UHF PD Detector has the following connections:

Element	Description
6	**UHF** UHF useful signal input
7	**REF / RF / CAL** This socket can be used for the following purposes: • Input for UHF reference signal • Input for RF signal (TEV and HFCT sensors) • Output of UHF pulse generator
8	**Radio antenna** For the synchronization with the synchronization sensor UHF MS5060
9	**12 V DC /** 🎧 Jack for the connection of charger and headphones
10	**EXT. SYNC. /** ⊞ This socket can be used for the following purposes: • Connection of the synchronization sensor UHF ES5060 • Service interface

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3   Start-up

⚠	**DANGER**
	Danger to life from electric shock or electric arcs
	To avoid any electrical hazards when starting up and using the detector, the following instructions must be followed:
	• All notices, instructions, rules of conduct and operating instructions of the facility manager/plant operator must be complied with!
	• When approaching live equipment, the safe distances applicable for the corresponding voltage level must be observed at all times! Information regarding the minimum distances to be observed must be obtained from the facility manager/plant operator before beginning work.
	• Antennas which are connected to the detector for measuring purposes are conductive components. Their length is therefore especially to be taken into account when approaching live components!

3.1   Ensuring the power supply

Battery operation   The UHF PD Detector is fitted with an internal Li-ion rechargeable battery. This can power the device for at least 10 hours.

Before installing at the place of use, the detector should be briefly switched on and the charge status of the battery determined by checking the charging bar shown at the bottom right in the display. If the bar is insufficiently full, it is recommended to charge the battery again before beginning the measurement.

If there is an electrical outlet in the immediate surroundings, the detector can also be operated via the connected charger while the measurement is in progress.

Charging the battery   To charge the UHF PD Detector, connect the device to the general power grid. Always use the supplied charger. Insert the round plug of the charger into the **12 V DC** socket of the detector. Observe the markings on the plug and socket. You must feel the plug engage.

It takes about 6 hours for a full charging cycle. During charging, the charging indicator light **10** is lit red. The battery is fully recharged once the charging indicator light goes out.

⚠	**NOTE**
	To avoid damage, please observe the following when charging:
	• Always use only the supplied charger.
	• The ambient temperature should lie between 10 °C and 35 °C.
	• In the event of problems with the battery, contact your sales or service partner at Megger. Do not open the device yourself.

3.2   Connecting antennas /sensors

Introduction   In principle, the most varied types of sensors and antennas can be connected to the device, providing they deliver a usable input signal.

Besides UHF antennas and sensors, which deliver signals in the frequency range of 150 MHz to 1000 MHz (UHF mode), the detector is also suitable for the connection of TEV and HFCT sensors. With sensors of this type, with which partial discharges can be diagnosed in a capacitive or inductive manner, the detector operates in RF mode in the frequency range of 100 kHz to 70 MHz.
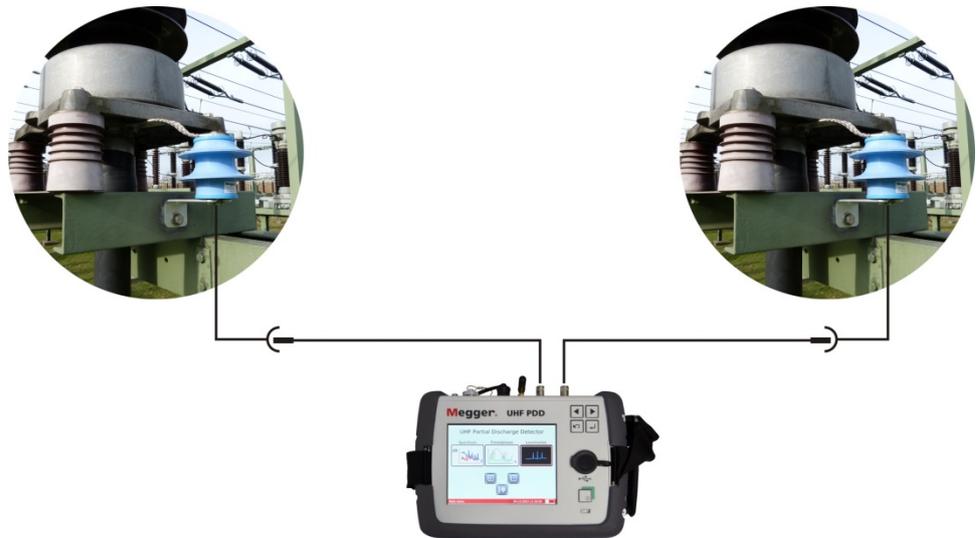
Connection of UHF sensors   In order to measure in UHF mode, a UHF antenna or a UHF coupler must be connected at the BNC plug connector of the measurement input **UHF** ❻.

There is also the option of coupling the reference signal of a UHF reference antenna (e.g. of the supplied UHF dipole) at the input **REF/RF/CAL** ❼.
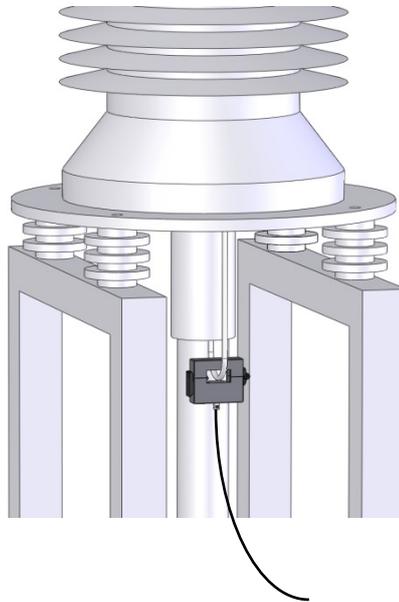

Useful signal

Instead of the reference antenna, a second sensor – as identical as possible in construction – can of course also be connected at the input **REF/RF/CAL** **7** for comparison purposes:

Measurements at TEV and HFCT sensors Basically, all types of HFCT and TEV sensors capable of decoupling partial discharge signals can be connected.

