

Clegg Impact Soil Tester 2.25 kg - 0-500g unit with Clegg Control App for Android Setup and Instruction Manual

V-7.0



Now with Bluetooth connection capability to the
FieldScout TDR350 for natural grass surfaces



Now with Bluetooth connection capability to the
Mascaro Infill and Cleat Depth Tester for synthetic
turf surfaces

Table of Contents

Hardware	Page #
System Description	3
Device Parts	3
Specifications	3
Precautions	4-5
Control: Power	5
Control: Hammer Connection	5
Control: Operational Check	6
Hammer Drop Procedure	6-7
Performing a Clegg Impact Test	7
Impact Control	7
Custom Protocols	8
Testing Procedure	7-8
Standard Drop Height	9
Dropping the Hammer	9
ASTM and Australian Standards	9
Hardware Warranty	10
Clegg Control App	
Clegg Impact Soil Tester with Clegg	11
What is New?	11
Getting Started	12
Connect a Clegg	12
App Settings	12
Contact Support	13
Connect a Field Scout TDR350 Moisture Sensor or a Mascaro Infill Cleat Depth Tester	13
Drop Modes	13
Quick Testing Mode	13
Setting Up a Quick Test	14
Create a Session	14
Performing a Drop	14
Adding a Drop Location	14
Advanced Testing Mode	15
What is a Drop Site?	15
What is a Drop Location?	15
Setting up an Advanced Test	15
Create a Session	16
Selecting a Drop Location	17
Performing A Drop	17
Natural Grass Fields – Connecting a TDR350 Moisture Sensor	17
Synthetic Turf Fields – Connecting a Mascaro Infill and Cleat Depth Tester	18
Horse Racetracks – Dirt and Synthetic Tracks / Horse Arenas	19
Deleting a drop location	19
Viewing results	19-20
Exporting Data	20
Suggested Drop Points for Football Fields	21
Suggested Drop Points for Turf, Dirt & Synthetic Tracks	22
Formula for converting GMax into F355 equivalent Units	23

Hardware

System Description

Dr. Baden Clegg developed the Clegg Impact Soil Tester while working for the Department of Civil Engineering at the University of Western Australia in the 1970's. The Clegg Hammer is an easy-to-use device consisting of two basic components: a flat ended cylindrical mass (the hammer) and a guide tube. When the hammer strikes the soil surface, a precision accelerometer mounted on the hammer feeds its output to a Control Unit, which sends a digital readout to a handheld tablet. A drop or sequence of drops of the hammer constitutes one test called a Clegg Impact Value (CIV).

The Clegg offers a rapid, simple, and relatively inexpensive assessment of the strength and stiffness properties of a variety of soils, aggregates, and synthetic materials. The impact test result reflects and responds to characteristics that influence strength. Such influences include material type, grading, layer thickness, density, moisture condition, and possibly the condition of the underlying layer. With all things being equal regarding material type and layer thickness and the nature of the support base, the primary influences are the density and/or moisture condition of the material. The CIT may be used to observe changes in strength/stiffness for a material with the changes in compactive effort, density, and moisture content.

Device Parts

- Hammer
- Guide Tube
- Bluetooth Control Unit
- BNC coaxial cable
- 12x12 inch foam Calibration Pad
- Locking pin to attach hammer to guide tube
- Handle and Hammer Release Spring Plunger with lockout
- Charger
- Tablet with Clegg Control App (available in the Google Play store)
- Hard Case



Clegg with hard case

Specifications

- Battery Life: 12 Hours
- 3.7V/1.75Ah Lithium Ion Battery
- Complete Charge in 3 hours
- Results displayed/stored on tablet-based app

Model	2.25 kg Unit 0-150 g	Maximum Gravities (g)	Maximum CIT's	Maximum F355 Equivalent
PNCLEGG-S-2.25	Clegg Impact Soil Tester 2.25 kg Model with Factory hard Case - 0 to 500 Gravities – Wi-Fi, Tablet and Hard Case	500	50	650

Precautions

The Clegg Impact Soil Tester has been designed to be easy-to-use and provide years of service. Though primarily used outdoors in many types of situations, it is a scientific instrument incorporating specialized electronic components meaning that due care is necessary to ensure trouble-free performance and avoid costly repairs. To prolong the use of the device, observe the following precautions.

AVOID PROLONGED EXPOSURE TO EXTREME HEAT AND COLD

Do not leave the instrument in full sun or freezing temperatures when not in use. In conditions of extreme temperature, the control unit may not activate. If this is suspected, allow the control unit to cool (or warm) before use.

EXTERNAL SIGNAL CABLE

The cable can be damaged by being pinched, pulled, worn, or cut. Ensure that the connectors are not strained, bent out of round or broken, and that the plugs and sockets are kept clean.

LOCKING THE HAMMER IN THE GUIDE TUBE (2.25 kg)

Always lock the hammer in the guide tube using the provided locking pin when instrument is not in use or during transport.

KEEP CLEAN AND DRY

Keep all components clean and dry, not only for correct test operation but also for the sake of protecting the instrument. When testing, do not allow material build-up inside the guide tube or on the hammer. Any build-up could prevent an accurate free fall of the hammer. Ensure that the hammer strike face is clear of any material build-up before starting each test. When transporting or storing the instrument, wipe down the hammer and guide tube, etc., so that all is dry and relatively clean. Never apply water under pressure when cleaning.

HAMMER AND CONTROL UNIT ARE NOT WATERPROOF

Do not expose the hammer or control unit to rain. If moisture enters either the hammer or control unit, damage may result. If moisture does enter the control unit, remove the rechargeable battery immediately and allow the circuitry to dry. Contact Lafayette Instrument for repair.

DO NOT EXCEED MAXIMUM LIMITS

Overloading may cause permanent damage to the accelerometer. To best protect the Clegg, do not operate in such a manner that values regularly exceed the device's stated maximum limits. *Maximum limits can be found in the Specifications table on page 3 of this manual.*

If the hardness of the material to be tested is uncertain, start with drops from a very low height, progressively getting higher until it is determined that it is safe to drop from the standard drop height. If it is determined that the standard drop height is too high, make note of what is considered to be a safe drop height for the particular situation and develop criteria for such materials based on this lower drop height. Be aware that this output is not directly proportional to the output obtained from using the standard drop-height so any correlation with other outputs or test properties will need to be re-determined or recalculated.



WARNING: Only authorized personnel should perform disassembly and calibration. Unauthorized disassembly or calibration will void any warranty.

The accelerometer generates a signal regardless of any other electronics or power supply; it is always “on” detecting vibrations. Protect the hammer from extreme shock even when the Control Unit is not switched on or connected.

Do not drop the hammer directly on concrete.

EACH HAMMER AND CONTROL ARE CALIBRATED AS A SET

Do not swap out either the hammer or control unit. Mismatching of these parts will give inaccurate results as each Bluetooth controller and hammer are calibrated as a “set”.

NEVER PLACE HANDS OR FEET IN OR UNDER THE GUIDE TUBE

The hammer is made to move freely inside the guide tube and injury is possible if hands or feet are placed in the path of the hammer. Use special attention when lifting the Clegg as the hammer can slide.

Control: Power

To power on control unit, toggle the power switch to the ON position where illuminated side of switch is depressed against the panel.

When the control unit is powered on, the Power LED will flash to show the device is in an unconnected state. At this time, the unit is able to be paired/connected to the tablet. The control unit is paired through the Clegg Control app (available Google Play store). **Do not connect** the Clegg device through the tablet Bluetooth settings. Use the Clegg app as instructed in the CONNECT A DEVICE section. When the device is in a connected state, the Power LED on the Bluetooth controller will stay lit continuously.

If the device is left in an unconnected state for a period of 10 minutes, it will automatically shut down. In order to power on the device on after an automatic shutdown, do either of the following:

- Plug the device in to charge
- Toggle the power switch OFF, then back ON

BATTERY

The Control Unit contains a rechargeable battery. Recharge the battery using the included charging cable. The Clegg Control app additionally displays a battery icon to denote the charge of the Control Unit. **Do not replace the battery.** A mismatch in battery type can cause incorrect results or damage to the electronics and charger. Unauthorized disassembly will void any warranty. **Call Turf-Tec International if battery replacement is needed.**

Control unit can be charged by either a computer’s USB port or with the supplied wall adapter. Charging via the supplied wall adapter results in a faster charge rate. While unit is charging, the charge LED will be illuminated red. Once charging has been completed, the LED will shut off.

Control: Hammer Connection

Use the supplied BNC coaxial cable to connect the hammer to the control unit. To connect a BNC plug to socket, line up the slots of the plug with the pins on the socket. Press the plug on and turn the plug clockwise until it locks. (Reverse steps to remove plug).

