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1 General

1.1 Introduction

This manual shall contribute to avoid dangerous situations, to prevent accidents and to protect the measurement equipment against the incorrect behavior of personnel.

This operating manual aimed to all persons who operate, maintain or repair the Light Weight Deflectometer LWD WEBERconnect.

1.1 Applicable Product Documents

Quick Start Guide LWD WEBERconnect (see included accessories)

1.2 Used Terms

1. Load Plate
2. Loading mechanism
3. Handheld

1.3 Liability Limitations

All data and notes in the operating manual were prepared with consideration to the applicable standards and regulations as well as the state-of-the-art engineering.

The company Weber Prüftechnik does not assume any liability for damages and malfunctions due to the following circumstances:

- Ignoring the documentation
- A usage not according to the intended purpose of the Light Weight Deflectometer LWD WEBERconnect

1.4 Copyright

All documents are protected under copyright law. The transmission and reproduction of documents – even extracts – as well as the utilisation and communication of its content is not allowed, unless explicitly authorized. Infringements are punishable and impose an obligation for compensation.

1.5 Customer Service



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2 Safety

2.1 Requirements on the Personnel

The Light Weight Deflectometer LWD WEBER*connect* may only be operated by qualified staff.

This operating manual defines qualified personnel as someone who passed a specific training, possesses knowledge and experience and who is also familiar with the relevant regulations that enables the person

- To do safely the assigned work and to estimate correctly the consequences of the activities
- To recognize independently a possible danger and to take necessary measures for its clearance
- To understand the present instruction due to the language knowledge

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2.2 Proper Use

The Light Weight Deflectometer LWD WEBERconnect was developed in accordance to the German test regulation TP BF-StB Part B 8.3 as well as the American standard ASTM E2835-11, to test the soil bearing capacity and the achieved degree of soil compaction in the area of soil construction, traffic route engineering or railway construction by means of a dynamic plate pressure test.

All tests have the purpose of a documentation and is suitable for the supervision of the quality reliability during the construction phase.

2.3 Requirement for the operating site

This test procedure is particularly suitable for coarse and mixed grains with the largest grain of maximum 63 mm. It can be applied to detect the dynamic deflection modulus E_{vd} in the range from 15 MN/m² to 70 MN/m². The application of the dynamic plate pressure test is not permitted to determine the dynamic modulus of resilience E_{va} higher than 70 MN/m² because in this range the Light Weight Deflectometer cannot be calibrated adequately.

In case of quick-drying, equal grainy sands, encrusted or superficially drenched test surfaces that is not intact in the upper zone due to other influences, the defective zone has to remove before the test can start. The density of the ground, which has to examined, has to remain without any modifications.

In case of fine grain (silts and clay), the dynamic plate pressure test can only be performed and evaluated if the ground has a stiff to rigid consistency.

In cases of doubt the consistency of the ground has to be checked in different depths to a deep of d (d = diameter of the load plate) underneath the test point.

The inclination of the test point may not be higher than 6 %.

The execution of the dynamic plate pressure test only permitted in a temperature range between 0 °C and 40°C. Tests on a frozen ground are not permitted.

2.4 Warnings

In this manual, all warnings are particularly highlighted compared to the remaining text. The warnings are marked in colours and introduced by a signal word that indicates the degree of danger. An icon specifies the kind of danger.

All warnings have to be followed strictly to carry out an accident-free work and to avoid injuries and damages.

The following categories of icons are used



DANGER

Dangerous situation, if not avoided could cause irreversible damages or death.



WARNING

Dangerous situation, if not avoided could cause severe injuries.



CAUTION

Dangerous situation, if not avoided could cause minor injuries and/or damages.

Warnings in this manual have the following structure:



SIGNAL WORD

Kind of danger

Consequences of the danger

Security measures

2.5 General Safety

The handheld may be connected only with the switched power supply included in the original accessory, to recharge the battery. Otherwise, no safe operation can be guaranteed. Only this switched power supply meets the requirements for power sources of limited power (LPS). A replacement switched power adapter can be purchased as an original spare part from the device manufacturer WEBER Prueftechnik.

The internal battery inside of the load plate may only be recharged via the charging socket on the handheld otherwise not a safe operation is guaranteed. Further or other recharging methods developed in case of the technical progress, may only be released for use from WEBER Prueftechnik.

Opening the device is prohibited to the users. The service and repair work is carried out exclusively from the manufacturer!

The device contains different electrical fuses that may only be replaced by the manufacturer!

To disconnect the device from the main power supply, unplug the included switching power supply from the main socket. Therefore, the socket for the main power supply has to be closely mounted to the handheld and to be easily accessible.

To disconnect the handheld from the charging voltage 12VDC, the plug of the connecting cable may be used. Pull the plug also in case of danger!

To disconnect the load plate from the charging voltage 5VDC, the plug of the connecting cable may be used. Pull the plug also in case of danger!

2.6 Hint and recommendation



HINT

Important information for efficient and trouble-free workflow.

3 Design and Function

3.1 Overview



Illu. 1 Overview

- 1 Loading Mechanism
- 2 Handheld
- 3 Load Plate
- 4 Switched power supply (not available in Picture)
- 5 connection cable (not available in Picture)

3.2 Load Plate

The load plate serves to measure the settlement. The inner electronic determines the value of settlement (deflection) and the resulting dynamic modulus of resilience (E_{vd})

The load plate consists of:

- Integrated measurement electronics including the printed circuit board (PCB)
- Rechargeable Lithium-ion battery
- Charging socket
- "Power On" button
- Bearing bolt
- Steel ball

The steel ball from the bearing bolt serves to transmit the linear forces between the load plate and the loading mechanism.



CAUTION

risk of explosion

Inside the equipment, there are special batteries. Improper replacement of these batteries may cause a risk of explosion!

The battery inside the load plate may not be replaced by self! Its replacement and disposal may only be carried out by the manufacturer WEBER Prueftechnik or his authorized service partners.

3.3 Loading mechanism

The loading mechanism serves to apply a defined force on the load plate. It controls also the application time of the load by means of a spring package.

The loading mechanism consists of:

- Guide rod
- Falling weight
- Release device
- Circular level
- Spring package
- Tilt protection
- Transport lock



CAUTION

risk of injury

Without latched transport lock, the falling weight could move uncontrolled!

The loading mechanism may not be transported without a latched transport lock! Before a safety transport begins, the transport lock must be latched in its locking position!

3.4 Handheld

The handheld is intended to display, to save, to print out and to transmit the results of measurement.

