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**Electrical Moisture / Density Gauge
SL950**

Impact Test Equipment Ltd

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User Guide
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**Impact Test Equipment Ltd.
Building 21 Stevenston Ind. Est.
Stevenston
Ayrshire
KA20 3LR**

T: 01294 602626

F: 01294 461168

E: sales@impact-test.co.uk

**Test Equipment
www.impact-test.co.uk**

**Test Sieves & Accessories
www.impact-test.com**

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Contents

First Steps with Your Electrical Density Gauge.....	1
Turning on the Battery Pack	1
Registering Your EDG.....	2
Components.....	2
Soil Model Calibration Preparation	6
Producing a Soil Model	6
Graph Refinement and Fit Adjustment.....	23
Performing Soil Tests.....	26
Storage and Transfer of Data.....	33
Calibration Check.....	35
Firmware Upgrade.....	37
EDG Screen Icons.....	39

First Steps with Your Electrical Density Gauge

Upon opening your Electrical Density Gauge (EDG), you will see the following card attached to the face panel of the gauge. Read the card and follow the instructions.

STOP

Before You Use Your EDG

TURN THE BATTERY ON!

Your EDG was shipped with the battery switched off and must be switched on before use.

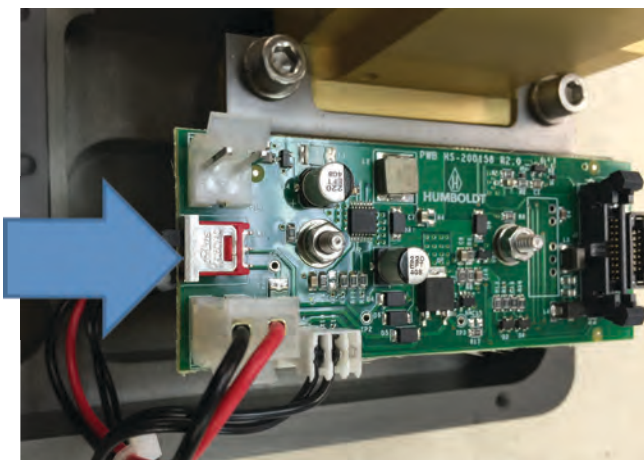
- 1) Remove this Tag and undo the six thumb screws holding the faceplate of the EDG in place.
- 2) Carefully lift off the faceplate. Be careful that you don't pull any wires out of their connections.
- 3) The battery is located at the bottom of the inner EDG compartment. At the top of the battery mount is a small sliding switch. Move the switch to the left to turn the EDG on.
- 4) Then replace the faceplate and tighten the thumbscrews.

Turning on the Battery Pack

As outlined on the card, you need to turn the battery pack on before you can use the Electrical Density Gauge (EDG).

Your EDG was shipped with the battery switched off and must be switched on before use.

- 1) Remove this Tag and undo the six thumb screws holding the faceplate of the EDG in place.
- 2) Carefully lift off the faceplate. Be careful that you don't pull any wires out of their connections.
- 3) The battery is located at the bottom of the inner EDG compartment. At the top of the battery mount is a small sliding switch. Move the switch to the left to turn the EDG on. See photo on next page for switch location.
- 4) Before you replace the faceplate, register your EDG and place the registration label inside the EDG above the battery switch. Then replace the faceplate and tighten the thumbscrews.



Battery switch location inside EDG.



The EDG and Its Components— What's in the box

Your EDG is comprised of a number of components. Below is a photograph of the components, check to make sure you have received everything. Following the photo is a description of each of the components.



1. The Case:

The Electrical Density Gauge is built into its case, providing storage of all the gauge components allowing for easy transportation. The actual gauge is built into the right side of the case and accessories are stored on the left side except for the Dart Template, which is stored in the lid of the case.

2. Dart Template:

The Dart Template is located in the lid of the EDG. It is secured with velcro to keep it in place. To remove unfasten the velcro straps.

3. Soil Sensor:

The Soil Sensor is located in the accessory caddy. It is the orange box with the two pins on top and the long black cable attached. In use it gathers electrical information about the soil under test and transfers the information to the EDG computer. During use, the Soil Sensor is connected to the Dart Template using the velcro attached to the Soil Sensor and the Dart Template. The Soil Sensor connects to the EDG through the attached long, black cable and the port on the lower front of the gauge to the right of the handle.

The Soil Sensor requires no maintenance or adjustment, so there is no need to open the enclosure. Keep it clean and dry when using it. It is an electronic circuit, so treat it with the same respect you use with your cell phone. If the Sensor Pins become loose, hold the pin with pliers while tightening the nut against the enclosure.

The Soil Sensor has a serial number, located on the label attached to its side. This serial number matches the serial number of your gauge and the Calibration Device included with the Gauge. In use, you should always use the Soil Sensor with the matching serial number with your gauge. If the Soil Sensor becomes damaged or lost, you will either need to send your Gauge back to the supplier or you can calibrate a new Soil Sensor

4. Soil Sensor Cables (set of two)

The Soil Sensor Cables are used to connect the Darts and the Soil Sensor together for testing. On one side of these cables is a female 1/4" phone plug and the other has an alligator clip. In use the 1/4" phone plug should attach to the Soil Sensor and the alligator clip is attached to one of the Darts. The EDG comes supplied with two of these cables.

5. Temperature Probe (Thermistor)

The Temperature Probe is located in the accessory caddy in a plastic box. For use, remove it from its storage box and plug it into the port on the side of the Soil Sensor using the mini-phone plug at one end of the Probe.

6. Battery Charger Cable

In use, the EDG runs on battery power supplied by a NiMH Battery. The battery provides about 60 hours of runtime from a fully charged battery.

The battery needs to be charged periodically. To charge it, use the supplied cable located in the accessory caddy. To use, plug the Battery Charger Cable into an electrical outlet and plug the other end into the port at the top right of the EDG's control panel. To fully charge the battery from a critically low point to full takes about 6 to 8 hrs.

Best practice is to keep the battery charged. The EDG can be stored between usage plugged into a power source via the Battery Charger Cable. For extended periods of downtime, it is recommended that the Battery be turned off for storage.

To do this, remove the six thumb screws holding the faceplate of the EDG in place. Carefully lift off the faceplate. Be careful that you don't pull any wires out of their connections. The battery is located at the bottom of the inner EDG compartment. At the top of the battery mount is a small sliding switch. Move the switch to the right to turn the battery off.

7. Darts

The EDG is supplied with a set of four (4) 6" Tapered Darts. These are stored on the lower level of the Accessory Storage Area. Darts are available in five different lengths: 4", 6", 8", 10" and 12". Dart lengths should be used to correspond to lift height being used in the project.

8. Hammer

The EDG is supplied with a hammer for driving Darts into the material to be tested. It is stored in the lower level of the Accessory Storage Area.

9. T-Handle Probe

The T-handle probe is used to assist in placing the Temperature Probe into the material to be tested. It is stored in the lower level of the Accessory Storage Area.

10. Calibration Device

The Calibration Device should have the same serial number as your Gauge and the Soil Sensor. It is used for a quick, one-point calibration check to make sure the Gauge and Soil Sensor are working properly. It is suggested that this test be run before each day of testing.

Soil Model Calibration Preparation

In order to use the Electrical Density Gauge (EDG) to determine moisture, density and % compaction of materials, you must first develop what is called a Soil Model of the material(s) you wish to ultimately measure. Per ASTM D7698-11, a Soil Model is defined as: the result of a calibration procedure that establishes a correlating linear function between measured electrical soil properties and measured physical soil properties.