Megger offers with the optionally available ground wire coupler ESC 40 (see page 8) a perfectly matched current transformer for quick and temporary installation at the ground wire of a termination.

For the connection of HFCT and TEV sensors to the detector, the input **REF/RF/CAL** **7** is to be used exclusively.
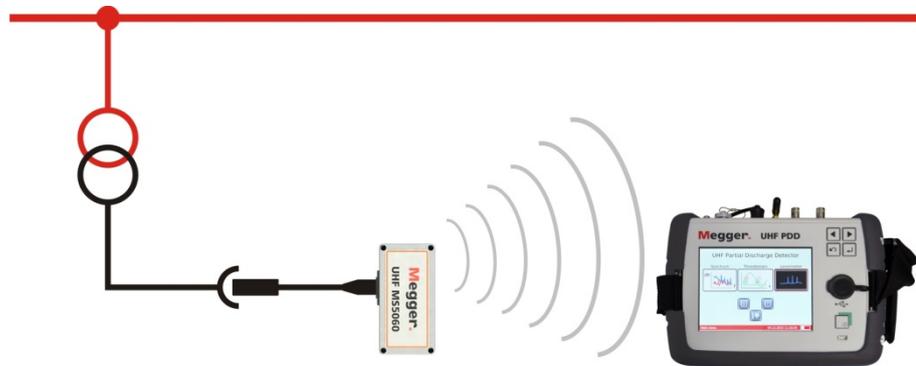

The connection of a comparison or reference sensor is not possible in RF mode.
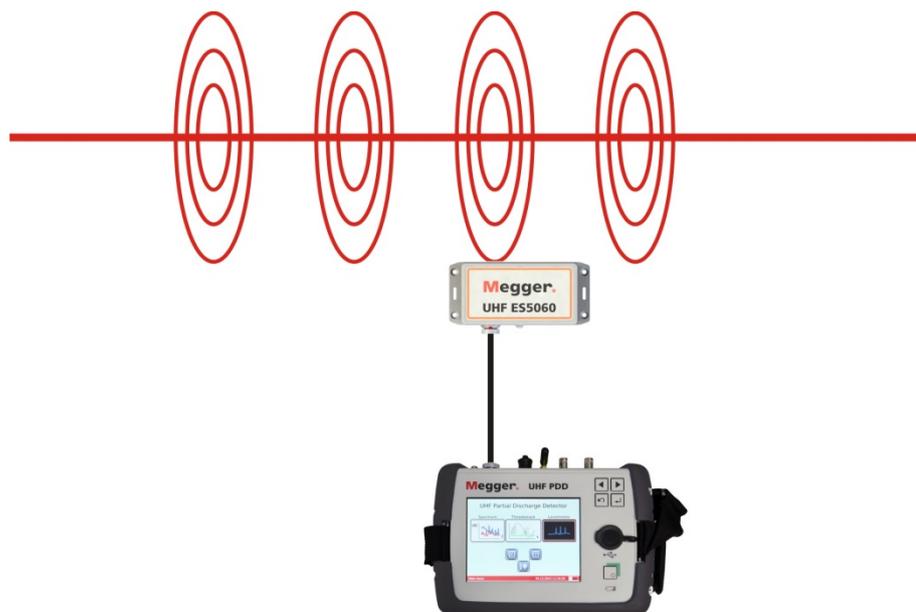
3.3 Ensuring network synchronization

Thanks to the comprehensive accessories, the network synchronization required for reliable analysis of the charge pulses in the time-based display can be ensured in various ways.

For the most reliable and therefore preferred method, the supplied network synchronization sensor UHF MS5060 must be plugged into a network socket within wireless range of the detector (<= 50 m with visual contact).

If this method cannot be implemented due to the distance of the socket or impaired radio wave propagation, the network synchronization can also be produced using the optionally available external synchronization sensor, which must then be connected to the socket **EXT. SYNC. 10** .

This sensor is able to synchronize based on the electrical or magnetic field of electrical equipment and can, for example, be laid underneath an overhead line.

It can also be attached in the shielded area of a cable termination with the aid of the supplied hook and loop fasteners.

If a synchronization using the external sensors fails or cannot be done, the detector itself can be brought as close as possible – while observing the mandatory minimum distances – to a live piece of equipment with a strong electrical field. Ideally, it should then be possible for the internal synchronization sensor to synchronize to the mains frequency.

In the case that the methods described above cannot be implemented, the measurement can, of course, also be performed without network synchronization.

3.4   Connecting headphones

In some cases, the supplied headphones can be used to acoustically perceive the demodulated partial discharge pulses during the time-resolved measurement.

When connecting the headphones to the socket **12 V DC /** the markings on the plug and socket must be observed. You must feel the plug engage.

4 Basics of operation

4.1 Operation

Basic operation Operation is performed either using the operating buttons **2** or via the touchscreen. While with touchscreen operation the desired functions are triggered with the brief press of a fingertip, the button operation is laid out as follows:

- Select required menu item
- Increase or decrease the value of a variable parameter
- Select an option from a selection list

- Call up selected menu item
- Confirm the setting or the selection made

- Exit measuring mode, selection window or menu

Inputs via the numeric keypad For the input of numerical values, a numeric keypad is shown in the display:

Enter start frequency

For values with a negative preceding sign, you first always enter the number and then press the **+/-** button once.

