

DYNATEST 3032 LWD

Light Weight Deflectometer

OWNER'S MANUAL

Version 2.0.1

ID Number 1110300

This document is subject to change without notice. No part of this document may be reproduced in any form without written permission of Dynatest.

© 2020 Dynatest A/S. All rights reserved

Arial and Times New Roman are registered trademarks of The Monotype Corporation PLC.
IBM is a registered trademark of International Business Machines Corporation.
Any other trademark is a registered trademark of the respective company.

Table of Contents

1	Instructions for use	5
1.1	Unpacking	5
1.2	Standard equipment	5
1.3	Optional equipment	5
1.4	Overview	6
2	Introduction to the 3032 LWD (Light Weight Deflectometer)	7
2.1	Description.....	7
2.1.1	Introduction.....	7
2.1.2	Key Operational Features	7
2.1.3	Key Field Software Features.....	8
2.1.4	Key LWDmod Analysis Software Features.....	9
2.2	Application.....	10
3	Technical specifications	11
3.1	Technical data.....	11
3.2	Transportation	11
3.3	Device minimum requirements.....	12
3.4	Registration.....	12
4	Preparing the LWD for use	13
4.1	Additional drop weight(s)	15
4.1.1	Setting up the 15 kg Drop Weight	15
4.1.2	Setting up the 20 kg Drop Weight	15
4.2	The weight catch assembly	16
4.2.1	Adjustment	16
4.2.2	Use	17
4.3	The Dual Plate System	18
4.4	To Centre and Seat the Geophone	19
4.5	Additional Geophones.....	20
5	Software & device connection setup	22
5.1	Connecting Bluetooth devices.....	22
5.1.1	Turn Bluetooth on or off	23
5.1.2	Scanning your device	24
5.1.3	Connecting your device	25
6	Using the Data Collection Software	26
6.1	Create a Project	27
6.2	Create a Session	28
6.3	Create a Location	29
6.4	Drops.....	30
6.5	Remote Control.....	31
6.6	Compaction.....	32
6.7	Settings pages.....	33

7	LWD Operation	36
7.1	Using the 300mm or Dual Plate System	36
7.2	Changing to the 100mm or the (optional) 200mm dia. plate	37
8	Maintenance	38
8.1	Battery charge	38
8.2	Calibration.....	38
9	Service and support	39
9.1	Support & Assistance	39
10	EU declarations and certificates	40
11	FAQ	41
11.1	General Questions	41
11.2	Questions related to the use.....	42
11.3	Questions related to measuring	42

1 Instructions for use

This manual helps the user to get the most from the Light Weight Deflectometer. Before operating the machine, carefully read the following information.



REMARK!

Encircled capital letters refer to an item illustrated.

1.1 Unpacking

When the machine is delivered, carefully inspect the shipping carton and the machine for damage. If damage is evident, save the shipping carton so that it can be inspected by the carrier that delivered it. Contact the carrier immediately to file a freight damage claim. Make sure all parts are included and in good condition.

1.2 Standard equipment

- Main Unit with integral load cell, centre deflection sensor, electronics unit, wireless module with battery compartment and including a 150 mm dia. loading plate, convertible to a 100mm dia. Plate.
- 300mm (11.8 in) diameter plate (for the 150/300 mm Dual Plate System).
- 300mm (11.8 in) diameter Ribbed Rubber Pad.
- Drop Weight Guide Shaft, top and bottom parts.
- Weight Catch Assembly.
- 2 Buffer Pad Stacks (1 stack of 4 (or5) black pads plus 1 stack of 2 grey pads).
- 10 kg (22 lb.) Basic Drop Weight.
- Sensor Locking Plug.
- USB charger cable.
- Transportation Box for standard equipment.
- 1 year of free support by phone or e-mail.

1.3 Optional equipment

- Transportation Trolley.
- 5 kg (11 lb) (2 max) additional drop weight(s).
- 2 Buffer Pad Stacks (1 stack of 5 grey pads plus 1 stack of 2 black pads).
- Loading Plate Ø200 mm (7.9 in).
- Additional Deflection Sensor(s) (one or two).
- Sensor Extension Bar for up to two deflection sensors.
- Transportation Box for optional equipment.

1.4 Overview

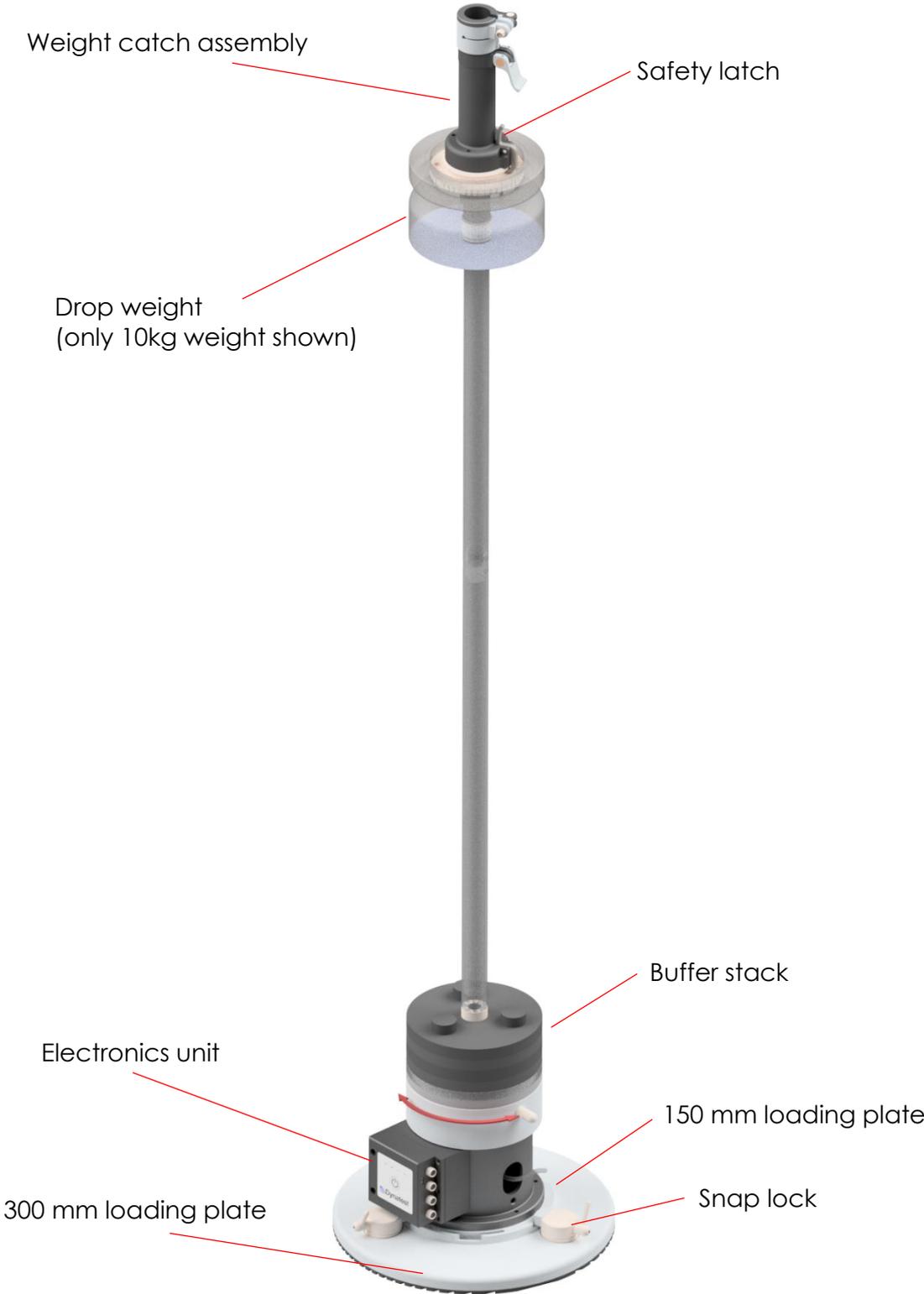


Figure 1 The Dynatest LWD

2 Introduction to the 3032 LWD (Light Weight Deflectometer)

2.1 Description

2.1.1 Introduction

Back in the early 1970's, as mechanistic (or analytical) approaches to pavement engineering found increased support internationally, Dynatest introduced the world's first portable LWD (Light Weight Deflectometer), as a new method to determine the E-modulus of un-bound materials in pavements.

Over the recent years demand for an automated device has arisen and this prompted Dynatest to re-design its 1970 device, enhancing and automating the LWD mechanics by means of the latest technology, adding electronics and analysis software that go far beyond what is currently offered in the marketplace. The new device has been designed to meet international standards that are under development for this type of equipment.

The Dynatest LWD meets all current standards the ASTM E 2583, the UK IAN73 and the standards in Denmark and Italy.

The equipment is precision-engineered, using stainless or anodized material for all metal parts. The system is powered by a pack of four AA alkaline or rechargeable batteries, providing approximately 2000 measurements or the equivalent to more than 12 hours of continuous operation.

With the additional (optional) 2 x 5kg weights added, the Dynatest LWD can produce up to 15kN peak loads. The LWD weighs about 22 kg (with the standard 10kg drop weight), and it is highly portable and easily carried around a construction site. There is an optional, specially designed trolley available.

The Dynatest LWD requires no reference measurements and provides a simple, cost effective alternative to time-consuming and expensive static plate bearing testing.

The LWD is ideal for Quality Assurance / Quality Control on subgrade, subbase and thin flexible constructions, on newly built or existing constructions to ensure that specifications are met. It can similarly be used to identify weaknesses, leading to further tests by FWDs and other material analysis techniques.

