

Instruction manual



Made in Germany

www.ferratest3000.de

Instruction manual
Light Falling Weight Deflectometer
„TERRATEST 3000“
with integrated GPS system and Google® Maps interface
-Patent pending-

in accordance with the German regulation:
**„Dynamic plate loading test with the aid of the light falling weight
deflectometer TP BF-StB section B 8.3“**

in accordance with the Austrian regulation:
**„RVS 08.03.04
Compaction tests by means of the dynamic plate“**



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1. Documentation

1.1 Directions

We wish to congratulate for your purchase of the light falling weight deflectometer "TERRATest 3000". With this innovative test instrument you have purchased a leading edge product in the latest technology, directly from the producer TERRATEST GmbH. In order to use all advantages and possibilities that this high-tech product offers you, we suggest you to take a little time and read carefully this documentation. The chapters include all valuable information and usefull tips for a correct use. In this way we guarantee that you will be always able to perform precise tests and obtain details on the bearing capacity of the soil.

We accept no responsibility for damages due to the disregard of this documentation.

The instructions of this document can be changed at any time without any notify. TERRATEST GmbH accepts no responsibility for this manual. This is valid without restrictions also for implicit guaranties for the merchantability and applicability of the device for a specific purpose.

TERRATEST GmbH accepts no responsibility for mistakes in the present documentation, for accidental damages or damages due to the delivery, the efficiency or the use of the material.

PLEASE FOLLOW THE INSTRUCTIONS OF THE GERMAN REGULATIONS

"Dynamic plate loading test with the aid of the light falling weight deflectometer TP BF-StB Teil B 8.3".
TERRATEST GmbH gives no guarantee for improper use of the instrument.

1.2 Used symbols

Pay attention to the safety and use instructions of the documentation



Usefull information and directions



Attention! Risk of danger for heath, product and environment.

1.3 Packaging



In case of future shipments (example:for the calibration) we kindly ask you to keep the packaging of the instrument. At the receipt of the goods make sure that the material and the box are complete and not damaged. In case of damages please report it and file a complaint against the forwarder. Kindly provide us information on the damage and the name of the transport agent so to be able to contact him.

1.4 General safety information



To avoid dangers to people or damages to the instrument, it's absolutely necessary to pay attention to the correct fixing of the instrument during transportation. Before performing a test, make sure that the transport safety lock has been released to avoid damages to the device that won't be covered by the guarantee since it is a human error.



Never work among the instrument while the drop weight is hanged up. It's necessary to insert the measuring cable and operate with the PC only when the drop weight is positioned far down at rest.

2. Delivery

2.1 "TERRATEST 3000" BASIC PACKET

Light Falling Weight Deflectometer - 10 kg drop weight
In accordance with the german regulations TP BF-StB section B 8.3

"TERRATEST 3000" with integrated GPS system and Google®-Maps interface

Consists of:

- loading device with 10 kg drop weight and ergonomic handle
- 300 mm loading plate
- electronic box with GPS system, internal automatic plausibility check and test data trimming, internal memory up to 2000 tests, back-lit graphic display to view the curves during the tests, thermal print complete with paper rolls, chip card reader, internal accumulator, external buttons, wide window for the use under bad weather conditions
- electronic box/loading plate connection cable with high quality plugs (self-closing)
- user-friendly software with statistical analysis
in accordance with the german regulations TP BF-StB section B 8.3
optional: Google® Maps connection
- chip card to save up to 125 tests
- external chip card reader with USB connection
- battery charger 220 volt
- practical training and user's manual
- car battery charger 12 V/DC
- official calibration protocol issued by the MPA Kalibrierdienst GmbH in Berlin

2.2 Optional

- Loading unit with 15 kg drop weight, complete with damper and calibration protocol
- "Milano" transport box, made of wood, with aluminium profiles, complete with integrated transport grips and wheels
- "Roma" transport box, made of wood, with aluminium profiles, complete with handles and wheels in order to transport both the 10 and 15 kg plates
- Extension cable for the electronic box/plate connection to perform tests in places not easy to access such as ditches or trenches
- Paper rolls for the thermal printer
- Chip card, 64 kb, to save aprox 125 tests, rewritable

2.3 General view of „TERRATEST 3000“

Electronic box

Loading unit



2.4 View of the electronic box



3. Technical data of the “TERRATEST 3000” plate

3.1 Plate:

Plate weight, sensor dome and handles included	15 kg
Diameter of the plate	300 mm
Power of the plate	20 mm

3.2 Loading unit:

Impact force	7,07 kN
Impact duration	17 ms
Weight of the drop unit	10 kg
Weight of the guide bar	5 kg
Length of the guide bar	1140 mm
Total height of the instrument, plate included	1230 mm

3.3 Electronic box

Weight without accessories	4,5 kg
Dimensions	length = 320 mm width = 300 mm height = 180 mm
Ideal measuring temperature	0 - 40 °C
Measuring range 10 kg	15-70 MN/m ²
Measuring range 15 kg	70-120 MN/m ²
Electricity supply	long life and rechargeable lead accumulator, 6 Volt PANASONIC-Super Life
Automatic turning off	after 4 minutes the device turns off automatically
Time and date	the ones of the satellite
Precision of the GPS reception	less than 10 meters

3.4 Power supply

In the electronic device is has been installed a 6 Volt, 4,5 Ah/20 HR long-life and rechargeable PAN-ASONIC - Super Life lead accumulator. This minimizes an innovative lead-calcium-tin alloy for the damaging corrosion of the positive electrodes. A well-balanced formula for the positive active material helps the battery to last longer as special material for the negative electrodes permit a minimization of the current necessary for the battery trickle charging. Also the well studied design of the cells is very important for the longevity of the battery as the special material used for the separators. This material guaranties a constant pressure during the whole life and a control on the oxygen development.

You can charge the battery with 220 Volt or 12 if you use the car battery charger. The charging socket is on the control panel close to the GPS antenna. Both recharger cables are delivered with the instrument (basic packet).

The status of the battery is displayed every time you turn the device on. A full charge is equal to 6,9 Volt. This allows you to perform aprox 300 tests and stamp the protocols by means of the thermal printer. The efficiency of the battery depends also on the density of the pressure, on the temperature of the environment, on the lifetime and on other elements.

The device turns off automatically four minutes after the last test (automatic turning off).

In order to avoid a deep discharge of the battery, the electronic device turns off by itself before being completely flat and you can activate it again after having recharged it.



Only the producer can change the battery! Never try to open the battery. Lead is a highly toxic heavy metal. Please pay attention to the transport and disposal instructions for lead batteries. Never burn the battery. Keep out of reach of children.

4. Introduction to the light falling weight deflectometer

4.1 Descriptions

“TERRATEST 3000” combines the most modern microelectronics components with the features of an ergonomic test instrument, perfect during road construction. Our instrument has improved the test method with the light falling weight deflectometer by giving the possibility to register immediately and automatically the data of the tested points by means of the GPS system and the Google®-Maps interface. The patent for the GPS system is still pending.

During the development of the software, complete with statistical analysis of the measuring data, we attached importance to the necessity of offering an user-friendly system.

4.2 Innovations

Besides the GPS system with Google®-Maps interface, whose patent is still pending, “TERRATEST 3000” has other important innovations that make it a unique instrument able to measure the soil bearing capacity:

4.2.1 mechanical innovations:

- drop weight with hexagonal ergonomic handle and smoothed edges for a „better grip“
- sloping handles for an easy carry on site
- solid screwed safety grip with spirit-level

4.2.2 electronical innovations:

- integrated GPS system with Google®-Maps interface to determine quickly the position of the test points (patent pending)
- internal memory up to 2000 tests with USB interface
- automatic plausibility check of the result
- audio signal
- practical and back-lit graphic display to view the curves during the tests and for a fast menu-shift
- first-rate plug connection thanks to the use of high quality plugs
- user-friendly and practical software for the data processing through a statistical analysis

4.3 Test with the light falling weight deflectometer

The method of testing by means of the light falling weight deflectometer is by setting a load and letting it drop to the ground on a 30 cm diameter plate with a maximum force (F_{\max}) of 7070 kN. This force is gauged during the calibration so to have a normal tension of 0,1 MN/m² under the plate while performing the tests. The deformability parameter of the soil caused by this vertical falling weight is called E_{vd} value.

$$E_{\text{vd}} = 1,5 r \frac{\sigma_{\max}}{s_{\max}}$$

s_{\max} = medium value of the displacements $\sigma_{4\max}$, $\sigma_{5\max}$, $\sigma_{6\max}$ of 3 tests (after 3 preconsolidation tests)

r = radius of the plate (30 cm)

σ_{\max} = normal tension under the plate (0,1 MN/m²)

4.4 Field of application

The test with the light falling weight deflectometer is suitable to verify the bearing capacity and the compaction of soils during subsoils and subbase works, earthworks and transport infrastructure construction. For ground it's meant backfill materials, unbound base layers, ground improvements, cold recycling materials, mineral impermeable layers, asphalt, cured concrete and asphalt and stone pavements. In accordance with the german technical regulations the maximum grain size of the soil to be tested has to be 63 mm.

The test can be performed in less than 2 minutes by a single person, without loading vehicle. You will obtain immediately an assessment of the bearing capacity of the soil tested.

The test by means of the light falling weight deflectometer can be performed in Germany and Austria as alternative to the static plate bearing testing in accordance with the regulations DIN 18134.

With this instrument, in comparison to the static plate bearing testing (DIN 18134) you can perform tests in places not easy to access such as trenches and backfill works.

In accordance with the german technical regulations TP BF-StB section B 8.3, the application field with the light falling weight deflectometer with 10 kg drop unit is between 15 MN/m² and 70 MN/m², since it's within these values that the instrument fulfils the strict rules of the calibration institutes.

4.5 Calibration

Before the delivery "TERRATEST 3000" is calibrated by the MPA Kalibrierdienst GmbH of Berlin. All components, such as the plate with incorporated sensor, the loading unit and the electronic system, are checked during the calibration. A precise result is guaranteed only if the instrument is used in its whole. On the plate, on the drop weight and on the electronic device there is the same four-figure number which is the number of the instrument. You can find this number also on the calibration certificate. On the tag of the drop weight you can find the last calibration date and the corresponding falling height in cm.

The instrument, in accordance to the german technical regulations TP BF-StB section B 8.3, must be calibrated once a year by an institute recognized by Federal Highway Research Institute.



4.6 10 basic rules

1. The plate must lie and adhere completely to the subbase. Make sure that the plate doesn't wobble (please use feet to verify). In case of soil irregularities, spread a thin layer of sand so to level the surface to be tested.
2. Keep the guide bar upright (spirit-level) and make sure that the plate doesn't move vertically during the impact. If necessary place the foot on one side of the plate (never on the plate).
3. **ATTENTION:** Before each measuring always perform three preconsolidation tests.
4. After each collision grab the drop weight immediately, it has to fall only once.
5. The inclination of the subbase to test doesn't have to be higher than 6%.
6. The relation displacement/speed has to be lower than 3,5 ms in case of compacted soils.
7. Never change the position of the release handle (calibration height).
8. Before each measuring verify that the underside of the plate is clean.
9. The maximum grain size of the material to test has to be 63 mm.
10. In case of good compaction the displacement curves of each single measurement have to be very close to each other.



4.7 proposal for the correlation test



The test methods performed with the static plate and the dynamic plate differ from each other especially in the load speed and the pressure exerted on the ground. Because of this reason there's no constant correlation between the parameters M_d and E_{vd} . In order to obtain a quite precise correlation, it's suggested to perform a specific comparison correlation test for each site.

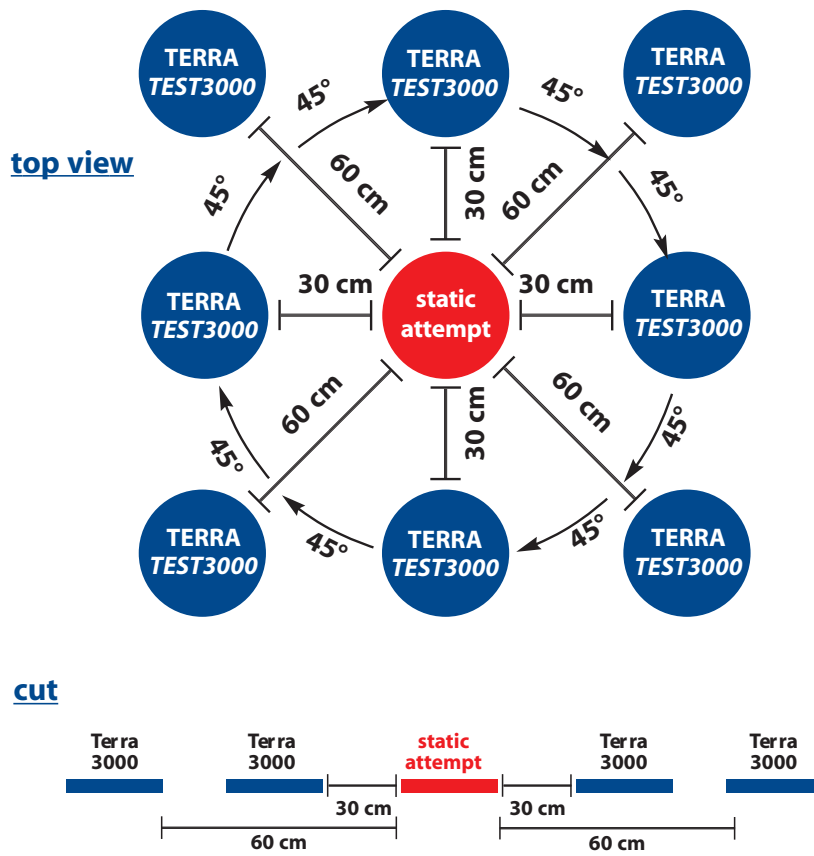
In order to have correlation values for the materials to use, we advise you the following procedure.

Verify that the materials have reached a sufficient compaction. Perform a test with the static plate on the area to be tested. Then, around that point, carry out eight tests with the dynamic plate at 30-60 cm and 45 degree distance from each other. According to the site size, it's necessary to take different tests in succession along the compaction line. You have to perform at least 3 test sequences at a distance of 20 meters from each other. At the end of the dynamic plate test you can determine the water content of the backfill materials. The loading vehicle has to leave the area very carefully in order not to cause any ground displacements. This procedure must be repeated also on other points of the area to test. After that the mean values of the E_{vd} values are compared with the mean values of the M_d values obtained with the static plate test, if the water content of each test point is not too different from each other.

In order to calculate the mean E_{vd} value, out of the 8 tests the highest and the lowest values won't be considered. Only the 4 values that showed results closed to each other will be taken into consideration. With the correlation values E_{vd}/M_d obtained, you can perform all the tests you have to take with the light falling weight, at least when the same materials are employed. We suggest to perform a correlation of values between the purchaser and the contractor so to agree on the test method.



schematical description for the correlation assessment of the static/dynamic plate loading test



All information are subject to correction!



4.8 Interpretation of the results

Interpretation of the curves

The three displacement curves of the print show the deflection curve of the three tests. In order to determine the Evd value, you have to take into consideration only the maximum displacement „Smax“. On bounded soils this value is registered approx after 8-10 milliseconds. On soft soils, the value can be registered later. In case of well compacted soils, the three displacement curves have to be close to each other, better would be to have them one on each other so to represent one single curve. In case the displacement curves are irregular right at the maximum displacement, please verify if there are lithoid elements under the plate that could affect the contact between plate and soil and/or consider to substitute the weight drop (10 of 15 kg) in case of stiff soils.

Evd value

The Evd values shows the compaction degree and the bearing capacity of bound and unbound soils till 60 cm thickness. The test is carried out up to 120 MN/m², as in presence of higher bearing capacity values the variability between the tests data can be extreme.

s/v value

The s/v value shows the relation between the maximum displacement and the maximum speed of the plate; this value is measured in milliseconds and gives more information about the compaction degree. If this value is higher than 3,5 ms, the compaction is not sufficient. This can depend on many reasons, such as the ground consistency, the water content and the compaction degree.

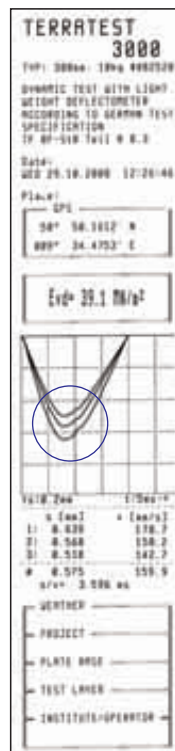
This interpretation is valid for normal sites. For special cases or in presence of special materials you can contact our serviceline. All information are subject to change.

4.9 How to determine the residual compaction

If on the test print you see three single curves, clearly away from each other, this means we are in front of the residual compaction. This means you probably have to proceed further on with the compaction. We suggest to perform 15 drop measurements and then make a test on that same point. At the end the three curves should be one on each other. This might confirm that the soil has to be compacted a little more.



Picture 1: Test on a relativ soft soil showing residual compaction by means of the dynamic plate loading test. You can see three single displacement curves.



Picture 2: Test after 15 compaction drops by means of the light falling weight deflectometer on the same point. The test protocol shows one single displacement curve consisting of three congruent curves. The Evd value and the bearing capacity of the soil has increased of 20% compared to the first test.

Clearly there are residual compactions on this test soil.

All information are subject to correction!