If the entered value lies outside the possible range of values, the input cannot be concluded via ✓. The range of values to be complied with is displayed underneath the numeric keypad.
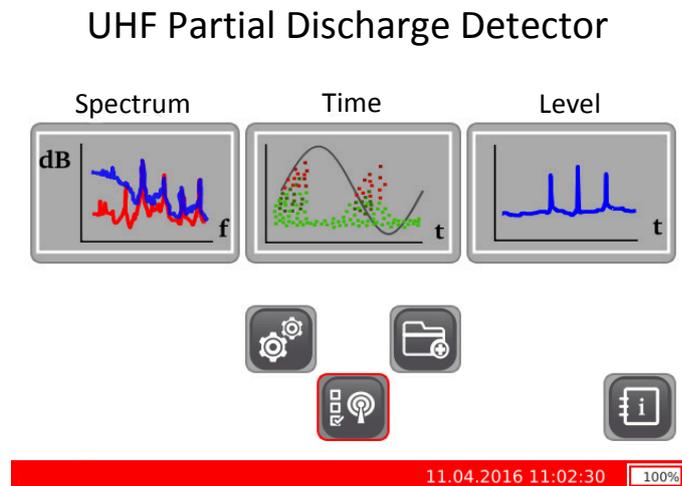
150 <= Value <= 950

With **x**, the numeric keypad can be closed at any time, without adopting the entered value.
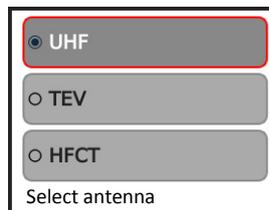
Validity of settings All settings that can be made in the various operating modes and the device adjustments are permanently saved and retain their validity, including in the case of a restarting of the device.

4.2   First steps

Switching on   Only a few seconds after the detector is switched on with a brief press of the button 🔘, the main menu appears.

UHF Partial Discharge Detector

Select sensor type   To ensure that the detector is working in the correct mode, the button ⬛ should always be used first directly after switching on in order to select the connected sensor type.

The selection **UHF** activates the UHF mode. When a TEV or HFCT sensor is selected, the RF mode is activated.

If basically only one type of sensor is used for measurement with the detector, this preselection can also be omitted, since the software automatically starts with the setting of the last performed measurement.

Creating a new measured data directory   In order to easily assign the saved measured data to the individual measurement procedures / equipment at a later time point in the office, the button ⬛ can be used at any time to create a new subdirectory in the internal memory. The name of the directory is comprised of the current date and a serial number (e.g. *2016-04-11_001*).

Directly after starting the device, a new directory is automatically created. Over the further course of the measurement, whether and when a new directory should be created is up to the operator. In principle, however, it is recommended to do this at least for phase changes or for coupler change. But it can also be useful to create a new directory after adapting certain measurement parameters.

On days with very numerous measurements (directories), it is also recommended to include handwritten notes on the content of the individual directories.
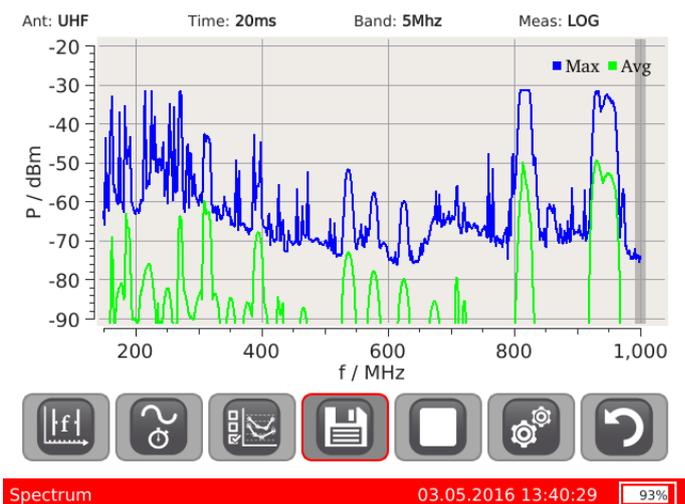
5 Performing measurements

5.1 Analysing the frequency spectrum

Introduction   In the spectrum analysis, the intensity of the recorded UHF signal (in dBm) in the frequency range is shown. Each measurement should always be started with this mode in order to obtain information on the base noise level and to identify ambient disturbances and conspicuous frequencies.

Starting the operating mode   The **Spectrum** operating mode can basically only be started from the main menu if the detector is operating in UHF mode (see page 20).
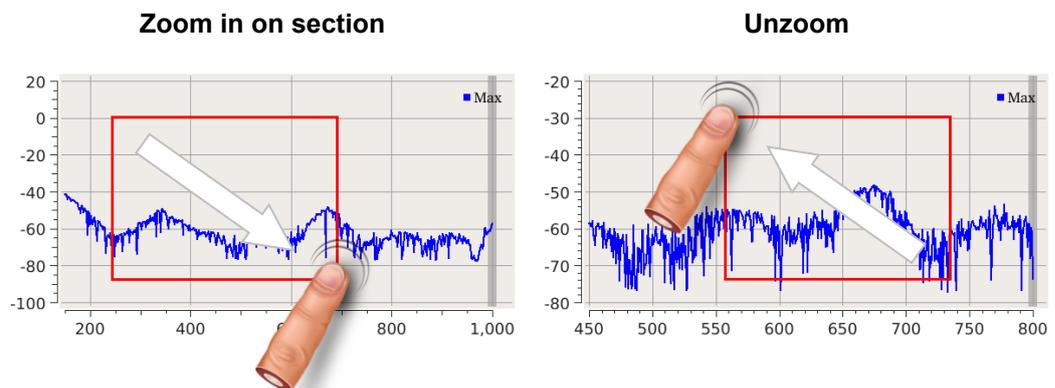
Directly after the operating mode is called up, the software begins with the successive measurement runs (sweeps) and presents the measurement curve(s) in the display.
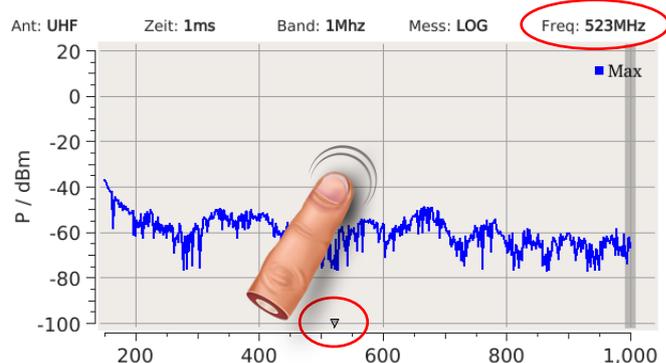
Procedure In order to identify conspicuous frequencies, it is recommended to compare the spectrum recorded on the UHF coupler or in the immediate vicinity of the test specimen with that of a reference signal. This reference spectrum should be recorded in advance with the aid of the supplied reference antenna placed at a sufficient distance (> 15 m) to the test specimen.