The handheld consists of:

- Touchscreen
- Mini printer
- GPS modul
- Rechargeable battery
- Switched power supply (see included accessories)
- Connection cable handheld/load plate (see included accessories)
- Internal memory
- WEBER SD-card



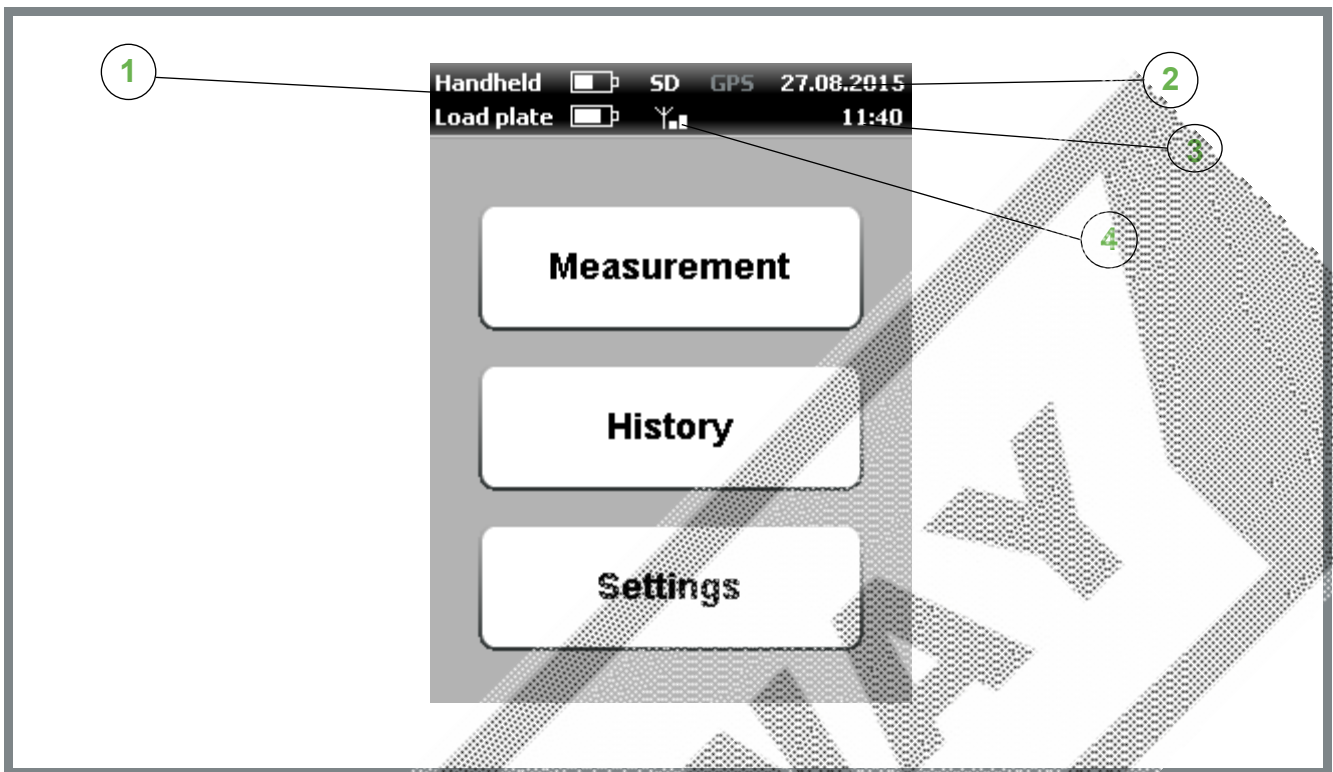
CAUTION

risk of explosion

Inside the equipment, there are special batteries. Improper replacement of these batteries may cause a risk of explosion!

The battery inside the handheld may not be replaced by self! Its replacement and disposal may only be carried out by the manufacturer WEBER Prueftechnik or his authorized service partners.

3.4.1 Display Touchscreen



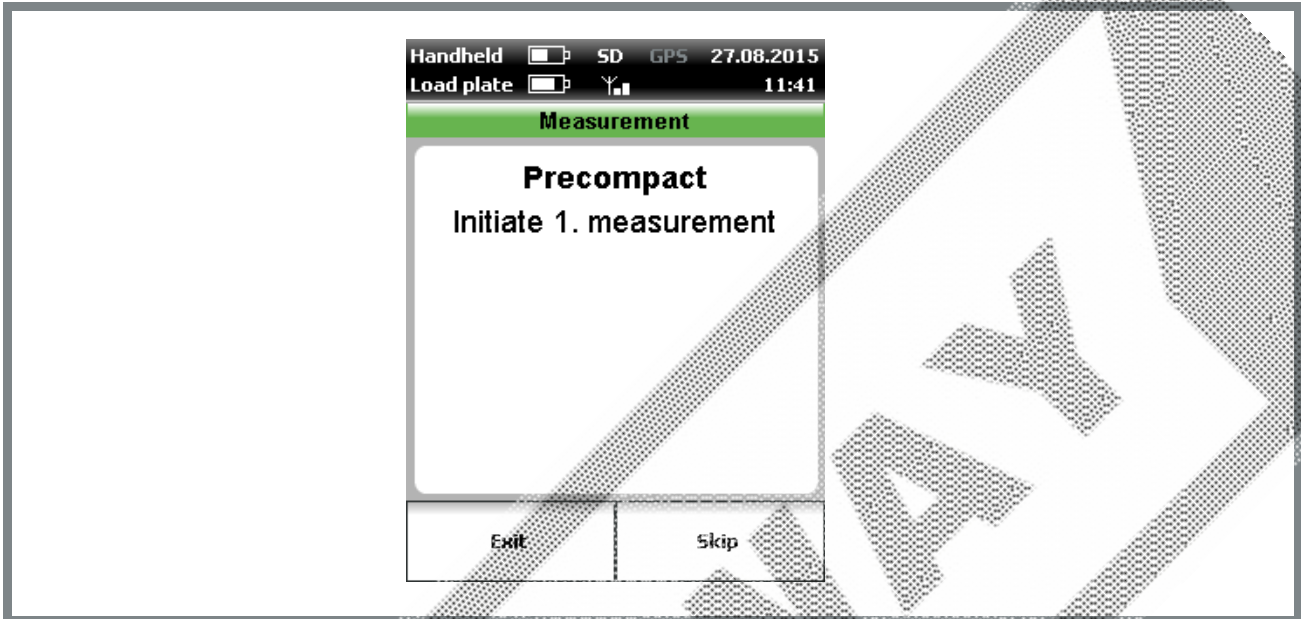
Illu. 2 start screen Handheld

- 1 Charge and battery status display
- 2 Date
- 3 Time
- 4 Signal strength to the load plate

3.4.2 Menu item Measurement

After activation of the menu „Measurement“, the display will change into check mode.