Part of this calibration procedure would be to obtain a representative sample of soil from the Job Site where in-place testing will be conducted or from the borrow area planned as a source of material. This sample should be of a sufficient amount of soil for at least five compaction specimens, typically about 20 Kg (44 lb) for material with a maximum particle size less than 5cm (No. 4) sieve with a 5cm screen. More material may be required if ancillary testing is planned, such as Atterberg Limits, particle size analysis, etc.

Determine the laboratory compaction characteristics of the material to be tested. Test Methods D698 or D1557 for fine grained soils and soil rock mixtures that exhibit a clear maximum dry density or Test Methods D4253 or D7382 for predominately granular material.

In many cases material selection for a particular project has already been made and the necessary testing, i.e. the ASTM tests listed above, as well as D2216 for determining moisture have already been completed. Results from these tests should be used to determine a suitable area at the project site to perform tests to develop a soil model, as well as what density and moisture levels to use for the soil model evaluation. In order to be able to determine % compaction readings for the material(s) when actual testing is being conducted, proctor and moisture data from the above tests needs to be entered into the gauge.

Producing a Soil Model

To develop an accurate soil model, it is suggested that you either use an area of the Job Site where the material to be tested has already been placed and compacted or a similar site, which has identical compacted material in place.

To quantify readings made with the EDG while developing the soil model, it is necessary to run a conventional method test (Nuclear Gauge, Sand Cone, Volu vessel or Drive Tube and Moisture Tests) at the same time. If you are going to use a nuclear gauge for this, it is recommended you still do an alternate test for moisture, such as oven-dry, speedy or field burn off. This correlates actual compaction and moisture numbers to the readings obtained with the EDG, which provides the information the EDG needs to make accurate determinations by itself. This regimen only needs to be done to develop a Soil Model.

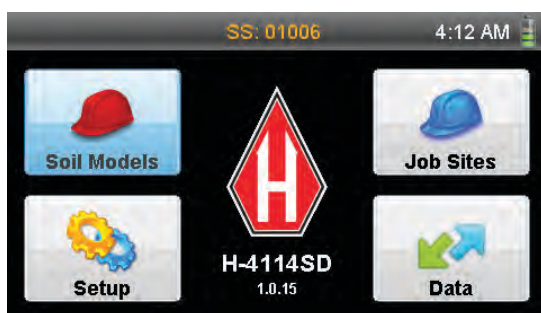
Select areas on the Job Site where the type of soil is consistent from place to place, and where there are differences in water content and compaction. Special preparation of spots of different densities or water contents should be done the day before, so as to allow stabilization of the soil water content.

A matrix of six (6) spots should be used during the soil model calibration procedure, which consists of two different soil density conditions and three (3) water content conditions that cover the range that is expected to be measured. The three calibration tests that evaluate high density soil will use test locations that ideally will have soil conditions that are close to the maximum density as determined by Test Methods D1557 or an equivalent method. The range in water content should include low water content, middle range water content, and high water content that is near the optimum water content as determined by Test Methods D1557 and D2216 or equivalent test methods.

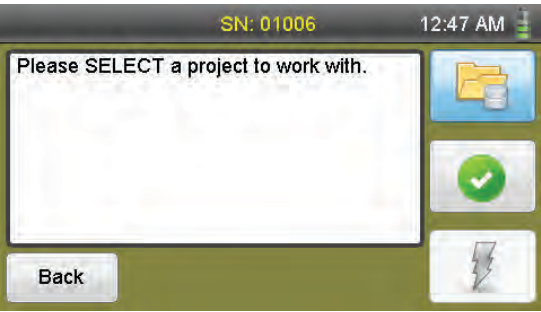
Once the Soil Model is developed, the EDG is ready to use by itself anytime this specific tested material is used. Additional readings (points) can always be added to the initial Soil Model. This allows you to provide more points from which your curve is developed, refining it and making it more accurate.

Initial Setup:

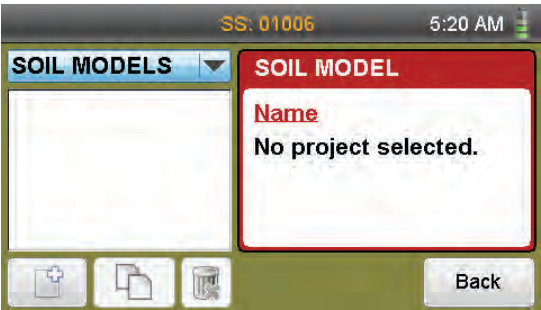
1. Turn the EDG ON by pressing the **POWER** button on the keypad for a few seconds and releasing.
(Once the EDG is on, please allow the EDG to warm-up for 5 minutes before proceeding)
2. The EDG opens to the home screen shown below. From this screen you can access the Soil Models or Job Sites sections, as well as the Setup and Data Transfer sections. Since we want to develop a Soil Model, press the **Soil Models** button with the red helmet.




3. You should be looking at a screen that looks like this:



To begin, press the **Projects** button  (Top right button with folder icon) on the Touch Screen or the **Projects** key on the Key Pad, You will see this screen:




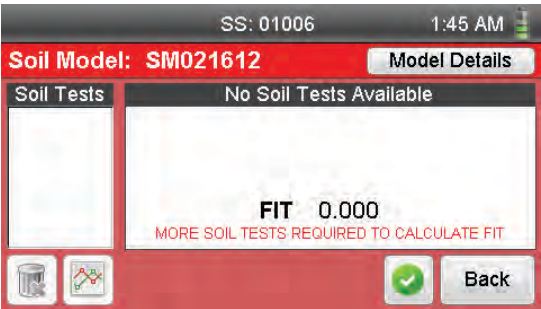
6. To create a new Soil Model, press the **NEW PROJECT** key . A keyboard will be displayed entitled: New Soil Model Name. Use the keyboard to type in a name for your Soil Model in the Value Field.



7. Type in a name for this Soil Model, which can be up to 8 characters long, i.e. soil type, date, location, test reference number, etc.

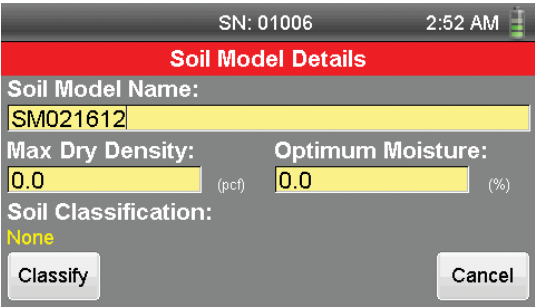


8. Press the **Select** button  to save the Soil Model you have created.
9. Once saved, a screen with your soil model name will appear with no data; stating: "No Soil Tests Available".




10. On this screen, press the **Model Details** button  on the top right of the screen.

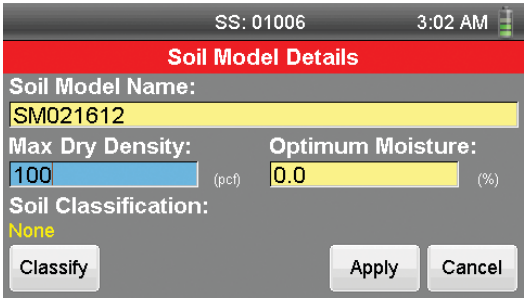
This screen is used to record your Soil Model Details (Proctor Data), as well as the Unified Soil Classification information or soil characteristics, if desired.