If, due to on-site conditions, the two spectra cannot be recorded simultaneously, the reference spectrum can be frozen in the diagram for the purpose of comparison (see table below).

To zoom in on a certain portion of the diagram for a detailed analysis, you need only mark it with your finger as follows:

Zoom in on section	**Unzoom**

If a conspicuous frequency was identified when comparing the two spectra, touching it will place a small triangle on it, earmarking it for a more detailed analysis in the time range.

The frequency selected in this way is then automatically preselected upon entering the **Time** operating mode.

Detailed instructions on the procedure and how to analyse the frequency spectra can be found in the included application note.

Adapting measurement and display parameters The most important measurement and display characteristics can be directly influenced during measuring with the aid of the following buttons:

Icon	Description
	Selection of the frequency measurement range (SPAN). For this, the start and end frequencies of the measurement range must be successively entered.
	In the "**Full**" setting, the diagram shows the signal progression over the complete frequency band from 150 MHz to 1000 MHz.
	With the "**Choose**" button, a deviating start and end frequency can be set if needed to limit the frequency range.
	Signal recording period per frequency measurement point in milliseconds.
	Selection of the displayed curves.
	These buttons can be used to show or hide the following curves:
	(Ref) Maximum — Signal maximum at the UHF or reference input. The points of this curve are derived from the highest values recorded during the respective signal recording period.
	(Ref) Average — Signal average values at the UHF or reference input. The points of this curve are derived from the average value of the signal level in the respective signal recording period. This display can be particularly useful in distinguishing between UHF interfering signals (such as the DVB-T signal, for example) and partial discharges, since these interfering signals are continually emitted and thus always present within the measurement period. In contrast, partial discharge signals do not continually occur within a period.
	Freeze trace — If only one curve is shown in the diagram, this menu item can be used to generate a picture of this curve and freeze it. In this way, for example, two spectra successively recorded at the UHF input can be compared with one another.
	Difference — If exactly two "Live" curves are shown in the diagram, this menu item can be used to show the difference of the two signals as an additional curve. Based on this curve, you can then quickly and unambiguously identify those frequencies at which the UHF signal clearly deviates from the reference signal on the test specimen.
	This button can be used to write a data set (including screenshot and measured data) from the current diagram view to the internal memory.
	To be able to unambiguously assign the data set at a later time point, after activating the button the phase at which is currently being measured can also be specified.
	An export of the saved data sets for the purpose of further processing can be performed at any time via the device settings (see page 31).
	This button can be used to stop the current run (sweep), and the button is then used to start it again.

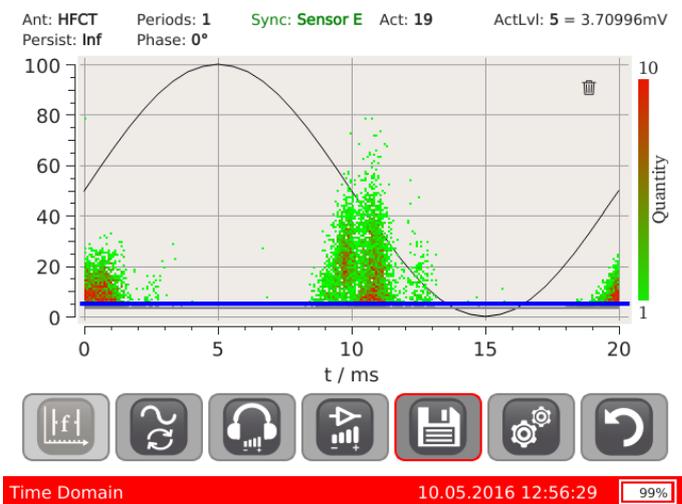The button ⚙ can in addition be used to perform the following advanced settings:

Parameter	Description
Pulse generator	This menu item can be used to switch on the internal pulse generator for the purpose of a functional test (see page 32).
Preamplifier	Activates / deactivates the preamplifier (30 dB) at the start of the signal path. With the preamplifier activated, weaker signals can be better distinguished from the background noise.
Bandwidth	Resolution bandwidth of the measurement filter (1, 5 or 20 MHz). A decrease of the bandwidth increases the frequency resolution and should particularly be considered for smaller frequency measurement ranges.
Amplitude (min / max)	This menu item is used to adapt the minimum and maximum values of the Y-axis so that the display optimally reflects the level of the currently measured signal.
Hold maximum	If this option is activated, the displayed curves are derived from the maximum values from all of the measurement runs (sweeps). The curves will accordingly hardly change at all as measurement duration is increased.

5.2 Analysing the time-resolved signal

Introduction This mode allows evaluation of a signal within a time range. Here, precisely those frequency windows must be considered in which the frequency spectrum was previously identified as conspicuous / suitable. Network synchronization ensures that the length of the time window corresponds exactly to a cycle of the mains voltage. In this way, the PD pulses that actually arise from the mains can be distinguished from the "wandering" interference pulses. The phase relationship also enables recording of the patterns of phase-resolved partial discharge (PRPD), which in turn can provide clues as to the type of partial discharge. For this, each measured pulse is represented according to its phasing and amplitude as a point in the diagram.