5. Test

5.1 Preparation of the test point

Make sure that the plate adheres perfectly to the ground. If necessary use the plate or other auxiliary tools (such as a trowel) to flatten the ground. Remove loose elements as stones or similar. Make sure that the contact between the plate and the subbase is even, if necessary spread a thin and regular layer of sand under the plate. Then replace the plate and use it to flatten the ground. The plate must completely adhere to the surface to be tested.



5.2 Carrying out of the test

After having prepared the test point and having placed the plate on the soil, set the loading unit on the center of the plate.



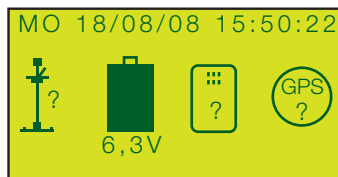
Use the cable to connect the sensor dome of the plate to the electronic device. Lift carefully the cover of the socket and put the plug in. The high quality LEMO plugs we use snap automatically and you can unplug them easily. Never pull the plug out by pulling the cable. Both plugs are identical, therefore it is impossible to have an incorrect plug connection.



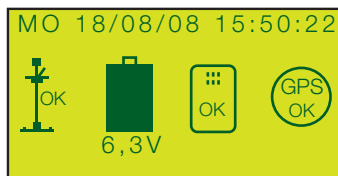
Turn on the electronic system by pressing "start". To activate immediately the graphic display, press the start button for three seconds at the switching on of the device till the status of the components is displayed.



By turning the electronic box on without activating the graphic display, the "TERRATEST 3000" logo and the firmware version will be displayed for three seconds. Afterwards, the status of the components will be automatically displayed.



The status checks that the sensor, the battery, the chip card and the GPS system are ready. If there are no problems, you will see "ok" on the display. If something is wrong, you will see a "?". The system may need 2-3 minutes to recognize the GPS connection. If there is no connection to the sensor, you won't enter the test mode.



If the chip card is not recognized, insert it once more, turn the electronic system off and then on. If still the chip card is not recognized, make sure it is reusable. You can reinitialize it in the menu "initialize card".

By pressing "start" again, you enter the test mode. You will be requested to proceed with the "10 kg 1st preconsolidation test".



You can now release the transport safety lock by pulling the orange button. **Before performing the test make sure that the transport safety lock has been released.** In case of improper use, which means in case you have been taking measurements with the safety lock inserted, this may cause damages to the instrument that won't be covered by the guarantee.



Following the “**10 kg 1. preload**” instructions, you can now take the measurement. Grip the blue handle at the end of the guide bar and open the release device by pressing the green lever towards the guide bar. Keep pressing. Take the drop weight with the other hand, lift it and fix it by releasing the green lever. The drop weight is now perfectly fixed to the release device. Open it by pressing again the green lever and let the drop weight fall. Grab it immediately after the first impact and fix it again to the release device as before.

After the audio signal and the request “**10 kg 2. preload**” proceed with the second measurement. A test taken before the audio signal won't be registered.

After the audio signal and the request “**10 kg 3. preload**” proceed with the third preconsolidation measurement.

The instrument checks the results of the three consolidation tests and enters automatically the measuring menu.

After the audio signal proceed with the “**1st test**” as requested.

The instrument will then show you the s4 displacement in mm and the relative displacement curve.

After the audio signal and the request “**2nd test**”, proceed with the second measurement.

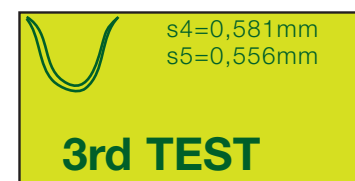
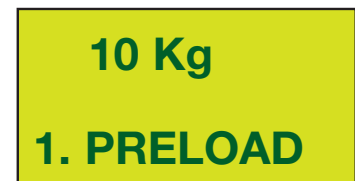
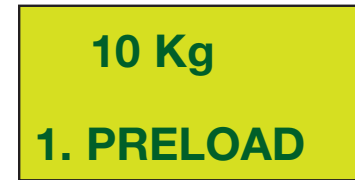
Now you can see the first two s4 and s5 displacements in mm and the relative displacement curves.

After the audio signal and the request “**3rd test**”, proceed with the third measurement.

Now you can see the displacements s4,s5 e s6 in mm and the relative displacements curves. Furthermore the display shows the result of the Evd value in MN/m².

A longer audio signal (bip) confirms the end of the tests and their storage on the internal memory and on the chip card. The test includes all data: deflection curves, Gps coordinates, date, time, number of the instrument, type of instrument. Press “print” to print the protocol. In order to proceed with other new tests press “start”(next).

Before each impact, make sure that the guide bar is set upright. Use the spirit level. If the plate moves vertically during the test, this won't be valid. This usually happens on sloped soils. You can avoid a possible lateral moving of the plate by laying a foot sideways. Never put the foot on the plate during the test! This would falsify the result. Each correct impact is confirmed by an audio signal (bip).



A possible test error is announced by a weird bip sound and the display displays “try again”. In this case move and relocate the plate and start over the tests proceeding with the first preconsolidation measurement.



Should you still have problems, this is due to the soil, either it is too soft or hard. The value obtained is out of the measuring range. You have to change place and restart the tests.

The electronic system is very sensitive and its sensibility is set so that by replacing the drop weight on the plate or by fixing it to the release device in a proper way no test is induced.

If instead the drop weight is placed on the plate or fixed to the release device in an offhand way, this may cause an impulse that could be registered by the automatic plausibility check. In this case the instrument starts over again the entire testing procedure. We suggest to change place to the plate.

In case of displacements very close to each other, please press the instrument -loading unit- on the central ball of the sensor dome, so to avoid the distortion of the result in case of a possible rebound of the guide bar.

5.3 Printout of the test protocol

Thanks to the thermal mini printer you can print easily and right away on site, or later according to your needs, the protocol of the test. This includes all information displayed during the test (see protocol). In order to print push the “print button” set on the control panel and on the lateral buttons. During the printout the check green light flashes. Once the printout is concluded, tear the protocol off using the border. If the “print” button doesn’t print and the green light is flashing, this means that printer ran out of paper. Please insert a roll of paper following the instructions as described in the following chapter. The paper feed button in on the left to the green light.



5.4 Change of the paper roll

A flashing green light means that the printer ran out of paper. To change the roll and open up the compartment, push the green light, lift the top and insert the new roll (57mm width and 25 m length) with the coated side outwards. With a roll you can print up to 100 protocols. Unroll approx 10 cm of paper upwards and close the top of the printer with a light pressure. Tear the exceeding paper off using the border. The printer is now ready for use. A colour ribbon is not necessary.



We definitely suggest to use thermal paper, setting the coated papers outwards. You can buy rolls by proper stationery shops or by TERRATEST GmbH.

Printout of the protocol

TERRATEST
3000
TYP: 300mm, 10kg #082520

DYNAMIC TEST WITH LIGHT WEIGHT DEFLECTOMETER
ACCORDING TO GERMAN TEST SPECIFICATION
TF 8F-StB Teil B 8.3

Date: WED 29.10.2008 12:26:46

Place: GPS
50° 50.1612' N
009° 34.4753' E

Evd= 39.1 MN/m²

Progress of the displacement with the 3 deflection curves

	s [mm]	v [mm/s]
1:	0.639	178.7
2:	0.568	158.2
3:	0.518	142.7
Ø	0.575	159.9
s/v= 3.596 ms		

WEATHER _____
PROJECT _____
PLATE BASE _____
TEST LAYER _____
INSTITUTE/OPERATOR _____

Data to be added manually

Name of the instrument

Type of instrument

Number of the instrument

German technical regulation

Time of the test

Date of the test

GPS coordinates of the test point

Dynamic deformation modulus

0-point surface to be tested

Progress of the displacement with the 3 deflection curves

Maximum displacement

Maximum displacement speed

Average of the maximum displacement

Average of the maximum displacement speed

s/v-value: relation displacement / speed

Data to be added manually

6. Menu

6.1 Chip card menu

The chip card has a memory capacity of 64kByte, equal to aprox 250 tests, depending on the quantity of data per each test (description of the curves).

When the chip card is inserted, the tests are automatically saved both on the chip card and on the internal memory. The chip cards are reusable. Once you turn the electronic device on, make sure that the status of the chip card on the display is "ok".

Each test saved on the chip card has a progressive data record number that is displayed down on the right together with the data record still storable.

The data on the chip card can be deleted by selecting "**CLEAR CHIP CARD**" from the menu. After that, the chip card can be used again.

6.1.1 Test Print

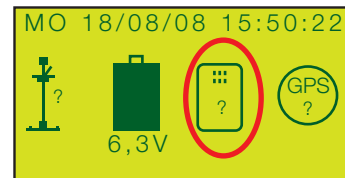
Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "CHIP CARD". With "START" you enter the "CHIP CARD MENU". On the display you will see the number of the chip card and the number of the tests already stored on it.

With the "SELECT" button, that is with the arrow, select from the menu "PRINT TEST".

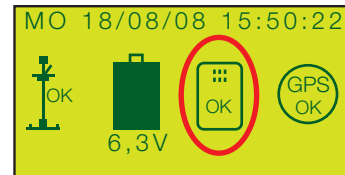
With "START" you enter the "test data list". Now on the display you can see all tests saved on the chip card complete with number of data record, date and Evd value. By pressing "SELECT" and "START", still with the arrow, choose the data record you wish to print. With the button "PRINT" you will print the relative protocol.

In case you don't find any data on the chip card, for a few seconds the display shows the notice "EMPTY CHIP CARD" and the display returns automatically in the "CHIP CARD MENU".

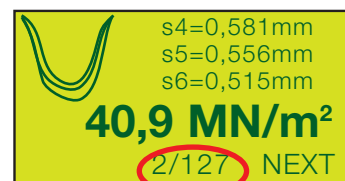
With the button "RESET/OFF" (EXIT) you return to the "CHIP CARD MENU", and with the same button you then return to the MAIN MENU. By pressing again "RESET/OFF" (EXIT) you get back to the status query and with "START" you can begin the test.



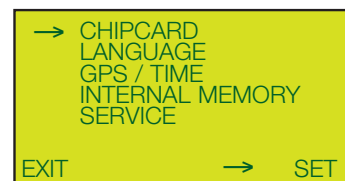
CHIP CARD NOT AVAILABLE



CHIP CARD AVAILABLE



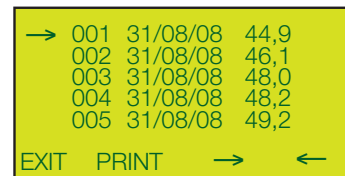
DATA RECORD COUNTER



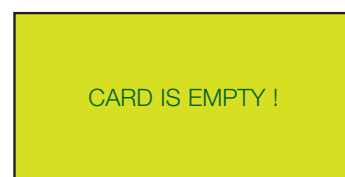
MAIN MENU



CHIP CARD MENU



TEST DATA LIST



6.1.2 Clear chip card

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "CHIP CARD". With "START" you enter the "CHIP CARD MENU". On the display you will see the number of the chip card and the number of the tests already stored on it.

With "SELECT", that is with the arrow, select "CLEAR CHIP CARD"

To delete the data stored on the chip card press "START"(SET).

You will be asked "DEFINITELY CANCEL?" With "START" you confirm and give the green light to the deleting process. At the end, the device displays "CHIP CARD CANCELLED" and the display returns to the "CHIP CARD MENU".

If you don't want to delete the data, press "RESET/OFF" (NO) to get back to the "CHIP CARD MENU".

With "RESET/OFF" (EXIT) you return to the MAIN MENU and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can begin the test.

6.1.3 Chip card initialisation

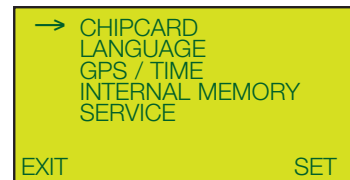
Every chip card receives a 12-figures number from the electronic system during the initialization phase. All chip card are initialized by the producer. This number is then reported in the software analysis. If you want to change the chip card number, you can re-initialize the card. For every subsequent initialization the electronic system generates a new chip card number. The initialization deletes automatically all the data stored.

Turn the instrument on by pressing "START". Insert the chip card. With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "CHIP CARD". With "START" you enter the "CHIP CARD MENU". With "SELECT"-arrow- choose "INITIALIZE CHIP CARD" from the menu. On the display you will see the number of the chip card and the number of the tests already stored on it.

Press "START" to initialize the card. You will be asked "DO YOU REALLY WANT TO INITIALIZE?" . With "START" you confirm. The display shows the notice "WAIT" and after the process it displays "INITIALIZED". Then the display returns automatically in the "CHIP CARD MENU".

If you don't wish to initialize the chip card, press "RESET/OFF" (EXIT) and you return to the "CHIP CARD MENU".

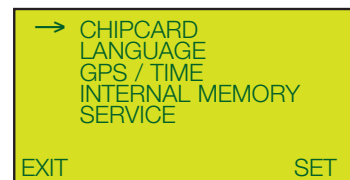
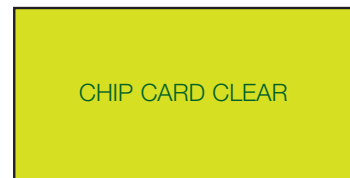
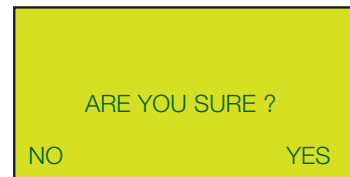
With "RESET/OFF" (EXIT) you return to the MAIN MENU and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can begin the test.



MAIN MENU



CHIP CARD MENU



MAIN MENU



CHIP CARD MENU

6.2. Languages

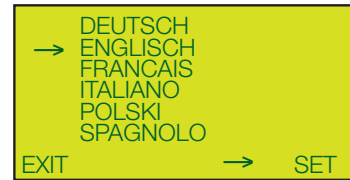
Turn the instrument on by pressing "START". With the "SELECT" button enter in the main menu and with the arrow – "SELECT" - choose from the menu "LANGUAGE". Press "START" to enter the "LANGUAGE MENU".

Press "SELECT" to choose the desired language and "START" to activate your choice. The main menu will automatically appear in the chosen language.

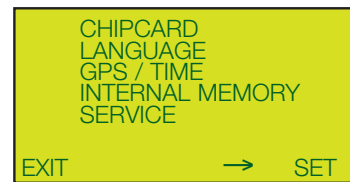
With "RESET/OFF" (EXIT) you return to the status query and with "START" you can begin the test.



MAIN MENU



LANGUAGE MENU



MAIN MENU
in the chosen language

6.3. GPS/TIME MENU

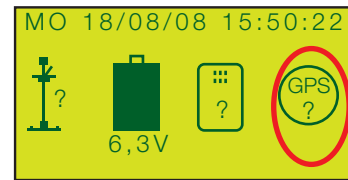
6.3.1 GPS RECEPTION

We send the device with the function “GPS ON”.

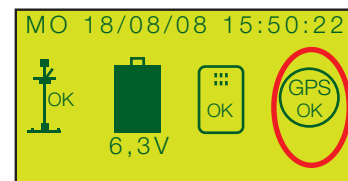
Wenn you turn the device on, the GPS function activates automatically, unless you had deactivated it before. Wait till the GPS connection has been established. The search of the satellite is displayed with a “?” on the GPS symbol. Once the connection has been completed, the status of the GPS is confirmed with an “OK” on the GPS symbol. The GPS connection can take a few minutes.

In case you start the test without GPS connection, the GPS doesn’t start up and all tests will be performed without the GPS funktion.

Instead if you wait for the GPS connection, you will automatically have on the protocol the GPS coordinates of the test points. These data are saved automatically on the internal memory and on the chip card (if inserted) for the analysis from your PC and for the connection to the Google®-Maps interface.



GPS NOT AVAILABLE



GPS AVAILABLE

6.3.2 PRECISION OF THE GPS RECEPTION

The GPS tracking system has been developed in the 70’s from the USA Ministry of Difence and stationed on space by means of 24 satellites. Due to the satellites orbits and to the transmission technique, the precision of the tasted points has its limits.

We wish to explain you this: a GPS receiver calculates its position analysing the signal of different GPS satellites. The more satellites it receives, preciser is the position. With good visibility you can receive at the same time the signal of different satellites, up to 12. In order to have a valid position, you must have the data of at least 3 satellites. This works very good in the open. In these cases the precision is lower than 10 meters.

In case of a moving vehicle, the precision is one meter or even lower. Unfortunately we are not always in the open. In cities or in built-up areas many factors come into play. Shade for example. This means that one or more satellites are hidden, shaded by high buildings. Therefore you might be able to riceive the west satellites and sometimes the north or south ones, but the east ones are completely obscured. This happens also when you stand very close to a building.

EAn other source of imprecisions are reflections. The signals and radio signals broadcasted by the GPS satellites spread out wavelike and can therefore be reflected, for example by big metal surfaces, such as aeroplanes. Through these reflections the GPS module receives signals indirectly, reflected by a surface. Therefore the signal propagation delay changes and as a consequence a bigger deviation is generated. In presence of high buildings,close to each other, this deviation can be of many dozens of meters.

EA car navigation system tries to balance these problems: on one side it makes sure you’re moving, on the other side it makes sure that the position ascertained by the GPS module on the actual route makes sense (you won’t turn 100 before a crossing and drive directly into a fied).

6.3.3 GPS ON/OFF

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "GPS/TIME". With "START" you enter the "GPS/TIME MENU".

If the arrow is on "GPS ON", you can now deactivate the GPS connection by pressing "START". The device will display "GPS OFF". Once it's deactivated, the GPS symbol won't be displayed on the status query.