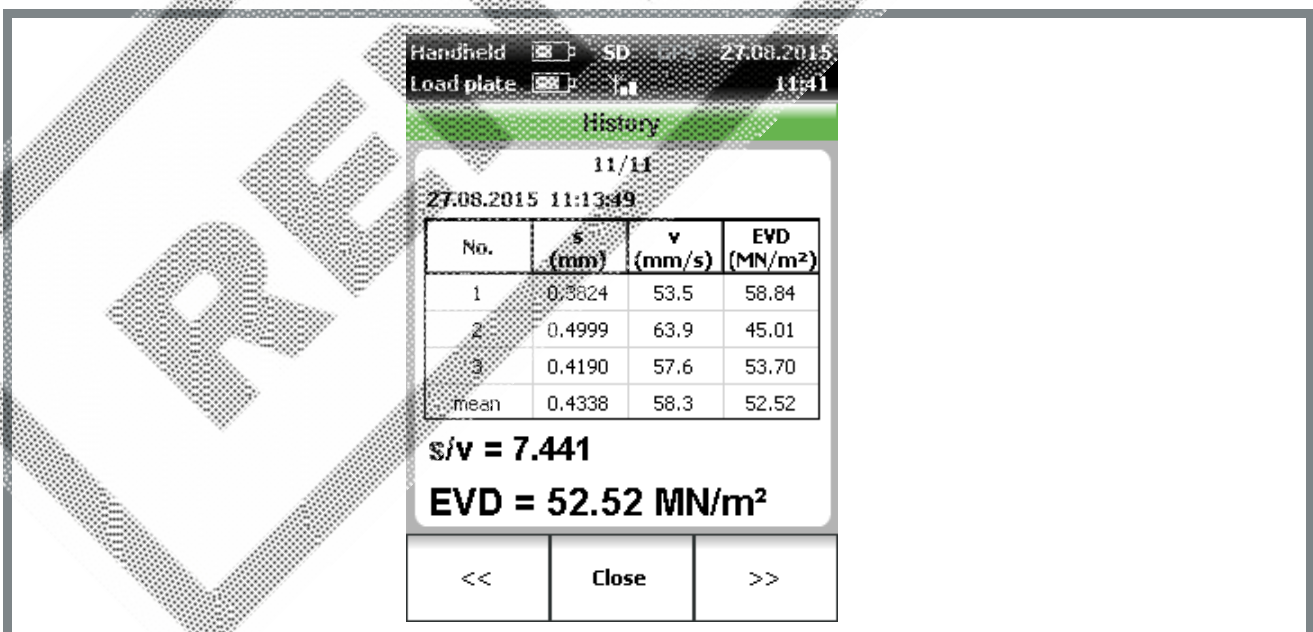
Depending of the setting parameters the handheld will guide the examiner automatically through the individual check steps.



Ilu. 3 Menu item Measurement

3.4.3 Menu item History

After activation of the menu „History“, all memorized tests can be displayed in series



Ilu. 4 Menu item History

3.4.4 Menu item Settings

After activation of the menu „Settings“, a submenu will appear with the following sub items:

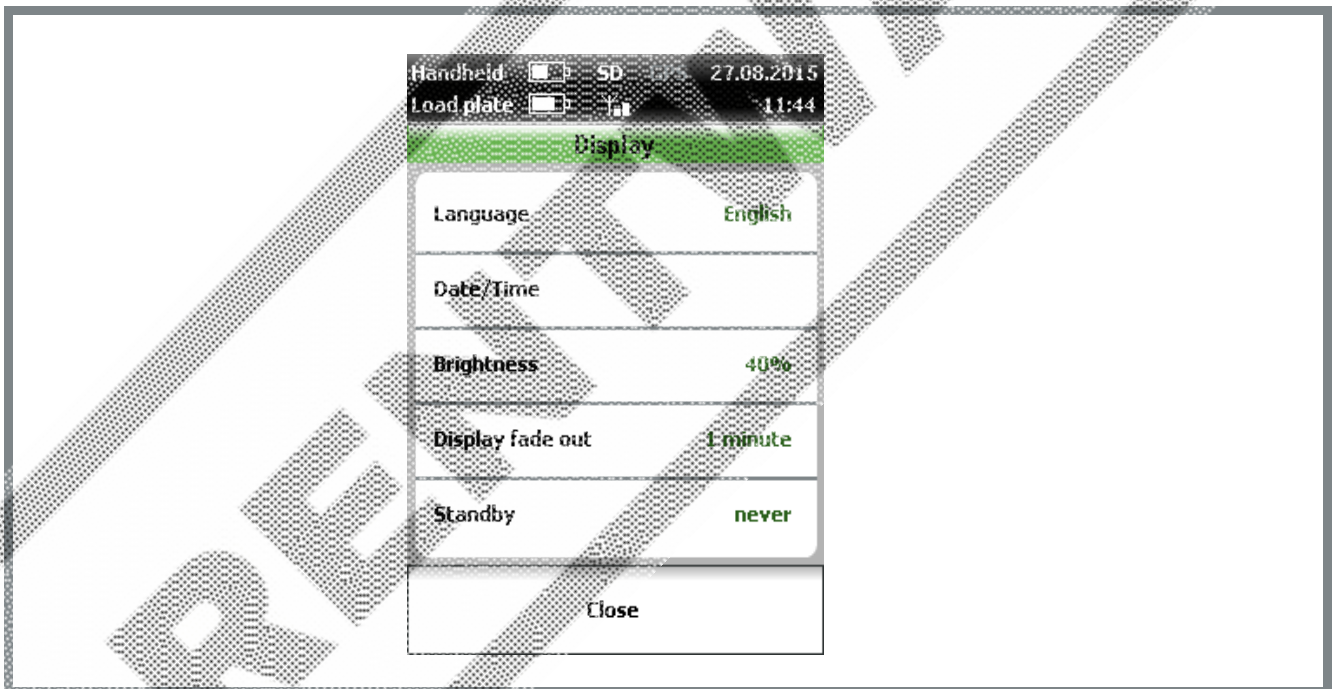
- Display
- Measurement settings
- Settings load plate
- Device info

Menu „Display“

The menu „Display“ permits the selection of different languages. The date as well as the clock settings can be adjusted in this menu.

As energy saving options an adjustment of the display screen-brightness, the delay time for display-fade-out and the standby timing of the handheld can be done.

The softkey “Close” leads to the previous main menu “Settings”.



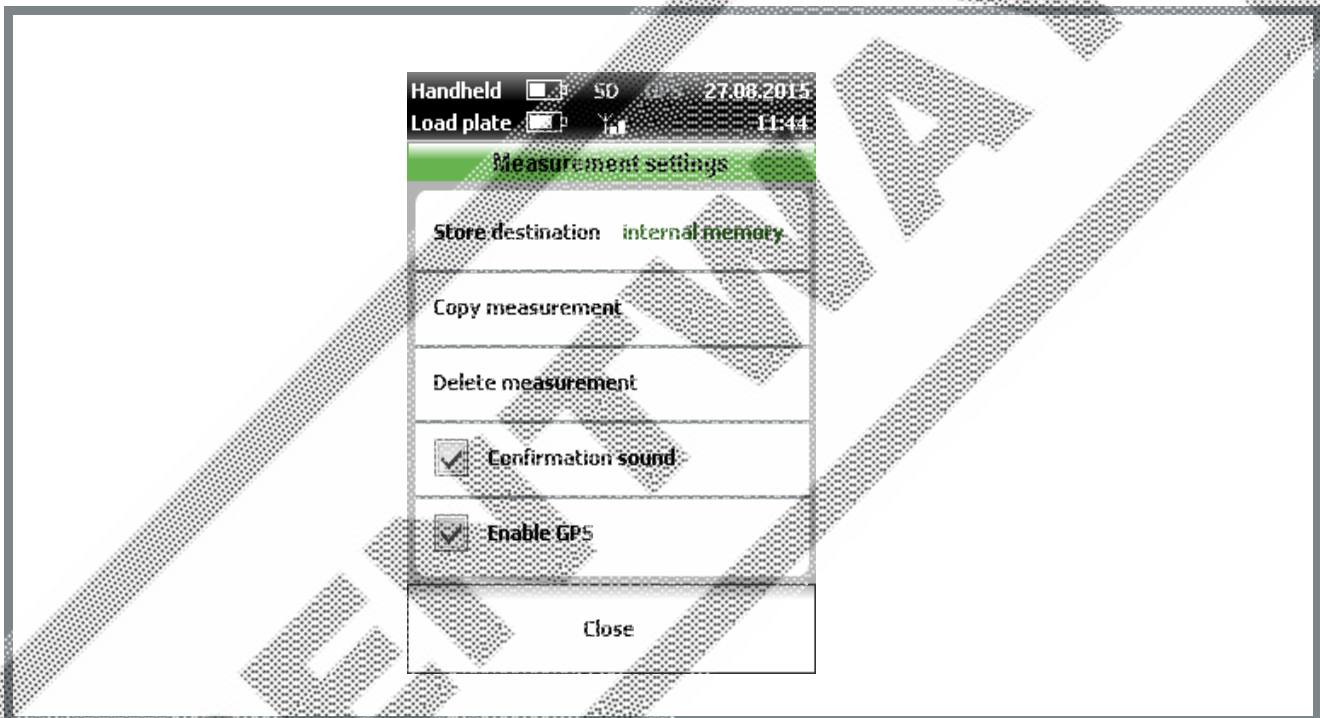
Ilu. 5 Menu „Display“

Menu “Measurement settings”

The memory location can be selected in the menu „Measurement settings“. The results of the test can be saved onto a SD-card or into the internal memory.