Control Unit



Important – Perform Operational Check on test pad before first use of Clegg

Control: Operational Check and to Verify Calibration

A 12x12 inch foam calibration pad is provided for the user to verify that the instrument is working properly. The operational check is carried out in a similar fashion as the standard test but always with the calibration pad in place on a smooth concrete surface. The pad is not used for normal testing but only when making an operational check.

It is suggested to make an operational check:

- Upon receipt of the instrument before any testing

Also, it is useful to make an operational check

- When results are not in accordance with expected results
- If the instrument has experienced some trauma

OPERATIONAL CHECK PROCEDURE

To determine the calibration pad value for the first time, carry out a modified Clegg Impact Test procedure to obtain six readings on a suitable surface, preferably one that is at an easily accessible “home” location. This same location should be used for all future operational checks.

For a home site, select a firm solid base such as a bare concrete slab floor. Be sure that the surface is smooth, dry and clean and that the surfaces of the calibration pad and hammer strike face are dry and free of any foreign material. Place the pad under the guide tube such that the hammer is centered on the pad. The pad must be between the hammer and floor. The hammer must fully strike the calibration pad and not the floor.

Take the average of the six drops in different areas on the test pad staying away from the edges to obtain the calibration value. Note this average in a logbook or in the app under “Advanced Testing” and call the test location “Test Pad”. You are looking for readings with the tolerance of +/- 1 CIT units or 5 G’s. **NOTE:** There are 10 Calibration pad G’s “gravities” per 1 CIT unit.

During future operational checks, make note of the value and tolerance on the calibration pad and compare with measurements. The average reading should agree within 5% the original test pad logged value. Also mark or paint a line on the area of the concrete slab to show the area where the calibration check will be performed. This way, the same test area is used to ensure consistency.



Calibration Pad

Hammer Drop Procedure

The 2.5 kg model hammer may be dropped in two ways: Freehand or Plunger Release. Freehand is used for non-standard drop heights. Freehand or Plunger Release can be used for standard drop heights.

FREEHAND

Leave the plunger pin retracted for all freehand hammer drops. To do this, pull back the knob on the hammer release spring plunger until the plunger pin is fully retracted from inside the guide tube then rotate the knob 90 degrees to lock the pin retracted.

For standard drop height, raise the hammer until the white line mark on the hammer, is even with the top of the guide tube. Drops should be made with the mark within + 1/2 inch (1.25 cm) from the top of the guide tube.

PLUNGER RELEASE

When using the Clegg, the plunger release can be used to provide consistent drop height. Place palm of hand against the handle and grasp the spring plunger knob between the index and middle finger. Pull the knob to retract the pin from inside the tube and raise the hammer so the white line mark is above the top of the tube guide.

Release the knob and rest the bottom of the hammer on the plunger pin inside the tube. When ready to open plunger knob release the hammer, place the palm of hand against the handle, grasp the spring plunger knob between the index and middle finger. Pull the knob back to retract the pin which releases the hammer to drop.



NOTE: The hammer release spring plunger can be locked out of the guide tube by pulling back the knob and rotating the knob 90 degrees while the pin is retracted. To unlock the spring plunger, rotate the knob until the key in the knob aligns with the slot in the shaft and the plunger pin springs into the guide tube.

Performing a Clegg Impact Test

IMPACT CONTROL – Testing Athletic Fields

The suggested protocol for performing a Clegg Impact Test (CIT) for surfaces where gMax Readings are the goal is a one-drop protocol. Impact Control is used in situations where soft surfaces and hard surfaces could result in the decline of performance and the increase in injuries (Natural grass like athletic fields, grass racetracks, tennis courts, golf courses, etc.). These surfaces are exposed to routine maintenance such as Mowing, Aerification, topdressing and rolling. Synthetic turf surfaces are exposed to routine maintenance practices like grooming, adding infill and other leveling steps. Both types of surface management has the objective of producing a finished product which falls within a specific range or window of impact values (not too soft and not too hard).

Typically, the 2.25 kg hammer models are used for Impact Control. Additionally, impact values noted in literature for natural and synthetic turf are often displayed in gravities (G's). **NOTE:** There are 10 G's "gravities" per 1 CIT unit.

Set up appropriate Impact Control test parameters in Clegg Control app. *See the Test Setup section on page 14 for more detailed app setup instructions.*

CUSTOM PROTOCOLS

Based on an examination of literature, different protocols have been used to target different surface and subsurface characteristics. These custom protocols (different number of drops, variations in drop height, peak impact value, or average impact value) can be effective when consistently used across an area. If an area tested results in readings that are consistently close to the maximum reading values of the Clegg, a shorter drop height might be considered in order to get a more meaningful result. Be sure that a modified drop height is used, the impact tester hammer



CAUTION: Do not operate hammer on concrete without the calibration pad in place as damage to the instrument may result.

is marked with a line showing this drop height and each subsequent test in that area is performed from this new marked drop height or results will not be comparable.

In the case of Impact Control, there are no hard and fast rules because the results for natural grass fields and grass racetracks are dependent on soil type, organic matter, moisture content, and the influence of the turfgrass and its root zone. For synthetic turf, the type of turf, length of fiber, and the type and amount of infill exert different variables in testing. The main thing you are looking for is consistency of gMax readings for all areas of the playing surface. It is recommended to run a few experiments to determine the protocol that works best for your application or use your experience which may be the best predictor of what range of impact values provide the desired results. In general, in gMax settings, a reading under 100g's is acceptable for sports field safety. For F355 Equivalent readings that equals 156 - F355 Clegg readings. Moisture Sensor readings are critical on natural grass fields to pair with the Clegg readings for more meaningful results as well as turf shear strength values. For Synthetic turf, clegg values should be paired and recorded with infill depth readings for meaningful results.

To determine another custom protocol, the initial step would be to collect or use historical data (Clegg impact values as well as moisture values on natural grass and infill depth values on synthetic turf) on surfaces you want to monitor. Take experimental data when the surface is in a desired condition and an unacceptable condition.

With this data you can:

- Select an acceptable range of impact values for the surface
- Track the change in impact values as maintenance or modifications are made to the surface

NOTE: Field test data has shown a correlation between gMax F355 test and Clegg impact values. If testing is performed with the App Settings in "gMax". The app also auto calculates the F355 Approximate readings by changing the setting in APP SETTINGS or you can also use the regression equation as shown on *page 23*.

- $F355 = (Clegg\ G's + 27.1) / .81$

TESTING PROCEDURE

Once the desired protocol has been chosen and set up in the Clegg Control app, follow this procedure to complete the testing process.

1. For standard sports turf testing of natural grass fields & synthetic turf fields, be sure that Display: PEAK is selected in the Clegg Control app settings.
2. Enter or select the appropriate drop site in the Clegg Control app. *For more information about setting a drop site, read the Adding a Drop site on page 15.*
3. Ensure that the cable between the control unit and hammer is properly connected. *For more information, read Control: Hammer Connection on page 5.*
4. Ensure that the striking face of the hammer is free of foreign material and the inside of the guide tube is reasonably clean so that the hammer is able to fall freely.
5. Locate then select the appropriate drop location in the Clegg Control app and clear any loose surface material or foreign objects from the test spot that could produce a result not indicative of the material being tested.
6. Place device vertically in position and hold down guide tube with a foot on the base flange. Brace guide tube with leg and/or knee (if necessary) to hold tube steady and as close to vertical as possible using the level provided by Turf-Tec International.
7. Raise the hammer to the white line or use the plunger knob to release the hammer and drop. This single drop represents the standard impact test protocol for sports field safety. Depending on the surfaces/materials being tested, a custom protocol may be used. On natural grass, connecting the TDR350 Moisture Sensor by Bluetooth and getting moisture

readings at the same time as the clegg readings is imperative for comparative testing. For Synthetic Turf, connecting the Mascaro Infill Depth Gauge by Bluetooth and getting infill depth readings at the same time as the clegg readings is also imperative for comparative testing

8. Move to next drop location and repeat steps 3 through 7.

NOTE: When using the Clegg, the Plunger Release can be used to provide consistent drop distance. *Read Hammer Drop Procedures on page 7 for more details on using the Hammer Release Spring Plunger.*

STANDARD DROP HEIGHT

Raise the hammer until the white line on hammer is even with the top of the guide tube. Drops should be made with the line within + 1.25 cm (1/2 inch) from the top of the guide tube or by using the Hammer Release Spring Plunger as described below.

Alternately: Rest the bottom of the hammer on the pin projecting inside the tube. Pull the knob on the Hammer Release Spring Plunger* to release the hammer to drop.