In case you want to reactivate the GPS system, proceed as described above. You will then see the GPS symbol displayed on the status query. With "RESET/OFF" (EXIT) you return to the MAIN MENU and by pressing "RESET/OFF" (EXIT) again you get back to the status query. According to the choice you made, GPS ON or OFF, the GPS symbol will be displayed or not. With "START" you can now begin the test.

6.3.4 Summer time function

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "GPS/TIME". With "START" you enter the "GPS/TIME MENU".

If the arrow is on "SUMMER TIME ON", you can now deactivate it by pressing "START". The device will display "SUMMER TIME OFF".

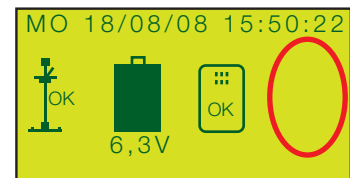
If the arrow is on "SUMMER TIME OFF", you can now deactivate it by pressing "START". The device will display "SUMMER TIME ON". With "RESET/OFF" (EXIT) you return to the main menu and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can now begin the test.



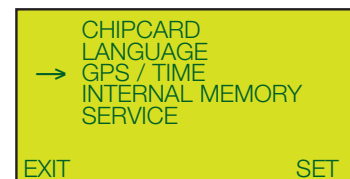
MAIN MENU



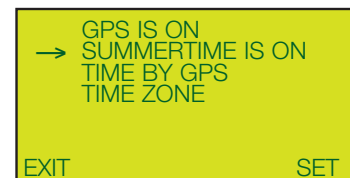
GPS/TIME MENU



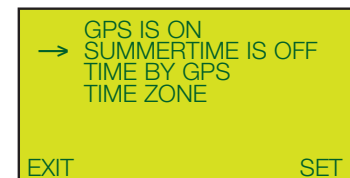
GPS symbol is missing



MAIN MENU



GPS/TIME MENU



6.3.5 Date and time

The device is delivered with the status "GPS TIME ON". The day, date and power-on time are automatically displayed with the status query once you turn the instrument on. These data are read worldwide through satellite and correspond to the Greenwich Mean Time, (GMT).

PLEASE PAY ATTENTION TO YOUR TIME ZONE ACCORDING TO THE GMT READ BY YOUR ELECTRONIC SYSTEM AND ADJUST THE DIFFERENCE ONCE YOU TURN THE DEVICE ON IN "TIME ZONE DISPLAY"(see time zones set up).

With the function "GPS TIME" on, time and date of the test are automatically printed on the protocol. These data are saved on the internal memory and on the chip card (if inserted) for the analysis from your PC and for the connection to the Google®-Maps interface.

6.3.6 Manual time

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "GPS/TIME". With "START" you enter the "GPS/TIME MENU".

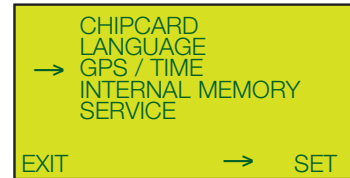
If the arrow is on "GPS TIME", you can now deactivate it by pressing "START" and turn the manual time on. The device will display "MANUAL TIME" and right after the menu point "SET UP TIME". Press "SELECT" and with the arrow choose "SET UP TIME". By pressing "START" you enter the "DATE-TIME MENU".

With "SELECT" you can choose the date (day/month/year) and the time and setting them manually by pressing "PRINT". You now have to confirm these data with "START". The day of the week will then automatically set up. At the same time you get back to the "MENU MANUAL TIME".

With "RESET/OFF" (EXIT) you return to the main menu and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can now begin the test.

If you wish to reactivate the GPS-time, proceed as above described. If the arrow is on "TIME IS MANUAL", with "START" you can deactivate this function and turn the GPS time on. The device will display "GPS TIME" and right after the menu point " TIME ZONE".

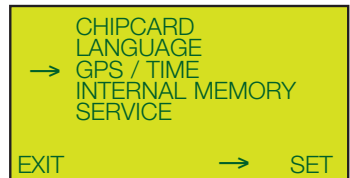
With "RESET/OFF" (EXIT) you return to the main menu and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can now begin the test.



MAIN MENU



GPS/TIME MENU



MAIN MENU



GPS/TIME MENU



MANUAL TIME MENU



MANUAL TIME MENU



DATE-TIME MENU

6.3.7 Time zone

The device is delivered with the status "GMT+00:00h" (Greenwich Mean Time). This setting corresponds to the European mean winter time read by the actual satellites through the GPS reception.

PLEASE PAY ATTENTION TO YOUR TIME ZONE ACCORDING TO THE GMT READ BY YOUR ELECTRONIC SYSTEM AND ADJUST THE DIFFERENCE ONCE YOU TURN THE DEVICE ON IN "TIME ZONE DISPLAY"(see time zones set up).

The time zone set is memorized on the PC, even though you change into manual time later on.

The time zone function is active only in the menu "GPS TIME".

6.3.8 Time zone set up

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "GPS/TIME". With "START" you enter the "GPS/TIME MENU".

With the arrow select "TIME ZONE". Press "START" to enter the "TIME ZONE MENU".

With "START" or "SELECT" you can set the desired time zone according to the Greenwich Mean Time. Press "RESET/OFF"(EXIT) to confirm the time zone selected and you enter automatically the "GPS-TIME MENU".

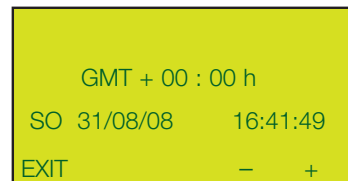
With "RESET/OFF" (EXIT) you return to the main menu and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can now begin the test.



MAIN MENU



GPS-TIME MENU



TIME ZONE MENU

6.4. Internal memory

In the internal memory of the electronic system are stored the last 2000 tests, also when the chip card is not inserted. If needed, you can transfer the data from the internal memory to the chip card.

With the USB interface and with the USB cable (not included), you can transfer the data on you PC for the analysis.

6.4.1 Internal memory printout

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "INTERNAL MEMORY". With "START" you enter the "MEMORY MENU".

If the arrow is on "PRINT TEST", by pressing "START" you enter the "TEST DATA LIST" of the internal memory. The device will display the tests stored in the internal memory with the actual number of data record, the date and the EVD value. With "SELECT" or "START", that is the arrow, choose the data record you wish to print. With "START" you print the corresponding test protocol. If there are no data in the internal memory, the screen will display for a few seconds "EMPTY MEMORY" and the system returns automatically in the "MEMORY MENU".

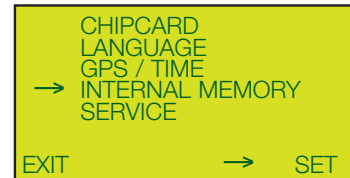
With "RESET/OFF" (EXIT) you return to the "MEMORY" menu and then with the same button you return to the MAIN MENU. By pressing "RESET/OFF" again you get back to the status query and with "START" you can now begin the test.

6.4.2 Internal memory on PC

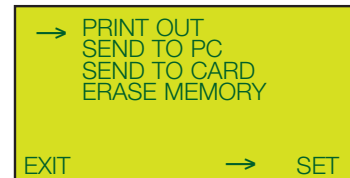
Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "INTERNAL MEMORY". With "START" you enter the "MEMORY MENU". If the arrow is set on "MEMORY ON PC" you can load the data of the test on your "TERRATEST" software. Set right now the USB connection of the electronic system to your PC. During the first connection of the electronic system to your PC, you have to install the correct driver from the attached CD-ROM "TERRATEST-Software". Please read the chapter "Driver installation for the electronic system". In case there is no connection to the PC, the screen will display "PLEASE ESTABLISH USB CONNECTION TO THE PC".

With successful connection the screen displays "PC CONNECTED". Turn the software "TERRATEST" on and click on the mask "load from electronic device". Now your PC will copy all the data record stored in the internal memory. You can now begin on your PC the analysis of the test data. All data remain stored also in the internal memory.

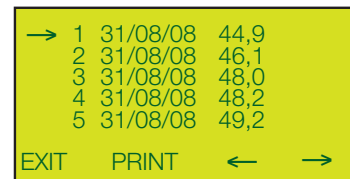
Once you have copied successfully the data, the screen will display a greeting and then the status query. Press "START" to begin the test.



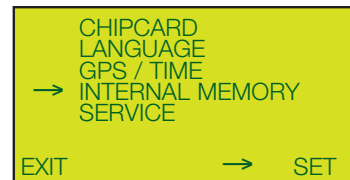
MAIN MENU



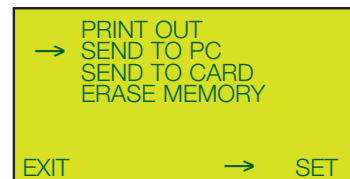
MEMORY MENU



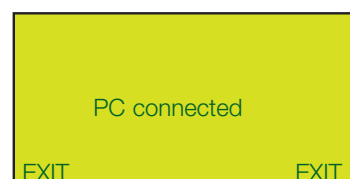
TEST DATA LIST



MAIN MENU



MEMORY MENU



6.4.3 Internal memory on the chip card

Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "INTERNAL MEMORY". With "START" you enter the "MEMORY MENU".

With the arrow set on "TEST ON CHIP CARD" press "START" to enter the "TEST DATA LIST".

With "START" or "SELECT", which is the arrow, select the data record you wish to copy on the chip card. Insert the chip card and press "START"(COPY).

Now the electronic system copies the desired data record on the chip card. You can copy as many data record as you wish, one at a time.

With "RESET/OFF" (EXIT) you return to the menu "MEMORY" and then, with the same button, to the main menu; by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can now begin the test.

6.4.4 Clear internal memory

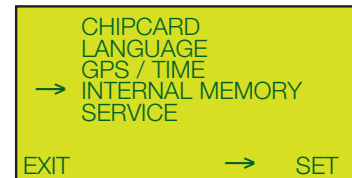
Turn the instrument on by pressing "START". With the "SELECT" button you first enter in the main menu and then, still with the "SELECT" button, that is with the arrow, you select "INTERNAL MEMORY". With "START" you enter the "MEMORY MENU".

With the arrow set on "CLEAR MEMORY" press "START" to cancel all the data record of the internal memory.

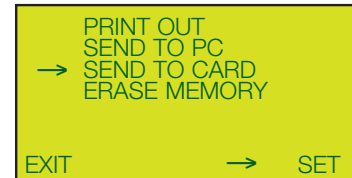
You will see displayed "DEFINITIVEY CANCEL?". With "START" you confirm and you begin the cancellation process. Once it's concluded, the screen displays "MEMORY CLEAR" and then the displays returns automatically in the "MEMORY MENU".

If you don't want to cancel the data, press "RESET/OFF" (NO) to get back to the "MEMORY MENU".

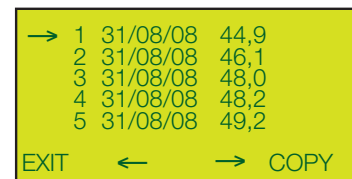
With "RESET/OFF" (EXIT) you return to the main menu and by pressing "RESET/OFF" (EXIT) again you get back to the status query and with "START" you can now begin the test.



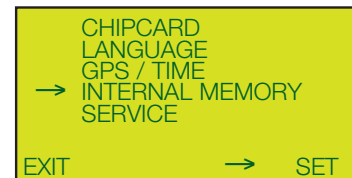
MAIN MENU



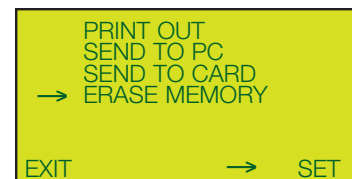
MEMORY MENU



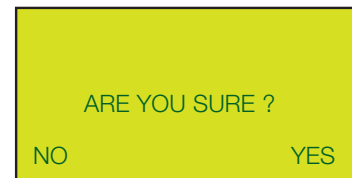
TEST DATA LIST



MAIN MENU



MEMORY MENU



6.5 Service

6.5.1 Inputtest

Turn the instrument on by pressing "START". Enter the main menu with the "SELECT" button and with the arrow select "SERVICE". Press "START" to enter the "SERVICE MENU".

With "SELECT", that is with the arrow, select from the menu "INPUT-TEST".

Press "START" to enter the "MENU INPUTTEST".

The "INPUTTEST" is useful to check the functions and it shows important function parameters of the components.

With "RESET/OFF" (EXIT) you return to the "SERVICE MENU" and then with the same button you return to the MAIN MENU. By pressing "RESET/OFF" again you get back to the status query and with "START" you can now begin the test.

6.5.2 Version

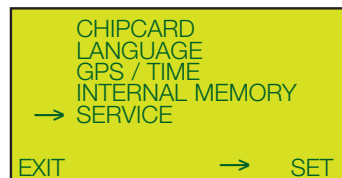
Turn the instrument on by pressing "START". Enter the main menu with the "SELECT" button and with the arrow select "SERVICE". Press "START" to enter the "SERVICE MENU".

With "SELECT", that is with the arrow, select from the menu "VERSION".

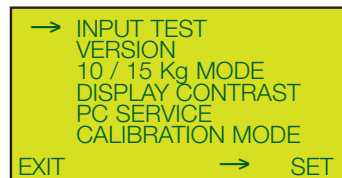
Press "START" to enter the "VERSION", where you can see displayed:

- the 12-figures number of the instrument
- type of instrument
- calibration date
- calibration factor
- version of the firmware
- number of the tests performed

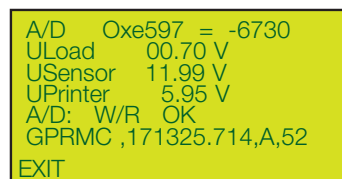
With "RESET/OFF" (EXIT) you return to the "SERVICE MENU" menu and then with the same button you return to the MAIN MENU. By pressing "RESET/OFF" again you get back to the status query and with "START" you can now begin the test.



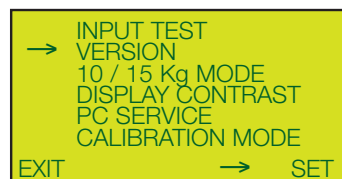
MAIN MENU



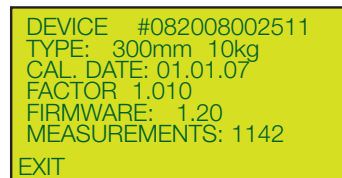
SERVICE MENU



INPUTTEST MENU



SERVICE MENU



VERSION MENU

6.5.3 Type of instrument 10 / 15 kg

Turn the instrument on by pressing "START". Enter the main menu with the "SELECT" button and with the arrow select "SERVICE". Press "START" to enter the "SERVICE MENU".

With "SELECT", that is with the arrow, select from the menu "MODE 10/15 kg".

Press "START" to enter the "MODE 10/15 kg".

The display shows the plate diameter and the actual chosen version with weight drop 10 or 15kg. With "START" you can change the version.

With "RESET/OFF" (EXIT) you return to the "SERVICE MENU" menu and then with the same button you return to the MAIN MENU. By pressing "RESET/OFF" again you get back to the status query and with "START" you can now begin the test.

6.5.4 Display contrast

Turn the instrument on by pressing "START". Enter the main menu with the "SELECT" button and with the arrow select "SERVICE". Press "START" to enter the "SERVICE MENU".

With "SELECT", that is with the arrow, select from the menu "Display contrast".

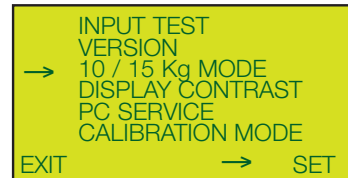
Press "START" to enter the "CONTRAST MENU".

By pressing "PRINT" or "SELECT" you can vary the display contrast.

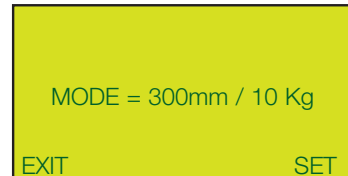
With "RESET/OFF" (EXIT) you return to the "SERVICE MENU" menu and then with the same button you return to the MAIN MENU. By pressing "RESET/OFF" again you get back to the status query and with "START" you can now begin the test.

6.5.5 PC service and calibration mode

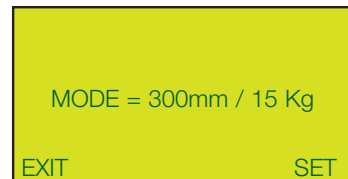
The functions "PC SERVICE" and "CALIBRATION MODE" are reserved for the installations of the producer and for the calibration and can therefore be selected only by the producer.



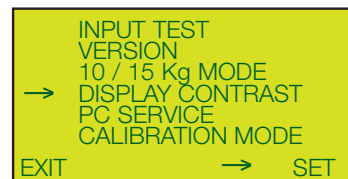
SERVICE MENU



MENU 10/15 kg



MENU 10/15 kg



SERVICE MENU



CONTRAST-MENU

7. Software

The basic packet "TERRATEST 3000" includes a software, very easy to use. Thanks to this software you can analyse on your PC the data of the tests stored. This analysis is in accordance with the german regulations TP BF-StB section B 8.3. The software is run capable with MS Windows XP, MS Windows 2000 and MS Windows Vista.

The software "TERRATEST" uses the connection settings of your internet explorers for all range of functions with the interface Google® Maps. Please make sure that the internet explorer installed on your PC is able to establish an internet connection.

The shipment includes also a chip card reader device, that's controlled by your PC by means of an USB interface.