In this operating mode, displayed is only the signal pending at the **UHF** input that arises from a UHF, TEV or HFCT coupler attached to the test specimen or from an antenna pointed at the test specimen. The signals of a reference antenna connected to the **REF** input are not considered.

Starting the operating mode The operating mode can be started from the main menu via the menu item **Time Domain**.

Creating network synchronization
Since for a meaningful measurement it is advantageous if the measuring cycle of the detector is absolutely synchronous with the mains frequency, once the operating mode is called up via the menu item ⟳, the synchronization sensors (see page 17) that are to be used should be selected.

The selected sensor type is then permanently shown in the upper right corner of the display. Based on the colour of the writing, the software signals whether synchronization to the mains frequency was successful (green script) or the attempt failed (red script).
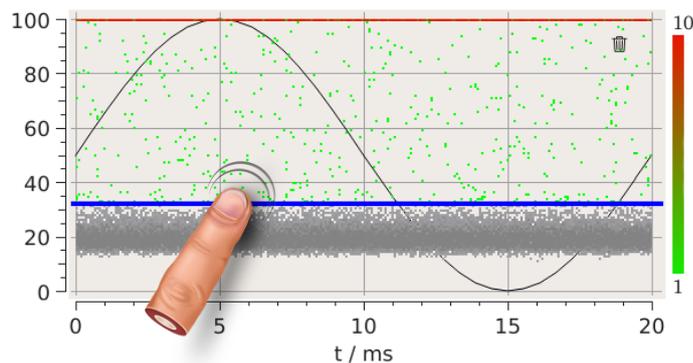
| **grid synchronous** | **not synchronous** |

If no synchronization could be created with the selected sensor, and also other synchronization methods (see page 17) have failed, the measurement can, of course, also be performed without network synchronization.

Procedure
At the start of the measurement, the variable amplification (see table below) should be adapted so that the recorded charge level is distributed evenly over the diagram to fill it. This makes it easier to identify and evaluate the appearing patterns of the phase-resolved partial discharge (PRPD).

The base noise threshold should be moved to a suitable position just above the base noise level by touching the screen.

Events underneath the base noise threshold (blue line) are not accumulated and are also not considered in the calculation of the activity level (**ActLvl**) displayed over the diagram. This is a measure for the frequency of events occurring above the noise threshold and facilitates evaluation of the changes and criticality of the fault location.

By touching the 🗑 symbol, the diagram can at any time be completely wiped clean and a new recording started.

Using the supplied headphones connected to the headphone socket ❾, the input signal can also be evaluated acoustically in **Time** mode. The tones produced by the partial discharges typically vary their sound with rising / falling amplification.

> Detailed instructions on the procedure and how to evaluate the phase-resolved partial discharge pattern can be found in the included application note.

Adapting measurement and display parameters

The most important measurement and display characteristics can be directly influenced during measuring with the aid of the following buttons:

Icon	Description
	Frequency at which the input signal is measured. If a conspicuous frequency was selected in the **Spectrum** operating mode, this is automatically preselected when entering the **Time** operating mode.
	Selection of the sensors (see page 17) to be used for the network synchronization.
	Volume setting for the headphone jack.
	Variable amplification, which is effected independently of the preamplification.
	This button can be used to write a data set (including screenshot and measured data) from the current diagram view to the internal memory. To be able to unambiguously assign the data set at a later time point, after activating the button the phase at which is currently being measured can also be specified. An export of the saved data sets for the purpose of further processing can be performed at any time via the device settings (see page 31).

The button 🔧 can in addition be used to perform the following advanced settings:

Parameter	Description
Bandwidth	Resolution bandwidth of the measurement filter (1, 5 or 20 MHz).
Gating Periods	Number of voltage periods to be considered for the cumulative measurement level.
Preamplifier	Activates / deactivates the preamplifier (30 dB) at the start of the signal path. In principle, it is always recommended to activate the preamplifier. It should only be deactivated if an overmodulation of the measurement signals cannot be reached by adapting the variable amplification (overmodulation is present if the measurement pulses always lie at the upper end of the Y-axis of the measurement graph).

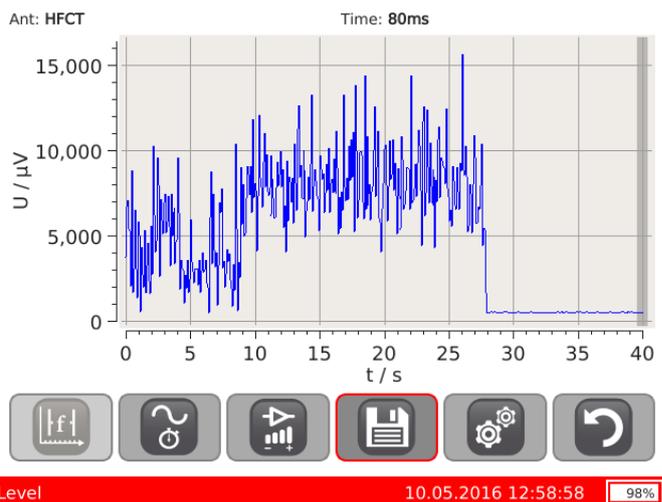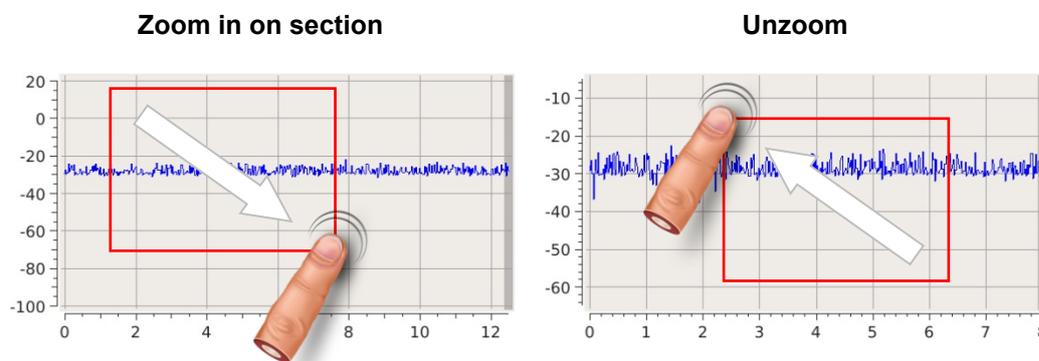| Parameter	Description
N°	This menu item is used to determine how many image points on a vertical line are to be shown at once before the respectively oldest image point is overwritten with the last measured activity.
	Only with a high number of displayed image points can a statement be made regarding the frequency and phase stability of the pulses and a PRPD pattern be recognised.
	If one and the same phase angle of multiple pulses is recorded with the same amplitude, the colour of the image point changes (green -> orange -> red) and signals in this way the increased frequency of the pulses.
	In the "**Infinite**" setting, new activities are continually shown without deleting old image points.
Phase shift	If between the current tested phase and the phase used for the synchronization a known phase shift exists, this can be input here and the measurements will be shifted accordingly within the diagram.
Amplitude (min / max)	This menu item is used to adapt the minimum and maximum values of the Y-axis so that the display optimally reflects the level of the currently measured signal.
Maximum quantity	This value is defined by the upper limit value of the frequency scale.
	If this value was set at 50 as shown in the adjacent example, a total of 50 charge pulses with the exact same amplitude and phasing must be measured before the corresponding display point in the diagram is shown in red.