If you already have Proctor data for the material you are going to be testing, enter the Maximum Dry Density and the Optimum Moisture in the appropriate fields. Simply press the appropriate field and a keyboard will appear for you to enter data into the field. The screen shots below show adding a value to the **Max Dry Density** field.




Once you've entered data, press the **Select** button  and your info will be saved to the field.



Now you can add a value to the **Optimum Moisture** field.



Once you've entered data, press the **Select** button  and your info will be saved to the field.

SN: 01006 3:03 AM

Soil Model Details


Soil Model Name:
SM021612

Max Dry Density: 100 (pcf) Optimum Moisture: 20.0 (%)

Soil Classification:
None

Classify Apply Cancel

In actual testing, The Maximum Dry Density and the Optimum Moisture data will be used by the EDG to generate % compaction results.





Next press the **Classify** button  at the bottom left of the screen. A scrolling list of the Unified Soil Classification descriptions will appear. Find the soil classification that best fits the material you are testing, click on it to highlight it and press the Done button at the bottom right to choose this description. You can also choose None or Other for this description, as well. If you choose Other, you will have the option to type in your own description.

SS: 01006 3:22 AM

Soil Classification

None
GW Well graded gravel, fine to coarse gravel
GP Poorly graded gravel
GM Silty gravel
GC Clayey gravel
SW Well graded sand, fine to coarse sand

Done

Once you've made your choice by selecting your description and pressing the **Done** button , you will be returned to the Soil Model Details Screen. If the data displayed is correct, press the **Apply** button  at the bottom right of the screen. If not, you can alter your information by pressing on the appropriate fields or the **Classify** button  to make changes, or you can simply press the **Cancel** button  to return to the Soil Model screen.

SS: 01006 3:22 AM

Soil Model Details

Soil Model Name:
SM021612


Max Dry Density: 100.0 (pcf) Optimum Moisture: 20.0 (%)

Soil Classification:
GW Well graded gravel, fine to coarse gravel

Classify Apply Cancel



11. Upon pressing the **Apply** button , you will see the following screen:


SN: 01006 3:03 AM

Soil Model: SM021612 


Soil Tests No Soil Tests Available

FIT 0.000
MORE SOIL TESTS REQUIRED TO CALCULATE FIT

  Save Cancel




Press the **Save** button , you will see the following screen:
(Or you can press the **Cancel** button .




SN: 01006 3:03 AM

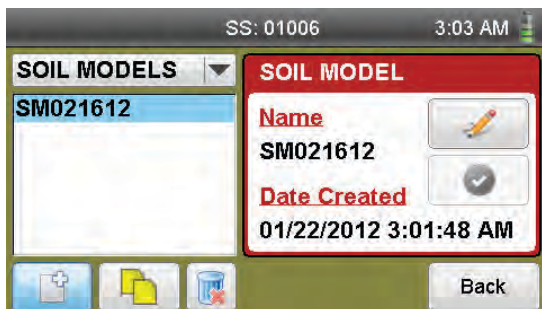
Soil Model: SM021612 

Soil Tests No Soil Tests Available


FIT 0.000
MORE SOIL TESTS REQUIRED TO CALCULATE FIT

   Done

Press the **Green Select** button  which selects the Soil Model for use and Turns the Green Dot to Gray . Press the **Done** button , you will see the following screen:



12. To continue to build a Soil Model, Make sure the name of your Soil Model on the left is selected, which will highlight the name of the Soil Model in blue. By selecting this specific Soil Model, any tests performed while it is selected will be linked to this specific Soil Model. Please note, if no Soil Model is selected, testing cannot be performed.

Press the **Back** button  at the lower right of the screen.

This action will take you to the Current Soil Model Screen. The screen will indicate a FIT of 0.000 and state: "MORE SOIL TESTS REQUIRED TO CALIBRATE FIT." Do not be concerned with the FIT at this point, it will be discussed later.



13. You are now ready to begin building your Soil Model.
To accomplish this you will need:
The EDG and its test accessories, as well as one of the following traditional test method apparatus:
- a. Nuclear Gauge
 - b. Sand Cone
 - c. Volu vessel
 - d. Drive Tube

ASTM Test Methods Related to Density and Moisture Determinations

ASTM D1556 – 07	Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D2167 – 08	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2937 – 10	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D4564 – 08	Standard Test Method for Density and Unit Weight of Soil in Place by the Sleeve Method
ASTM D6938 – 10	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
ASTM D2216 – 10	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D4643 – 08	Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating
ASTM D4944 – 04	Standard Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester
ASTM D4959 – 07	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating

14. What you are trying to accomplish by building a soil model is to develop a curve, which illustrates the density and moisture characteristics of the material you wish to ultimately test. This curve will be comprised of a series of tests (typically 6 to 12 tests) of the material at different levels of compaction effort and different levels of moisture, which when completed will produce a curve used by the EDG to provide accurate readings of density and moisture.

To produce a Soil Model, traditional test methods (i.e. nuclear gauge, sand cone, volu vessel or drive tube) are performed simultaneously on the same location as each of the EDG tests you perform. This method links the readings attained by the EDG to actual, density and moisture readings attained from traditional methods. By using the EDG in conjunction with a traditional method for providing density and moisture readings, a curve is developed, which provides an accurate depiction of the material's properties for varying density and moisture readings. It is this curve, which allows the EDG to then produce accurate readings in subsequent testing of this specific material.


15. You are now ready to proceed with the actual Soil Model development. If you are not already at the test site, proceed there. The test site can either be the actual project site you desire to test or a site that uses the same material you will be using at your project site.

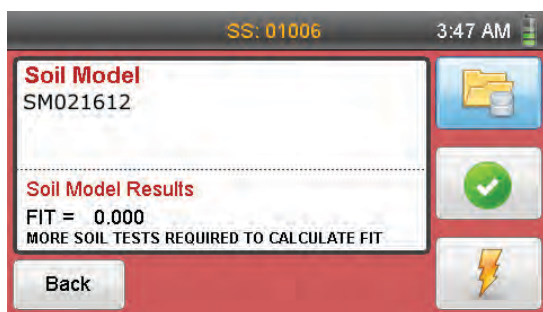
When doing your Soil Model, you should use a Dart Length that coincides with the expected lift height, which will be used for the project. Darts are available in the following lengths: 4" (10.2cm); 6" (15.2cm); 8" (20.3cm); 10" (25.4cm), and 12" (30.5cm).

Select areas on the Job Site where the type of soil is consistent from place to place, and where there are differences in water content and compaction. Special preparation of spots of different densities or water contents should be done the day before, so as to allow stabilization of the soil water content.

A matrix of six (6) spots should be used during the calibration procedure, which consists of two different soil density conditions and three (3) water content conditions that cover the range that is expected to be measured. The three calibration tests that evaluate high density soil will use test locations that ideally will have soil conditions that are close to the maximum density as determined by Test Methods D1557 or an equivalent method. The range in water content should include low water content, middle range water content, and high water content that is near the optimum water content as determined by Test Methods D1557 and D2216 or equivalent test methods.