7.1 Chip card reader device

7.1.1 Software installation of the chip card reader device

Install the software of the chip card reader device on your PC. Insert the attached CD-ROM, "CHIPdrive® desktop pro" in the driver of your PC.

The installation starts automatically.

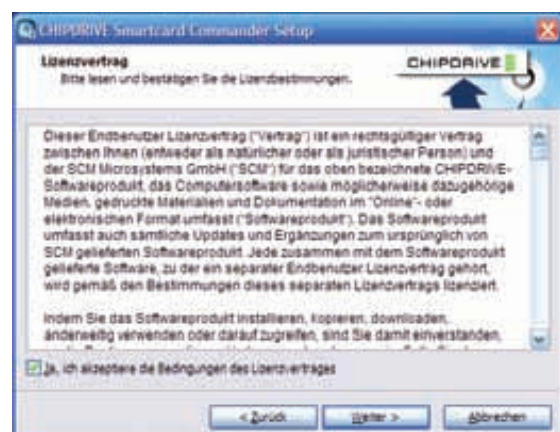
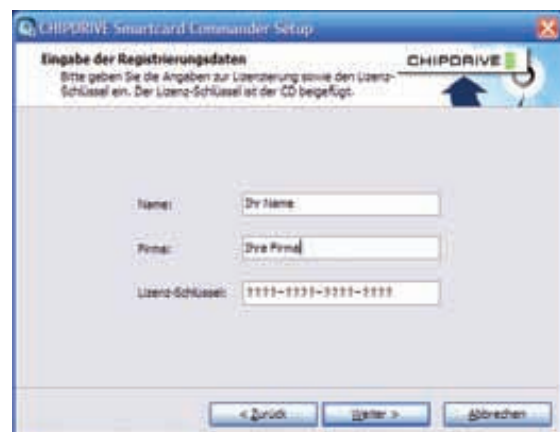
Select the desired language, german or english.

Confirm the selection with "weiter" or "next" (according to the choosen language).

You will be asked to put in the user name, the company and the licence number. User and company are optional, you can find the licence number on the back of the covering of the installation CD. After having put the licence number in, proceed selecting "weiter" or "next".

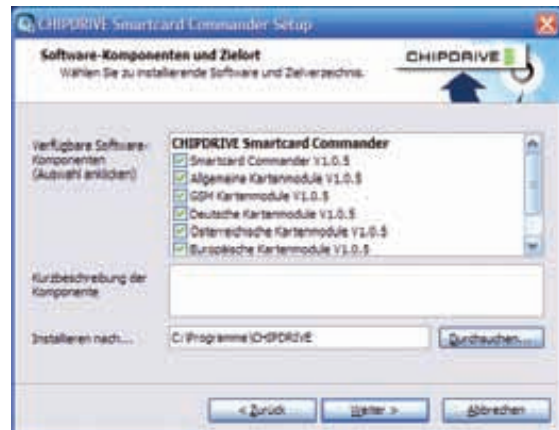
Now you will be asked for your acceptance to the licence clauses of the software for the chip card reader device. Click on the optional field "yes, I agree with the clauses of the licence contract".

Confirm with "weiter" or "next".



Now you are in the window where you can choose the software modules you want to install and the directory where you can save the software for the chip card reader device. Usually the software module and the directory are preset in C:\Programma\CHIPDRIVE.

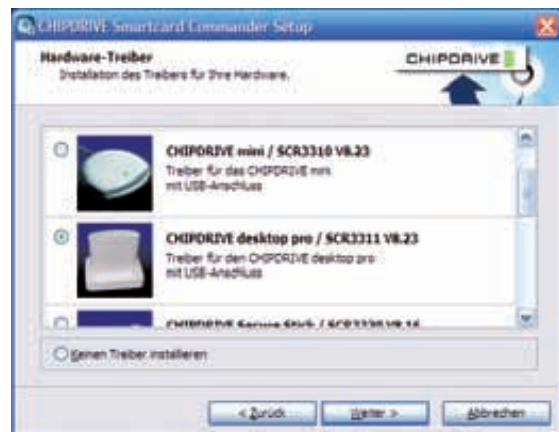
Confirm with “weiter” or “next”.



Now you are in the window where you can choose the driver for your special chip card reader device. Its installation starts automatically after the software installation.

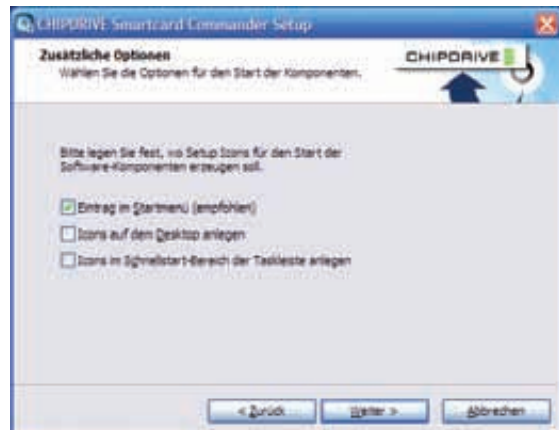
Choose “CHIPDRIVE@desktop pro/SCR3311 V.23”. Compare the pictures for a correct assignment of your reader device.

Confirm with “weiter” or “next”.



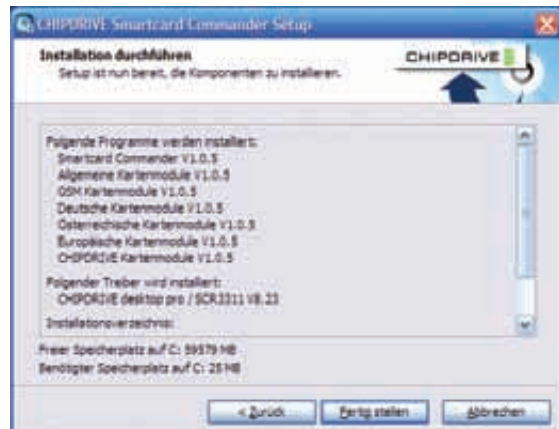
In the following screen you can choose other options for the start of the components. Usually the entry in start menu is preset.

Confirm with “weiter” or “next”.



Now the window with the compilation of the components to install opens.

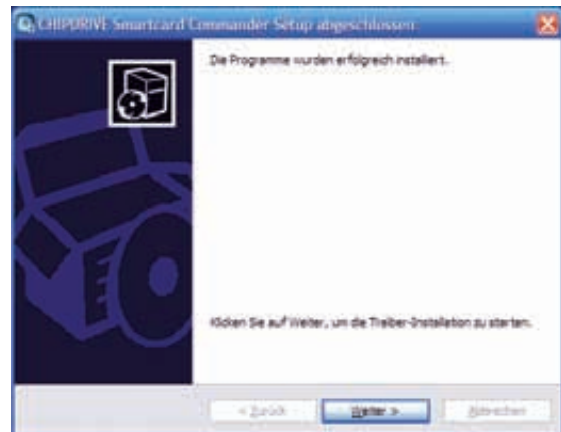
Select “fertigstellen” or “complete”.



Your computer starts now automatically the installation of the software for your chip card reader device.

At the end the system confirms the successful installation.

Confirm with “weiter” or “next”.

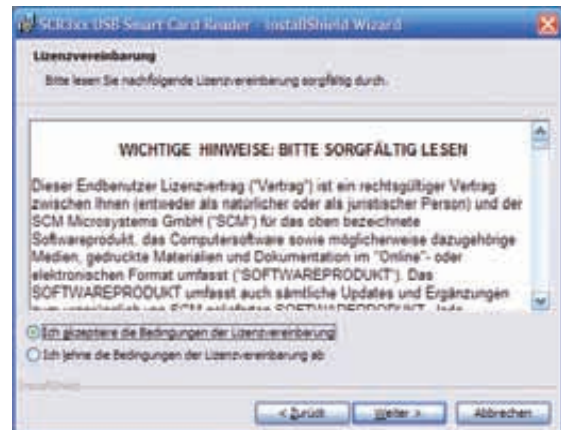


Now the installation of the driver software for the chip card reader device starts. Confirm with “weiter” or “next”.



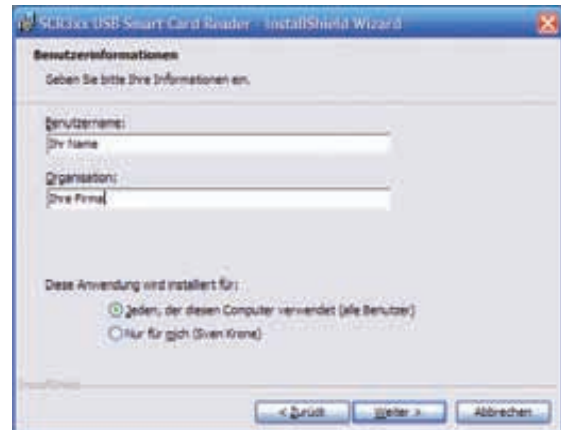
Select “I accept the clauses for the licence contract”.

Confirm with “weiter” or “next”.



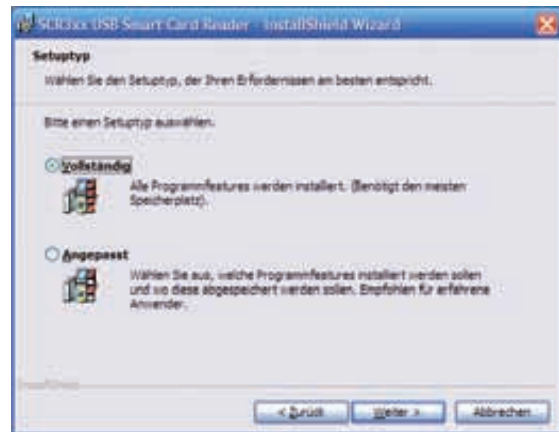
Insert now the user options such as user name, company and user rights.

Confirm with “weiter” or “next”.



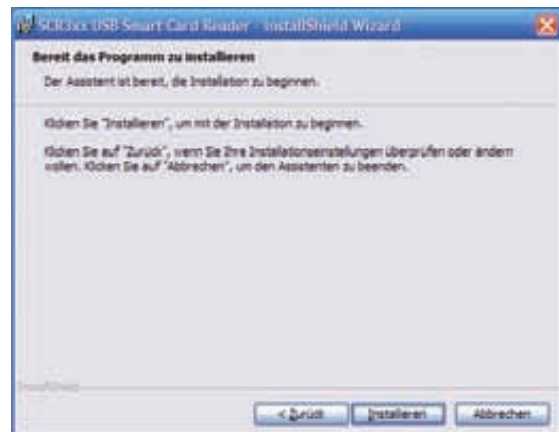
Now you will be asked if you want to install the complete driver software or just an adapted version. Usually the version “complete” is already preset, and we also suggest to select it.

Confirm with “weiter” or “next”.

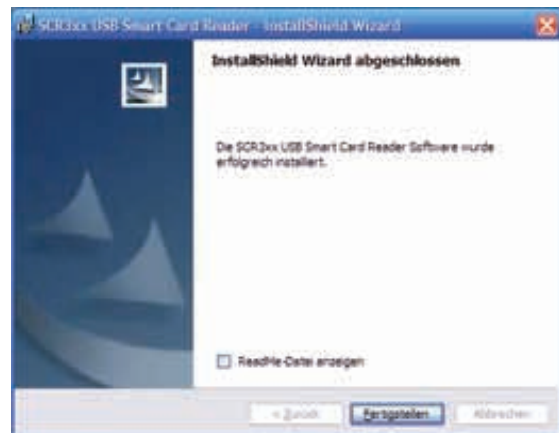


Now the installation window opens. Select “install” to start the installation of the driver.

Now the driver software will be automatically installed on your PC.



After the successful installation, confirm the completion by selecting “complete”.



Now you have to restart your PC to fully complete the installation. Confirm by selecting “finish”.



7.2 Software TERRATEST

7.2.1 Uninstalling of the software „TERRATEST“

If on your PC it's installed an old version of "TERRATEST", you first have to uninstall it before proceeding with the new version.

Select "START", "CONTROL PANEL", "SOFTWARE", and then the software "TERRATEST". Select "Change/Remove". Now your PC uninstalls automatically the current "TERRATEST" version.

7.2.2 New installation of the software „TERRATEST“

Insert the CD "TERRATEST" in your PC. The programm installation starts automatically. If not, you can start it with the "Setup.exe" file from the CD by selecting "START", "MY COMPUTER ", "CD drive"..

In case the components "NET Framework 2.0" are not available on your PC for the software applications, you first have to install them. Confirm you accept the clauses of the licence by selecting "I agree".



Once you have concluded successfully the installation, the installation-assistant starts automatically in order to install the software "TERRATEST". The installation-assistant is available only in english.

Select "next" to start the installation.



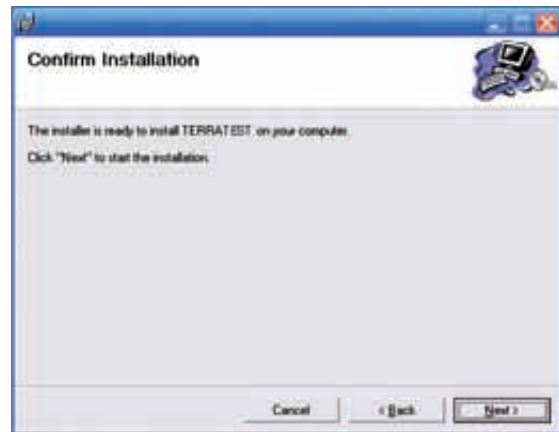
Confirm the installation directory or choose an other directory for the program data.

Furthermore select the user's rights by selecting the correspondent option field.

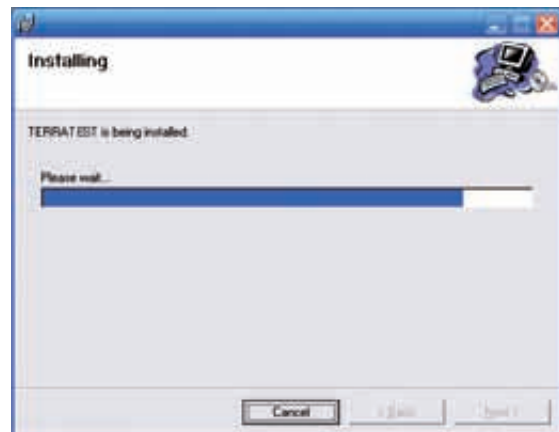
Confirm with "next".



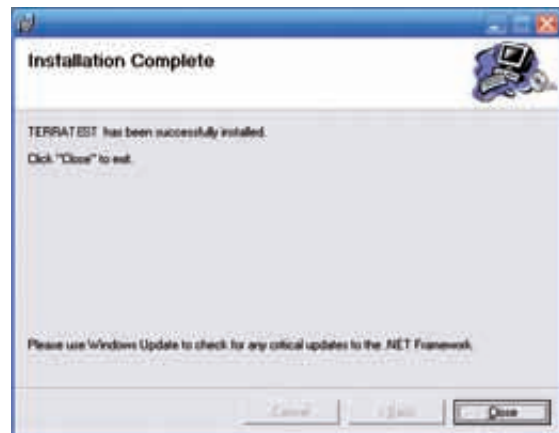
Now the confirmation window opens. Reconfirm by selecting “next”.



From now on the real installation process of the software “TERRATEST” begins. It can last a few minutes.



At the end a window opens to confirm the successful installation. Press “close” to close the application.



7.2.3 Service of the software „TERRATEST“

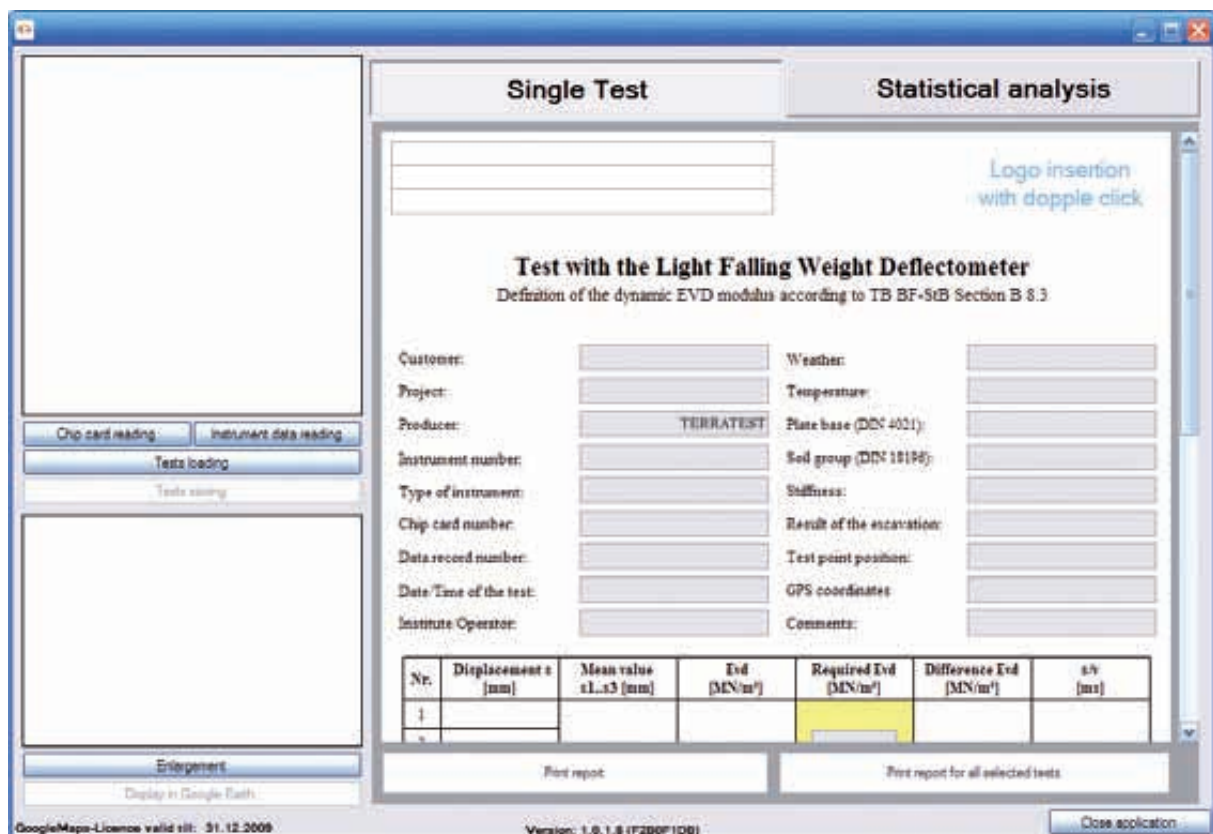
If you have not changed the computer presettings during the installation, this means that the software “TERRATEST” has been saved in the folder “PROGRAMMS”. Furthermore a shortcut to the program start opens on your desktop in the form of as a small TERRATEST logo in a white square. Start the software with “START > PROGRAMMS > TERRA 3000 > TERRA 3000 ” or with double click on the TERRATEST logo on the desktop. Now the main screen opens.