5.3 Analysing the level

Introduction   In this operating mode, the signal progression for a certain frequency window can be recorded and displayed over a longer period of up to 40 seconds, which allows a trend observation of the discharge level to be made and aids in identification of sporadically occurring partial discharges.

In this operating mode, displayed is only the signal pending at the **UHF** input that arises from a UHF, TEV or HFCT coupler attached to the test specimen or from an antenna pointed at the test specimen. The signals of a reference antenna connected to the **REF** input are not considered.

Starting the operating mode   The operating mode can be started from the main menu via the menu item **Level**.

Procedure   To zoom in on a certain portion of the diagram for a detailed analysis, you need only mark it with your finger as follows:

Zoom in on section

Unzoom

Detailed instructions on the procedure and analysis can be found in the included application note.

Adapting measurement and display parameters The most important measurement and display characteristics can be directly influenced during measuring with the aid of the following buttons:

Icon	Description
	Frequency at which the input signal is measured.
	If a conspicuous frequency was selected in the **Spectrum** operating mode, this is automatically preselected when entering the **Level** operating mode.
	Signal recording period per measurement point in milliseconds.
	An increase in this value automatically also raises the displayed time range in a proportional manner.
	This button can be used to write a data set (including screenshot and measured data) from the current diagram view to the internal memory.
	To be able to unambiguously assign the data set at a later time point, after activating the button the phase at which is currently being measured can also be specified.
	An export of the saved data sets for the purpose of further processing can be performed at any time via the device settings (see page 31).
	Variable amplification, which is effected independently of the preamplification.

The button ⚙ can in addition be used to perform the following advanced settings:

Parameter	Description
Measure Mode	This button can be used to select between the following measurement modes:
	LOG Logarithmic scaling (dBm)
	RMS Effective value of the measured level
	ENV Maximum value of the measured level
Bandwidth	Resolution bandwidth of the measurement filter (1, 5 or 20 MHz).
Preamplifier	Activates / deactivates the preamplifier (30 dB) at the start of the signal path.
Amplitude (min / max)	This menu item is used to adapt the minimum and maximum values of the Y-axis so that the display optimally reflects the level of the currently measured signal.

6 Adapting device settings

The menu item ⬚ takes you from the main menu to the device settings, where you can make the following adjustments:

Setting	Description
Copy data to USB	For the purpose of archiving and further processing, activating this button enables you to copy all measured data sets in the internal memory onto an inserted USB stick.
Clear data	Deletes all data in the internal memory.
Time	Set the time
Date	Set the date
Language	Set the menu language.
Date format	Date format
Sweep rate	Run-through frequency for the time-resolved measurement. The frequency must generally be set only once to the value of the applicable mains frequency in the usage range.
Query phase	This menu item can be used to activate or deactivate the phase query when saving measured data.
SW update	When this button is activated, the inserted USB stick is searched for legitimate installation files containing a more current version of the installed firmware. ⓘ The firmware file must be located in the main directory of the USB stick! After the desired file is touched, the installation of the new firmware starts directly. ⓘ The device may not be switched off during the update! After completion of the installation, the detector is restarted.
Factory defaults	Activating this button will reset the device and measurement settings back to their original factory defaults. The saved measured data sets will remain however.
Enable Service mode	This password-protected area is only accessible to authorised service employees.

7   Functional tests

The functioning and measurement accuracy of the detector should be tested at regular intervals with the aid of the internal pulse generator. Proceed as follows:

Step	Action
1	Use the BNC cable to connect the calibrator output **REF/RFF/CAL** **7** with the **UHF** **6**.
2	Switch on the detector, switch to UHF mode (see page 20) and start the **Spectrum** operating mode.
3	Start the internal pulse generator through the menu item ⚙ → **Pulse generator** on.
4	Set the measurement and display parameters as follows: • **Preamplifier**: On • **Bandwidth**: 1 MHz • **Gating Time**: 5 ms • **Amplitude**: -80 to -20 dB **Result:** The spectrum should now display the pulse of the generator and look similar to the following screenshot: If the display deviates greatly, it is recommended to send the detector into a Megger service centre for calibration.

8   Processing and archiving of measured data

In an export, the measured data are stored in a chronological folder structure and grouped by day. Each of these folders contain an *index.html* file, through which all measurements of the respective day can be quickly and easily displayed as an overview in the browser.