2.1.2 Key Operational Features

- The Dynatest LWD electronics are interfaced to a smartphone via a wireless Bluetooth connection.
- The LWD electronics are dust and splash proof (IP56) for safe outdoor use.
- The drop height is easily and quickly adjusted by a movable catch assembly.
- A laser engraved scale on the weight guide shaft allows for easy setting of the desired drop height.
- The magnitude of the impact force is determined from actual measurements by a precision load cell, measuring the time history and peak value of the

- impact force from the std. 10kg or the optional 15kg or 20kg drop weight setups.
- The loading plate diameter can quickly and easily be switched between 300mm and 150mm. A 100mm plate diameter is also available as standard, and an optional 200mm plate is available.
 - The centre deflection time history and peak value are measured through a hole in the loading plate by a highly accurate, seismic transducer (geophone).
 - Built-in ability to ensure that the centre geophone is centred and seated correctly.
 - Optionally, two more geophones can be added.

2.1.3 Key Field Software Features

- The data collection software residing on the smartphone displays - in real time - the surface modulus and the time history graphs from the geophone as well as from the load cell.
- Relevant information such as name, place and comments can be added to the data file for each measuring point.
- Poisson's Ratio as well as Stress Distribution Factor parameters may be defined by the operator.
- With the use of a smartphone, data can be collected and e-mailed, sent directly to a server or downloaded from the Dynatest LWD Connect PC software which can be downloaded through the DynaHub software.

2.1.4 Key LWDmod Analysis Software Features



The optional software package LWDmod offers advanced features for data organization, analysis and reporting:

- Imports data into a project database, allowing organization of multiple files into one database.
- Graphical features to view test results, and to eliminate selected drops or points from the file.
- Editing features.
- Automated selection of drops to be used in the analysis.
- Calculation of surface moduli, as shown in Fig. 2.

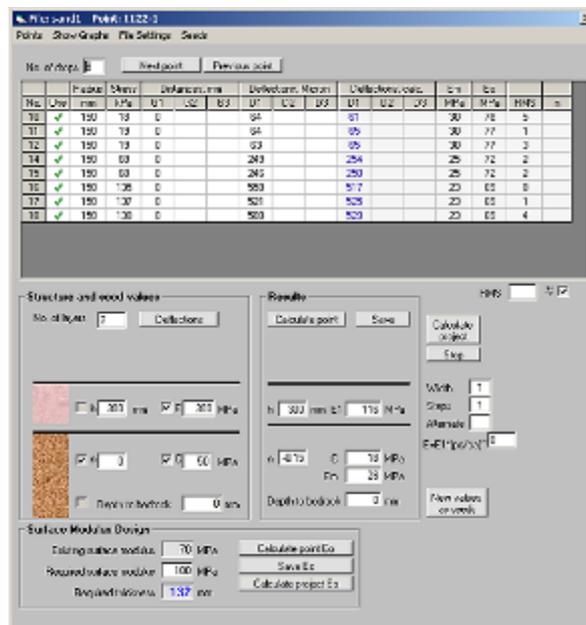


Figure 2 LWDmod surface modulus screen

- Back-calculation of layer moduli for multi-layer systems, using the results of multiple tests.
- Calculation of subgrade non-linearity.

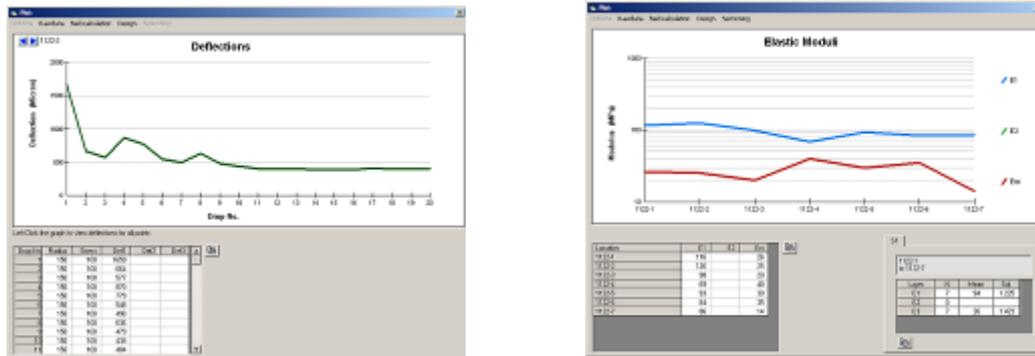


Figure 3 - LWDmod deflection and elastic modulus displays

- Calculation of needed overlay thickness based on design surface moduli.
- Analysis of load/deflection time histories (see Figure 3).
- Graphical presentation of all analysis results.
- Possibility to export result tables and graphics.

2.2 Application

The Light Weight Deflectometer is a handy instrument for on-site measurement of bearing capacity and stiffness of subgrade, subbase and thin flexible constructions. Only one person is needed for the operation and the equipment can work under very difficult conditions and areas with poor accessibility like in excavation trenches. Site locations can be captured by means of GPS (Geographic Positioning System), which enable presentation of data in maps or general plans of site.

3 Technical specifications

3.1 Technical data

General

Height	1,38 m (54.3 in), assembled
Total weight	Approx. 22 kg. (49 lb.) (Std. equipment w/o Transportation Box)

Loading

Loading plate diameters	100mm (3.9 in), 150mm (5.9 in) & 300 mm (11.8 in) standard (optional 200 mm (7.9 in))
Drop Weight Mass	10 kg (22 lb) (optionally 15/20 kg (33/44 lb))
Drop Height	850 mm (33.5 in) max.
Loading range	>15 kN (3370 lbf) peak load using the optional 20 kg (44 lb) drop weight
Loading type	Essentially half sine
Pulse duration	15 - >30 ms

Load Cell

Range	0-25.0 kN (0-5,500 lbf)
Accuracy	2% ± 2 kPa (2.25 lbf)
Precision	0,0003 kN (0.067 lbf)

Deflection Sensor(s)

Type of sensor	Velocity transducer (Geophone)
Number	1 with the standard unit (optionally 1 or 2 additional sensors)
Range	0-2200 µm (0-87 mil)
Sampling frequency	4,000 Hz on each sensor
Sampling period	60-120 ms (set by user)
Accuracy	2% ± 2 µm (0.08 mil)
Precision	0.1 µm

3.2 Transportation

Transportation box for standard equipment

Material	High impact ABS
Carrying capacity	80 kg (176 lb)
Net weight	11 kg (24 lb)
External dimensions	750 x 500 x 250 mm (29.5 x 19.7 x 9.8 in)

Transportation box for additional equipment (optional)

Material	High impact ABS
Carrying capacity	50 kg (110 lb)
Net weight	3,3 kg (7.3 lb)
External dimensions	470 x 370 x 150 mm (18.5 x 14.6 x 5.9 in)

Transportation trolley (optional)

Material	Stainless Steel and POM
Net weight	2.9 kg (6.4 lb)
Wheels	Pneumatic

3.3 Device minimum requirements

- iOS 10.2 or newer / Android 5.1 or newer
- Bluetooth LE capability
- GPS Capability
- Internet Capability

3.4 Registration

The machine Model and Serial Numbers are shown on the main unit or can be found in the “about” box in the LWD software (e.g. 3032-3115). This information is needed when ordering spare parts for the machine. Use the space below to note the machine Model and Part Numbers for future reference.

Model Number.....

Serial Number.....