The SD-card is located in the card slot left-hand side of the handheld. Applying a soft push on the SD-card is enough, to insert or to eject the medium. The data can be copied from the internal memory to the SD-card by using the function “Copy measurement”. The data on the SD-card can be transferred later to a PC.

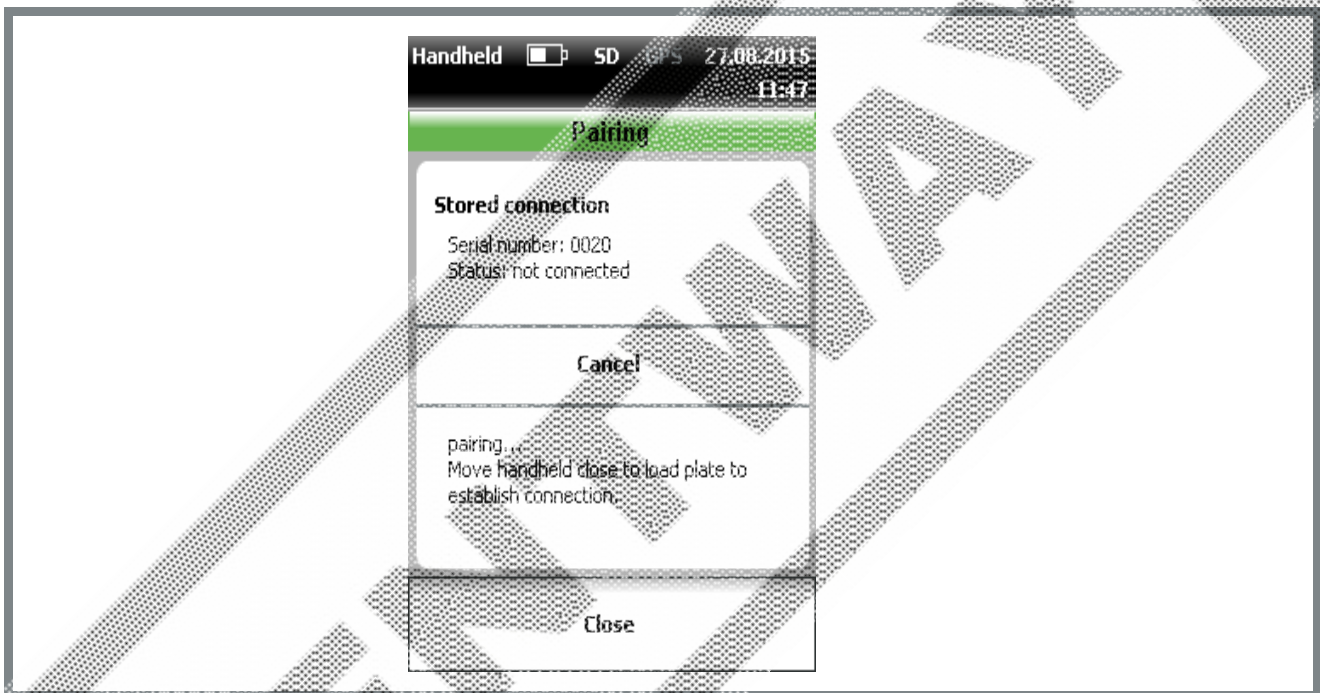
Touching the button “Delete measurement” will delete all data/tests on the corresponding memory location. In addition, the “confirmation sound” as well as the “GPS”-option can be enabled or disabled in the menu “Measurement settings”. The soft key “Close” guides the user to the previous menu “Settings”.



Ilu. 6 Measurement - Settings

Menu “Setting Load Plate”

Four items are available in the menu „Settings Load Plate“: Pairing, calibration, charging mode and system information. The handheld can only be used as display instrument. It is exchangeable between all LWD WEBERconnect testers. The handheld can be connected with any ground sensor / load plate of a LWD WEBERconnect device. The soft key PAIRING activates the function. The display changes into the status “Pairing”. The first line informs the user about the currently existing connection to the ground sensor / load plate. The connection can be renewed at any time. The soft key “Reconnect” has to be activated and for 5 seconds the handheld has to be positioned next to the recording-spigot of the load plate to be connected. Later the existing connection to the ground sensor / load plate will be displayed and can be saved. Upon activation the saved connection will be established automatically between handheld and load plate.



Ill. 7 Menu Setting Load Plate



HINT

Load plate and load device form a single unit. They are each other potash calibrated and may not be interchanged from parts of another LWD WEBERconnect!

Menu Device info:

The menu „Device info“ provides information about serial number, firmware version, battery status and charge status, RF connection and GPS status. The soft key “Close” leads back to the previous menu “Settings”.

3.5 Function

When carrying out a dynamic load plate test with the Light Weight Deflectometer LWD WEBERconnect the load plate will be charged impulsively with a light falling weight by using a defined force.

The acceleration, deflection (s) and speed (v) of the load plate depends on the ground that has to be tested. After the evaluation of the test, the dynamic modulus of resilience in MN/m² as well as the ratio of deflection/speed (s/v) are available.

The curves for the settlement measurement and the average values of deflection and speed will be displayed.