If necessary, the data of the individual measurements can also be separately called up from the directory and further processed with suitable software. Each measured data set contains the following files:

- Screenshot (*%meas. mode%_yyyyMMdd_hhmmss.png*)
- Measurement file in XML format (*%meas. mode %_yyyyMMdd_hhmmss.xml*)

9   Maintenance, care and transport

Repair and maintenance

Repair and maintenance work may only be performed by Megger or authorised service partners and only using genuine replacement parts. Megger also offers its customers on-site service. Please contact your service centre as needed.

To ensure that a high measuring accuracy can be maintained for a long period of time, the device should be regularly calibrated at the manufacturer's (a two-year cycle is recommended).

Caring for the display

Do not clean the display with aggressive products such as solvents or spirits.

Instead, lukewarm water containing some washing-up liquid and a microfibre cloth should be used to clean the display.

Special transportation requirements

The lithium batteries of the device are dangerous goods. The transport of the batteries itselves and of devices which contain such batteries is subject to regulations based on the UN Model Regulations "Transport of Dangerous Goods" (ST/SG/AC.10-1).

Please inform yourself about the transportation requirements and follow them when shipping the device.

Storage

If the device is not used for a lengthy period, it should be stored in a dust-free and dry environment.

For lengthier periods of non-use, charge the battery about once a year.

Tento symbol indikuje, že výrobek nesoucí takovéto označení nelze likvidovat společně s běžným domovním odpadem. Jelikož se jedná o produkt obchodovaný mezi podnikatelskými subjekty (B2B), nelze jej likvidovat ani ve veřejných sběrných dvorech. Pokud se potřebujete tohoto výrobku zbavit, obraťte se na organizaci specializující se na likvidaci starých elektrických spotřebičů v blízkosti svého působiště.

Dit symbool duidt aan dat het product met dit symbool niet verwijderd mag worden als gewoon huishoudelijk afval. Dit is een product voor industrieel gebruik, wat betekent dat het ook niet afgeleverd mag worden aan afvalcentra voor huishoudelijk afval. Als u dit product wilt verwijderen, gelieve dit op de juiste manier te doen en het naar een nabij gelegen organisatie te brengen gespecialiseerd in de verwijdering van oud elektrisch materiaal.

This symbol indicates that the product which is marked in this way should not be disposed of as normal household waste. As it is a B2B product, it may also not be disposed of at civic disposal centres. If you wish to dispose of this product, please do so properly by taking it to an organisation specialising in the disposal of old electrical equipment near you.

Този знак означава, че продуктът, обозначен по този начин, не трябва да се изхвърля като битов отпадък. Тъй като е B2B продукт, не бива да се изхърля и в градски пунктове за отпадъци. Ако желаете да извърлите продукта, го занесете в пункт, специализиран в изхвърлянето на старо електрическо оборудване.

Dette symbol viser, at det produkt, der er markeret på denne måde, ikke må kasseres som almindeligt husholdningsaffald. Eftersom det er et B2B produkt, må det heller ikke bortskaffes på offentlige genbrugsstationer. Skal dette produkt kasseres, skal det gøres ordentligt ved at bringe det til en nærliggende organisation, der er specialiseret i at bortskaffe gammelt el-udstyr.

Sellise sümboliga tähistatud toodet ei tohi käidelda tavalise olmejäätmena. Kuna tegemist on B2B-klassi kuuluva tootega, siis ei tohi seda viia kohalikku jäätmekäitluspunkti. Kui soovite selle toote ära visata, siis viige see lähimasse vanade elektriseadmete käitlemisele spetsialiseerunud ettevõttesse.

Tällä merkinnällä ilmoitetaan, että kyseisellä merkinnällä varustettua tuotetta ei saa hävittää tavallisen kotitalousjätteen seassa. Koska kyseessä on yritysten välisen kaupan tuote, sitä ei saa myöskään viedä kuluttajien käyttöön tarkoitettuihin keräyspisteisiin. Jos haluatte hävittää tämän tuotteen, ottakaa yhteys lähimpään vanhojen sähkölaitteiden hävittämiseen erikoistuneeseen organisaatioon.

Ce symbole indique que le produit sur lequel il figure ne peut pas être éliminé comme un déchet ménager ordinaire. Comme il s'agit d'un produit B2B, il ne peut pas non plus être déposé dans une déchetterie municipale. Pour éliminer ce produit, amenez-le à l'organisation spécialisée dans l'élimination d'anciens équipements électriques la plus proche de chez vous.

Cuireann an siombail seo in iúl nár cheart an táirgeadh atá marcáilte sa tslí seo a dhiúscairt sa chóras fuíoll teaghlaigh. Os rud é gur táirgeadh ghnó le gnó (B2B) é, ní féidir é a dhiúscairt ach oiread in ionaid dhiúscartha phobail. Más mian leat an táirgeadh seo a dhiúscairt, déan é a thógáil ag eagraíocht gar duit a sainfheidhmíonn i ndiúscairt sean-fhearas leictrigh.

Dieses Symbol zeigt an, dass das damit gekennzeichnete Produkt nicht als normaler Haushaltsabfall entsorgt werden soll. Da es sich um ein B2B-Gerät handelt, darf es auch nicht bei kommunalen Wertstoffhöfen abgegeben werden. Wenn Sie dieses Gerät entsorgen möchten, bringen Sie es bitte sachgemäß zu einem Entsorger für Elektroaltgeräte in Ihrer Nähe.

Αυτό το σύμβολο υποδεικνύει ότι το προϊόν που φέρει τη σήμανση αυτή δεν πρέπει να απορρίπτεται μαζί με τα οικιακά απορρίματα. Καθώς πρόκειται για προϊόν B2B, δεν πρέπει να απορρίπτεται σε δημοτικά σημεία απόρριψης. Εάν θέλετε να απορρίψετε το προϊόν αυτό, παρακαλούμε όπως να το παραδώσετε σε μία υπηρεσία συλλογής ηλεκτρικού εξοπλισμού της περιοχής σας.