4 Preparing the LWD for use

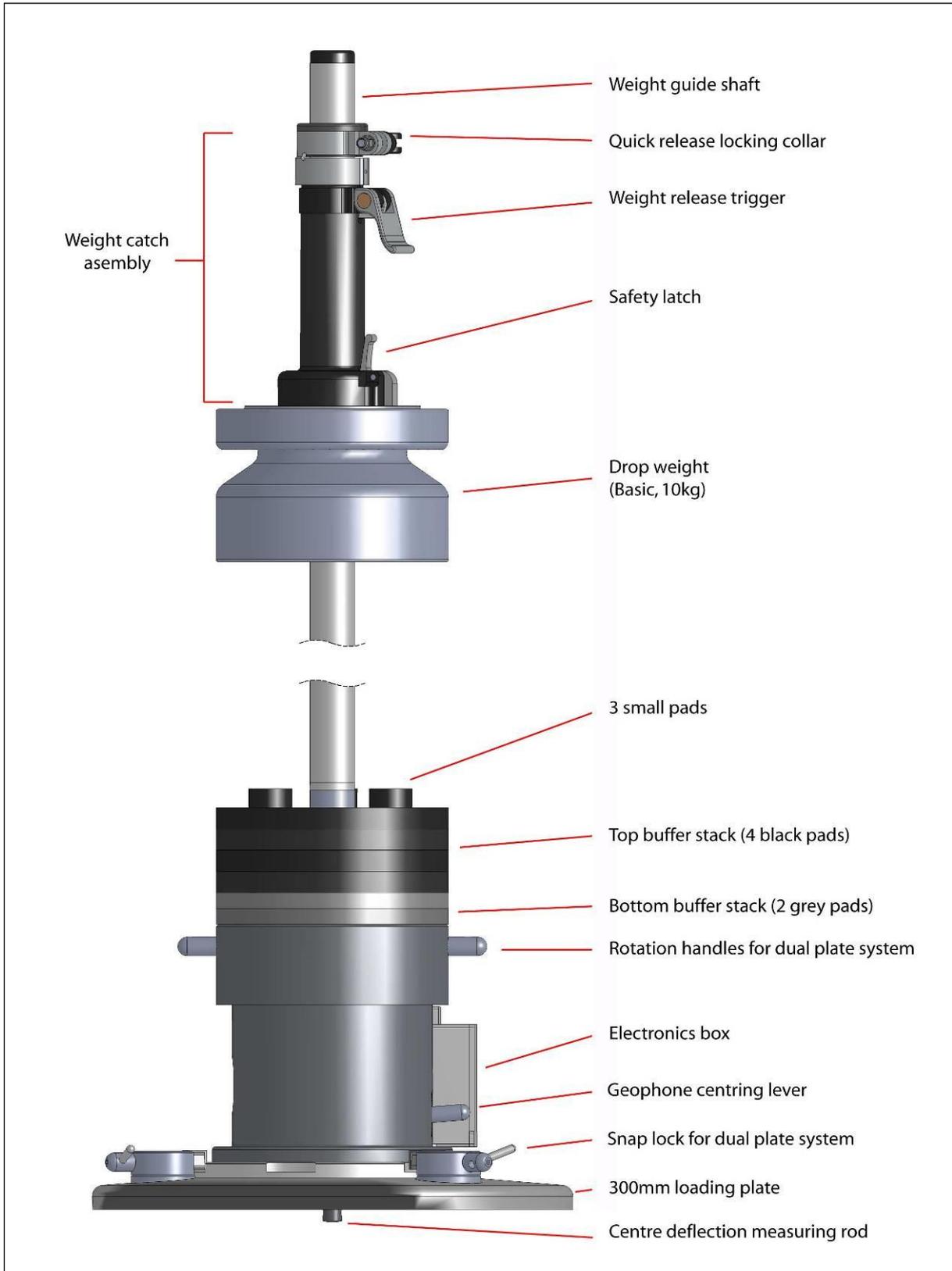


Figure 4 - Standard LWD

1. Place the 300mm dia. ribbed rubber pad on a flat surface.
2. Place the 300mm loading plate on the ribbed rubber pad.
3. Rotate the 3 snap locks to click-lock in an “open” position.
4. Check that the centre deflection measuring rod (at the bottom of the Main Unit) is TIGHT (In case of testing on a very soft material, it may be necessary to unscrew the centre deflection measuring rod and replace it with the supplied Sensor Locking Plug, which will then plug the centre hole of the 150mm plate and also lock the centre geophone to the plate).
5. Place the Main Unit in the centre of the 300mm plate, so that the small, vertical indicator pin of the 300mm plate will fit into the mating groove in the edge of the 150mm plate (= the bottom of the Main Unit).
6. Rotate the Main Unit anticlockwise until the indicator pin is at the end of the groove at the “300mm” engraved mark (under the electronics module).
7. Lock each of the 3 snap locks: First rotate the knurled knob till the hole just behind the knob is vertical and the clamping piece (opposite to the knob) is in its top position, then rotate the snap lock 90 degrees clockwise and turn the knob firmly (the 4mm Allen key may be stuck in the hole behind the knob for further tightening, but please do not over tighten!).
8. Add on the appropriate Buffer Pad Stack:



NOTE:
NEVER use a low, 2-pad stack ALONE!!

The additional three smaller pads **must always be on top of the buffer pad stack!**

- a. **For the basic 10 kg weight**, first apply the low stack of “2” **Grey** pads, then the stack of “4” (or 5) **black** pads (with the additional three smaller pads on top).



If either the optional 15kg or 20kg drop weight is used (see “Additional Drop Weight(s)” below), add on buffer stacks as follows:

- b. **For the 15 kg weight** (1 x 10 kg plus 1 x 5 kg weights), first apply the low stack of “2” **black** pads, then the stack of “5” **Grey** pads (with the additional three smaller pads on top).



- c. **For the 20 kg weight** (1 x 10 kg plus 2 x 5 kg weights), first apply the low stack of “2” **grey** pads, then the stack of “5” **grey** pads (with the additional three smaller pads on top).



9. Screw the lower part of the Weight Guide Shaft (the one with engraved drop height Nos 1 to 11, No. 11 upwards) into the top stem of the LWD Main Unit.
10. Slide the Drop Weight over the lower Weight Guide Shaft onto the combined Buffer Pad Stack.
11. Un-tighten the Locking Collar of the Catch Assembly and insert the upper part of the Weight Guide Shaft through the centre of the Catch Assembly.
12. Re-tighten the Locking Collar.
13. Connect the upper and lower parts of the Weight Guide Shaft together.

4.1 Additional drop weight(s)

4.1.1 Setting up the 15 kg Drop Weight

1. Move the Catch Assembly to the top part of the Weight Guide Shaft.
2. Unscrew the top part of the Weight Guide Shaft from the lower part.
3. Remove the 10 kg Basic Drop Weight.
4. Replace the combined Buffer Pad Stack with the appropriate, combined stack explained above for the **15 kg weight**.
5. Re-apply the 10 kg weight.
6. Place the additional 5 kg (11 lb) drop weight **with six magnets** on top of the 10kg weight and secure in place using the Allen key and bolts.
7. Re-apply the top part of the Weight Guide Shaft.

4.1.2 Setting up the 20 kg Drop Weight

1. Move the Catch Assembly to the top part of the Weight Guide Shaft.
2. Unscrew the top part of the Weight Guide Shaft from the lower part.
3. Remove the current Drop Weight (10 or 15 kg).
4. Replace the combined Buffer Pad Stack with the appropriate, combined stack explained above for the **20 kg weight**.
5. Re-apply the current drop weight.
6. If the current drop weight is 15 kg, skip the following step.
7. Place the additional 5 kg (11 lb) drop weight **with six magnets** on top of the 10kg weight and secure in place using the Allen key and bolts.
8. Place the additional 5 kg (11 lb) drop weight **with eight magnets** on top of the 15kg weight and secure in place using the Allen key and bolts.
9. Re-apply the top part of the Weight Guide Shaft

4.2 The weight catch assembly

The weight catch assembly is used to drop the weights and steady the guide shaft during a measurement (see Figure 5). It can be moved up and down the shaft to give different drop heights and be setup to suit left and right-handed operators.



Figure 5 - Weight catch assembly

4.2.1 Adjustment

To change the drop height, flip the quick release collar handle open. The weight catch assembly can now be moved up and down. Then close the quick release collar handle once in the correct position. Note that the clamping pressure of the quick release collar can be adjusted by tightening or loosening the nut opposite the quick release collar handle.

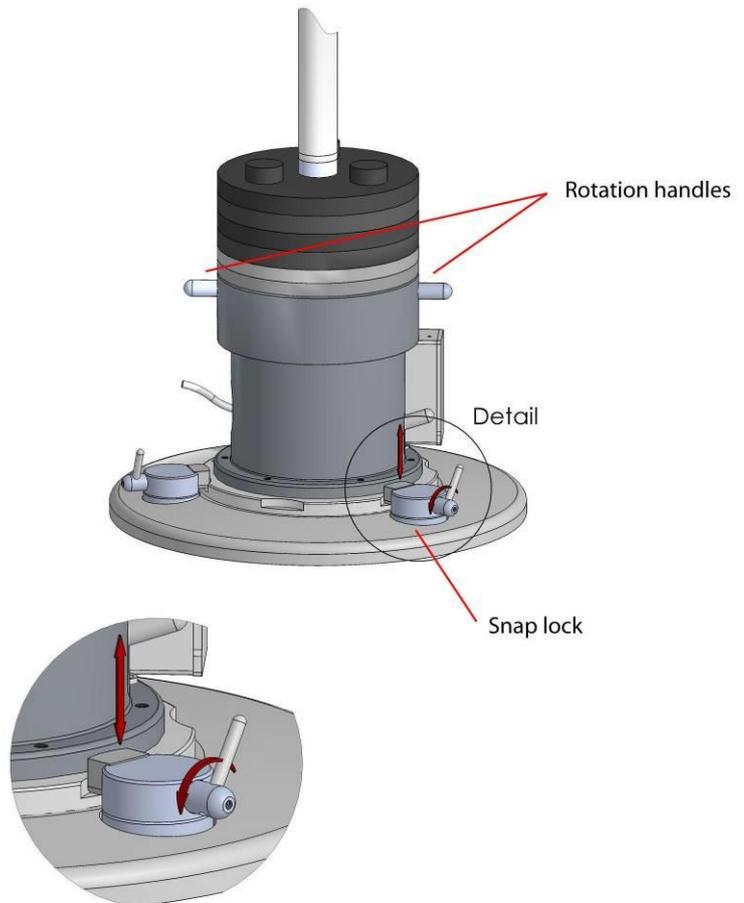
To change the weight catch assembly for left handed use, unscrew the clamping pressure adjustment screw entirely. The quick release collar handle can then be removed along with its bushing and switched to the other side. Be sure to swap everything from side to side then fit and adjust the clamping pressure adjustment screw.

4.3 The Dual Plate System

The Dynatest LWD comes standard with a dual 150 mm and 300 mm diameter plate, which can be switched between WITHOUT removing the LWD from a test point. Please place a 300 mm dia. ribbed rubber pad under the dual plate.

IF both plate sizes are used in a test point, then ALWAYS FIRST test with the 300 mm plate, THEN with the 150 mm plate.

- By turning anticlockwise, the 3 Snap Lock mechanisms, the locks can be released and turned 90 degrees to either side.
- With released Snap Locks, the LWD Main Unit can be rotated using the LWD Rotation Handles
- By rotating the Main Unit, the indicator pin in the groove in the edge of the 150 mm plate will move from the 150 mm to the 300 mm marking or vice versa, indicating which plate diameter is in use
- When selecting the 300 mm plate, the 3 Snap Locks MUST be locked securely by turning the snap lock clockwise. The snaps locks should clamp firmly, but do not over-tighten them.
- When selecting the 150 mm plate, the 3 Snap Locks MUST be LEFT RELEASED (but preferably NOT turned 90 degrees). It is IMPORTANT that the indicator pin is at and stays at the very end of the groove, at the 150 mm mark, for any drop made with this setting!



4.4 To Centre and Seat the Geophone

Just before making the first drop in a test point, press down FULLY and then release the centring lever to ensure that the centre geophone is seated correctly.

This can be repeated at any time between drops and should always be done if the plate has shifted position after a drop.

