MOHR™

Operator's Manual

MOHR DIGI-TEST MDT-2
Agricultural Penetrometer and Texture Analyzer

Part No.: MDT2-M-OM-001
Revised: June 5, 2012

Warranty

Purchase and/or use of this product signifies your agreement to the terms of this Warranty. MOHR Test and Measurement LLC (MOHR) warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, MOHR, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this Warranty, customers must notify MOHR of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customers shall be responsible for packaging and shipping the defective product to MOHR with shipping charges prepaid. Customer shall be responsible for paying all return shipping charges, duties, taxes, and other charges for instruments returned to any location.

This Warranty is given by MOHR with respect to this product in lieu of any other warranties expressed or implied. MOHR and its vendors disclaim any implied warranties of merchantability or fitness for a particular purpose. MOHR's responsibility to repair or replace defective instruments is the sole and exclusive remedy provided to the customer for breach of the Warranty. MOHR and its vendors will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether MOHR or the vendor has advance notice of the possibility of such damages.

Specific limitations of this Warranty:

This Warranty only applies to normal and reasonable use of this product. Damage to this product resulting from improper use, the determination of which is solely at the discretion of MOHR, is specifically excluded from this Warranty.

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Chapter 1: General Information

1.1 Product description

The MOHR Digi-Test 2 (MDT-2) is a portable, computer-controlled materials test instrument designed to fit the needs of the agriculture industry. It provides advanced penetrometer tests, digitally records results, generates reports and spreadsheets, calculates statistics, and facilitates data tracking.

The MDT-2 keeps all of the MDT-1's sophisticated test capabilities, including constant rate, constant force (Creep), and Crispness tests, and gains a number of new features and capabilities. In particular, the MDT-2 features 24-bit digital sampling with the industry's best force sensitivity, standard external scale with automated fruit weighing, integrated automated calibration functionality, intuitive color touchscreen graphics, advanced data handling and test definition capabilities, and modern connectivity options including host/client USB and Ethernet.

The MDT-2 will perform several hundred tests on a single battery charge and the internal computer will retain the results of thousands of tests with full raw data storage.

Microsoft® Windows® XP/Vista/7 compatible software is provided to download data from the MDT-2 for further analysis and to export data to a spreadsheet-readable format.

1.2 Battery pack and AC power requirements

The MDT-2 may be operated using either the supplied AC adapter or the internal NiMH batteries. The internal NiMH batteries charge under AC during normal operation.

The external AC power adapter is intended to be used with either a 120 VAC or 240 VAC RMS power source. Use of a standard 3-prong AC socket with intact ground connection is essential for safe operation of the MDT-2 with the included AC power adapter. Review the Safety Summary section before operating the MDT-2.

1.3 Options and accessories

Options and accessories available for the MDT-2 are described in *Chapter 8: Options and Accessories*.

1.4 Unpacking and initial inspection

Before opening the shipping package containing the MDT-2, first inspect it for signs of damage. If there is evidence of damage to the shipping package, notify both the shipping carrier and MOHR.

The shipping container should contain the MDT-2 and standard accessories, including an

Operator's Manual, external AC adapter and power cord, and external load cell. If the shipping container is intact but there are missing items or if the MDT-2 is damaged, defective, or does not meet operational requirements, contact a MOHR-authorized sales representative.

1.5 Repacking for shipment

When the MDT-2 needs to be shipped to a MOHR-authorized service center for repair, calibration, or other service, affix a label to the outside of the shipping container indicating the name, address, phone, and e-mail of the owner, the name of the MOHR service representative who was contacted regarding the shipment, the serial number of the instrument, and a description of the problem with the instrument and/or the desired service or maintenance.

Optimally, the original shipping carton and packing material should be used to repack the MDT-2 for shipment. Otherwise, the following steps should be taken:

1) Obtain a heavy-duty corrugated cardboard box at least 6 in. (15 cm) larger in each dimension than the equipment to be shipped to allow for protective cushioning material. The shipping carton should have at least 200 lb. (90.7 kg) test strength.

2) Make sure the MDT-2 is turned off by setting the side panel power switch to the OFF position.

3) Wrap the MDT-2 in polyethylene sheeting to protect the case.

4) Cushion the MDT-2 on all sides with equal amounts of urethane foam or other firm packing material so that the instrument is centrally situated in the shipping container and there is no free space for the MDT-2 to move about during shipment.

5) Seal the container with packing tape.

Chapter 2: Safety Summary

The safety information presented in this brief summary is only intended for operators of the MDT-2. Safety information relating to specific circumstances is present throughout this manual and is not necessarily present in this summary. Please read this manual in its entirety before using the MDT-2 and take note of safety information not included in this summary.

2.1 Terms in the manual

WARNING: Refers to conditions or practices that could result in personal injury or loss of life.

CAUTION: Refers to conditions or practices that could result in damage to this product or other products and in some cases could void the Warranty.

2.2 Terms on the product

DANGER

Indicates an injury hazard immediately accessible as you read the marking.

WARNING

Indicates an injury hazard not immediately accessible as you read the marking.

CAUTION

Indicates a hazard to property including the product.

2.3 Symbols in the manual

WARNING or CAUTION
Information

2.4 Symbols on the product

ATTENTION
Refer to the
Manual

DANGER
High Voltage
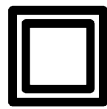
Double Insulated

Protective Ground
(Earth) Terminal

2.5 Fuses

There are no external fuses or breakers accessible to the user. There is an internal circuit breaker. When opened, the circuit breaker can be closed again by disconnecting the AC/DC adapter and both batteries from the device. This will require a technician to open the case.

2.6 AC power source

The MDT-2 is intended to operate only from a 120 VAC or 240 VAC RMS power source using the CE- and UL-approved 24 VDC external power supply/adapter provided with the instrument.

 WARNING: Only use the power cord supplied with the instrument, and then only if the cord is in good condition. Refer all maintenance regarding the power supply or power cord to qualified service personnel.

 CAUTION: Use of any power source other than the supplied external power adapter(s) could damage the instrument and may void the Warranty. Use only MOHR-approved accessories.

2.7 Explosive atmospheres

Do not operate the MDT-2 in an explosive atmosphere unless your instrument has been specifically certified for that condition.

2.8 Do not remove covers or panels

To avoid personal injury and risk of electric shock, do not open the MDT-2 case and do not operate unless the case is fully intact.

2.9 Battery replacement and disposal

The MDT-2 contains two 2200 mA·h internal battery packs consisting of 12 AA NiMH batteries, as well as a single lithium coin cell battery for the internal clock. Depending on the state or local jurisdiction, these batteries may require special disposal and/or recycling. Contact your local authorities for safe disposal in your area, or you may return them to MOHR for recycling.

2.10 Testing

The MDT-2 is capable of generating much higher forces than are necessary for testing. There is a hardware current limit and a software force limit that will stop a test when high forces are encountered. A block of metal or wood or similarly unyielding object may, however, develop a force fast enough that the MDT-2's drive mechanisms or electronics could be damaged. Therefore, do not use the MDT-2 to test rigid materials unless using fixtures and test protocols that have been specifically designed and approved by MOHR for that purpose.

Do not place your hands in the path of the probe or leave valuables in the test chamber when testing.

Please keep the following guidelines in mind while operating the instrument:

1) Do not test hard objects such as wood, steel, etc.

2) Keep your fingers away from the probe during testing.

3) Hold the fruit in place with one hand and start the test with the other hand.

4) Make sure that your fingers are out of the way of the probe before you start the test.

5) Press the red Quick Button™ or the *STOP* soft button at any time to cancel a test or to return the probe to home position.

6) Press the *EMERGENCY STOP* button to stop the instrument at any point (see the *Emergency stop* section below).

2.11 Emergency stop

The *EMERGENCY STOP* button is the large red button on the front panel of the instrument. The *EMERGENCY STOP* button is included as a method of safely stopping the instrument in an emergency situation, whether or not the instrument is operating as intended. The visual appearance of the *EMERGENCY STOP* button has been designed to international safety

standards so that its function is obvious to an operator who may be otherwise unfamiliar with the instrument.

When pressed, the MDT-2 immediately retracts the probe to a safe position and electromechanically disconnects the motor system from power in a fail-safe manner so that, in the event of equipment malfunction, the unsafe motion will not immediately resume when the *EMERGENCY STOP* button is disengaged.

In the event the *EMERGENCY STOP* button is actuated, the MDT-2 will display a message on the screen describing the situation and prompting the operator with the following general instructions on how to proceed (see Figure 2.11.1):
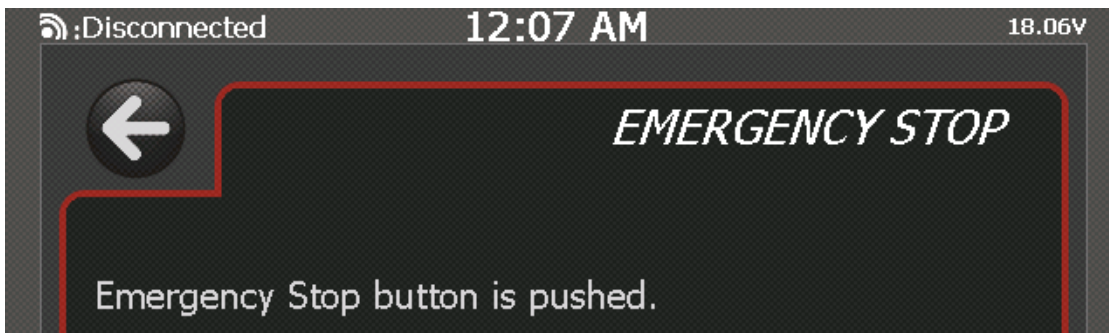
Figure 2.11.1. MDT-2 screen after the EMERGENCY STOP button has been pressed.

1) Twist the *EMERGENCY STOP* button to release it and return the instrument to a state in which reset is possible. Power will not be restored to the motor system until the MDT-2 instrument has been turned off and then on again (see Figure 2.11.2).
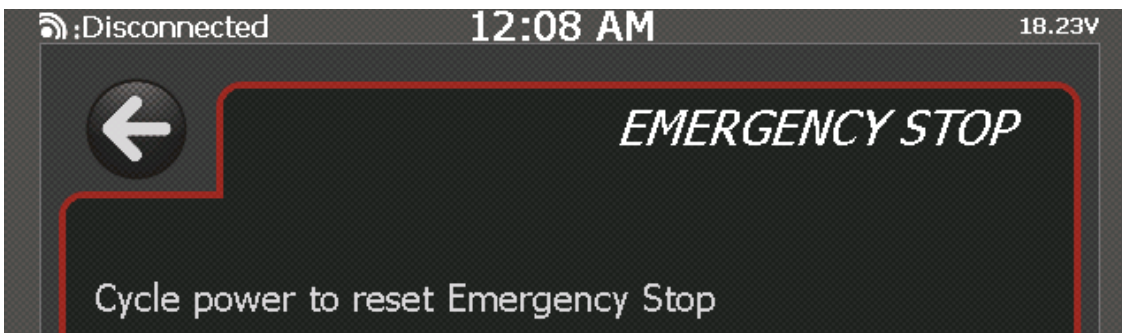
Figure 2.11.2. MDT-2 screen after the EMERGENCY STOP button has been twisted to release it so that the instrument can be reset.

2) When you are ready to reset the instrument, turn the MDT-2 off and then on again. The MDT-2 will detect that it has been through an emergency stop reset and will display the following message (see Figure 2.11.3):

Figure 2.11.3. MDT-2 following emergency stop after power has been turned off and on again.

Before restoring normal operation, make sure that whatever situation precipitated the emergency stop event has been addressed. If appropriate, press the *OK* button to restore normal operation.

Chapter 3: Preparing to use the MDT-2

Before using the MDT-2, make sure you have read and understand the *Safety Summary* and power requirements described in the previous sections. After making sure the instrument is fully charged before first use, turn the instrument on. You are ready to test almost any type of fruit or vegetable with the most versatile and sophisticated portable materials tester on the market.

3.1 Controls and connectors

3.1.1 Front panel

The following numbered items describe the controls and connectors identified on the front panel diagram below (Figure 3.1.1):

Figure 3.1.1. Front panel of the MDT-2. Numbered controls and connectors are described in the text below.