* *Read Hammer Drop Procedures on page 6 for more details on using the Hammer Release Spring Plunger.*

What to do if the hammer is dropped below the desired height?	<ul style="list-style-type: none"> If the operator is recording impact values for each individual drop, the undesirable drop should be deleted.
What to do if the hammer is dropped above the desired height?	<ul style="list-style-type: none"> If the operator is recording impact values for each individual drop, the undesirable drop should be ignored.
What to do if the guide tube shifts off a test site?	<ul style="list-style-type: none"> If the hammer cannot be re-aligned with the test site, another set of drops should be performed in a location adjacent to the current location.
What to do if the hammer does not fall freely?	<ul style="list-style-type: none"> If the operator is recording impact values for each individual drop, the undesirable drop should be deleted.

ASTM and Australian Standards

ASTM D5874	Standard test method for determination of the impact value (IV) of a soil.
ASTM F355	Standard test method for shock absorbing properties of playing surface systems and materials. By putting your Clegg Impact Tester in the App setting menu under “drop units” to display F355. This will auto convert your readings to approximate (+/- 5%) of F355 test units.
ASTM F1702	Standard test method for measuring shock-attenuation characteristics of natural surface systems using lightweight portable apparatus (refers to 2.25 kg mass)
ASTM F1551	Standard test method for comprehensive characterization of synthetic turf playing surfaces and materials
AS 1289.6.9.1	Soil strength and consolidation test – Determination of stiffness of soil – Clegg impact value (CIV).

Hardware Warranty

Lafayette Instrument (The manufacturer) guarantees its instrumentation against all defects in materials and workmanship to the ORIGINAL PURCHASER for a period of one (1) year from the date of shipment, unless otherwise stated. During this period, Lafayette Instrument will repair or replace, at its option, any instrumentation found to be defective in materials or workmanship. If a problem arises, contact Turf-Tec International for prior authorization before returning the item. This warranty does not extend to damaged instrumentation resulting from alteration, misuse, negligence or abuse, normal wear or accident. In no event shall Lafayette Instrument be liable for incidental or consequential damages. There are no implied warranties or merchantability of fitness for a particular use, or of any other nature. Warranty period for repairs or used instrumentation is 90 days.

Lafayette Instrument Company offers the information in this manual in good faith as a guide to suggested operation and procedure. Actual operation of the instrument or reporting and interpretation of the test results are the sole responsibility of the user. Liability is not accepted for any inaccuracies this manual may contain or for any defects in the Clegg Soil Impact Tester. Furthermore, it is the responsibility of the user to establish appropriate safety and health practices.

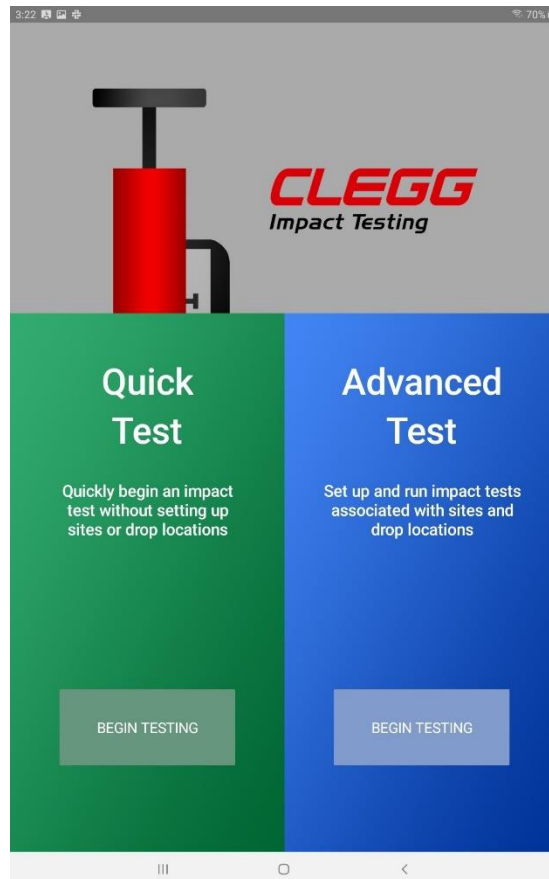
LIMITED WARRANTY OF TURF-TEC INTERNATIONAL PRODUCTS

Turfgrass Products Corporation - dba - Turf-Tec International ("Seller") warrants to the final purchaser, that all Turf-Tec International tools will be free from defects in material or workmanship for a period of one year from date of purchase. SELLER'S SOLE OBLIGATION AND YOUR EXCLUSIVE REMEDY under this Limited Warranty and, to the extent permitted by law, any warranty or condition implied by law, shall be the repair or replacement of parts, without charge, which are defective in material or workmanship and which have not been misused, carelessly handled, or improperly repaired by persons other than Turf-Tec International. To make a claim under this Limited Warranty, you must return the complete tool, transportation prepaid, to Turf-Tec International after contacting Turf-Tec International and receiving a return authorization number. Please include a dated proof of purchase with your tool. ANY IMPLIED WARRANTIES SHALL BE LIMITED IN DURATION TO ONE YEAR FROM DATE OF PURCHASE. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING BUT NOT LIMITED TO LIABILITY FOR LOSS OF PROFITS) ARISING FROM THE SALE OR USE OF THIS PRODUCT.

Hold Harmless Agreement

The seller shall protect, defend, indemnify and hold the purchaser and their respective assigns and their attorneys, accountants, employees, officers and directors harmless from and against all losses, costs, liabilities, claims, damages and expenses of every kind and character, as incurred, resulting from or relating to or arising out of the inaccuracy of results, injury of user, injury of sports participant, animal injury or turfgrass loss, warranty, covenant or any agreement made by the seller in this agreement.

Clegg Control App



Clegg Impact Soil Tester with Clegg Control App

For convenience of portability and simplicity of updating, the most up-to-date Clegg Impact Soil Tester and Clegg Control app manual is readily available via the Clegg Control app. This version is sports field specific and is available from Turf-Tec International www.turf-tec.com with the purchase of a Clegg Impact Tester from Turf-Tec International or one of our distributors.

What is New?

The Clegg Control app replaces the previously available Clegg Control hardware with an app and a tablet. The app is more user-friendly and contains many more advanced features. The app further improves the Clegg test process by allowing users to preset specific testing locations and save readings based on previously tested locations.

The new version also allows you to connect by Bluetooth a FieldScout TDR350 Moisture Sensor or a Turf-Tec Mascaro Infill and Cleat Depth Tester (MICDT). The Clegg Control app is installed on the provided tablet and can be accessed by tapping the appropriate icon. It also allows GPS mapping data and GPS Coordinates to be stored and all data acquired during testing to be exported to a .CVS file and emailed directly from the app.

Follow these instructions to view the manual.

1. Open Clegg Control app.
2. Tap the hamburger-style button (3 vertical dots) on the upper right side of the screen.
3. Tap SHOW MANUAL from the menu to display manual

Getting Started

CONNECT A DEVICE

In order to connect the Clegg Control app to a Clegg device, be sure that the tablet with the Clegg Control app has Bluetooth enabled; the Clegg Control unit uses Bluetooth to communicate with the tablet. If a situation arises where the app is started without Bluetooth enabled, the app will display a warning allowing the user to enable Bluetooth. **Note:** Do not connect the Clegg Bluetooth device through the tablets Bluetooth settings. Instead, connect the device through the Clegg app.

1. Enable Bluetooth via tablet settings.
2. Open the Clegg Control App
3. Click on Advanced test – Begin Testing
4. Tap the menu (hamburger-style) button (3 vertical dots) on the upper right of the screen.
5. Tap SELECT CLEGG from the new window.

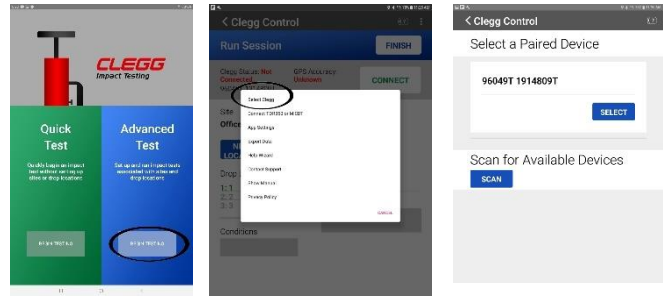


For a new app installation

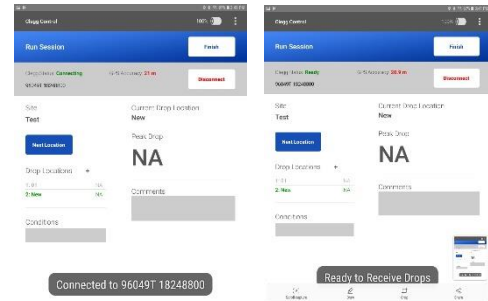
Tap the SCAN button under the Scan for Available Devices area.