16. To begin, place the gauge on the ground near you and open the case.
- a. Turn the gauge on, and remove the gray, circular Dart Template from the lid of the case.
 - b. Place the gray, circular template on the ground. Remove the accessory caddy from the EDG case and place it on the ground, out of the way. Remove the Hammer and the four Darts from the bottom of the case. Position the Darts at the detents on the gray template and pound them into the ground with the Hammer. The shoulder of the Darts should be level and in contact with the ground surface. Darts should be driven perpendicular into the ground, not more than 20° from perpendicular. If rocks are encountered during the process of driving the Darts, which prevent the driving of a particular Dart, move your test site slightly to accommodate the rock.
 - c. Unscrew the cap to the sensor port, located on the front base of the EDG case, to the right of the handle. Remove the Sensor Unit from the Accessory Caddy and attach the black cord attached to the Sensor Unit to the sensor port. Then, attach the Sensor Unit, pins up, to the center of the gray, Dart Template, using the velcro fastening system attached to each item.
 - d. Remove the 2 Cables, which are used to make a connection between the Darts and the Sensor Unit. These cables have an alligator clamp on one end and a 1/4" phone plug on the other. Attach the two cables to the Sensor Unit using the 1/4" phone plug ends of the cables. Then, take the alligator clamp end of each cable and attach each one to a single opposing positioned Dart. When attaching cables between the Darts and the Sensor Unit, it is best to have as straight a run as possible. The Cables should not cross. Care should be taken not to cross the Cables when asked to switch them from the A-A position to the B-B position during the testing process.
 - e. Remove the Thermistor (Temperature Sensor), located in its plastic case, in the accessory caddy. Plug the Thermistor (Temperature Sensor) into the mini-phone plug port located on the side of the Sensor Unit directly above where the Black cable enters. Remove the T-handle Probe from the bottom tray of the EDG case and use it to create a hole away from the Dart Template, into which you will place the Thermistor (Temperature Sensor). The placement of the Temperature Sensor is not critical and only needs to be placed beneath the surface of the material.

17. You are now ready to begin running your first test for your Soil Model. If you are already at the screen below from the previous step, simply press the **Test** button  at the bottom right of the screen to begin a test.



NOTE: If you have turned the gauge off and transported it to a test site, when you turn the gauge back on, it will default to the last chosen Project/Soil Model you were previously working with, which will return you to the screen above.

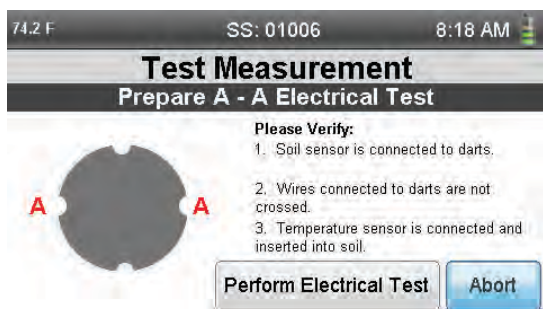
When you press the **Test** button , the screen below will appear. As the directions on this screen state:

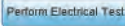
Verify that the Soil Sensor is connected to the darts.

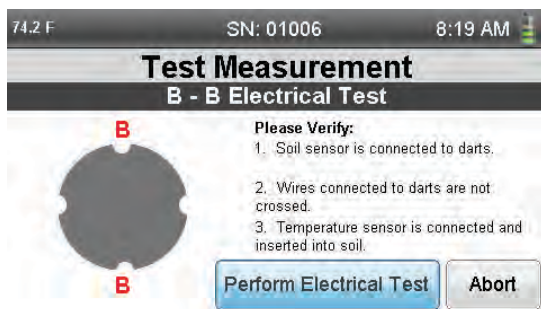
Make sure the wires connected to the darts are not crossed.

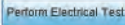
Make sure the Temperature Sensor is connected and inserted into the soil.

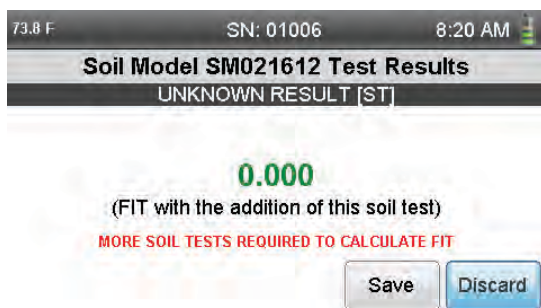
The diagram on the screen illustrates which darts should be connected for a test. Tests always involve connection to opposing dart positions, or in the first instance A and A. The diagram on the screen below illustrates the correct position of the darts to use.



Press the **Perform Electrical Test** button . Once this is done the Gauge will perform a test and the next window will appear, telling you to switch the connectors on the Darts to the B and B position. The diagram on the screen below illustrates the correct position of the darts to use.




Press the **Perform Electrical Test** button . The Gauge will now perform a second test and the next window will appear.



At this point you can ignore the numbers in green and the reference to FIT. This will be explained once you complete your soil model. The first two test you perform when building a Soil Model will also include the statement in red:


MORE SOIL TESTS REQUIRED TO CALCULATE FIT. This will not appear after the third test, as fit will begin to be calculated as you build your Soil Model.

Press the **Save** button . You have saved the first point on your first Soil Model Test.

18. Now that you have conducted your first test in developing your Soil Model, you will also need to run a test on the same spot using the traditional density and moisture test method you have chosen to use in conjunction with the EDG. Complete this test and maintain the results for entering the results into the EDG. If the method you have chosen to use provides results on-site, like a nuclear gauge, you can enter the results into the EDG as you build your soil model. Or, you can wait and enter all the results when the traditional method results are completed.
19. To complete your Soil Model, you will need to do a total of 6 to 12 tests with a range of different compaction levels and different moisture levels.

To review the ASTM procedure: A matrix of six (6) spots should be used during the calibration procedure, which consists of two different soil density conditions and three (3) water content conditions that cover the range that is expected to be measured. The three calibration tests that evaluate high density soil will use test locations that ideally will have soil conditions that are close to the maximum density as determined by Test Methods D1557 or an equivalent method. The range in water content should include low water content, middle range water content, and high water content that is near the optimum water content as determined by Test Methods D1557 and D2216 or equivalent test methods.

20. To do your next test, move to a new spot and repeat the testing process you used for your first test. Refer to Instruction 18 to Instruction 20. Remember to do a traditional density and moisture test with each EDG test. Do these at the same location immediately following the Soil Model Test so that moisture and density levels are the same as when you do the EDG test.
21. When you are ready to match the results of your traditional density and moisture tests with the EDG soil model you have constructed, follow these steps to enter your information.

From the Soil Model Screen, press the **Select** button .



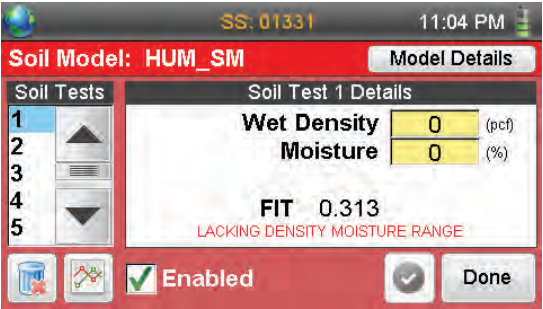
SS: 01006 3:47 AM


Soil Model
SM021612

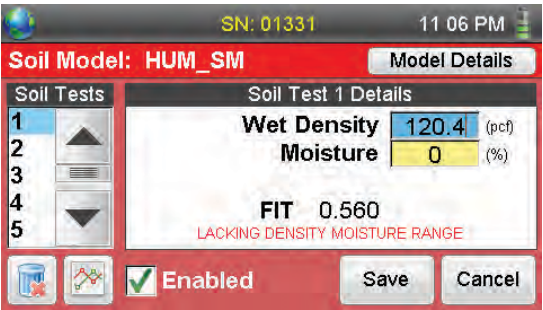
Soil Model Results
FIT = 0.114
LACKING DENSITY MOISTURE RANGE