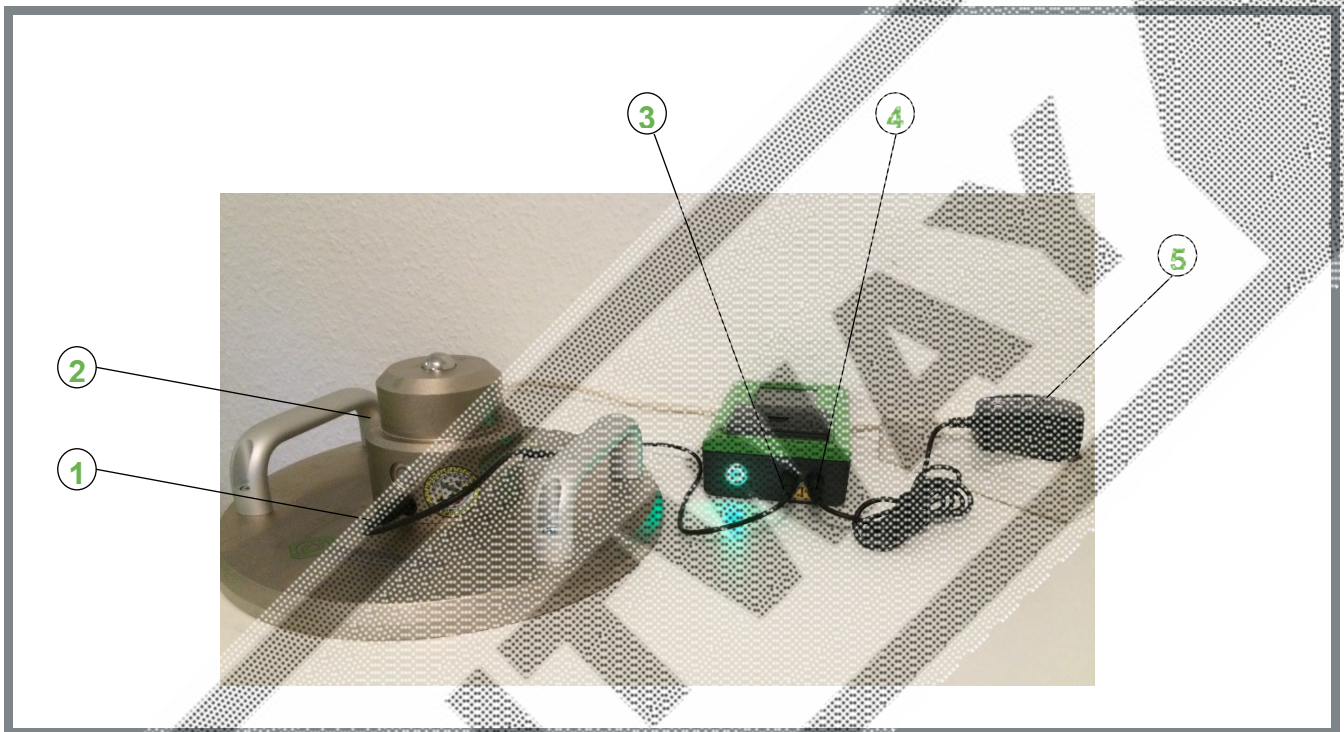
All data will be stored automatically and can be printed on-site. A transfer of results to the PC software can realised by means of a SD card.

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4 Commissioning

4.1 Charging the battery

For charging the battery of the handheld and the load plate a switched power supply with different globally used adapters as well as a connection cable is included.



Ilu. 8 Charging the battery

- 1 connection cable Load Plate - Handheld
- 2 load plate
- 3 charging output socket (connection cable)
- 4 charging input socket (power cord)
- 5 switched power supply



CAUTION


Voltage fluctuations

Higher voltage fluctuations can destroy the charging connection.

The power supply unit may not be connected to non-regulated emergency generators.

1. Connect the switched power supply (5) with the proper adapter to your AC power supply network
2. Connect the power cord to the handheld's charging socket (4), left-hand side (outer)
3. Plug in the connection cable (1) into the right charging socket (3) of the handheld
4. Plug in the connection cable (1) to the charging socket of the load plate (2)
5. **Switch on the handheld and the load plate**
 - The green LED ring of both ON/OFF buttons will light on constantly (load plate and handheld) while charging procedure.
 - At the handhelds display, an additional plus sign will appear at both battery status bars during charging process.
 - After the charging process of the load plate is finished, its LED-ring shut down and the load plate switched off automatically the additional plus sign will disappear. Often the charging of the handheld takes more time. This is completely normal and due to the much larger battery.
 - After completing the charging process of the handheld, it changes to the standby-modus and the LED ring of its ON/Off button starts blinking slowly.



 CAUTION
Battery load plate In this device combination, the load plate battery must be charged via the socket on the handheld, otherwise no safe operation is guaranteed!



HINT
A swapping of both sockets on the handheld is not possible due to the design.



HINT
The maximum charging time is about 3,5 hours. The charging device will stop automatically the charging process to avoid an overcharging of the battery.



HINT
The switched power supply can stay connected also after charging is finished, for example over night. But to save the environment, your equipment and money, a disconnection is recommended. Think green!

5 Operation

5.1 Activate Handheld

The LWD WEBERconnect can be full operated by the touchscreen of the handheld.

Press the ON/OFF button of the handheld

→ *Load plate and handheld will connect automatically*

→ *Start screen appears*



HINT

The maximum distance for the wireless data transmission is approx. 10 m.

5.2 Conducting a measurement

The default setting of the LWD WEBERconnect requires prior to any measurement a performance of three preload impulses. These impulses establishes a proper contact (soil contact tension) between ground and load plate.

The display will skip automatically into the measurement mode as soon as the three preload impulses have been carried out. A beep tone confirms each step. Every test has three measurement impulses.

1. Switch-on handheld
2. Press soft key Measurement
→ *Display skips into test mode*
3. Conduct three preload impulses
→ *Display skips into measurement mode*



HINT

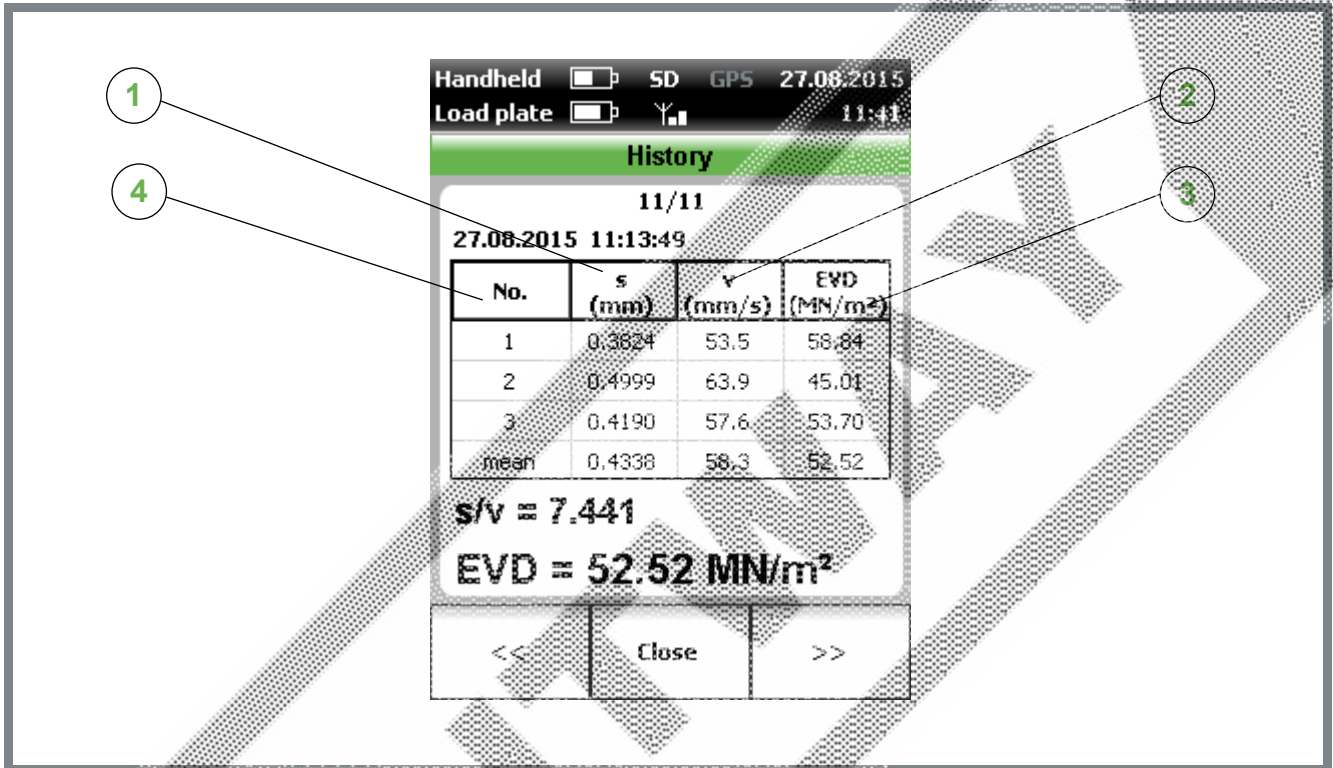
After activating „Measurement“, a series of beep tones could indicate an error. This refers e.g. to an interruption of the wireless connection to the load plate, a lost GPS signal, or a missing SD card. The corresponding error message will appear on the display.