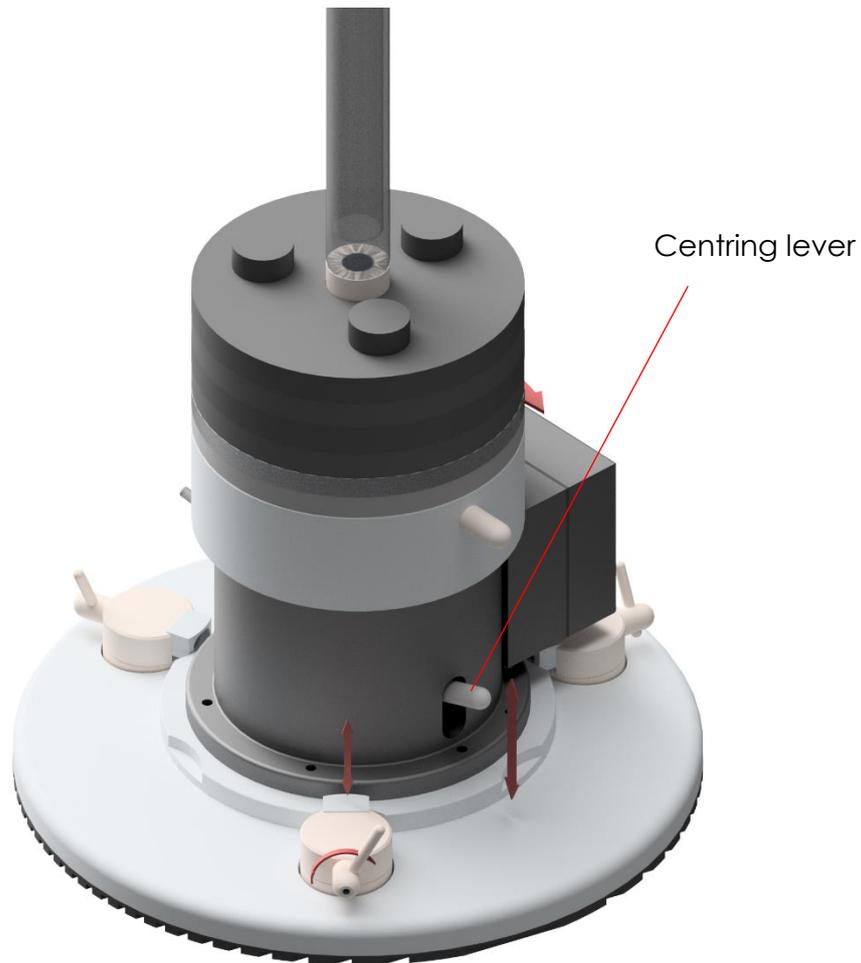


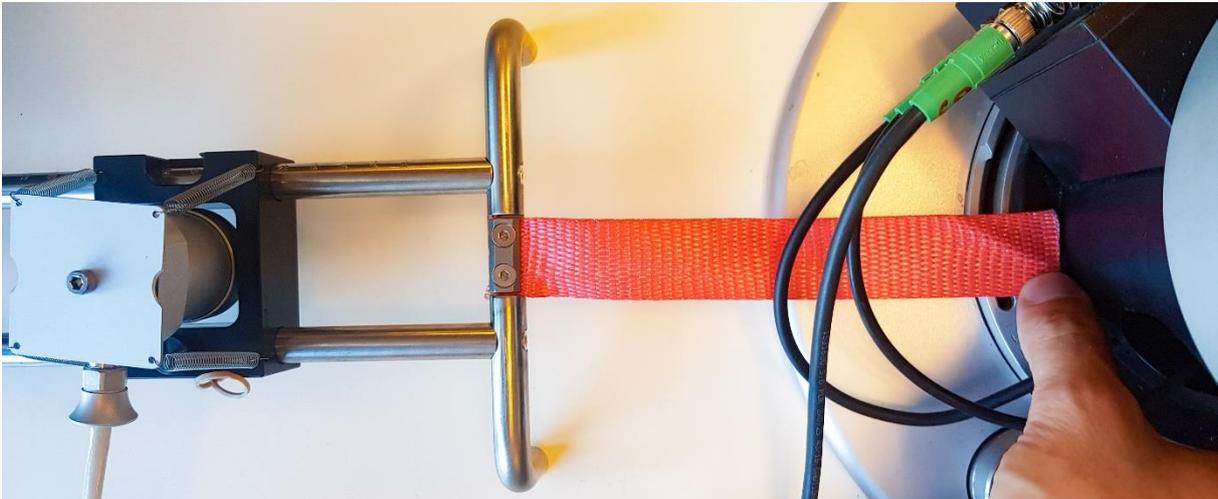
Figure 7 - Centring the geophone

4.5 Additional Geophones

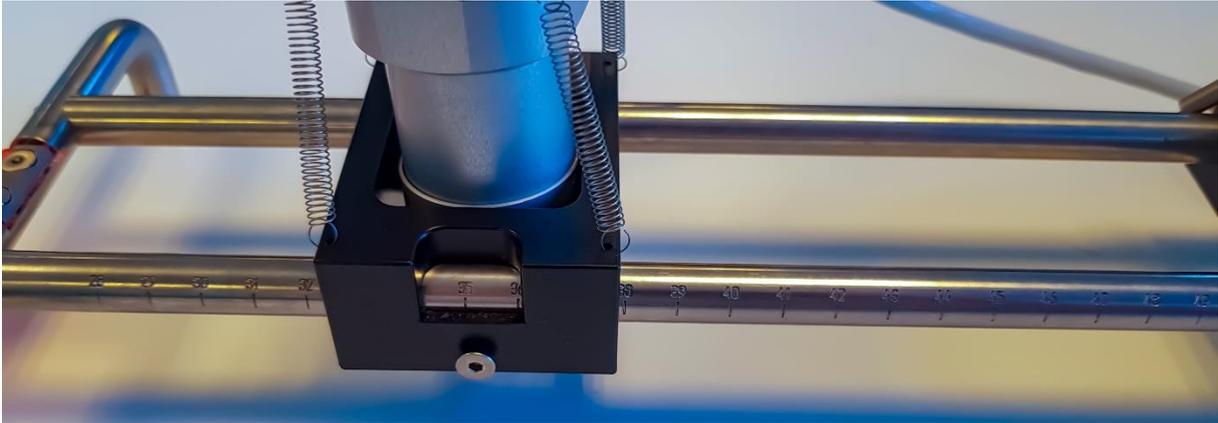
If using additional geophones, these must be located correctly and plugged into the correct sockets on the LWD electronics box.



Connect the additional geophones to the connectors on the right side of the electronics box. It is very important that geophone number 2 is connected to D2 and geophone number 3 to D3. Each plug should be pressed in until it locks with a click (to later disconnect, pull the plug body, NOT the cable!!)



Use the nylon strap on the geophone extension bar to ensure its correct position. The end of the strap should touch the outer surface of the LWD body.



The scale on the beam (cm/in) can be used to adjust and determine the position of the geophones from the centre of the plate for input into the Field Program (see section 6, "Using the Software")

- Ensure that the additional geophones are placed vertically on the subbase/subgrade layer.
- The sensors must remain vertical with their cables not pulled tight.

5 Software & device connection setup

5.1 Connecting Bluetooth devices

The LWD wireless module (Figure 9) will start in discoverable mode for 5 minutes after connecting the batteries or until a connection has been established, whichever occurs first. An intermittent blue light on the module indicates that the module is in discoverable mode by flashing one time.

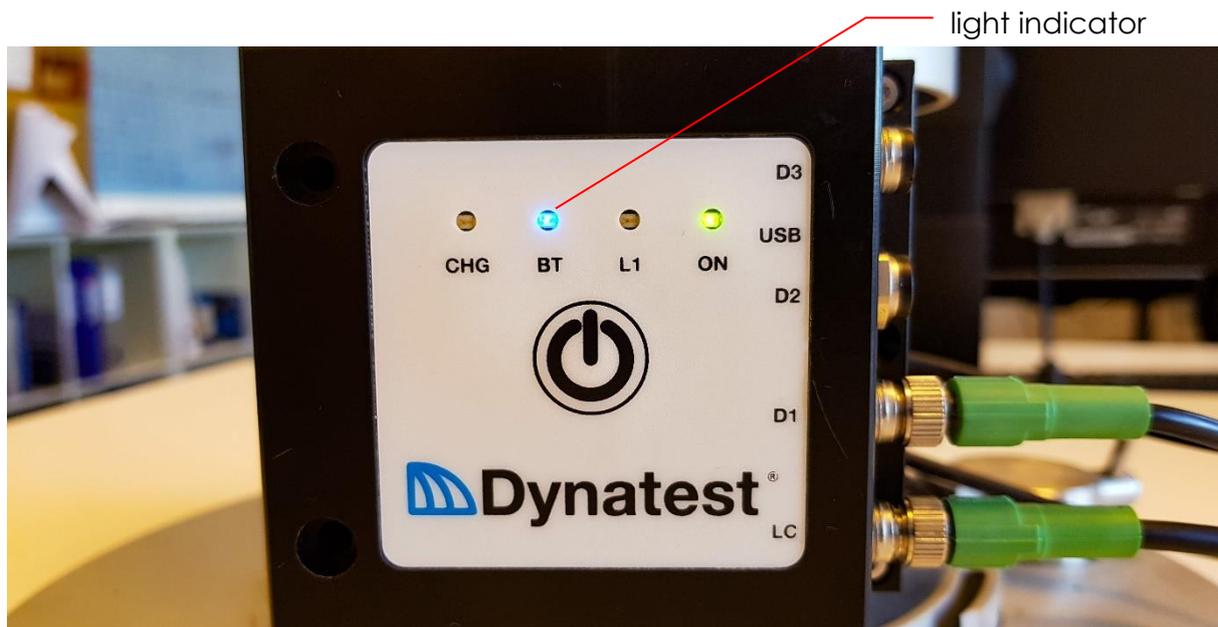


Figure 9 – LWD wireless module

When the App connects to the device, the blue LED will flash two times.

Module
Serial Number



Figure 10 – Bluetooth module serial number

LWD wireless module (Figure 9) behaves as any other Bluetooth peripheral on the smartphone. To connect to an LWD wireless module, first turn on your phone or tablet's Bluetooth. Then use the Dynatest LWD App to scan for devices to be able to connect to your LWD Wireless Module.

5.1.1 Turn Bluetooth on or off

1. Open your device's Settings app .
2. Under "Wireless & networks," tap **Bluetooth**.
3. Tap the **On/Off** switch.

At the top of your screen, a Bluetooth icon  shows when Bluetooth is turned on.