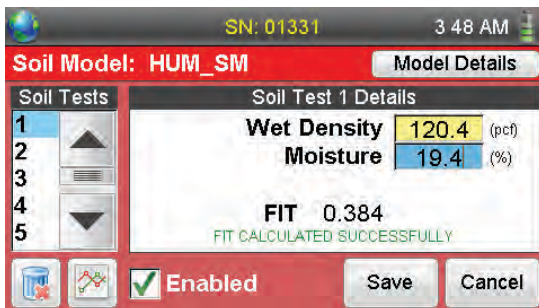
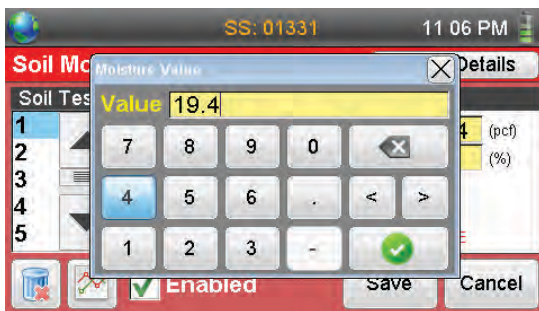
Back

You will see the following Screen. On the left is a scrolling list of the soil tests you made with the EDG. Select each one at a time and fill in the corresponding data for Wet Density and Moisture Content, which you recorded with your traditional method testing apparatus at each test location.





Select the field for Wet Density by pressing on its yellow box, a keyboard will appear for you to enter the corresponding value from your first traditional method test, when you have entered your number, Press the **Select** button  on the keyboard.

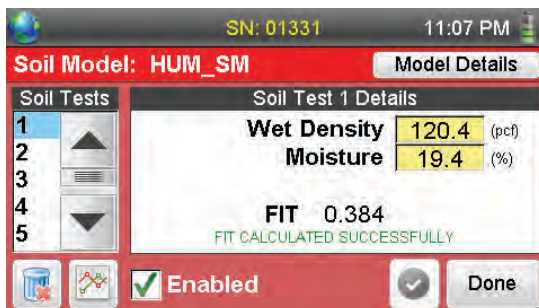





When you have completed this step,
DO NOT PRESS THE SAVE BUTTON.

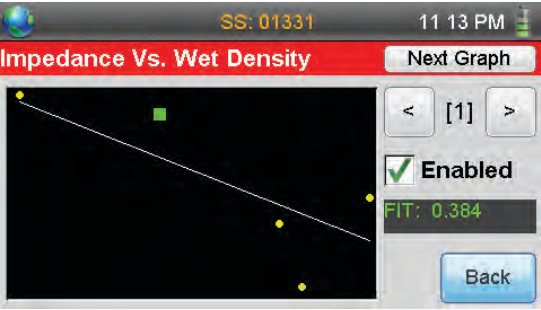
Continue entering the Wet Density and Moisture values from your traditional method tests into each of the corresponding Soil Tests you have run with the EDG. From the Screen above, choose each point in the Soil Tests list on the left and enter the Wet Density and Moisture data for each Test in the same manner as you just did the first one.


Once you have completed entering the information for all your points. Press the **Save** button . This will save all the entries you have made for all Soil Tests and completes the Soil Model. Once you press the **Save** button , you will see this Screen:

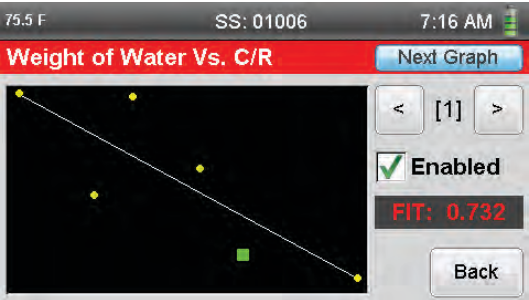


22. Once your Soil Model is completed, you can view the Graphs (Curves), which make up the Soil Model. To view the Graphs, press the **Graphs** button  at the bottom left of the screen next to the **Trash** button.

There are actually two Graphs, which make up your Soil Model. The first is the Impedance vs. Wet Density Graph. This Graph should appear similar to this:

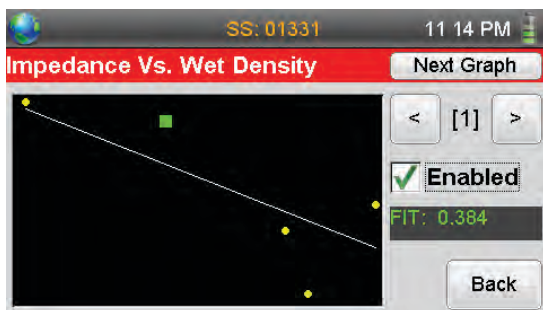


The second Graph is Weight of Water vs. C/R, which you can view by pressing the **Next Graph** button  on the top right of the screen. It will appear similar to this:



23. Graph Refinement and Fit Adjustment

Each point (soil test) on either Graph (Curve) can be evaluated. To do this use the Back and Forward Arrows at the Top right of the Screen. Using the Arrows, cycles you through the different Points on the Graph, and the corresponding number of the current point is shown between the buttons. The current selected point will be highlighted as a green box on the Graph. See Screen below:

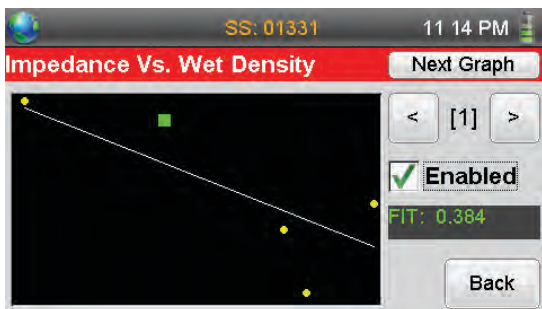


In addition, each individual point of the Graph can be Enabled or not. The Gauge defaults to all points of a Soil Model being Enabled, however, you can turn off individual points. This is typically done to eliminate outlying points from the Graph to achieve a higher FIT for more accuracy.

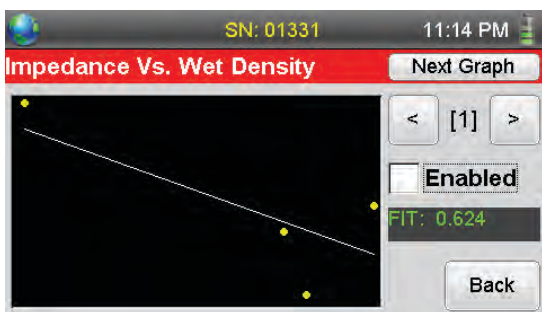
You have probably noticed the word FIT with a corresponding number on the screen for each of the tests you have run. FIT refers to the overall accuracy of the Curve you have developed. A fit of 1.000 is perfect and it is recommended that you try to work with a Soil Model Curve that has a FIT of at least .600. While you can operate with any FIT; for accurate and reliable readings it is recommended the FIT be above a .600 reading.

Fit numbers should appear as a Green-colored number. Fit numbers that appear as Red-colored numbers denote an inappropriate fit and result in a bad soil model.

The following Screens show what happens to the overall fit of your Soil Model Curve when you eliminate an outlying point from the Graph. Below is the original Graph with a FIT of 0.384. Point number 1 is selected, which is indicated by the green square on the graph. This point is not close to the curve indicated by the white line. Clicking on the green check mark in the box next to Enabled, turns this point off.



By turning off outlying point 1 on the Graph, the Curve is redrawn and the FIT improves to 0.624, as shown in the Graph below. This creates a much tighter and more accurate Curve, which will result in more accurate readings when using the EDG.

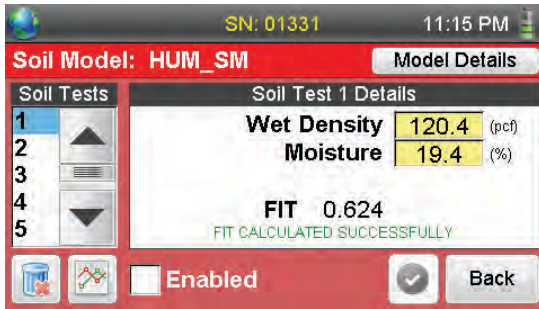



To save these changes, press the **Back** button , which will return you to this screen:

The screen displays the soil model details for HUM_SM. It shows the results of Soil Test 1, including Wet Density and Moisture, and the improved FIT value of 0.624.

Soil Tests	Soil Test 1 Details
1	Wet Density 120.4 (pcf)
2	Moisture 19.4 (%)
3	FIT 0.624
4	FIT CALCULATED SUCCESSFULLY
5	

To save these changes, press the **Save** button , which will return you to this screen:



To close this screen, press the **Done** button , which will return you to this screen:




At this point your Soil Model is complete, press the **Back** button  to return to the Soil Model Testing Screen.

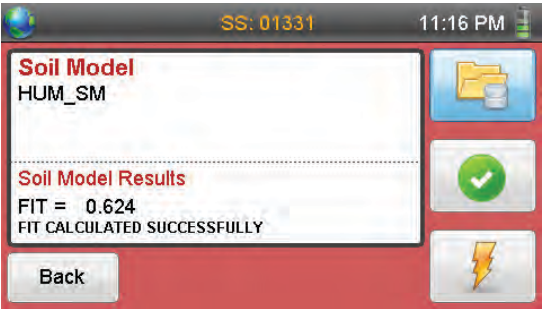


Remember, over time, you can always add points to the your Soil Model to make it more accurate. To do this you would select the Soil Model you want to alter and follow the steps beginning with Step 12.

At this point you are ready to begin actual testing, using the Soil Model you have created on the specific material you used to build the Soil Model.

24. Performing Soil Tests

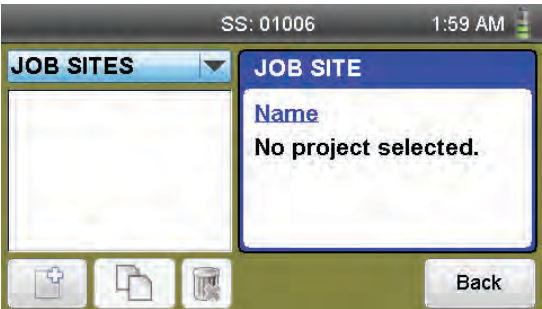
To begin Soil Testing with the EDG, if you are still on the screen below after completing your soil model, press the **Back** button .





You will see the home screen below:



And, If you have turned the gauge off before beginning your Soil Testing, you will also see this screen. Press the **Job Sites** button with the blue helmet. You will see this screen:

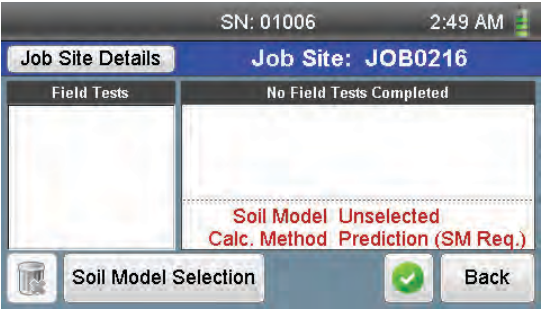


From this screen, create a new Job Site by pressing the **Add** button  in the lower left of the screen.

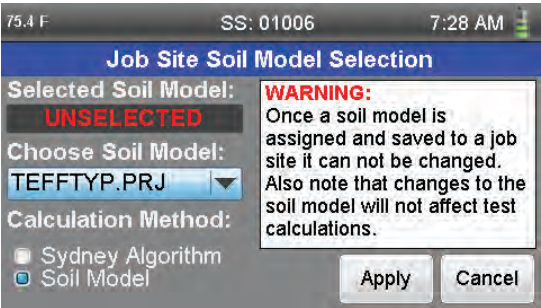
A keyboard will appear. Type a name for your Job Site and press the **Select** button .




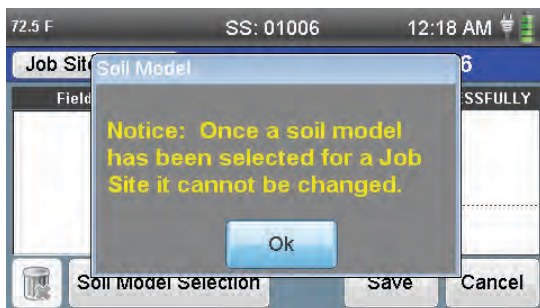
You've now created a Job Site and need to assign a soil model to it. To do this, press the **Soil Model Selection** button  at the lower left of the screen below.



Until you actually select a soil model the Selected Soil Model Field will say UNSELECTED. To select a Soil Model, press the drop-down menu under Choose Soil Model: and choose the Soil Model you wish to assign to this Project.



Press the **Apply** button  at the bottom right of the screen. You will see the screen below.



Remember: Once a Soil Model has been selected (linked) for a Job Site, it cannot be changed.

Press the **Ok** button .

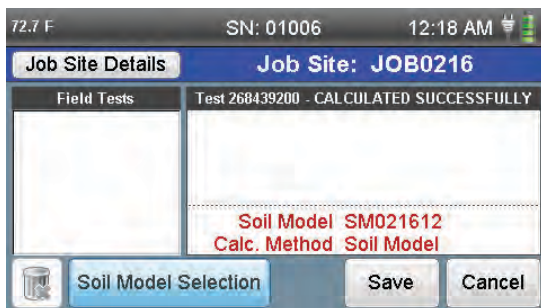
Notes:


Warning: Once a Soil Model is linked with a job site and saved, it can not be changed. Also note that changes to the soil model will not take effect on the current Job Site.

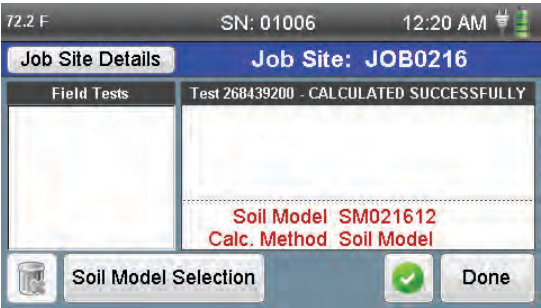
Essentially what this means, is that once you link a Soil Model to a specific Job Site, the data in that Soil Model in relationship to this specific Job Site is frozen. While you still can add points and change data to the original Soil Model, those changes will not affect the current Job Site it is linked to. Thus, after linking a Soil Model to a Job Site and proceeding with actual tests, you will not see changes to your results, if you go back and add points or change data in that original Soil Model.


However, this does not prevent you from making a copy of the original Soil Model, altering the data or adding points, and then linking this new Soil Model to your Job Site. It also does not prevent you from linking a new and different Soil Model to your Job Site.

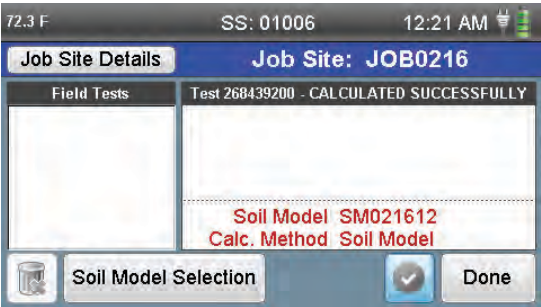
After pressing the **Ok** button  above you will see the screen below.




On this screen, you can see your Job Site at the top: and, at the bottom, in red, the Soil Model you have linked to it. Press the **Save** button . You will see the following screen.



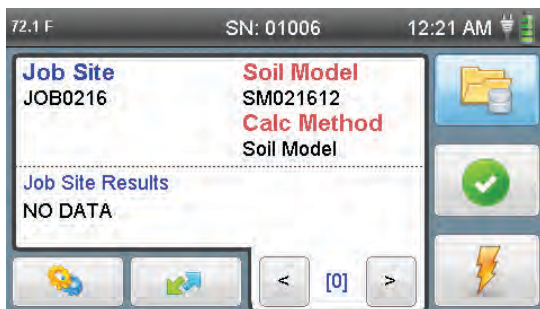
You can select this as your working Project by clicking on the green **Select** button  at the bottom right of the screen.



The Select Button will turn gray, indicating it is selected. By clicking on the Select Button now will pre-select this combination of Job Site and Soil Model, saving you a step when you go to use this combination for testing. Click on the **Done** button  and your are ready to begin testing. You will see the following screen:



Press the **Back** button .




- 25.** You are now ready to begin actual testing at your jobsite. Testing follows the same process you used to create your soil model, except that you won't need the traditional methods anymore.

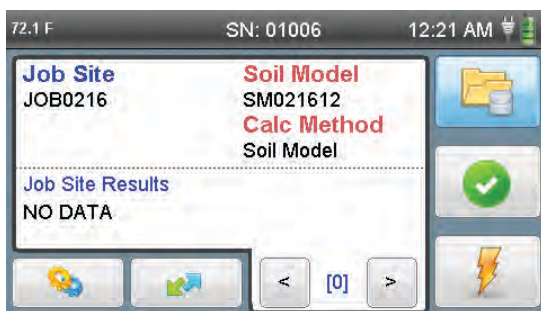
So to begin, place the gauge on the ground near you and open the case.

- a. Turn the gauge on, and remove the gray, circular Dart Template from the lid of the case.
- b. Place the gray, circular template on the ground. Remove the accessory caddy from the EDG case and place it on the ground, out of the way. Remove the Hammer and the four Darts from the bottom of the case. Position the Darts at the detents on the gray template and pound them into the ground with the Hammer. The shoulder of the Darts should be level and in contact with the ground surface. Darts should be driven perpendicular into the ground, not more than 20° from perpendicular. If rocks are encountered during the process of driving the Darts, which prevent the driving of a particular Dart, move your test site slightly to accommodate the rock.
- c. Unscrew the cap to the sensor port, located on the front base of the EDG case, to the right of the handle. Remove the Sensor Unit from the Accessory Caddy and attach the black cord attached to the Sensor Unit to the sensor port. Then, attach the Sensor Unit, pins up, to the center of the gray, Dart Template, using the velcro fastening system attached to each item.
- d. Remove the 2 Cables, which are used to make a connection between the Darts and the Sensor Unit. These cables have an alligator clamp on one end and a 1/4" phone plug on the other. Attach the two cables to the Sensor Unit using the 1/4" phone plug ends of the cables. Then, take the alligator clamp end of each cable and attach each one to a single opposing positioned Dart. When attaching cables between the Darts and the Sensor Unit, it is best

to have as straight a run as possible. The Cables should not cross. Care should be taken not to cross the Cables when asked to switch them from the A-A position to the B-B position during the testing process.

- e. Remove the Thermistor (Temperature Sensor), located in its plastic case, in the accessory caddy. Plug the Thermistor (Temperature Sensor) into the mini-phone plug port located on the side of the Sensor Unit directly above where the Black cable enters. Remove the T-handle Probe from the bottom tray of the EDG case and use it to create a hole away from the Dart Template, into which you will place the Thermistor (Temperature Sensor). The placement of the Temperature Sensor is not critical and only needs to be placed beneath the surface of the material.

26. If you are already at the screen below from the previous step, simply press the **Test** button  at the bottom right of the screen to begin a test.



NOTE: If you have turned the gauge off and transported it to a test site, when you turn the gauge back on, it will default to the last chosen Project/Soil Model you were previously working with, which will return you to the screen above.

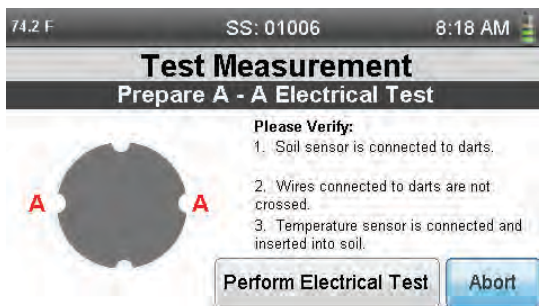
When you press the **Test** button , the screen below will appear. As the directions on this screen state:

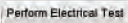
Verify that the Soil Sensor is connected to the darts.

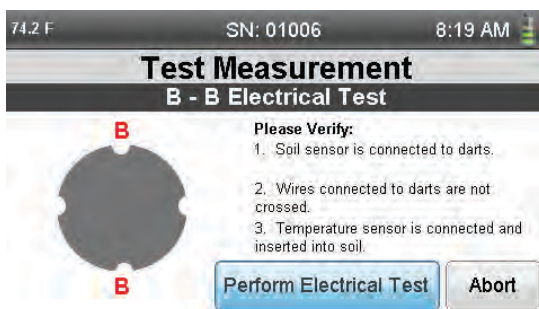
Make sure the wires connected to the darts are not crossed.


Make sure the Temperature Sensor is connected and inserted into the soil.

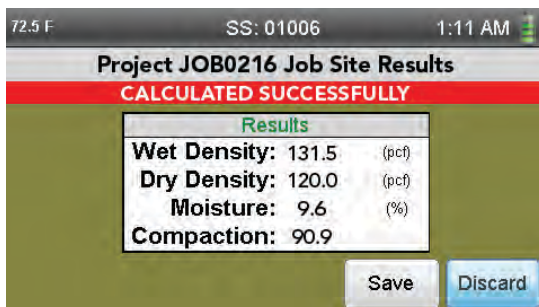
The diagram on the screen illustrates which darts should be connected for a test. Tests always involve connection to opposing dart positions, or in the first instance A and A. The diagram on the screen below illustrates the correct position of the darts to use.





Press the **Perform Electrical Test** button . Once this is done the Gauge will perform a test and the next window will appear, telling you to switch the Dart positions to the B and B position. The diagram on the screen below illustrates the correct position of the darts to use.

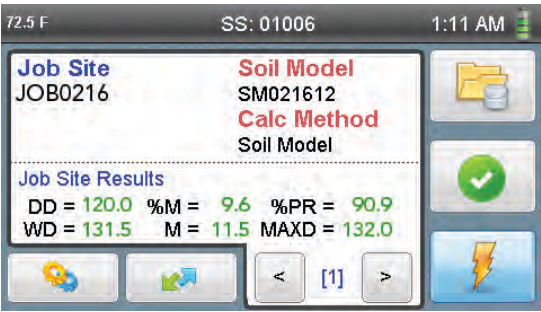


Press the **Perform Electrical Test** button . The Gauge will now perform a second test and the next window will appear.



This window shows the results of your test. To save your results, Press the **Save** button . (You can also Press the **Discard** button , if for some reason you don't want to save the results of the test)

You will see the following Screen.




From this screen, after each test you will see the Test Results. You can also review the results of individual Soil Tests by Pressing the Arrow Keys at the bottom of the screen. The number between the Arrows indicates which test the results above it correspond to. Using the Arrows, cycles you through the completed tests you have conducted for this Job Site. Job Site Results listed include:

- DD: Dry Density
- WD: Wet Density
- %M: Percent Moisture
- M: Moisture
- %PR: Percent Compaction
- MAXD: Maximum Density

27. To perform additional tests, first move to a new location and then follow the same steps you used to produce your first test in explained in **Step 26**.

28. **Storage and Transfer of Data**

Storage of Test Data on the EDG is more than robust. There is enough storage on the EDG to store 2,000 Projects of 2000 Tests each, so you should never have a problem with storing your Soil Models and Test Data.

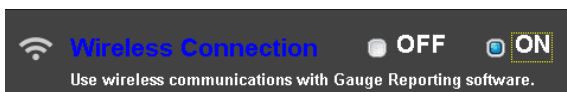
Transferring data from the EDG to your computer can be accomplished in several ways. The first way would be to use the Blue Tooth capabilities of the EDG to connect to your PC. To accomplish this, Press the **Data** button  on the Home Screen.



Pressing the **Data** button  will present you with the following screen:



The EDG features Wireless Capabilities, So if you computer works with wire-less-enabled hardware, you can access the data in your EDG and transfer it to your computer for use with the EDG software. To be able to import data to your computer via wireless connection, you must turn on the Wireless Connection. This is accomplished by Pressing the ON next to Wire-less Connection.



Once on, the radio button next to the word ON will be highlighted in Blue and the wireless icon will appear at the top left-hand corner of the screen and the Power Light above the Power Button on the console will be blinking with a Blue light.

Data can also be transferred to a computer by using the USB port located above and to the left of the Touch Screen. The EDG comes supplied with a USB thumb drive, which can be used to transfer files to a computer or another gauge.

To transfer data via USB, insert a USB thumb drive into the USB slot. The thumb drive must be formatted in Base 16 format or it may not work. Base 16 is the default formatting within Windows® 7. When transferring data from the EDG, you have your choice of **Exporting Job Sites**, **Exporting Soil Models** or **Exporting All**. You make your choice by pressing the corresponding button on the Communication screen.

You can also use the USB device and port to import Soil Models from other gauges or previous Projects. This is simply accomplished by inserting the USB device containing desired **Soil Models** into the port and pressing the **Import Soil Model** Button.

The USB port is also used in Updating Firmware for the EDG. This is accomplished by downloading a Firmware Update from:

<http://www.humboldtmg.com/EDG/Firmware Update>.

Place the downloaded file on the USB device and insert it into the USB port on the gauge. Navigate to the Communication screen and Press the **Update** button  under the Heading: Perform Firmware Update.

29. Calibration Check

To run the Calibration Check using the Calibration Check Box. Locate the Calibration Check Box, which is included with your gauge.



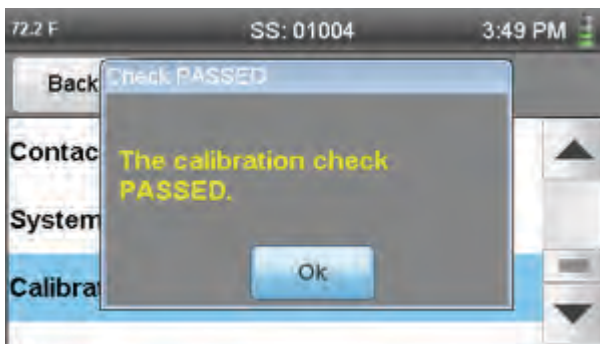
Select the **SETUP** key on the keypad to open the setup menu. Scroll thru the menu until you come to "Calibration Check". Select Calibration Check, you will see this screen. Follow the screen prompts. First, slide the Calibration Check Box onto the Soil Sensor and connect them to the Gauge's Soil Sensor Port.



Next, press the **Test** button on the screen below.



If your gauge passes the calibration check test, you will see the screen above.




30. Firmware Upgrade

Firmware upgrades will be available. When one is available, you will get an email to the email address you used when you registered your Gauge. This email will include a link, from which you will be able to download the Firmware upgrade to your computer.

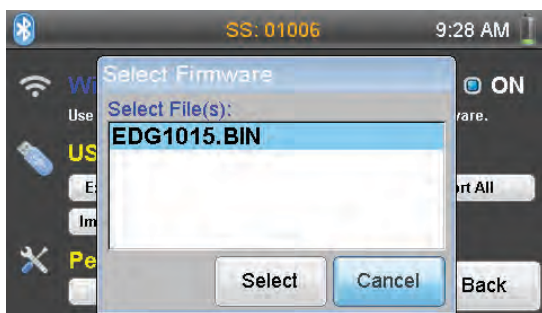
To install this Firmware upgrade, copy it from your computer to a USB thumb drive. Take this thumb drive and inset it into the EDG's USB port, located on the Faceplate.

BEFORE PROCEEDING, MAKE SURE YOUR GAUGE IS PLUGGED INTO AN AC POWER SOURCE.

Press the **Data** button  on the **Home** screen. You will see this screen:

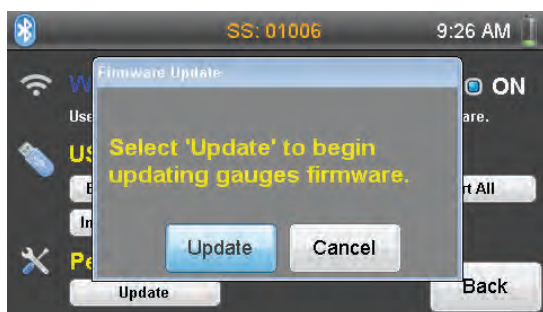


Press the **Update** button in the lower left of the screen under Perform Firmware Update. You will see this screen:





















Select the Firmware file you downloaded, and Press the **Select** button.

You will see the following screen:



Press the **Update** button and follow the directions. The Gauge's Power light will flash green, when you have completed the Update process.

EDG Screen Icons

-  Takes you to the Soil Models Screen where you can create and store Soil Models data
-  Takes you to the Job Sites Screen where you can create and store Job Sites data
-  Takes you to the Data Screen where you can transfer data to and from the EDG
-  Takes you to the Setup Screen where you can set Date, Time, Engineering info, Contact data
-  OK or Select buttons. Used to select current Soil Model or Job Site. When selected circle is gray. Also used to OK information typed into keyboards.
- 
-  Projects button, used to access list of Soil Models or Job Sites
-  Add button, used to add a new Soil Model or Job Site
-  Copy button, used to copy an existing Soil Model or Job Site
-  Trash button, used to delete Soil Model or Job Site
-  Test button, used to run a test for either Soil Models or Job Sites
-  Edit button, used to edit selected Soil Model or Job Site data
-  Graphs button, used to view and edit Fit details of Soil Models
-  Done button, used to complete an operation
-  Back button, used to return to the previous screen
-  Cancel button, used to cancel current operation
-  Classify button, used to view and edit Soil Classifications of Soil Models
-  Wireless Connectivity Icon