HINT

Based on the settings of the handheld the menu will guide the user automatically through all the test steps.

The single results of the three measurement impulses are displayed graphically in a table.



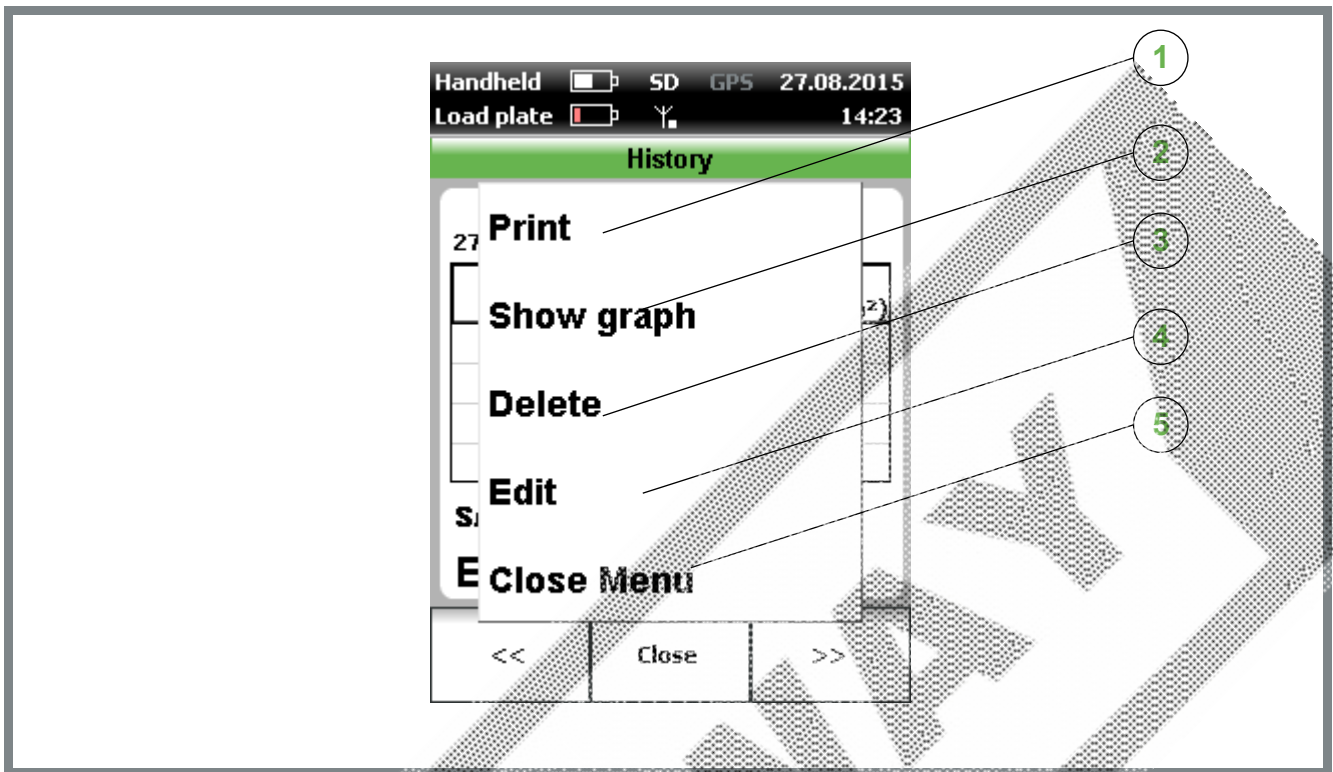
Ilu. 9 Start screen Handheld

- 1 Deflection (s)
- 2 Speed (v)
- 3 E_v-value
- 4 Number of Measuring impuls

The arithmetic average calculated based on the single results, will be integrated into the calculation of the measurement.

The test result contains the determined dynamic modulus of resilience value in MN/m² and the ratio value s/v. This will determine the further compactability of the ground.

Touching the table on the display opens further sub menus.



Illu. 10 menu Measurement

- 1 Softkey Print
- 2 Softkey Show graph
- 3 Softkey Delete
- 4 Softkey Edit
- 5 Softkey Close Menu

5.3 Print out a test

1. touch the table at the touchscreen.
→ *sub menu will open*
2. Press soft key Print
→ *the displayed measurement will be printed*



HINT

The printer will be triggered and started by the firmware automatically and does not need any manually activation.

5.3.1 Replacing printer paper

Dimensions of the thermal printer paper:

Width: 58mm Diameter: 31mm Length: max.10,5m paper thickness: 55g/m²

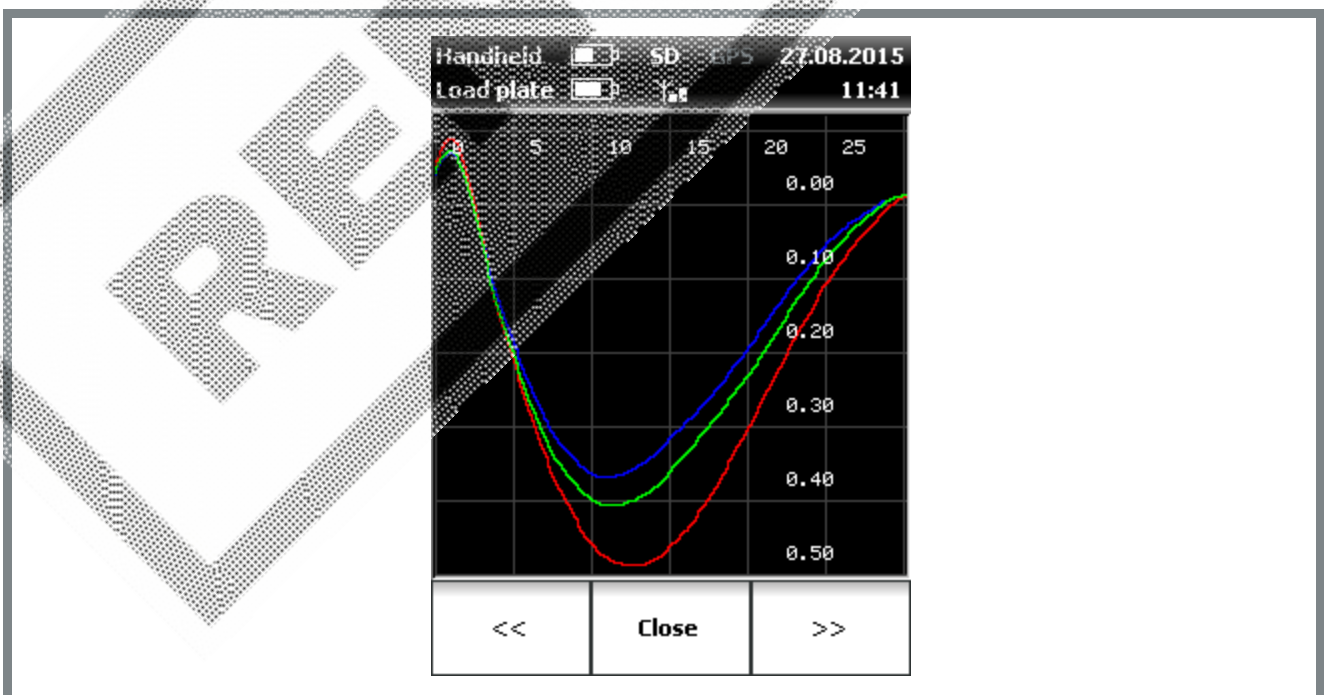
In case of missing thermal paper, the printer signal LED will flash in red.