Note: The screenshots are taken on an Android device, so please be aware that they might not be the same on all devices. The screens might look a bit different as well in iOS, mostly for the settings pages.

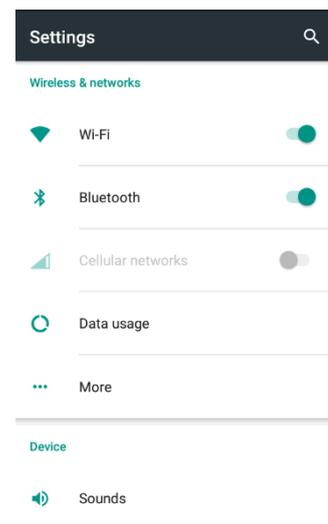
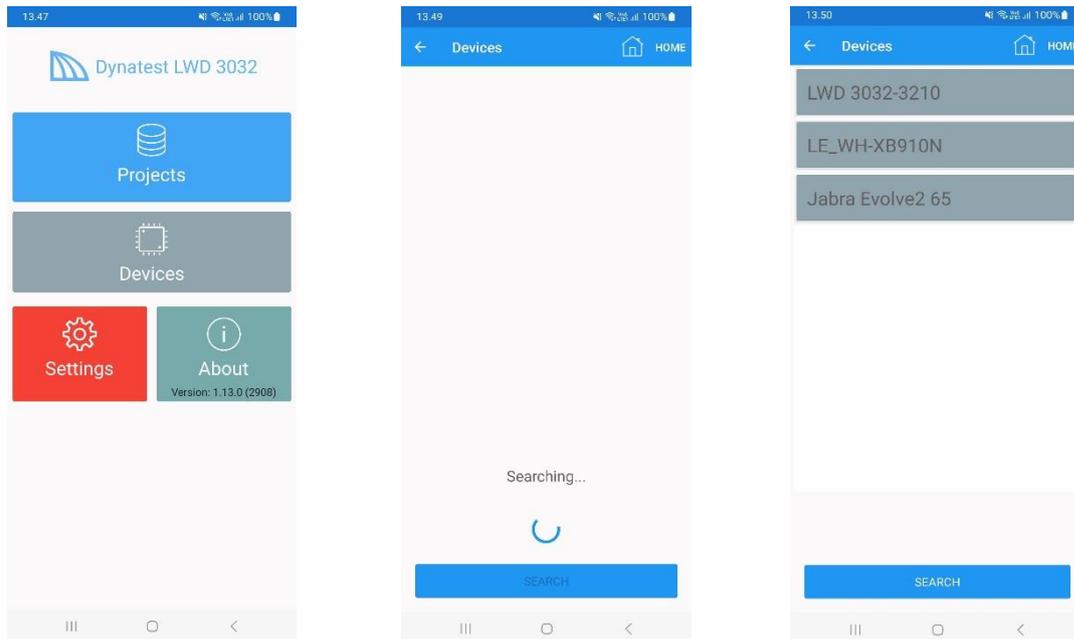


Figure 11 – Android Main Settings Screen

5.1.2 Scanning your device



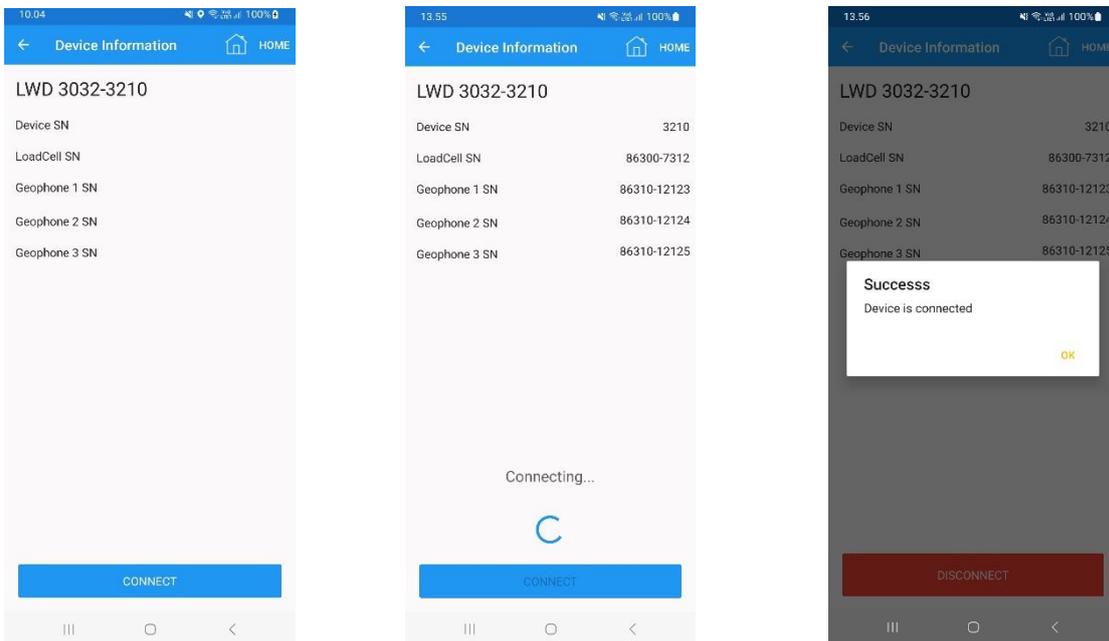
Tap “Devices” to start scanning.

After scanning (about 10 seconds) a list of found devices will appear.

The list will contain all Bluetooth devices in the area, and LWD devices will appear at the top of the list.

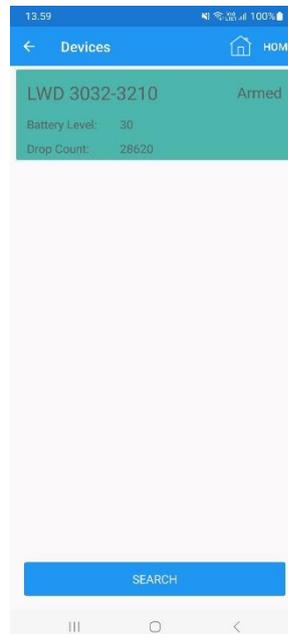
Tap the desired device to continue or tap “SEARCH” to re-scan.

5.1.3 Connecting your device



Tap "CONNECT" to start connecting to your device. If successful, the screen will show serial numbers of the device and sensors and display a confirmation.

Tap OK to see the status of the device:

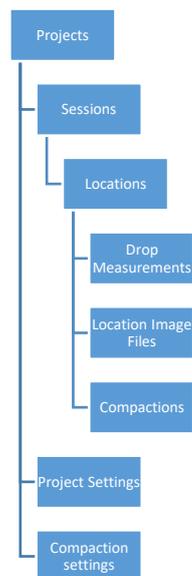


6 Using the Data Collection Software

In the LWD mobile app all the collected data is organized at the top level into projects. Projects serve the function of separating the collected data into different Database files. The Application works on only one active project at a time and all options connected to Export or Settings are related to the currently active project or active user.

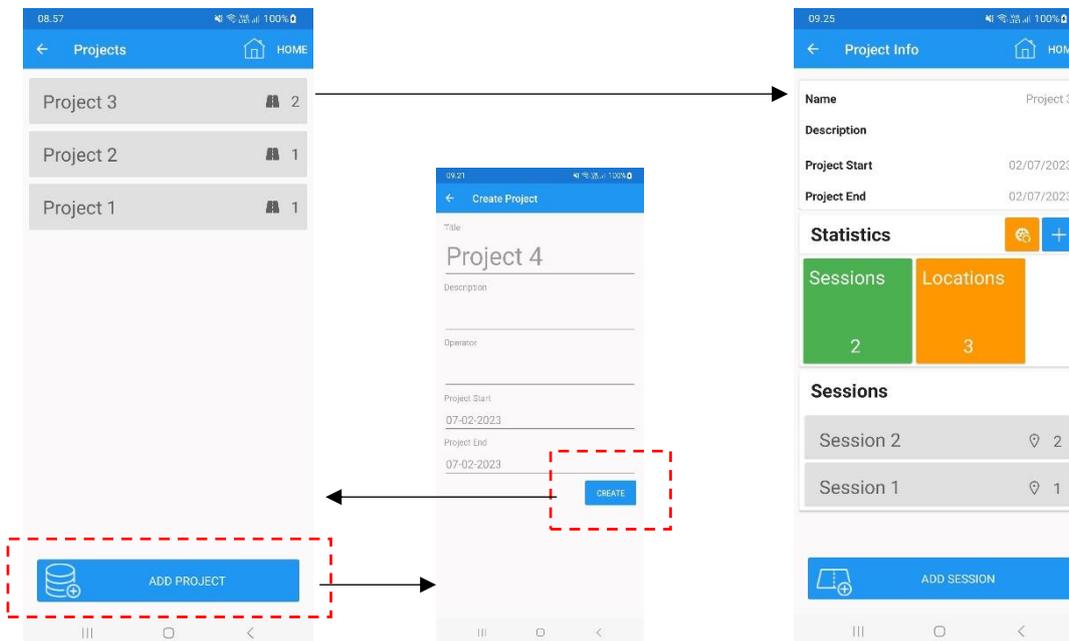
Each project is organized into several data Collection Sessions. Sessions are used to organize the locations where drop measurements must be performed. Each Session contains location definitions of where measurements have been performed. Each location definition is associated with a GPS as well as other meta data which categorizes the real-world position. Image files can also be associated with the location to provide a world reference of the test conditions.

For each location, you can have as many Drop measurements as needed. Each measurement stores the calculated results but also raw data from the sensors. In an event where measurements have been performed with not properly calibrated device it would be possible to apply the correct calibration and adjust the measurements (please contact us, in these situations).



At present, it is not possible to move Drop measurements from one location to another or a location from one session to another, so selecting the correct location and session definition is important.