Ez a jelzés azt jelenti, hogy az ilyen jelzéssel ellátott terméket tilos a háztartási hulladékokkal együtt kidobni. Mivel ez vállalati felhasználású termék, tilos a lakosság számára fenntartott hulladékgyűjtőkbe dobni.Ha a terméket ki szeretné dobni, akkor vigye azt el a lakóhelyéhez közel működő, elhasznált elektromos berendezések begyűjtésével foglalkozó hulladékkezelő központhoz.

Questo simbolo indica che il prodotto non deve essere smaltito come un normale rifiuto domestico. In quanto prodotto B2B, può anche non essere smaltito in centri di smaltimento cittadino. Se si desidera smaltire il prodotto, consegnarlo a un organismo specializzato in smaltimento di apparecchiature elettriche vecchie.

Šī zīme norāda, ka izstrādājumu, uz kura tā atrodas, nedrīkst izmest kopā ar parastiem mājsaimniecības atkritumiem. Tā kā tas ir izstrādājums, ko cits citam pārdod un lieto tikai uzņēmumi, tad to nedrīkst arī izmest atkritumos tādās izgāztuvēs un atkritumu savāktuvēs, kas paredzētas vietējiem iedzīvotājiem. Ja būs vajadzīgs šo izstrādājumu izmest atkritumos, tad rīkojieties pēc noteikumiem un nogādājiet to tuvākajā vietā, kur īpaši nodarbojas ar vecu elektrisku ierīču savākšanu.

Šis simbolis rodo, kad juo paženklinto gaminio negalima išmesti kaip paprastų buitinių atliekų. Kadangi tai B2B (verslas verslui) produktas, jo negalima atiduoti ir buitinių atliekų tvarkymo įmonėms. Jei norite išmesti šį gaminį, atlikite tai tinkamai, atiduodami jį arti jūsų esančiai specializuotai senos elektrinės įrangos utilizavimo organizacijai.

Dan is-simbolu jindika li l-prodott li huwa mmarkat b'dan il-mod m'għandux jintrema bħal skart normali tad-djar. Minħabba li huwa prodott B2B , ma jistax jintrema wkoll f'ċentri ċiviċi għar-rimi ta' l-iskart. Jekk tkun tixtieq tarmi dan il-prodott, jekk jogħġbok għamel dan kif suppost billi tieħdu għand organizzazzjoni fil-qrib li tispeċjalizza fir-rimi ta' tagħmir qadim ta' l-elettriku.

Dette symbolet indikerer at produktet som er merket på denne måten ikke skal kastes som vanlig husholdningsavfall. Siden dette er et bedriftsprodukt, kan det heller ikke kastes ved en vanlig miljøstasjon. Hvis du ønsker å kaste dette produktet, er den riktige måten å gi det til en organisasjon i nærheten som spesialiserer seg på kassering av gammelt elektrisk utstyr.

Ten symbol oznacza, że produktu nim opatrzonego nie należy usuwać z typowymi odpadami z gospodarstwa domowego. Jest to produkt typu B2B, nie należy go więc przekazywać na komunalne składowiska odpadów. Aby we właściwy sposób usunąć ten produkt, należy przekazać go do najbliższej placówki specjalizującej się w usuwaniu starych urządzeń elektrycznych.

Este símbolo indica que o produto com esta marcação não deve ser deitado fora juntamente com o lixo doméstico normal. Como se trata de um produto B2B, também não pode ser deitado fora em centros cívicos de recolha de lixo. Se quiser desfazer-se deste produto, faça-o correctamente entregando-o a uma organização especializada na eliminação de equipamento eléctrico antigo, próxima de si.

Acest simbol indică faptul că produsul marcat în acest fel nu trebuie aruncat ca şi un gunoi menajer obişnuit. Deoarece acesta este un produs B2B, el nu trebuie aruncat nici la centrele de colectare urbane. Dacă vreţi să aruncaţi acest produs, vă rugăm s-o faceţi într-un mod adecvat, ducând-ul la cea mai apropiată firmă specializată în colectarea echipamentelor electrice uzate.

Tento symbol znamená, že takto označený výrobok sa nesmie likvidovať ako bežný komunálny odpad.Keďže sa jedná o výrobok triedy B2B, nesmie sa likvidovať ani na mestských skládkach odpadu. Ak chcete tento výrobok likvidovať, odneste ho do najbližšej organizácie, ktorá sa špecializuje na likvidáciu starých elektrických zariadení.

Ta simbol pomeni, da izdelka, ki je z njim označen, ne smete zavreči kot običajne gospodinjske odpadke. Ker je to izdelek, namenjen za druge proizvajalce, ga ni dovoljeno odlagati v centrih za civilno odlaganje odpadkov. Če želite izdelek zavreči, prosimo, da to storite v skladu s predpisi, tako da ga odpeljete v bližnjo organizacijo, ki je specializirana za odlaganje stare električne opreme.

Este símbolo indica que el producto así señalizado no debe desecharse como los residuos domésticos normales. Dado que es un producto de consumo profesional, tampoco debe llevarse a centros de recogida selectiva municipales. Si desea desechar este producto, hágalo debidamente acudiendo a una organización de su zona que esté especializada en el tratamiento de residuos de aparatos eléctricos usados.

Den här symbolen indikerar att produkten inte får blandas med normalt hushållsavfall då den är förbrukad. Eftersom produkten är en så kallad B2B-produkt är den inte avsedd för privata konsumenter, den får således inte avfallshanteras på allmänna miljö- eller återvinningsstationer då den är förbrukad. Om ni vill avfallshantera den här produkten på rätt sätt, ska ni lämna den till myndighet eller företag, specialiserad på avfallshantering av förbrukad elektrisk utrustning i ert närområde.