1. Lift up the flap of the paper tray slightly
2. Open the printer flap
3. Insert the new thermal paper roll (thermoactive front of the paper towards the touchscreen)
4. Close and lock the printer flap
5. Press the feed button of the printer until the paper has left the housing
→ *Printer signal LED lights green*

5.4 Indication of settlement graphs:

The settlement curves are displayed in different colours with a graphical format. The different colours are indicating the corresponding measurement impulse.

1. Touch the table on the touchscreen
→ *sub menu opens*
2. Press soft key Show graph
→ *the indicated measurement will be displayed as graph*



Illu. 11 Example view of a measurement graphic

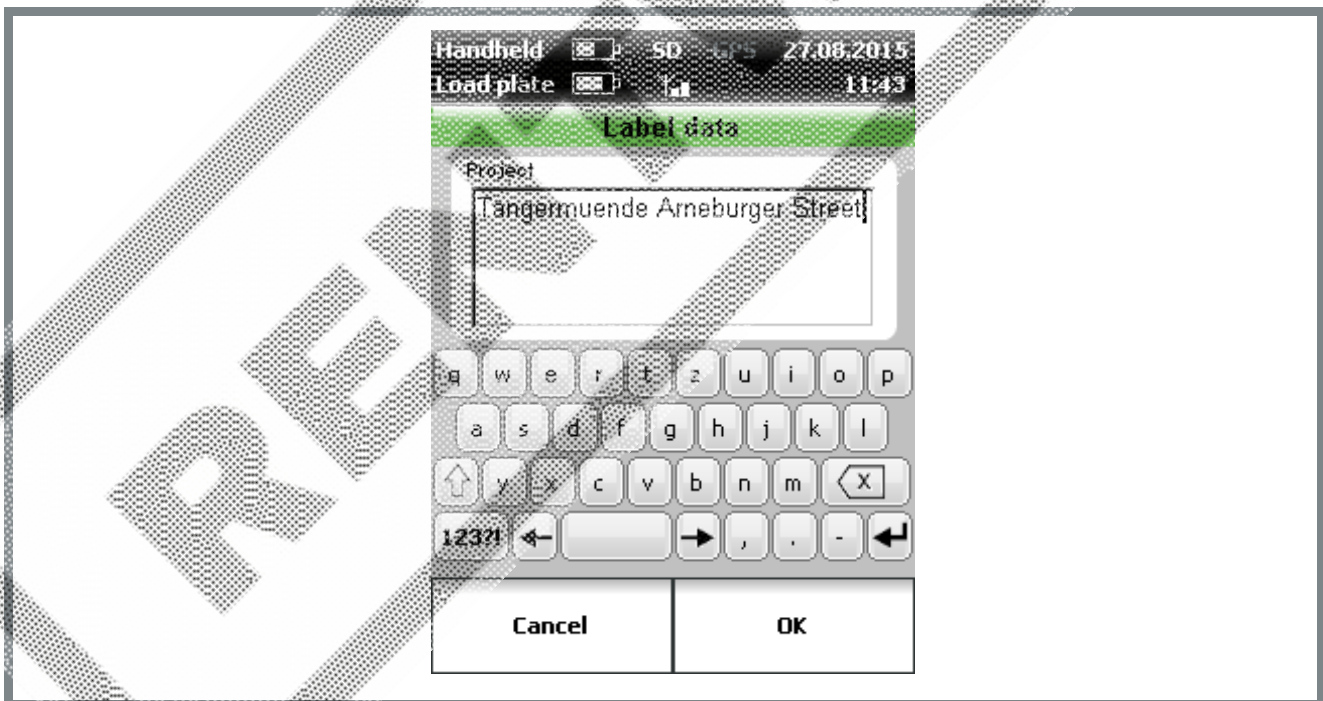
5.5 Deleting the last test:

1. Touch the table on the touchscreen
→ *sub menu opens*
2. Press soft key Delete
→ *Last measurement will deleted*

5.6 Labelling of test data:

The labelling fields allow to insert comments for each test.

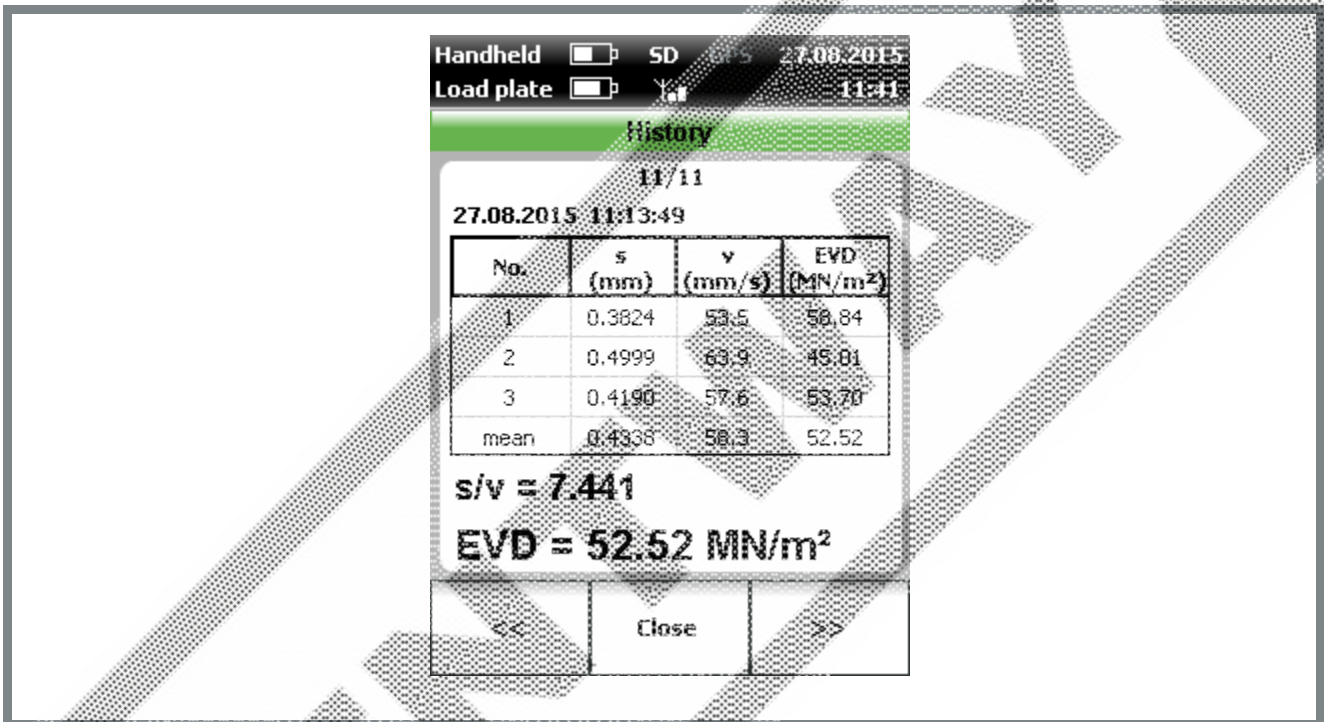
1. Touch the table on the touchscreen
→ *sub menu opens*
2. Press soft key Edit
3. Press the corresponding comment field
→ *A virtual screen keyboard will open*
4. Type in the required comment and save with OK