This is divided in two fields: on the left side you load the tests present on the chip card, in the electronic system or the ones already revised on the PC. Click on the relative button. Once you have loaded the data, they will be displayed on the list up on the left with number of data record, date, time and Evd value.

Below the list of the test data you have the preview window for the representation of the satellite photos of the test point, which is active up on the list of the test data. Google®-Maps offers no updated representations of satellite photos. The up-to-dateness of the pictures differs from region to region and can be from one to five years old.

The data with the representation of the satellite photos with the test point are loaded automatically from internet. Therefore an active internet connection is necessary.

On the right field you have the preview of the test protocol with the displacement curves . If you click on the button “statistical anaysis” you have the chart for the statistical analysis of the tests in accordance with the german technical regulations TP BF-StB section B 8.3.

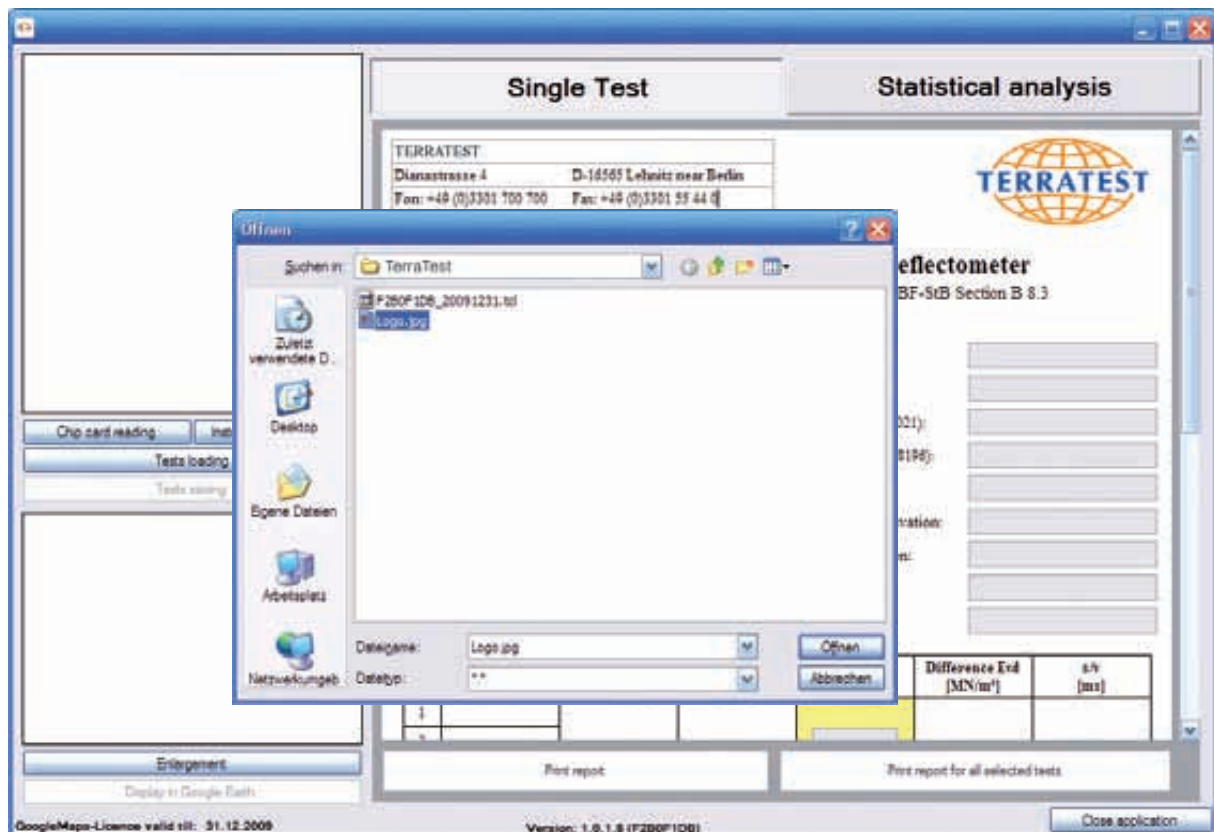


The main screen for the revision of the test data: on the left the window for the list of the test data and the representation of the test point according to the satellite photo, on the right the test protocoll for each single test.

7.2.3.1 Insert/change/delete logo

In every report you can insert up right the company logo. In order to change or insert a logo, click twice on the corner up right of the report. A window opens: you can now choose the file you need (supported formats *.bmp, *.jpg). The logos are automatically scaled and displayed. You can remove a logo by clicking with the right button of the mouse and selecting “remove logo”.

At the same time you can insert your company details up left on the test protocol. The logo and the company details are saved automatically when you insert them and are therefore imported in all reports.



Loading of the company logo with double click on the button.

7.2.3.2 Chip card loading

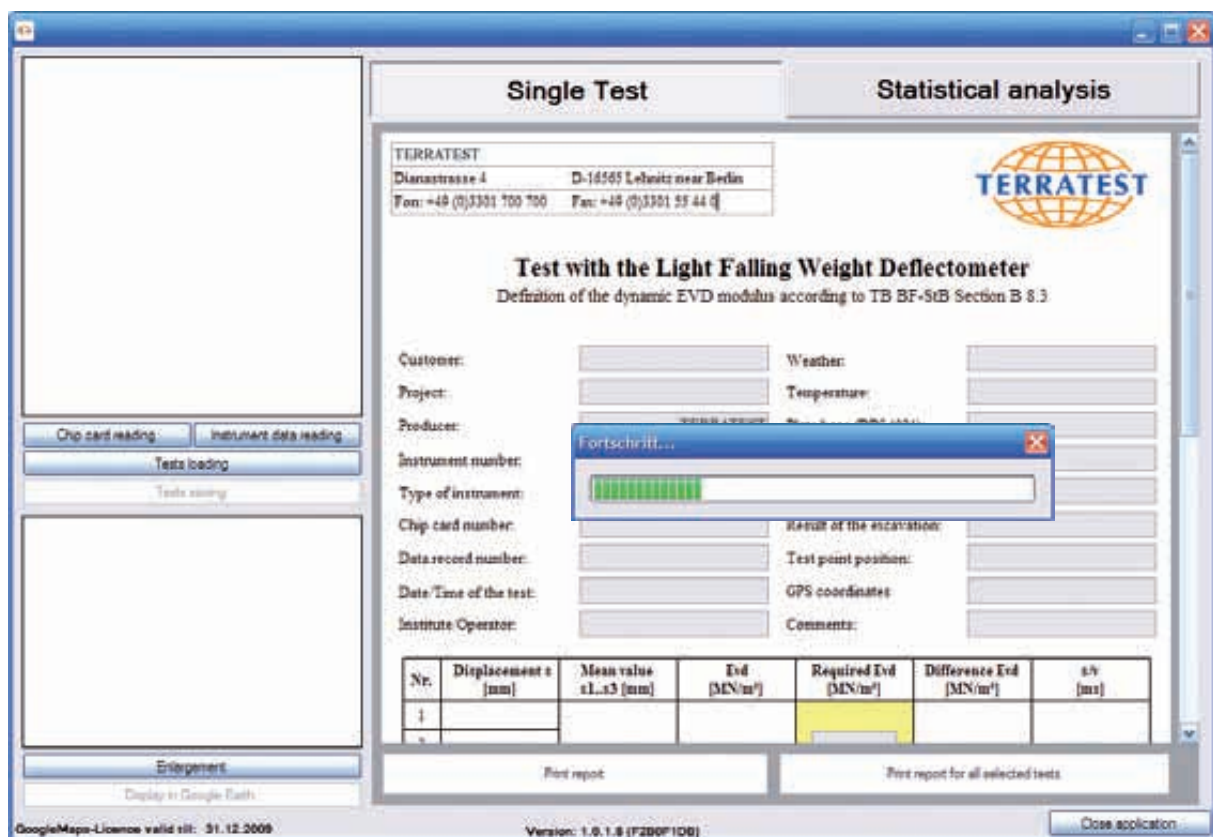
In order to load the data saved on the chip card, you first have to connect the chip card reader device to the USB interface of your PC. Insert the chip card, with the chip downwards, in the slot of the chip card reader.

Make sure that the software and the driver of the chip card reader device are correctly installed on your PC. If not, you will have the error “no chip card reader found”. In this case, install both the software and the driver. Read chapter “**Software installation of the chip card reader device**”.

Click on “chip card reading”. The process bar opens, showing the downloading of the test data from the chip card. The data on the chip card are loaded and displayed up left in the test data list with number of data record, date, time and Evd value. These data are now ready for the analysis.

In case there are no data on the chip card, after the reading process of the chip card reader the screen displays “no data available”.

In the test data list you can load the contents of a file, of a chip card or of the electronic device, one at a time. If you wish to represent different data lines in one test data list, save first all data in one file and then load it.



The process bar represents the downloading of the test data from the chip card.

7.2.3.3 Test protocol of the single test

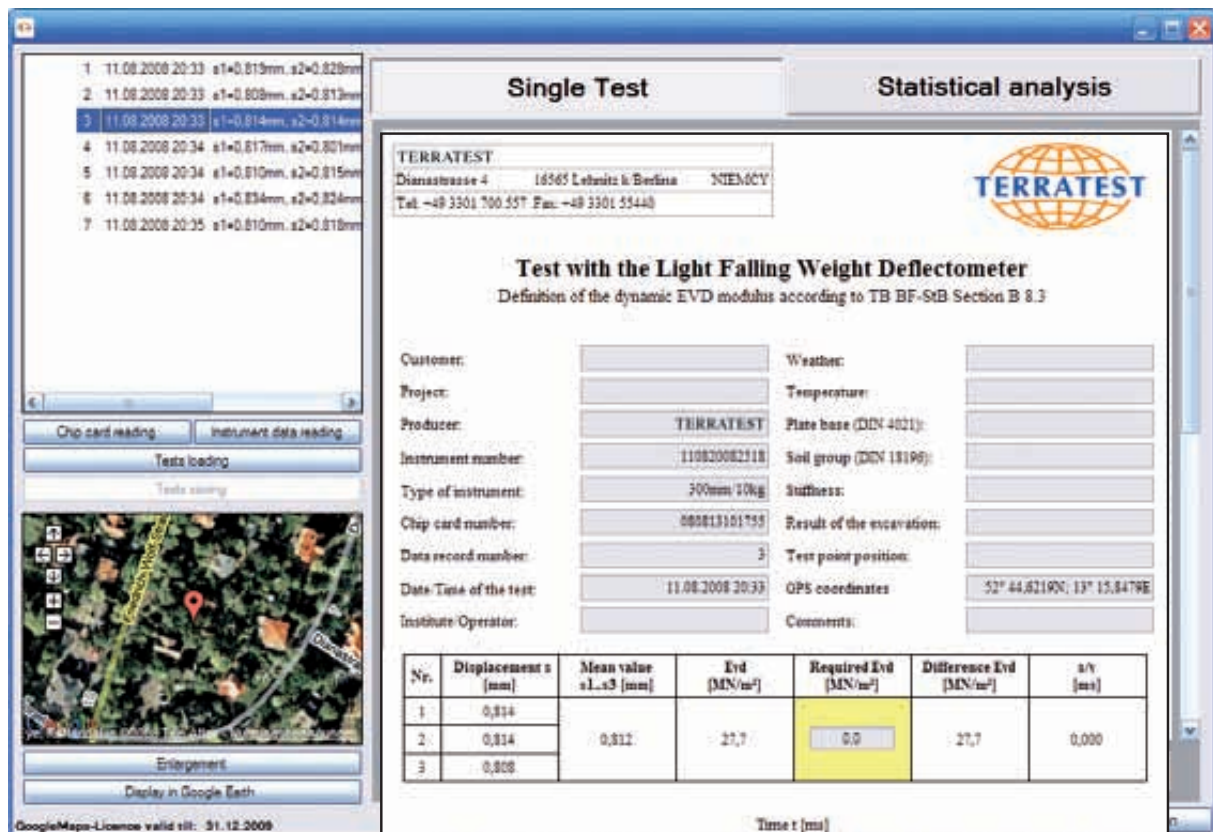
The test protocol consists of three fields:

- protocol heading** with the general data of the test and of the electronic device
- chart of the test results** with the results of the tests obtained and the required Evd value
- displacement curves** with the representation of the three displacement curves process

For each single test ,the following data are automatically reported on the protocol heading: instrument producer, instrument number, type of instrument, chip card number, data record number, date and time of the test, GPS coordinates (if GPS is on). To register the order-related data read the chapter “Analyse/save test data”.

The chart of the test results represents the three curves in mm, the mean value of the displacement also in mm, the Evd value in MN/m², the difference between the required Evd (you must previously insert the required Evd value manually) and the s/v in ms.

Under the chart of the test results are represented the three displacement curves in three different colours (s1=red, s2=green, s3=blue). According to the process of the curves you can read the test duration, the maximum displacement and its process. In case of good compacted soils the three displacement curves have to be congruent. The test duration has to be 17,5 ms +- 1,5 ms.



The screenshot shows the TERRATEST software interface. On the left, a list of tests is displayed, with the third test selected. Below the list is a satellite photo of the test location. The main window is titled 'Single Test' and 'Statistical analysis'. It contains a form for test details, including customer, project, producer (TERRATEST), instrument number (110820082118), type of instrument (500mm/10kg), date and time of the test (11.08.2008 20:33), and GPS coordinates (52° 44.82190'; 13° 15.8479E). Below the form is a table with the following data:

Nr.	Displacement s [mm]	Mean value s1..s3 [mm]	Evd [MN/m ²]	Required Evd [MN/m ²]	Difference Evd [MN/m ²]	s/v [ms]
1	0,814	0,812	27,7	0,0	27,7	0,000
2	0,814					
3	0,808					

Below the table is a graph showing displacement in mm versus time in ms. The x-axis ranges from 0 to 24 ms, and the y-axis ranges from 0.0 to 0.9 mm. Three curves (red, green, blue) are plotted, showing a characteristic U-shaped curve that reaches a minimum displacement of approximately 0.8 mm at around 10 ms.

The test data list up left represents all single tests loaded. For each selected test you will see down left a satellite photo. The right window represents the test protocol with the three displacement curves.

TERRATEST
 Dianastrasse 4 D-16565 Lehnitz near Berlin
 Fon: +49 (0)3301 700 700 Fax: +49 (0)3301 55 44 0

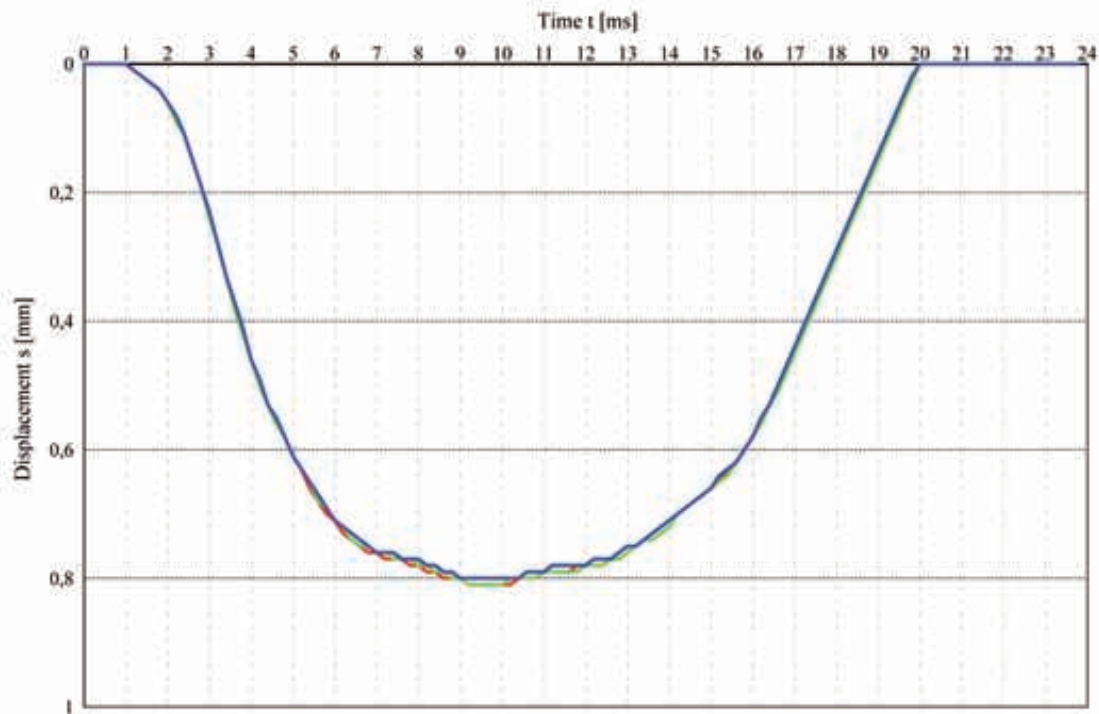


Test with the Light Falling Weight Deflectometer

Definition of the dynamic EVD modulus according to TB BF-StB Section B 8.3

Customer:		Weather:	
Project:		Temperature:	
Producer:	TETTATEST	Plate base (DIN 4021):	
Instrument number:	110820082518	Soil group (DIN 18196):	
Type of instrument:	300mm/10kg	Stiffness:	
Chip card number:	080813101755	Result of the excavation:	
Data record number:	3	Test point position:	
Date/Time of the test:	11.08.2008 20:33	GPS coordinates:	52° 44,6219N; 13° 15,8479E
Institute/Operator:		Comments:	

Nr.	Displacement s [mm]	Mean value s1..s3 [mm]	Evd [MN/m²]	Required Evd [MN/m²]	Difference Evd [MN/m²]	s/v [ms]
1	0,814	0,812	27,7	0,0	27,7	0,000
2	0,814					
3	0,808					



19.11.2008 15:11:44

1/1

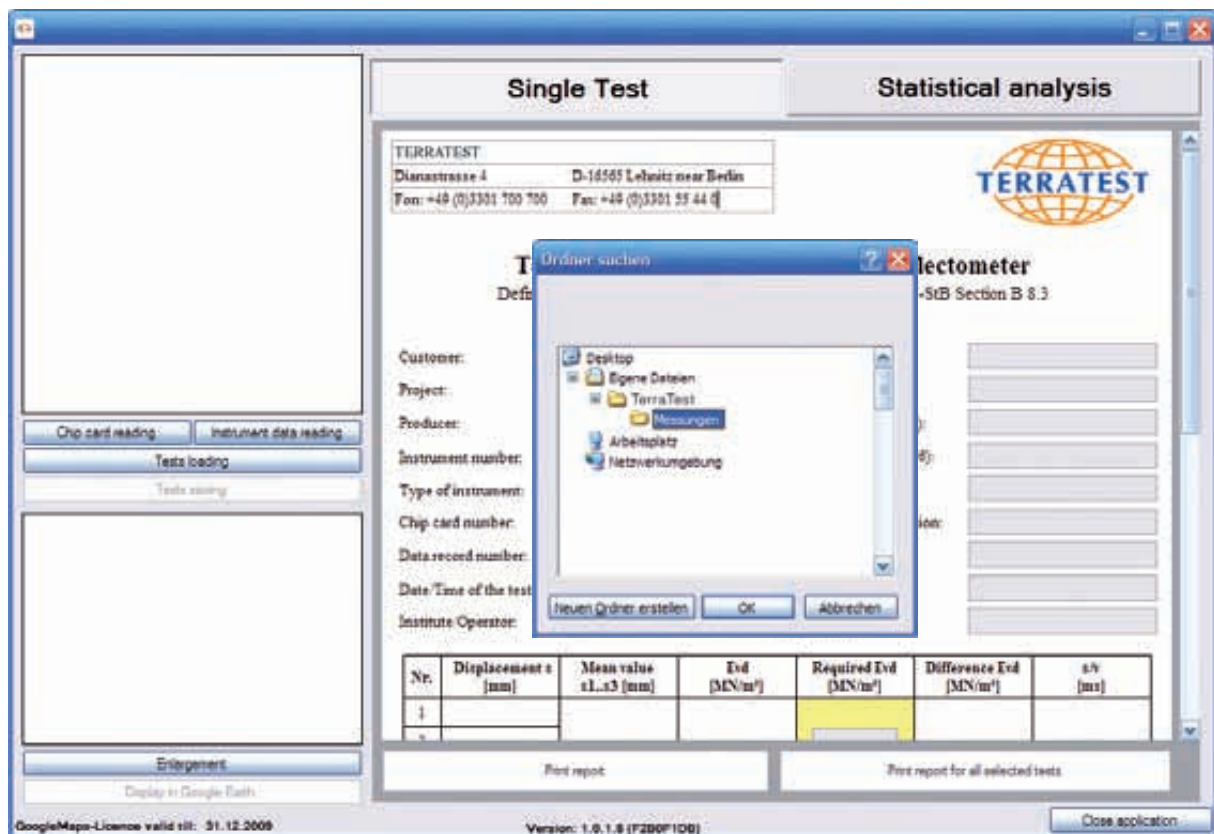
7.2.3.4 Test report printout

As soon as in the data list left you choose a measurement (marked with the blue bar) and on the right you see the report of the single test, you can print the report by pressing “print report”. If you click on “print report for all selected tests”, you print all test reports marked with the pencil symbol.

7.2.3.5 Test loading

To load the tests saved through a storage medium, (PC, USB pen drive, etc), click on “tests loading”. The directory where you saved the tests last time opens. Select the data desired and confirm with “OK”. Now the data are being loaded and are listed in the window up left complete with data record number, date, time and Evd value. These data are now ready for the analysis.

In the test data list you can load the contents of a file, of a chip card or of the electronic device, one at a time. If you wish to represent different data lines in one test data list, save first all data in one file and then load it.



To load the stored data click on “TESTS LOADING” and select where you want to save the data filed. Click “OK” and your data will be loaded.

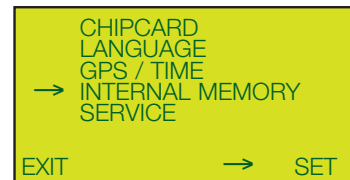
7.2.3.6 Loading from the electronic system

To load the data from the internal memory of the electronic device, connect it to the USB interface of your PC. In case there is no PC-connection, the display requires "PLEASE ESTABLISH USB CONNECTION TO THE PC". Make sure that the driver on the electronic system has been installed correctly on your PC. For the driver installation please read chapter " **Driver installation for the electronic system**". To start downloading the test data from the electronic system, turn the instrument on by pressing "START". Enter the main menu with the "SELECT" button and with the arrow select "INTERNAL MEMORY". Press "START" to enter the "MEMORY MENU".

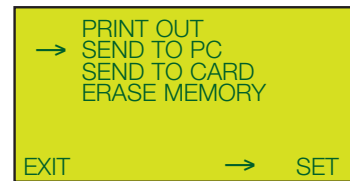
With the arrow set on "MEMORY ON PC" and by pressing "START" you can load your test data directly on your software "TERRATEST".

If the PC connection is successful, the screen displays "PC CONNECTED". Click on "Loading from electronic system". The process bar opens showing the downloading of the test data. The data stored in the electronic device are now being loaded and represented left in the test data list with data record number, date, time and Evd value. These data are now ready for the analysis.

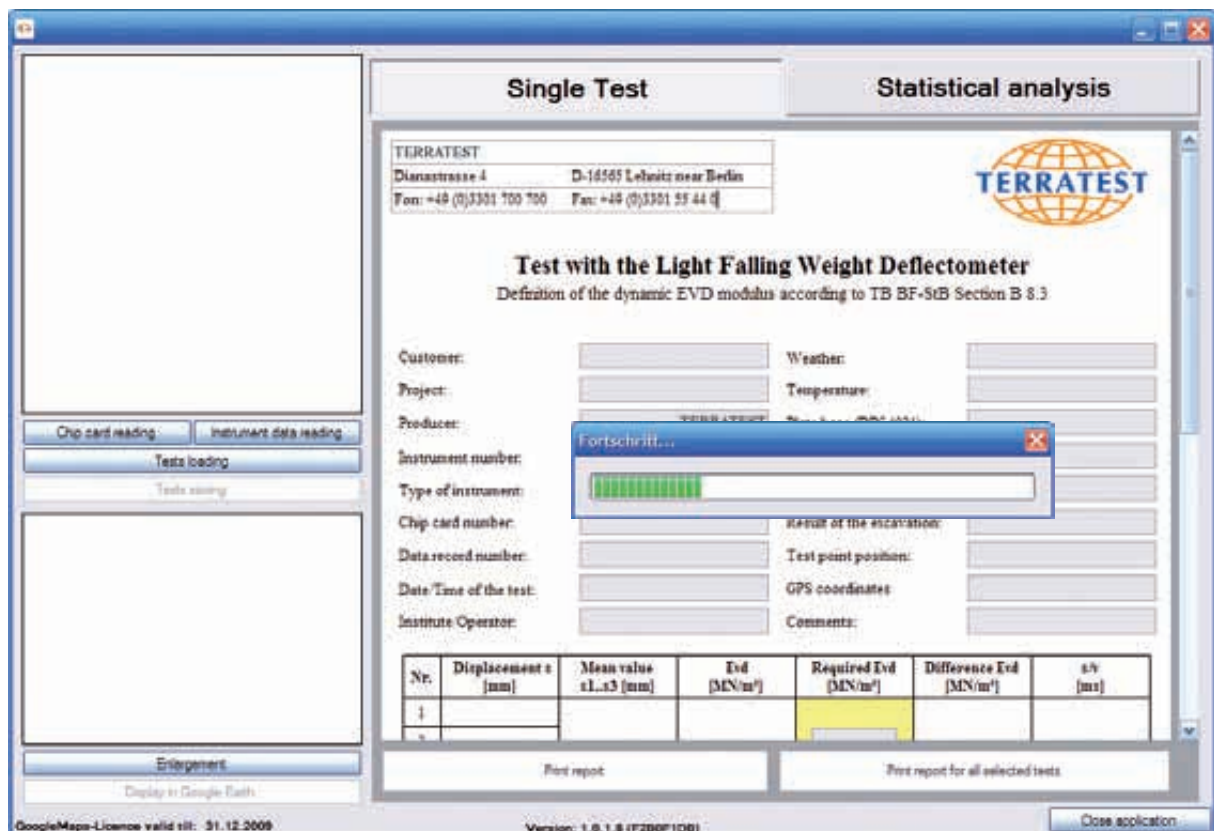
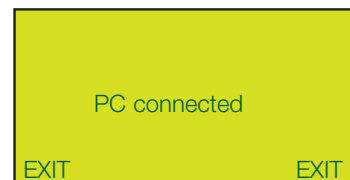
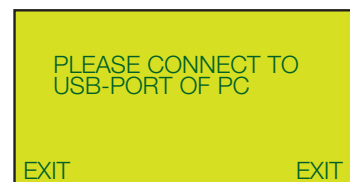
In the test data list you can load the contents of a file, of a chip card or of the electronic device, one at a time. If you wish to represent different data lines in one test data list, save first all data in one file and then load it.



MAIN MENU



MEMORY MENU



To download the test data from the electronic system, connect it to the USB interface of your PC and establish the connection in the menu of the electronic system.

7.2.3.7 Driver installation for the electronic system

You have to install the relative driver from the attached CD-ROM "TERRATEST-Software" the first time that you connect the electronic system to the PC.

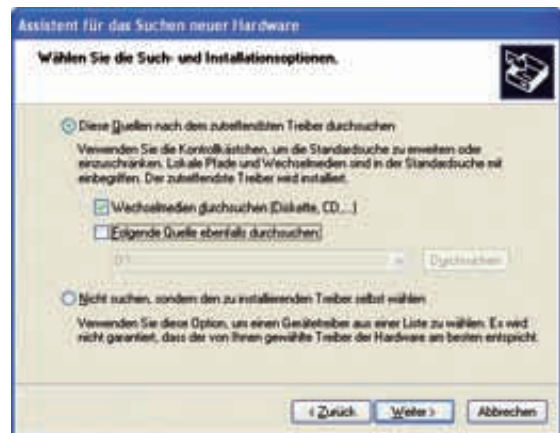
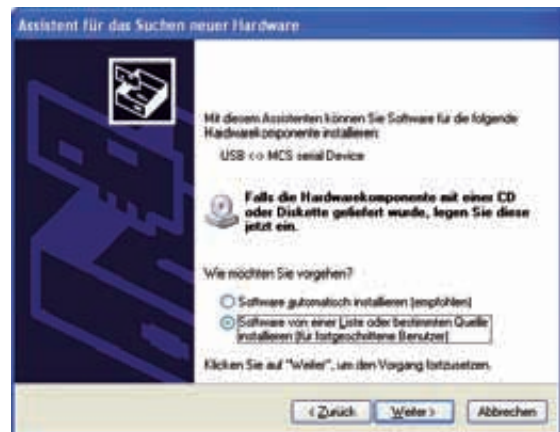
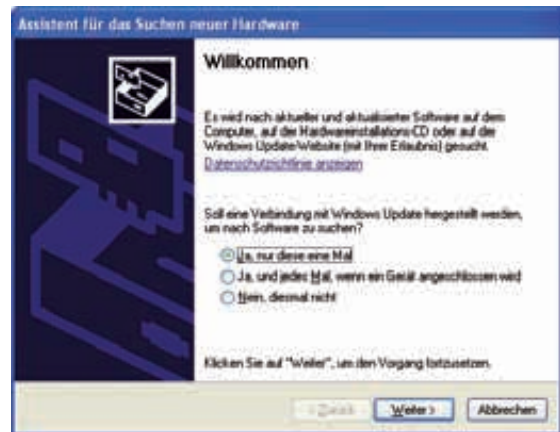
Insert the CD-ROM "TERRATEST-Software" in the CD-drive of your PC.

At the connection of the electronic system to the PC the display indicates you automatically the necessary driver. To install it on you PC click "YES, ONLY THIS ONCE" and then on the button "CONTINUE".

In the following window click on "INSTALL SOFTWARE FROM A LIST OR SPECIFIC SOURCE" and then "CONTINUE".

In the following window click on "BROWSE THESE SOURCES IN SEARCH OF THE MOST APPROPRIATE DRIVER" and activate the option "BROWSE REMOVABLE MEDIA". Click on "CONTINUE".

Now the PC looks for the driver of the electronic system on the CD-ROM "TERRATEST-Software" you inserted.



As the driver is not certified by Microsoft® for MS-Windows®, you will be asked if you want to proceed with the installation. Please confirm with “CONTINUE INSTALLATION”.



Now the driver is being installed.



At the end confirm the driver installation with “COMPLETE”.

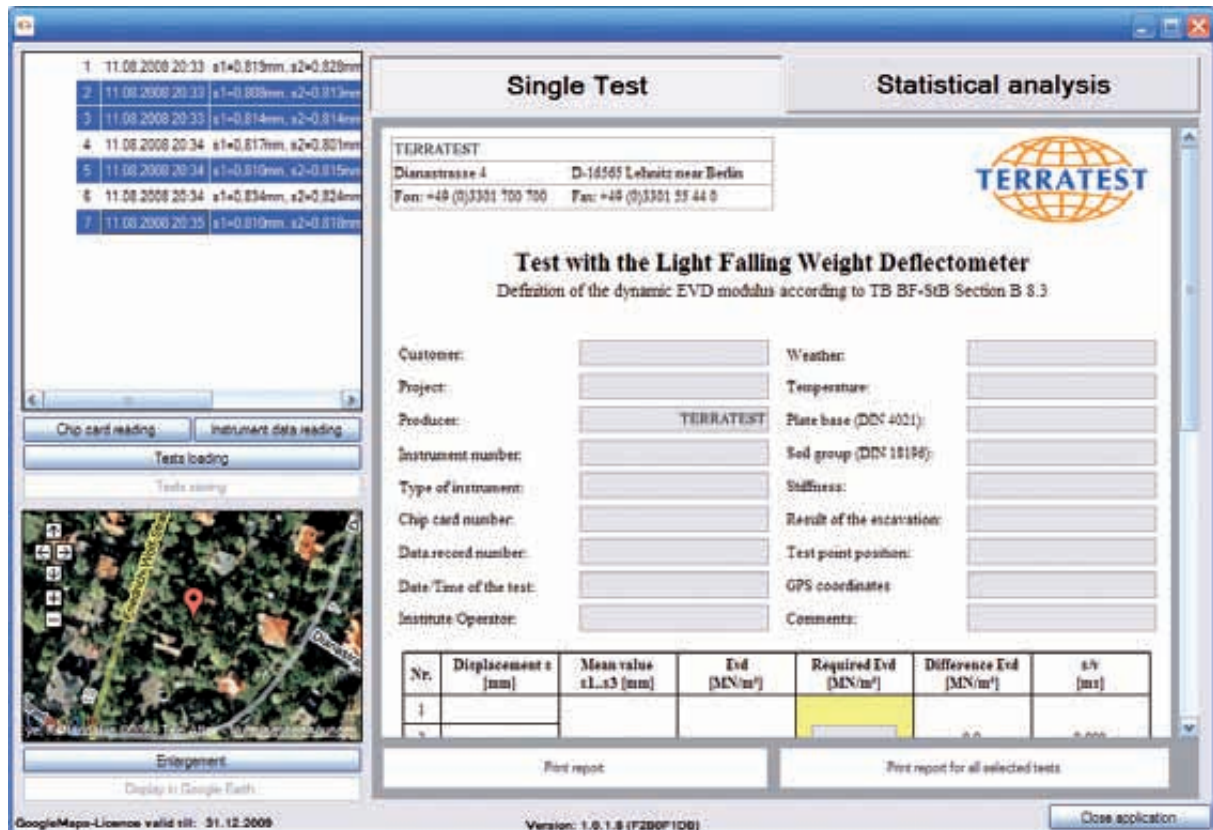
Now the driver of the electronic system is installed on your PC.