For an existing app installation

A list of previously connected devices is available. The devices are listed by serial number. The device serial number is available via the silver tag on the Control unit. Tap the SELECT button for the device to which you wish to connect.



Once the device is connected, the bottom of the screen will show “Connected to 96049 + SN#” briefly then “Ready to receive drops”. These indicators will disappear and a “Connected” indicator will appear in the upper left of the screen. The battery level of the Control Unit is also denoted by an icon in the top right of the screen.



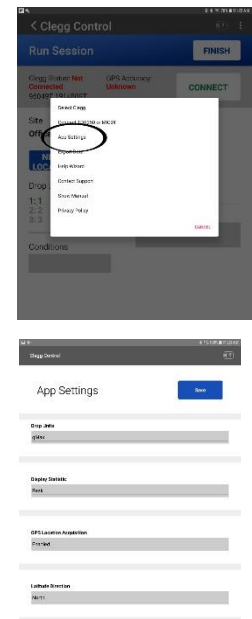
APP SETTINGS

The App settings screen is used to personalize the application to the specific needs for sports field testing. The App settings screen is available by tapping the hamburger menu button (3 vertical dots) on the upper right of the screen and selecting APP SETTINGS.

For Sports Field Testing, Set the app settings as follows:

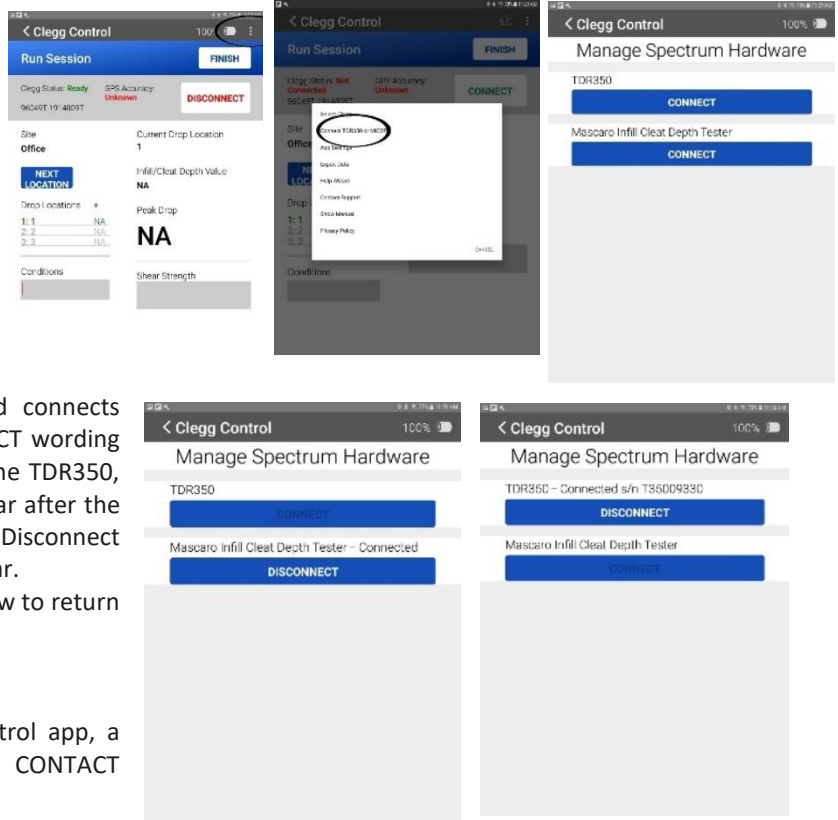
- Drop unit: **g** (For Gravities) *
- Display statistic: **Peak**
- Export Preference: **All Drops**
- GPS Location Acquisition: **Enabled** – (Disabled if an indoor facility)
- New Location Threshold: **5 meters** is most accurate; you can change this setting if needed
- Latitude direction: **North**, South (North or South of equator) USA = North
- Longitude direction: East, **West** (East or west of the prime meridian) USA = West

*Note – For drop units, you can also use F355 which automatically convert your gMax readings to F355 equivalent readings by using the conversion formula. $F355 = (Clegg\ g's + 27.1) / .81$, however most testing with the Clegg is usually performed in (g) Gravities setting.



CONNECT A FIELD SCOUT TDR350 MOISTURE SENSOR OR MASCARO INFILL AND CLEAT DEPTH TESTER (MICDT)

1. When in the Run Session Screen, Click the hamburger menu in the upper righthand corner of the app.
2. Click: "Connect TDR350 or MICDT"
3. When Manage Spectrum Hardware screen appears, be sure to have the TDR350 or MICDT in Bluetooth range and powered on and select the connect button for that device. Note, you can only connect one device at the same time as the Clegg)
4. Once the device is discovered and connects properly, the other button's CONNECT wording will disappear and if connected to the TDR350, that devices serial number will appear after the word "Connected" and the option to Disconnect from the connected device will appear.
5. Click on the <Clegg Control back arrow to return to the testing screen.



SUPPORT

Should you have any issues with the Clegg Control app, a contact support form is available by selecting CONTACT SUPPORT or by calling Turf-Tec International.

Drop Modes

The Clegg Control app has 2 drop modes: Advanced and Quick testing. Each time the application starts, the startup screen will have the user pick between Quick and Advanced testing. From the Home page for each type of test, the user will be able to switch to the other test type using the menu button and selecting either QUICK TESTING or ADVANCED TESTING. Note – Advanced testing is preferred as you can have more data access. It takes additional set up for the first time you test an area, but it is necessary for easier future data reference.

Quick Testing Mode

This mode allows a user to quickly make and store the readings for a series of drops from multiple locations. No settings are pre-loaded when performing a Quick Test. It is possible to add drops from multiple locations by tapping the NEW LOCATION button or configuring the app to automatically detect movement of the tablet. *See the Using New Application Threshold section on page 14 for more information about available settings.*



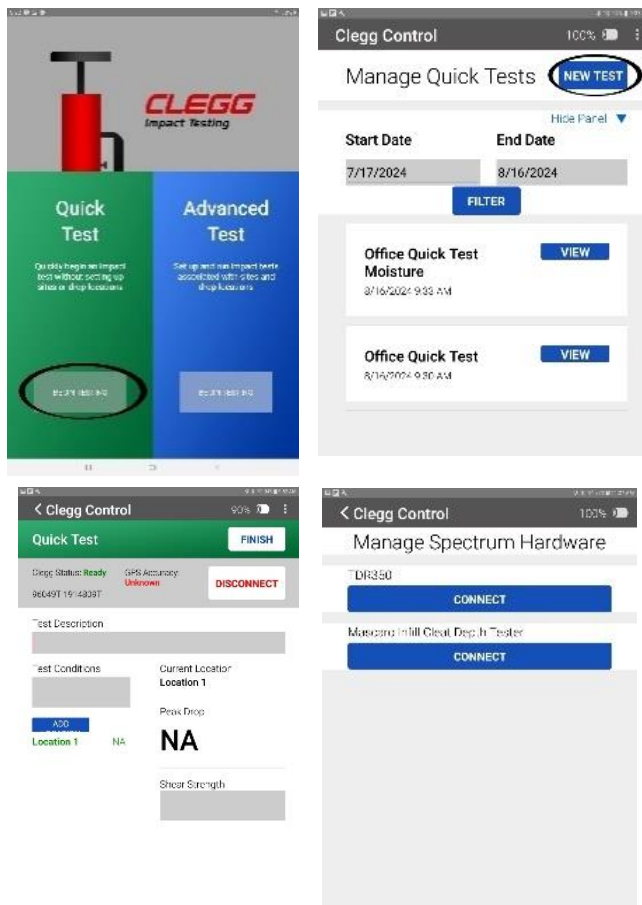
Setting up a Quick Test (For sports field testing, advanced testing mode is preferred. See “Advanced Testing Mode”)

CREATE A SESSION

A Quick test can be started by tapping BEGIN TESTING from the app startup screen then from the Manage Quick test screen, click on NEW TEST. Note, this data is also saved in the app but has far less features compared to doing an advanced test.

Before beginning a test session be sure to have the necessary app settings selected via the App settings screen. Specific settings are detailed in the App settings area of this manual; the specific settings for standard procedures are available in the Testing procedure section.