Chapter 3: Preparing to use the MDT-2

1) Touchscreen. The touchscreen is the primary operator control interface. Context-sensitive soft menu items allow you to configure the instrument, initiate tests, and save, sort, and recall data. See *Chapter 5: Operating the MDT-2* for more information on soft menu controls.

2) *EMERGENCY STOP* button. The *EMERGENCY STOP* button is included as a method of safely stopping the instrument in an emergency situation, whether or not the instrument is operating as intended. Please read the *Safety Summary* for more information about the *EMERGENCY STOP* button.

3) Test probe. The test probe is the part of the MDT-2 that contacts the produce under test. Test probes are interchangeable. See *Section 4.7* for instructions on how to change the test probe.

4) Quick Load™ base. The Quick Load™ Teflon® base is where the test material is placed during the test. The base has two test wells so that the operator can load one well while the other well is being tested.

3.2 Right side panel

The following numbered items describe the controls and connectors identified on the right side panel diagram below (Figure 3.2.1):

Figure 3.2.1. Right side panel of the MDT-2. Numbered controls and connectors are described in the text below.

5) 24 VDC power adapter plug. The provided 24 VDC AC adapter plugs into this port. Only MOHR-approved positive center tip, 24V adapters may be used.

6) Power switch. This is a manual ON/OFF power switch that turns the instrument off and prevents it from powering on.

7) Host USB ports (4x). These USB (V1.1) connections can be used to interface to a client USB device such as a barcode reader, keyboard, or thumbdrive.

8) RS-232 serial port. This port allows the MDT-2 to interface to legacy serial devices.

9) Client USB port. This USB (V1.1) connection can be used to interface the MDT-2 to a host PC and printers capable of interfacing with client USB devices.

10) RJ-45 Ethernet port. This is a 10/100 Mb Ethernet port that can be used for data transfer and remote PC control.

11) Quick Buttons™. The Quick Buttons™ are an easy way to control the MDT-2 during routine testing.

3.3 Left side panel

The following numbered items describe the controls and connectors identified on the left side panel diagram below (Figure 3.3.1):
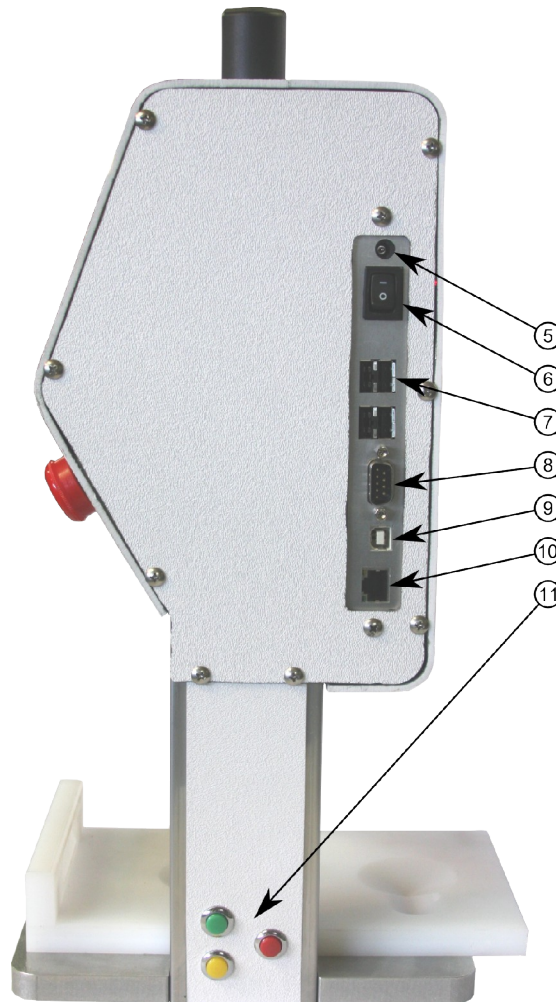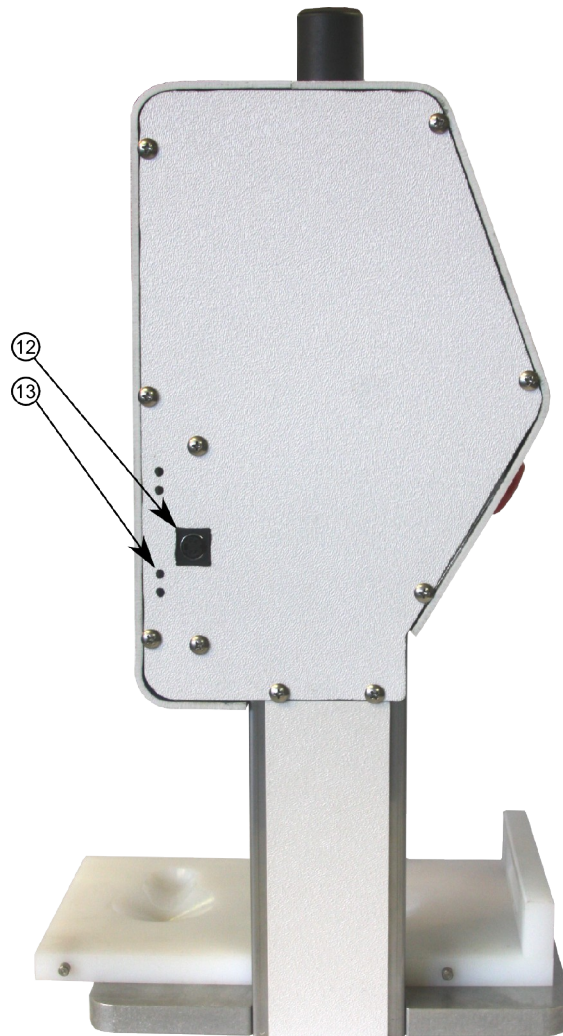
Figure 3.3.1. Left side panel of the MDT-2. Numbered controls and connectors are described in the text below.

12) External load cell port. This port connects to MDT-2-compatible external load cells.

13) Configuration ports. These are reserved for future use and may or may not be present on some instrument models.

Chapter 4: Setting Up the MDT-2

What you need:

1) A host computer running Windows XP, Vista, or 7.

2) An Ethernet connection for the host computer, and an Ethernet connection for the MDT-2 on the same network.

3) The "netmask" for the network, and a free IP address to be used by the MDT-2. You may need the help of a network administrator to set up the Ethernet connection.

4) A calibration weight between 25 and 35 pounds with known weight, ideally accurate to at least 0.0001 lbs. (50 mg). The weight must be able to rest on the external load cell.

4.1 Installing the software

Insert the CD. Find and run *setup.exe* from the CD. This creates a directory (folder) called "c:\digitest" and a subdirectory called "c:\digitest\mdtfiles".

Windows program files are copied into c:\digitest. Files needed in the MDT-2 are copied to c:\digitest\mdtfiles. Note that c:\digitest is the default installation directory, but you can change it at the beginning of installation.

4.2 Start the MDT-2

Plug the MOHR-supplied power adapter into the MDT-2 and connect it to the network. Turn it on. The MDT-2 screen's back light should come on. After a few seconds, the instrument should load the start screen. The start screen shows the date and time at the top, as well as some other info.

4.3 Set up the network settings on the MDT-2

Install the Winapples software on the host computer. It should auto-install from the CD, or you can use Windows Explorer to get to the CD and run setup.

Start the Winapples software. An icon that looks like an apple tree labeled *Winapples* should appear on your desktop after installation.

In order to connect to the host computer, the MDT-2 needs to have settings that match your Ethernet network. From the start screen, press the *CONNECTIONS* button. You may need to ask a network administrator for a valid address. To bring up the on-screen keyboard just tap any of the input boxes. Enter the name and address of the server you want the MDT-2 to connect to. See Figure 2.4.1.
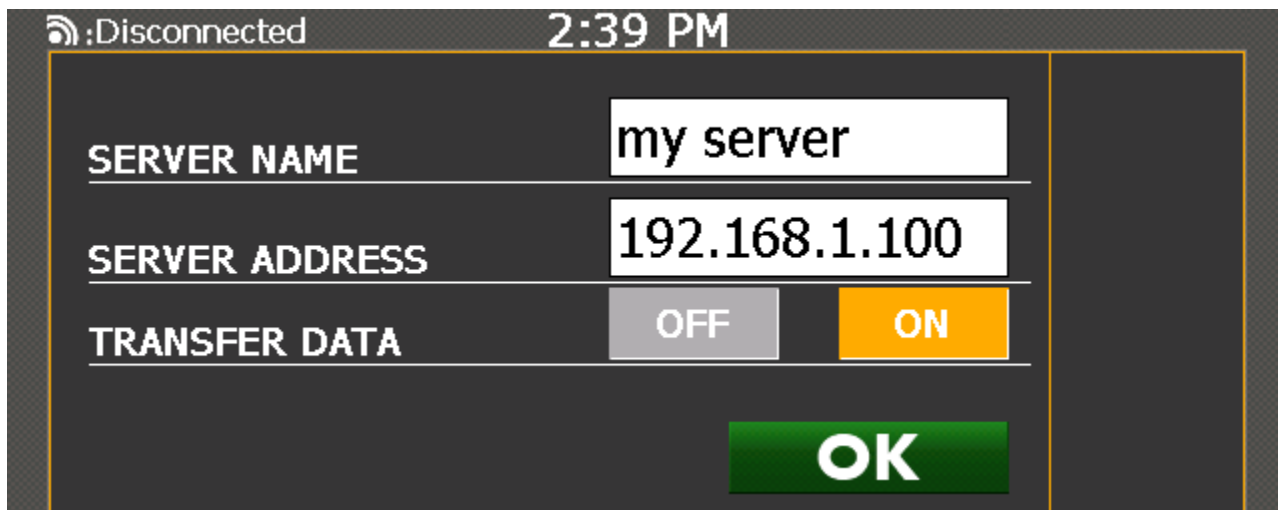
Figure 2.4.1. Example of the connection screen.

If the *Transfer Data* option is switched to the on position, the MDT-2 will send a copy of the data to the server after each test.

Before pressing the *OK* button, launch the windows software on the host computer.

Press the *OK* button on the connection screen. The MDT-2 will try to initialize a connection to the host computer. At the top left of the display, you can monitor the progress of the attempt. A successful connection will show the server address next to the small connection icon.

4.4 License codes

Your MDT-2 may require a license code to operate. Without the correct code, menus and buttons still function, your instrument may not be fully functional. The correct code for a particular device can be requested from MOHR. Installation instructions will be included with the license code.

4.5 Calibrate the load cell

See *Appendix D: Calibration Procedures* for details on how to calibrate the MDT-2's load cell.

4.6 Set the date and time

1) Go to the MDT-2 start screen.

2) Press the *SETUP* button.

3) Press the *DATE-TIME* button on the setup screen.

4) Tap and input data for the month, day, year, etc.

5) Tap if the time is either AM or PM. Press the *OK* button.

4.7 Install the proper test probe

1) Make sure the MDT-2 is empty and remove the test base.

2) From the start menu, select *SETUP*.

3) From the SETUP menu, select *PROBE SETUP*.

4) From the probe setup form, select *CHANGE PROBE*. The probe now moves to its lowest position. This will expose the squared-off area at the top of the probe.

5) Use a wrench to remove the probe.

6) Screw in the new probe by hand and tighten lightly with a wrench.

7) From the PROBE SETUP menu, select *PROBE DIAMETER* and enter the diameter of the new probe.

You must also calibrate the length of the probe. See the section on calibrating length.

4.8 Set probe diameter

1) Go to the MDT-2 start screen.

2) Press the *SETUP* button.

3) Press the *PROBE DIAMETER* button on the setup screen.

4) Tap and input the length of the probe in inches.

5) Press the *OK* button.

Chapter 5: Operating the MDT-2

The MDT-2 makes fruit testing easy. The operator can begin testing almost immediately with little setup. This section shows you how to start using the MDT-2.

5.1 MDT-2 screen navigation

The MDT-2 has a modern touch user interface. Tapping an icon on the MDT-2 start screen will load in the specific sub interface for the option. For example, if you want to change the server host connection, simply tap on the *CONNECTIONS* button on the start screen.

Figure 5.1.1. MDT-2 start screen with main menu items.

 Pressing the back arrow will take the user back to the previous user interface. This will usually be the start screen because most options are never more than one screen deep.

 Pressing the home button will take the user back to the MDT-2 start screen.

5.2 The main menu

All of the functions of the MDT-2 can be reached from the main menu. The main menu is a collection of buttons that lead to the various menus when pressed.

Chapter 5: Operating the MDT-2

Use the *GRAPHS* button to view a graphical drawing of the current data set. This screen will also display any statistics and calculated values for the current test. The user tags that are currently set are also displayed.

Use the *SEARCH DATA* button to search and view any previous test that the MDT-2 has taken. For example, you can view all tests within a certain date period or all tests that have a certain user tag value.

Use the *USER TAGS* button to change/add/delete the current user tags list. Any changes made will reset the next test number to 1. Any new test after will be tagged with the new list of user tags.

Use the *TEST PROFILES* button to change/add/delete the current test profile that the MDT-2 uses to perform its test. Use the *TEST NUMBER* button to change the test number of the next test.

Use the *TEST NUMBER* button to select the number of the next test.

The *SOFTWARE INFO* button displays the current software version. You can also update to the latest version of the software if the MDT-2 is connected to the Internet.

The *HARDWARE INFO* button displays the current hardware information. This also displays the current firmware on each major hardware component

The *MEASUREMENTS* button displays the current units and test speed. You can change the test speed and the units of measurements.

Use the *CONNECTIONS* button to connect the MDT-2 to Winapples software.

Use the *SETUP* button to calibrate the MDT-2. You can also change various settings (time, probe diameter, etc.) using this menu option.

The following sections describe each menu and associated features and settings.

5.3 GRAPHS — Testing and data analysis

From the start screen, press the *GRAPHS* button. You will be taken to the data result screen (See Figure 5.3.1). The data result screen will show the calculated results for the last test. The next fruit number is at the bottom of the screen. Modifying any user tags automatically sets the number of the next fruit to 1.

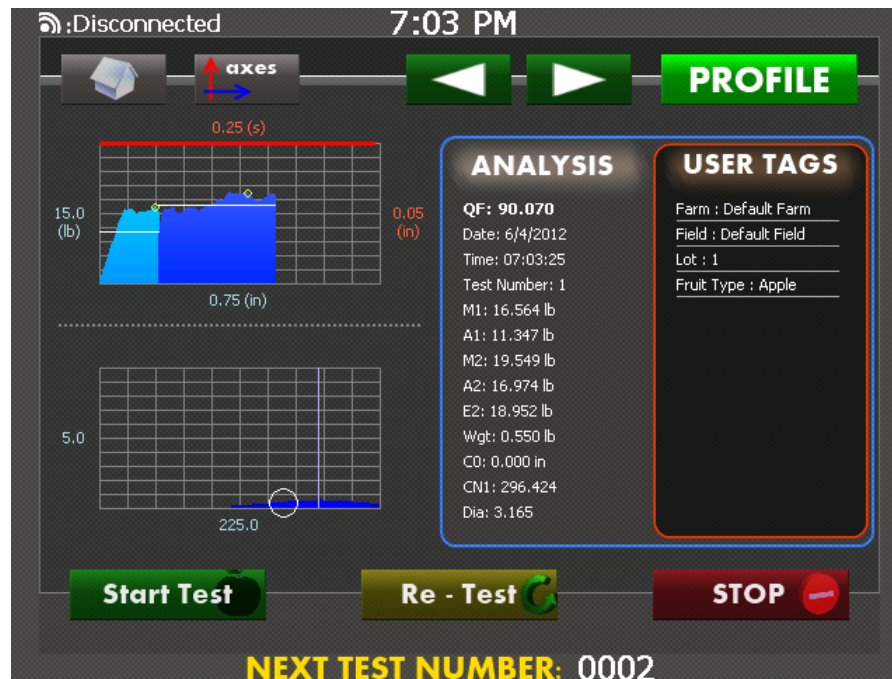*Figure 5.3.1. GRAPHS menu page showing analysis results. Press PROFILE to zoom in or out on the pressure graph.*

The test screen is divided into three sections. The graph section (left) shows a visual representation of the data set. The analysis section (middle) displays the calculated values for the data set. The user tags section (right) displays the current tags associated with the test.

The test profile (*Section 5.6*) determines how the tests are to be performed. Place a fruit to be tested in the MDT-2, then press the *START TEST* button or the green button on the side of the MDT-2. The MDT-2 will now move through the fruit. When the test is complete the test plunger will return to its pre-test position. To review the results of a previous test, use the *ARROW* buttons to scroll through the test list.

5.3.1 MDT-2 multiregion fruit analysis

Interpretation of the analysis results from the GRAPHS menu requires an understanding of MOHR's MDT multiregion fruit model and associated test parameters. Figure 5.3.2 shows the standard MDT model of the apple, consisting of three concentric regions: R1, R2 and R3. R1 extends inward from the outer surface of the fruit to a depth of approximately 0.32 in. (~8 mm), the Magness-Taylor firmness measurement depth used by most firmness measurement tools.
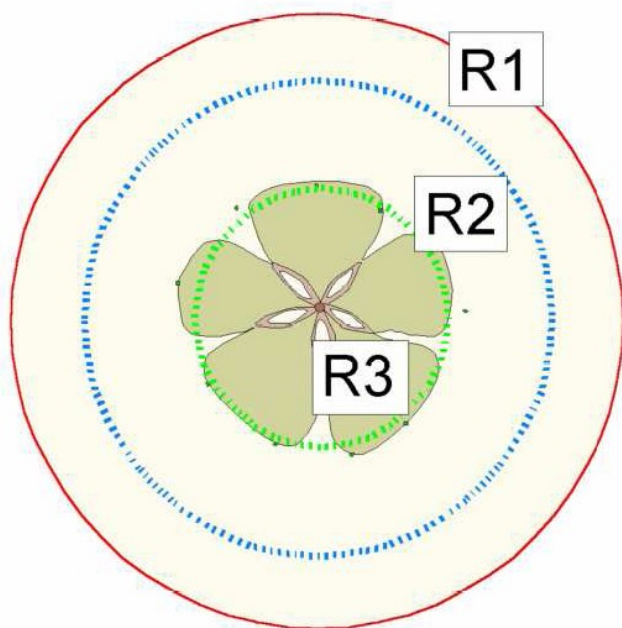
Region 2 (R2) runs from the boundary of R1 to a depth proportional to the radius of the fruit (0.6 for apples). The MDT-2 computes the diameter of the fruit and the R2 boundary as soon as it detects the surface of the fruit. R3 is the core region and runs from R2 to the center of the fruit. R2 contains the bulk of the edible material in an apple and is therefore an important region with respect to texture and maturity analysis.

In the MDT apple test profile *(see Section 5.6 TEST PROFILES)*, constant rate testing is performed through R1 and R2, Creep (constant load) testing is performed at the R1/R2 boundary (denoted C0), and Crispness testing is performed using data acquired starting at the R1/R2 boundary following the C0 test (denoted CN1). Tests at the R2/R3 boundary and in R3 have variable utility and are typically excluded.

Figure 5.3.2. MDT model of the apple.

In the standard MDT nomenclature, the maximum and average pressure values in Region X are denoted MX and AX, respectively. EX values are average values from the last 20 firmness readings from Region X.

Texture and maturity information gathered by the MDT-1 can be conveniently conveyed in one term, the Quality Factor (QF). The QF is the weighted sum of M1, A2, E2, C0, and CN1. QF measurements are scaled between 0, representing Washington State Apple Commission minimum shipping requirements, and 100, representing the Apple Maturity Program's optimum picking guidelines. QF values above 50 represent desirable apples. Consumer acceptability diminishes rapidly below QF values of 20. QF values below 0 represent lower quality apples that may not be acceptable to the consumer. QF values are based on Red Delicious varieties,

and interpretation of QF values with respect to other apple cultivars should be interpreted with this in mind.

5.3.2 Weighing of fruit

With its external scale, the MDT-2 can weigh fruit before testing and report the weight as part of the test. The scale must be plugged in to the MDT-2. The MDT-2 needs to have been previously calibrated with that scale.

When a piece of fruit is placed on the scale, the screen will update with the currently measured weight. The MDT-2 will then take a series of readings over a short period of time in order to get a more accurate measurement. The MDT-2 will notify you when the weighing is done. The whole process takes a couple of seconds.

The last good weight recorded by the MDT-2 is used for test results. Therefore, if you weigh one piece of fruit, then test it twice, both test results will include the same weight. The piece of fruit must weigh more than 0.1 lb. (44 g) in order to be weighed by the scale.

When the fruit is removed, the scale automatically tares itself. The scale can also be manually tared with the *TARE* button that appears on the test screen. The weight appears as one of the calculated results on the profile screen.

5.4 SEARCH DATA — Viewing statistics
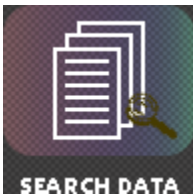
The MDT-2 stores test data using the user-configurable user tags and the date that the test was recorded.

Creating a search query will allow you to view the statistics of any test that matches the search criteria. The matching tests will be grouped together as a single test set.

5.4.1 Loading saved data

1) Go to the MDT-2 start screen

2) Press the *SEARCH DATA* button. You will be presented with the SEARCH DATA menu (Figure 5.4.1).

3) Select the options to search by: Date, User Tags, and Measurements.

4) Press the *CREATE A SEARCH QUERY* button.

5) Select or deselect the items in the SEARCH RESULTS menu (Figure 5.4.2) and press the *VIEW* button or press *Transmit* to send to the remote server.
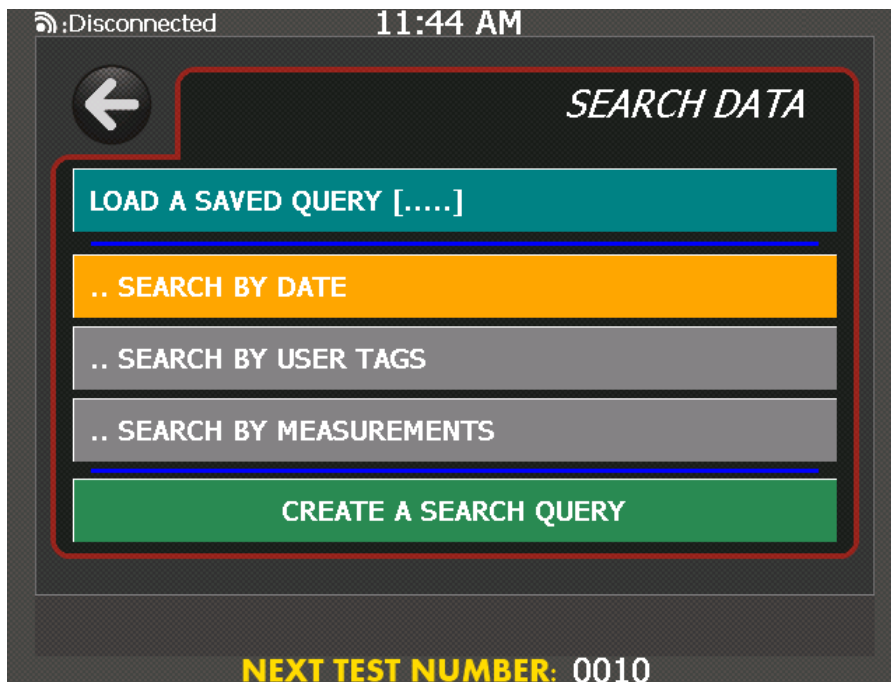
Figure 5.4.1. SEARCH DATA menu
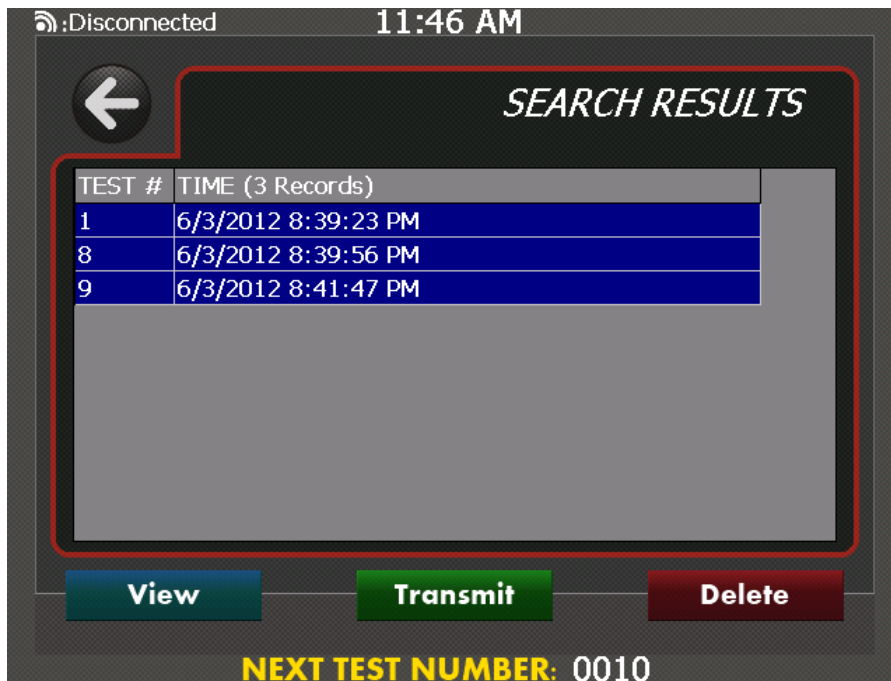
Figure 5.4.2. SEARCH RESULTS menu.

5.5 USER TAGS — Labeling your test data

User tags are data values that are attached to the tests. They are user-defined and should be set before taking a sample. User tags help to differentiate between samples. The default user tags are farm, field, fruit type, and lot, but the MDT-2 allows you to allows you to rename or delete these tags and add new tags. Note that user tags need to be set correctly before tests are taken.

5.5.1 Creating a new user tag

1) Go to the MDT-2 start screen.

2) Press the *USER TAGS* button. You will be presented with the USER TAGS menu (Figure 5.5.1).

3) Press the *NEW USER TAG* button.

4) Tap and enter the name and value for the new user tag. See Figure 5.5.2.

5) Press the *OK* button.
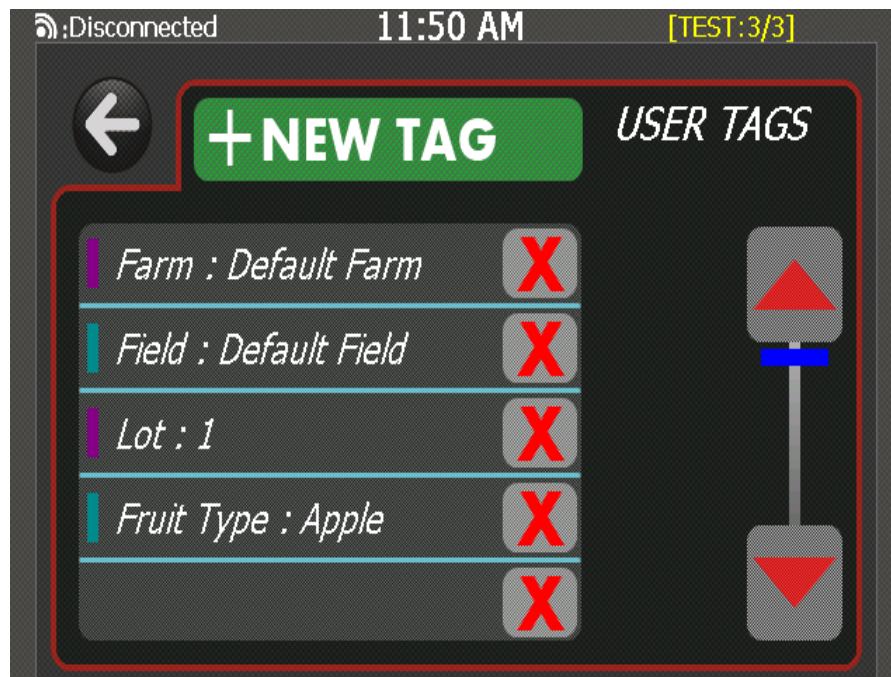
Figure 5.5.1. USER TAGS menu. The current user tags and their values are displayed in the list. Press the tag to edit or the red 'X' to delete. Use the scroll control on the right of the screen if necessary.
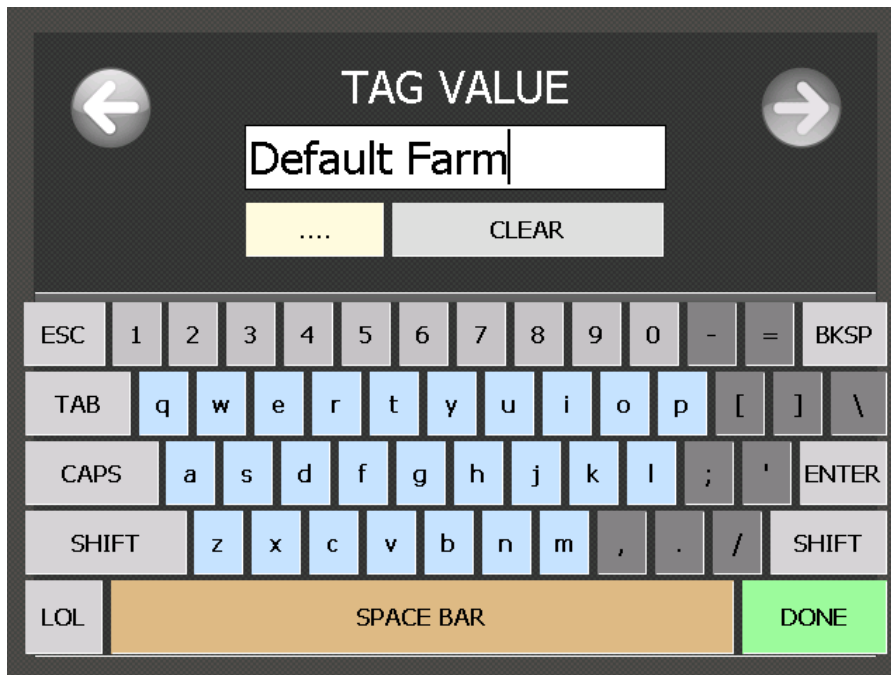
Figure 5.5.2. Editing a user tag.

5.5.2 Deleting a user tag

1) Go to the MDT-2 start screen.

2) Press the *USER TAGS* button.

3) Scroll until the specific user tag is on the screen.

4) Tap the *X* button next to the name.

5) Tap the *OK* button to confirm.

5.5.3 Modifying a user tag

1) Go to the MDT-2 start screen.

2) Press the *USER TAGS* button.

3) Press the specific user tag that you want to modify.

4) Tap and input new data for the name and values.

5) Tap the *OK* button.

Note: After changing the user tag values any new test will be tagged with those specific values.

5.5.4 User tags and Winapples software

The MDT-2 can have any number of user tags with any values. The Winapples software, however, is legacy software from the MDT-1 and is more restrictive with user tags. Winapples only has four user tags and they have fixed names: farm, field, lot, and fruit type.

Farm and field are limited to 20 characters each. Lot is limited to integers between 1 and 32767 inclusive. Fruit type is limited to a pre-defined list.

For compatibility with Winapples, farm field, lot, and fruit type are the default user tags for the MDT-2. When a test result is transferred from the MDT-2 to the Winapples software, the more flexible structure of the MDT-2 data is translated into the more rigid structure of the Winapples data using the following rules:

1) If any of the four Winapples user tags is not set, then a default value is used.

2) Any tags in addition to the four Winapples tags are dropped.

3) Farm and field are truncated to 20 characters if the values are longer.

4) Lot number is set to a default value if it is not a number between 1 and 32767 inclusive.

5) Fruit type is compared to the fixed list (see *Appendix F: Fruit Types for Winapples*). If the value cannot be found on the list, then a default value is used instead.

5.6 TEST PROFILES — Modifying test parameters
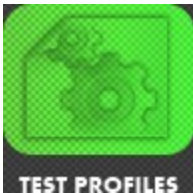
The MDT-2 uses test profiles to determine the parameters of a test, such as velocity, maximum distance, etc. Test profiles can be changed and copied from within the MDT-2. From the main menu select *TEST PROFILES*. From the TEST PROFILES menu, the current profile used for testing can be switched, test profiles can be altered, and new test profiles can be created.

5.6.1 Types of tests

The MDT-2's built in test profiles for apples, pears, cherries, and other produce include specialized routines to measure different material properties to help the operator determine the maturity, texture, and overall quality of the produce under test.   Because many of these routines were developed through testing apples, apple testing methods are referenced in the examples below, but these routines are equally applicable to measure these characteristics in a wide variety of produce.

A typical test profile will include multiple sequential test segments, delineated by distance and/or time. For instance, the standard MDT-2 apple test profile includes the following test segments:

1) Constant rate test through Region 1 (the Magness-Taylor test depth).

2) Constant load test for 0.5 s at the Region 1 - Region 2 boundary.

3) Constant rate test through Region 2 (the region between the Magness-Taylor test depth and the calculated core boundary) including Crispness data acquisition.

4) Crispness analysis.

These standard test segments are described in more detail below.

5.6.1.1 Constant rate test

Commonly used manual and electronic pressure testers that are not motor-driven are susceptible to changes in testing rate. Variations in test velocity between operators and/or individual tests can skew results. Slow rates allow the fruit material to relax (or Creep) during testing, producing low pressure readings. Higher testing rates conversely produce higher pressure readings.   A constant-rate test is ideal, but is not possible with a hand-powered testing device. The original MOHR Digi-Test was the first portable agricultural test instrument to provide constant rate test capability, which was improved upon in the MDT-1. Like the MDT-1, the MDT-2 monitors test speed thousands of times per second to maintain a constant rate test.

5.6.1.2 Constant load (Creep) test

The Creep test is based on the standard engineering Creep test method in which a test item is subjected to a constant tensile or compressive stress and the resultant strain of the material is measured. This is useful to measure the viscoelastic properties of the material under test.

During the Creep test segment, the MDT-2 maintains a constant pressure against the fruit, typically 10 lbs. (4.5 kg) for apples, by varying the motion of the probe. As the viscous fruit material gives way, the MDT-2 advances the probe to maintain constant pressure. Fruits with intact, elastic cellular structure are able to maintain the standard Creep pressure with minimal deformation. As fruit matures, the deformation increases.

At lower fruit pressures, Creep is useful to detect changes in fruit maturity that would otherwise be difficult to identify using firmness alone. Creep has also been used to identify abnormalities such as water core.

5.6.1.3 Crispness test

The Crispness test measures the frequency-dependent fracturing of the fruit material during a constant rate test. This fracturing is analogous to the crunch a person experiences when they bite into a fruit, and that is why the Crispness term has been shown to have a good correlation with the Crispness textural characteristics evaluated by expert testers when comparing the merits of different apple cultivars.

The MDT-2's Crispness test utilizes high-frequency sampling and a specialized Fast-Fourier Transform (FFT) digital filtering technique with data de-trending to isolate the frequency-dependent fracturing characteristics of the produce under test from the low frequency pressure variations that determine overall firmness.

Crispness measurements are particularly useful for identifying textural variation in firmer fruit that would be difficult or impossible to detect using firmness measurements alone.

When changing a test profile or creating a new test profile, the test profile form appears, showing every parameter.

5.6.2 Test parameters

Groups of the parameters define different aspects of the test profile. Below is a table describing the different values used in a test profile and showing the values used in an apple test.

Parameter	Type	Description	Value in apple test
Region1?	True / False	If true, then the test will include region 1.	True
Index Distance	Distance	Depth of region 1 test.	0.32 in. (0.8 cm)
Region2?	True / False	If true, then the test will include region 2.	True
Core Ratio	Fraction	The ratio between the total test depth and the diameter of the fruit.	0.3, meaning the maximum extent of an apple test is 30% the diameter of the apple.
Creep?	True / False	If true, then the test will include a Creep test.	True
Creep Force	Force	The force to hold during the Creep period.	10.0 lbs.
Creep Time	Time	The amount of time to hold the Creep force.	0.5 s
Crispness?	True / False	If true and Region2? also true, then calculate the Crispness value from the Region2 data.	True
Rind Thickness	Distance	The closest distance the MDT-2 will allow the probe to get to the base.	0.1 in.
Test Velocity	Speed	The velocity the probe moves through the fruit.	1 in./s
Seek Velocity	Speed	The velocity the probe moves before the MDT-2 senses the fruit.	1.5 in./s
Sensitivity	Force	The force needed for the MDT-2 to sense the top of the fruit.	0.1 lbs.

When the instrument first begins a test, it seeks the surface of the fruit. It moves at set velocity, labeled "Seekvelocity" in the test profile. "Seekvelocity" is entered in units of inches per second.

While it is moving, the instrument continuously measures force readings until it records a force greater than a set trigger value. This trigger value is labeled "Sensitivity" in the test profile. "Sensitivity" is entered in pounds.

"Sensitivity" and "Seekvelocity" determine how the tester performs while searching for the surface.

Before the tester begins to test the fruit, it checks the "Region1?" value from the test profile. This tells the tester to perform a constant velocity test. If this "Region1?" is false, then the Region 1 constant velocity test is skipped.

As the tester continues with the Region 1 test, it takes readings of force and displacement at a constant velocity. That velocity is labeled "Testvelocity" in the test profile, and is entered in inches per second.

The sampling continues until the test plunger reaches a set maximum distance from the surface of the fruit. This distance is defined as "Index distance" in the test profile. After the Region 1 test is finished (or skipped), the tester checks the "Creep?" value. If it is set to true, the tester performs a constant-load Creep test for a set period of time. If it is set to false, the Creep test is skipped.

During a Creep test, the tester presses down on the fruit with a force in lbs. equal to "Creep Force". It does so for the number of seconds equal to "Creep Time". The tester measures and records the displacement of the plunger during this period.

After the Creep test, the tester checks "Region2?". If it is true, the tester performs another constant velocity test using the same "Testvelocity" as the Region 1 test. If "Region2?" is false, that section of the test is not performed.

Unlike the Region 1 test, the Region 2 test proceeds to a set percentage of the diameter of the fruit. This fraction is given in the variable "Core Ratio".

For example, a "Core Ratio" of 0.5 would set Region 2 to test to the center of the fruit. The distance from the home position to the base needs to be calibrated accurately for the measured diameter to be accurate. See *Appendix D: Calibration Procedures*.

When "Crispness?" is 1, the tester calculates the Crispness measured in the data from Region 2. If Region 2 is not used, "Crispness?" should be set to 0.

If a fruit has a particularly tough rind at the base, and you want to avoid testing it, you can set the "rind thickness" value in inches. The tester will not approach the testing base any closer than this distance when collecting data. This requires an accurate calibration of the distance from the home position to the base.

5.6.3 TEST PROFILES menu

The TEST PROFILES menu (Figure 5.6.1) shows you the currently loaded test profile. Scroll using the right hand scroll bar and select an option to edit it as needed. Press the *NEW PROFILE* button to copy the current profile to a new profile.

5.6.4 Loading a saved profile

From the TEST PROFILES menu, press the *LOAD* button to access built-in and user-defined test profiles. Figure 5.6.2 shows the LIST OF PROFILES menu. Select the desired test profile.
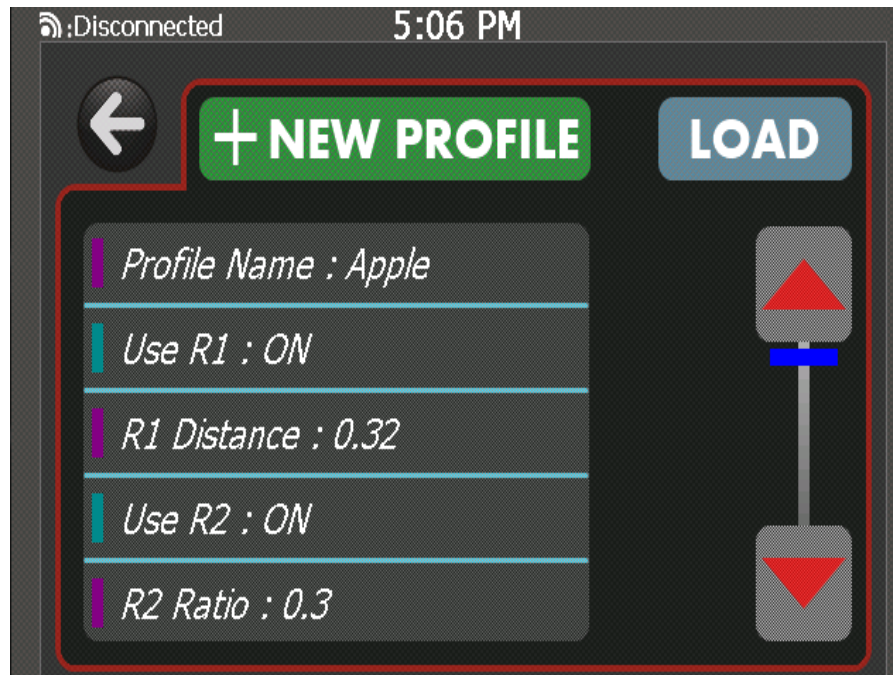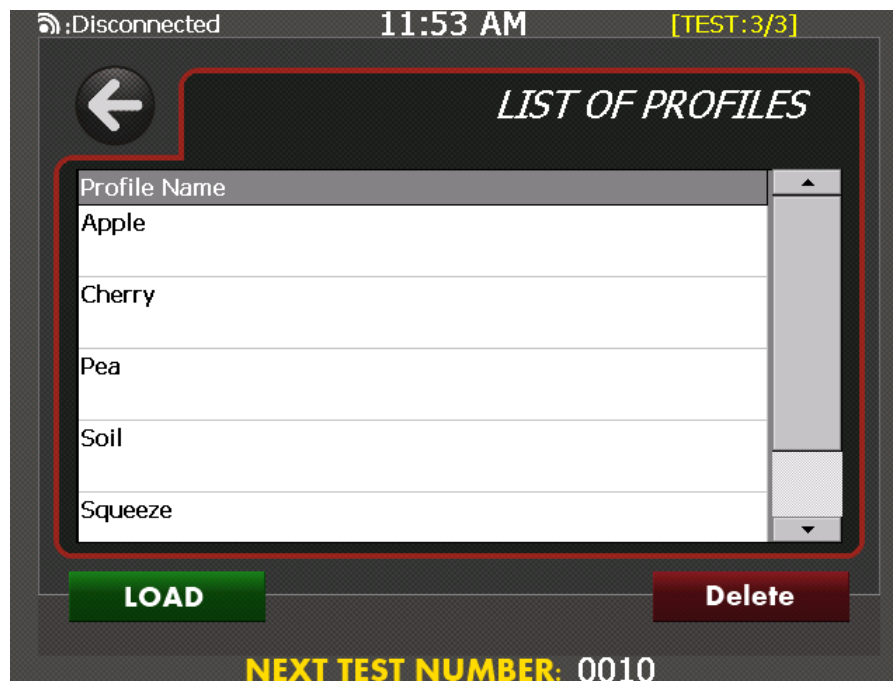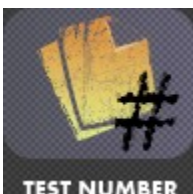
Figure 5.6.1. TEST PROFILES menu.

Figure 5.6.2. LIST OF PROFILES menu.

5.7 TEST NUMBER — Setting the number of the next test

The operator can set the number of the next test using the *TEST NUMBER* button. Press the *TEST NUMBER* button, and set the new value using the on-screen keyboard.

5.8 SOFTWARE INFO — Software updates

Use the *SOFTWARE INFO* button to check the installed version of the software and check for updates over the Internet. You need to have set up the network using the CONNECTIONS menu for updates to work. Press the *SOFTWARE INFO* button and press the *CHECK FOR UPDATES* button to install the latest software from the web.
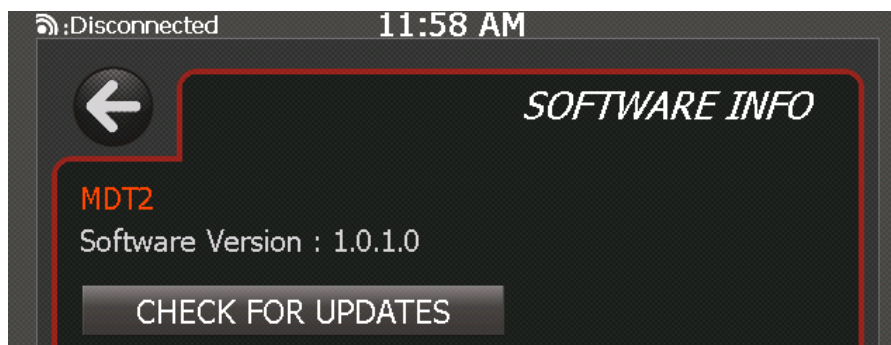
Figure 5.8.1. SOFTWARE INFO menu. Press the CHECK FOR UPDATES button to connect to the MOHR website to check for software updates.

5.9 HARDWARE INFO — Batteries and firmware

Use the *HARDWARE INFO* button to access hardware info and install firmware from the USB thumbdrive. The HARDWARE INFO menu also displays the current battery voltage and temperature. From the HARDWARE INFO menu, press the *UPDATE FIRMWARE (USB)* button after plugging in the USB thumbdrive containing the new firmware.

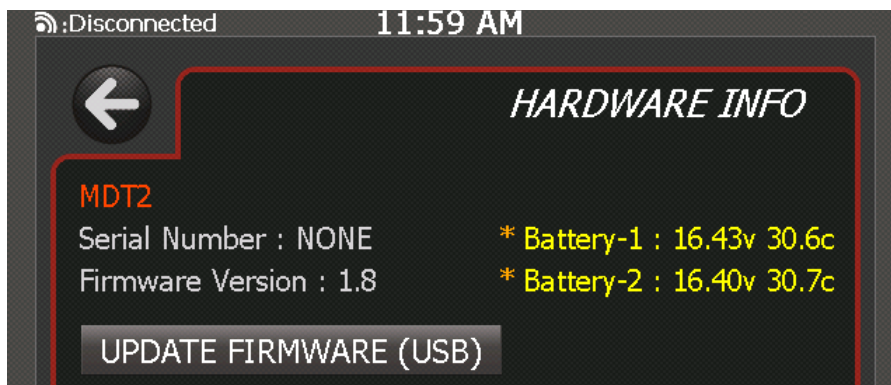*Figure 5.9.1. HARDWARE INFO menu. This menu allows you to update instrument firmware from a USB thumbdrive and provides battery status information.*

5.10 MEASUREMENTS — Test options and measurement units

Use the *MEASUREMENTS* button to change measurement units and set the test type. The MEASUREMENTS menu is shown in Figure 5.10.1.

Press the *SET LENGTH* button to choose units for length (Figure 5.10.2).

Press the *SET FORCE* button to choose units for force.

Press the *SET TEST TYPE* button to choose the type of test. This menu option is not currently implemented fully.
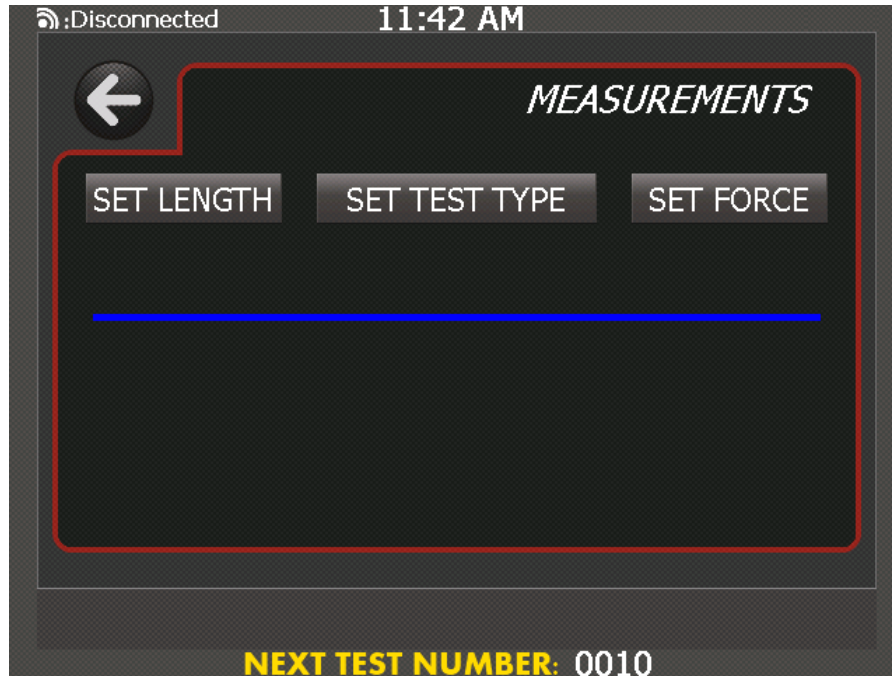

Figure 5.10.1. MEASUREMENTS menu. Select the option to change.
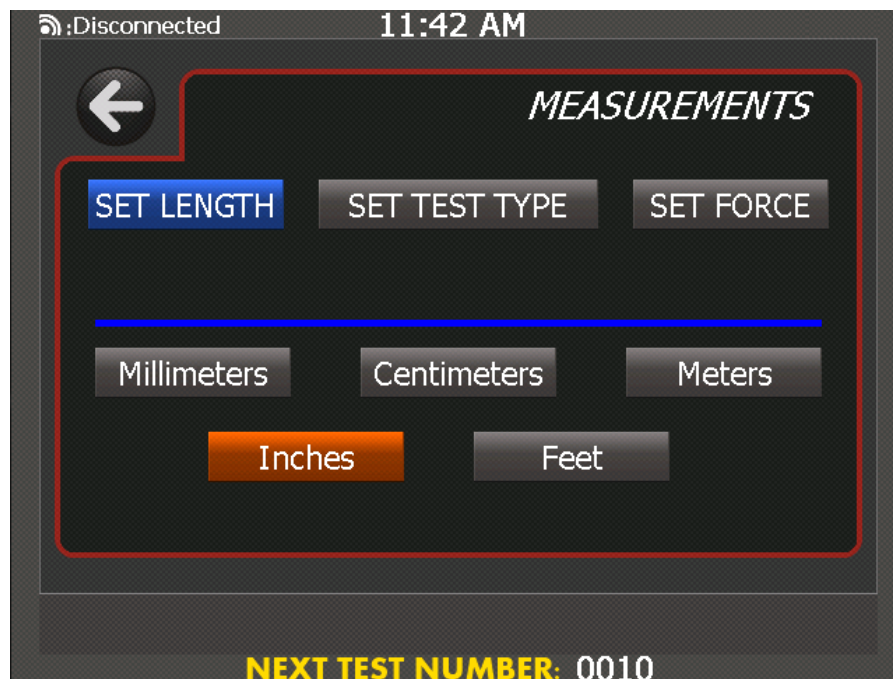
Figure 5.10.2. SET LENGTH menu. Select the desired length units.

5.11 CONNECTIONS — Set up a Winapples connection

Use the *CONNECTIONS* button to set up a connection with a Winapples server over Ethernet. Press the *CONNECTIONS* button to enter the CONNECTIONS menu (Figure 5.11.1).
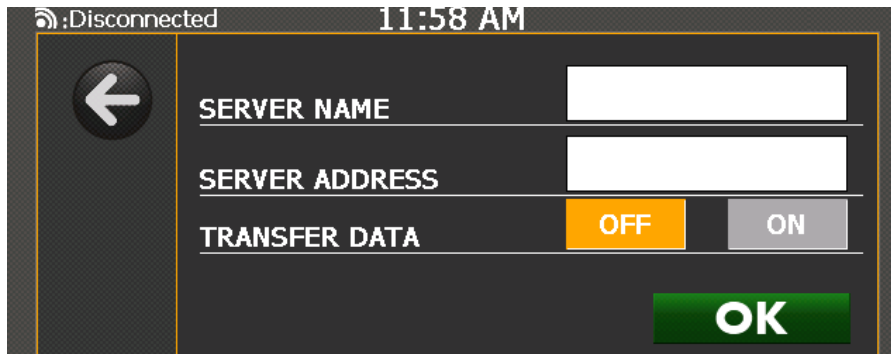
Figure 5.11.1. CONNECTIONS menu. Press the text boxes to enter the name and address of the server. Within each edit dialog, press the [...] button to select a previously entered item.

5.12 SETUP — Setting hardware options

Use the *SETUP* button to access instrument configuration options including calibration, date-time, probe geometry, safety limits, barcode options, and network configuration settings.

5.12.1 CALIBRATION

Use the *CALIBRATION* button to calibrate the instrument. Please see *Appendix D: Calibration Procedures* for further details.

5.12.2 DATE-TIME

Use the *DATE-TIME* button to set the date and time of the instrument. Set each value as shown in Figure 5.12.1.

Figure 5.12.1. DATE-TIME menu.

5.12.3 PROBE SETUP

Use the *PROBE SETUP* button to modify probe settings. The PROBE SETUP menu is shown in Figure 5.12.2. Press the *CHANGE PROBE* button to move the probe to the installation position. Select the *PROBE DIAMETER* text box to set the probe diameter in inches.

Figure 5.12.2. PROBE SETUP menu. Use this menu to change the probe and set the probe diameter.

5.12.4 RETRACT DISTANCE

This menu button sets the distance to retract after the last test. The shorter the distance, the more rapidly the next test will find the surface of the fruit and initiate the test, but the less room available for maneuvering the fruit.

5.12.5 LOAD LIMIT

This menu item sets the load limit safeguard. The default is 40 lbs. (18.1 kg). Exercise caution when changing this setting, as higher load limits could cause injury or dismemberment or damage the instrument.

⚠	*WARNING: Exercise caution when changing the load limit safeguard. Changing the load limit to values higher than the default value could result in injury or dismemberment.*

⚠	*CAUTION: Changing the load limit safeguard can result in damage to the instrument. Damage to the instrument caused by circumventing instrument safeguards is not covered under the instrument Warranty.*

5.12.6 SURFACE PAUSE

This menu item lets the operator select whether the instrument pauses after the surface of the fruit is found.

5.12.7 BARCODE DELAY

This menu item lets the operator select the delay between characters used by instrument to determine whether text input is from keyboard or barcode. Change this setting only if there is difficulty with barcode input.

5.12.7 NETWORK CONFIG

This menu allows the operator to set up the Ethernet network connection. Figure 5.12.3 shows the NETWORK CONFIG menu when DHCP (Dynamic Host Control Protocol) is turned on. With DHCP turned on, there is automatic discovery of network settings.
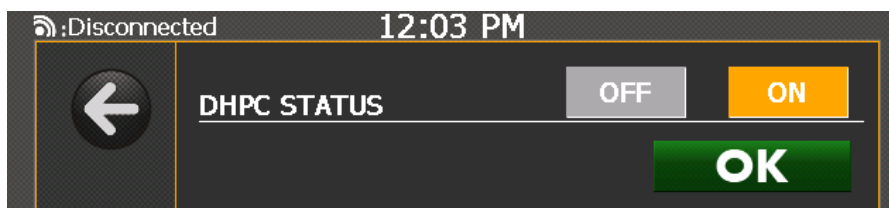
Figure 5.12.3. NETWORK CONFIG menu with DHCP turned on.

If DHCP is not available on your network, DHCP should be turned off and the network settings must be manually entered, as shown in Figure 5.12.4. Contact your network administrator for the proper settings.

DHPC STATUS	OFF	ON

IP ADDRESS

0.0.0.0

SUBNET MASK

0.0.0.0

DEFAULT GATEWAY

0.0.0.0

DNS SERVER

0.0.0.0

WINS SERVER

0.0.0.0

OK
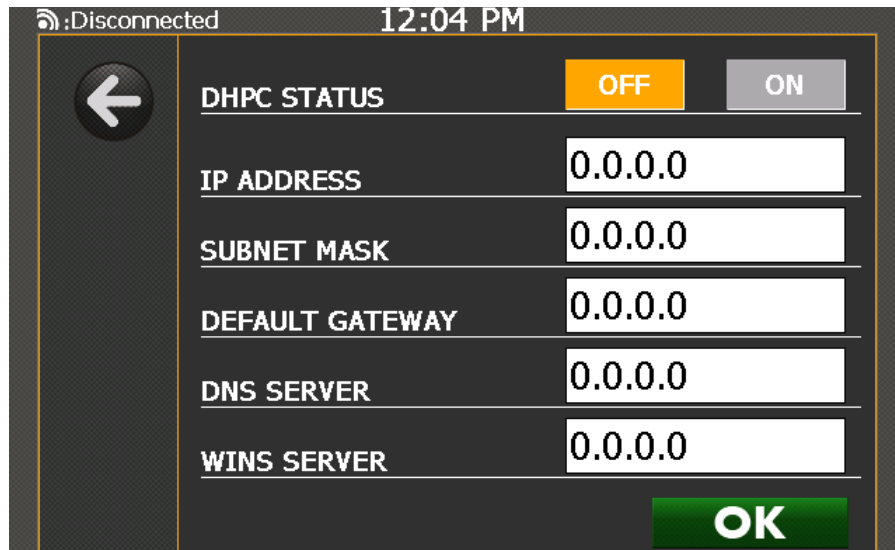
5.12.4. NETWORK CONFIG menu with DHCP turned off.

Chapter 6: Barcodes

6.1 Use and setup

The MDT-2 can use barcodes to enter values in two ways. Any barcode can be used to enter text directly into a text entry box. Simply scan the code while the edit box is selected.

Specially made barcodes can be used to set user tag values at any time without going to an entry box. Using the specially made barcodes is highly recommended as they greatly increase efficiency.

Barcode scanners used with the MDT-2 have to be set up with the open square bracket '[' as a preamble character, and the close square bracket ']' as a postamble character. Barcode scanners purchased from MOHR Test and Measurement LLC come preconfigured.

6.2 Format for special barcodes

The special barcodes described in this section can be used to set user tags at any time. Special barcodes require some setup but are the most efficient way to use the MDT-2. All of the special barcode commands to the MDT-2 are in the form of a command code followed by a value.

6.2.1 Prefixes

+ Set farm. Value is new farm name.

- Set field. Value is new field name.

$ Set fruit type. Value is an integer fruit type code found in fruits.txt in the Winapples install directory, not the variety name.

%L Set lot. Value is new lot number.

6.3 Examples

+SHADYACRES
In this code "+" is a prefix that commands a change to the farm setting of the Digitest, while the rest of the string is the new value of the farm. After scanning this example, subsequent tests will be set to the farm "SHADYACRES".

%L1066
"%L" is the prefix code. This example instructs the digitest to set the lot number to 1066 (lot numbers are always integers).

6.4 Codes and fonts

MOHR uses a Code 39 font to print barcodes out of Microsoft Word. Code 39 requires each barcode to begin and end with '*'. We create our test codes, then bracket them with '*', then change the font. While standard Code 39 works with the MDT-2, the full-ASCII variation of Code 39 does not.

Code 128 is known to work. Code 128 typically requires special software for barcode creation.

Chapter 7: Winapples Software

7.1 Connections

The MDT-2 can be connected to the Winapples software to transfer test results. The MDT-2 can transfer stored test results and results in real time while testing.

The Winapples software is included on a CD with the MDT-2. It runs on Microsoft Windows computers. The Winapples software provides flexible storage of test data and a friendly interface for reviewing and sorting results. With Winapples, you can generate detailed spreadsheets and create reports that are easy to print and e-mail.

7.2 Setup

Setting up the Winapples software and the MDT-2 for transferring test results may require the help of a computer technician or network administrator. This will depend on the security and network policies at your organization.

7.2.1 Setting up Winapples

First set up the Winapples software on a Windows computer. This will be the computer that test results are transferred to.

To install the software, insert the Winapples CD into the computer. If the computer does not automatically run the installation, use Windows Explorer to go to the CD and run setup.

During the setup process, you will be asked to enter an organization name and to confirm the installation folder.

7.2.2 Setting up the MDT-2

The MDT-2 needs a network address to communicate with the Winapples software. By default, the MDT-2 is set up to use DHCP to automatically get an address when it's plugged into a network.

Instead of DHCP, the MDT-2 can be set up to use a static IP address. From the main screen, select *SETUP* on the touch screen, then *NETWORK CONFIG*. This will bring up a form with five entries: Address, Netmask, Gateway, DNS1 and DNS2. There will also be an option to turn DHCP on and off. To configure a static address, these need to be set appropriately for your network and DHCP needs to be turned off. These values should be determined by a network administrator.

In order to turn automatic addresses through DHCP back on, go to the network configuration screen and switch DHCP to on. There is no need to change the other settings.

7.2.3 Network security

Each network has its own security policies. For the MDT-2 to connect to Winapples software, the computer running Winapples needs have TCP port 1570 opened. This is often best handled by a network administrator. Opening the port may mean changing firewall settings on the computer or adding the MDT-2 to a "white list" or both.

7.3 Connecting

From the main screen of the MDT-2, select the *CONNECTIONS* button with the touch screen. The connection screen has three fields: the name of the server to connect to, the address of the server, and an option for real-time testing.

The name of the server is for informational purposes only. The address needs to be a network name or IP address.

If the option for real-time testing is turned on, then results are transferred to the server immediately after a test is finished.

The target server must be running the Winapples software.

When *OK* is pressed, the MDT-2 will try to connect to the server. Connection status is shown in the upper left corner of the screen. If the connection succeeds, the corner will show the address of the server.

7.4 Transfer while testing

If the MDT-2 is connected to a server and the real-time transfer option is turned on, then the MDT-2 will transfer test results to Winapples immediately after the test is finished. There is in option in Winapples, View->Autofollow, that makes Winapples show the latest test that's been transferred.

7.5 Transfer of stored results

The MDT-2 also records all test results to its own internal memory. Test results can be transferred to Winapples after the fact.

To transfer all tests, make sure the MDT-2 is connected to a computer running Winapples. From the main screen select *SEARCH DATA.*

This will bring up several query options for selecting the data. If you click *OK* on this screen, then you'll be shown a range of dates. By default this just includes today's date.

If you click through the dates, you'll be given a list of all tests for the day. By default they are all highlighted. If you press the *TRANSMIT* button, the MDT-2 will send all of today's tests to Winapples.

Winapples will take care not to allow duplicate test entries, so it's safe to send the same data twice.

Chapter 8: Options and Accessories

8.1 Options

Model MDT-2 — standard internal and external load cells

8.2 Accessories

8.2.1 Standard accessories (MDT-2)

External Load Cell +- 65 lb.(30kg)	MDT2-AC-ES65
Small Form-Factor Keyboard	MDT2-AC-KBD
24 VDC External Power Supply	MDT2-AC-PS
MDT-2 Operator's Manual, Printed	MDT2-M-OM-xxx[*]
Winapples™ Installation CD, w/ Digital MDT-2 Operator's Manual	MDT2-S-WAOM-xxx[*]
NIST-Traceable Calibration with Certificate	MDT2-AC-NISTCC

8.2.2 Optional accessories (MDT-2)

Barcode Reader Kit	MDT2-AC-BCD
Hard Carrying Case	MDT2-AC-CH
Probe 4 mm	MDT2-AC-P4M
Probe 8 mm	MDT2-AC-P8M
Probe 11 mm	MDT2-AC-P11M
Probe Cherry	MDT2-AC-PCH
Probe Compress	MDT2-AC-PCM
Probe Rheology	MDT2-AC-PRH

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[*]   xxx applies to revision number. Accessory part number is incremented per revision.

Appendix A: Specifications

Force system characteristics

Characteristic	Specification	Notes
Range	+- 65 lbs (+- 30 kg)	using standard load cell
Sensitivity	1×10^{-5} lbs (5 mg)	using standard load cell
Gain	176 x	
Sample resolution	24 bits	
Sample rate	6 kHz	

Distance system characteristics

Characteristic	Specification	Notes
Range	2.9 in. (7.3 cm)	
Precision	3×10^{-5} in. (0.001 mm)	
Sampling resolution:	24 bits	
Velocity	2 in./s (50 mm/s)	
Velocity resolution	32 bits	
Acceleration resolution	32 bits	

Power system

Characteristic	Specification	Notes
AC power	110/220 VAC (+- 10%) 50/60 Hz.	single phase
AC current rating	3 A	
Battery charge time	4 h fully discharged	2 h low battery warning

Environmental and mechanical

Characteristic	Specification	Notes
Operating temperature	0°C to 50°C	
Non-operating temperature	-20°C to 60°C	
Dimensions	16.5(H) x 7.0(W) x 8.0(L) in. (42.0 x 17.8 x 20.3 cm)	
Weight	12 lbs. (4.5 kg)	

Certifications and compliances

EC

The MDT-2 complies with all applicable EU directives as described in the Declaration of Conformity supplied with the instrument.

FCC Compliance

MDT-2 emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.

Appendix B: Block Diagram

Appendix C: Operator Performance Check

Routine performance checks

The instrument and external load scale are calibrated using NIST-traceable standards at the time of manufacture and at subsequent yearly scheduled calibration intervals using the procedures in *Appendix D: Calibration Procedures*.

Between calibrations, routine operator performance checks are carried out to check that the instrument is operating within expected tolerances and to highlight any unexpected deviation from normal operation. To be useful, routine performance checks should be quick and simple to perform, and should let the operator evaluate both the force and distance measurement system.

One routine performance check that MOHR has found useful is the following:

1) Start with a freshly calibrated MDT-2, connected to an external scale that has been calibrated with that instrument.

2) Using a permanent marker, mark a spot on a new tennis ball and label the ball with the MDT-2 serial number.

3) Visually inspect the instrument and make sure that the instrument is clean and shows no sign of damage. In particular make sure that the plunger and stripper plate are clean. Stop and clean or repair, as necessary.

4) Using the TEST PROFILE menu, select the built-in "apple" test profile.

5) If you are checking the external scale, use the MEASUREMENTS --> SET TEST TYPE menu to select the "normal" test type. If you are not checking the external scale, the "fast" test type can be used.

6) If you are not checking the external scale, skip to step #8. Otherwise continue to step #7.

7) Place the tennis ball on the external scale and start a test. When prompted continue to step #8.

8) Place the tennis ball in the test chamber on the Quick Load base with the spot mark facing the test plunger.

9) Test the tennis ball and record M1, A2, E2, C0, CN1, QF, and, if applicable, weight values.

10) On a periodic basis (e.g., daily), repeat steps 3-9 and compare to the recorded values.

11) There will be slow drift in the pressure values as the tennis ball ages but any variation greater than 1 to 2% in any parameter should prompt inspection by a qualified technician.

Appendix D: Calibration Procedures

Calibration interval

The MDT-2 should be calibrated at least once a year.

Setup

From the main menu, select *SETUP*.

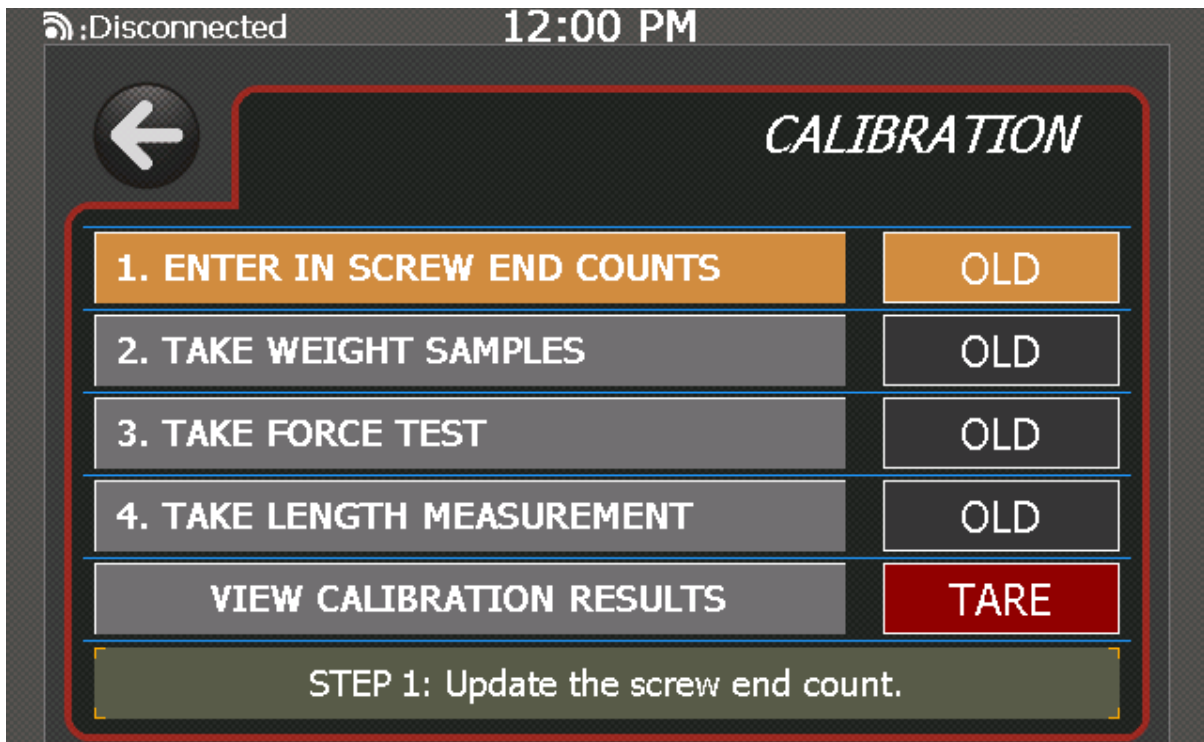From the setup screen, select the *CALIBRATION* button. This will load the calibration screen. See Figure D1.

Figure D1. CALIBRATION menu. This will guide you through the calibration process.

The calibration screen will guide you through the calibration process. It shows the steps to take for a complete calibration of the MDT-2 and highlights the next step to take. Status symbols to the right of each step show whether the step has been completed successfully.

Press the highlighted step to go to the instruction screen for that step.

Note that it's not necessary to perform all of the steps. Later steps can be run without running the previous steps.

Enter in screw end counts

The first step, *enter in screw end counts*, sets the number of encoder counts that the probe may travel from its top position to the bottom. This value should never be changed.

Take weight samples

The second step, *take weight samples*, calibrates the external scale using one or more calibration weights of known weight. For most testing applications, use of a calibration weight in the range of 25 to 35 lbs. is recommended. The more accurately the weight of the calibration weight(s) are known, the more accurate the calibration will be. To maximize the accuracy of the instrument, the calibration weight(s) should be know to at least 0.0001 lbs. (50 mg).

Please note that if multiple calibration weights are used, the resulting calibration will reflect a linear regression through the measurements from all of the weights. MDT-2 load cells show extremely linear response characteristics, and multiple weights are unlikely to be of significant benefit for most applications.

Make sure the external scale is plugged into the MDT-2.

Place the calibration weight on the scale and enter the weight of the calibration weight (see Figure D2). Then press the *LOAD* button. A progress bar will fill while the MDT-2 takes measurements.
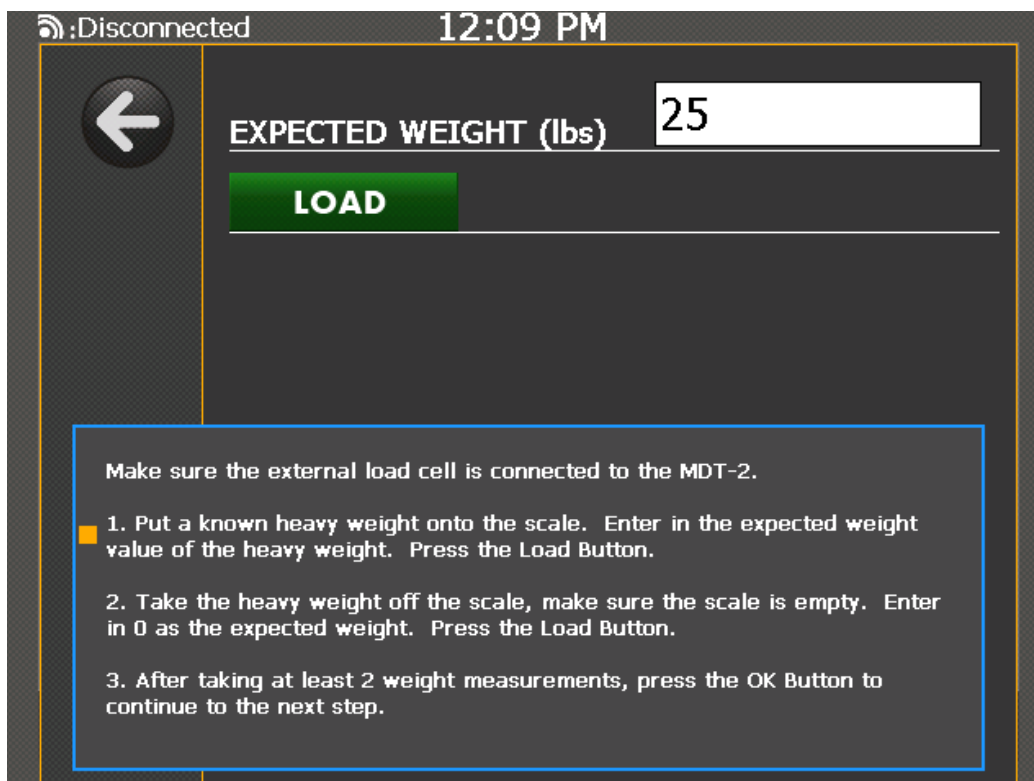

Figure D2. Calibrating the external scale. After you've placed the calibration weight on the scale, enter its weight.

After the calibration weight has been measured, a 0 appears in the text field. Remove the calibration weight and press the load button again.

Once the second run is finished, the scale calibration is complete. Press the *OK* button to accept the calibration.

The final set of buttons on the calibration screen is used to check the external scale calibration. Press the *TARE* button to tare the external scale. Press the *CHECK CALIBRATION* button to load a screen that shows the weight sensed by the external scale. Place the calibration weight on the scale to check the calibration.

Take force tests

With a calibrated external scale, the internal load cell of the MDT-2 can be calibrated (see Figure D3).
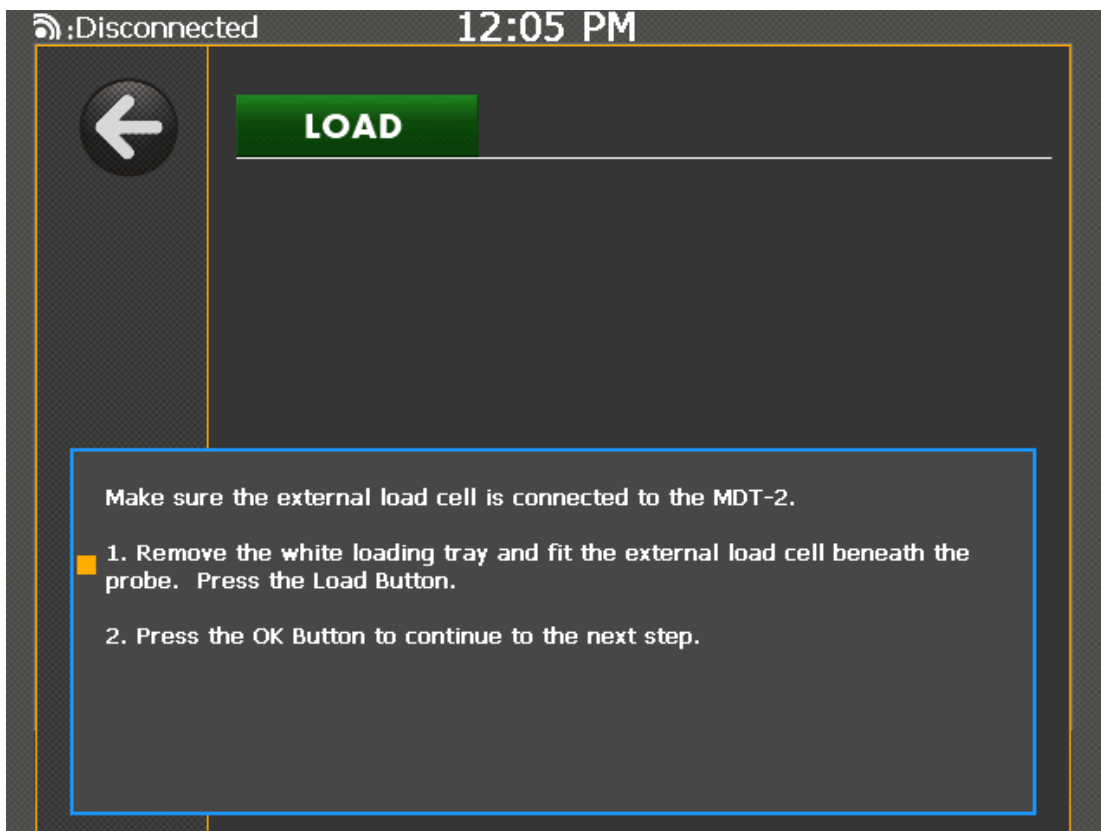
Figure D3. Taking force tests to calibrate the internal load cell.

Remove everything, including the testing tray, from the MDT-2. Then put the external scale into the MDT-2 so that the center of the scale is directly underneath the probe.

Press the *LOAD* button. The MDT-2 will now lower the probe onto the scale and press a gradually increasing force into it. A progress bar will fill as the calibration continues. To accept the calibration when finished, press the *OK* button.

Take length measurement

Take length measurement should be run whenever the probe is changed or the testing base is changed in addition to routine calibration.

The MDT-2 comes with a wooden ball of known diameter. Place the ball in the tester so that the target on the ball is directly beneath the probe.

Enter the diameter of the ball (see Figure D4).
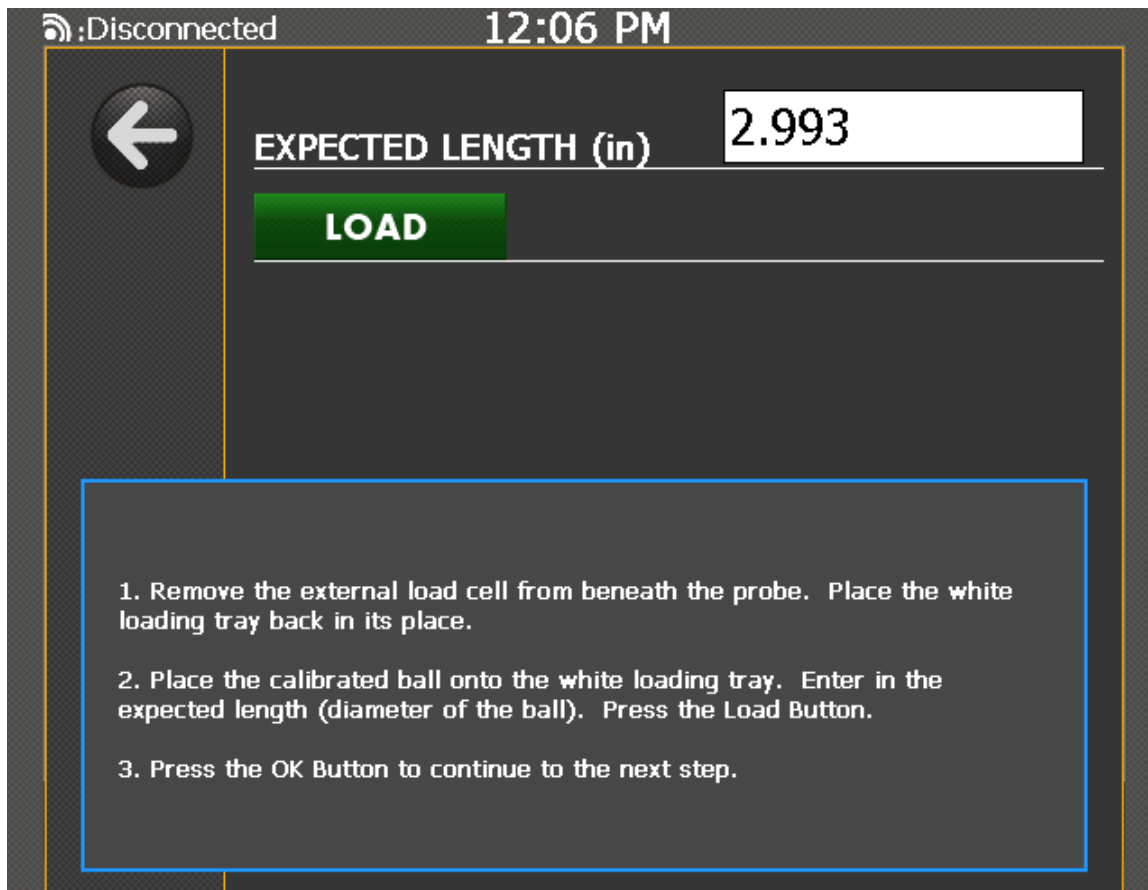
Figure D4. Taking length measurement. After placing the calibrated ball on the loading tray, enter in the expected length (diameter of ball).

Press the *LOAD* button. The probe will come down and touch the ball, then retract.

Press *OK* to accept the length calibration.

Appendix E: Maintenance and Service Instructions

Cleaning and lubrication

Clean the MDT-2 with a damp cloth. Clean the LCD screen with Windex. Do not use any powerful solvents when cleaning the MDT-2. The sliding tray can be removed and washed under running water.

For the most effective cleaning of the probe, it should be washed when at its lowest extent. From the main menu, press the *SETUP* icon to get to the setup screen, then press the *PROBE SETUP* button to go to the probe setup screen.

Press the CHANGE PROBE button to move the probe to its lowest extent.

Lubrication of the drive screw should be done by a MOHR Test and Measurement approved technician.

Cleaning and lubrication interval

The MDT-2 should be cleaned after each use.

The lubrication of the drive screw should be checked once a year by a MOHR-approved technician.

Battery removal

1) Ensure that the MDT-2 power is off.

2) Remove all external devices and connections from the instrument.

3) Remove the twelve screws holding on the rear plastic panel of the case: Two on the top edge, three on each side, and four on the bottom edge.

4) Carefully remove the plastic back panel of the case.

5) The battery connectors will be found at the top of the exposed circuit board.

6) Unclip the 3-pin battery connectors by pressing on the release tab and pulling on the connector.

7) Lift the battery out.

Inspection

Inspection should proceed as follows:

1) From the main menu, check that each of the icons can be pressed.

2) From the main menu, check in turn the operations of the green, yellow, and red quick buttons.

3) Run a test with nothing in the tester. Check to see that no false test is triggered.

4) Run another test with an object in the chamber. Check to see that a test is triggered when the probe contacts the object.

5) Use the instructions in *Appendix D: Calibration Procedures* to perform a calibrations check.

Inspection interval

The MDT-2 should be inspected every 6 months.

Calibration and calibration interval

See *Appendix D: Calibration Procedures* for appropriate calibration interval and detailed instructions on how to calibrate an MDT-2.

Appendix F: List of Fruit Types for Winapples

The MOHR Winapples software has a fixed list of fruit types that can be used to define tests. When transmitting tests to the Winapples software from the MDT-2, the fruit type user tag is checked. If the fruit type is on the list for Winapples, then the test appears in Winapples with the correct fruit type. Otherwise, the test appears under "Generic Apple".

This appendix is the complete list of fruit type values recognized by the Winapples software.

Apples

Generic Apple
Akane
Braeburn
Cameo
Criterion
Dulcet
Elstar
Flaming Rose
Fuji Bagged
Fuji Blush
Fuji Stripe
Gala
Early Gold
Firm Gold
Prime Gold
Ginger Gold
Golden Delicious
Granny Smith
Hokuto
Jonagold
Jonagold Bagged
Lucky Rose
Pink Lady
Prime Gold
Red Ace
Red Blush
Red Oregon
Red Red Chief

Appendix F: List of Fruit Types for Winapples

Red Scarlett
Red Top Red
Red Starking
Red Rome
Sunrise
Tydeman
Winesap
Winegold
Red Silver Spars
Red Dark Stripe

Pears

Generic Pear
Bartlett
Bosc
Concorde
D'Anjou
Flemish Beauty
Red Bartlett
Red Clapp
Red D'Anjou
Russet Bosc
Seckel
Stark Crimson

Asian pears

Generic A Pear
20th Century
A Ri Rang
Chojuro
Hosui
Kosui
Olympic
Shinko
Shinseki

Cherries

Generic Cherry

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