6.1 Create a Project



From the Main screen, tap “Projects”.

Projects screen:

A list of projects (if any) is shown.

- Tap “ADD PROJECT” to create a new project.
- Tap an existing project to view the Project Info screen.
- Touch-and-hold an existing project in the list to Export, Edit or Delete it.

Create Project screen:

Edit the project information (for instance the Title) as you please.

- Tap “CREATE” to save the project and return to the Projects screen.

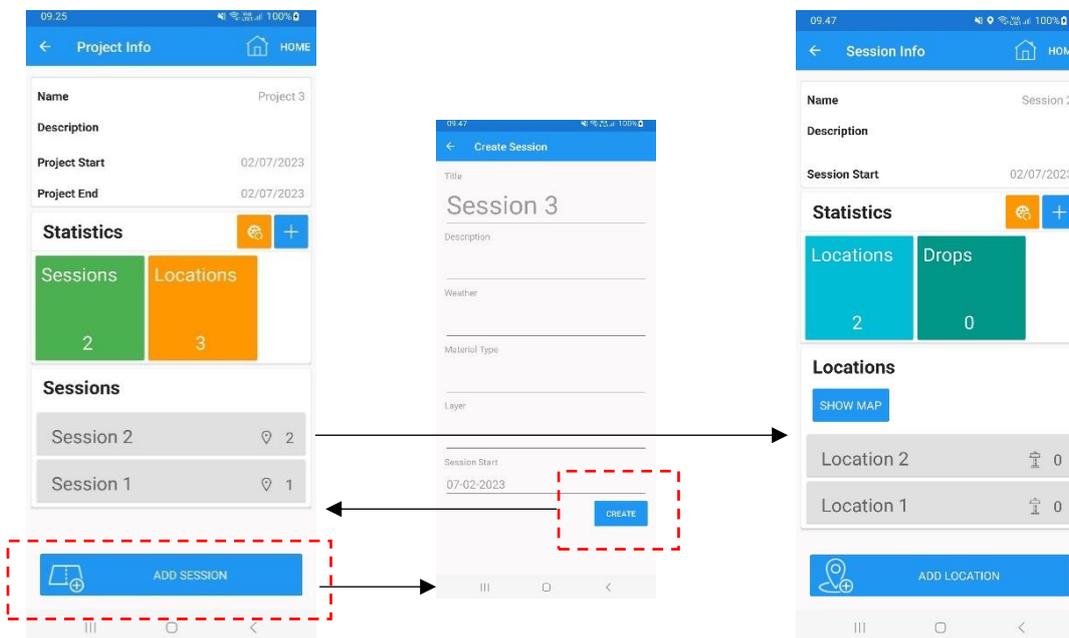
Project Info screen:

Statistics (Pro License only) and a list of related sessions are shown.

- Tap “ADD SESSION” to create a new session (see 6.2).
- Touch-and-hold an existing session in the list to Edit or Delete it.

The main menu of the application can be accessed by tapping the Home icon on the top bar.

6.2 Create a Session



From the Project Info screen, tap "ADD SESSION".

Create Session screen:

Edit the session information (for instance the Title) as you please.

- Tap "CREATE" to save the session and return to the Project Info screen.

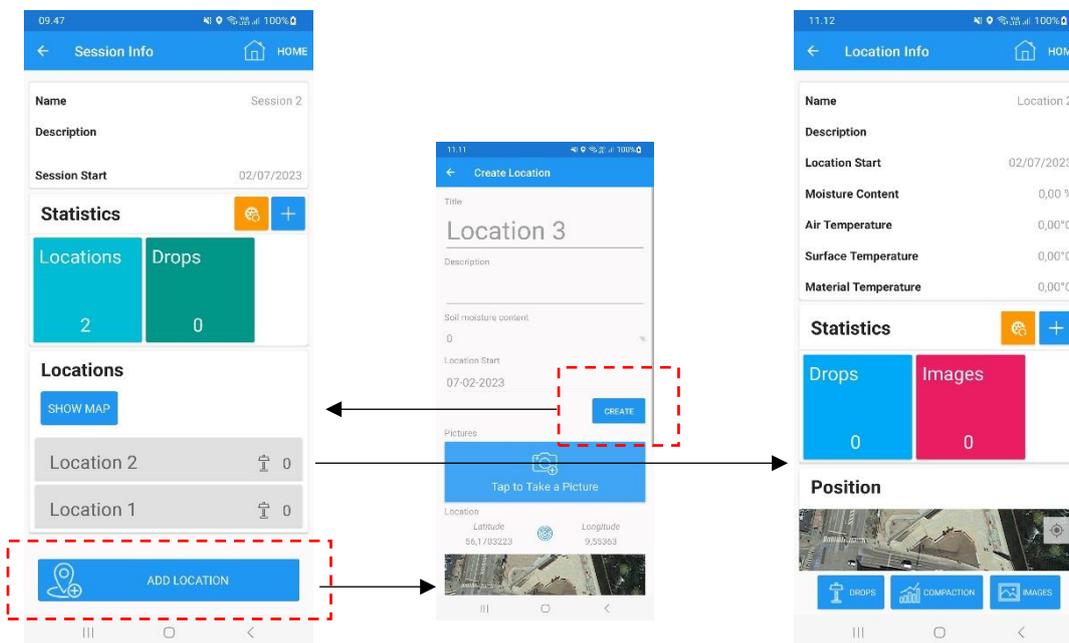
Session Info screen:

Statistics (Pro License only) and a list of related locations are shown.

- Tap "SHOW MAP" to see the positions of all related locations.
- Tap "ADD LOCATION" to create a new location (see 6.3).
- Tap an existing location to view the Location Info screen.
- Touch-and-hold an existing location in the list to Edit or Delete it.

The main menu of the application can be accessed by tapping the Home icon on the top bar.

6.3 Create a Location



From the Session Info screen, tap "ADD LOCATION".

Create Location screen:

Edit the location information (for instance the Title) as you please.

- Tap "Tap to Take a Picture" if you like to add a picture.
Pictures can also be added/removed later.
- Tap "CREATE" to save the location and return to the Session Info screen.

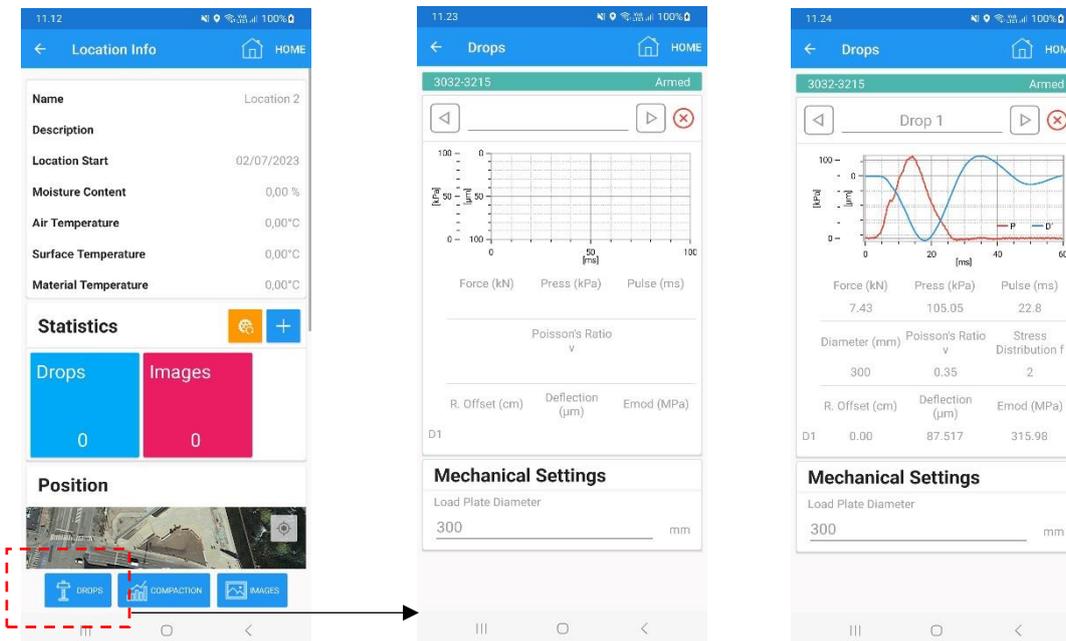
Location Info screen:

Location info, statistics (Pro License only) and a Map showing the position of the location are shown.

- Tap "DROPS" to go to the Drops screen.
- Tap "COMPACTION" (Pro license only) to go to the Compaction screen.
- Tap "IMAGES" to go to the Images screen.

The main menu of the application can be accessed by tapping the Home icon on the top bar.

6.4 Drops



From the Location Info screen, tap "DROPS" or "COMPACTION".

The Drops screen will contain device status at the top. Make sure the status is "Armed" before performing the drop.

When ready, do a drop and check that the measurement is shown.

Multiple drops can be performed, just make sure that the device status is "Armed" before each drop.

- Tap the arrow buttons to scroll through the drops.
- Tap the red X to delete a drop.

The main menu of the application can be accessed by tapping the Home icon on the top bar.

6.5 Remote Control



It is possible to remote control the App from to a PC, enabling download of projects.

This will require:

- The PC Software: "LWD Connect".
- The Phone and the PC must be on the same wireless network.
- The App must be in Main screen.

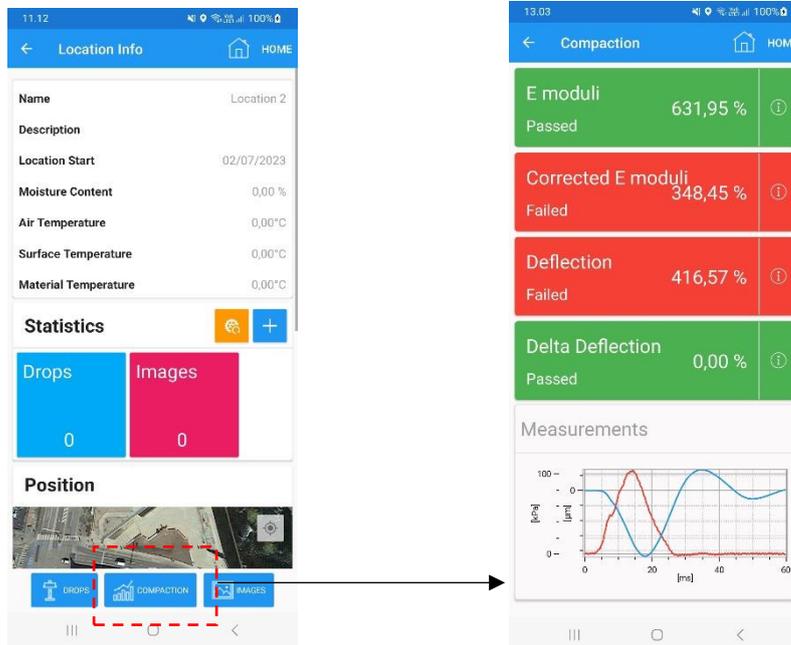
When the Phone enters the same wireless network as the (running) PC software, a confirmation request will appear on the Phone.

If the user accepts (taps the orange button), the App will connect to the PC, and the PC user is allowed to download any project from the phone.

Note: If "Auto Accept Remote Control" is ticked under General Settings, the phone will automatically accept remote control.

If the user leaves Main screen on the phone, the connection is closed.

6.6 Compaction



Compaction will only be available to Pro License users.

The compaction tab will display the compaction calculations provided two conditions are met. That in the settings of the application (in Compaction Settings) the user has chosen to perform compaction calculations (this is important since they can be disabled, so they need to be enabled before creating the location). And data is collected with a device with a pro license. The compaction calculation will be based on the drops collected so far (the drops will be selected based on the compaction criteria and not on the license, so compaction can consist of basic and prolicense drops), provided there is at least one drop that matches the user licenses. The user in settings can select how many drops should be used in the calculations, by default all drops will be used for all the calculations, but the Delta Deflection will use of course only the last two drops.

All compaction values are set from the Compaction Settings page upon the Location Creation. The user must remember to change his desired settings before the location he wants to test in is created.

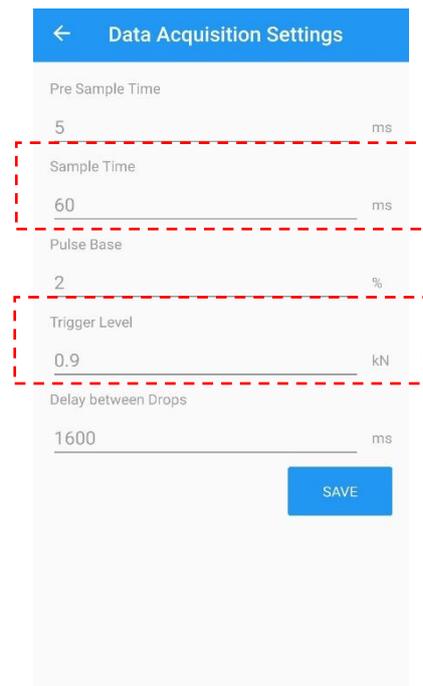
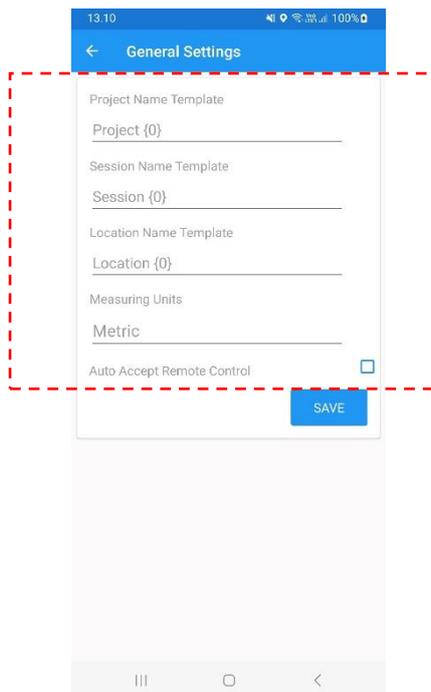
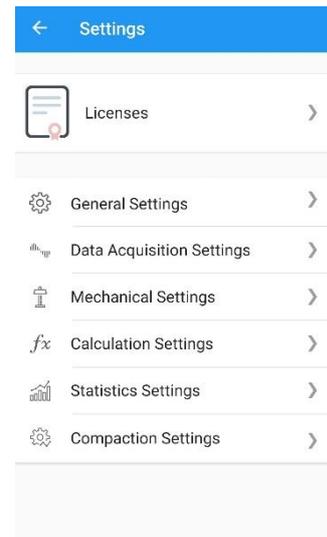
The main menu of the application can be accessed by tapping the Home icon on the top bar.

6.7 Settings pages

In the Main Menu, in Settings the user will be able to set the settings as desired for data collection.

At the top of the screen, you can access the licenses currently in use (all the devices that have been at some point paired with the smartphone).

Under it you will have the links to the different settings pages: General, Data Acquisition, Mechanical and Calculation. As well as the Statistics and Compaction Settings pages which are only available for the LWD devices with a Pro License.



The General Settings page handles all default naming conventions in the app, so the user can predefine a name template for faster Project, Session and Location creation. It also handles if the user wants to see the data in Metric or Imperial units.

The user can also enable Automatic Accept of Remote Control connections.

The Data Acquisition Settings page handles all sampling options such as pre-sample time, trigger level and the sample window.

←
Mechanical Settings

Load Plate Diameter
300 mm

Number of Geophones
1

Radial Offset D1
0 cm

Radial Offset D2
30 cm

Radial Offset D3
60 cm

SAVE

←
Calculation Settings

Field (half-space) ✔

Poisson's Ratio ν
0.35

Stress Distribution f
2 i

Lab (Proctor mold) ✔

Poisson's Ratio ν
0.35

Mold Height H
114.00 mm

SAVE

←
Statistics Settings

Project Statistics ⚙️ +

Sessions
Count

Value

Locations
Count

Value

Session Statistics ⚙️ +

Locations
Count

Value

Drops
Count

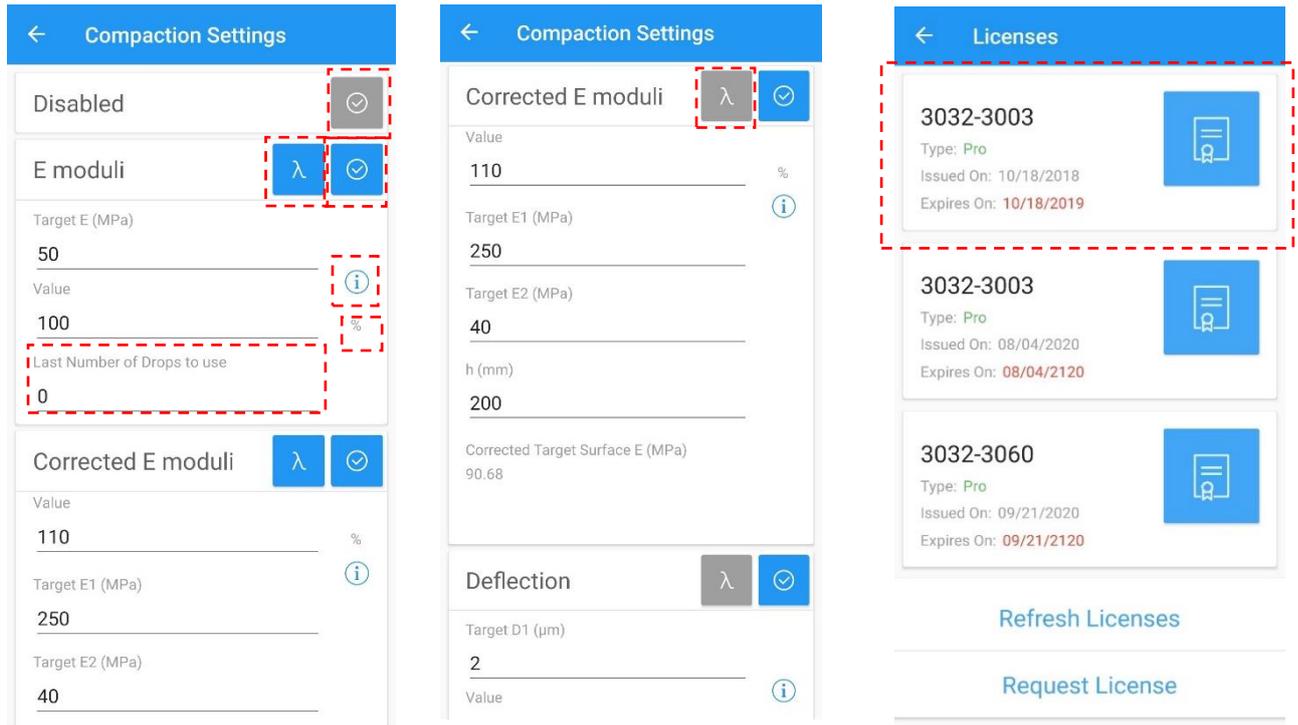
Value

Location Statistics ⚙️ +

Drops
Count

Images
Count

The Mechanics Settings page handles all the device measurement setup parameters such as number of geophones, the used plate radius and geophone placement. The Calculation Settings page allows the user to switch calculation methods between real world and lab tests. The user can also adjust the poisson's ratio to increase the accuracy of the modelled representing of the deflections. If the LWD has a Pro License, the Statistics Settings page will be visible and then the user will be able to select what statistics should appear by default when a new Project, Session and Location are created.



The last Tab handles the Compaction settings. This is only available when using an LWD with a Pro license. The user can select the appropriate compaction method and compaction parameters, as well as the number of drops to use in the calculations. Each compaction can display the equation that will be applied on the measured drops. In the Corrected E moduli at the bottom the Corrected Target Surface E moduli is given, that way the user can see what the output value would be with the current inputs. Be aware that if the compaction calculations are disabled when creating the location, you will not get compaction calculations.

The application will automatically update the licenses when it is started. To see a complete list of the assigned licenses, simply navigate from the Main Menu, Settings and then Licenses.

7 LWD Operation

7.1 Using the 300mm or Dual Plate System

- Setup the LWD as described in **Section 4 “Preparing the LWD for use”**.
- If the surface to be tested is a coarse material or uneven, spread some sand (like e.g. used with a Sand Cone Density Apparatus) on the testing point and flatten it out over an area of at least 300mm diameter, only filling the holes and grooves (meaning that the highest points should still be just visible).
- Place the 300mm ribbed rubber pad on the flattened test spot and locate the LWD 300mm plate on top.
- IF both plate sizes (i.e. 150 & 300mm dia.) are to be used in a test point, then ALWAYS FIRST test with the 300 mm plate, THEN with the 150 mm plate. For each plate diameter, start with a sequence at a large drop height, then at a small drop height. Changing between the two plate diameters is explained in **Section 4 “Preparing the LWD for use” - “The Dual Plate System”**.

NOTE: when testing on soft material and utilising the Sensor Locking Plug (to lock the geophone to the plate and plugging the centre hole of the plate), the test should be performed WITHOUT using the 300mm ribbed rubber pad.

- Launch the LWD software on the smartphone device, by following the instructions as described in **Section 6 “Using the Software”**.
- Press the POWER button and check that the green LED in the top of the LWD Bluetooth Module is now constantly ON.
- Establish a connection between the mobile App and the Device.
- Wait until the blue LED on the LWD Bluetooth Module moves from blinking slowly, indicating Bluetooth ON but no connecting, to blinking twice fast with a long pause between the two fast blinks, indicating successful connection.
- Ensure the geophone is correctly centred and seated by FIRST pressing down FULLY the Centre Lever, then RELEASING it swiftly.
- Place one foot on either side of plate, slightly on the edges of the plate to prevent the LWD from making a small jump and side shift as the weight connects Catch Assembly.
- Grasp the weight using both hands!
- Using the knee-bend or squatting position, keep the back straight.
- Tuck arms and elbows into the side of the body and position the body so that your weight is centred.

- Lift the weight until it clicks onto the catch assembly.
- With your feet still partly on the edge of the plate, release the weight as described in **Section 4.2 “The weight catch assembly”**, ensuring that your hands or other objects will not be hit by the weight as it drops. KEEP HOLDING the Catch Assembly. until the weight stops bouncing!
- The Device Screen will update with the latest drop measurements. Depending on drop settings you can immediately do another drop.
- The test should be repeated at least 3 times, or until the results show consistency from one drop to the next.
- It is recommended to re-seat/centre the geophone regularly, especially if the deflections do not seem to be repeatable.
- In case of testing with two plate diameters, please repeat the above procedure using a significantly smaller drop height.
- In case of testing with two plate diameters, now change from the 300mm to the 150mm dia. plate as described in **Section 4 “Preparing the LWD for use” - “The Dual Plate System”** and repeat the tests from a large as well as from a small drop height.
- On completion of testing, the data can be transferred via email through the Export and Share tabs that you see by clicking in the sandwich menu in the top left corner when you are in the Main page.
- See LWDmod for instruction on analysis.

7.2 Changing to the 100mm or the (optional) 200mm dia. plate

- The 100mm dia. loading plate diameter is obtained by removing the six M6 Allen bolts in the bottom of the Main Unit, close to the edge of the 150mm diameter plate (using the supplied 5mm Allen key), and then removing the flange which was held by these bolts.
- Please re-insert the bolts in the threaded holes and tighten them all the way (to prevent contamination of the threaded holes and loss/misplacement of the bolts)
- The 200mm dia. loading plate diameter is obtained by first performing the first of the two steps above, and then replacing the removed flange with the (optional) 200mm dia. plate, re-applying and tightening the six M6 Allen bolts.

8 Maintenance



CAUTION!

Do not rinse down the machine with a high-pressure cleaner, this may cause damage to the electrical components.



REMARK!

Clean the machine regularly to ensure that the loading plate and geophones are seated properly while testing. The accumulation of dirt around the geophone pin may impact the accuracy of the measurements.

8.1 Battery charge



REMARK!

Charge the battery on a regular basis. Keeping the battery charged make them last longer.

8.2 Calibration

It is recommended that the LWD should be calibrated every 25,000 measurements or every second year. All calibrations can be traced back to National laboratory reference standards.

In order to have the LWD calibrated, please ship only the **Main Unit and the 2 additional geophones (if any)** to Dynatest A/S (please see the section Support & Assistance for the nearest Dynatest service address).



IMPORTANT!

All calibrations of the LWD must be carried out by Dynatest.

9 Service and support

Repairs, when required and calibration should be performed by Dynatest service personnel using original replacement parts and accessories.

Call Dynatest for repair parts or service. When discussing your machine, please have available the Model and Part Number.

Dynatest limits service & support covers the equipment and software manufactured by Dynatest.

For warranty issues and enquiries concerning the general use of the smartphone equipment please contact the manufacturer.

9.1 Support & Assistance

Please contact our local Dynatest offices listed below for assistance and support.

Dynatest A/S

Tempovej 27

2750 Ballerup

Denmark

Phone: +45 7025 3355

Email: Info@dynatest.com

10 EU declarations and certificates

The LWD is verified in accordance with the following EMC standards

- EN50081-1, 1992 Generic Emission Standard
Part 1: Residential, commercial and light industry
- EN50081-2, 1993 Generic Emission Standard
Part 2: Industrial environment
- EN50082-1, 1997 Generic Immunity Standard
Part 1: Residential, commercial and light industry
New version of the standard
- EN 61000-6-2, 1999 Generic Immunity Standard
Part 2: Industrial environment

In accordance with the EMC directive 89/336/EEC article 10 part 1



The LWD was verified 10-01-2001 by	
Delta	Erhvervsvej 2 A, DK-8653

11 FAQ

11.1 General Questions

How do you calibrate the load cell?	The base unit of the LWD plus geophones must be returned to either the Dynatest office in Denmark. Each load cell is individually calibrated against a laboratory reference load cell LVDT. The laboratory reference load cell is calibrated at a certified calibration institute at least every second year. The calibration is done with dynamic loads at different load levels. The following parameters are observed and calibrated: Linearity offset and gain.
How often does it need calibration?	In general the LWD should be calibrated approximately every 25000 measurements or about every second year.
Is the LWD delivered with a calibration certificate?	Yes.
How do I know when I have a problem?	A simple "self-test" can be done by making a drop from max fall height with the 10 kg (22 lb) weight and 4 buffer pads and observe that the peak value of the force is about 8 to 10 kN (1800-2200 lbf). The geophone can be tested by observing that the surface E-modulus is in the following range: Soft clay: about 1 to 20 MPa (0.1-2.9 ksi), Hard clay: about 20 to 50 MPa (2.9-7.3 ksi), Sand: about 30 to 70 MPa (4.4-10.2 ksi), Gravel: about 60 to 200 MPa (8.7-29 ksi).
How soon can I get a new load cell or geophone?	The main LWD unit has to be shipped back to Dynatest to have the new load cell or geophone installed. This typically is done in one working day, the shipping time must be added and can be arranged by Dynatest or the client.
Is there a rechargeable battery in the main unit?	Yes, the LWD comes with a rechargeable battery, however recharging is only possible via connector on Bluetooth box (Black).
Is there something extra I should purchase before getting started?	Dynatest can supply all components. The client must supply the smartphone.
What is preferable to purchase together with the standard equipment?	It is recommended to purchase a transportation trolley and box for easy safe transportation and storage of the equipment.

Is it possible to use our existing PDA or Smart Phone?

Yes, Check the minimum requirements section to see which mobile phones are compatible.

11.2 Questions related to the use

Are the geophones interchangeable?

No! Each geophone is calibrated specifically for the instrument it is assigned to. The centre geophone is not labelled and must be connected to the input "D (1)". The additional geophones are labelled "2" and "3" and must be connected to "D (2)" and "D (3)" respectively, on the electronics unit

The LWD sometimes makes a false measurement when I connect the weight to the Weight Catch Assembly?

The LWD makes a measurement when the load on the load cell is larger than a predetermined threshold. The threshold can be adjusted in the data collection program under "Setup -> Trigger" in the field "Trig level (kN)". In case the LWD triggers too easy you must increase this value. Default value is 0.9 kN (2000 lbf).

Communication is lost with the Smart phone

This can be because of a low battery power level in the LWD wireless module – change or re-charge the batteries. Or you are out of range.

11.3 Questions related to measuring

On which materials can the LWD do measurements?

The LWD is best suited for use on unbound materials such as gravel, or sand because of their typically very low static pressure. The LWD is not suited to measure on bound layers like asphalt and concrete because it cannot apply enough force to make accurate measurements.

What falling height / stress level should I apply when measuring?

In general the E-moduli should be measured at the stress level at which the material will be exposed to when the finished construction is in use. Typically, this level is about 10 - 50 kPa (1.5-7.3 ksi) on sub-grade, 50-150 kPa (7.3-21.8 ksi) on capping or drainage layer (e.g. sand) and 100 - 200 kPa (14.5-29 ksi) on sub-base (e.g. gravel). It is recommended always to make measurements from 3 - 4 different falling heights/stress levels - this way you will always be able to interpolate or extrapolate to the right stress level

Are the results from a trailer based FWD and the LWD comparable?

A trailer based FWD and the LWD are based on the same principles. Therefore, you should, in theory, be able to compare the results directly but in general practice it is not advisable because the FWD usually applies a rather large static pressure to the surface, which has an influence on the measurement.

What is the penetration depth of the force applied?

There is no rule of theoretical penetration depth for the LWD. The penetration depth depends entirely on the stiffness of the material, the force applied and the load plate radius.

Can the LWD be used for compaction control?

No! Percent of compaction and Bearing capacity are not related and there is no known relation between them.