1. Tap the NEW button on the Manage Quick Tests screen to display Quick Test Run session screen.
2. Connect the Clegg as shown in the CONNECT A DEVICE section.
 - A connected device will become disconnected after 30 minutes of downtime.
 - A disconnected device will power off after 10 minutes. *For more information about how to power up the device, see the Control: Power section on page 5.*
3. Connect the desired additional Bluetooth device (TDR350 or Mascaro Infill Cleat Depth Tester) as shown in the CONNECT A FIELD SCOUT TDR350 MOISTURE SENSOR OR MASCARO INFILL AND CLEAT DEPTH TESTER (MICDT) section.
4. Verify the on-screen details.
 - Serial number and status of Clegg device connection (at left)
 - Use the ADD LOCATION button as testing moves to different locations
 - Enter Test Description and Test Conditions in labeled locations.



ADDING A DROP LOCATION

There are multiple ways to add new Drop locations for Quick tests. Comments can be entered for each location in the box labeled Location Comments. Prior rainfall data is most relevant in this box and for synthetic turf, the last grooming date should be recorded. Tap on an existing location to go to that location.

- New Application Threshold can automatically prompt to add a new location when the GPS coordinates suggest the user has moved to a new location. Required distance can be set up via the App settings.
- Tap ADD LOCATION to create a new location

Using New Application Threshold: During a Quick Test, the app compares the current drop location with the previous drop location and prompts the user to create a new location if the distance between drops exceeds this threshold. The selection should be based on the GPS accuracy and the typical distance between drop locations for the user. If Disabled is selected, the App will not perform the comparison.

Advanced Testing Mode (Preferred method of testing)

Allows users to create specific locations to define and store testing readings. *For more information about creating an Advanced Drop test, read the Setting up an Advanced test section.* The Clegg Control app uses the terms DROP SITE and DROP LOCATION to describe differing levels of location organization and cannot be used interchangeably.

WHAT IS A DROP SITE?

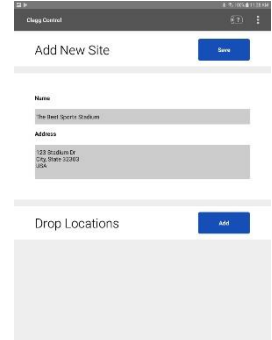
A Drop site often describes the place where the testing is located (e.g. a park, sporting complex, racetrack, golf course). A Drop site must be entered in order to continue the Advanced testing process. Drop sites are defined using a name and optionally an address.

How do I add a Drop site?

- A Drop site is added by tapping the NEW SITE button on the Manage sites screen
- Drop locations can also be added in advance by tapping the ADD button in the Drop locations area of the Drop site screen.

How do I edit a Drop site?

- Select a Drop site by tapping the EDIT button on the Manage sites screen.
- Site name and address as well as any available drop locations can be added or edited from the Edit site screen

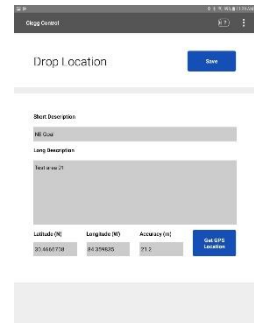


WHAT IS A DROP LOCATION?

A Drop location describes the precise location of each testing drop within the drop site. Drop locations can be defined using a name and optionally a description or GPS location. Stored locations can be optionally carried over into subsequent tests in order to make testing even simpler and more consistent.

How do I add a Drop location?

- Locations can be set up in advance using the Add or Edit Drop site screens.
 - Add a new Drop site or select a Drop site by tapping the EDIT button on the Manage sites screen.
 - Add a Drop location by tapping ADD button in the Drop locations section.
- On-the-fly by tapping the “+” icon in the Drop locations area of the Run session screen.



How do I edit a Drop location?

- Select a Drop site by tapping the EDIT button on the Manage sites screen.
- Select a Drop location by tapping the EDIT button corresponding to the drop location.
- Descriptions, GPS location and future usage can be edited.

Setting up an Advanced Test

In order to run a Clegg Impact Test, be sure to first define a Drop site. Drop locations can be added in advance or on-the-fly via the Run test area. A short Help wizard is available by tapping the menu button (3 vertical dots) on the upper right of the screen and selecting HELP WIZARD.

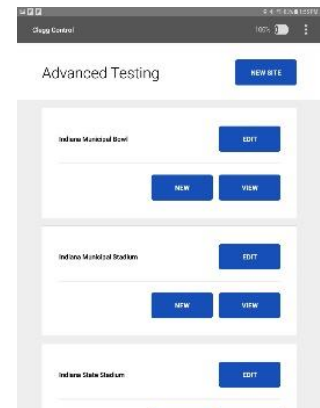
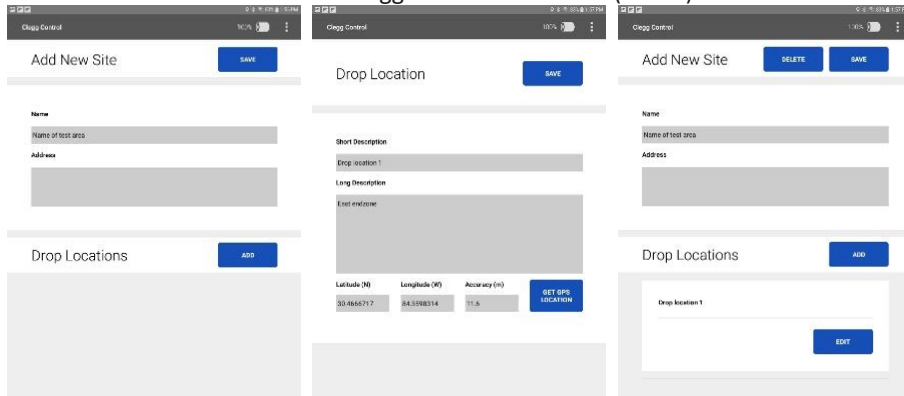


CREATE A SESSION

Before beginning a test session be sure to have the necessary app settings selected via the App settings screen. Specific settings are detailed in the App settings area of this manual; the specific settings for standard procedures are available in the Testing procedure section.

1. Tap the NEW button under a Drop site to bring up the Run session screen.
2. Verify the on-screen details.

- Drop site location (at left)
- Serial number and status of Clegg device connection (at left)

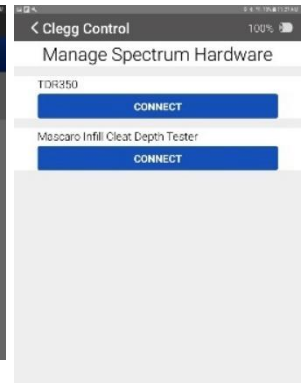
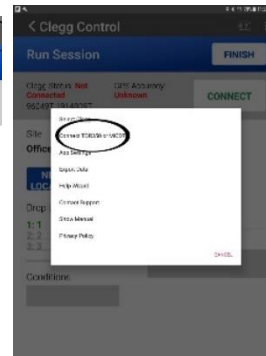


- Drop locations, add additional locations by tapping “+” icon (at left)
 - Enter desired Site conditions in available text area (at left)
 - Drop Type: PEAK (at right); controlled via App settings
3. Connect Clegg device by tapping CONNECT button, if necessary
 - A connected device will become disconnected after 30 minutes of downtime.
 - A disconnected device will power off after 10 minutes. *For more information about how to power up the device, see the Control: Power section on page 5.*

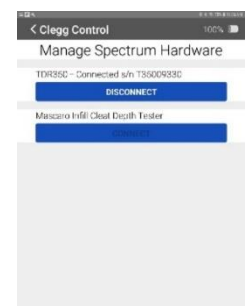
4. When in the Run Session Screen, Click the hamburger menu in the upper righthand corner of the app.

5. Click: “Connect TDR350 or MICDT”

6. When Manage Spectrum Hardware screen appears, be sure to have the TDR350 or MICDT in Bluetooth range and powered on and select the connect button for that device. Note, you can only connect one device at the same time as the Clegg)



7. Once the device is discovered and connects properly, the other button’s CONNECT icon will disappear and if connected to the TDR350, that devices serial # will appear after the word “Connected” and the option to Disconnect from the connected device will appear. Connecting the MICDT will produce a “Connected” comment above the appropriate blue box.



8. Click on the <Clegg Control back arrow to return to the testing screen.

9. Follow the appropriate Testing procedures. *Standard testing procedures are available in the Performing a Clegg Impact Test section on page 14 and Advanced testing on page 15.*

SELECTING A DROP LOCATION

The listing of Drop locations can be traversed in multiple ways. In order to go down the list in sequential order tap the NEXT LOCATION button above the Drop location list. See map on page # 21 and 22 for suggested drop locations on a football field and for racetracks. If you desire to move through the list in any order, tap a location name from the list. The currently selected Drop location is highlighted in green.



PERFORMING A DROP

When performing a drop, it is important to follow appropriate testing procedures. *Standard testing procedures are available in the Performing a Clegg Impact Test section on page 7 and Advanced Testing Mode on page 15.* Each drop reading is listed in order and can have comments* added by tapping the drop value.