Illu. 12 Menu data edit

5.7 Show tests

1. Press the soft key History on the start screen
→ all stored tests will be displayed in the numeric order
2. Press the arrow FORWARD
→ the next test will appear
3. Press the arrow BACK
→ the previous test will be displayed



Ill. 13 menu Historie



HINT

Touching the table leads to the sub menu during a test.

5.8 Execution of test

Prerequisite:

- The test zone has to carry the entire load plate
- Weather related loose material on the test zone has to be removed
- Cavities in the test zone have to be filled with fine-grained sand

Execution

1. Place the load plate
2. Center the loading mechanism on the load plate



HINT

The loading mechanism that is mounted on a ball head of the bearing bolt can tilt up to 10 degrees in all directions. A tilt protection at the spring package avoids any tipping over.

3. Activate handheld and load plate
→ *the wireless connection will be confirmed on the display after a few seconds*
4. Press the soft key MEASUREMENT
5. Release transport locking
6. Position the loading mechanism with one hand in a vertical position
7. Pull up the weight inside the handle with the second hand to the latch
→ *the weight engages*
→ *the second hand is free again*
8. Release the latch
→ *the weight will fall down along the shaft and hits on the spring package*

Depending on the load-bearing capacity of the ground the weight will spring back about half of the way and has to be caught manually at the handle. It has to be pulled up to the latch, till it is locked and the process can restart. During the single measurements the load plate may not wobble or slip.



CAUTION

Danger of injury

The falling weight can cause injuries or damages on the measurement equipment.

The handle always must be used to catch the weight. Do not reach into the equipment at any time when the weight is falling down.

All preload and measurement impulses will be applied as described above. The menu steps will guide the test personnel through all steps and will confirm each step with a beep signal. The handheld will confirm the successfully finished test with three consecutive beep tones.



CAUTION

Danger of injuries

The falling weight can cause injuries or damages on the measurement equipment.

Immediately after each test activate the transport lock!

6 Evaluation by Handheld

6.1 Interpretation of results

After completing a test the result is displayed below the upper table including corresponding test impulses. The E_{vd} value in MN/m^2 informs about the load bearing capacity and the compaction of the tested ground. At the same time the ratio s/v (deflection/speed) is displayed without unit. The numerical value determines if the tested ground allows a further compaction. The threshold value of 3,5 was determined on an empirical basis. If the displayed value is below the threshold it will not be possible to increase the compaction of the ground furthermore. If the displayed value is higher than the threshold a further compaction of the tested ground is possible to increase the load bearing capacity.

6.2 Display and storing of results

Each result will create its own file and indicated the test date, the time as well as the GPS coordinates if applicable. In addition the file can be labeled manually. The information about the project or type of ground and group as well as further details will be entered by using the virtual keyboard. All data will be saved automatically in the file by means of the SOFTKEY OK and can be retrieved in the history. If the file should be printed out on the mini printer or transferred into the PC software all registered data will be processed.

After finishing the test the options "New Measurement" or "End" are available.

7 Data transfer to PC-Software

For storage and documentation the data records of the different tests can be transferred into the PC software. The data records are stored on the SD card and can be transmitted to the computer. The data records from the internal memory of the handheld have to be copied to the SD card first (refer to “Settings Measurement”).

In the PC software the data records or the tests can be allocated to the corresponding project or client. The manually edited records in the handheld and the standard information remain in the data records and the PC software permits a completion and further editing.

The system creates individual and group protocols. A Google Maps[®] interface enables a visualisation of single or multiple measurement points on a satellite image. Therefore each test has registered not only the date and time but also the relevant test point will be provable.

The final data records (test protocols) will be saved as PDF files which can be archived, printed and sent.

→ *Further information: refer to the manual PC software*

8 Transport

8.1 General Information



CAUTION

Danger of Injuries

The falling weight can move uncontrolled without transport lock.

The loading mechanism may not be transported without an activated transport lock.
For all transports the transport lock must be engaged.

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9 Malfunction

Error message	Fault	Display info	Remedy
Several beep tones after system start	SD card is not available	SD card missing	Install SD card
Several beep tones after system start	No wireless connection to the ground sensor	Ground sensor could not be localised	<ul style="list-style-type: none"> • Switch on ground sensor • Battery of the ground sensor discharged / → recharge battery • Ground sensor is out of transmitter range
Several beep tones after system start	GPS not available	GPS signal is not available	<ul style="list-style-type: none"> • Activate the GPS reception in Settings • No clear view to the satellite • Change position, if possible
Several beep tones during the measurement	Load plate moves horizontally	Impulse invalid, check the position of the load plate	Reposition the load plate according to instructions

10 Disposal

Take into account the local regulations for the disposal of material and consumables.

Clean correctly the assemblies and components and disassemble the equipment according to the local labour and environmental regulations.

Send disassembled components to recycling:

- Scrap the metals
- Forward plastic elements to recycling
- Recycling of remaining components according to the material

Local authorities or waste specialized companies will give information about environment-friendly disposal.

11 Technical Data

Operating temperature	0 – 35° C
permissible humidity	90 %
protection grade	IP 20
mains voltage	250 V
Battery runtime	min 30 h

12 Attachments

12.1 Declaration of conformity:

EG- declaration of conformity

in accordance with the EC Low Voltage Directive 2006/95/EG as set out in Annex III B;
from Dec. 12, 2006

We hereby declare that the product described below in its conception, design and of
the version which we have placed on the market complies with the essential health
and safety requirements of the EC Directive Low Voltage.

Manufacturer:

WEBER Prüftechnik
Torsten Weber
Arneburger Straße 121
39590 Tangermünde

Description of electrical equipment:

- **Function:** Measuring device for checking load bearing capacity and compaction of soil.
- **Type / model:** LWD WEBERconnect
- **Serial number:** 2015-0001
- **Year of construction:** 2015

We furthermore declare the compliance with the following directives and regulations,
which apply to the product:

- **EMV - Directive (2004/108/EG) of 15. December 2004**
- **Low voltage directive 2006/95/EG**


Applied harmonized standards, in particular:

- **Safety test according to EN 60950-1**

Number of CE marking: 2015

Place / Date: Tangermünde, October 2015

Torsten Weber
Owner WEBER Prüftechnik
(name, position)

Signature: 

12.2 Original Calibration Certificate:

