

# Instruction Manual



'TERRATEST 4000 STREAM'  
'TERRATEST 6000 BLE'



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Made in Germany





# Instruction Manual

Light Weight Deflectometer  
for the dynamic plate load test

**'TERRATEST 4000 STREAM'**

**'TERRATEST 6000 BLE'**

with integrated GPS system and Google® Maps interface

Corresponding to

international standard:

**'ASTM E2835-11 Standard Test Method for Measuring  
Deflection using a Portable Impulse Plate Load Test Device'**

German standard:

**'Technical Test Code for Soil and Rock Mechanics  
in Road Constructions TP BF-StB Part B 8.3'**

Austrian standard:

**'RVS 08.03.04**

**Compaction Tests by means of the Dynamic Plate Load Test'**

as well as

**'RIL 836 - Deutsche Bahn AG for Track Construction'**



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## 1. Documentation

### 1.1 Notes on the Documentation

Congratulations on your purchase of your Light Weight Deflectometer from the **TERRATEST** product family. By selecting this innovative test instrument you have chosen a cutting-edge product featuring the latest technology. To be able to make full use of all the advantages and possibilities that this high-tech product offers, and to ensure the proper use of the device according to the manual, please take a little time to read this documentation carefully before use. The chapters contain everything you need to know about the device and give valuable tips and recommendations for the proper use of this product. Reading this documentation carefully will ensure that you will always obtain precise test results, which will give you a clear indication as to the bearing capacity of the soil.

**Read the instruction manual carefully and operate the device in accordance with the instructions. TERRATEST GmbH will not be liable for damages caused by failure to observe these instructions.**

All details contained in this documentation are subject to change without prior notice. TERRATEST GmbH gives no assurance as to the accuracy of this documentation, and specifically disclaims any implied warranties of merchantability or fitness for a particular purpose.

TERRATEST GmbH cannot be held liable for errors contained in this documentation, or for accidental or sequential damage in connection with the delivery, performance, or use of the material.



PLEASE OBSERVE THE INSTRUCTIONS OF THE GERMAN STANDARD  
'**Technical Test Code for Soil and Rock Mechanics in Road Construction TP BF-StB Part B 8.3**'.  
**Evaluate the test data strictly in accordance with ZTV-E, ZTV-A, RIL 836 and/or RVS 08.03.04.**



**We would like to point out explicitly that a reliable evaluation of the test data is only possible if a correlation measurement with the static plate load test is performed for every dynamic test with the Light Weight Deflectometer. At least three static plate load tests should be performed for a reliable calibration (see p. 29/30).**



## 1.2 General Safety Information

Please read and understand the following safety guidelines, before starting to use 'TERRATEST 4000 STREAM' / 'TERRATEST 6000 BLE'.



Useful information and instructions



### ATTENTION

Indicates processes where incorrect execution could result in physical injury or material damage. Please observe these warnings carefully to ensure a safe operation of the device.



### ATTENTION

**If the Light Weight Deflectometer is used in a manner not specified by these instructions, the protection provided by this instrument may be impaired.**



### ATTENTION (Quotation from ZTV E-StB 09)

**'The deformation modulus  $E_{v2}$  is to be assessed by the static plate load test, in accordance with DIN 18134, and the dynamic deflection module  $E_{vd}$  with the dynamic plate load test, in accordance with TP BF-StB Part B 8.3.... The specifications of the building contract should state whether the static or dynamic deflection modulus is to be established. If no such statement is to be found in the contract, the static deformation modulus will need to be established.'**



### ATTENTION

**The evaluation of the measured  $E_{vd}$  value depends on the material and the subsoil being tested. It is always necessary to determine correlation values of the static plate load test on a trial basis for the pre-existing ground or the ground intended for backfilling. Homogeneous ground is a prerequisite for properly correlating the two measuring methods. Accordingly, the water content of the soil must not vary widely.**



### ATTENTION

**According to German standard TP BF-StB Part B 8.3, Light Weight Deflectometers must be calibrated at least once a year at a calibration institute accredited by the German Federal Road Research Institute (Bundesanstalt für Straßenbau). Test results of a device that has not been calibrated or of a device with an expired calibration date must not be used for evaluating the bearing capacity of soil or rock. Abide by the mandatory calibration intervals.**



### CAUTION

**Never place the testing computer or load plate of 'TERRATEST 6000 BLE' near any inflammable liquids such as alcohol, thinner etc. There is a risk of fire if such flammable liquids make contact with the electric components in the interior of the device.**



### CAUTION

**Never place or charge the testing computer or load plate of 'TERRATEST 6000 BLE' in areas with excessive humidity, high temperatures, direct sunlight, or close to open flames. Doing so carries the risk of fire or electric shock.**



### CAUTION

**Whenever the loading device is not placed on the metal ball of the sensor dome on the load plate, always store it horizontally or on the magnetic plate, which may be purchased separately. The loading device could fall over and cause injuries otherwise.**



### CAUTION

**Before operating the Light Weight Deflectometer read the instruction manual carefully to ensure correct set-up of the device. When no test is performed, keep the drop weight in its 'rest' position at the bottom of the guide rod. The drop weight could fall down and cause injuries or damage otherwise.**

### 1.3. Safety Precautions during Power Supply



#### CAUTION

Never place any heavy objects on the measuring or charging cables. Never twist or pull them, and take care that they do not become knotted.



#### CAUTION

Ensure that the charging and measuring cables are fully inserted into their sockets. A poor connection can lead to equipment damage. Use only the cables provided.

#### 1.3.1. Power Supply



#### ACHTUNG ATTENTION

Only batteries approved by the manufacturer (Panasonic LC-R064R5) should be used for the testing computer. Batteries should only be replaced and disposed of by qualified personnel. The plugs of the cable, to which the battery will be connected, are colour-coded. The white wire with the red plug should be connected to the positive (+) pole of the battery (+6 volts). The brown wire with the black plug should be connected to the negative (-) pole of the battery. The cable contains a 2A/32V fuse.



Only the permanently-installed, long-lasting, rechargeable battery pack approved by the manufacturer (type 8904 7.4 V/2.4 Ah) should be used in the Bluetooth® sensor dome 'TERRATEST 6000 BLE'. This battery pack should only be replaced by the manufacturer.



#### ATTENTION

The assembly may be destroyed if the leads of the battery are interchanged, or a different type of fuse is inserted.

**No tests should be performed while charging the device.**

#### 1.3.2. Mains Power Supply



#### ATTENTION

Only power cables approved by the manufacturer (ADS18B-B 120100) may be used for the testing computer. When using the power cable to charge the device, take care to do so only in dry, indoors locations. The inner pole is the positive (+) pole.



Only power cables with LEMO-plugs approved by the manufacturer (SYS1308-1809-W2E) should be used for charging the Bluetooth® transmission unit in the Bluetooth® sensor dome 'TERRATEST 6000 BLE'. When using the power cable to charge the device, take care to do so only in dry, indoors locations. The inner pole is the positive (+) pole.

#### 1.3.3. Car Charger Lead



#### ATTENTION

Only car chargers approved by the manufacturer may be used. Charging should only be done inside dry rooms (the interior of the vehicle, for example). The inner pole is the positive (+) pole.



#### ATTENTION

Always hold the plug when disconnecting the charger cable. Wires may be damaged if the cables are pulled directly.

#### 1.3.4. Measuring Cable



#### ATTENTION

Only the original measuring cable / extension cable supplied by the manufacturer should be used. Cables should not be disassembled or extended. Incorrect test results may occur otherwise.



#### 1.4. Safety Precautions during Operation



##### ATTENTION

TERRATEST GmbH shall not be liable for any damage, consequential damage, or financial loss that occurs as a result of improper use of the device and / or lack of professional knowledge when evaluating the test data. It is essential to ensure that the calibration of the device is always up to date and that the device is always operated in accordance with the instructions of this document as well as your local standard.



##### CAUTION

Use the Light Weight Deflectometer only outdoors. Never use it inside any enclosed area. Using the device indoors carries the risk of damage to the building. Never use the device on paving stones, tiles, cobblestones, floor boards, asphalt, cement, industrial flooring, or any other type of flooring; these may be damaged by the impact of the dropping weight.



##### ATTENTION

Never disassemble or alter the Light Weight Deflectometer, the testing computer, or any other equipment such as the charger cable etc.



##### ATTENTION

In case of unusual noise, smoke, smell, or excessive heat generation, switch off the device immediately and contact TERRATEST customer support.



##### ATTENTION

Do not expose the testing computer or load plate of 'TERRATEST 6000 BLE' to direct rainfall. If it rains, cover and protect testing computer and load plate of 'TERRATEST 6000 BLE'.



##### ATTENTION

Protect the testing computer and load plate of 'TERRATEST 6000 BLE' from water, liquids, and any flammable substances. There is a risk of fire if flammable liquids enter the device and make contact with the electric components.



##### CAUTION

Clean surfaces with solvent-free cleaning agents only. Gently wipe surfaces with a soft, dry cloth. If dirt remains, use a cloth moistened with water, well-wrung, and then wipe with a soft, dry cloth to absorb any remaining moisture. Never use flammable substances such as alcohol, benzine or thinner for cleaning. There is a risk of fire if flammable liquids enter the device and make contact with the electric components, or if the cables get damaged. Thus, always take care when connecting or disconnecting the cables.



##### ATTENTION

Let go of the lid of the testing computer only after it has been fully closed / opened. If the lid falls down it may cause injury to your hands. No objects should be placed on the inspection window.



##### ATTENTION

The lid of the measuring computer features stickers inside and outside, showing the usual minimum requirements for bearing capacity of the soil. This information is provided without warranty. The requirements of the actual project or order have to be observed, in case of need the requirements must be determined by a geotechnical expert. A correlation measurement on the basis of a static load plate test is required anyway.



##### CAUTION

When placing the load plate on the test ground, and for removing it, kneel down on one knee and grab the load plate with both hands on the handles. Do not let the load plate fall down; doing so may injure your feet, or damage the device.

**CAUTION**

Always transport the loading device with the drop weight locked; failure to do so carries the risk of personnel injury or damage to the device. Keep the drop weight locked in its 'rest' position at the bottom of the loading device and unlock it only immediately prior to conducting a test. Failure to observe these points may cause the device to be damaged, and there may be a high risk of personnel injury. When latched at the top of the loading device, take care to release the drop weight only immediately prior to conducting a test. Pull up the drop weight, latch it at the top, and release it immediately afterwards.

**CAUTION**

The transportation lock should be unlocked only immediately prior to conducting a test. Uncontrolled movements of the weight may cause injury, or damage to the device or its surroundings. Regularly check that the transportation lock of the Light Weight Deflectometer is functioning properly. If you notice signs of wear, stop using the device immediately. Send the device back to TERRATEST GmbH for the transportation lock to be repaired or replaced.



**Never transport the loading device, or let it stand around, while the drop weight is latched at the top!**

**ATTENTION**

When conducting a test, only the operator should come close to the device. Release the drop weight only when no one else is beneath or near the Light Weight Deflectometer.

**CAUTION**

**Hearing protectors must be worn when operating the Light Weight Deflectometer, since the noise level may rise over 85 dB. ATTENTION: Operating the device without hearing protection may result in permanent hearing impairment.**

**ATTENTION**

If the device will not be used for a longer period of time, ensure that all cables are disconnected. Before transporting the device, ensure that all cables are disconnected. Before moving the device around the construction site, ensure that all cables are disconnected. Damaged cables may cause fire.



**No tests should be performed while the apparatus is on charge; this can distort test results!**



According to the Waste Electrical and Electronic Equipment Directive (2011/65/EG) the battery, electronics, and especially the electronics of the load plate may not be disposed of with your domestic waste. Comply with your local regulations. In some countries you are required by law to dispose of these products only at the collection points provided. In some countries manufacturers of similar electronic equipment are obliged by law to take back electronic waste. Due to potentially hazardous substances, often contained in electronic waste, incorrect handling of such waste may have negative impacts on the environment and human health. By disposing of electronic parts in an appropriate way you also contribute to an effective use of natural resources.



For more information about collection points for electronic waste please contact your city council, your public waste management authorities, or your garbage disposal service.



TERRATEST GmbH will take back electronic waste free of charge, and dispose of it in a safe and environmentally appropriate manner.

## 1.5 Packaging



We strongly recommend that you keep the original packaging of the device for transport at a later date (e.g. when sending the device in for calibration). Upon delivery, inspect the device immediately. Make sure that the goods are undamaged and complete. Check in particular that there is no visible external damage to the packaging. If the device or any other item included in the delivery is damaged, immediately record the type of damage and notify the carrier that you may seek compensation. Please also advise TERRATEST GmbH of the damage and the name of the carrier, so that we can also get in contact with the transport company.

## 2. Contents of Delivery

### 2.1 Basic Package 'TERRATEST 4000 STREAM'

Light Weight Deflectometer 10 kg  
corresponding to German standard TP BF-StB Part B 8.3

#### 'TERRATEST 4000 STREAM' with integrated GPS system and Google® Maps interface

consisting of:

- 10 kg loading device with ergonomic weight-catching grip
- Load plate 300 mm
- Testing computer with GPS system, internal plausibility check and test data comparison, Voice Navigation (Voice output), internal memory for up to 2000 tests, backlit graphic display for presentation of settlement curves during test, thermal printer with paper roll, port for USB flash drive, integrated rechargeable battery, external control button, large inspection window enabling operation under adverse weather conditions
- Connection cable with jack plug for testing computer / load plate
- User-friendly web-based software 'TEOLO' with statistical analysis in accordance with German standard TP BF-StB Part B 8.3
- USB stick for test data storage
- Power cable 100 ... 240 V~ / 12 V= 1.25 A
- Car charger lead 12 V/DC
- Detailed instruction manual
- Calibration certificate according to German standard 'TP BF-StB Part B 8.3 for Soil and Rock Mechanics in Road Constructions'

### 2.2 Optional Equipment 'TERRATEST 4000 STREAM'

- Medium weight falling weight, 15 kg drop weight and strengthened spring assembly, with double impact force acc.to TB Stone-StB, calibrated acc. to TP BF-StB, section B8.4, calibration certificate
- 'CARRELLO', the mobile testing system, for testing without carrying
- Transport box 'MILANO', made of flight case material, with integrated handles and rollers
- Transport box 'ROMA', made of flight case material, with integrated handles and rollers, for combined transport of 10 kg basic package and 15 kg loading device
- Magnetic plate 'TRETMINÉ', for the convenient placement of the loading device on the ground
- STREAM dongle for storage and wireless transmission of measuring results to TERRATEST App
- Extension cable, load plate / testing computer, for extended range as well as tests in areas that are difficult to access such as trenches etc.
- Paper rolls for thermal printer
- Off-road tires for transport box

## 2.3 Basic Package 'TERRATEST 6000 BLE'

Light Weight Deflectometer 10 kg  
corresponding to German standard TP BF-StB Part B 8.3

### 'TERRATEST 6000 BLE' with integrated GPS system and Google® Maps interface

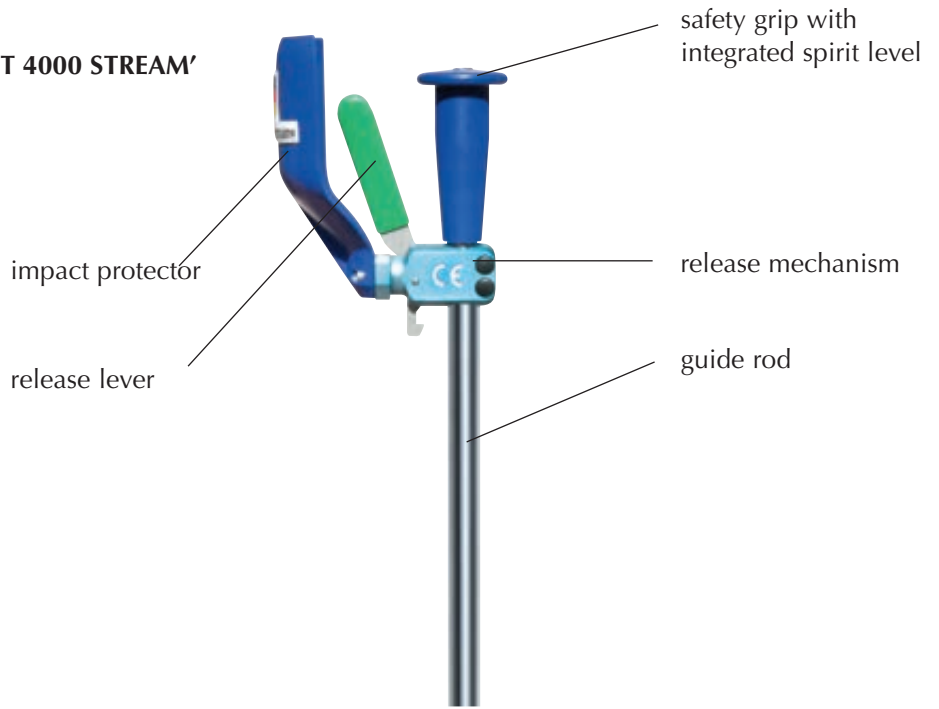
consisting of:

- 10 kg loading device with ergonomic weight-catching grip
- Load plate 300 mm with Bluetooth® transmission electronics in the sensor dome and integrated rechargeable battery pack type 8904 7.4V/2.4Ah
- Testing computer with GPS system, internal plausibility check and test data comparison, 'continuous measuring mode', Voice Navigation (Voice output), internal memory for up to 2000 tests, backlit graphic display for presentation of settlement curves during test, thermal printer with paper roll, port for USB flash drive, integrated rechargeable battery, external control button, large inspection window enabling operation under adverse weather conditions
- User-friendly web-based software 'TEOLO' with statistical analysis in accordance with German standard TP BF-StB Part B 8.3
- USB stick for test data storage
- Power cable 100 ... 240 V~ / 12 V== 1.25 A and power cable 100 ... 240 V~ / 9 V== 2 A with plugs from LEMO
- Car charger lead 12 V/DC
- Detailed instruction manual
- Calibration certificate according to German standard 'TP BF-StB Part B 8.3 for Soil and Rock Mechanics in Road Constructions'

## 2.4 Optional Equipment 'TERRATEST 6000 BLE'

- Medium weight falling weight, 15 kg drop weight and strengthened spring assembly, with double impact force acc.to TB Stone-StB, calibrated acc. to TP BF-StB, section B8.4, calibration certificate
- 'CARRELLO', the mobile testing system, for testing without carrying
- Transport box 'MILANO', made of flight case material, with integrated handles and rollers
- Transport box 'ROMA', made of flight case material, with integrated handles and rollers, for combined transport of 10 kg basic package and 15 kg loading device
- Magnetic plate 'TRETMINÉ', for the convenient placement of the loading device on the ground
- Paper rolls for thermal printer
- Off-road tires for transport box

**2.5 General View – ‘TERRATEST 4000 STREAM’**



**electronic testing computer**

**mechanical loading device**

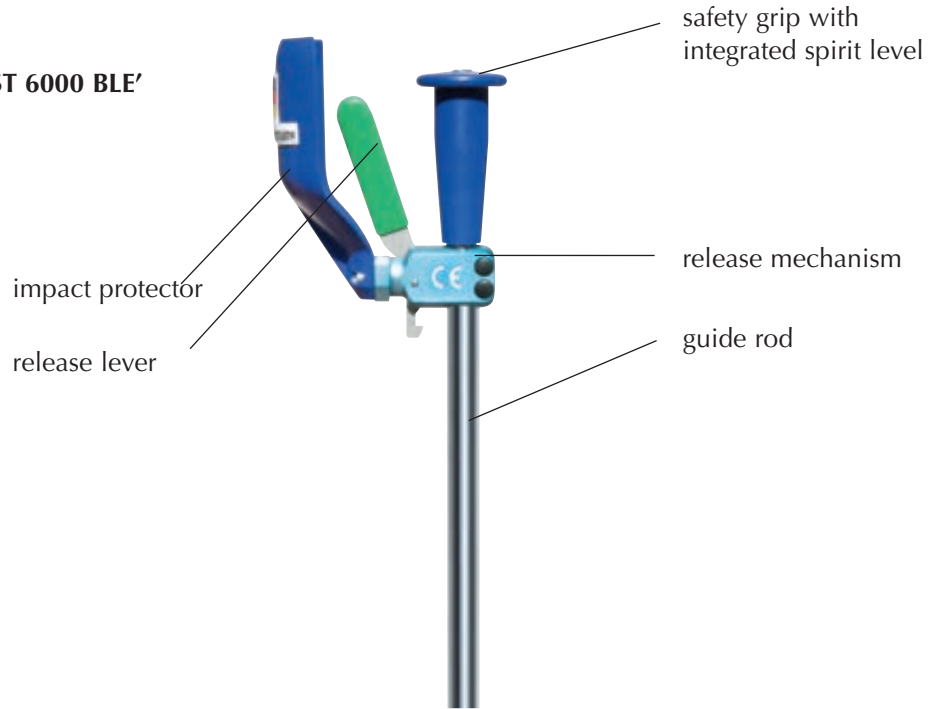




## 2.6 Top View of Control Panel, Testing Computer – 'TERRATEST 4000 STREAM'



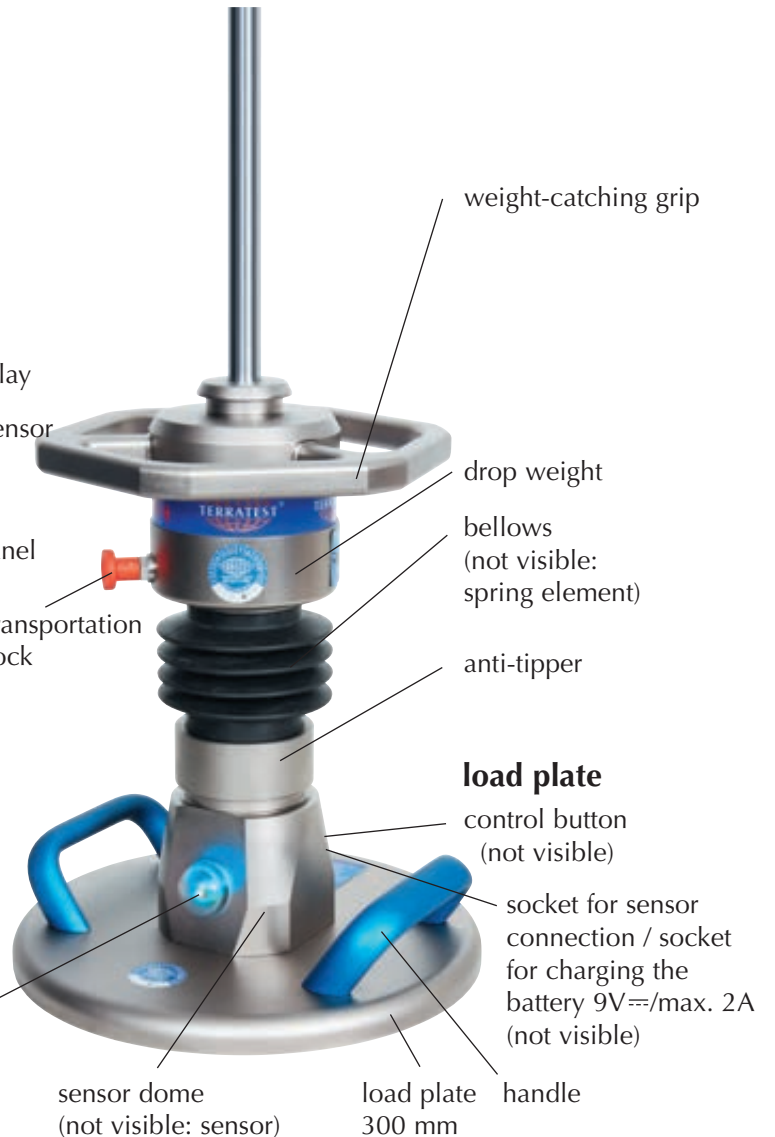
## 2.7 General View – 'TERRATEST 6000 BLE'



### electronic testing computer



### mechanical loading device



## 2.8 Top View of Control Panel, Testing Computer – ‘TERRATEST 6000 BLE’





### 3. Technical Specifications

#### 3.1 Device Designation:



‘TERRATEST 4000 STREAM’  
with box for testing computer ‘Robusta’  
(box made of flight case material,  
and aluminium profiles,  
external button on the front face)



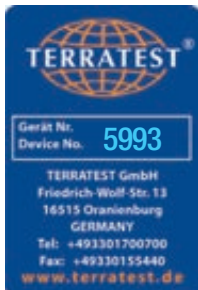
Model designation  
on acrylic glass lid and  
on start display



‘TERRATEST 6000 BLE’  
with box for testing computer ‘Robusta’  
(box made of flight case material,  
and aluminium profiles,  
external button on the front face)

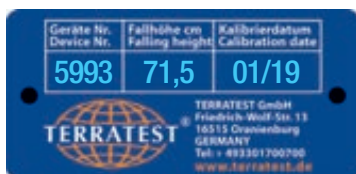


Model designation  
on acrylic glass lid and  
on start display



#### 3.2 Serial Number:

Load plate, loading device and testing computer form a single unit and have been attuned to one another during calibration of the device. These three components may only be used in conjunction with each other and may not be interchanged with the components of other devices. Accordingly, the single components are identified with particular serial numbers. These serial numbers are identical and located on metal tags, which are attached to each component. Each serial number consists of a four-digit number.



The serial number is located:

On the **load plate**, directly between the handles.

Inside the **testing computer**, on the partition panel in the storage box.

On the drop weight of the **loading device**. Additionally, drop height as well as month and year of last calibration are noted here.

### 3.3 Load Plate:

Weight of load plate, including sensor dome and handles	15 kg
Diameter of load plate	300 mm
Thickness of load plate	20 mm
Power supply Bluetooth® transmitter	long-lasting, rechargeable
Bluetooth® sensor dome 'TERRATEST 6000 BLE'	battery pack type 8904 7.4V/2.4Ah
For charging use only included power supply type SYS1308-1809-W2E with LEMO®-plug (9V $\overline{=}$ /max. 2A)	

### 3.4 Mechanical Loading Device:

	Light weight 10 kg	Medium weight 15 kg
Impact force	7.07 kN $\pm$ 1%	10.605 kN $\pm$ 1%
Impact duration	17 ms $\pm$ 1.5 ms	17 ms $\pm$ 1.5 ms
Weight of drop weight	10 kg	15 kg
Weight of guide rod	5 kg	5.5 kg
Length of guide rod	1140 mm	1140 mm
Total height of device, including load plate TERRATEST 4000 STREAM	1230 mm	1230 mm
Total height of device, including load plate TERRATEST 6000 BLE	1260 mm	1260 mm
Sound power level	95 dB(A)	95 dB(A)
Sound pressure level	84 dB(A)	84 dB(A)

### 3.5 Testing Computer

Weight without accessories 'TERRATEST 4000 STREAM'	4,2 kg
Weight without accessories 'TERRATEST 6000 BLE'	4,1 kg
Dimensions	length = 240 mm width = 230 mm height = 230 mm
Measurement range (settlement)	15-70 MN/m <sup>2</sup> 30-150 MN/m <sup>2</sup>
Power supply	long-lasting, rechargeable 6 Volt PANASONIC-Super-Life lead acid battery Type LC-R064R5P
Automatic switch-off	after three minutes
Radio clock, date display	satellite-based, can be configured manually
Precision GPS receiver	less than 20 meters
Maximum voltage variation	+/- 10%
Bluetooth® transmitter / receiver bei 'TERRATEST 6000 BLE'	Type RN4020 Bluetooth 4.1 Low Energy Certifications RED, FCC, ICS, CE, RoHS Frequency range 2,402 ~ 2,480 MHz

For charging use only included power supply type ADS18B-B 120100 or included car charger type MWCP1 (712026) (12V $\overline{=}$  /max. 1.25A)

### 3.6 Environmental Conditions

Charge the device only in dry, indoors locations.	
Protection class	IP53
Do not expose the testing computer to direct rain. If it rains, cover and protect the testing computer.	
Do not expose Bluetooth® load plate 'TERRATEST 6000 BLE' to direct rain. If it rains, cover and protect Bluetooth® load plate 'TERRATEST 6000 BLE'.	
Temperature range	0 - 40 °C
Maximum height for use above sea level	2,000 metres
Maximum relative humidity for use	< 80%, dew must be avoided

### 3.7 Power Supply

Power consumption while on battery  
normally 6V DC/0.5A (when backlight is on)  
normally 6V DC/0.4A (when backlight is off)

### 3.8 Battery Performance

Battery 6V type Panasonic LC-R064R5 (which may be replaced only by Technical Support Service)  
Charging time approx. 4-5h, depending on ambient temperature, in the case of exhaustive discharge at least 12 h  
Fuse in battery cable: Little Fuse 218 in Fuse Holder 8601 2000

A long-lasting, rechargeable 6 Volt, 4.5 Ah built-in battery is located in the testing computer, type Panasonic LC-R064R5.

The device may be charged via either the supplied power cable or a 12 Volt car battery. The charging socket '12V==/max 1.25A' on the control panel, next to the GPS antenna, must be used for this. Both car charger and power cable are included with the contents of delivery (basic package).

A long-lasting, rechargeable, built-in battery pack type 8904 7.4 V/2.4 Ah is located in the sensor dome 'TERRATEST 6000 BLE'. It should be charged with the supplied power cable 9V DC/2A with plugs from LEMO.

The battery charge of the testing computer will be shown on the display 'STATUS REQUEST' upon switching ON the device. Fully charged, the battery holds 6.3 V. In this state, 2.000 measurements or 600 printouts are possible. However, the battery performance also depends largely on density of air pressure, ambient temperature, battery lifetime, and other criteria. The activated device switches OFF automatically three minutes after last use (automatic switch-off). Shortly before total discharge of the battery, the testing computer also turns off automatically to avoid deep discharge. It can only be activated again after recharging.

The battery charge of the Bluetooth® transmitter in the sensor dome of the Bluetooth® load plate 'TERRATEST 6000 BLE' will be shown on the display 'STATUS REQUEST' below the battery symbol in value of percentage, upon switching ON the device. Fully charged, the battery holds 7.4 V = 100%. In this state, 500 measurements are possible. However, the battery performance also depends largely on density of air pressure, ambient temperature, battery lifetime, and other criteria. The activated device switches off automatically three minutes after last use (automatic switch-off). Shortly before total discharge of the battery, the testing computer also turns off automatically to avoid deep discharge. It can only be activated again after recharging.



The battery should be replaced only by the manufacturer. Never attempt to dismantle the battery. Lead is a highly toxic heavy metal. Please comply with the regulations regarding transport and disposal of lead batteries. Do not dispose of batteries by burning them. Batteries must be kept out of reach of children.

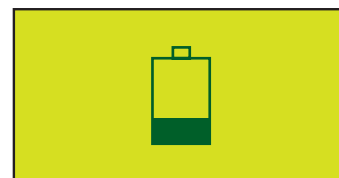


According to the Waste Electrical and Electronic Equipment Directive (2011/65/EG) the battery, electronics, and especially the electronics of the load plate may not be disposed of with your domestic waste. Comply with your local regulations. In some countries you are required by law to dispose of these products only at the collection points provided. In some countries manufacturers of similar electronic equipment are obliged by law to take back electronic waste. Due to potentially hazardous substances, often contained in electronic waste, incorrect handling of such waste may have negative impacts on the environment and human health. By disposing of electronic parts in an appropriate way you also contribute to an effective use of natural resources. For more information about collection points for electronic waste please contact your city council, your public waste management authorities or your garbage disposal service. TERRATEST GmbH will take back electronic waste free of charge, and dispose of it in a safe and environmentally appropriate manner.

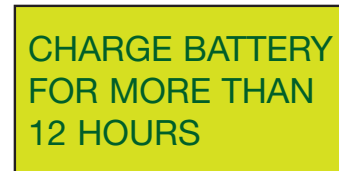


### 3.9 Charging of Testing Computer

Only the charging equipment supplied by the manufacturer should be used for charging the battery. To charge the battery of the testing computer, plug the power cable into the '12 V  $\overline{=}$  /max. 1.25 A' socket on the testing computer. This socket is located on the top left of the control panel, next to the GPS antenna. If the power cable is plugged in, the charge status will be symbolised by an animated filling level icon on the display of the testing computer. The battery is fully charged if the battery symbol is completely dark. Depending on ambient temperature, charging time is approximately 4-5 hours, when the battery is empty. In case of deep discharge of the battery, the display will show 'CHARGE BATTERY FOR MORE THAN 12 HOURS'. If this is the case, charge battery over a period of more than 12 hours. The maximum variation in voltage must not exceed 10%. During the charging process place the testing computer inside a dry room and take care that it is possible to disconnect the device from power at any time.



CHARGE STATUS INDICATOR



DISPLAY DURING DEEP DISCHARGE

### 3.10 Charging of Bluetooth® Load Plate 'TERRATEST 6000 BLE'

To charge the battery pack in the Bluetooth® load plate ('TERRATEST 6000 BLE'), the item must be switched OFF. Use the supplied charging cable with LEMO plug and insert it into the LEMO connector of the Bluetooth® load plate. This socket is labeled with '9V  $\overline{=}$  2A IP53'. If the LED of the 'magic Eye' is lit in yellow, the battery pack is being charged, after completion it is lit in green. If the LED is flashing 10 times in red, the battery pack is defective; an LED flashing 10 times in blue indicates that charging is required. Depending on ambient temperature, charging time is approximately 8 hours, when the battery pack is empty. The current battery charge will be shown as a percentage below the battery charge of the testing computer during 'STATUS REQUEST', when switching on first the load plate and subsequently the testing computer. The maximum variation in voltage must not exceed 10%. During the charging process, place the load plate inside a dry room and take care that it is possible to disconnect the device from power at any time.

### Power Supply, Testing Computer:



Only the power cable supplied by the manufacturer (ADS18B-B 120100) vshould be used. Charge the device only in dry, indoors locations. The inner pole is the positive (+) pole.

Type ADS18B-B 120100 (OEM Co., Ltd.)

Prim: 100-240V AC, 50-60Hz, 0,5A Class II

Sec: 12V/1,0A

IP20

First plug the power cable into the appropriate '12V  $\equiv$  / max. 1.25A' socket of the testing computer, located on the top left of the control panel, beside the GPS antenna. Then plug the other end of the cable into the wall socket.



When disconnecting the cable always take hold of the plug. Pulling on the cable may result in damage to the wires.

### Power Supply, Bluetooth® Load Plate

#### 'TERRATEST 6000 BLE':

Only the power cable supplied by the manufacturer (SYS1308-1809-W2E) with LEMO-plugs should be used for charging the Bluetooth® transmitter in the Bluetooth® sensor dome. The LEMO connector after insertion is self-locking by means of a push-pull coupling, thus protecting the cable against removal by mistake. To open the push-pull coupling, first slide back the outer sleeve of the connector. Charge the device only in dry, indoors locations. The inner pole is the positive (+) pole.

Type: SYS1308-1809-W2E with LEMO-plugs

Prim: 100-240V AC, 47-63Hz, 1A Class II

Sec: 9V/2A

IP20

First plug the power cable into the socket of the Bluetooth® sensor dome. Then plug the other end of the cable into the wall socket.



When disconnecting the cable always take hold of the plug. Pulling on the cable may result in damage to the wires.



The power cable for the Bluetooth® load plate 'TERRATEST 6000 BLE' is equipped with a plug with LEMO 'PUSH-PULL' lock and anti-kink protection. The LEMO connector after insertion is self-locking by means of a push-pull coupling, thus protecting the cable against removal by mistake. To open the push-pull coupling, first slide back the outer sleeve of the connector. For this reason, for unlocking only grasp from the plug housing, otherwise cable or socket can be damaged. Charge the device only Failure to do so may cause damage to the cable or socket.

### Car Charger for Testing Computer:

Only the car charger supplied by the manufacturer type MWCP1 (712026) should be used. Charge the device only in dry, indoors locations (e.g. inside vehicles). The inner pole is the positive (+) pole.

Type MWCP1 (712026)

inner pole positive (+)

Fuse T2A F (6.3mm x 32mm)

First plug the power cable into the appropriate '12V $\equiv$  / max. 1.25A' socket of the testing computer, located on the top left of the control panel, beside the GPS antenna. Then plug the other end of the car charger into the cigarette lighter socket.



When disconnecting the cable always take hold of the plug. Pulling on the cable may cause damage to the wires, fire or electric shock.



**No tests should be performed while charging the device; doing so may distort test results.**

### 3.11 USB Cable Port

The testing computer is equipped with a USB cable port on the partition panel of the storage box. This USB port provides service access for the manufacturer, and can also be used by the operator to transfer test data from the internal memory to a computer via a standard USB2.0-A/A-m/m cable (see also section 6.4.2 of this manual).

### 3.12 Measuring Cable

'TERRATEST 4000 STREAM': The measuring cable for transferring the sensor signals to the testing computer can be extended to a maximum of 2.5 meters. It is equipped with two identical 6.35 mm jack plugs.



**Never pull on the measuring cable to disconnect the plug-socket connection; doing so may cause damage to the cable and/or socket.**



Never place any heavy objects on the measuring cable; never twist or pull it. Take care that it does not become knotted. Damaged cables can cause fire or electric shock.



Ensure that the measuring cable is fully inserted into the socket. A poor connection can cause fire or electric shock. Use only the cables provided. Failure to do so may cause fire or electric shock.



When closing the lid of the testing computer, take care not to trap the measuring cable.

For wiring diagram for cables and sockets, refer to page 102.



Jack plugs  
'TERRATEST 4000 STREAM'

### Extension Cable

To expand the reach between the testing computer and load plate (for example, in areas that are difficult to access, such as trenches and shafts), the measuring cable for transferring the sensor signals to the testing computer can be extended by 2.5 m to a maximum length of 5 m with the aid of an extension cable. This extension cable can be purchased separately. It is equipped with a male jack plug as well as a female jack socket at the other end. To connect the extension cable, disconnect the measuring cable from the testing computer as described above. Insert the plug of the extension cable laterally from the measuring computer until it stops. Afterwards, connect the measuring cable and extension cable by sliding the plug of the measuring cable into the socket of the extension cable all the way until it stops.



**Never pull on the measuring cable to disconnect the plug-socket connection; doing so may cause damage to the cable and/or socket.**



Never place any heavy objects on the extension cable; never twist or pull it. Take care that it does not become knotted. Damaged cables can cause fire or electric shock.



Ensure that the extension cable is fully inserted into the socket. A poor connection can cause fire or electric shock. Use only the measuring cables provided. Failure to do so may cause fire or electric shock.



When closing the lid of the testing computer, take care not to trap the measuring cable.



'TERRATEST 4000 STREAM'

## 4. General Overview: Light Weight Deflectometer

### 4.1 Introduction

The 'TERRATEST' product family combines highly modern microelectronic components with the properties of an ergonomic test instrument, which is extremely suitable for the use on construction sites. Testing with the Light Weight Deflectometer has been brought to perfection and is now more authentic than ever. This is due to the possibility of automatically registering the testing points simultaneously via Global Positioning System (GPS) and a Google® Maps interface. Voice output of all devices of the TERRATEST® product family and Bluetooth® data transfer of the TERRATEST 6000 BLE model represent unique features on the market.

The accompanying web-based TERRATEST® software 'TEOLO' enables a statistical analysis of the test data in accordance with German standard TP BF-StB Part B 8.3. Our focus during its development has been to make it as user-friendly as possible.

### 4.2 Innovations

All 'TERRATEST' products have such outstanding, innovative features that they have become globally unique testing instruments for measuring bearing capacity:

#### 4.2.1 Mechanical Innovations::

- Ergonomic hexangular weight-catching grip with chamfered edges for a better grip of the drop weight
- Angled handles to facilitate handling of the load plate on the construction site and aid picking-up of the device by means of the mobile testing system 'CARRELLO'
- Firmly fixed safety grip with integrated spirit-level

#### 4.2.2 Electronic Innovations:

- Integrated GPS system with Google® Maps interface for immediate positioning
- Voice output to help and support the operator
- Bluetooth® transmitter and receiver unit for tests without cable ('TERRATEST 6000 BLE')
- 'Continuous measuring mode' for quick performance of several tests without additional operation of the testing computer, when multiple testing points are close to each other ('TERRATEST 6000 BLE')
- Text input function to add notes about material or altitude of the testing point
- Insertion of customer's company data on report documents possible
- Insertion of determined correlation factor for converted  $E_{V2}$  respectively  $E_{V1}$  values on report documents possible
- USB stick or 'STREAM' dongle (available upon request) for storage of measuring results
- Internal memory for up to 2000 tests, with USB interface
- Automatic plausibility check and result comparison of test data
- Audio signal
- Convenient graphic display with backlight for clear menu guidance, and for showing settlement curves during testing
- Quality connection assemblies featuring high-quality plugs and sockets
- Convenient, user-friendly web-based TERRATEST® software 'TEOLO' with statistics function for evaluating test data



### 4.3 Dynamic Plate Load Test

The dynamic plate load test with the Light Weight Deflectometer is a test method during which the ground is subjected to an impact load. This impact load is caused by a weight dropping onto a load plate with a diameter of 30 cm (radius  $r = 15$  cm), which generates a maximum force ( $F_{\max}$ ) of 7.070 kN. During calibration of the device this force is adjusted so that the normal stress ( $\sigma_{\max}$ ) under the load plate amounts to 0.1 MN/m<sup>2</sup> while tests are being performed. The parameter for the deformability of the soil under this defined vertical impact load  $t_{\max}$  is the so-called  $E_{vd}$  value.

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

$s_{\max}$  = mean value of the settlements  $\sigma_{4\max}$ ,  $\sigma_{5\max}$ ,  $\sigma_{6\max}$  of 3 tests (after 3 pre-consolidation tests)

$r$  = radius of the load plate (15 cm)

$\sigma_{\max}$  = normal stress under the load plate (0.1 MN/m<sup>2</sup>)

### 4.4 Area of Application

The dynamic plate load test with the Light Weight Deflectometer is suitable for testing the bearing capacity and the compaction of subsoil / soil on the subbase of earthworks and road constructions. 'Soil' shall be understood as including backfill materials, base courses without binding agents, soil improvements, cold recycling layers, mineral sealing layers, asphalt and cement, which has yet to set. The testing method is especially suitable for coarse-grained and mixed soils with a maximum grain size of 63 mm.

The test can be performed in less than two minutes by a single operator, without a load testing vehicle. Thus, it is possible to immediately evaluate the evenness of the bearing capacity within the inspection lot.

In Germany and Austria the dynamic plate load test may be performed as an alternative to the static plate load test according to DIN 18134.



**The use of the Light Weight Deflectometer always requires a prior determination of correlation values with the degree of compaction or the deformation modulus. The evaluation of the measured  $E_{vd}$  value depends on the material and the subsoil being tested. It is always necessary to determine correlation values of the static plate load test on a trial basis for the pre-existing ground or the ground intended for backfilling. Homogeneous ground is a prerequisite for properly correlating the two measuring methods. Accordingly, the water content of the soil must not vary widely at the different testing points.**



**ATTENTION (Quotation from ZTV E-StB 09)**

**'The deformation modulus  $E_{v2}$  is to be assessed by the static plate load test in accordance with DIN 18134 and the dynamic deflection module  $E_{vd}$  with the dynamic plate load test in accordance with TP BF-StB Part B 8.3.... The specifications of the building contract should state whether the static or dynamic deflection modulus is to be established. If no such statement is to be found in the contract, the static deformation modulus will need to be established.'**

One advantage over the static plate load test according to DIN 18134 is the possibility to perform tests in confined areas such as utility trenches or construction backfills.

In accordance with the German standard TP-BF StB Part B 8.3 the measuring range of a Light Weight Deflectometer with 10kg drop weight must be specified as 15 MN/m<sup>2</sup> to 70 MN/m<sup>2</sup>, since it is only within this measuring range that the device complies fully with the strict rules of the German Federal Road Research Institute (Bundesanstalt für Straßenwesen).

#### 4.5 Calibration

Before delivery 'TERRATEST 4000 STREAM' and 'TERRATEST 6000 BLE' are in standard calibrated according to German 'Technical Test Code for Soil and Rock Mechanics in Road Constructions TP BF-StB Part B 8.4'. Calibration acc. to Austrian Test Specification RVS 08.03.04 is also available as an option. During calibration all components of the device, such as the load plate with integrated sensor, the loading device and the electronic testing computer, are attuned specifically to one another. After successful calibration, respective calibration tags with the expiry date of the calibration are affixed to the load plate, the loading device, and the testing computer. These calibration marks also contain the name of the calibration institute and the BAST registration no. Each device is provided with a calibration certificate which meets the requirements of the German standard TP BF-StB Part B 8.3. A precise test result can only be guaranteed if the device is used as a single unit with all its corresponding parts. Identification plates with the same four-digit serial number are located on the load plate, the drop weight and the testing computer for this purpose. This serial number is also recorded on the calibration certificate. On the identification plate of the drop weight the date of the last calibration and the respective drop height of the weight in cm are also noted.

According to German standard TP BF-StB Part B 8.4 the device must be calibrated at least once a year at a calibration institute accredited by the German Federal Research Institute (Bundesanstalt für Straßenwesen).



**Test results of a device that has not been calibrated, or of a device with an expired calibration date, must not be used for evaluating the bearing capacity of soil and rock. Abide by the mandatory calibration intervals and ensure that the device is re-calibrated in due time.**



#### 4.6 12 Rules for Proper Use



**1. Always perform a correlation measurement with the static plate load test. For every static plate load test at least three dynamic tests must be performed.**

2. The section examined by the device reaches down to a maximum of 40 cm in depth, depending on backfill materials and subsoil.
3. Remove any loose material from the test area; create a smooth and level surface on which to place the load plate. Ensure full and even contact between the load plate and the ground. In the case of soil irregularities, spread a thin layer of sand on the surface and reduce the thickness of the layer by moving the plate back and forth.
4. Keep the guide rod vertical and make sure that the plate does not move horizontally during the impact.



**5. ATTENTION:** The transportation lock must be unlocked before each drop. Catch the weight on the side opposite the lock. No warranty for damages caused by improper use.

6. The decline of the test area must not be greater than 6°.
7. Pull on the plugs only, never on the measuring cable!
8. Never change the position of the release handle!
9. Before each test, make sure that the bottom side of the plate is clean and remove any material stuck to it.
10. The grain size of the material to be tested may be a maximum of 63 mm.
11. If the three settlement curves vary widely, re-compaction has occurred caused by the test.
12. Make sure that latching the drop weight into the release mechanism does not trigger an accidental reading of the testing computer.



**Only transport the loading device when the drop weight is in its 'rest' position at the bottom of the guide rod and the transportation lock is locked. Any other way of transport is prohibited, and carries with it considerable risk of accident due to the movement of the drop weight.**

#### 4.7 Proposal for the Correlation of Static / Dynamic Plate Load Test



The static and the dynamic plate load test differ from each other especially in the load speed and the pressure exerted on the ground. Therefore there is **no constant correlation** between the parameters  $E_{v1}$  /  $E_{v2}$  and  $E_{vd}$ .

In order to achieve the most accurate reading possible, we recommend performing site-specific correlation tests for every construction project directly on-site. To determine correlation values for the required backfill material we advise you to adhere to the following procedure: After the first phase of compaction work has been sufficiently completed, perform a static plate load test on the test area. Make sure that the loading vehicle leaves the area very carefully to avoid any ground disturbances. Afterwards, determine the water content of the backfill material. Then, in a circle around this first testing point, carry out eight dynamic plate load tests – four tests 30 cm away from the first testing point, and four 60 cm away, each with a 45 degree distance from the next. Several test sequences must be performed in succession along the centre of the compaction line; the required number depends on the size of the construction site. In all cases, at least three test sequences, at a distance of 20 metres from each other, should be performed.

The procedure must be repeated at other points of the test area. If the water content at the different testing points does not vary widely, compare the mean values of the measured  $E_{vd}$  values with the mean values of the  $E_v$  values obtained through the static test.

For the calculation of the  $E_{vd}$  mean value, ignore the two highest and the two lowest test results and consider only the four test results which show parameters close to each other. After having determined the correlation values  $E_{vd} / E_v$  all other tests can be performed with the Light Weight Deflectometer, provided that it is used on the same type of soil. Contractor and client should perform the correlation procedure together, so that they can both agree on the standard test method.

#### 4.8 Interpreting the Test Results

According to German standards ZTV E-StB 09, ZTV A-StB 12 and RIL 836 Deutsche Bahn AG as well as Austrian standard RVS 08.03.04, an inspection with the dynamic plate load test (in accordance with 'TP BF-StB Part 8.3 for Soil and Rock Mechanics in Road Constructions') can be conducted instead of the static plate load test. Please strictly follow the instructions of ZTV-E, ZTV-A and/or RVS 08.03.04 (Austria).

For every static plate load test at least three dynamic tests must be performed. However, these must not be conducted side by side, but can be spread over the entire test area.



**The evaluation of the measured  $E_{vd}$  value depends on the material and the subsoil being tested. It is always necessary to determine correlation values of the static plate load test on a trial basis for the pre-existing ground or the ground intended for backfilling. Homogeneous ground is a prerequisite for properly correlating the two measuring methods. Accordingly, the water content of the soil must not vary widely.**



**ATTENTION (Quotation from ZTV E-StB 09)**

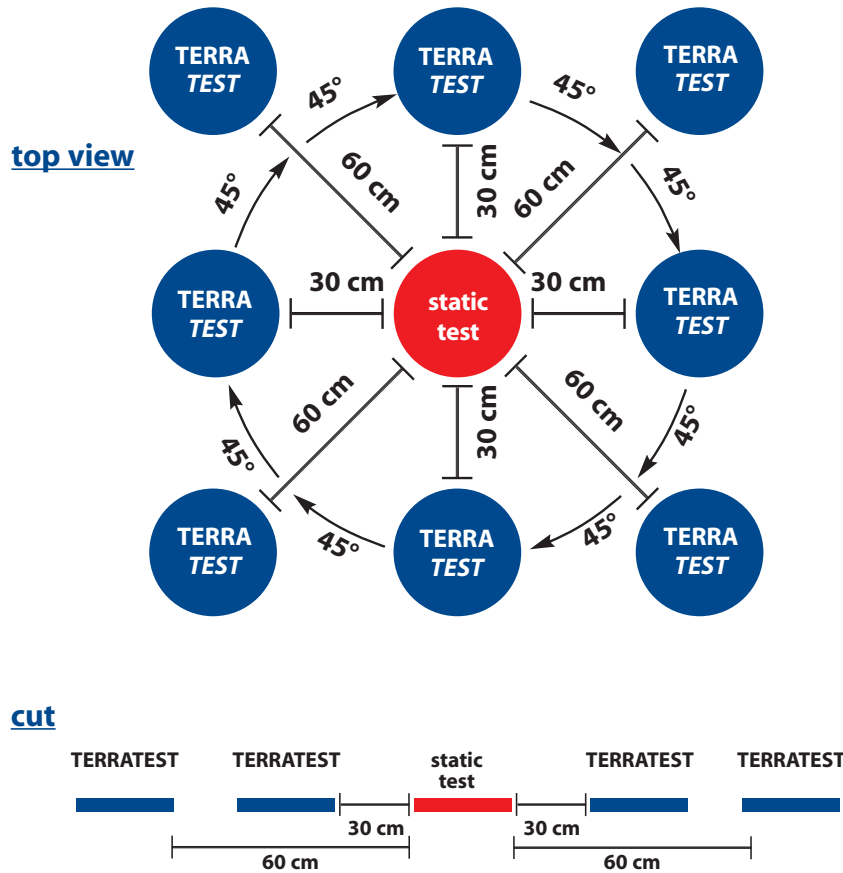
**'The deformation modulus  $E_{v2}$  is to be assessed by the static plate load test in accordance with DIN 18134 and the dynamic deflection module  $E_{vd}$  with the dynamic plate load test in accordance with TP BF-StB Part B 8.3.... The specifications of the building contract should state whether the static or dynamic deflection modulus is to be established. If no such statement is to be found in the contract, the static deformation modulus will need to be established.'**



**According to German standard TP BF-StB Part B 8.3 Light Weight Deflectometers must be calibrated at least once a year at a calibration institute accredited by the German Federal Road Research Institute (Bundesanstalt für Straßenbau). Send the device back to TERRATEST GmbH for calibration at least once a year, otherwise test results may be imprecise. Test results of a device that has not been calibrated, or of a device with an expired calibration date, must not be used for evaluating the bearing capacity of soil and rock. Abide by the mandatory calibration intervals.**



## Schematic Representation – Determination of Correlation Values Static / Dynamic Plate Load Test



**For general information only! All details are subject to change.**



Always perform a correlation measurement with the static plate load test, before evaluating the test results.

The water content at the different testing points must not vary widely.

For every static plate load test at least three dynamic tests must be performed.



**TERRATEST GmbH shall not be liable for any damage, consequential damage, or even financial loss that occurs as a result of improper use of the device and / or lack of professional knowledge when evaluating the test data. It is essential to ensure that the calibration of the device is always up to date, and that the device is always operated in accordance with the instructions of this document as well as your local standard.**



#### 4.9 Determining the Residual Compaction

If three individual curves are shown on the protocol printout (see Figure 1) and if the  $S_{max}$  value of the individual settlements decreases significantly, re-compaction has occurred caused by the test; further compaction work is usually necessary. In this case we recommend improving the compaction at the same place by performing 15 more impact drops with the Light Weight Deflectometer. Afterwards, repeat the compaction test. If the distance between the individual curves decreases, in the ideal case only one single curve composed of three congruent curves will be shown (see Figure 2), one can conclude that the ground can be further compacted without difficulty, due to residual compaction.

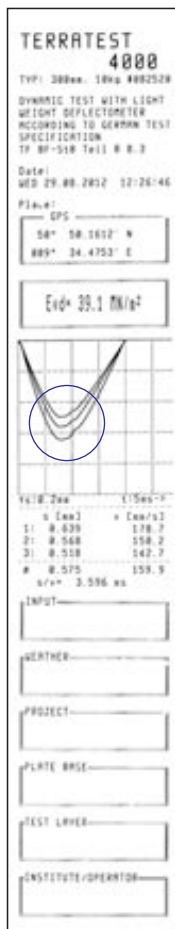


Figure 1: Test performed on relatively soft soil with visible re-compaction by the dynamic plate load test. Three individual curves are shown.

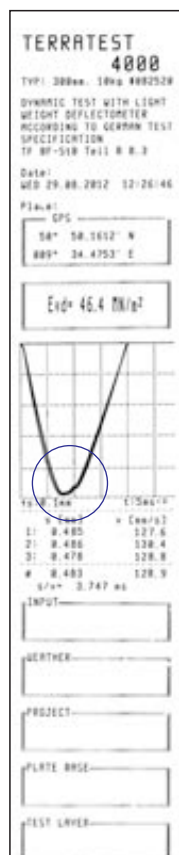


Figure 2: Test performed after 15 re-compacting impact drops with the Light Weight Deflectometer at the same testing point: The protocol printout shows a single settlement curve composed of three congruent curves. The Evd value, and thus the bearing capacity of the ground, has increased by 20% compared to the first test.

Further compaction work should be considered for this test area.

## 5. Test Execution 'TERRATEST 4000 STREAM' ('TERRATEST 6000 BLE' see page 38)

### 5.1 Preparing the Testing Point

Place the load plate on the ground, ensuring full and even contact between the load plate and the ground. Create a smooth and level surface on the area where the load plate will be placed. This can be done by moving the load plate back and forth, or by using appropriate tools (such as a trowel). Remove any loose soil from the area. In case of soil irregularities, spread a thin levelling layer of fine-grained quartz sand. Make sure to add only a few millimetres; it should compensate only for uneven patches under the load plate. Next, place the load plate on top and move it back and forth to reduce the thickness of the sand layer. Full contact between the load plate and the test area is essential.



### 5.2 Test Execution / Data Input Function

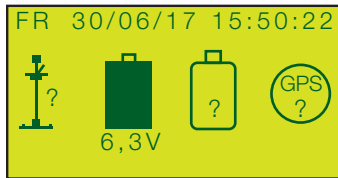
After preparing the testing point and placing the load plate on the ground, place the loading device in the centre of the sensor dome on the load plate.

Connect the sensor dome of the load plate with the testing computer, using the measuring cable.

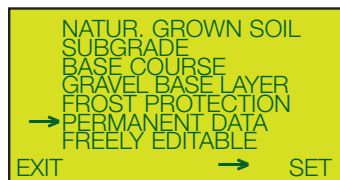
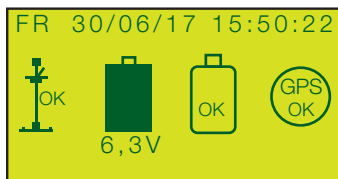
Press and hold the start button to turn on the testing computer. To activate the backlight of the graphic display, press the start button for approximately three seconds, when turning on the device, until the start screen switches automatically to 'STATUS REQUEST'.



START SCREEN



STATUS REQUEST



TEXT INPUT MODE

When turning on the testing computer with the backlight off, the start screen will show the 'TERRATEST 4000 USB' logo, the firmware version number as well as the expiration date of calibration as initial screen for approximately three seconds, until the start screen switches automatically to STATUS REQUEST.

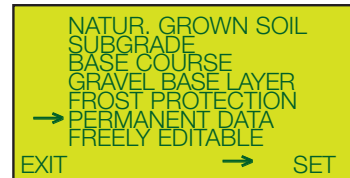
STATUS REQUEST checks sensor connection, battery charge, USB stick respectively readiness to 'STREAM' dongle and GPS operation and acknowledges availability by 'OK' in the display, and the voice output by 'Welcome to TERRATEST. Sensor OK. Start test'. If one of these features is unavailable, display shows '?' instead. Absent sensor connection is notified by voice output 'No sensor'. Checking the GPS connection can take 2-3 minutes. If the sensor connection is not established, the computer will not progress to the measuring mode and no test can be performed. The current battery charge is visualized by charge level of battery as well as by voltage value below the battery symbol.

If the USB stick respectively the 'STREAM' dongle is not recognized at once, turn the device OFF; pull off the USB stick or 'STREAM' dongle, insert the element again and switch ON the device again. If the problem persists verify whether the concerned element is correctly formatted. In case of need, formatting procedure can be carried out at the PC by a right clicking on the drive symbol of USB stick or 'STREAM' dongle in context menu 'Format...'. .

Return to measurement mode by briefly pressing Start button. Long pressing start button opens text input mode, featuring 5 predefined soil layers and two editable text field for selection.



Each of the displayed soil layers can be chosen by 'SELECT' button, individual text entry is also possible PERMANENT DATA or FREE EDITABLE. Press START button to accept the selection, and the measurement mode opens automatically.



Pressing PERMANENT DATA and FREE EDITABLE opens data entry mode. Select the desired digits by <= or =>, and confirm the selection by 'ENTER' and briefly pressing START button.

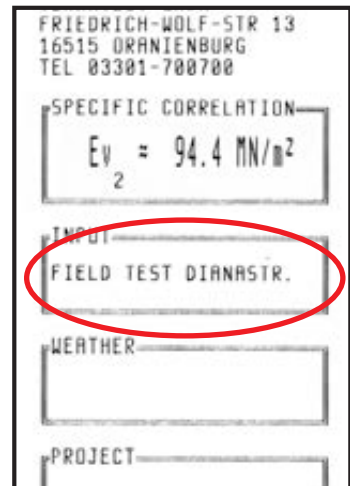
Press 'TEXT' to select particular characters to overwrite or delete them.



Long pressing 'START' button confirms data input and directly guides to measuring mode. Data entry is stored on data carrier.

Each selection respectively text entry remains stored as long as the device is activated, or the entry is overwritten. PERMANENT data remain stored even when the device is switched OFF.

The confirmed entry will be shown in the 'INPUT' field of the protocol printout and in the 'Comments' field of the web-based software 'TEOLO'.



After placing the loading device on the metal ball in the centre of the sensor dome, unlock the transportation lock of the drop weight by pulling the orange knob. The transportation lock should only be unlocked immediately prior to a test being performed, as uncontrolled movements of the weight may cause injury or damage to the device or its surroundings.



**Ensure that the transportation lock is unlocked before each drop.**

In case of improper use, i.e. if the weight is dropped while the transportation lock is still pushed in, damage to the device may occur. Damage caused by improper use is not covered by the device warranty.



Regularly check that the transportation lock of the drop weight is functioning properly. If you notice signs of wear, stop using the device immediately. Send the device back to TERRATEST GmbH for the transportation lock to be repaired or replaced.



UNLATCHING THE TRANSPORTATION LOCK



Put on hearing protectors before the first drop. **Hearing protectors must be worn when operating the Light Weight Deflectometer, since the noise level may rise over 85 dB during the test. ATTENTION: Operating the device without hearing protection can result in permanent hearing impairment.**

Following the instruction by voice output 'FIRST PRELOAD', and display instruction '**LFG 1.0 1. Preload**', continue with the first pre-consolidation test as follows: Take hold of the blue safety grip at the end of the guide rod; open the release mechanism by pushing the green start lever towards the guide rod and holding it there. With your other hand pull up the unlocked drop weight all the way until it stops. Fix it in place by releasing the green start lever and thus latching the drop weight into the release mechanism. The drop weight is now fastened securely in the release mechanism on top of the device. Open the release mechanism by pushing the green start lever towards the guide rod, and let the drop weight fall freely until it hits the spring assembly. Catch the drop weight immediately after first contact and in the same way as described above, latch it back into the release mechanism. In total, six drops are required to complete the test (three preloads and three test drops).

After hearing the audio signal and receiving the instruction '**LFG 1.0 2. Preload**' on display and voice message 'SECOND PRELOAD', continue with the second pre-consolidation test in the same way as described above. The testing computer will not register any drops performed before the audio signal.

After hearing the audio signal and receiving the instruction '**LFG 1.0 3. Preload**' on display and voice message 'THIRD PRELOAD', continue with the third pre-consolidation test in the same way as described above.

The device checks the results of the three pre-consolidation tests and then progresses automatically to the main test.

After hearing the audio signal and receiving the instruction '**LFG 1.0 1. Test**' on display and voice message 'FIRST TEST', continue with the first test in the same way as described above.

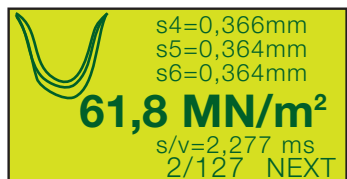
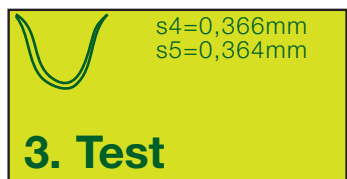
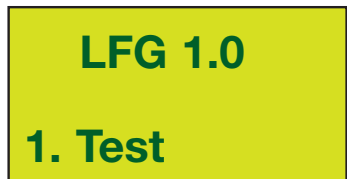
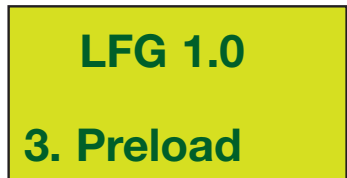
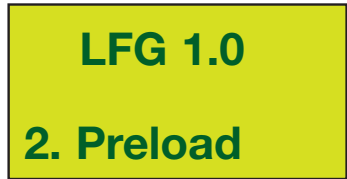
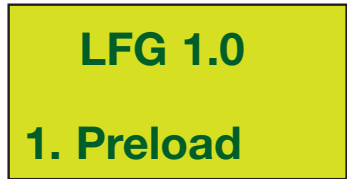
After performing the first test, the device will show the settlement  $s_4$  in mm, as well as the respective settlement curve.

After hearing the audio signal and receiving the instruction '**2. Test**' on display and voice message 'SECOND TEST', continue with the second test in the same way as described above

After performing the second test, the device will show the settlements of both prior tests,  $s_4$  and  $s_5$ , in mm, as well as the respective settlement curves.

After hearing the audio signal and receiving the instruction '**3. Test**' on display and voice message 'THIRD TEST', continue with the third test in the same way as described above.

After performing the third test, the device will show the settlements  $s_4$ ,  $s_5$  and  $s_6$  in mm, as well as the respective settlement curves. Additionally the final result of  $E_{vd}$  value is displayed in  $MN/m^2$ . Simultaneously it is also announced by voice output, rounded to integers in  $MN/m^2$ .



A longer audio signal (a beep lasting 1 second) and the voice message 'TEST COMPLETED. LAY DOWN WEIGHT AT THE BOTTOM' informs the user about the end of the test, and about registration of the measurement in the internal memory and on USB stick (if plugged in). All test data including settlement curves, GPS coordinates, date, time, serial number, device type, and the test results themselves, are now saved. The protocol can be printed by pressing the 'PRINT' button. Alternatively, continue with the next test by pressing the 'START' button (NEXT) again.

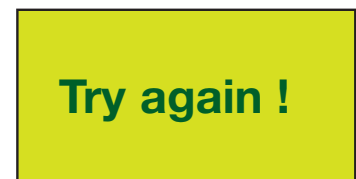


Keep the safety grip on top of the device tight in your hand during the whole test. When a test is not being performed, never leave the weight latched on top of the loading device, as it could fall over and cause injury or damage. The drop weight should only be latched on top of the device immediately prior to an upcoming test. While in use, only the operator should come close to the device. All other persons should stay at a safe distance to ensure that no one is injured by the dropping weight. After the sixth drop place the drop weight in its 'rest' position on top of the bellows at the bottom of the device and lock it immediately with the transportation lock.



Ensure that the guide rod is kept upright during the impact. Use the spirit level integrated in the safety grip to aid in the vertical positioning of the guide rod. The test is invalid if the load plate moves horizontally during the impact. This risk exists particularly if the test area is inclined. Avoid sideward movements of the load plate on inclined test areas by placing your foot against the side of the plate. Never stand on the plate! Doing so will distort the test results. Every correct impact will be acknowledged by an audio signal (a single beep).

A different signal (a stuttering beep) will announce a possible measuring error. In this event, 'Try again' will be shown on the display, accompanied by 'REPEAT DROP' via voice output. Should this occur, move the load plate and restart the complete test from the first pre-consolidation drop.



If this error message 'REPEAT DROP' shows again, the soil is probably much too hard or much too soft, so that the measured value is outside the measuring range. In this case, move the load plate to another testing point and repeat the test there.

The sensitivity of the testing computer is set up in such a way that a normal placing of the loading device on the load plate, or a normal latching of the drop weight into the release mechanism will not trigger a measurement.

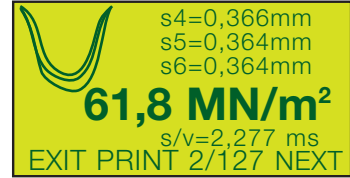


However, abrupt movements when placing the loading device on the load plate, or latching the drop weight into the release mechanism, may trigger an impulse. The electronic plausibility check will recognise the error and the device will restart the complete test. Move the load plate and start the test procedure again from the beginning.

If the settlement is very small, it is advisable to push the loading device onto the metal ball of the sensor dome during impact. Doing so will help to avoid a possible rebound of the guide rod and thus a distortion of the test results.

### 5.3 Printing the Test Protocol

The integrated thermal printer allows printouts of the test protocols to be created conveniently on-site, immediately after the test; protocols can also be printed at any later point in time. The protocol shows all data obtained during the test (see printout on page 37). To print the test protocol, activate the thermal printer by pressing the 'PRINT' button. It is located on the internal control panel. During printing process, the green control lamp of the printer will show green. When printing is finished, detach the protocol by tearing it against the tear-bar. If the green light is flashing and the thermal printer does not start printing after pressing the 'PRINT' button, this is usually due to the absence of paper. In this case, follow the instructions below to insert a new roll of paper. The button for the paper feed is located on the left of the green control lamp.



### 5.4 Changing the Paper

A flashing green control lamp signals the absence of paper. To open the paper tray and replace the paper roll, press the button on the green control lamp. Lift the cover and insert the new thermal paper roll (57 mm wide and 25 mm long) with the coated side facing outwards. One roll of paper will print approximately 100 printouts. Unroll approximately 10 cm of the edge of the paper and hold it up, while closing the printer by gently pressing the cover on both sides. Detach the protruding end of the paper by tearing it against the tear-bar. The printer is now ready for use again. An ink ribbon is not necessary for the thermal print method.

Use only thermal paper; the coated, heat-sensitive side must face outwards. Suitable paper rolls can be obtained in most office supply stores, or ordered at TERRATEST GmbH.

Specifications of paper rolls:

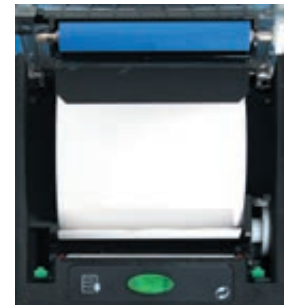
Thermal paper roll  
Width 57 mm  
Length 25 metres  
Diameter 47 mm  
Core 12 mm



If you intend to store printouts for an extended period of time, make sure that the thermal paper is not exposed to direct sunlight or temperatures over 30°C. Thermal paper ages relatively quickly, so ensure to make copies on normal paper.



*During the printing process the control lamp will show green.*



*Inserting a new roll of thermal paper*

**Printout of the Test Protocol**

**TERRATEST**  
**4000 VOICE**  
 FW 0021 #176442  
 TYP: 300mm, LFG 1.0

DYNAMIC LOAD PLATE TEST  
 WITH LIGHT WEIGHT  
 DEFLECTOMETER ACC. TO  
 GERMAN TECHNICAL  
 SPECIFICATIONS  
 TP BF-StB PART 08.3-12  
 & STANDARD TEST METHOD  
 ASTM E2835-11

Date:  
 MON 04.03.2019 09:38:29

Place:  
 GPS  
 52° 44.6150' N  
 013° 15.8568' E

$E_{vd} = 47.2 \text{ MN/m}^2$

ts: 0.2mm      t: 5ms →

s [mm]	v [mm/s]
4: 0.482	139.7
5: 0.478	138.2
6: 0.472	136.6
Ø 0.477	138.2
s/v* 3.451 ms	

TERRATEST GMBH  
 FRIEDRICH-WOLF-STR 13  
 16515 ORANIENBURG  
 TEL 03301-700700

SPECIFIC CORRELATION  
 $E_v = 94.4 \text{ MN/m}^2$

INPUT  
 FIELD TEST DIANASTR.

WEATHER

PROJECT

PLATE BASE

TEST LAYER

INSTITUTE/OPERATOR

device name

device type

date of test

dynamic deflection module

zero point test area

maximum settlement

average maximum settlement

s/v value: relation between settlement and speed

display of text input function

serial number

German standard

time of test

GPS coordinates of testing point

progress of settlement with the three settlement curves

maximum speed of immersion

average maximum speed of immersion

address (only visible if activated, see p. 58)

Specific correlation (only visible if activated, see p. 59)

handwritten comments



## 6. Test Execution 'TERRATEST 6000 BLE' ('TERRATEST 4000 STREAM' see page 32)

### 6.1 Preparing the Testing Point

Place the load plate on the ground, ensuring full and even contact between the load plate and the ground. Create a smooth and level surface on the area where the load plate will be placed. This can be done by moving the load plate back and forth, or by using appropriate tools (such as a trowel). Remove any loose soil from the area. In case of soil irregularities, spread a thin levelling layer of fine-grained quartz sand. Make sure to add only a few millimetres; it should compensate only for uneven patches under the load plate. Next, place the load plate on top and move it back and forth to reduce the thickness of the sand layer. Full contact between the load plate and the test area is essential.



### 6.2 Test Execution / Data Input Function

After preparing the testing point and placing the Bluetooth® load plate on the ground, turn on the Bluetooth® sensor dome by pressing the green button on the Bluetooth® sensor dome. The Bluetooth® sensor dome will perform a quick self-test. This will be shown by changing LED colours of the 'magic eye'. At the end of the self-test the LED will turn red. Place the loading device in the centre of the Bluetooth® sensor dome on the load plate which must be switched ON.

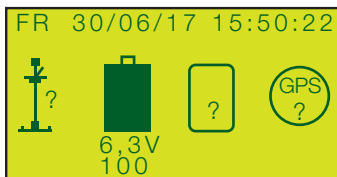


**During the test the 'magic eye' (the transparent hemisphere), which protects the antenna of the Bluetooth® transmitter, must always face the testing computer.**

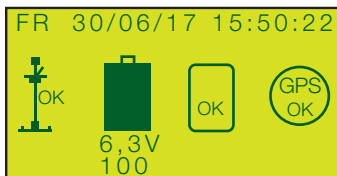
Press and hold the 'START' button to turn on the testing computer. To activate the backlight of the graphic display, press the 'START' button for approximately three seconds, when turning on the device, until the start screen switches automatically to 'STATUS REQUEST'. An audio sonar signal announces the setup of the Bluetooth® connection to the Bluetooth® load plate. Once established, you will hear the voice instruction: 'Bluetooth OK, start test.' The 'magic eye' on the Bluetooth® sensor dome will show blue.



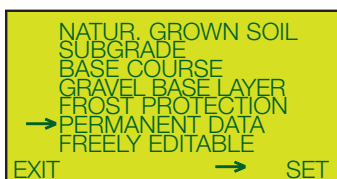
START SCREEN



STATUS REQUEST



STATUS REQUEST



TEXT INPUT MODE

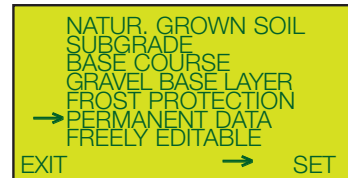
When turning on the testing computer with the backlight off, the start screen will show the 'TERRATEST 6000 BLE' logo, the firmware version number as well as the expiration date of calibration as initial screen for approximately three seconds, until the start screen switches automatically to STATUS REQUEST.

STATUS REQUEST checks sensor connection, battery charge, USB stick respectively readiness to 'STREAM' dongle and GPS operation and acknowledges availability by 'OK' in the display, and the voice output by 'Welcome to TERRATEST. Sensor OK. Start test' If one of these features is unavailable, display shows '?' instead. Absent sensor connection is notified by voice output 'No sensor'. Checking the GPS connection can take 2-3 minutes. If the sensor connection is not established, the computer will not progress to the measuring mode and no test can be performed. The current battery charge is visualized by charge level of battery as well as by voltage value below the battery symbol.

If the USB stick respectively the 'STREAM' dongle is not recognized at once, turn the device OFF; pull off the USB stick or 'STREAM' dongle, insert the element again and switch ON the device again. If the problem persists verify whether the concerned element is correctly formatted. In case of need, formatting procedure can be carried out at the PC by a right clicking on the drive symbol of USB stick or 'STREAM' dongle in context menu 'Format...'.  
Return to measurement mode by briefly pressing Start button. Long pressing start button opens text input mode, featuring 5 predefined soil layers and two editable text field for selection.



Each of the displayed soil layers can be chosen by 'SELECT' button, individual text entry is also possible PERMANENT DATA or FREE EDITABLE. Press START button to accept the selection, and the measurement mode opens automatically.



Pressing PERMANENT DATA and FREE EDITABLE opens data entry mode. Select the desired digits by <= or =>, and confirm the selection by 'ENTER' and briefly pressing START button.

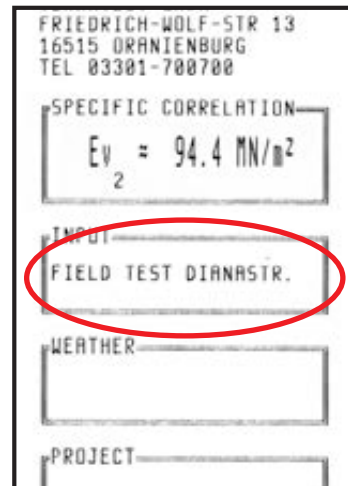
Press 'TEXT' to select particular characters to overwrite or delete them.



Long pressing 'START' button confirms data input and directly guides to measuring mode. Data entry is stored on data carrier.

Each selection respectively text entry remains stored as long as the device is activated, or the entry is overwritten. PERMANENT data remain stored even when the device is switched OFF.

The confirmed entry will be shown in the 'INPUT' field of the protocol printout and in the 'Comments' field of the web-based software 'TEOLO'.



After placing the loading device on the metal ball in the centre of the Bluetooth® sensor dome, unlock the transportation lock of the drop weight by pulling the orange knob. The transportation lock should only be unlocked immediately prior to a test being performed, as uncontrolled movements of the weight may cause injury or damage to the device or its surroundings.



**Ensure that the transportation lock is unlocked before each drop.**

In case of improper use, i.e. if the weight is dropped while the transportation lock is still pushed in, damage to the device may occur. Damage caused by improper use is not covered by the device warranty.



Regularly check that the transportation lock of the drop weight is functioning properly. If you notice signs of wear, stop using the device immediately. Send the device back to TERRATEST for the transportation lock to be repaired or replaced.



UNLATCHING THE TRANSPORTATION LOCK



**Put on hearing protectors before the first drop. Hearing protectors must be worn when operating the Light Weight Deflectometer, since the noise level may rise over 85 dB during the test. ATTENTION: Operating the device without hearing protection can result in permanent hearing impairment.**

When Bluetooth® connection is established, the Status LED of the Bluetooth® load plate is lit in green (and signals that the system is ready for data transfer from Bluetooth® load plate to measuring computer. Following the voice instruction **'FIRST PRELOAD'** and the display instruction **'LFG 1.0 1. Preload'**, continue with the first pre-consolidation test as follows: Take hold of the blue safety grip at the end of the guide rod; open the release mechanism by pushing the green start lever towards the guide rod and holding it there. With your other hand pull up the unlocked drop weight all the way until it stops. Fix it in place by releasing the green start lever and thus latching the drop weight into the release mechanism on top of the device. Open the release mechanism by pushing the green start lever towards the guide rod, and let the drop weight fall freely until it hits the spring assembly. Catch the drop weight immediately after first contact and, in the same way as described above, latch it back into the release mechanism. The Status LED of the Bluetooth® load plate is lit in blue and signals that the system is ready for data transfer to measuring computer. When the color of the lamp changes to green, the instrument is ready to perform the next test. In total, six drops are required to complete the test (three preloads and three test drops).

After hearing the audio signal, receiving the instruction **'LFG 1.0 2. Preload'** on the display of the testing computer, and hearing the voice instruction **'SECOND PRELOAD'**, continue with the second pre-consolidation test in the same way as described above. The testing computer will not register any drops performed before the acoustic signal.

After hearing the audio signal, receiving the instruction **'LFG 1.0 3. Preload'** on the display of the testing computer, and hearing the voice instruction **'THIRD PRELOAD'**, continue with the third pre-consolidation test in the same way as described above.

The device checks the results of the three pre-consolidation tests and then progresses automatically to the main test.

After hearing the audio signal, receiving the instruction **'LFG 1.0 1. Test'** on the display of the testing computer, and hearing the voice instruction **'FIRST TEST'**, continue with the first test in the same way as described above.

After performing the first test, the device will show the settlement  $s_4$  in mm, as well as the respective settlement curve.

After hearing the audio signal, receiving the instruction **'2. Test'** on the display of the testing computer, and hearing the voice instruction **'SECOND TEST'**, continue with the second test in the same way as described above.

After performing the second test, the device will show the settlements of both prior tests,  $s_4$  and  $s_5$ , in mm, as well as the respective settlement curves.

After hearing the audio signal, receiving the instruction **'3. Test'** on the display of the testing computer, and hearing the voice instruction **'THIRD TEST'** continue with the third test in the same way as described above.



'Magic eye' GREEN: ready for testing


**LFG 1.0**  
**1. Preload**


**LFG 1.0**  
**2. Preload**

**LFG 1.0**  
**3. Preload**

**LFG 1.0**  
**1. Test**

  $s_4=0,366\text{mm}$   
**2. Test**

  $s_4=0,366\text{mm}$   
 $s_5=0,364\text{mm}$   
**3. Test**

  $s_4=0,366\text{mm}$   
 $s_5=0,364\text{mm}$   
 $s_6=0,364\text{mm}$   
**61,8 MN/m<sup>2</sup>**  
 $s/v=2,277\text{ ms}$   
EXIT PRINT 2/127 NEXT

After performing the third test, the device will show the settlements s4, s5 and s6 in mm, as well as the respective settlement curves. Additionally, the final result, the E<sub>vd</sub> value in MN/m<sup>2</sup>, will be shown and will also be announced, rounded to whole numbers in MN/m<sup>2</sup>, via the voice output.

A longer audio signal (a beep lasting one second) and the voice output '**TEST FINISHED, PLACE WEIGHT BELOW**' announces the end of the test and the recording of measured data on both the internal memory and the USB stick (if in use). All test data including settlement curves, GPS coordinates, date, time, serial number, device type, and the test results themselves are now saved. The protocol can be printed by pressing the 'PRINT' button. Alternatively, continue with the next test by pressing the 'START' button (NEXT) again.



Keep the safety grip on top of the device tight in your hand during the whole test. When a test is not being performed, never leave the weight latched on top of the loading device, as it could fall over and cause injury or damage. The drop weight should only be latched on top of the device immediately prior to an upcoming test. While in use, only the operator should come close to the device. All other persons should stay at a safe distance to ensure that no one is injured by the dropping weight. After the sixth drop place the drop weight in its 'rest' position on top of the bellows at the bottom of the device and lock it immediately with the transportation lock.



Ensure that the guide rod is kept upright during the impact. Use the spirit level integrated in the safety grip to aid in the vertical positioning of the guide rod. The test is invalid if the load plate moves horizontally during the impact. This risk exists particularly if the test area is inclined. Avoid sideward movements of the load plate on inclined test areas by placing your foot right next to the plate. Never stand on the plate! Doing so will distort the test results. Every correct impact will be acknowledged by an audio signal (a single beep).

A different signal (a stuttering beep) will announce a possible measuring error. In this event 'Try again' will be shown on the display, accompanied by 'REPEAT DROP' via voice output. Should this occur, move the load plate and restart the complete test from the first pre-consolidation drop.

If the error message shows again, the soil is probably much too hard or much too soft, so that the measured value is outside the measuring range. In this case, move the Bluetooth® load plate to another testing point and repeat the test there.

**Try again !**

The sensitivity of the testing computer is set up in such a way that a normal placing of the loading device on the Bluetooth® load plate, or a normal latching of the drop weight into the release mechanism will not trigger a measurement.



However, abrupt movements when placing the loading device on the Bluetooth® load plate, or latching the drop weight into the release mechanism, may trigger an impulse. The electronic plausibility check will recognise the error and the device will restart the complete test. Move the load plate and start the test procedure again from the beginning.

If the settlement is very small, it is advisable to push the loading device onto the metal ball of the sensor dome during impact. Doing so will help to avoid a possible rebound of the guide rod and thus a distortion of the test results.

### 6.3 The 'Magic Eye' of the Bluetooth® Sensor Dome

The Bluetooth® transmission unit of the Bluetooth® sensor dome is equipped with a status LED, which indicates three different states. During the test, these are displayed via the 'magic eye' (a transparent hemispherical cover over the transmitter) on the Bluetooth® sensor dome.

#### 'Magic Eye' RED

After turning on the transmission unit by pressing the button on the Bluetooth® sensor dome, the 'magic eye' will show red, indicating that the device is ready for use. In this state, the Bluetooth® sensor dome is waiting for the connection with the testing computer to be established. If the 'magic eye' switches to red during the test, it indicates that the Bluetooth® connection between the testing computer and the Bluetooth® load plate has been lost. This may be caused by the distance between the Bluetooth® load plate and the testing computer being too great. In this case, testing stops and the voice output of the testing computer will issue a sonar signal and voice message 'NO SENSOR', indicating that the testing computer is attempting to re-establish the connection. Reduce the distance between the Bluetooth® load plate and the testing computer. Another possible cause for the failure might be that the automatic switchoff mechanism of the testing computer has turned off the computer after three minutes of inactivity. In this case, turn the testing computer back on and wait for the connection to be re-established. If the Bluetooth® connection has been successful, the voice instruction will announce 'BLUETOOTH OK – START TEST'.

#### 'Magic Eye' BLUE

If the Bluetooth® connection between the testing computer and the Bluetooth® load plate has been successfully established, the 'magic eye' will show blue. The voice output of the testing computer will also indicate the successful connection by announcing 'BLUETOOTH OK – START TEST'.

**Always ensure that the 'magic eye' faces towards the testing computer, so that there is a line of sight between the two.**

#### 'Magic Eye' GREEN

Whenever the Bluetooth® sensor dome is ready to start a test, the 'magic eye' will show green. After every drop the test data will be transferred to the testing computer. During data transfer the 'magic eye' will switch to blue. As soon as the data transfer is finished the 'magic eye' will switch back to green, indicating that the device is ready for the next drop.

#### Test Mode of the LED Light

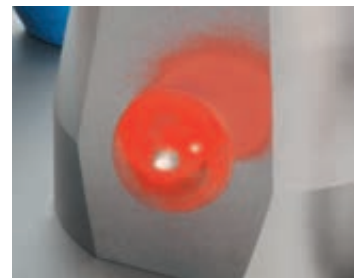
The test mode of the LED diodes on the 'Magic Eye' will be started by pressing the green button on the Bluetooth® sensor dome and holding it down for 5 seconds. The LED diodes will now change colours. To end the test mode press and hold down the green button on the Bluetooth® sensor dome until the LED turns red.



Control elements of the Bluetooth® sensor dome



View of the 'magic eye' on Bluetooth® sensor dome



'Magic Eye' RED:  
the sensor dome is ready for use and waiting for connection



'Magic Eye' BLUE:  
the connection is established



'Magic Eye' GREEN:  
ready to start a test

### Error Displays in LED Screen

If after switching ON the Bluetooth® load plate the LED diodes of the 'Magic Eye' start to flash ten times in Blue with the Bluetooth® load plate switching OFF, the battery pack of the Bluetooth® load plate needs recharging. Connect the charging device as described on page 21.

If after switching ON the Bluetooth® load plate the LED diodes of the 'Magic Eye' start to flash ten times in Red with the Bluetooth® load plate switching OFF, the battery pack is defective and must be replaced. Consult TERRATEST® customer support.

### 6.4 Continuous Measuring Mode

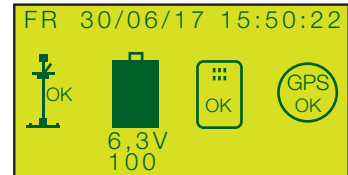
If the test shall be performed on several testing points close to each other, the testing computer can be operated in 'CONTINUOUS MEASURING MODE'. In this mode tests can be performed in quick succession, without the need to operate the testing computer between each individual test.

To turn on the 'CONTINUOUS MEASURING MODE', press the 'SELECT' button during 'STATUS REQUEST'. In the 'MAIN MENU' press the 'SELECT' button, until the arrow is positioned on the menu entry 'SENSOR'. Then press the 'START' button to select the menu 'SENSOR'. Finally, press the 'START' button again to select the menu 'STAND-BY TIME'.

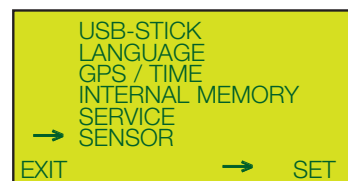
By 'SELECT' button, increase the Standby phase in steps of 5 minutes up to a maximum of 30 minutes up to a maximum of 30 minutes. Automatic Switch-OFF is increased to this value as well. Press EXIT to confirm the value. Continue pressing the EXIT button,, until the screen shows 'STATUS REQUEST' again. Then start the first test, as described above, by pressing START button. The activated 'CONTINUOUS MODE' is confirmed by voice message 'CONTINUOUS MODE ON' and display 'LIFT WEIGHT'. The voice output will then direct you through the test, as described above. At the end of the test, move to the next testing point. Firmly latch the drop weight back into the release mechanism. This will start the next test without needing to operate the testing computer.

If no new test is started within the set wait time, the testing computer will switch off automatically.

The 'STAND-BY TIME' can be set back to '00 MIN' by using the 'PRINT' button. The testing computer will then go back to single measuring mode and will operate with the default switch-off after three minutes of inactivity.



STATUS DISPLAY



MAIN MENU



MENU SENSOR

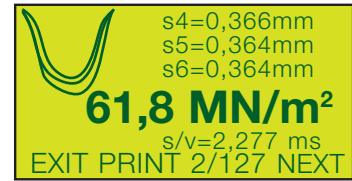


Measurement by firmly latching the drop weight.



### 6.5 Printing the Test Protocol

The integrated thermal printer allows printouts of the test protocols to be created conveniently on-site, immediately after the test; protocols can also be printed at any later point in time. The protocol shows all data obtained during the test (see printout on page 45). To print the test protocol, activate the thermal printer by pressing the 'PRINT' button. It is located on the internal control panel. During the printing process the control lamp will show green. When printing is finished, detach the protocol by tearing it against the tear-bar. If the green light is flashing and the thermal printer does not start printing after pressing the 'PRINT' button, this is usually due to the absence of paper. In this case, follow the instructions below to insert a new roll of paper. The button for the paper feed is located on the left of the green control lamp.



### 6.6 Changing the Paper

A flashing green control lamp signals the absence of paper. To open the paper tray and replace the paper roll press the button on the green control lamp. Lift the cover and insert the new thermal paper roll (57 mm wide and 25 mm long) with the coated side facing outwards. One roll of paper will print approximately 100 printouts. Unroll approximately 10 cm of the edge of the paper and hold it up, while closing the printer by gently pressing the cover on both sides. Detach the protruding end of the paper by tearing it against the tear-bar. The printer is now ready for use again. An ink ribbon is not necessary for the thermal print method.

Use only thermal paper; the coated, heat-sensitive side must face outwards. Suitable paper rolls can be obtained in most office supply stores, or ordered at TERRATEST GmbH.

Specifications of paper rolls:

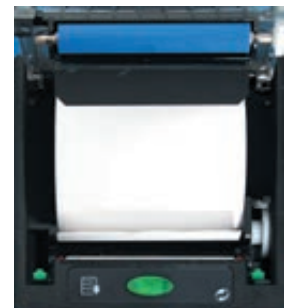
Thermal paper roll  
Width 57 mm  
Length 25 Meter  
Diameter 47 mm  
Core 12 mm



If you intend to store printouts for an extended period of time, make sure that the thermal paper is not exposed to direct sunlight or temperatures over 30°C. Thermal paper ages relatively quickly, so ensure to make copies on normal paper.



*During the printing process the control lamp will show green.*



*Inserting a new roll of thermal paper*



**Printout of the Test Protocol**

**TERRATEST 6000 BLE**  
 FW 6020 #191329  
 TYP: 300mm, LFG 1.0

DYNAMIC LOAD PLATE TEST  
 WITH LIGHT WEIGHT  
 DEFLECTOMETER ACC. TO  
 GERMAN TECHNICAL  
 SPECIFICATIONS  
 TP BF-StB PART 88,3-12  
 & STANDARD TEST METHOD  
 ASTM E2835-11

Date:  
 MON 04.03.2019 09:38:29

Place:  
 GPS  
 52° 44.6150' N  
 013° 15.8568' E

$E_{vd} = 47.2 \text{ MN/m}^2$

Graph showing settlement curves with axes for time (t) and settlement (s).

s [mm]	v [mm/s]
4: 0.482	139.7
5: 0.478	138.2
6: 0.472	136.6
$\bar{s}$ 0.477	138.2
$s/v^*$ 3.451 ms	

TERRATEST GMBH  
 FRIEDRICH-WOLF-STR 13  
 16515 ORANIENBURG  
 TEL 03301-700700

SPECIFIC CORRELATION  
 $E_v = 94.4 \text{ MN/m}^2$

INPUT  
 FIELD TEST DIANASTR.  
 WEATHER  
 PROJECT  
 PLATE BASE  
 TEST LAYER  
 INSTITUTE/OPERATOR

device name

device type

date of test

dynamic deflection module

zero point test area

maximum settlement

average maximum settlement

s/v value: relation between settlement and speed

display of text input function

serial number

German standard

time of test

GPS coordinates of testing point

progress of settlement with the three settlement curves

maximum speed of immersion

average maximum speed of immersion

address (only visible if activated, see p. 58)

Specific correlation (only visible if activated, see p. 59)

handwritten comments

## 7. Menu Guidance

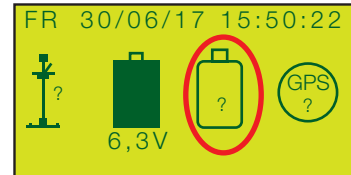
### 7.1 Menu 'USB STICK'

All commercially available USB sticks can be used. However, pay attention to the height of the USB stick; if it has a height over 45 mm, it could cause damage to the testing computer when closing the cover. The USB stick can be replaced by an optional STREAM dongle for extended functions, which has to be inserted to the measuring computer by means of an angular adapter. This element acts like a normal USB stick.

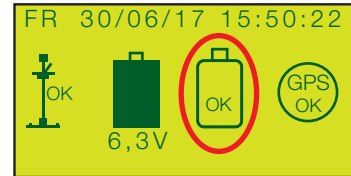
If a USB stick is in use, all test data will be automatically saved to both the USB stick and the internal memory. The supplied USB stick is already formatted. When turning on the device make sure that the display shows an 'OK' on the USB stick icon during 'STATUS REQUEST'.

Every test saved to the USB stick receives a consecutive data record number. Tests performed on the same day will be saved in one folder, named after the test date.

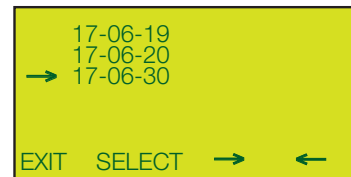
The data on the USB stick can only be deleted by re-formatting the medium on the PC. The USB stick can be used again afterwards. It is only possible to delete ALL data from the USB stick. Deleting single records from the USB stick is not possible.



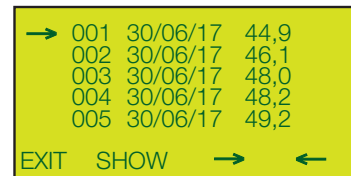
USB STICK NOT AVAILABLE



USB STICK AVAILABLE



FOLDER LIST



TEST DATA LIST

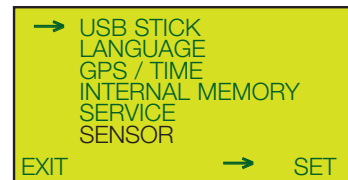
## 7.2 Subsequent Printing of Test Data

Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'USB STICK' from the menu. Press the 'START' button (SET) to enter the test data list. You will then be forwarded to the folder list, named after the date on which the respective test was performed. Move the arrow with the 'START' and 'SELECT' buttons to the folder of your choice. Open the folder with the 'PRINT' button and enter the test data list.

All tests with their consecutive data record number, date and Evd value will be shown on the display. Move the arrow with the 'START' and 'SELECT' buttons to select the data record which you would like to print. Upon pressing the 'PRINT' button (SHOW) the test data of the selected test will be shown. Press the 'PRINT' button again to print the corresponding test protocol.

Pressing the 'RESET/OFF' button (EXIT) will direct you to the 'TEST DATA LIST'. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.

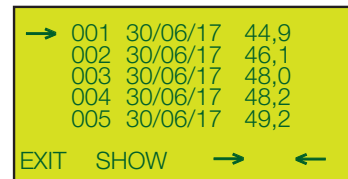
If no test data is saved on the medium, 'USB-STICK IS EMPTY' will appear on the screen for a few seconds; the screen will then return automatically to the 'MAIN MENU'.



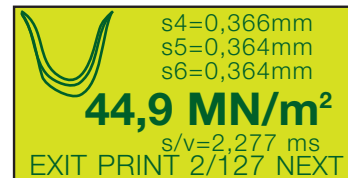
MAIN MENU



FOLDER LIST



TEST DATA LIST



SHOW FUNCTION

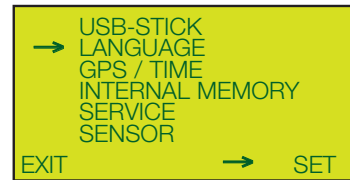


### 7.3 Language Menu

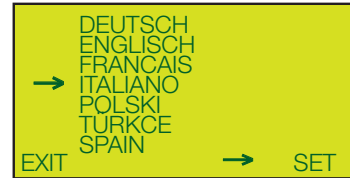
Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'LANGUAGE' from the menu. Then press the 'START' button to enter the 'LANGUAGE' menu.

Choose the desired language by pressing the 'SELECT' button. To activate the selected language, press the 'START' button (SET). The 'MAIN MENU' will then appear automatically in your desired language.

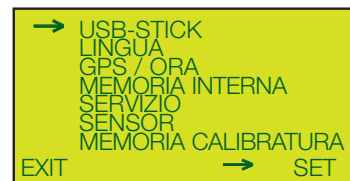
Press the 'RESET/OFF' button (EXIT) to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.



MAIN MENU



LANGUAGE MENU



MAIN MENU  
new language (Italian)

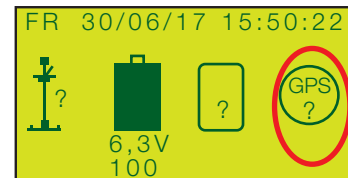
## 7.4 Menu GPS / TIME

### 7.4.1 GPS Reception

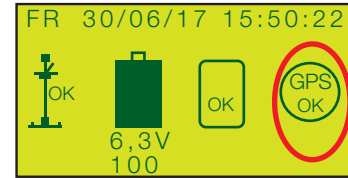
The device is delivered with the status set to 'GPS IS ON'.

The GPS reception is automatically activated when turning on the device, unless it has been switched off previously. After turning on the device, wait until the GPS reception has logged in. While searching for satellites a '?' will be shown on the GPS icon. Once the GPS reception is established, the display will show an 'OK' on the GPS icon during 'STATUS REQUEST'. This process may take a few minutes.

If a test is started without waiting for GPS reception during 'STATUS REQUEST', the GPS logs in also afterwards, as soon as the GPS signal is detected.



GPS NOT AVAILABLE



GPS AVAILABLE

If the GPS reception is turned on, the GPS coordinates of the testing point will automatically appear on the test protocol. They will also be saved automatically to both the internal memory and the external media (if in use) for later analysis on a PC and connection to the Google® Maps interface.

### 7.4.2 Accuracy of GPS Reception

The GPS satellite positioning system was developed by the U.S. Department of Defense at the beginning of the 1970s. 24 satellites were placed in space. Due to the orbits of the satellites and the deployed transmission technology, the accuracy of the determined position is limited.

We would like to briefly explain this further: A GPS receiver calculates its position by analysing the signal of several GPS satellites. The more satellite signals it receives, the more accurate the determined position. If the view of the sky is clear, the signals of up to 12 satellites may be received at the same time. To determine a valid position, the data of at least three satellites is necessary. This works very well in open field. In this case, the accuracy is below 30 metres.

On a moving vehicle, accuracies of one metre and below can be achieved. Unfortunately, construction work is not always conducted in open space. In cities or in a built-up areas, various disturbances occur, shade for example. In this case, one or more satellites are likely to be blocked by high buildings. It is possible that the signals of only western, northern and southern satellites may be received, while all eastern satellites are blocked completely. This may be the case when standing very close to a building, for example.

Reflections are another cause of inaccuracy. The signals sent out by the GPS satellites are radio signals, which spread in wave form and can be reflected, by large metal surfaces (such as aeroplanes) for example. Due to these reflections the GPS module may not receive the signals directly, but after being reflected by another object or surface. The signal propagation delay may change, which may result in a greater divergence than normal (outlier). In a densely built area with high buildings, this may mean errors of tens of metres.

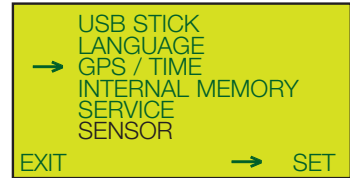
A car navigation system tries to offset the effects of these problems by assuming that the car is moving, and by checking that the position determined by the GPS module makes sense on the current road (a signal which indicates a sharp turn into a nearby field 100 metres before a junction is most likely an error, for example).

### 7.4.3 GPS ON / GPS OFF

Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'GPS / TIME' from the menu. Press the 'START' button (SET) to enter the 'GPS / TIME' menu.

To deactivate the GPS reception, position the arrow on 'GPS IS ON' and press the 'START' button (SET). 'GPS IS OFF' will then show on the display. If the GPS system is deactivated, the GPS icon will be absent from the 'STATUS REQUEST' screen.

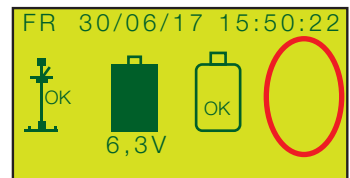
If the GPS reception is switched off, and you would like to re-activate it, proceed as described above. After activating the GPS reception the GPS icon will appear during 'STATUS REQUEST'. Press the 'RESET/OFF' button (EXIT) to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. The chosen GPS status will be shown either by the presence or by absence of the GPS icon, depending on whether you have chosen 'GPS IS ON' or 'GPS IS OFF'. Pressing the 'START' button will start the test procedure.



MAIN MENU



GPS / TIME MENU



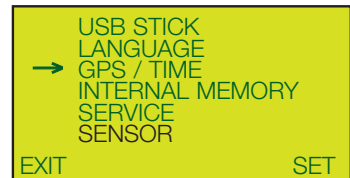
GPS icon is missing: GPS is off

### 7.4.4 Summer Time Function

Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'GPS / TIME' from the menu. Press the 'START' button (SET) to enter the 'GPS / TIME' menu.

To deactivate the summer time, position the arrow on 'SUMMER TIME IS ON' and press the 'START' button (SET). 'SUMMER TIME IS OFF' will then show on the display.

To activate the summer time, position the arrow on 'SUMMER TIME IS OFF' and press the 'START' button (SET). 'SUMMER TIME IS ON' will then show on the display. Press the 'RESET/OFF' button (EXIT) to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.



MAIN MENU



GPS / TIME MENU





### 7.4.5 Date and Time

The device is delivered with the status set to 'TIME IS GPS TIME'. Weekday, date and switch-on time will be shown automatically during 'STATUS REQUEST', when turning on the device. This data is globally imported via satellite; the default setting corresponds to 'GMT + 01:00 h' (GMT = Greenwich Mean Time).

**PAY ATTENTION TO YOUR TIME ZONE IN RELATION TO THE GMT IMPORTED BY THE TESTING COMPUTER. ADJUST THE DIFFERENCE IN THE 'TIME ZONE' MENU BEFORE FIRST USE OF THE DEVICE (see time zone set-up).**

If the mode 'TIME IS GPS TIME' is switched on, date and time of the test will be automatically added to the test protocol. This data will be also saved automatically to both the internal memory and the external media (if in use) for later analysis on a PC and connection to the Google® Maps interface.

### 7.4.6 Manual Time

Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'GPS / TIME' from the menu. Press the 'START' button (SET) to enter the 'GPS / TIME' menu.

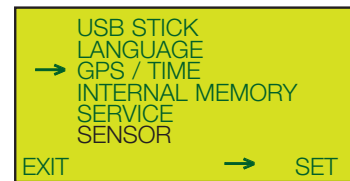
Position the arrow on 'TIME IS GPS TIME' and press 'START' (SET) to deactivate this mode and set the clock manually. 'MANUAL TIME' will then show on the display with the menu option 'SET CLOCK' directly below.

Use the 'SELECT' button to move the arrow and select 'SET CLOCK'. Press the 'START' button (SET) to enter the 'SET CLOCK' menu.

With the 'SELECT' button you can then choose between date (day / month / year) and time, and set both manually by pressing the 'PRINT' button (+). The modified details must be confirmed by pressing the 'START' button. The corresponding weekday will be adjusted automatically. Simultaneously, the screen will return to the 'MANUAL TIME' menu.

Press the 'RESET/OFF' button (EXIT) to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.

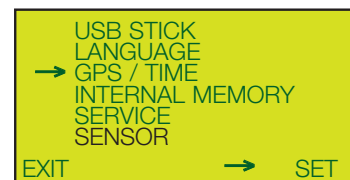
If the GPS time is switched off and you would like to re-activate it, proceed as described above. Position the arrow on 'MANUAL TIME' and press 'START' (SET) to deactivate this mode and switch back to GPS time. 'TIME IS GPS TIME' will then show on the display with the menu option 'TIME ZONE' directly below.



MAIN MENU



GPS / TIME MENU



MAIN MENU



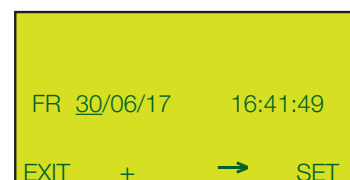
GPS / TIME MENU



MANUAL TIME MENU



MANUAL TIME MENU



SET CLOCK MENU

### 7.4.7 Time Zones

The testing computer is delivered with the time zone set to 'GMT + 01:00 h' (GMT = Greenwich Mean Time). This setting corresponds to Central European Winter Time, imported via the corresponding satellites by the GPS receiver. Central European Summer Time can be set separately; it corresponds to the time zone set-up 'GMT + 02:00 h'.

**PAY ATTENTION TO YOUR TIME ZONE IN RELATION TO THE GMT IMPORTED BY THE TESTING COMPUTER. ADJUST THE DIFFERENCE IN THE 'TIME ZONE' MENU BEFORE FIRST USE OF THE DEVICE.**

The testing computer will remember the set time zone, even if it is subsequently switched to a manual time setting.

The automatic time zone mode is active only, when the device is set to 'TIME IS GPS TIME'.

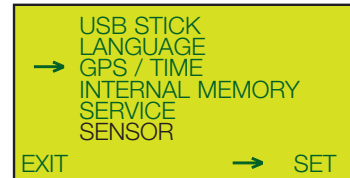
### 7.4.8 Time Zone Set-up

Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'GPS / TIME' from the menu. Press the 'START' button (SET) to enter the 'GPS / TIME' menu.

Use the 'SELECT' button to move the arrow and select 'TIME ZONE' from the menu. Press the 'START' button (SET) to enter the 'TIME ZONE' menu.

Use the 'START' (+) and 'SELECT' (-) buttons to set the desired time zone in relation to Greenwich Mean Time. Confirm the chosen time zone by pressing the 'RESET/OFF' button (EXIT); you will be automatically returned to the 'GPS / TIME' menu.

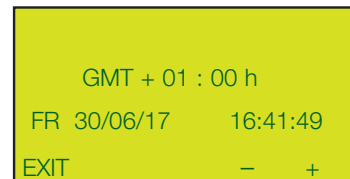
Press the 'RESET/OFF' button (EXIT) to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.



MAIN MENU



GPS / TIME MENU



TIME ZONE MENU

## 7.5 Internal Memory

The last 2000 tests will automatically be saved in the internal memory of the testing computer, even if the external medium (USB stick) is not in use. The test data can be transferred from the internal memory to the external medium, if required.

The USB cable port allows test data to be transferred to a PC for analysis using the USB cable (included in the basic package).

### 7.5.1 Printing from the Internal Memory

Turn on the device by pressing the 'START' button. Then enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'INTERNAL MEMORY' from the menu. Press the 'START' button (SET) to enter the 'INTERNAL MEMORY' menu.

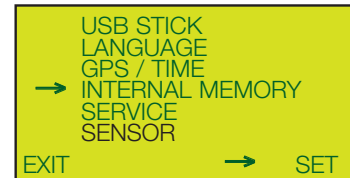
If the arrow is positioned on 'SELECT MEASUREMENT', press 'START' (SET) to enter the 'TEST DATA LIST' of the internal memory. All test data saved in the internal memory will be shown on the display, including the consecutive data record number, date, and Evd value. Move the arrow with the 'START' and 'SELECT' buttons to select the data record which you would like to print. Upon pressing the 'PRINT' button (SHOW) the test data of the selected test will be shown. Press the 'PRINT' button again to print the corresponding test protocol. If no test data is saved in the internal memory, 'MEMORY IS EMPTY' will appear on the screen for a few seconds. The screen will then return automatically to the 'INTERNAL MEMORY' menu.

Pressing the 'RESET/OFF' button (EXIT) will direct you back to the 'TEST DATA LIST'. Press the 'RESET/OFF' button (EXIT) again to return to the 'INTERNAL MEMORY' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.

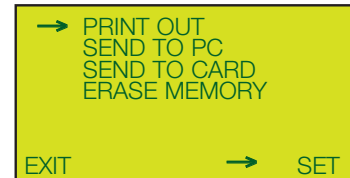
### 7.5.2 Internal Memory to PC

Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'INTERNAL MEMORY' from the menu. Press the 'START' button (SET) to enter the 'INTERNAL MEMORY' menu. Position the arrow on 'SEND TO PC', and press the 'START' button (SET) to load test data directly to 'TERRATEST.Utility' (refer to page 67 ff). Establish the USB connection between the testing computer and PC by plugging in the USB cable included in the basic package. Upon initial connection of the testing computer to the PC the respective driver will have to be installed from installation download 'TERRATEST.Utility'. For details, refer to page 70 (Driver installation for testing computer). If there is no connection to the PC, the instruction 'PLEASE CONNECT TO USB-PORT OF PC' will appear on the display.

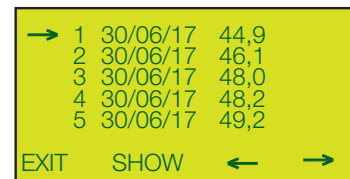
After the USB connection has successfully been established 'PC connected' will appear on the display.



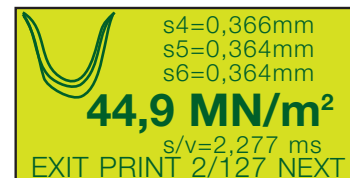
MAIN MENU



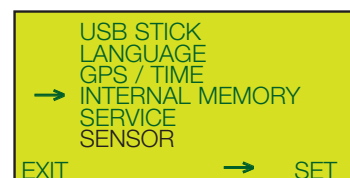
INTERNAL MEMORY MENU



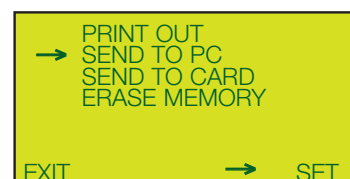
TEST DATA LIST



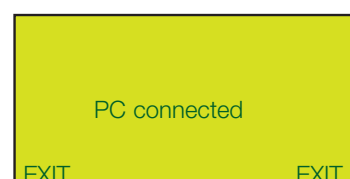
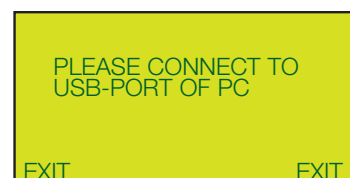
SHOW FUNCTION



MAIN MENU



INTERNAL MEMORY MENU

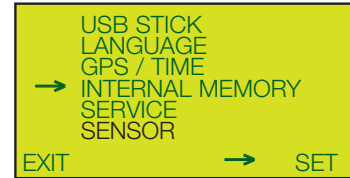


Launch the software 'TERRATEST.Utility' and click on field 'Read Files' under tab 'Testing computer'. All data records saved in the internal memory will then be copied to the PC. (page 69) You can then undertake an analysis of the test data on your PC. All test data will be retained in the internal memory.

After successful copy, the testing computer automatically switches OFF.

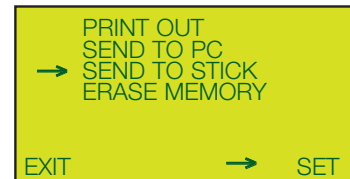
### 7.5.3 Internal Memory to External Media

Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'INTERNAL MEMORY' from the menu. Press the 'START' button (SET) to enter the 'INTERNAL MEMORY' menu.



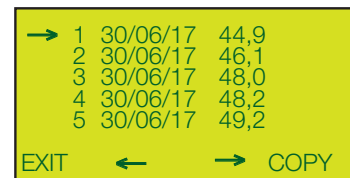
MAIN MENU

Position the arrow on 'SEND TO STICK' and press the 'START' (SET) button to enter the 'TEST DATA LIST'.



INTERNAL MEMORY MENU

Move the arrow with the 'PRINT' and 'SELECT' buttons to select the data record which you would like to copy to the external media. Then press the 'START' button (COPY).



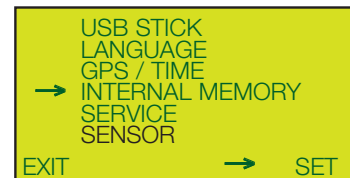
TEST DATA LIST

The testing computer will then copy the selected data record directly to the external media. You can then copy any number of data records, one-by-one, to the external media. After successful copy, a short message 'COPY DONE' appears on the display. If the file is already present, a short message 'ALREADY EXISTING' is shown.

Press the 'RESET/OFF' button (EXIT) to return to the 'INTERNAL MEMORY' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'.

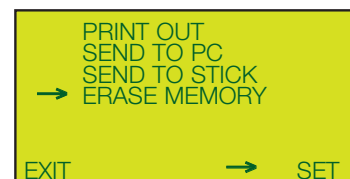
### 7.5.4 Clear Internal Memory

Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'INTERNAL MEMORY' from the menu. Press the 'START' button (SET) to enter the 'INTERNAL MEMORY' menu.



MAIN MENU

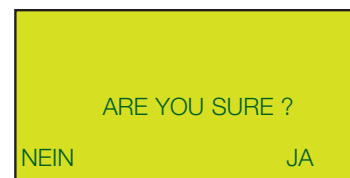
Position the arrow on 'ERASE MEMORY' and press the 'START' (SET) button to clear all data records from the internal memory.



INTERNAL MEMORY MENU

You will be asked 'ARE YOU SURE?'. Confirm by pressing the 'START' button (YES). The deletion procedure will be started. Upon completion of the deletion procedure, 'MEMORY CLEAR' will appear on the display. The display will then return automatically to the 'INTERNAL MEMORY' menu.

If you do not want to erase the data, press the 'RESET/OFF' button (NO). The screen will return to the 'INTERNAL MEMORY' menu.



Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.



## 7.6 Service

### 7.6.1 Input Test

Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'SERVICE' from the menu. Press the 'START' button (SET) to enter the 'SERVICE' menu.

Use the 'SELECT' button to move the arrow and select 'INPUT TEST' from the menu.

Press the 'START' button (SET) to enter the 'INPUT TEST' menu.

The 'INPUT TEST' serves to check the functionality of the device and shows important function parameters of the device components.

Press the 'RESET/OFF' button (EXIT) to return to the 'SERVICE' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.

### 7.6.2 Version

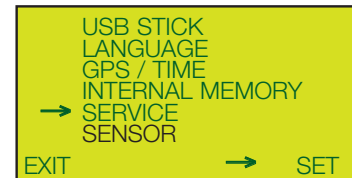
Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'SERVICE' from the menu. Press the 'START' button (SET) to enter the 'SERVICE' menu.

Use the 'SELECT' button to move the arrow and select 'VERSION' from the menu.

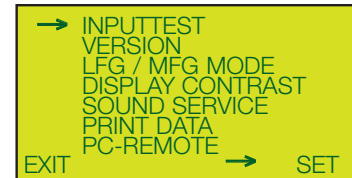
Press the 'START' button (SET) to enter the 'VERSION' menu, where you will find:

- 12 digit device number
- device type
- last calibration date
- calibration factor
- firmware version
- number of tests performed in the lifetime of the instrument

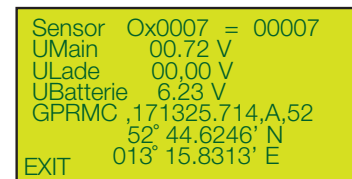
Press the 'RESET/OFF' button (EXIT) to return to the 'SERVICE' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.



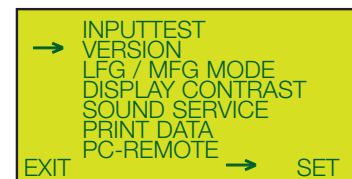
MAIN MENU



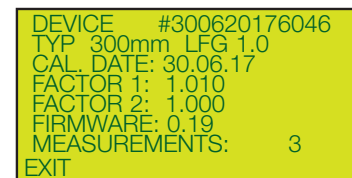
SERVICE MENU



INPUT TEST MENU



SERVICE MENU



VERSION MENU

### 7.6.3 Device Type LFG / MFG

Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'SERVICE' from the menu. Press the 'START' button (SET) to enter the 'SERVICE' menu.

Press 'SELECT' button and select by arrow menu point 'LFG/MFG MODE' (which specifies Light Weight with 10 kg and Medium Weight for 15 kg loading device).

Press 'SELECT' button and select by arrow menu point 'LFG/MFG' mode (which specifies Light Weight with 10 kg and Medium Weight for 15 kg loading device).

If the measuring computer is released for operation with MFG, this menu point is accessible by 'START' button (SET).

The display shows the currently selected version by 'LFG 1.0' or 'MFG 2.0'. Press 'START' (1.0) or 'SELECT' (2.0) to change the version. The safety prompt appears on the screen, accompanied by voice output 'Are you sure?'. Pressing START button (YES) confirms, SELECT button (NO) aborts the change. After safety prompt, the display shows the currently selected version.

Press the 'RESET/OFF' button (EXIT) to return to the 'SERVICE' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.

### 7.6.4 Display Contrast

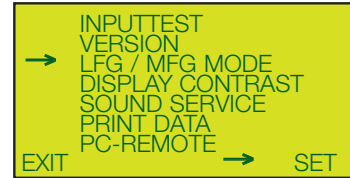
Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'SERVICE' from the menu. Press the 'START' button (SET) to enter the 'SERVICE' menu.

Use the 'SELECT' button to move the arrow and select 'DISPLAY CONTRAST' from the menu.

Press the 'START' button (SET) to enter the 'CONTRAST' menu.

The display contrast may be adapted by using the 'PRINT' (-) and 'SELECT' (+) buttons.

Press the 'RESET/OFF' button (EXIT) to return to the 'SERVICE' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.



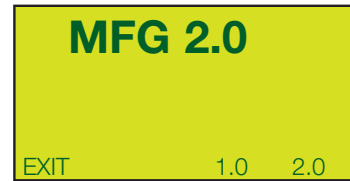
SERVICE MENU



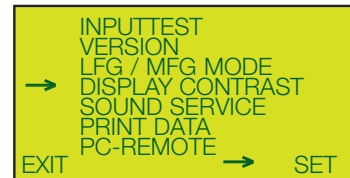
10 / 15 KG MODE MENU



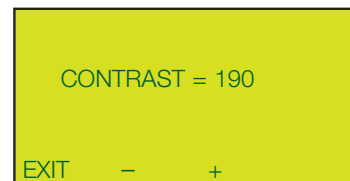
SAFETY QUERY



10 / 15 KG MODE MENU



SERVICE MENU

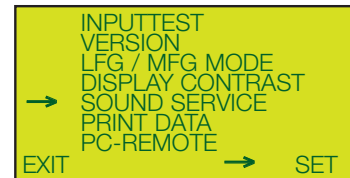


CONTRAST MENU



### 7.6.5 Voice Output: Sound Service

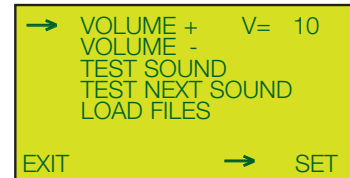
Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'SERVICE' from the menu. Press the 'START' button (SET) to enter the 'SERVICE' menu.



SERVICE MENU

Use the 'SELECT' button to move the arrow and select 'SOUND SERVICE' from the menu.

Press the 'START' button (SET) to enter the 'SOUND SERVICE' menu.



SOUND SERVICE MENU

You can then adapt the volume level of the voice output. The symbol 'V=...' shows the currently selected volume, minimum 0, maximum 20.

To increase the volume, use the 'SELECT' button to move the arrow and select 'VOLUME +' from the menu. Press the 'START' button (SET), until the desired volume is reached.

To decrease the volume, use the 'SELECT' button to move the arrow and select 'VOLUME -' from the menu. Press the 'START' button (SET), until the desired volume is reached.

To test the selected volume, use the 'SELECT' button to move the arrow and select 'TEST SOUND' or 'TEST NEXT SOUND' from the menu. Press the 'START' button (SET). A voice instruction in the selected volume will follow.

The menu entry 'LOAD FILES' permits TERRATEST GmbH to install other language versions (if available). Only one language per device can be used at a time.

Press the 'RESET/OFF' button (EXIT) to return to the 'SERVICE' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure.

### 7.6.6 Print Data

'Print Data' offers an additional possibility to enter company or order data as well as conversion factors to  $E_{v2}$  or  $E_{v1}$  determined by correlation measurement (refer to page 29, **Proposal for Correlation of Static/Dynamic Load Plate Test**) into the test protocol.

#### 7.6.6.1 Company Data (Header)

Activate the instrument by 'START' button, and press 'SELECT' to gain access to the MAIN MENU, and then once more to enter menu point 'PRINT DATA'. The menu itself is entered by 'START' button (SET).

Press 'SELECT' to activate menu point 'HEADER', and then 'START' button (SET) to activate text input.

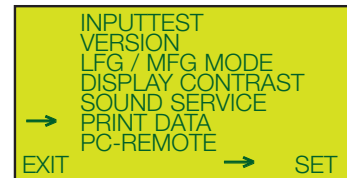
Up to 4 lines can be used for company data on the test protocol. The currently selected line is shown on the display below the alphabet.

Select the desired digits by  $\leftarrow$  or  $\rightarrow$ , and confirm the selection by 'ENTER' and briefly pressing START button.

Digits already entered can be chosen by 'TEXT' and then overwritten or erased by blank.

Long pressing the 'START' button confirms data input and changes to the next line. Repeat this procedure for all lines. After confirmation of 4th line, the menu 'PRINT DATA' appears again, and the entry is stored in the system. All data appear on the test protocol between settlement values and handwritten complements.

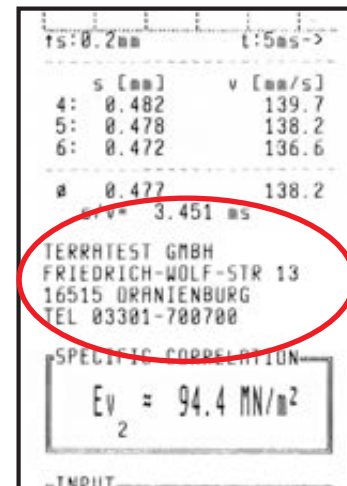
Press 'RESET/OFF' button (EXIT) to automatically return to the 'SERVICE' menu. Pressing 'RESET/OFF' once more opens the MAIN menu, and pressing a third time returns to 'STATUS REQUEST'. Press 'START' to initiate measurement.



MENU SERVICE



MENU PRINT DATA



### 7.6.6.2 Ev<sub>2</sub> Factor / Ev<sub>1</sub> Factor

Note that it is only possible to activate one single of the conversion data for Ev<sub>2</sub> or Ev<sub>1</sub> determined by correlation measurement to appear on the printout of the test protocol. Activation in menu point 'EV2 FACTOR' and 'EV1 FACTOR' is identical. If one of these values is activated, the other one is automatically disabled.

Switch ON the instrument by 'START' button; and press 'SELECT' to gain access to the MAIN MENU, and then once more to enter menu point 'PRINT DATA'. The menu itself is entered by 'START' button (SET).

Press 'SELECT' to select by arrow 'EV2 FACTOR' or 'EV1 FACTOR'. The current selection is shown, when 'START' button (SET) is pressed.

If the selection is disabled (default configuration) press 'START' button (ON) once more to enter SET mode, and activate printout of the desired correlation on the test protocol. Default value is 1.0.

Pressing 'SELECT' (+) increases, pressing 'PRINT' lowers that value in steps of tenths.

Press 'START' button (OFF) to disable this output on printout.

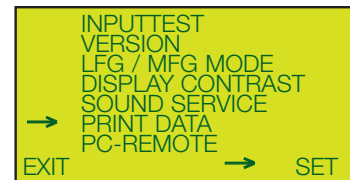
'RESET/OFF' button (EXIT) on the other hand confirms data input, and menu 'PRINT DATA' is opened again.

After activation, data converted by specified Ev<sub>2</sub> or Ev<sub>1</sub> factors appear on the test protocol immediately above handwritten complements.

Press 'RESET/OFF' button (EXIT) to automatically return to the 'SERVICE' menu. Pressing 'RESET/OFF' once more opens the MAIN menu, and pressing a third time returns to 'STATUS REQUEST'. Press 'START' to initiate measurement.

### 7.6.7 PC-Remote

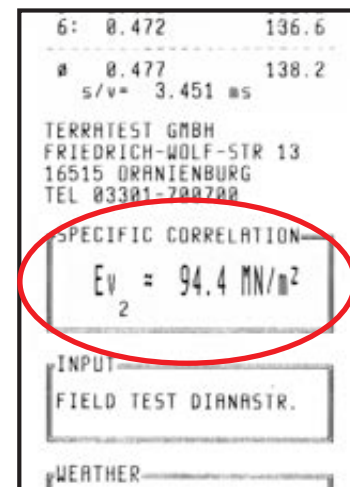
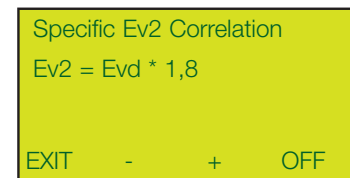
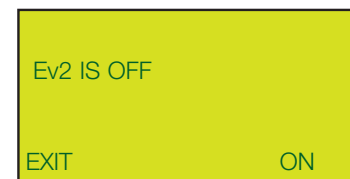
The function PC REMOTE is reserved for factory settings and calibration mode, accessible only for TERRATEST personnel.



MENU SERVICE



MENU PRINT DATA



## 7.7 Load Plate

### 7.7.1 Stand-by Time

The testing computer can be operated in two measuring modes: 'SINGLE MEASURING MODE' and 'CONTINUOUS MEASURING MODE'. If several tests shall be performed in a limited period of time, it is useful to set the testing computer to 'CONTINUOUS MEASURING MODE'. If set to 'SINGLE MEASURING MODE' (default setting), the testing computer must be operated between the single tests by pressing the appropriate buttons on the testing computer. If set to 'CONTINUOUS MEASURING MODE', the next test will be started if the drop weight is firmly latched back into the release mechanism on top of the guide rod. (Also see 'Continuous Measuring Mode' on page 43).

Turn on the device by pressing the 'START' button. Enter the 'MAIN MENU' by pressing the 'SELECT' button. Use the 'SELECT' button to move the arrow and select 'SENSOR' from the menu. Press the 'START' button (SET) to enter the 'SENSOR' menu.

Use the 'SELECT' button to move the arrow and select 'STAND-BY TIME' from the menu.

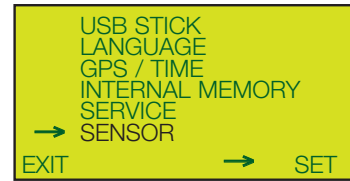
Press the 'START' button (SET) to enter the 'STAND-BY TIME' menu.

The current settings will be displayed.

Using the 'SELECT' button you can increase the stand-by time by 5-minute increments, up to a maximum of 30 minutes. Values greater than zero imply that the testing computer is operating in 'CONTINUOUS MEASURING MODE', and will only switch itself off after an inactivity of the time set.

Using the 'PRINT' button you can decrease the time by 5-minute increments, up to a minimum of 00 minutes. The testing computer will operate in 'SINGLE MEASURING MODE' if the time is set to '00 MIN'.

Press the 'RESET/OFF' button (EXIT) to return to the 'SERVICE' menu. Press the 'RESET/OFF' button (EXIT) again to return to the 'MAIN MENU'. Press the 'RESET/OFF' button (EXIT) again to return to the 'STATUS REQUEST'. Pressing the 'START' button will start the test procedure. As soon as the 'CONTINUOUS MEASUREMENT MODE' is activated, the voice output confirms by 'CONTINUOUS MEASUREMENT', and the display shows message 'LIFT WEIGHT'.



MAIN MENU



SENSOR MENU



### 7.8 Calibration Reminder

Acc. to German Standard TP BF-StB, section B8.3, Appendix A1, loading assembly, settlement measuring assembly and load plate of light weight deflectometers have to be calibrated at least once per year by an authorized institution. TERRATEST® is qualified for this service and has obtained the admission. During each calibration, the expiration date is entered in the measuring electronics (refer to point 7.6.2, page 55) and noted on the type plate.

Whenever the system is switched ON, this date is checked. Up from 30 days before expiration, the user is informed by continuous beep for 5 seconds, and the displays shows message 'NEW CALIBRATION IN 30 DAYS'; afterwards it returns to 'STATUS REQUEST'. This procedure is repeated every day until the calibration expires. In this case, the display message is 'CALIBRATION EXPIRED', accompanied by identical voice output. The message can be aborted by pressing 'START' button, and the display returns to 'STATUS REQUEST'.

**NEW  
CALIBRATION  
IN 21 DAYS**

**CALIBRATION  
EXPIRED**

## 8. Analysis Software 'TEOLO'

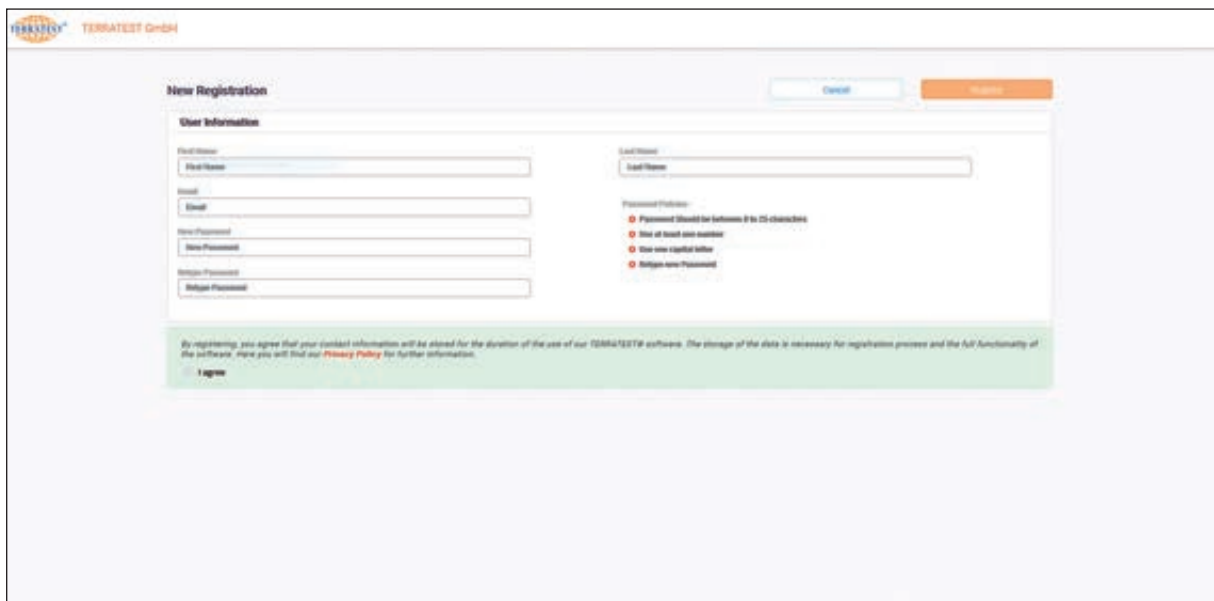
To evaluate the measuring results on PC, TERRATEST® offers a web-based software under [www.terratest.de](http://www.terratest.de). The routine can be activated by a click on 'Software', available for every browser. The analysis corresponds to German Standard TP BF-StB, section B8.3. Verify that the installed browser represents a recent version and able to establish the connection.



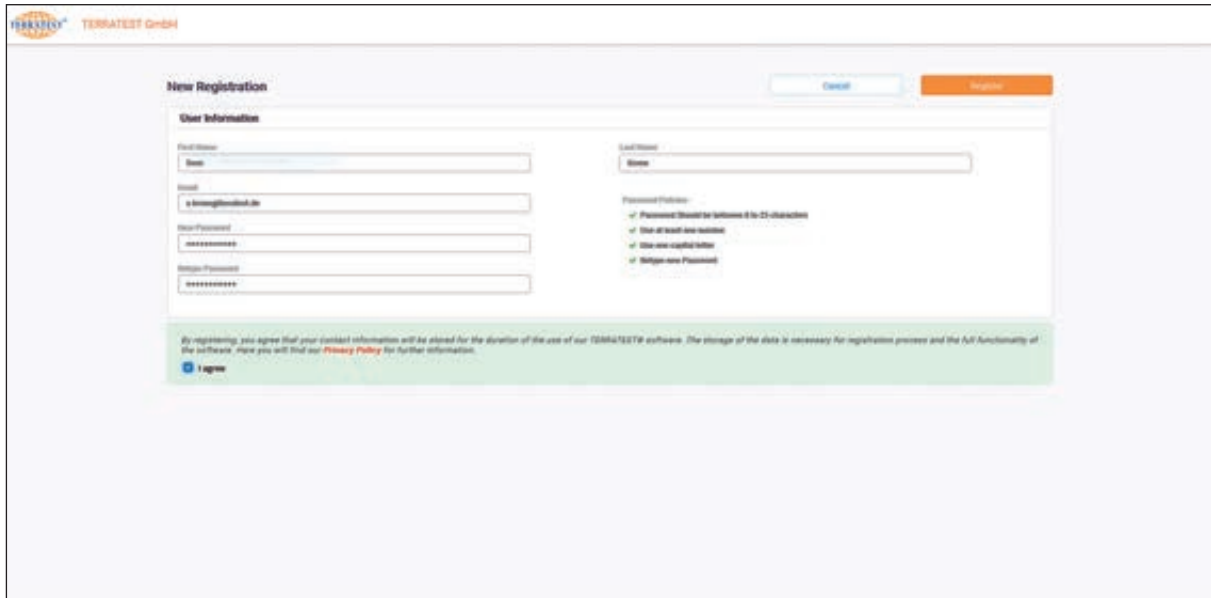
### 8.1 Software 'TEOLO' Login

#### 8.1.1 Registration

User must in a first step be registered. Therefore click on 'Registration' in the Login screen. Name, family name, E-Mail and password must be specified. Password guidelines appearing at the right side of the screen must be observed.







**New Registration**

**User Information**

First Name:

Last Name:

Email:

New Password:

Repeat Password:

**Registration Details**

- Password should be between 8 to 25 characters
- Use at least one number
- Use one capital letter
- No space allowed

By registering, you agree that your contact information will be stored for the duration of the use of our TERRATEST® software. The storage of the data is necessary for registration process and the full functionality of the software. Here you will find our [Privacy Policy](#) for further information.

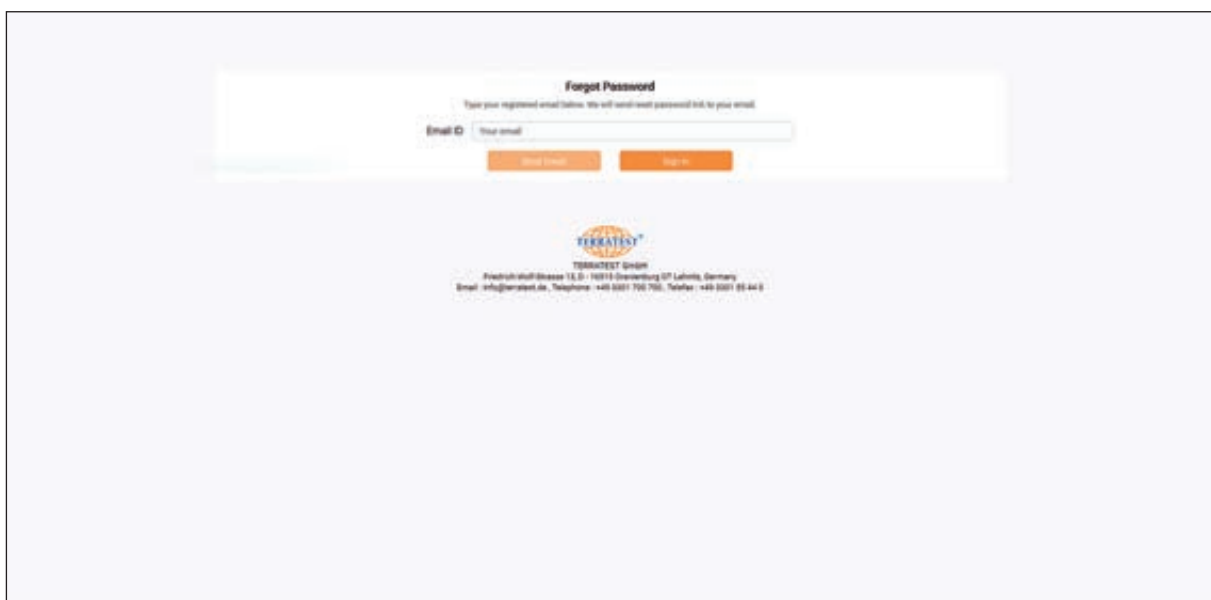
I agree

If the guidelines are correctly observed, the screen shows a green tick at the beginning of the corresponding text, otherwise a red cross. As soon as all information is checked and data protection declaration accepted, 'Registration' button is activated. Click on this button, so the system sends a mail to the specified mail address, and the link contained must be confirmed. When the E-Mail address specified by the user has been checked, he is guided back to the Login page.

### 8.1.2 Login

Enter the E-Mail address registered beforehand and the corresponding password on the Login page. After confirmation by Enter key or mouse click on the corresponding button, the user enters to the user interface of 'TEOLO'. In the case of incorrect E-Mail address or password, a corresponding message appears. Correct the entry and repeat the procedure.

### 8.1.3 Password Reset



**Forgot Password**

Type your registered email below. We will send you a password link to your email.

Email ID:

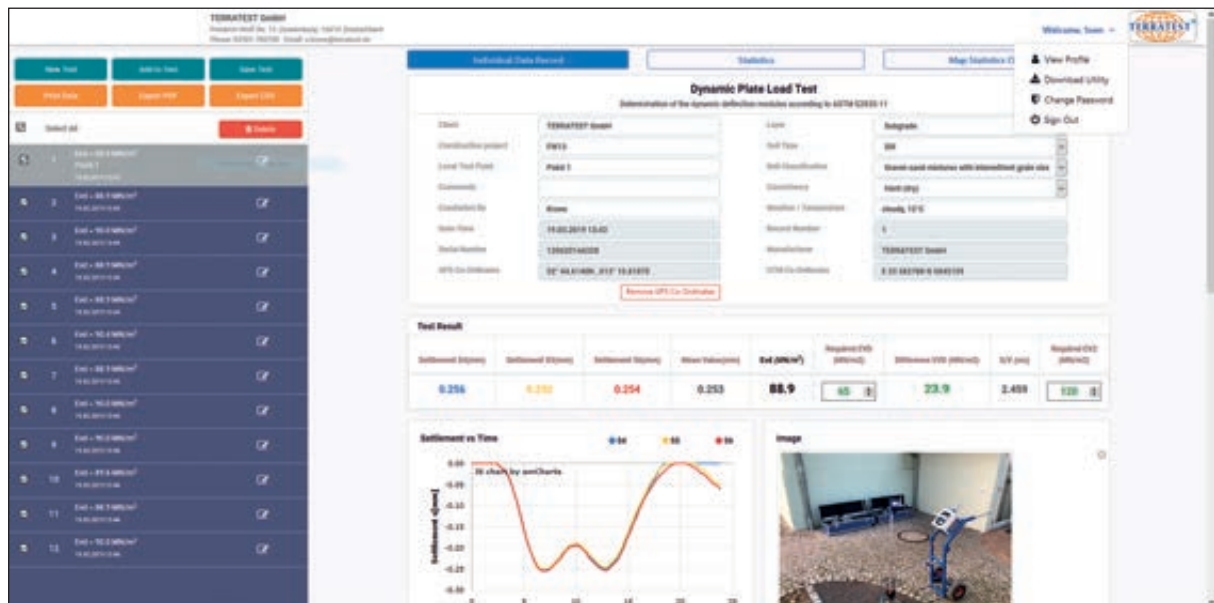
**TERRATEST**  
TERRATEST GmbH  
Friedrichshof-Strasse 12, D - 14813-Dorstenburg OT Lohrke, Germany  
Email: [info@terratest.de](mailto:info@terratest.de), Telephone: +49 3381 700 700, Telefax: +49 3381 85 44 8

A forgotten password does not represent any problem. Simply click on 'Password reset' in the Log-In screen, and enter the E-Mail address specified beforehand in the 'Password reset' page. After clicking on 'Send E-Mail', a pop-up window informs the user about the action performed. Open the corresponding mail, and enter the new password in the page opening then. From now on, access is allowed after input of specified E-Mail and the new password.

If however 'TEOLO' detects that the specified E-Mail is unknown, a corresponding message appears and new registration of the user is required, as explained in section 8.1, page 62. After starting the registration procedure, the user must check his E-Mail account for arrival of the corresponding mail ('TERRATEST' activation), and then complete the procedure.

## 8.2 Operation

The main screen is subdivided into 3 zones:



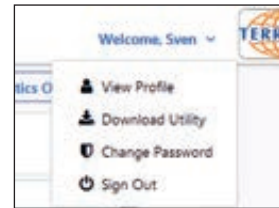
**Header** contains company data specified by the user (explained on page 65) and a menu for basic functions of the web portal.

The **left upper field** features buttons to load, add and store measurements and for printout, PDF and CSV export. Measurements after reading are displayed in an overview below the buttons, together with data set number, Evd value, time and date.

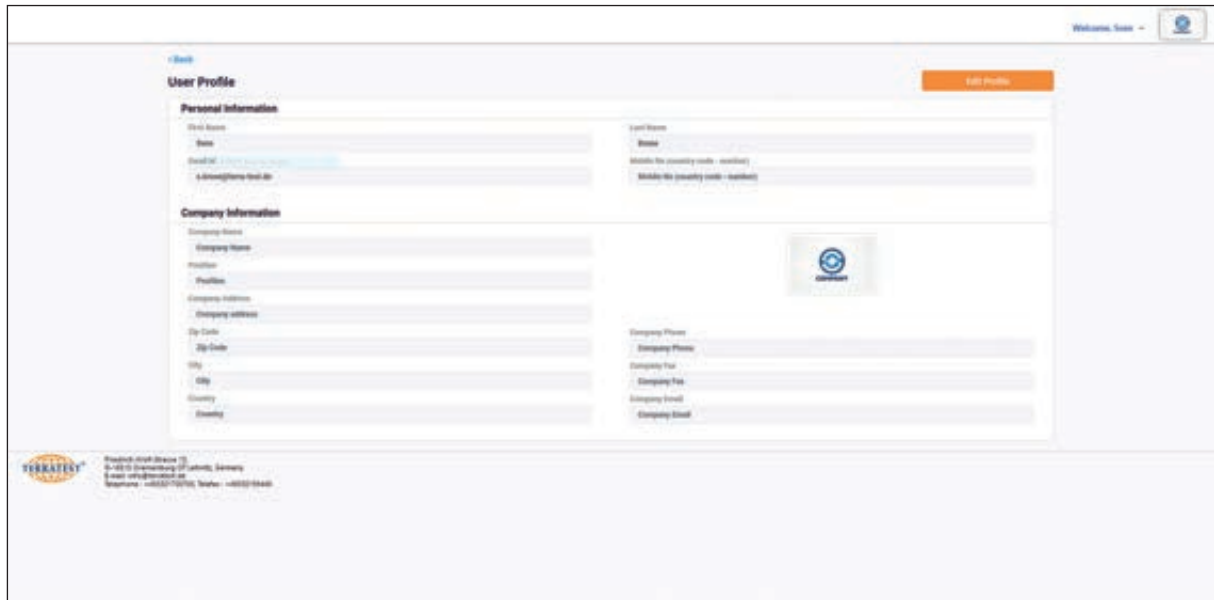
Buttons for single protocols, statistical analysis and statistical overview map are located in the **right upper field**. All of them refer to the elements appearing in the right side of the page. According to the selection of the corresponding button, the following functions appear: Preview for test protocol with settlement curves, statistical analysis according to German Standard TP BF-StB, section B8.3 or the Google® maps overview for all selected measurements.

### 8.2.1 Insert Logo and Modify Company Data

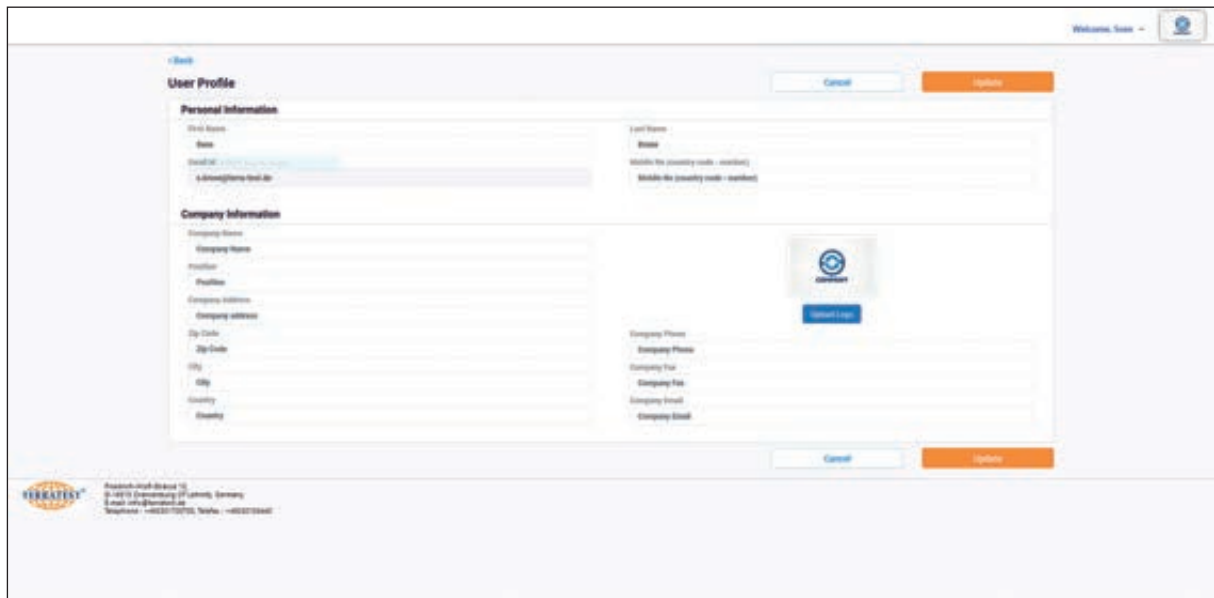
The menu with user functions opens after a click on the 'Welcome' line at the upper right corner.



'Show Profile' calls up the profile page. After a left click on 'Edit profile', it is possible to add personal data and to enter or edit company name, company address and contact data. The company logo in form of a JPG or PNG file can be uploaded as well. It is scaled automatically to the available space. Company data and logo afterwards appear in printouts and pdf files of single protocols and statistical evaluations.



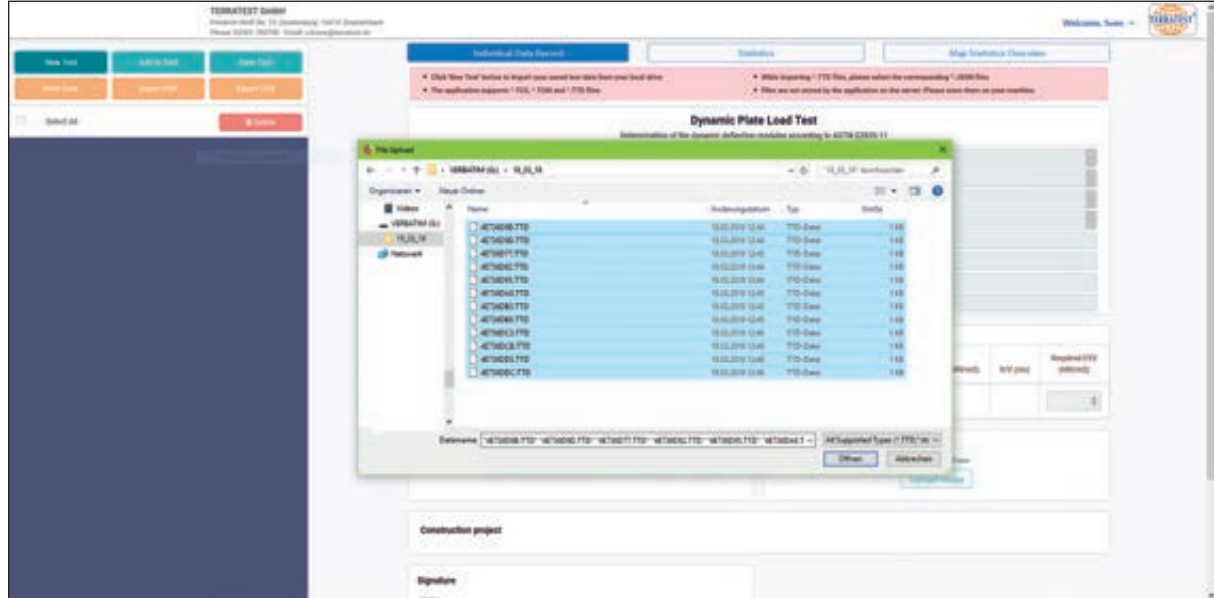
User profile inactive



User profile after left click on 'Edit Profile' button

### 8.2.2 Read Measuring Data

Within the window appearing after a click on button 'New Analysis', select drive, folder and file of the desired measuring data. 'TEOLO' supports data in \*.TC5, \*.TCM and \*.TTD file format. **For measurements carried out by Smartphone 'APP TERRATEST', additionally to the generated \*.TTD files, the corresponding \*.JSON files must be selected and uploaded.** Load the measurements for evaluation to the server by 'Open' button.



After upload, the measuring data appear in form of a list with data set number, Evd Value, time and date. These data can be analyzed now.



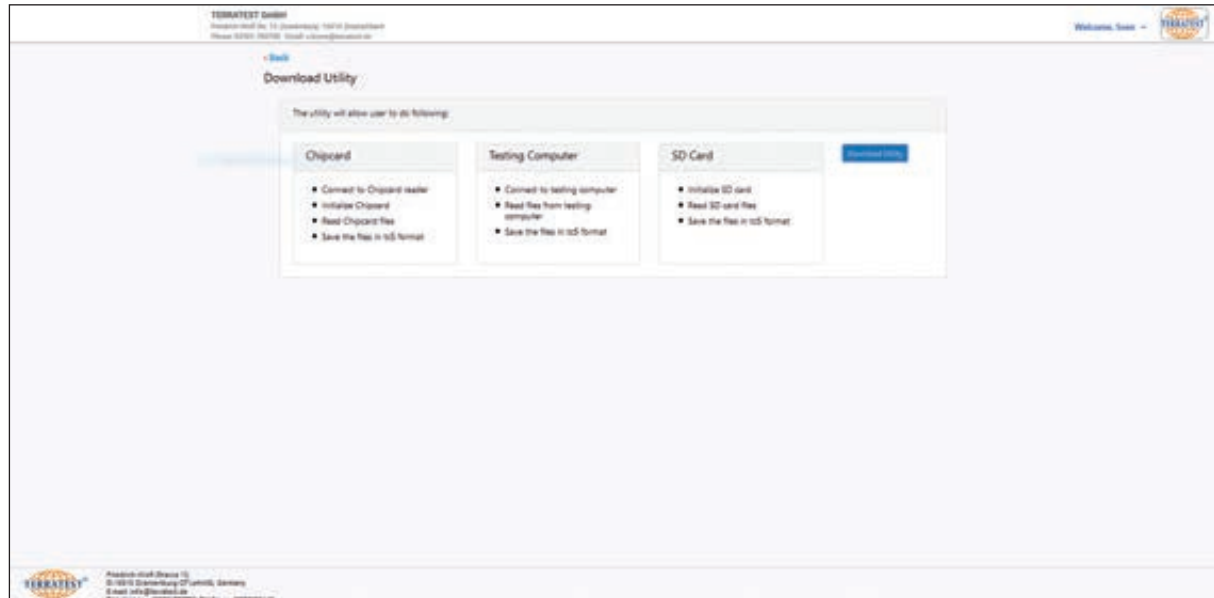
Further data sets may be added to the list after a click on button 'Add to Analysis'.

### 8.2.3 Converting Measuring Data by 'TERRATEST.Utility'

Service program 'TERRATEST.Utility' is offered as download, in order to allow access to measuring data from chip card (only TERRATEST 3000GPS), SD card (only TERRATEST 5000 BLU-SD) or directly from measuring electronics (all models). The menu with user functions opens after a click on the 'Welcome' line at the upper right corner.



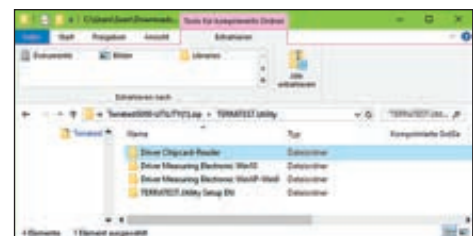
The Utility page opens after selection of 'Download Utility'.



A click on 'Download Utility' starts 'TERRATEST.Utility'.

Unpack the downloaded ZIP file by right click. Then select 'Extract all...', or copy folder 'TERRATEST.Utility' from the ZIP file by double click to a convenient location. The folder contains the following sub-folders:

1. 'TERRATEST.Utility Setup' for installation of the software
2. 'Driver Chipcard reader' for installation of this driver
3. Driver for TERRATEST® measuring electronics Windows XP to Windows 9 'Driver Measuring Electronic WinXP-Win9', and a separate driver for Windows 10 'Driver Measuring Electronic Win10'



The file 'TERRATEST.Utility-Setup.msi' for installation of the service program is located in subfolder 'TERRATEST.Utility Setup'. Double click on this file activates the procedure. After completion, this program can be started by left click on the Windows symbol (in the left lower corner of the screen) and subsequent left click on 'TERRATEST.Utility 1.0'.



### 8.2.3.1 Read Chip Card (only TERRATEST 3000 GPS)

In order to be able to read measuring data from chip card (credit card format) connect an external chip card reader to the USB interface of the PC. Insert the chip card into the slot with the chip facing downward.

Measuring data available on the chip card are transferred after a click on button 'Read Chip Card' under tab 'Chip Card reader', and presented in form of a list in the left window. Selecting elements in that window and clicking on Arrow Right shifts them into the right window. This can be repeated several times. A click on button 'Save file(s)' converts the measurements in the right window and stores them to a desired position on PC, directly accessible by software 'TEOLO' for analysis.



Message 'No Chip Card Reader' signifies that the chip card reader is not correctly connected, does not dispose of a driver or that the card is not correctly inserted. The required driver can be found in TERRATEST.Utility download folder 'Driver Chip Card reader' (refer to section 8.2.3, page 67). A double click on this file initiates installation of the driver.

Button 'Initialize Chip Card' enables the complete chip card to be erased and initialized.

### 8.2.3.2 Read SD Card (only TERRATEST 5000 BLU-SD)

In order to be able to read measuring data from SD card, insert this card into a slot of the PC or into an external card reader connected to the PC.

Measuring data available on the card are transferred after a click on button 'Read SD Card' under tab 'SD Card', and presented in form of a list in the left window. Selecting elements in that window and clicking on Arrow Right shifts them into the right window. This can be repeated several times. A click on button 'Save file(s)' converts the measurements in the right window and stores them to a desired position on PC, directly accessible by software 'TEOLO' for analysis.



Button 'Initialize SD Card' enables the complete SD card to be erased and initialized.



### 8.2.3.3 Load from Measuring Computer

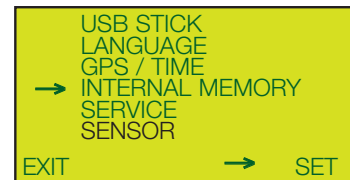
In order to be able to read measuring data from internal memory of the measuring computer, first connect it to the USB interface of the PC. Use the USB cable included in the delivery and the socket at the inner wall of the storage compartment of the measuring electronics. **The USB socket at the front is not intended for this purpose.** In the case of absent PC connection, the display shows 'PLEASE ESTABLISH USB CONNECTION TO PC'.

The driver of the measuring computer must be correctly installed on PC, and the PC Windows version must match the driver. For details, refer to 'Driver Installation for Measuring Computer' (section 8.2.3.4, page70). The drivers can be found for Windows XP to Windows 9 in unpacked download folder under 'Driver Measuring Electronic WinXP-Win9', and a separate driver for Windows 10.

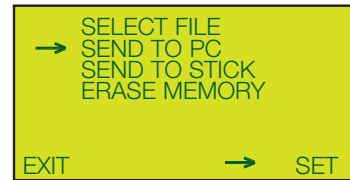
To download measuring data from measuring computer, start the device by 'START' button; then press 'SELECT' to gain access to main menu. Press 'SELECT' once more, and move the arrow to 'INTERNAL MEMORY'. Enter this menu by pressing 'START' button (SET).

With the arrow beside 'MEMORY to PC', it is possible to load measuring data into TERRATEST.Utility by pressing 'START' button (SET).

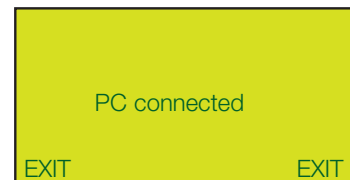
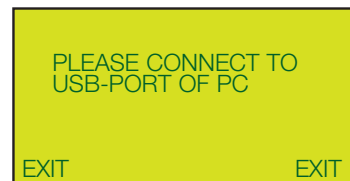
As soon as the USB connection is established, the display shows 'PC connected'. Measuring data available in the measuring electronics are transferred after a click on button 'Read Files' under tab 'Testing Computer', and presented in form of a list in the left window. Selecting elements in that window and clicking on Arrow Right shifts them into the right window. This can be repeated several times. A click on button 'Save file(s)' converts the measurements in the right window and stores them to a desired position on PC, directly accessible by software 'TEOLO' for analysis.



MAIN MENU



MENU INTERNAL MEMORY



### 8.2.3.4 Driver Installation Measuring Computer

When the measuring computer is connected to the PC for the first time, the corresponding driver for measuring electronics must be installed from unpacked download folder 'TERRATEST.Utility', as mentioned in section 8.2.3, page 67.

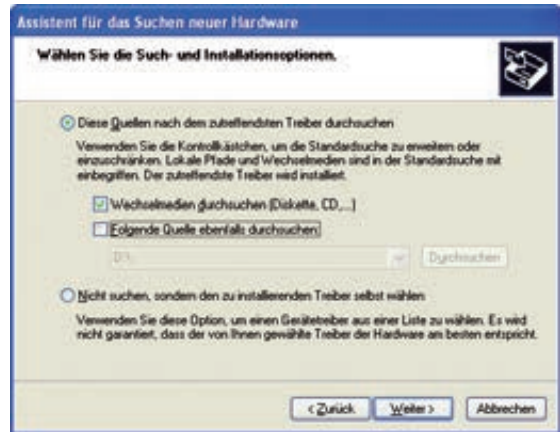
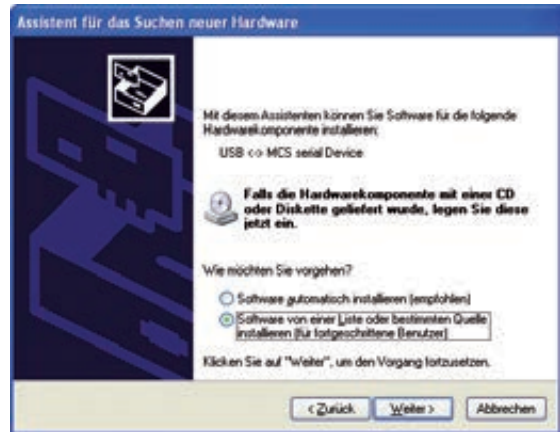
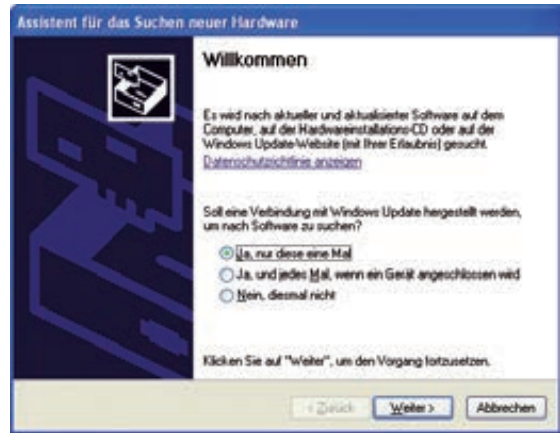
The drivers can be found for Windows XP to Windows 9 in folder 'Driver Measuring Electronic WinXP-Win9', and a separate driver for Windows 10 under 'Driver Measuring Electronic Win10'.

During connection of the measuring computer to the PC, the system informs the user about necessity of the driver. In order to install the driver, click on 'YES, ONLY THIS TIME', and then on 'NEXT'.

In the next window, click on option 'INSTALL SOFTWARE FROM A LIST OR FROM A SPECIFIC SOURCE', then press 'NEXT'.

In the next window, click on 'SEARCH FOR ADEQUATE DRIVER IN THESE SOURCES'; then on 'NEXT'.

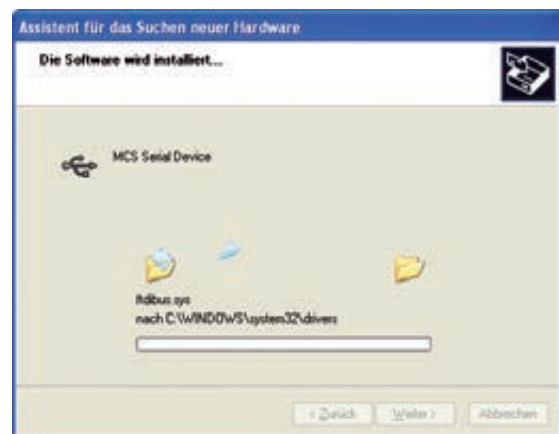
Assign to the installation routine (depending on Windows version) the corresponding folder 'Driver Measuring Electronics Win..' in the unpacked download folder, activate submenu 'Include Subfolders' and confirm by 'NEXT'.



Under Windows XP to Windows 9, the system asks whether the user intends to continue installation, because the driver is not certified by Microsoft® for MS-Windows®. Confirm by 'Continue Installation' (left field).



The driver is being installed now.



Confirm installation by clicking on 'COMPLETE'.

From now on, the driver is present on the PC.



### 8.2.4 Test Protocol of Single Measurement

The test protocol (page 74) is subdivided into five zones:

**Protocol Header** with general information concerning measurement and device.

**Table of Results** with results and Evd value required

**Settlement Curves** presenting the course of time of the settlement curves as well as an optional photograph of the measuring point

**Google® Maps® Satellite Photograph** of GPS coordinates (if available)

**Signature** of Responsible

The screenshot displays the TERRATEST software interface. On the left, a list of measurements is shown with columns for ID, Date, Time, and a checkmark. The right side features a detailed view for a 'Dynamic Plate Load Test'. This view includes a 'Protocol Header' section with fields for 'Construction project', 'Load Test Point', 'Coordinates', 'Created by', 'Date Test', 'Serial Number', and 'GPS Co-ordinates'. Below this is a 'Test Result' table with columns for 'Settlement (mm)', 'Settlement (kPa)', 'Settlement (kN/m²)', 'Mean Settlement', 'Evd (kN/m²)', 'Required Evd (kN/m²)', 'Settlement EVD (mm/m²)', 'EVD (mm)', and 'Required EVD (mm/m²)'. The table shows values: 0.256, 0.250, 0.254, 0.253, 88.9, 45, 23.9, and 2.499. Below the table is a 'Settlement vs Time' graph showing three curves (0.2k, 0.4k, 0.6k) and a photograph of the test setup. At the bottom, there is a 'Satellite Photograph' of the measuring point and a 'Signature' field.

All collected single measurements are contained in the data list at the left side. A satellite photograph of the measuring point is shown for the currently selected element. The right upper zone presents the single measurement with three settlement curves; a photograph of the measuring position can be added as well.

The protocol header provides the following information for each single measurement: Manufacturer, device no., data set no., test date and time. **This information cannot be arbitrarily modified by the user.** Remarks may appear as well, if they have been specified by text entry mode. GPS and UTM coordinates stored by the measuring computer may be erased or modified by shifting the red dot in the Google® Maps® map. If data have been recorded by smartphone APP 'TERRATEST' and loaded together with their \*.JSON files, they are read together with the data entered by the user at the smartphone. For entry of order specific information, refer to chapter 'Edit/Save Protocol'.

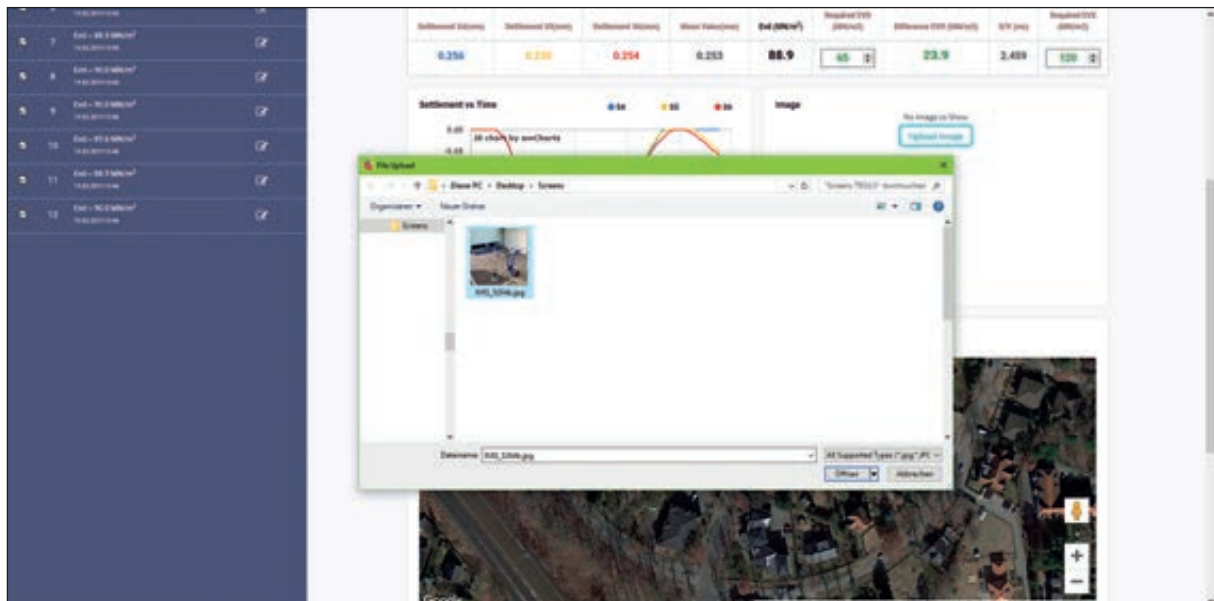
The measuring results table lists the three detected single settlements in mm, the average of the three single settlements in mm, the Evd value in MN/mm<sup>2</sup>, the difference to the required Evd value (this parameter has to be entered manually), the s/v value (relation settlement/speed) in ms, as well as the manual entry of the required Ev2 value.

At the left below the table, the three settlement curves are displayed in different colors (s4 = blue, s5 = red, s6 = yellow). Duration of measurement, maximum settlement and trend become obvious from the curve progression. In the case of compacted soil, the three curves usually appear close to each other.

At the right side of the table, a photograph of the measuring point may be entered by the user. It is stored in single protocol together with the measuring data.

If Internet connection has been activated and GPS coordinates are available, a Google® Maps® map of the measuring point is meanwhile automatically stored in single protocol as well.

Below the Google® Maps® presentation, the user may enter his name and insert a facsimile of his signature by upload.



For each test protocol, a photograph of the measuring point may be loaded. It will be stored together with the measurement itself.



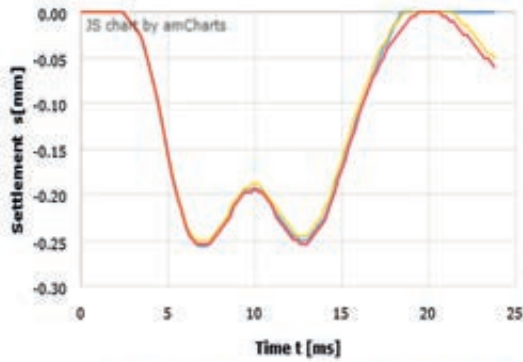
TERRATEST GmbH  
 Friedrich-Wolf-Str. 13  
 16515 Oranienburg  
 Phone: 03301-700700 / Fax: 03301-55440

## Dynamic Plate Load Test

Determination of the dynamic deflection modulus according to ASTM E2835-11

Client	TERRATEST GmbH	Layer	Subgrade
Construction project	FW13	Soil Type	Silt
Local Test Point	Point 1	Consistency	Hard (dry)
Conducted By	Krone	Weather / Temp	cloudy, 12°C
Date-Time	19.03.2019 13:43	Record Number	1
Serial Number	120620144328	Manufacturer	TERRATEST GmbH
GPS Co-Ordinates	52° 44.6140N 013° 15.8187E	UTM Co-Ordinates	E 33 382788 N 5845159
Comments		Soil Classification	Gravel-sand mixtures with intermittent grain...

Settlement S4(mm)	Settlement S5(mm)	Settlement S6(mm)	Mean Value(mm)	Evd (MN/m <sup>2</sup> )	Required EVD (MN/m <sup>2</sup> )	Difference EVD (MN/m <sup>2</sup> )	s/v (ms)	Required EV2 (MN/m <sup>2</sup> )
0.256	0.250	0.254	0.253	88.9	65	23.9	2.459	120



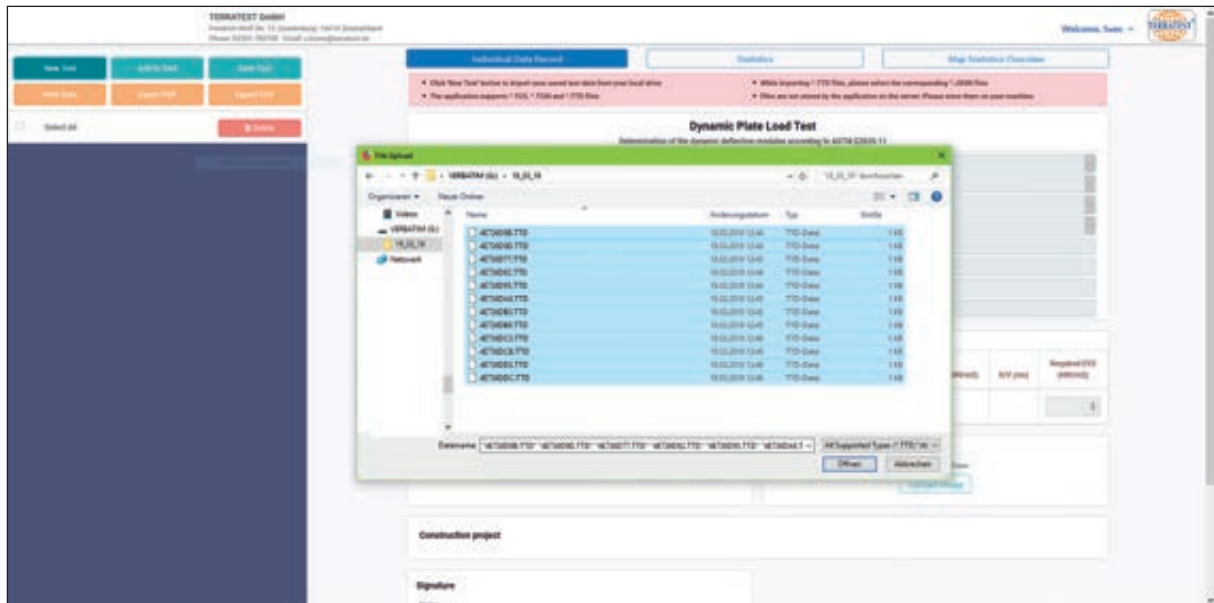
(Krone)



### 8.2.5 Load Measurements

In order to read a measurement stored beforehand from any storage medium (PC, USB stick etc.), click on button 'New Analysis'. The file explorer is opened. Select the desired data, and confirm by 'OK'. If data have been recorded by smartphone APP 'TERRATEST', specify also their \*.JSON files. The system reads the stored data and presents them in the left window as an overview together with data set no., Evd value, time and date, ready for further evaluation.

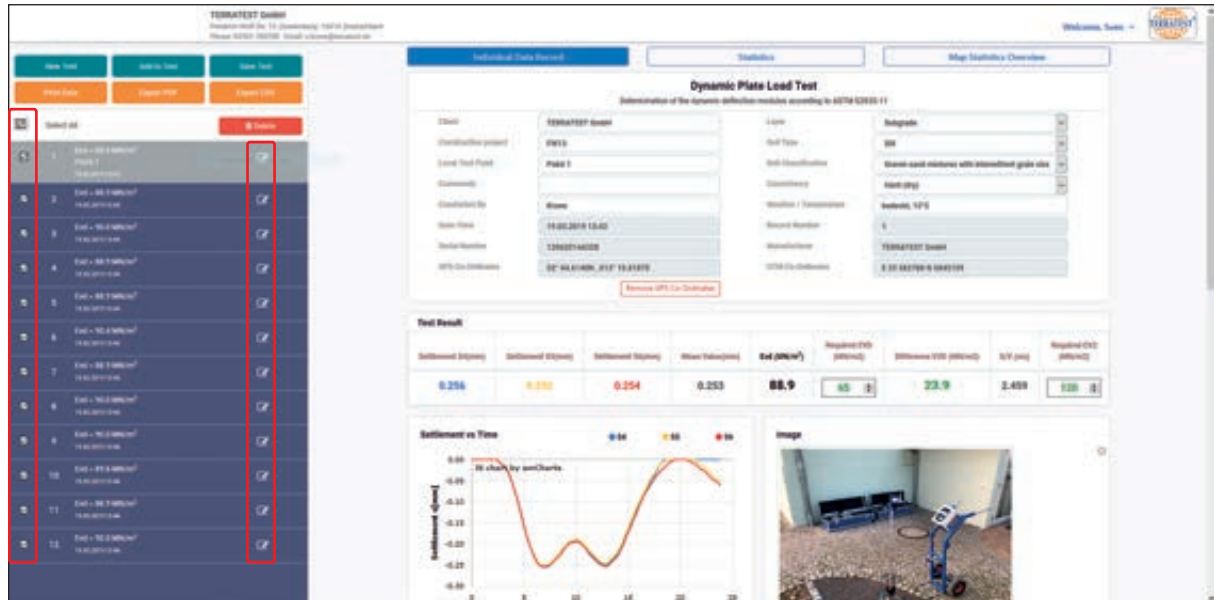
Note that the content of only one folder or data carrier can be loaded in the measuring data list. If several measuring sequences are intended to be evaluated, click on button 'Add to analysis' every time, and proceed as described above.



*In order to read data stored beforehand, click on 'New Analysis' and select their storing location. Data are loaded upon confirmation by 'OK'. If several sequences are required, click on button 'Add to analysis'.*

### 8.2.6 Edit/Store Protocol

To edit test protocols of single measurements, select the desired element from the measuring data list in the left field by a click on the preceding selection box. If all data sets are intended to be edited, click on button 'Select All' shown above. All selected data sets are marked by a pencil symbol.



Click in the selection box of the measurement intended to be edited. Released measurements are marked by a pencil symbol.

Any data set marked by pencil symbol can be selected by click; afterwards site specific data can be entered into the white fields of the single protocol, including required Evd Value. All entered information is automatically copied to all data sets previously marked by pencil symbol.

'Test point position' and 'Remarks' are not included here, but these points can be edited for each single measurement individually. If at the beginning of the measurement data input function of the measuring computer has been used, these input data appear of the field 'Remarks'. This field can be edited.

Entries in field 'Test point position' are transferred into statistical analysis when selecting the corresponding data set.

In order to describe the soil conditions of the test point in a single protocol, besides manual entry drop-down buttons (featuring a selection of standard descriptions) may be used.

For each single measurement, the difference between measured and required Evd value is displayed (if the latter one has been specified beforehand). If the measured exceeds the required Evd value, the difference is shown in green, otherwise in red (with a preceding minus sign).

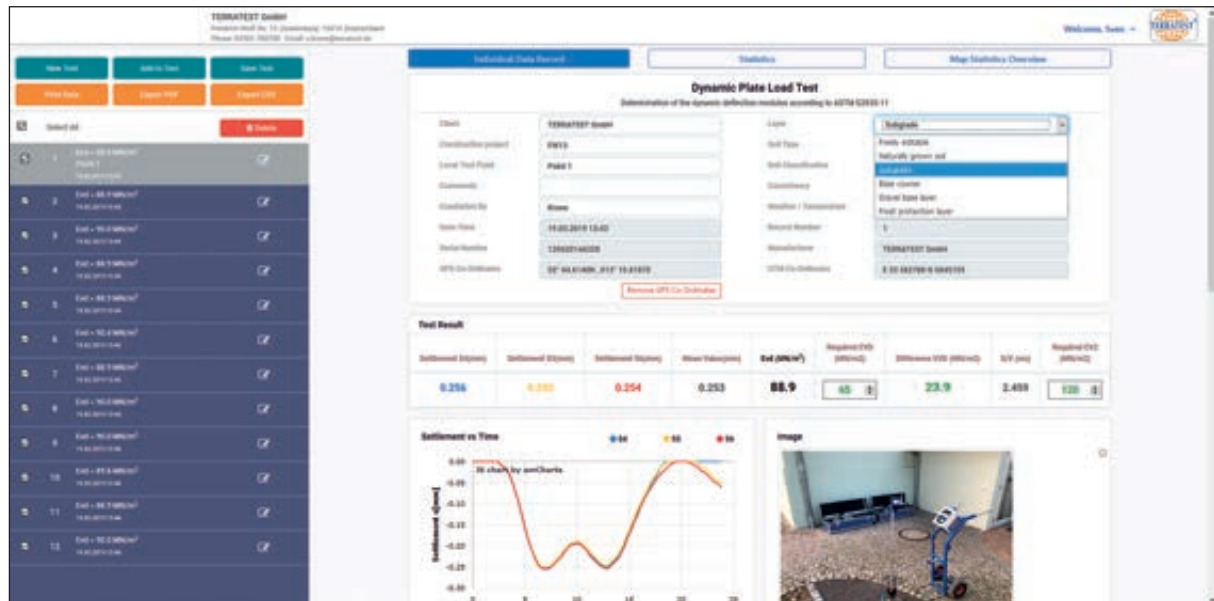
A click on button 'Remove GPS coordinates' removes GPS, UTM coordinates as well as the Google® maps® presentation from the measurement.

If a measurement has been selected for editing by mistake, or if the entries at the right side are not applicable for this measurement, click into the preceding selection box of this element in the list, so the activation of this data set is cancelled, entries are erased and the pencil symbol disappears.



**Note that read measuring data are not stored on server. They have to be stored on the local PC!**

By a left click on button 'Store measurements', read data sets of a project are collected in a ZIP file which is offered for download. According to the browser currently used, the ZIP file automatically is transferred into download folder, or into a folder to be specified by the user. A ZIP file after download can be opened by double click. The file name of the stored measuring data is composed as follows:  
 <Data carrier>\_<Data set>\_<Date>\_<Time>\_<Evd value>.tc5.



The screenshot displays the TERRATEST software interface. On the left, a sidebar lists several measurements with checkboxes and pencil icons. The main panel shows details for a 'Dynamic Plate Load Test'. Below this, a 'Test Result' table is visible:

Settlement (mm)	Settlement (mm)	Settlement (mm)	Mean Settlement	Ed (MPa)	Resistance Q10 (kN/m <sup>2</sup> )	Settlement Q10 (mm)	Q10 (mm)	Resistance Q20 (kN/m <sup>2</sup> )	Settlement Q20 (mm)	Q20 (mm)
0.256	0.250	0.254	0.253	88.9	65	23.9	2.499	120		

Below the table is a 'Settlement vs Time' graph showing a curve with a peak and a trough. To the right of the graph is an 'image' section showing a photograph of the test setup in a laboratory.

*Drop-Down-Menus simplify input of soil properties. Own descriptions may be used as well.*

### 8.2.7 Print protocol / Export as pdf or CSV file

Use buttons 'Print data' or 'PDF export' to perform the corresponding action for the single protocols selected for editing. 'CSV Export' of the measuring data is available as well.



**To establish statistical analysis, at least two measurements are required.**

The evaluation is subdivided into six zones:

**Protocol Header** with general information concerning measurement, construction site and device.

**Table of Results** with results and Evd value required, as well as GPS coordinates of the test points (if available) and description of the test point

**Statistics** with required minimum quantile, arithmetic average, standard deviation, coefficient of variation, quality value and test criterion.

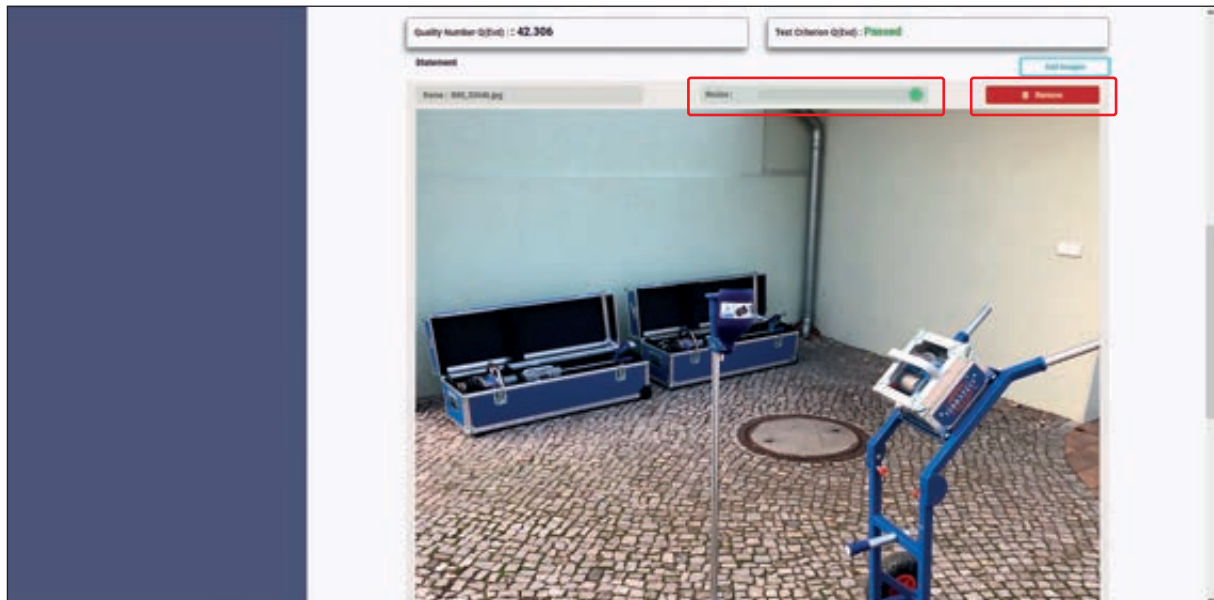
**Add Pictures** button enables additional photographs to be loaded to the protocol. These photographs after loading can be zoomed in or out by slider, or erased by a corresponding button above the picture.

**Comments** to the analysis can be added as well.

**Signature** of Responsible (if already present in the single protocol, it is automatically inserted).

Analysis follows the principle 'Single Plan – Variable Check', taking into consideration only the dynamic deformation module Evd.

Protocol header automatically delivers device manufacturer and device number; order specific data can individually be entered in the white fields.



*Use the slider to adapt the photograph size as desired. Illustrations can also be removed by 'Erase' button.*







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## Dynamic Plate Load Test, Statistic Analysis

Determination of the dynamic deflection modulus

according to TP BF-StB Part B 8.3 and TP BF-StB, Part E1: 'Test on a statistical basis - sample testing plans'

Client	TERRATEST GmbH	Layer	Subgrade
Construction project	PW13	Soil Type	Silt
Comments		Soil Classification	Gravel-sand mixtures with intermittent grai...
Conducted By	Krone	Consistency	Hard (dry)
Weather / Temp	cloudy, 12°C	Local test point	
Serial Number	120620144328	Manufacturer	TERRATEST GmbH

#	Date/Time	Settlement S4(mm)	Settlement S5(mm)	Settlement S6(mm)	Settlement Mean Value (mm)	Evd (MN/m2)	GPS Coordinates	Local test point
1	19.03.2019 13:43	0.256	0.250	0.254	0.253	88,9	52° 44.6140N, 013° 15.8187E	Point 1
2	19.03.2019 13:44	0.252	0.255	0.252	0.253	88,9	52° 44.6121N, 013° 15.8251E	
3	19.03.2019 13:44	0.250	0.250	0.250	0.250	90,0	52° 44.6193N, 013° 15.8220E	
4	19.03.2019 13:44	0.252	0.252	0.255	0.253	88,9	52° 44.6225N, 013° 15.8234E	
5	19.03.2019 13:44	0.255	0.250	0.254	0.253	88,9	52° 44.6098N, 013° 15.8375E	
6	19.03.2019 13:45	0.250	0.247	0.250	0.249	90,4	52° 44.6160N, 013° 15.8478E	
7	19.03.2019 13:45	0.252	0.256	0.250	0.253	88,9	52° 44.6124N, 013° 15.8491E	
8	19.03.2019 13:45	0.248	0.250	0.252	0.250	90,0	52° 44.6152N, 013° 15.8551E	
9	19.03.2019 13:46	0.249	0.250	0.250	0.250	90,0	52° 44.6094N, 013° 15.8506E	
10	19.03.2019 13:46	0.252	0.248	0.252	0.251	89,6	52° 44.6146N, 013° 15.8589E	
11	19.03.2019 13:46	0.252	0.252	0.255	0.253	88,9	52° 44.6077N, 013° 15.8521E	
12	19.03.2019 13:46	0.248	0.252	0.250	0.250	90,0	52° 44.6109N, 013° 15.8596E	

Required minimum quantile : undefined MN/m2

Arithmetic Mean  $X_m$  (Evd) : undefined MN/m2

Standard Deviation  $s$ (Evd) : undefined MN/m2

Coefficient of variation  $V$ (Evd) : undefined %

Quality Number  $Q$ (Evd) :

Test Criterion  $Q$ (Evd) : Failed

**Statement** Measurements carried out according to measurement plan 28549 / U dated 15.03.2019.  
Nothing special



  
( Krone )

## 9. App 'TERRATEST'

### 9.1 Installation

Start 'Google' Play Store or Apple' App Store on your smartphone/tablet and enter 'TERRATEST' into the search line. Install the App acc. to the Google' or Apple' instructions. 'TERRATEST' App is free of charge.



#### 9.1.1 System Requirements

'TERRATEST' App can be installed on every usual smartphone/tablet with Bluetooth' interface and operating system Android up from version 4, or operating system iOS up from version 10 and is only to be used together with light weight deflectometers 'TERRATEST 5000 BLU' (only operating system Android) and 'TERRATEST 6000 BLE' and for using the STREAM function of 'TERRATEST 4000 USB', 'TERRATEST 4000 VOICE' and 'TERRATEST 4000 STREAM' with STREAM dongle connected. GPS must be available for identification of the position.

#### 9.1.2 Important Note

 **When transforming an LFG to an MFG model, corresponding calibration data must be transferred from the measuring computer of the light weight deflectometer to the Bluetooth' load plate as well, as described in the following section.**

#### 9.1.3 First Steps

**Before establishing common applications between light weight deflectometer 'TERRATEST 6000 BLE' and 'TERRATEST' App, electronics of the Bluetooth' transmitting unit in the load plate must be prepared for the App.** For this purpose, calibration data of the instrument must be transferred from the measuring electronics to the Bluetooth' load plate. Required settings for LFG (10 kg loading assembly) have been established at factory during each calibration by TERRATEST'. This step is also required whenever changing the loading assembly (10 kg or 15 kg).

First switch ON Bluetooth' load plate by pressing its green button. The load plate performs a self-test, after completion the LED is lit in red.

Now switch ON the measuring computer by long pressing 'START' button. The display of 'TERRATEST 5000 BLU' automatically changes to 'STATUS REQUEST'. As long as the Bluetooth' connection to Bluetooth' load plate is established, an acoustic sonar signal sounds. Completion is signaled by voice message 'Bluetooth OK, start measurement', and the 'magic eye' of the Bluetooth' load plate is lit in blue.

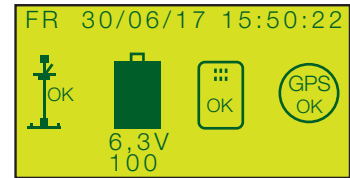
When changing an application of a 10 kg or 15kg load assembly, first set the corresponding falling weight at the measuring computer (refer to section 'Type LFG/MFG' (page 56), otherwise preform the following steps:

Press 'SELECT' to gain access to the main menu and then once more to choose by arrow menu point 'LOAD HEAD' Enter this menu by pressing 'START' button (SET). Now press 'PRINT' button twice to make appear menu point 'SEND DATA TO HEAD'. Press 'SELECT' to choose by arrow menu point 'SEND DATA TO HEAD', so the calibration data of the currently selected load assembly are transferred to the Bluetooth' load plate. This is indicated on display by a short message 'DONE'. Press 'RESET/OFF' button (EXIT) to return to 'STATUS REQUEST', and then once more to switch OFF the measuring computer. Switch OFF the Bluetooth' load plate by pressing its green button.

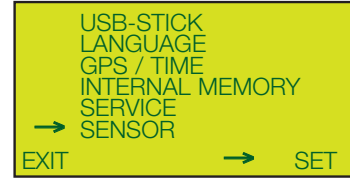
This way the calibration data have been changed to the currently used load assembly.

### 9.1.4 Pairing with Bluetooth® load plate (only TERRATEST 5000 BLU)

Switch ON Bluetooth® load plate by pressing its green button. Open Bluetooth settings on smartphone/tablet and scan for devices (usually via 'Settings' – 'Bluetooth' – 'Scan for Devices'). The designation of the Bluetooth® load plate consists of 'RNBT-' or 'Firefly', followed by a four-digit hexadecimal number. Perform the pairing with the device, the required password is 1234. **This pairing between smartphone/tablet and load plate must be performed once.**



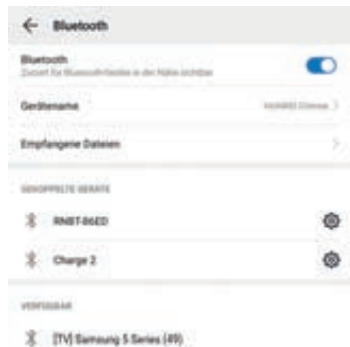
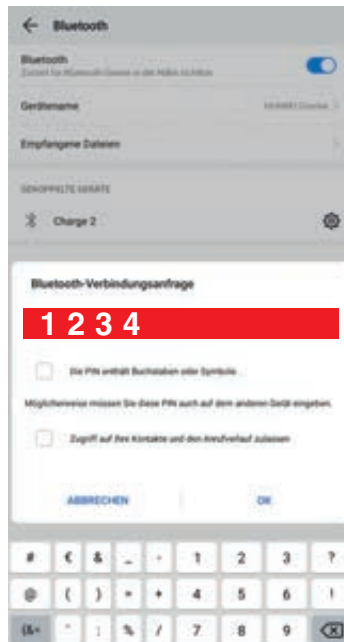
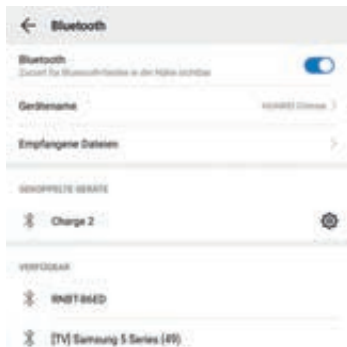
STATUS DISPLAY



MAIN MENU



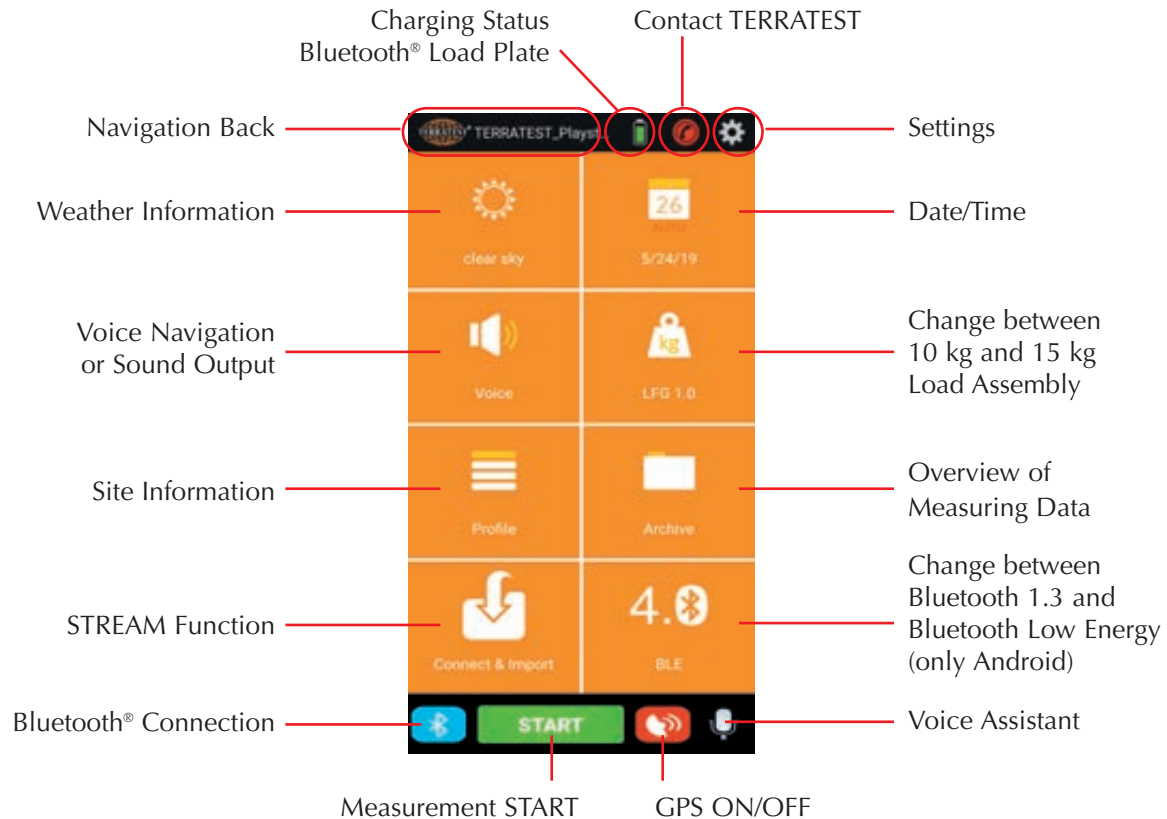
MENU LOAD HEAD



Example for the Bluetooth® pairing procedure between load plate 'TERRATEST 5000 BLU' and Android smartphone.

## 9.2. Operation

### 9.2.1 Operating Elements of 'TERRATEST' App



The interface of 'TERRATEST' App is subdivided into 3 zones:

#### Upper zone:

- Button for navigation to initial screen
- Charging status of battery for Bluetooth® load plate (connection must have been established beforehand)
- Contact button for TERRATEST GmbH hotline
- Basic settings of 'TERRATEST' APP

#### Center zone:

- Weather information (internet connection required)
- Information/button for time/date
- Information/button for voice navigation / sound output
- Information/button for selection of 10 kg or 15 kg load assembly
- Button for input of site information
- Button for retrieval and editing of data for measurements performed beforehand
- Button for activation of 'STREAM' function (only 'TERRATEST 4000')
- Information/button for common use with light weight deflectometer TERRATEST 5000 BLU or TERRATEST 6000 BLE (only Android operating system)

#### Lower zone:

- Button for establishment of Bluetooth® connection to load plate TERRATEST 5000 BLU
- Button for start of measurement
- Button for GPS ON/OFF
- Button for activation of voice assistant



## 9.2.2 Settings

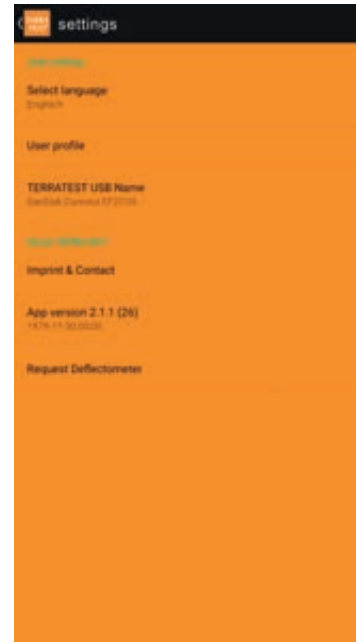
Before first use of 'TERRATEST' app, the software must be configured with basic settings and is subdivided into elements 'USER SETTINGS' and 'ABOUT TERRATEST'.

### 9.2.2.1 User Settings

Select the ⚙-symbol on initial screen.

Then select desired language via language button (English, German and Polish are available).

Now select button 'User Profile', and use the keyboard to enter required data for the user of the App and for the company, as these data are necessary for creation of test protocols and message transfer. Further input fields appear after wiping over the window upward. Field 'Impact Force' decides, whether the system is used for Light or Medium Weight load assemblies. For alternating use, select the current application by slider and confirm safety prompt 'ARE YOU SURE' by 'YES'. The company logo has to be entered into the lower field. The image file must have been loaded to smartphone/tablet beforehand.



SETTINGS

After entry of all data press the navigation button above at the left side. Data are stored, and the initial screen appears again.

Button 'TERRATEST USB Name' is required for functions of model 'TERRATEST 4000...' and is described on page 90 (**STREAM function**).

Press the navigation button above at the left side to return to initial screen.

### 9.2.2.2 About TERRATEST

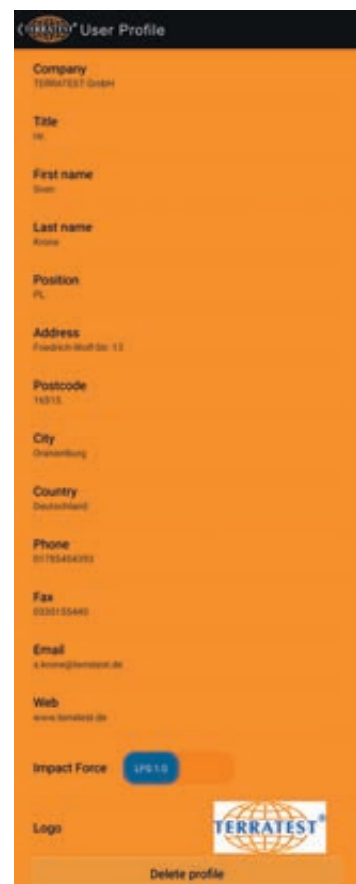
Select the ⚙-symbol on initial screen.

Pressing button 'Imprint & Contact' opens an additional window informing about TERRATEST contact data. Press 'Close' button to return to initial screen.

Below 'Imprint & Contact' button, information is given concerning the currently installed version of 'TERRATEST' App.

Pressing 'Ask for offer for a measuring instrument' generates an E-Mail with user data, which can be modified before sending.

Press the navigation button above at the left side to return to initial screen.



USER PROFILE



## 9.2.3 Measurement

### 9.2.3.1 Connection to Bluetooth® Load Plate

First switch ON Bluetooth® load plate by pressing its green button. The load plate performs a self-test, after completion the LED is lit in red.

Start 'TERRATEST' app on your smartphone/tablet. On the initial screen of the App, press the left lower operating element with Bluetooth® symbol. In the window appearing now, select the Bluetooth® load plate. Its designation starts with 'RNBT-' or 'Firefly' (for TERRATEST 600 BLE: 'RN'), followed by a hexadecimal number composed of several digits. The color of the Bluetooth® button changes from Grey to Blue, the 'START' button of the App is activated; simultaneously the Status LED of the Bluetooth® load plate is lit in Blue as well, thus showing that the required connection exists.

### 9.2.3.2 Preparation

Check the '**Weather**' field. If required, wait some seconds until the information is updated. Internet connection of course must be provided.

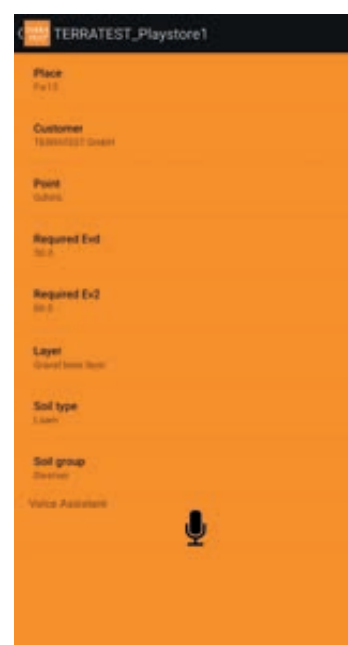
If information field '**Date/Time**' shows 'AUTO', date/time settings from smartphone are automatically adopted. Otherwise press the field to enter date/time manually.

Check the '**Voice Navigation/Sound Output**' field. Pressing this field enables the selection to be switched. 'VOICE' guides the user through the measurement by spoken instructions. In the case of 'SOUND' selection, a beep informs the user every time before the next step of a measurement.

Field '**LFG 1.0/MFG 2.0**' allows change between these two system configurations (Light or Medium weight). This field must match the current application, as before change the corresponding calibration data from measuring computer of the instrument must be transmitted to the Bluetooth® load plate, **as described under 'First steps', page 83.**

Then inspect the data entered for the construction site. Pressing '**Profile**' opens a window with the existing sites. Pressing a name activates the corresponding site, which will represent the basis for the measurement. Pressing the pencil symbol at the right side of the name enables the data of the site to be checked or modified. After pressing 'Abort', data entered for the previous measurement are inserted to the current measurement as well. Press 'New' to input data for a new construction site, by pressing this field and use the keyboard provided. After completion, press the navigation button above at the left side. The data are stored, the new construction site becomes active, and the initial screen appears again.

Check the **GPS button** as well. In the case of absent connection, this button is shown in Grey. If it is red, the position of the user is detected by GPS and added to the measurement data.



PROFILE OF  
CONSTRUCTION SITE

### 9.2.3.3 Test Procedure

For measurements with model 'TERRATEST 5000 BLU', it is important to observe instructions on page 38ff.

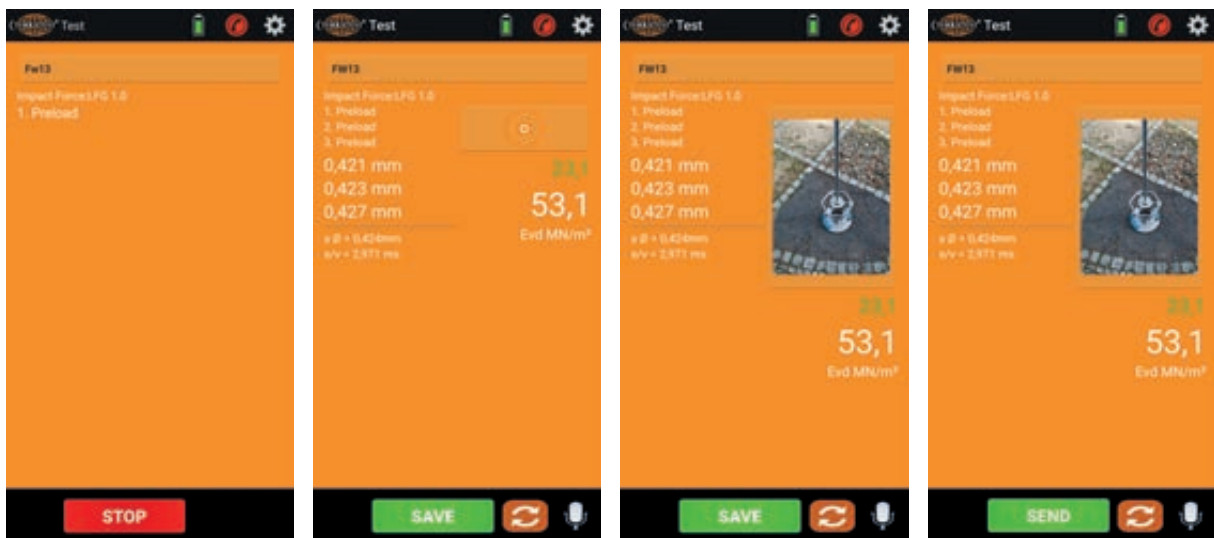
Draw the falling weight of the load assembly upward, and latch it into the catch device at the upper end. Press 'START' button to initiate measurement. The following window shows a button with the corresponding site and instruction to perform first preload. **If the construction site is not correct, interrupt the procedure, unlock the falling weight and place it at the bottom.** Then modify data as required by pressing the button for site information. Afterwards return to measurement by the navigation button above at the left side.

Perform three preloads and three test drops as described on page 38. After each drop, the next step is announced by voice message or beep. A corresponding message appears also in the APP display. The settlements of the drops are immediately shown after each step. In the course of the measurement, it is always possible to interrupt by pressing 'ABORT' button, so the initial screen of the App appears again.

At the end of the measurement, the result of Evd value is displayed in MN/m<sup>2</sup>. Button 'ABORT' changes to display of button 'STORE'. If desired, press the camera symbol in the right upper corner to insert a photograph of the test point into the protocol as well, which will be stored after pressing 'STORE' on smartphone/tablet.

Afterwards 'STORE' button changes to display of 'SEND' button, enabling the measuring data to be transferred as attachment of an automatically generated and pre-formulated E-Mail.

For further measurements click on Repeat symbol appearing at the right side of 'SEND' button. The next measurement can be launched.



Display in the course of a test procedure

### 9.2.3.4 Transmission of Measuring Data

From initial screen of 'TERRATEST' App, press button 'Measuring Data'. This opens the window for the site overview.

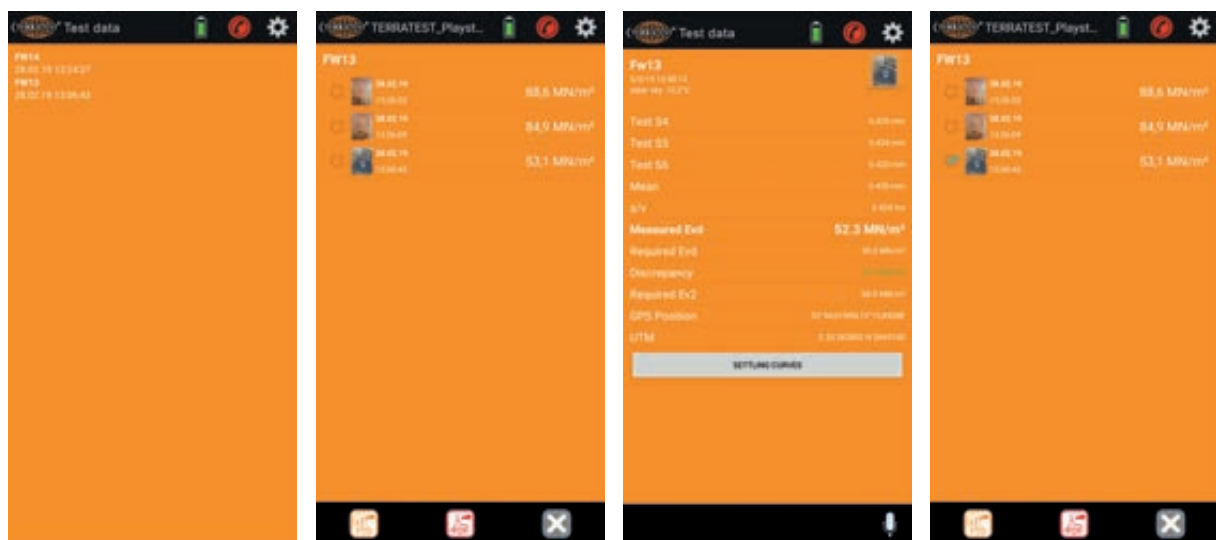
Press the construction site containing the data intended to be sent, to gain access to the window containing the overview of measuring data.

Select a particular measurement to display corresponding data. Return to the general overview of measuring data takes place by the navigation button above at the left side.

Press the selector buttons in front of the measuring data, and select all data to be sent.

Pressing button 'TTD' afterwards generates files for each selected measurement which are appended as attachment to an automatically created and pre-formulated E-Mail which can be sent. These files can also be opened and further processed by 'TEOLO' software. Each measurement is composed of 2 files with identical name, but different extension. The file with extension 'ttd' contains only measuring data like date and time, settlement of each drop, average of settlements, Evd value, device number and GPS coordinates of test point. Site description, weather information and (if recorded) photograph of the test point are included in a separate file with extension 'json'. Both files must be located in the same PC folder, otherwise they cannot be read by 'TERRATEST 2.0'.

Pressing 'PDF' instead of 'TTD' button generates a test protocol in pdf format with measuring data, photograph (if available) company data and logo stored in the settings. This file can be used as attachment to an automatically created and pre-formulated E-Mail which can be sent.



Profile Overview

Overview of Measuring Data

Presentation of Measurement

Selection for Transmission

### 9.2.3.5 Voice Assistant

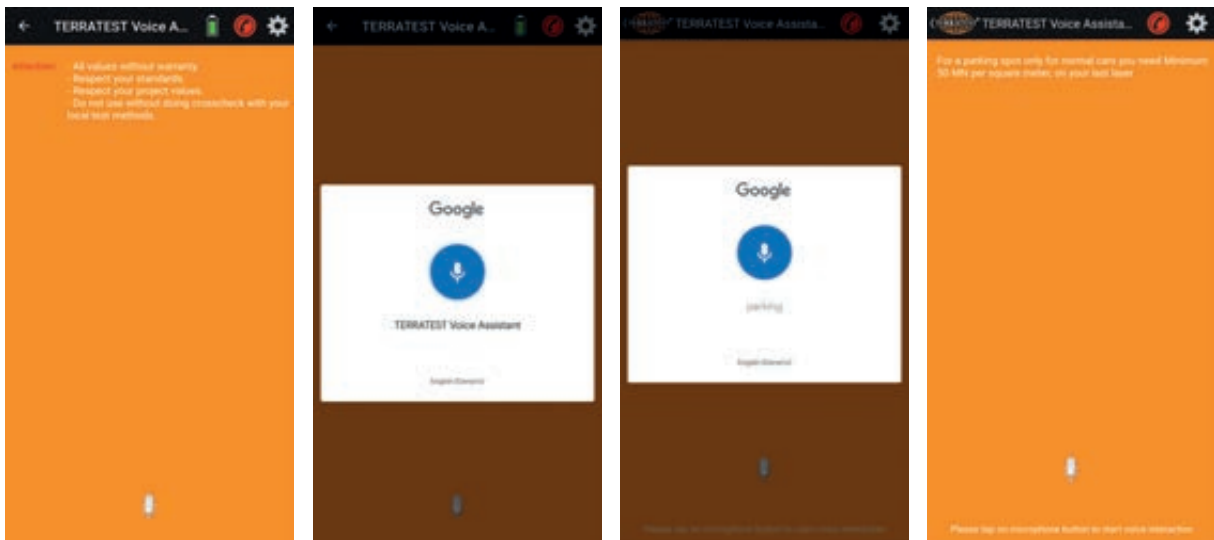
On the initial page of the App, or when creating or editing a site profile, as well as at the end of a measurement, a microphone is displayed in the lower zone of the app. Pressing this symbol activates the voice assistant.

First, some instructions for use of the voice assistant are displayed and read. Voice input is started after pressing the microphone on instructions page again. Entire sentences can be spoken, and the voice assistant reacts to following key words: 'Grown soil', 'Sidewalk', 'Bikeway', 'Floor plate', 'Car Parking', 'Road'.

If the question is understood, the system informs about minimum bearing capacity of the upper base layer. Example: 'Which value is required for construction of car parking?' Answer: 'Minimum requirement car parking is 50 MN/m<sup>2</sup> on the upper base layer.'



**This information is without warranty. The requirements of the actual project or order have to be observed, in case of need the requirements must be determined by a geotechnical expert. A correlation measurement on the basis of a static load plate test is required anyway.**



Voice assistant shown for an Android smartphone

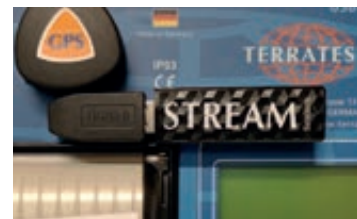
### 9.2.4 STREAM Function (only 'TERRATEST 4000' in connection with STREAM dongle)

The optional STREAM dongle enables data transfer to be carried out from measuring electronics to smartphone/tablet. This way, the 'TERRATEST' can also be used with a cable device. The dongle is delivered with an angular USB adaptor.

The STREAM dongle works in two operating modes.

**Mode 1:** If the STREAM dongle is inserted into the USB socket of the measuring computer, all measurements are stored on STREAM dongle. It acts like a normal USB stick.

**Mode 2:** Remove the STREAM stick from USB port of the measuring computer, and switch on the STREAM stick by pressing the small lateral button. As WLAN access of the STREAM dongle is now activated, it can be connected to 'TERRATEST' App, in order to import measuring data into the App.



Operating mode 1: USB Stick



Operating mode 2: WLAN

### 9.2.4.1 Initial Installation of STREAM Dongle (Android Operating System)

Switch OFF the measuring computer. Separate the STREAM dongle from USB port of measuring computer, and press the lateral button. Keep the lateral button pressed until a status LED on the upper face of the STREAM dongle is lit in white. As soon as the button is released, the status LED starts flashing, showing that the WLAN network has been prepared.

Start 'TERRATEST' app on smartphone/tablet. Select the ⚙-symbol on initial screen for settings.

Select button 'TERRATEST USB name', and then the desired STREAM dongle, its name starts with 'SanDisk Connect' and ends with six digit hexadecimal number. This procedure has to be carried out only once.

Press the navigation button above at the left side. Setting is stored, the STREAM dongle is stored with name 'TERRATEST' in the App, and the settings screen appears again. Press the navigation button once more to return to initial screen.



TERRATEST USB Name

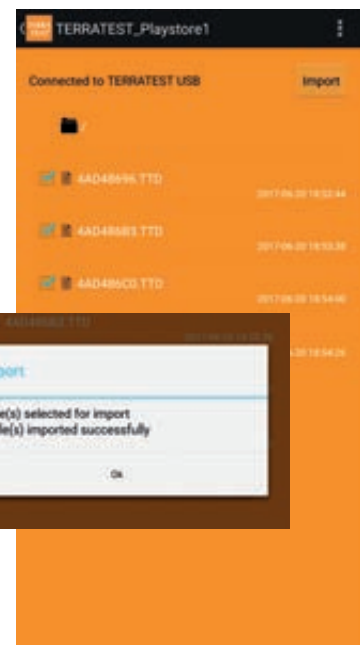
### 9.2.4.2 Connection and Import (Android Operating System)

First create a new or edit an existing construction site profile (refer to page 87).

Switch OFF the measuring computer. Separate the STREAM dongle from USB port of measuring computer, and press the lateral button. Keep the lateral button pressed until a status LED on the upper face of the STREAM dongle is lit in white. As soon as the button is released, the status LED starts flashing, showing that the WLAN network has been prepared.

Start 'TERRATEST' app on smartphone/tablet. On initial screen, select symbol 'Connection & Import'. The App is connected to the STREAM dongle and then shows its content. Select the desired folder and mark measuring data intended to be imported. Press 'Import' button. If the import has been successfully carried out, a corresponding status message is displayed.

Press the navigation button above at the left side twice. The WLAN connection of the STREAM dongle is separated, and the initial screen appears again. Use button 'Measuring data' to view and send the imported data.



Import of selected files

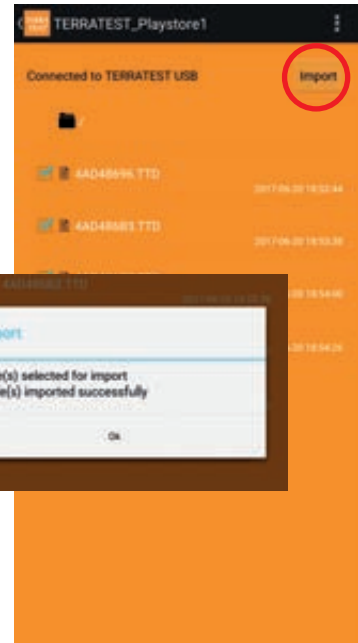
### 9.2.4.3 Connection and Import (Android Operating System)

First create a new or edit an existing construction site profile (refer to page 87).

Switch OFF the measuring computer. Separate the STREAM dongle from USB port of measuring computer, and press the lateral button. Keep the lateral button pressed until a status LED on the upper face of the STREAM dongle is lit in white. As soon as the button is released, the status LED starts flashing, showing that the WLAN network has been prepared.



Start 'TERRATEST' app on smartphone/tablet. On initial screen, select symbol 'Connection & Import'. The App for a moment displays a message and then changes to the smartphone settings. Select WLAN settings, and establish connection to the WLAN of the STREAM dongle, to be identified by 'SanDisk Connect', followed by a six digit hexadecimal number. Return to 'TERRATEST' App by pressing 'TERRATEST' word at the left side below time display. Press button 'Connection & Import' again. The App is connected to the STREAM dongle and then shows its content. Select the desired folder and mark measuring data intended to be imported. Press 'Import' button. If the import has been successfully carried out, a corresponding status message is displayed.



Press the navigation button above at the left side twice. The initial screen appears again. Use button 'Measuring data' to view and send the imported data. The WLAN connection to STREAM dongle must be closed either by switching OFF the STREAM dongle itself, or by plugging it into the USB port of the measuring computer, or by selection of another WLAN network in the WLAN settings of the smartphone.

Import of selected measuring data



## 10. Warranty

TERRATEST GmbH provides a warranty for this device of one year from date of delivery. This 1-year warranty granted in addition to statutory provisions is subject to the following warranty conditions. Statutory warranty claims shall not be affected by these warranty claims. If a manufacturing or material defect occurs within the warranty period, the device will be repaired or replaced at the expense of TERRATEST GmbH. Any warranty claim presupposes the presentation of sufficient proof, e.g. an accurate invoice. The warranty claim must be raised within the warranty period. The warranty does not cover devices or device parts which are exposed to normal wear and must thus be considered as wear parts.

The warranty will be void, if the device should be damaged and/or not be used and serviced appropriately (for example if the instructions provided in this manual are not followed).

The warranty period expires if the device is not calibrated within a year from date of purchase at a calibration institute accredited by the German Federal Road Research Institute (Bundesanstalt für Straßenbau).

Repairs may be carried out only by TERRATEST GmbH or authorised repair shops.

All instructions mentioned in this manual must be strictly observed for proper use of the device. Strictly avoid any utilisation of the device and any way of operating that this instruction manual advises or warns against.

### 1. Scope of Warranty

1.1. With this warranty declaration, TERRATEST GmbH grants you certain rights, restricted by kind and content (see 'Exclusions' and 'Limitations' in section 2). Please read this document carefully. By exercising any rights derived from this warranty you declare concurrently that you have understood and accepted their conditions. Your statutory provisions (warranty) against the party from which you have directly acquired this product persist irrespective of and in addition to this warranty and will not be affected by it.

1.2. TERRATEST GmbH guarantees that under normal circumstances every 'system' (see below) which is sold for the first time by TERRATEST GmbH or one of our dealers in a country of the European Economic Area or Switzerland (our trading area) will be free of defects in material or workmanship for the duration of time noted on the warranty card supplied with the system. 'System' refers to your brand-new product, including all original parts and components (provided that these were offered as options and/or accessories and installed at the time of purchase).

1.3. Software supplied with the system does not fall within the scope of this warranty. TERRATEST GmbH does not guarantee that the software will work faultlessly or without disruptions and neither that it will meet your requirements.

1.4. In case of a warranty claim TERRATEST GmbH will, at reasonable discretion, repair or replace faulty systems or parts covered by this warranty by new or as good as new parts or systems. In cases where TERRATEST GmbH uses parts or systems that are as new, these will be original TERRATEST GmbH products that underwent a general overhaul, so that their characteristics and performance equals brand-new products. All exchanged parts and systems replaced under the terms of this limited warranty become the property of TERRATEST GmbH.

1.5. The warranty period starts at time of delivery. Your invoice stating the purchase date of the system is your proof of purchase.

## 2. Exclusions and Limitations

This warranty is subject to the following exceptions and limitations:

### 2.1. Exclusions

This limited warranty does not cover:

2.1.1. Products which were not manufactured by TERRATEST GmbH or which were originally sold to an end user in a county outside the area in which this warranty applies.

2.1.2. Products which were damaged or rendered inoperable by one of the following ways of utilisation or operating:

2.1.2.1. Any use of the product for purposes other than the intended, including but not limited to non-compliance with the instruction manual supplied with the system, or other forms of improper use or neglect of the system;

2.1.2.2. Any modification of the system, for instance, the use or mounting of components which were not manufactured and/or sold by TERRATEST GmbH;

2.1.2.3. Any service or repair carried out by non-authorized third parties, i.e. not by TERRATEST GmbH;

2.1.2.4. Improper transport or packaging when returning the system to TERRATEST GmbH.

2.1.3. Loss or damage of programs, data, or media (except in cases of producer's liability, according to the product liability legislation which will be applied as appropriate to the damage suffered). You are responsible for a backup of all programs, data and/or media. As mentioned above, TERRATEST GmbH reserves the right to replace any systems sent in for repair with new or overhauled products of comparable quality and performance, in which case all data saved on the original system may become permanently inaccessible.

2.1.4. Consumables, i.e. any parts which need to be replaced regularly under normal conditions of use.

2.1.5. Minor defects of LC displays that occur in devices which are equipped with LC display technology.

### 2.2. Limitations and exclusion of warranty

2.2.1. No rights other than those explicitly granted herein can be derived from this warranty. This applies in particular to all other warranties, whether expressed, implied, or statutory, for which TERRATEST GmbH disclaims any liability. These include, amongst others, any implied warranties of marketability or fitness for a particular purpose. Any compulsory official warranty deriving from the applicable law is limited by the conditions of this warranty.

2.2.2. In no case shall TERRATEST GmbH be liable for damages caused by coincidence, for consequential damages caused by a defect, or for loss of profit, employment opportunities, data or use, irrespective of whether such claims are based on contractual entitlements, assurances concerning the utilisation or performance of the system, or the use of the device in any way prohibited by law or advised against in this documentation, or whether such claims concern the software supplied by TERRATEST GmbH, regardless of whether it was pre-installed or enclosed with the product. This exclusion of liability applies even if TERRATEST GmbH has been informed about the possibility of such damages.

2.2.3. The limitations and exclusions of liability mentioned in section 2.2.2 do not apply if the suffered loss or damage is the direct result of an arbitrary deception or a violation of a legal obligation by TERRATEST GmbH, provided that TERRATEST GmbH has acted with gross negligence. Neither do they apply if their exertion would restrict a valid entitlement against TERRATEST GmbH under the product liability legislation, which applies respectively to the damages suffered by the end-user.

2.3. If you make a claim under the warranty, you acknowledge concurrently that no further entitlements against TERRATEST GmbH regarding the purchase or use of your system exist other than those warranty and compensation benefits described above.

2.4. All entitlements based on this warranty become time-barred, if they are not claimed within one year after emergence.

### 3. Obtaining warranty service

Please contact TERRATEST GmbH to obtain warranty service, or should you have any cause for complaint.

TERRATEST GmbH  
Friedrich-Wolf-Strasse 13  
16515 Oranienburg  
Germany  
Phone: +49 33 01 700 700  
Fax: +49 33 01 55 44 0

[www.terratest.de](http://www.terratest.de)  
[info@terratest.de](mailto:info@terratest.de)

## 11. EC Declaration of Conformity

**in accordance with the EC Low Voltage Directive 2006/95/EC Annex III B;  
of 12 December 2006**

We hereby declare that the below mentioned product complies with the fundamental health and safety regulations of the EC Low Voltage Directive, by virtue of its design and construction, as well as its configuration, which was placed on the market by us, TERRATEST GmbH. This declaration shall become null and void should any alterations be made to the product without our prior agreement.

**Manufacturer/Representative:** TERRATEST GmbH  
Friedrich-Wolf-Strasse 13  
16515 Oranienburg / Berlin  
GERMANY

**of** Light Weight Deflectometer

### Description of electrical equipment:

Function: Test instrument to determine bearing capacity of soil  
Type: TERRATEST 4000 STREAM / TERRATEST 6000 BLE  
Serial number: 3001  
Year of construction: 2019

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

- EC Low Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- Degrees of protection provided by enclosures (IP53)  
according to DIN EN 60529 (edition 09/2015)
- RoHS Directive 2011/65/EC
- WEEE Directive 2012/19/EC

**Applied harmonised standards, in particular:**

**Other applied technical standards and specifications:**

- EN ISO 12100-1:2003 Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology
- EN ISO 12100-1:2003/A1:2009 Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology – Amendment 1
- EN ISO 12100-2:2003 Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles
- EN ISO 12100-2:2003/A1: 2009 Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles – Amendment 1
- EN ISO 14121-1: 2007 Safety of machinery – Risk assessment – Part 1: Principles
- EN 61010-1: 2001 Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements

**Years of CE marking:** 10

**Place / Date:** Oranienburg, 15.01.2019




**Personal details / identity of the signatory:**





Frank G. Schulz  
General Manager

## 12. Certificate TUV Rheinland - TUV GS

### 12.1 TUV GS

<b>Zertifikat</b>		<b>Certificate</b>			
<b>Zertifikat Nr. Certificate No.</b>	<b>Blatt Page</b>				
S 60101620	0001				
<b>Ihr Zeichen Client Reference</b>	<b>Unser Zeichen Our Reference</b>	<b>Längstens gültig bis Latest expiration date</b>			
	0010-- 21225919 001	06.05.2020	(day/mo/yr)		
<b>Genehmigungsinhaber License Holder</b>		<b>Fertigungsstätte Manufacturing Plant</b>			
TERRATEST GmbH		TERRATEST GmbH			
Friedrich-Wolf-Str. 13		Friedrich-Wolf-Str. 13			
16515 Oranienburg		16515 Oranienburg			
Deutschland		Deutschland			
<b>Prüfzeichen Test Mark</b>		<b>Geprüft nach Tested acc. to</b>			
		EN 61010-1:2010			
		AfPS GS 2014:01			
<b>Zertifiziertes Produkt (Geräteidentifikation)</b>		<b>Lizenzentgelte - Einheit License Fee - Unit</b>			
<b>Certified Product (Product Identification)</b>					
<b>Analysegerät Fallgewichtsgesetz zur Tragfähigkeitsmessung von Böden</b>					
<b>Bezeichnung</b>	: 1) TERRATEST 4000 USB	11			
<b>/type designation</b>	2) TERRATEST 5000 BLU	1			
	3) Measuring adapter with/without Bluetooth				
<b>Nennspannung</b>	: 1)2) 12V DC				
<b>/rated Voltage</b>	3) 9V DC				
<b>Nennaufnahme</b>	: 1)2) 1.25A				
<b>/rated input</b>	3) 2A				
<b>Schutzklasse</b>	: II (isolated) plug-in power supplies				
<b>/protection class</b>	III device				
<b>Schutzart</b>	: IP53				
<b>/Degree of protection</b>					
<b>Nur zur Verwendung mit folgenden Ladegeräten:</b>					
<b>/to be used with the following chargers exclusively</b>					
1)2) UE15WCP1-120125SPA oder/or 710226					
3) SYS1308-1809-W2E					
Ersetzt Zertifikat/replaces certificate: S 60100429					
12					
<p>Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde. Produkt und Fertigungsstätte erfüllen § 20 und § 21 des Produktsicherheitsgesetzes.  <i>This certificate is based on our Testing and Certification Regulation. Product and production fulfill par § 20 and § 21 of the Product Safety Law.</i></p> <p><b>TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg</b>            Tel.: +49 221 806-1371 e-mail: cert-validity@de.tuv.com            Fax: +49 221 806-3935 http://www.tuv.com/safety</p> <p><b>Ausstellungsdatum Date of Issue : 07.05.2015 (day/mo/yr)</b></p>					
<p><b>Zertifizierungsstelle</b></p>  <p>G. Stupp</p>					



<h1 style="margin: 0;">Certificate</h1>		
<b>Certificate no.</b> <span style="border: 1px solid black; padding: 2px 10px; display: inline-block;">CU 72150565 01</span>		
<b>License Holder:</b> Terratest GmbH Friedrich-Wolf-Str. 13 16515 Oranienburg Germany	<b>Manufacturing Plant:</b> Terratest GmbH Friedrich-Wolf-Str. 13 16515 Oranienburg Germany	
<b>Test report no.:</b> USA-JE 31580556 001 <b>Client Reference:</b> Frank Schulz		
<b>Tested to:</b> UL 61010-1:2012 CAN/CSA-C22.2 NO. 61010-1-12		
<b>Certified Product:</b> Light Weight Deflectometer		<b>License Fee - Units</b>
<b>Model Designation:</b> 1) TERRATEST 4000 USB 2) TERRATEST 5000 BLU 3) Measuring adapter		7
<b>Rated Voltage:</b> 1)+2) 12VDC; 3) 9VDC <b>Rated Input:</b> 1)+2) 1.25A; 3) 2A <b>Protection Class:</b> 1)+2)+3) III; (II for plug-in power supplies)		
To be used with the chargers listed in appendix 1		<hr style="width: 50px; margin: 0 auto;"/> 7
<b>Appendix:</b> 1, 1-7		
<b>Licensed Test mark:</b>  <div style="text-align: center;">  </div>	<b>Date of Issue</b> (day/mo/yr) 29/05/2015	
<small>TÜV Rheinland of North America, Inc., 12 Commerce Road, Newton, CT 06470, Tel (203) 426-0888 Fax (203) 426-4009</small>		





## 13. Standards

### 11.1 ZTV-E-StB 09 German Road and Transportation Research Association (Issue 2009)

‘..... 3.4.7.2 Requirements for deflection modulus

The requirements detailed below are based on the 10% minimum quantile. When constructing roads corresponding to Construction Classes SV, or I to IV on frost-free subsoil or substructure, it is necessary to obtain a deflection modulus of at least  $E_{v2} = 120 \text{ MN/m}^2$  or alternatively  $E_{vd} = 65 \text{ MN/m}^2$  on the subgrade. For Construction Classes V and VI a deflection modulus of at least  $E_{v2} = 100 \text{ MN/m}^2$  or alternatively  $E_{vd} = 50 \text{ MN/m}^2$  must be obtained. The deflection modulus  $E_{v2}$  is to be verified through the static plate load test, as defined in DIN 18134, and the deflection modulus  $E_{vd}$  through the dynamic plate load test, as defined in TP BF-StB Part B 8.3. If these requirements can be met only through compaction of the base courses, which are to be laid on the subgrade, it will be sufficient to prove or assess, by separate examination, a deflection modulus of at least  $E_{v2} = 100 \text{ MN/m}^2$  or alternatively  $E_{vd} = 50 \text{ MN/m}^2$  on the subgrade for Construction Classes SV, or I to IV, and a deflection modulus of at least  $E_{v2} = 80 \text{ MN/m}^2$  or alternatively  $E_{vd} = 40 \text{ MN/m}^2$  on the subgrade for Construction Classes V and VI. If the subsoil or substructure is susceptible to frost, a deflection modulus of at least  $E_{v2} = 45 \text{ MN/m}^2$  or alternatively  $E_{vd} = 25 \text{ MN/m}^2$  is necessary on the subgrade. For the scenarios outlined above, if the specifications of the building contract do not state whether the static or dynamic deflection modulus is to be established, the static deflection modulus should always be used. Alternatively, one can perform a calibration according to TP BF-StB Part E4, using the static deflection modulus to calibrate the dynamic deflection modulus. Afterwards, the dynamic deflection modulus may be used as a requirement. If the deflection modulus required on the subgrade cannot be achieved through compaction, it will be necessary to either

- (1) improve or solidify the subsoil or substructure, or
- (2) increase the thickness of the unbound base courses.

The measures must be listed in the specifications of the building contract.

Benchmarks for the allocation of the static deflection modulus $E_{v2}$ or the dynamic deflection modulus $E_{vd}$ to degree of compaction $D_{pr}$ on coarse-grained soil types			
	Required compaction in different depths (ZTVT-StB 95*) (ZTVE-StB 94)	Based on benchmarks for the allocation to $D_{pr}$ (ZTVE-StB 84 Chart 8)	1) <b>Proposal</b> for the allocation of $E_{vd}$ to $E_{v2}$ (acc. ZTV-E StB, Oct. 09)
Soil Types DIN 18 196	Degree of compaction $D_{pr}$ in %	Deflection modulus $E_{v2}$ in $\text{MN/m}^2$	Deflection modulus $E_{vd}$ in $\text{MN/m}^2$
Gravels and sands with $\leq 7\%$ by weight $<0,063 \text{ mm}$ (gravels with wide or intermittent grain size distribution, gravel-clay and gravel-peat mixtures)	$\geq 103$	$\geq 120$	$\geq 65$
	$\geq 100$	$\geq 100$	$\geq 50$
	$\geq 98$	$\geq 80$	$\geq 40$
	$\geq 97$	$\geq 70$	$\geq 35$
Gravels and sands with narrow grain size distribution, sands with wide or intermittent grain size distribution	$\geq 100$	$\geq 80$	$\geq 40$
	$\geq 98$	$\geq 70$	$\geq 35$
	$\geq 97$	$\geq 60$	$\geq 32$
Mixed gravels and sands with 7-15% by weight $<0,063 \text{ mm}$ (gravel-silt and gravel-clay mixtures, sand-silt and sand-clay mixtures)	$\geq 100$	$\geq 70$	$\geq 35$
	$\geq 97$	$\geq 45$	$\geq 25$
Silty and clayey as well as mixed soils 15-40% by weight $<0,063 \text{ mm}$ (silt, clay, gravel-silt and gravel-clay mixtures, sand-silt and sand-clay mixtures)	$\geq 97$	$\geq 45$	$\geq 25$
	$\geq 95$	$\geq 30$	$\geq 20$

ZTV E  
StB 09

ZTV A  
StB 12

1) In accordance with ZTV E-StB 09 §14.2.5 and ZTV E-StB 12 client and contractor may agree upon these reference values as benchmarks for verification of the achieved compaction.

**To be on the safe side always perform a correlation measurement with the static plate load test in accordance with DIN 18134.**

**The test must be performed and evaluated according to German standard TP BF StB Part B 8.3.**

**For general information only! All details are subject to change.**

**13.2 IL 836 – German National Railway Company Deutsche Bahn AG**

**Extract from German standard RIL 836 - Deutsche Bahn AG**

836.501 RIL 836- Earthwork structures – design, construction and maintenance  
Seite 10 Standard for embankments and cuttings

Requirements for railway track substructure under embankments or cuttings													
1	Type of railway line		Top soil		Protective layer					Subgrade		general assembly	
	Line category <sup>1)</sup>	Track ballast	E <sub>v2</sub> [MN/m <sup>2</sup> ]	E <sub>vd</sub> <sup>2)</sup>	Material mix	D <sub>pr</sub> (-)	Standard thickness [cm] area affected by frost			E <sub>v2</sub> [MN/m <sup>2</sup> ]	E <sub>vd</sub> <sup>2)</sup>	acc. attachment 1, figure	
							I	II	III			embankment	cutting
2	3	4	5	6	7	8	9	10	11	12	13	14	
New construction	P 300	Ballast track	120	50	KG 1/2	1,00	70	70	70	80	40/35	A 1.1	A 1.3
		Solid track	120	50	KG 2	1,00	<sup>3)</sup> 40	<sup>3)</sup> 40	<sup>3)</sup> 40	60	35/30	A 1.2	A 1.4
	P 230 M 230	Ballast track	120	50	KG 1/2	1,00	50	60	70	60	40/35	A 1.9	A 1.7
		Solid track	120	50	KG 2	1,00	<sup>3)</sup> 40	<sup>3)</sup> 40	<sup>3)</sup> 40	60	35/30	A 1.6	A 1.8
	P 160, M 160 G 120, R 120	Ballast track	100	45	KG 1/2	1,00	40	50	60	45	35/30	A 1.9	A 1.10
	R 80, G 50 all other lines	Ballast track	80	40	(KG 1/2) <sup>4)</sup>	1,00	30	40	50	45	30/25	A 1.11	A 1.12
Maintenance <sup>5)</sup> Improvement	P 230 M 230	Ballast track	80	40	KG 1/2	1,00	30	40	50	45	30/25	A 1.13	A 1.13
		Solid track	100	45	KG 2	1,00	<sup>3)</sup> 40	<sup>3)</sup> 40	<sup>3)</sup> 40	45	30/25	A 1.14	A 1.14
	P 160, M 160 G 120, R 120	Ballast track	50	35	KG 1/2	1,00	20	25	30	30	25/20	A 1.15	A 1.15
	R 80, G 50 all other lines	Ballast track	40	30	(KG 1/2) <sup>4)</sup>	0,97	20	20	20	20	25/20	A 1.16	A 1.16

(1) Types of railway lines according to modulus 413.0202

P 300	High-speed traffic	300 km
P 230	Passenger traffic line (upgraded)	230 km
M 230	Mixed traffic line (upgraded)	230 km
P 160	Passenger traffic line (I+II)	160 km
M 160	Mixed traffic line	160 km
G 120	Freight transport line	120 km
R 120	Regional transport line	120 km
G 80	Regional transport line	80 km
G 50	Freight transport line	50 km

(2) Dynamic deflection modulus: For conditions of use see article 6; paragraph 5 for subgrade:

1. Value for coarse-grained soil
2. Value for mixed and fine-grained soil

(3) This thickness assumes a hydraulically bound base course of at least 30 cm under the solid track.

(4) as well as coarse-grained soils, gravels and sands with wide or intermittent grain size distribution; see modulus 836.0503, article 3

(5) when improving lines for high-speed traffic

**The test must be performed and evaluated according to German standard TP BF StB Part B 8.3.  
For general information only! All details are subject to change.**



Extract from Austrian standard RVS 08.03.04 – Compaction Tests by means of the Dynamic Plate Load Test; Issue 1st March 2008; Austrian Association for Research on Road · Rail · Transport

### 8.1 Conversion of Minimum Requirements

A minimum requirement for the deformation modulus  $E_{v1}$  of the static plate load test can also be checked with the dynamic plate load test. The conversion of minimum requirements for the deformation modulus of the static plate load test ( $E_{v1}$ ) to those for the dynamic deflection module of the dynamic plate load test ( $E_{vd}$ ) is carried out with the following formula for **non-cohesive soils**:

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

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

and for **cohesive soils** with the formula:

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

Chart 1 presents the relation.

**Note:**

Chart 1 helps you to convert requirements (limit values); however it should not be used to convert the test values ( $E_{vd}$ - $E_{v1}$ ). The influence of the dynamic excess pore water pressure, which occurs with cohesive soils, the dispersion due to the high number of tests as well as the deviations caused by various tests under high rigidity have been considered during the creation of the chart.

**Chart 1: Conversion of the Minimum Requirements from  $E_{v1}$  to  $E_{vd}$**

Static Plate Load Test $E_{v1}$	Dynamic Plate Load Test $E_{vd}$	
Deformation Modulus $E_{v1}$ [MN/m <sup>2</sup> ]	Dynamic Deflection Module $E_{vd}$ [MN/m <sup>2</sup> ]	
	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	

The current calibration chart of the LWD in use must be carried along with the device. The test value  $E_{vd}$ , which corresponds to the minimum requirement  $E_{v1}$ , may be found in this calibration chart and must be verified.

**The test must be performed and evaluated according to Austrian standard RVS 08.03.04. For general information only! All details are subject to change.**

## 14. Cable Layout

### 14.1 LEMO Push-Pull Connection ('TERRATEST 5000 BLU' ONLY)

#### 14.1.1 Female Socket

	Codification	Testing Computer	Bluetooth® Sensor Dome
	GND	green	black
	+U	white	red
	OUT	brown	green

#### 14.1.1 Male Plug

	Codification	Wire
	+U	red
	OUT	white
	GND	yellow

### 14.2 Jack Connection ('TERRATEST 4000 USB' ONLY)

#### 14.2.1 Female Socket

	Codification	Testing Computer	Sensor Dome
	OUT	brown	green
	GND	green	black
	+U	white	red

#### 14.2.1 Male Plug

	Codification	Wire
	OUT	white
	+U	red
	GND	yellow



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