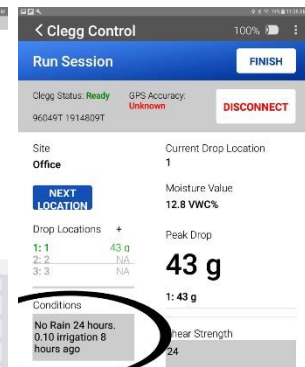
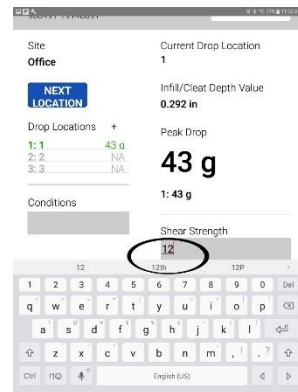
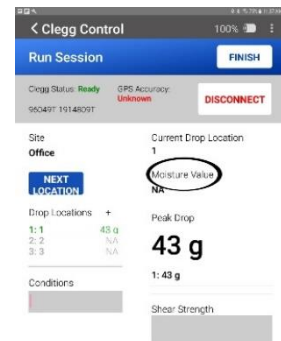
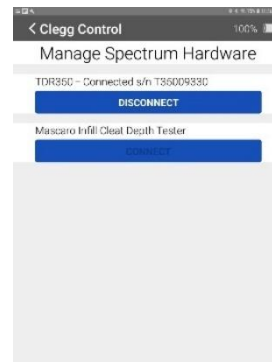
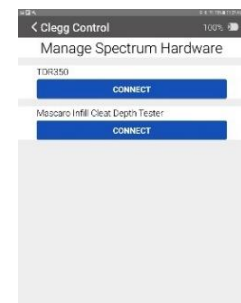
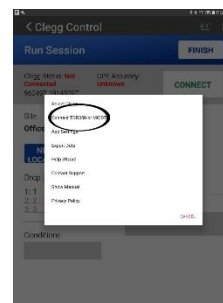
***The comments added to the drop reading should be as follows:**

Natural Grass Fields – Connecting a TDR350 Moisture Sensor

After Connecting the Clegg in the app as instructed under the section entitled “CONNECT A DEVICE”.

Next connect the FieldScout TDR350 as follows:

- When in the Run Session Screen, Click the hamburger menu in the upper righthand corner of the app.
- Click: “Connect TDR350 or MICDT”
- When the “Manage Spectrum Hardware” screen appears, be sure to have the TDR350 in Bluetooth range and powered on and select the connect button for that device. (Note, you can only connect one device (TDR350 or MICDT) at the same time as the Clegg)
- Once the device is discovered and connects properly, the Mascaro Infill and Cleat Depth Tester button’s CONNECT icon will disappear and the TDR350’s serial # will appear after the word “Connected” and the option to Disconnect from the TDR350 device will appear. Connecting the MICDT will produce a “Connected” comment above the appropriate blue box.
- Click on the < Clegg Control back arrow to return to the testing screen.
- On the Run Sessions screen, the Moisture Value wording will appear below the Current Drop Location wording.
- Each time you take a Clegg gMax drop, also insert the TDR350 probes into that same area and press the “Read” button on the TDR350. The Moisture readings will be displayed on the Run Sessions screen along with the Clegg readings. (Note, the app is also capturing the additional data from the TDR like Surface temperature and EC readings. These can be viewed in the .CVS file in the Export Session function.
- There is also a box provided for manual input of the Turf-Tec Shear Strength Readings. This data will also be exported into the .CVS file in the Export Session function.
- Under Conditions manual entry box, rainfall and irrigation data should be entered here for future reference.



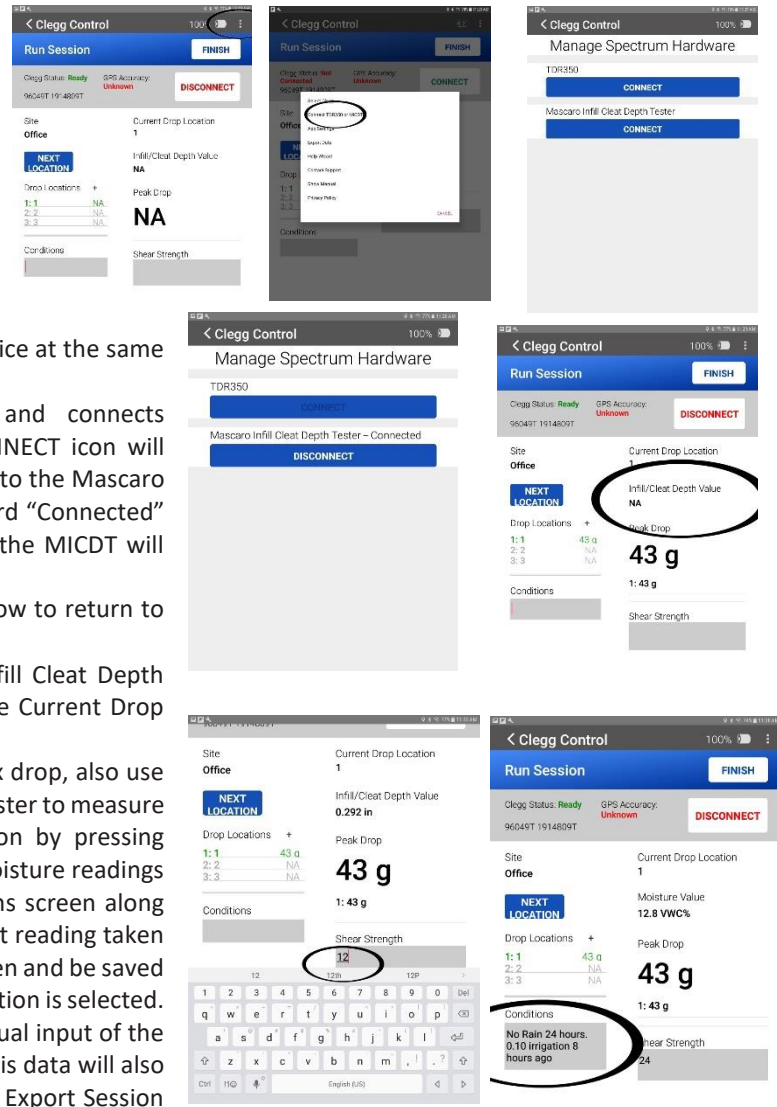
Note: When performing testing in the Run session screen and moving between test locations. Be sure to keep the Clegg, the tablet and the Field Scout TDR350 units near each other so that the Bluetooth connections will not be disconnected. If this occurs, you will need to reconnect the disconnected device before additional testing can be done.

Synthetic Turf Fields – Connecting a Mascaro Infill and Cleat Depth Tester

After Connecting the Clegg in the app as instructed under the section entitled “CONNECT A DEVICE”.

Next connect the Mascaro Infill and Cleat Depth Tester as follows:

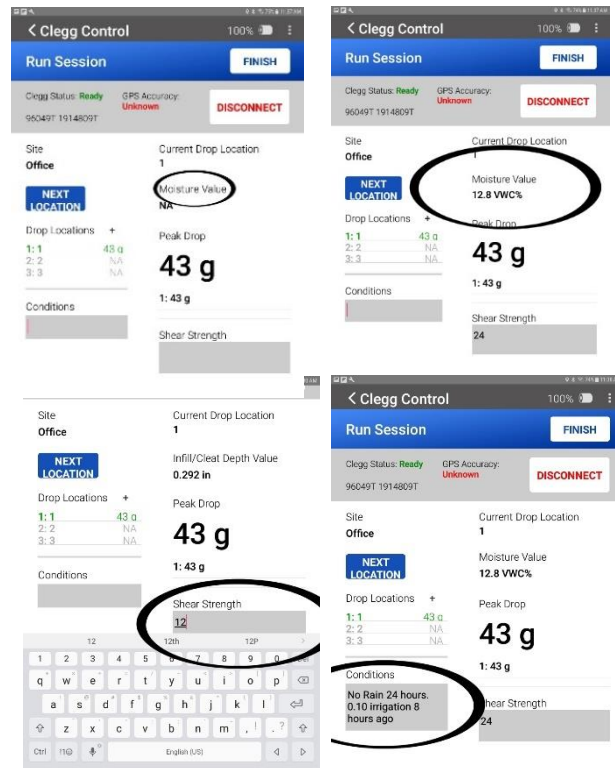
1. When in the Run Session Screen, Click the hamburger menu in the upper righthand corner of the app.
2. Click: “Connect TDR350 or MICDT”
3. When the “Manage Spectrum Hardware” screen appears, be sure to have the Mascaro Infill and Cleat Depth Tester in Bluetooth range and powered on and select the connect button for that device.
(Note, you can only connect one device at the same time as the Clegg)
4. Once the device is discovered and connects properly, the TDR350 button’s CONNECT icon will disappear and if properly connected to the Mascaro Infill and Cleat Depth Tester, the word “Connected” and the option to Disconnect from the MICDT will appear.
5. Click on the <Clegg Control back arrow to return to the testing screen.
6. On the Run Sessions screen, the Infill Cleat Depth Value wording will appear below the Current Drop Location wording.
7. Each time you perform a Clegg gMax drop, also use the Mascaro Infill and Cleat Depth Tester to measure the infill depth in the same location by pressing down on the MICDT Plunger. The Moisture readings will be displayed on the Run Sessions screen along with the Clegg readings. Note the last reading taken will be the one to appear on the screen and be saved into the database when the next location is selected.
8. There is also a box provided for manual input of the Turf-Tec Shear Strength Readings. This data will also be exported into the .CVS file in the Export Session function.
9. Under Conditions manual entry box, rainfall or relevant data like last grooming data should be entered here for future reference.



Note: When performing testing in the Run session screen and moving between test locations. Be sure to keep the Clegg, the tablet and the Mascaro Infill and Cleat Depth Tester units near each other so that the Bluetooth connections will not be disconnected. If this occurs, you will need to reconnect the disconnected device before additional testing can be done.

Horse Racetracks - Turf Tracks – Connecting the Field Scout TDR350 Moisture Sensor.

- See **Natural Grass Fields** section for information on how to connect the TDR350 Moisture Sensor to the Clegg Tablet and app.
- Once the TDR350 is connected properly, on the Run Sessions screen, the Moisture Value wording will appear below the Current Drop Location wording.
- Each time you take a Clegg gMax drop, also insert the TDR350 probes into that same area and press the Read button on the TDR350. The Moisture readings will be displayed on the Run Sessions screen along with the Clegg readings. (Note, the app is also capturing additional data from the TDR like Surface temperature and EC readings. These can be viewed in the .CVS file in the Export Session function.
- There is also a box provided for manual input of the Turf-Tec Shear Strength Readings. This data will also be exported into the .CVS file in the Export Session function.
- Under Conditions manual entry box, rainfall and irrigation data should be entered here for future reference.



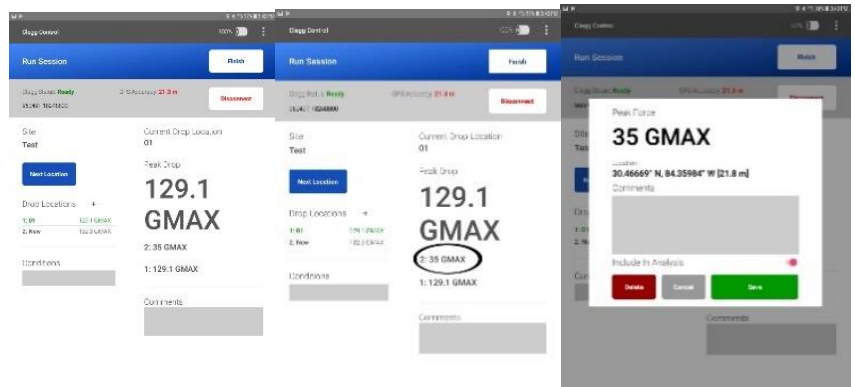
Horse Racetracks – Dirt and Synthetic Tracks / Horse Arenas

- Clegg readings should be taken by manually removing the cushion layer to reveal the base pad.
- Place the Clegg directly on the base pad and test.
- Moisture Sensor Reading – After connecting the TDR350, the readings will appear each time you press Read on the TDR350 into the Clegg app. Also test the base pad for moisture content.
- Shear Strength Reading - There is also a box provided for manual input of the Turf-Tec Shear Strength Readings. This data will also be exported into the .CVS file in the Export Session function.
- Under Conditions manual entry box, rainfall and irrigation data should be entered here for future reference.



DELETING UNWATED READINGS:

1. If a drop is recorded improperly, you can delete that reading by clicking on the incorrect reading on the left.
2. Next click on “Delete”
3. Verify the Delete function.



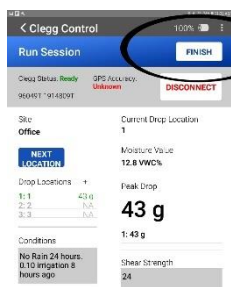
Viewing Results

One of the biggest improvements of the Clegg Control app is that previous readings are stored in the app database as well as readings from the TDR350 Moisture Sensor or the Mascaro Infill and Cleat Depth Tester.

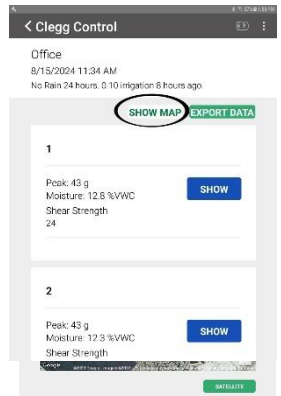
SAVING SESSION READINGS

The Clegg Control app saves the session after each drop is recorded. The current session can be exited by tapping the FINISH button in the upper right of the Run session screen. A finished session cannot have additional drops added or data modified.

VIEWING PREVIOUS READINGS



1. Because of the difference in record keeping, each testing type follows specific methods to view readings.
 - Quick test: Enter Start and End dates and tap FILTER
 - Advanced: Tap VIEW on the desired Drop site
2. Previous sessions are listed by date and time. Select a session (date/time) by tapping the VIEW button for the desired session.
3. Drop locations are listed with the gMax reading as well as the TDR350 Moisture or Mascaro Infill and Cleat Depth Tester data that was recorded during testing as well as any conditions or comments concerning that specific location.
4. All drop readings for a specific location are available by tapping the SHOW button (at right). After showing the readings, tapping the HIDE button will hide the readings.
 - Drops are listed by number and contain a reading as well as the additional data and any comments concerning that specific drop.
 - Units shown are based on the current app settings. *Details for the app settings are available in the Getting Started section on page 12.*
 - Each drop can optionally have comments recorded by tapping the value and entering them into the provided text box as shown under “Performing a Drop” on Page 17.



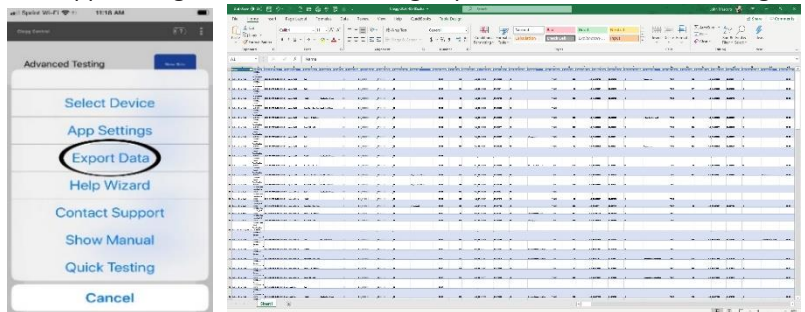
SHOW MAP

The SHOW MAP button appears when viewing results for either a Quick test or Advanced test session. It displays a map with markers at all drop locations for which GPS coordinates were obtained. Tapping on a marker brings up details about the drop including the result, time, and GPS accuracy for the drop. A button in the lower right corner allows switching between a “Satellite” or “Street” view for the map.

EXPORTING DATA

Two distinct ways to export data are available:

- Selecting EXPORT DATA from the menu exports all stored results in XML format.
- Tapping the EXPORT DATA button when viewing results for a Quick or Advanced Test session exports data for the current session in CSV format. App Settings contains the setting Export Preference for selecting whether to include all drops or only the peak value in the CSV file.



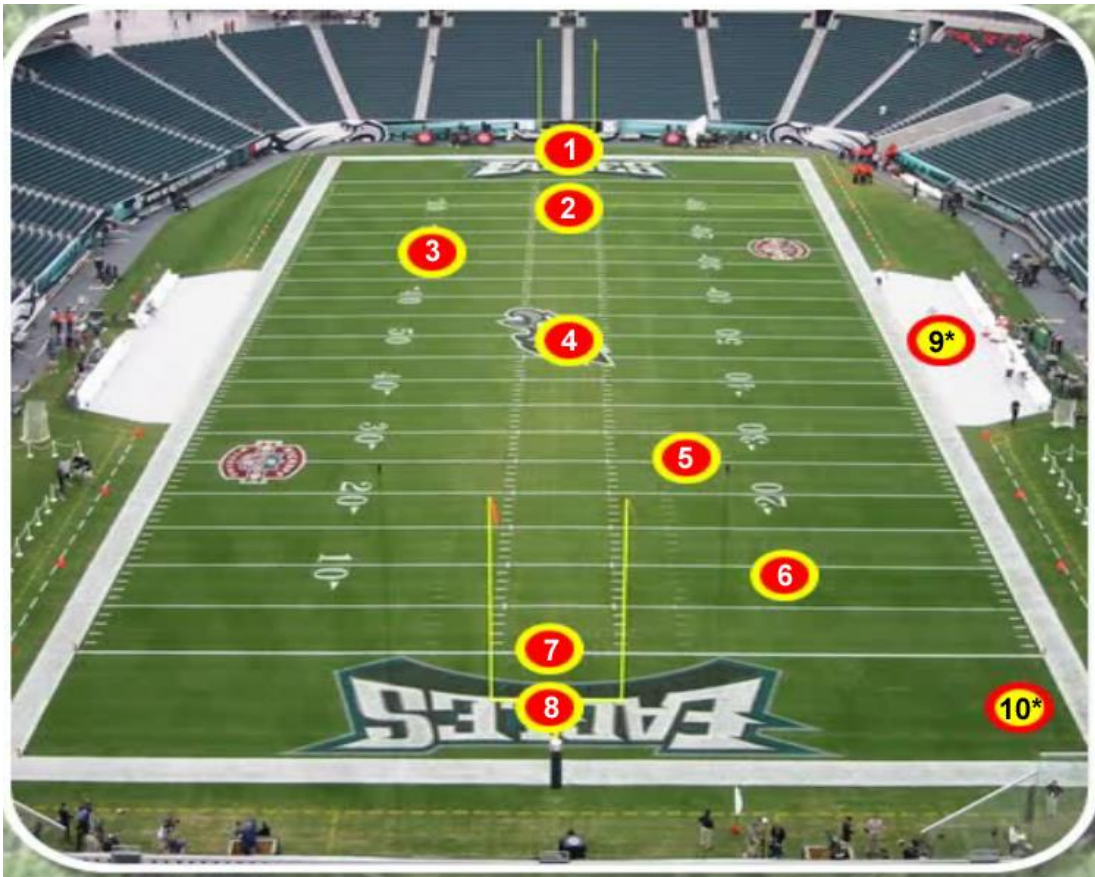
NOTE: The default application for handling exported files can be selected by following the instructions for updating default applications for your operating system.

****Important** It is important to export data to a CVS file in the event that the tablet is damaged or lost, or the app becomes corrupted. Backing up data to a CVS file and saving it to a computer will insure against data loss.**

RETURNS

Equipment may not be returned without first receiving a Return Goods Authorization Number (RGA).

Suggested Clegg Drop Points for GMax readings on Football Fields



Penn State's Center for Sports Surface Research

- The Clegg 2.25 kg reading should be the first drop of the hammer
- Total of 10 test areas.
- Drop points 1 through 8 are required areas.
- Drop points 9 and 10 are areas of your choosing in areas where you suspect high GMax levels might be expected (areas where equipment enters the field or bench areas for example).
- A maximum reading of 100 g's in the GMax setting is acceptable for sports field safety (F355 calculated equivalent of 157-F355)

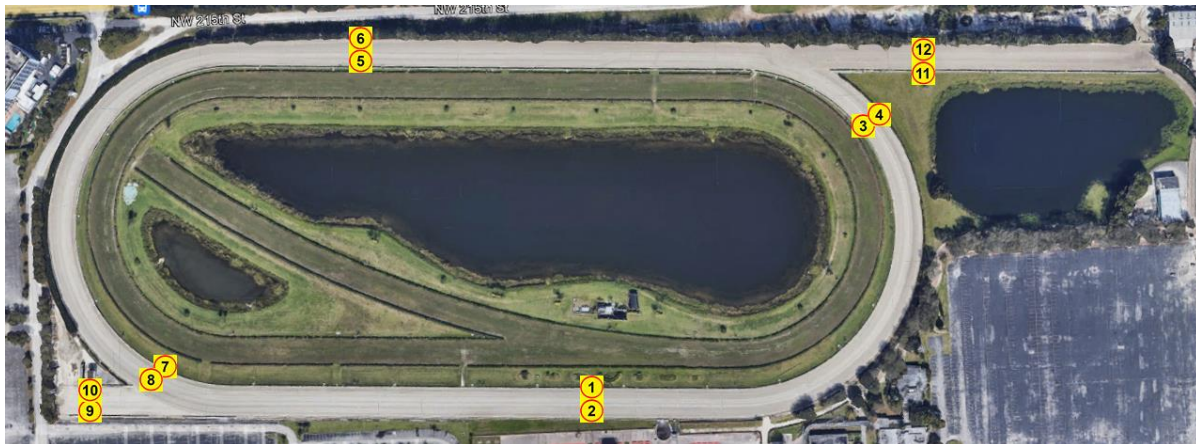
Suggested Clegg Drop Points for gMax readings on Turf Tracks



- The Clegg 2.25 kg reading should be the **first drop** of the hammer
- Total of 16 test areas at 1/8 mile posts.
- Odd Numbered Drop points 1, 3, etc... are taken 5 feet inside the rail.
- Even Numbered Drop points 2, 4, etc... are taken 15 feet inside the rail.
- 2 additional test points can be added, 1 for the “Best” or unused area of the track and 1 for the “Worst” or most used area of the track like an equipment access gate.

These tests reference ASTM D5874 and F1702

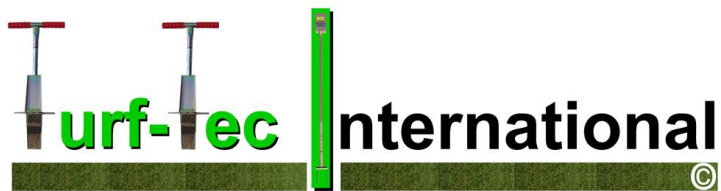
Suggested Clegg Drop Points for gMax readings on Dirt & Synthetic Tracks



The Clegg 2.25 kg reading should be the **first drop of the hammer**

- First the cushion layer should be removed, and the Clegg Impact test should be performed on the base material.
- Total of 12 test areas the first 8 are at 1/4 mile posts.
- Odd Numbered Drop points 1, 3, 5, 7 are taken 5 feet inside the rail.
- Even Numbered Drop points 2, 4, 6, 8 are taken 15 feet inside the rail.
- Drop Points 9&10 at the ¼ mile pole in the front chute (¼ chute).
- Drop Points 11&12 at the ¾ pole area that is in the back chute (¾ chute).
- 2 additional test points can be added, 1 for the “Best” or unused area of the track and 1 for the “Worst” or most used area of the track like an equipment access gate.
- In addition, a 2nd set of Clegg impact tests can be performed on the track over the entire surface including the cushion layer by gently placing the clegg on top of the cushion layer until it sits firm and level. Next, the drop values can be measured and recorded.

These tests reference ASTM D5874 and F1702



Formula converting gMax from Clegg to F355 units

*****Note***** The reading will be the *first drop* of the hammer, not the highest reading after 4 drops as described in the ASTM F355 instructions.

The Clegg is NOT an F355 ASTM Test.*

*Also, if App Settings are in "gMax" and "Peak" as described on page # 12 of this instruction manual, you do not need to use the below regression equation. Only use this equation if your App Settings are in "G" and "Peak".

The inverse of the regression equation is as follows:

$$(\text{Clegg Impact Soil Tester Value} + 27.1) / 0.81 = \text{F355}$$

*Note, this formula can be used in the Clegg app by going into APP SETTINGS by tapping the hamburger menu (3 vertical dots) on the upper right of the screen and selecting APP SETTINGS and putting the Drop unit setting to F355 (Note this is a +/- 2.5% of actual F355 readings and not actual F355 readings).

Clegg Impact Soil Tester regression equation

$$(\text{F355} \times 0.81) - 27.1 = \text{Clegg Impact Soil Tester Value}$$

"The regression coefficient for this equation was 0.95 and indicates that the Clegg Impact Soil Tester would be a suitable device to measure the surface hardness of artificial and natural grass playing fields."

*Required reading:

"Surface Hardness (gMax)"

By: Andrew S. McNitt, Thomas Serensits and Dianne M. Petrukak
The Pennsylvania State University

<http://cropsoil.psu.edu/ssrc/research/infill/surface-hardness-gmax>

Also:

<http://cropsoil.psu.edu/ssrc/sportsturf-scoop/gmax>

Video Showing uses of Clegg:

<http://www.youtube.com/watch?v=4cCq1O8TNml>

How to set up Clegg Impact Tester for Sports Field Specific Testing instructional video

<https://www.youtube.com/watch?v=QtU81qY033g>