7.2.3.8 Analyze/save test data

In order to analyze the test protocols of each single measurement, select the desired test from the list in the field up left using the left button of the mouse. If you wish to select many contiguous data, mark the first and the last value and keep pressing the shift key. All data record marked are ready to be analyzed and are highlighted with a blue bar.

Instead if you wish to select differet test data not contiguous to each other, select the desired data record once with the left button of the mouse and keep the Strg button pressed. All data record marked are ready to be analyzed and are highlighted with a blue bar.



The record data selected are ready to be analyzed and are marked with a blue bar.

You can now share the selected data record for the analysis by clicking them with the right button of the mouse and selecting "PROCESS". All selected data records are marked with the pencil symbol right in front of the relative data record. Now select a random data record between those marked and process the white field of the test protocol: insert the specific details of your site complete with Evd values required. All inserted data will be automatically copied for all selected data record to be analyzed. For each single measurement you will see the difference between the Evd values obtained and the Evd value required (if you have inserted it).

In case you have selected a measurement by mistake or the data you completed on the right side are not valid for that test, select it and select with the right button of the mouse "DELETE THE CHANGES". In this way you deactivate the relative data record from the analysis.

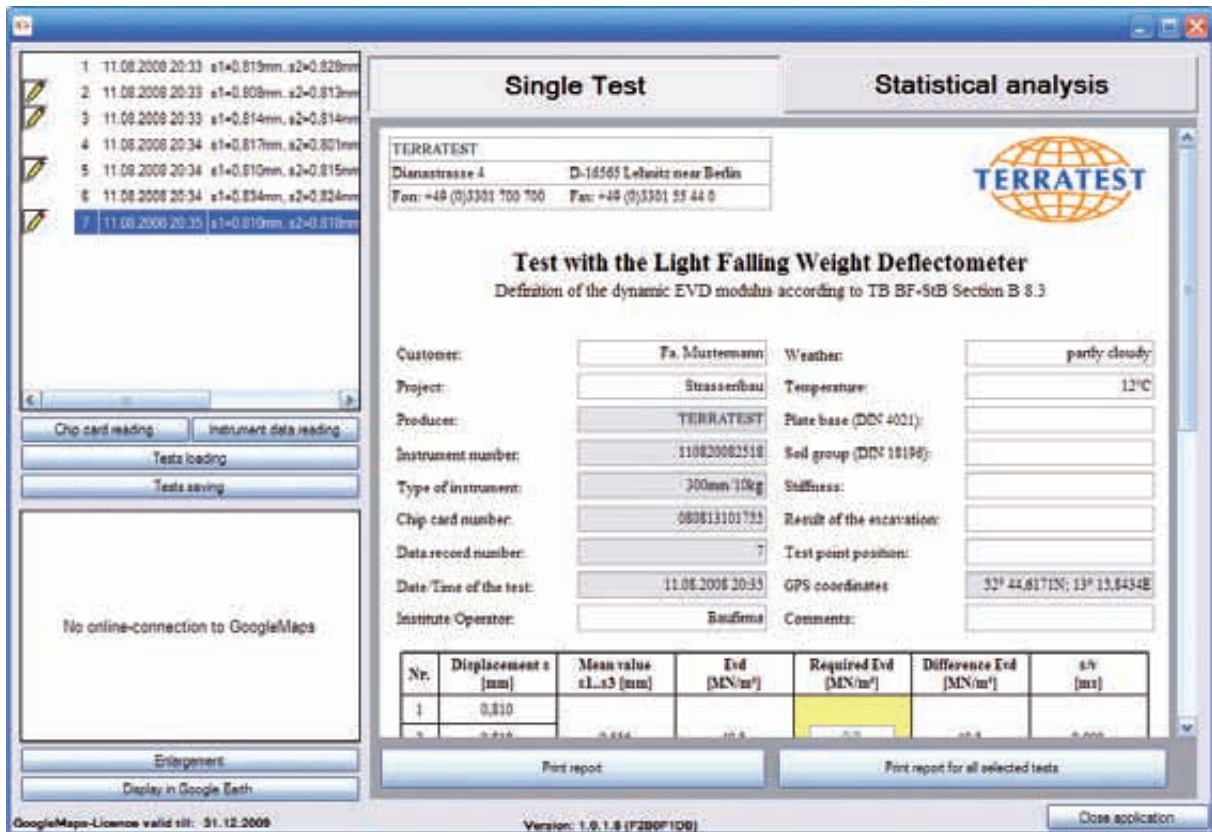
Please pay attention that the test data stored in the chip card are not saved automatically, only the data record selected for the analysis are ready to be saved.

The screenshot shows the 'Single Test' and 'Statistical analysis' tabs. A context menu is open over the list of test records, with the 'PROCESS' option selected. The menu options are: PROCESS, DELETE THE CHANGES, Add to 'Statistical analysis', and Remove from 'Statistical analysis'. The main window displays the test details for 'TERRATEST' at 'Dianastrasse 4, D-16565 Lehnitz near Berlin'. The test is titled 'Test with the Light Falling Weight Deflectometer' and is used for 'Definition of the dynamic EVD modulus according to TB BF-StB Section B 8.3'. The form includes fields for Customer, Project, Producer (TERRATEST), Instrument number, Type of instrument, Chip card number, Data record number, Date/Time of the test, Institute Operator, Weather, Temperature, Plate base (DIN 4021), Sed group (DIN 18196), Stiffness, Result of the excavation, Test point position, GPS coordinates, and Comments. A table at the bottom shows test results with columns for Nr., Displacement s [mm], Mean value s1..s3 [mm], Evd [MN/m²], Required Evd [MN/m²], Difference Evd [MN/m²], and s/h [ms].

If you have selected some data records for the analysis, click with the right button of the mouse on "PROCESS" to share the tests for the revision of these tests.

The screenshot shows the same software interface, but now the list of test records on the left has pencil icons next to records 2, 3, 4, 5, 6, and 7, indicating they are selected for analysis. The 'Statistical analysis' tab is active, and the 'Print report for all selected tests' button is highlighted. The rest of the interface, including the test details and the results table, remains the same as in the previous screenshot.

The pencil symbol marks the data records that can be share for the analysis.



The screenshot shows the 'Single Test' window of the TERRATEST software. The window is divided into several sections:

- Left Panel:** A list of test records with columns for date, time, and displacement values (s1, s2). Record 7 is selected.
- Buttons:** 'Chip card reading', 'Instrument data reading', 'Tests loading', 'Tests saving', 'Engagement', and 'Display in Google Earth'.
- Header:** 'Single Test' and 'Statistical analysis' tabs.
- Company Info:** TERRATEST logo and contact information for Dianastrasse 4, D-16565 Lehwitz near Berlin.
- Test Title:** 'Test with the Light Falling Weight Deflectometer' with a definition reference to TB BF-StB Section B 8.3.
- Data Entry Fields:**
 - Customer: Fa. Mustermann
 - Project: Strassenbau
 - Producer: TERRATEST
 - Instrument number: 110820082518
 - Type of instrument: 300mm/10kg
 - Chip card number: 080813101755
 - Data record number: 7
 - Date/Time of the test: 11.08.2008 20:33
 - Institute Operator: Baufirma
 - Weather: partly cloudy
 - Temperature: 12°C
 - Plate base (DIN 4021):
 - Soil group (DIN 18196):
 - Stiffness:
 - Result of the excavation:
 - Test point position:
 - GPS coordinates: 52° 44,6171'N; 13° 13,6434'E
 - Comments:
- Results Table:**

Nr.	Displacement s [mm]	Mean value s1..s3 [mm]	Evd [MN/m²]	Required Evd [MN/m²]	Difference Evd [MN/m²]	s/s [mm]
1	0.810					
2	0.816	0.814	10.8	10.8	0.0	0.000
- Footer:** 'Print report', 'Print report for all selected tests', 'Close application', 'GoogleMaps-Licence valid till: 31.12.2009', and 'Version: 1.0.1.8 (F2B0F108)'.

Test protocol with the data inserted manually. These data are then copied also in the data record ready for the analysis. If the required Evd value is inserted manually, the display shows you automatically the difference with the analyzed measurement.

7.2.3.9 Creation of the statistical analysis

In order to start the statistical analysis of different measurements, select each single measurement from the list in the field up left using the left button of the mouse. If you wish to select many contiguous data, mark the first and the last value and keep pressing the shift key. All data records marked are ready to be analyzed. Instead if you wish to select different test data not contiguous to each other, select the desired data record once with the left button of the mouse and keep the Strg button pressed.

A minimum of two measurements are required for a statistical analysis.

All data records selected are marked with the blue bar.

You can now share the selected data record for the analysis by clicking with the right button of the mouse and selecting "ADD TO STATISTICAL ANALYSIS". All selected data records are marked with the report symbol right in front of the relative data record. In case you have selected a measurement by mistake or if you need to remove a specific data record from the statistical analysis, select it and select with the right button of the mouse "REMOVE FROM STATISTICAL ANALYSIS".

When you have selected all the desired data records for the statistical analysis and these are present in the test data list and marked with the report symbol, click up on the right window on "statistical analysis".

Now the display shows you the statistical analysis in accordance with the German technical regulations TP BF-StB section B 8.3. This statistical analysis contains all the data records that you have chosen.

The statistical analysis consists of:

protocol heading with the general data of the tests, the site and the electronic device

chart of the test results with the results of the tests obtained and the required E_{vd} value

statistic with the required minimum quantile, the arithmetic mean, the standard deviation, the variation coefficient, the quality number and the test criterion.

The statistical analysis follows the principle "Statistical analysis of the different tests – Check of the variables", whereas only the dynamic deformation modulus E_{VD} is analyzed.

The following details are inserted automatically in the protocol heading: instrument producer, instrument number, type of instrument. The details of the order can be inserted distinctly in the white fields.

In the field below you can insert the minimum quantile of the actual site. A non-numerical value is not valid and will be marked in red.

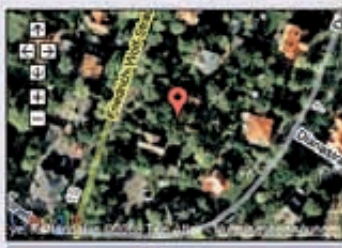
In order to stamp the statistical analysis click on "REPORT PRINT".

1	11.08.2008 20:33	s1=0.819mm, s2=0.828mm
2	11.08.2008 20:33	s1=0.809mm, s2=0.813mm
3	11.08.2008 20:33	s1=0.814mm, s2=0.814mm
4	11.08.2008 20:34	s1=0.817mm, s2=0.801mm
5	11.08.2008 20:34	s1=0.810mm, s2=0.815mm
6	11.08.2008 20:34	s1=0.834mm, s2=0.824mm
7	11.08.2008 20:35	s1=0.810mm, s2=0.819mm

Chip card reading Instrument data reading

Tests loading

Tests saving



Enlarge map

Display in Google Earth

GoogleMaps-Licence valid till: 31.12.2009


Single Test

Statistical analysis

TERRATEST

Dianastrasse 4 D-16565 Lelitz near Berlin

Fax: +49 (0)3701 700 700 Fax: +49 (0)3701 55 44 0



Test with the Light Falling Weight Deflectometer

Definition of the dynamic EVD modulus according to TB BF-StB section B 3.3 and TB BF-StB, section E1: "Tests on statistical basis-sampling test plan:"

Statistical analysis of the different tests - Check of the variables

Customer: Weather:

Project: Temperature:

Producer: Plate base (DIN 4001):

Instrument number: Soil group (DIN 18196):

Type of instrument: Stiffness:

Institute Operator: Result of the excavation:

Comments:

Nr.	Date/Time	Displacement s1 [mm]	Displacement s2 [mm]	Displacement s3 [mm]	Displacement mean value s [mm]	Evd [MN/m²]
1	11.08.2008 20:33	0,814	0,814	0,808	0,812	27,7
2	11.08.2008 20:34	0,817	0,801	0,827	0,815	27,6
3	11.08.2008 20:34	0,810	0,815	0,829	0,818	27,5
4	11.08.2008 20:34	0,834	0,824	0,814	0,824	27,3

Minimum quartile required: 27,0 MN/m²

Arithmetic mean of the sample X̄(Evd): 27,572 MN/m²

Standard deviation s(Evd): 0,172 MN/m²

Coefficient of variation V(Evd): 0,006 %

Quality number Qc(Evd): 3,090

Test method Qc(Evd)=0,88 is: full

Statistical analysis with manual insertion of the details.

TERRATEST

Dianastrasse 4 D-16565 Lehnitz near Berlin

Fon: +49 (0)3301 700 700 Fax: +49 (0)3301 55 44 0



Test with the Light Falling Weight Deflectometer

Definition of the dynamic EVD modulus according to TB BF-StB section B 8.3

and TB BF-StB, section E1: "Tests on statistical basis-sampling test plan-"

Statistical analysis of the different tests - Check of the variables

Customer:		Weather:	
Project:	TERRATEST	Temperature:	
Producer:	TERRATEST	Plate base (DIN 4021):	
Instrument number:	110820082518	Soil group (DIN 18196):	
Type of instrument:	300mm/10kg	Stiffness:	
Institute/Operator:		Result of the excavation:	

Comments:

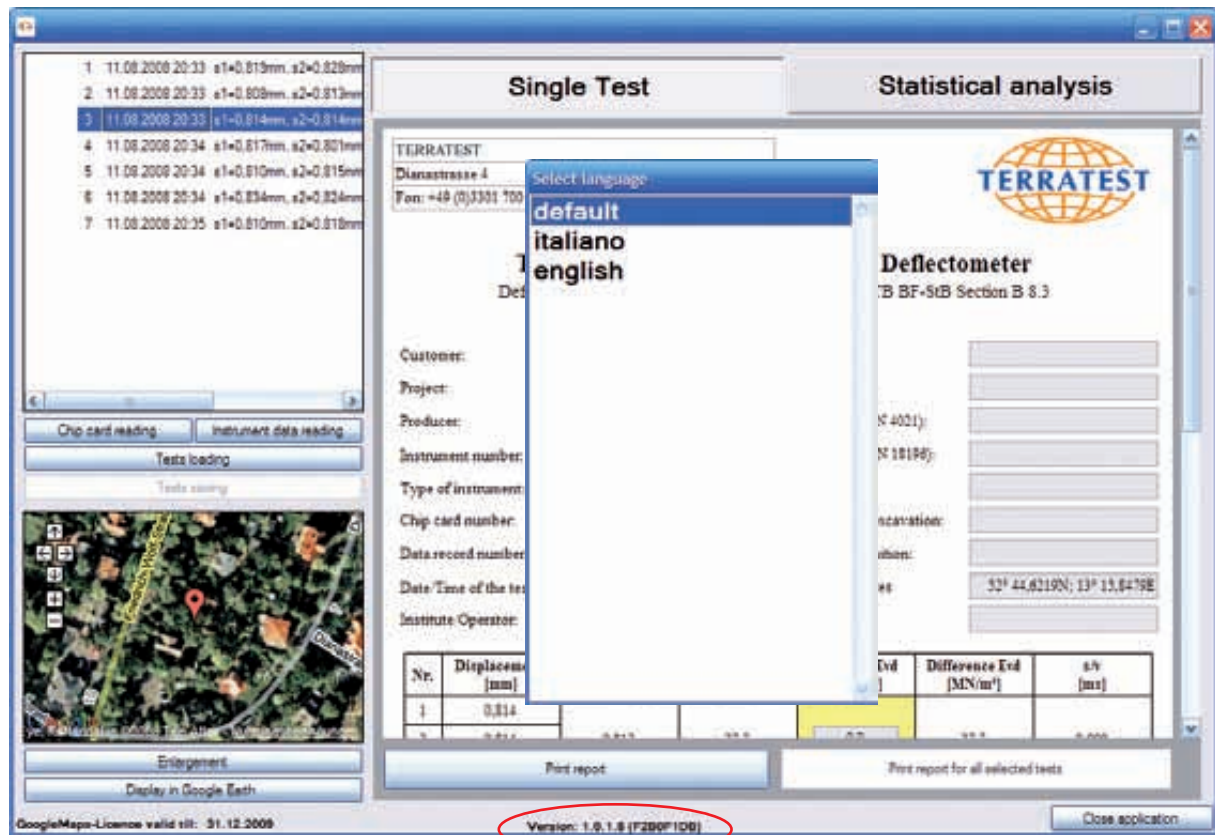
Nr.	Date/Time	Displacement s1 [mm]	Displacement s2 [mm]	Displacement s3 [mm]	Displacement mean value s [mm]	Evd [MN/m ²]
1	11.08.2008 20:33	0,814	0,814	0,808	0,812	27,709
2	11.08.2008 20:34	0,817	0,801	0,827	0,815	27,607
3	11.08.2008 20:34	0,810	0,815	0,829	0,818	27,506
4	11.08.2008 20:34	0,834	0,824	0,814	0,824	27,306

Minimum quantile required:	27,0 MN/m ²
Arithmetic mean of the sample $\bar{X}_m(\text{Evd})$:	27,532 MN/m ²
Standard deviation $s(\text{Evd})$:	0,172 MN/m ²
Coefficient of variation $V(\text{Evd})$:	0,006%

Quality number $Q(\text{Evd})$:	3,090
Test method $Q(\text{Evd}) > 0,88$ is:	full

7.2.3.10 How to select the language

Click twice on the version number to select the desired language.



With a double click on the version number a windows with the language selection opens.

7.2.3.11 Google®-Maps interface

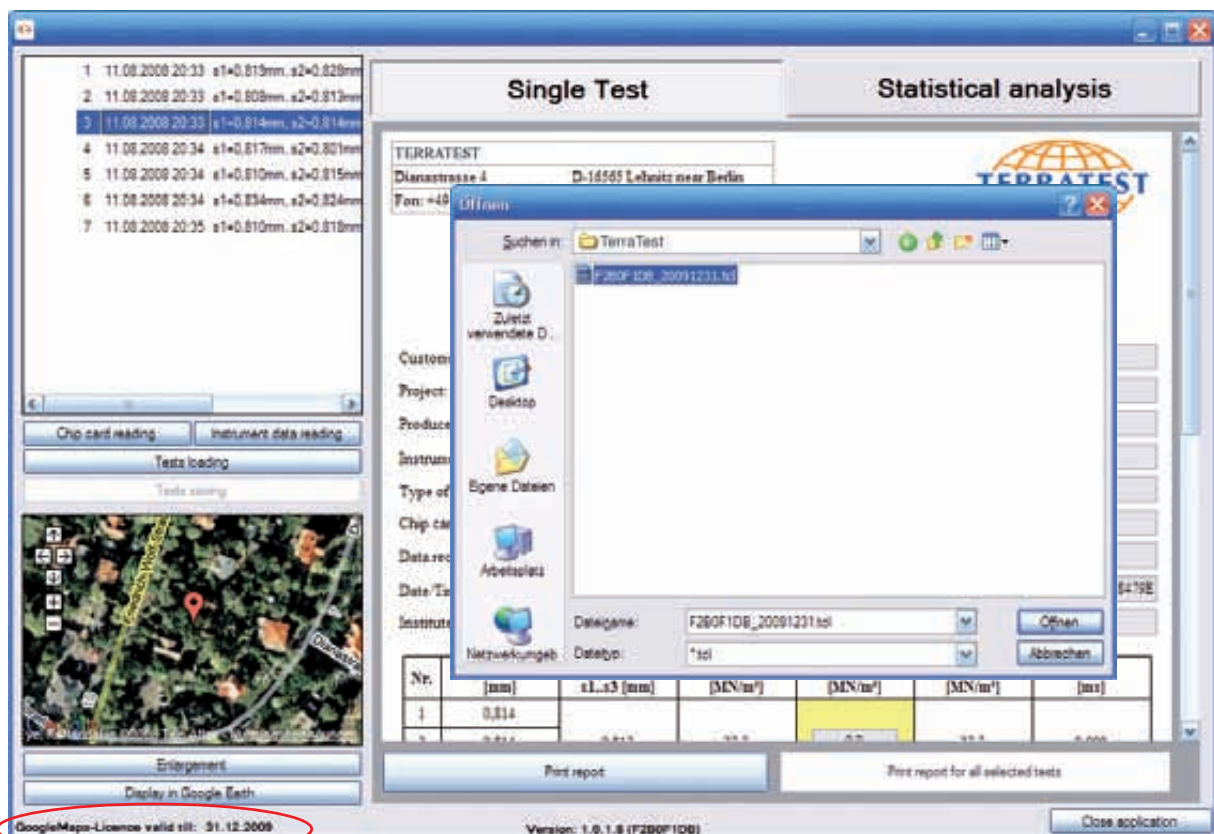
In order to be able to see the actual test points with Google®-Maps on your display you must purchase the licence not included in the basis packet, so to activate the option. Furthermore you need an internet connection.

7.2.3.12 Loading of the Google®-Maps licence file

The Google®-Maps licence is provided by the producer, is valid only for the PC you are using and for a specific period. In order to load the licence file, click twice on "GoogleMaps valid till". A window opens, you now have to choose where you want to save the licence file on the PC you are working with. Each licence is valid only for one specific PC. Confirm by clicking "Open". Below left it appears the expire date of the licence. If there's no date, this means that the PC code and the licence key don't correspond. In this case contact TERRATEST GmbH.

With a valid Google®-Maps licence and an active GPS system, your screen displays for each test the exact position according to a satellite photo. If you wish to enlarge click on "Enlarge".

Once you have installed the "GOOGLE®-Earth" program on your PC, you can export each measurement by clicking "DISPLAY ON GOOGLE EARTH". You will have a scale view complete with date, time and Evd value.



With double click on "GoogleMaps valid till" you open up a window in which you can choose where you want to save the file. Confirm with "open", and the expire date will appear down left.

8. Guarantee

TERRATEST GmbH guarantees the instrument for a year starting from the purchase date. Should you have a material or manufacturing defect during this period, the device will be repaired or replaced at TERRATEST GmbH expenses. The guarantee presupposes that you show a valid invoice and that you claim the right to be reimbursed within the expiry date. The guarantee is not extended to instruments or part of them subject to normal use and that can therefore be considered subject to wear.

You lose all guarantee rights in case the instrument has been damaged, in case you have not used it properly and in case of no maintenance (for example if you have not followed the owner's manual).

Repairs must be carried out only by TERRATEST GmbH.

For a proper use of the instrument please follow all the instructions of this manual.

You must absolutely avoid any use or action that this handbook dissuades from.

The guarantee can be extended up to two years by purchasing the 2 years service packet.

9. EU-Declaration of Conformity

Name and address
of the producer: TERRATEST GmbH
Dianastrasse 4
16565 Lehnitz bei Berlin
GERMANY

Product name: Light Falling Weight Deflectometer
TERRATEST 3000

This is to confirm that the device stated above is compliant with the protection requirements set forth in the EU Council Directive as of May 3 1998 for the Harmonization of Legal Stipulations of the Member States concerning Electromagnetic Compatibility (89/336/EWG) and the Low Voltage Regulations (72/23/EWG).

The device is compliant with the following standards:

EN 50081-1
EN 50082-1
EN 50082-2
EN 55013
EN 55020

DIN EN 292/T1
DIN EN 292/T2
DIN EN 294
DIN EN 414
DIN EN 418
DIN EN 1050
DIN EN 60204/T1

DIN VDE 0100-200
DIN VDE 0100-520
DIN VDE 0100-540
DIN VDE 0100-550
DIN VDE 0100-610

Therefore, the above mentioned instrument is designated with the CE label.

Any manipulation or modification on the supplied device and/or any use for other than for the intended purposes shall render this Certificate of Conformity null and void.

Lehnitz, 21st October 2008



Frank G. Schulz
Owner



10. Regulations

10.1 ZTVE-StB 94

ZTVE-Stb 94

German Road and Transportation Research Association (edition 2005)

„..... 3.4.7.2 requests concerning the deformation modulus

The following requests are based on a minimum quantile of 10%. For road superstructure class SV and from I to IV with a frost-proof subsoil and subbase on the planum, it's necessary a deformation modulus of at least

$E_{v2} = 120 \text{ MN/m}^2$ or in alternative $E_{vd} = 65 \text{ MN/m}^2$

For the classes V e VI it's necessary a deformation modulus of at least

$E_{v2} = 100 \text{ MN/m}^2$ or in alternative $E_{vd} = 50 \text{ MN/m}^2$ required.

The deformation modulus E_{v2} is proved by the regulations DIN 18134 through the static plate test, the E_{vd} one is proved by the regulations TPBF section B 8.3 through the dynamic plate test.

When these requests can be satisfied at least from the compaction of the base course that has to be done on the planum, on it it's sufficient for the classes SV and from I to IV a deformation modulus of at least

$E_{v2} = 100 \text{ MN/m}^2$ or in alternative $E_{vd} = 50 \text{ MN/m}^2$

For the classes V e VI it's necessary a deformation modulus of at least

$E_{v2} = 80 \text{ MN/m}^2$ or in alternative $E_{vd} = 40 \text{ MN/m}^2$

To be proved and verified by tests performed separately.

For frost-proof subsoils and subbases, on the planum it's necessary a deformation modulus of at least

$E_{v2} = 45 \text{ MN/m}^2$ or in alternative $E_{vd} = 25 \text{ MN/m}^2$.

If in the technical specifications of the cases described in this chapter it's not provided if you have to prove the static or dynamic deformation modulus, it's then always to prove the static one. In alternative you can perform a calibration of the dynamic deformation modulus to the static one in accordance with the regulation TPBF section E4 and you can then use the dynamic deformation modulus as request.

In case, despite the compaction, you are not able to reach the dynamic deformation modulus, this means:

- (1) you have to improve or solidify the subsoil and subbase
- (2) to have to increase the thickness of the unbound base courses.

The measures are to be specified in the technical specifications.

...

Chapter 14.2.5

Chart 8: standard values for the assignment of the static deformation modulus E_{v2} or of the dynamic one E_{vd} to the Compaction D_{pr} degree in coarse-grained soils.

Type of soil	E_{v2} static deformation modulus in MN/m^2	E_{vd} dynamic deformation modulus E_{vd} in MN/m^2	Compaction D_{pr} degree in %
GW, GI	≥ 120	≥ 65	≥ 103
	≥ 100	≥ 50	≥ 100
	≥ 80	≥ 40	≥ 98
	≥ 70	≥ 30	≥ 97
GE, SE, SW, SI	≥ 80	≥ 50	≥ 100
	≥ 70	≥ 40	≥ 98
	≥ 60	≥ 35	≥ 97

All information are subject to correction!



10.2 Backfilling of utility trenches

Material and place of the test Wetzlar

Quality certificate of the compaction by means of the light falling weight deflectometer in accordance with the German regulations TP BF-StB section B 8.3

Reference values for the assignment of the compaction degree D_{pr} and of the dynamic deformation modulus E_{vd}

	Required compaction in different deep layers (ZTVT-StB 95*) (ZTVE-StB 94)	Reference to the standard values for the assignment to the D_{pr} (ZTVE-StB 84 Tab. 8)	1) Proposal for the assignment of the E_{vd} to the E_{v2} (according to the technical proof FGSV AA, Oct 96)
Type of soil DIN 18 196	Compaction degree D_{pr} in %	Deformation modulus E_{v2} in MN/m ²	Deformation modulus E_{vd} in MN/m ²
GW, GI (for example stone soil and mineral mixed 0/32)	≥ 103 ≥ 100 ≥ 98 ≥ 97	≥ 120 ≥ 100 ≥ 80 ≥ 70	≥ 60 ≥ 50 ≥ 40 ≥ 35
GE, SE, SW, SI	≥ 100 ≥ 98 ≥ 97	≥ 80 ≥ 70 ≥ 60	≥ 40 ≥ 35 ≥ 32
Mixed and fine-grained soils	≥ 100 ≥ 97 ≥ 98	≥ 45 ≥ 30 ≥ 20	≥ 25 ≥ 15 ≥ 10

1) These reference values can be agreed as standard values for the proof of the compactions obtained in accordance with the guideline ZTVE –StB 94, chapter 14.2.5 between AN e AG.

All information are subject to correction!



10.3 RVS 08.03.04 Austrian Road, Rail and Transportation Research Association

Abstract of the guideline RVS 08.03.04 - Compaction proof by means of the plate dynamic test; edition 1st march 2008; Austrian Road, Rail and Transportation Research Association

8.1 Conversion of the minimum requirements

A minimum requirement referring to the first loading modulus E_{v1} of the static plate test can be proved by means of the dynamic plate test. The conversion of the minimum requirements of the first loading modulus of the static plate test (E_{v1}) with the dynamic deformation one of the dynamic plate test (E_{vd}) for **non cohesive soils** is:

$$\text{für } E_{v1} \geq 25 \text{ MN/m}^2 \text{ gilt: } E_{vd} = 10 + \frac{4}{5} E_{v1}$$

$$\text{für } E_{v1} < 25 \text{ MN/m}^2 \text{ gilt: } E_{vd} = \frac{6}{5} E_{v1}$$

and for **cohesive soils**:

$$E_{vd} = 10 + \frac{4}{5} E_{v1}$$

This relation is represented in chart 1.

Advice:

With chart 1 you can convert the requirements (limit values), but it's useless for the conversion of the test values (E_{vd} - E_{v1}). During the preparation many factors have been taken into consideration: the influence that comes into play in cohesive soils during the excess pore water pressure, the dispersion caused by the increased test number and the deviations due to the various technical attempts in presence of high stiffness.

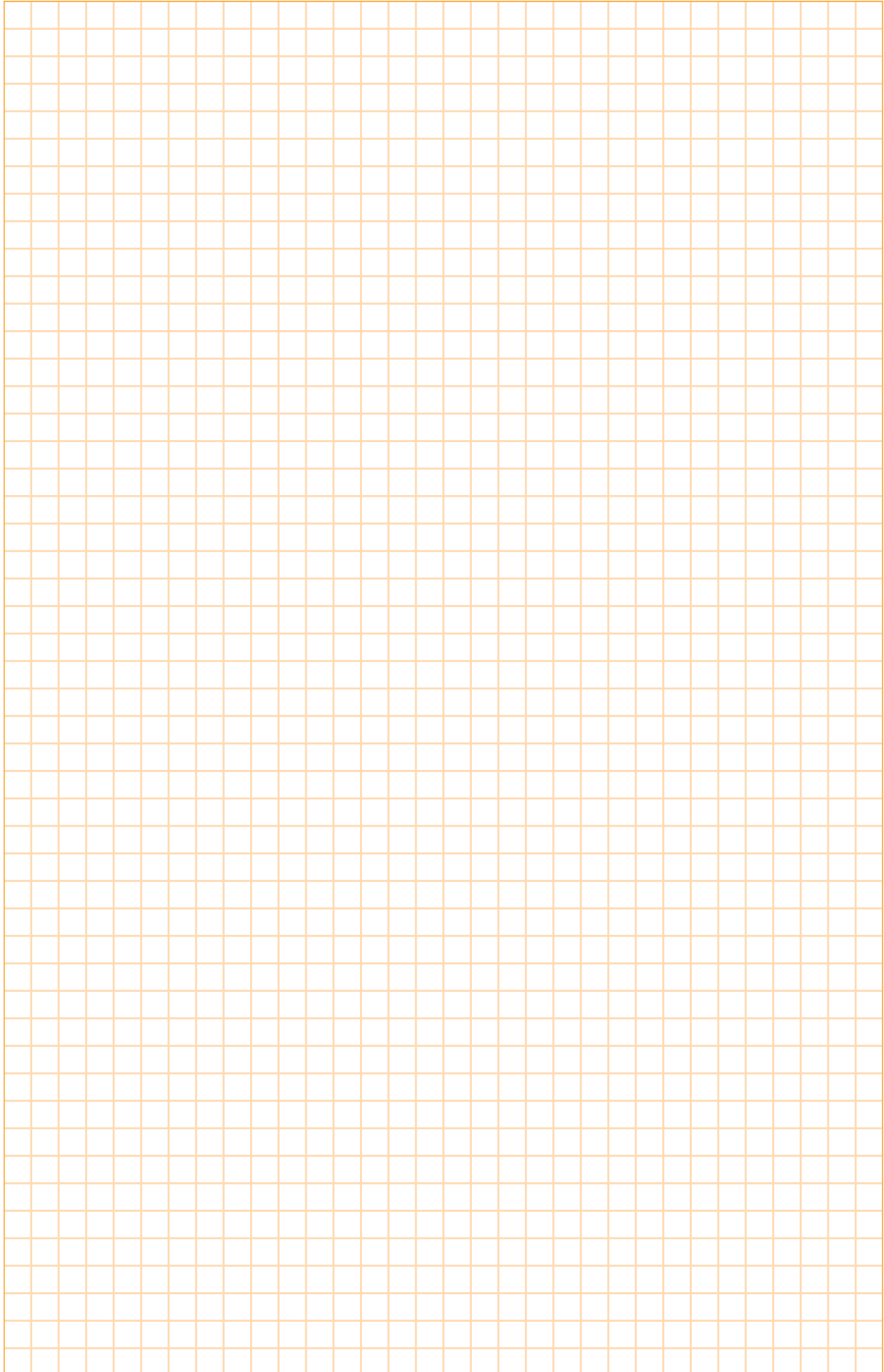
Chart 1: Conversion of the minimum requirements from E_{v1} to E_{vd}

Static plate test E_{v1}	Dynamic plate test E_{vd}	
First loading modulus E_{v1} [MN/m ²]	Dynamic deformation modulus E_{vd} [MN/m ²]	
	non cohesive	cohesive
0	0	10
5	6	14
7,5	9	16
10	12	18
15	18	22
20	24	26
25	30	30
30	34	
35	38	
40	42	
45	46	
50	50	
55	54	
60	58	
65	62	
70	66	
75	70	
80	74	
85	78	
90	82	

We advice to take always the calibration chart of the instrument with it. The test value E_{vd} corresponding to the minimum requirement E_{v1} of this calibration chart has to be taken as sample and proved.

All information are subject to correction!

Notes

A large rectangular area filled with a light blue grid pattern, intended for taking notes. The grid consists of small, uniform squares.