

Lafayette Manual Muscle Test System User Instructions



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The Lafayette Manual Muscle Tester (MMT) System is an ergonomic hand-held device used for objectively quantifying muscle strength. The test is performed with the clinician applying force to the limb of a patient. The objective of the test is for the clinician to overcome or “break” the patient’s resistance. The MMT records the peak force and the time required to achieve the “break” providing reliable, accurate, and stable muscle strength readings.

The MMT also features interactive menus to allow a wide range of options such as data storage, preset test times, and force thresholds to be implemented. While powerful and versatile, the MMT is still small enough to fit comfortably in the palm of the hand. Its ergonomic design allows for both patient and tester comfort while easily conforming to manual muscle testing protocols.

Features

- Designed for high inter and intra instrument reproducibility
- Three, easy to change molded plastic stirrups with pads
- Force measurements in pounds, kilograms, or Newton (user selectable)
- Measures peak force, time to reach peak force, total test time, time within selectable ranges, and the average force
- Data storage for up to 150 tests in on-board memory
- Automatic or manual storage of data
- Measurement range 0-300lbs (136.1kg/1335N)
- Selectable test time form 1 – 10 seconds
- Tone to indicate start, stop, and entering within a range
- Microprocessor controlled
- Built-in stored data browsing capability
- Easy to read graphical LCD display
- Automatic shut off after 5 minutes of inactivity
- Battery indicator on LCD display
- Interactive menus allowing users to select device options
- Battery powered: (1) rechargeable lithium-ion battery
- Minimal measurement drift

Specifications

- Size: 3.16" x 5.11" x 1.6" (8.03cm x 12.98cm x 4.1cm)
- Weight: 312 g
- Range: 0-300 lbs (136.1kg) (1335 N)
- Accuracy: $\pm 1\%$ over full scale or ± 0.2 lbs
- Resolution: 0.1lbs/0.1kg/0.1N(0-999.9N) / 1N(1000N-1335N)
- Battery Life: 6 hrs powered on, 30 minutes after low battery condition
- Charge Time: 80% charge => 45 minutes / Full charge => 2 hrs
- Data Storage Capacity: 150 tests
- Preset Test Length: 0.5-10 seconds; in 0.1 second increments

Precautions

- When performing repeated tests, inconsistent placement of the MMT will adversely affect scores.
- Extreme temperature, especially heat, may affect the values obtained.
- The MMT cannot tolerate the stress of being used as a floor scale.
- Care should be taken not to drop the MMT, as it may affect the calibration.
- Exceeding the force limit (300lbs/136kg/1335N) may permanently damage and/or invalidate the calibration of the MMT.
- Upon initial receipt of MMT, charge for 2 hours.
- Stirrup should be rotated clockwise on and off to reduce friction on O-ring.

Basic Operations

The Lafayette MMT is small enough to be held in one hand and easily read. The size and weight of the MMT permit the examiner to use the same procedures and break test techniques described in the literature and taught by academic institutions without any modification of technique or positioning. The unit is simply placed between the examiner's hand and the limb being tested. The examiner's downward force is transmitted to the limb through the MMT unit. The MMT is designed for one hand operation. It can comfortably fit in the right or left hand, with settings for both dexterities. The hand is placed under the strap and around the body of the MMT. This allows easy access to the TOP buttons with the thumb. All of the other buttons are pressed using the opposite hand.

The MMT is activated by pressing the Menu/Select button. Measurements are taken by pressing the padded stirrup against the muscle being tested on the subject. The force and time data are displayed on the LCD screen. To conserve battery life, the MMT will deactivate itself when not in use for five minutes. All data on the main screen at power down is saved and will be shown when the MMT is activated again.

Function Buttons

The MMT has five function buttons that control the menus and allow the selection of options and settings.

- 1. POWER/MENU/SELECT Button:** The round MENU/SELECT button is located on the bottom middle of the MMT. This is the button used to power on the device. Holding the MENU/SELECT button for 5 seconds will power off the unit. It is placed for easy access regardless of right or left hand operation. The MENU/SELECT allows you to enter into the Menu screen and select various options within it.
- 2, 3. NAVIGATION Buttons:** While on the Test screen the NAVIGATION buttons are used to enlarge the graph and return back to the Test screen from the enlarged graph. While in the Menu screen, the NAVIGATION buttons are used to navigate the various menu screens.
- 4, 5. TOP buttons:** On the Main screen the TOP buttons are used to SEND, CLEAR, and START tests when applicable. On the menu screen these buttons are used to return back one screen, BACK, or return to the Test screen, TEST. These buttons can be flipped for a specific dexterity by changing the button orientation in the OPTIONS menu.



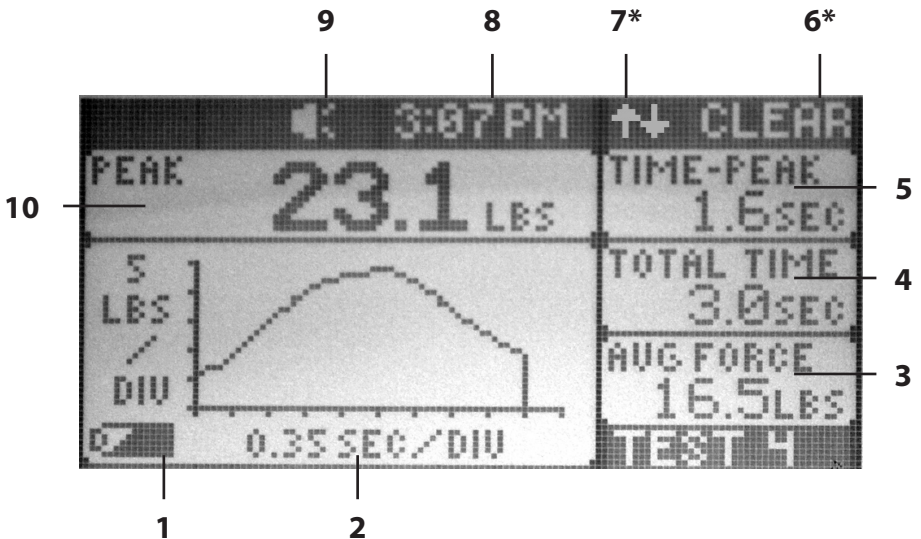
Screens

Test Screen

The Main Measurement Screen shows all measurement information that is being captured. This screen is shown whenever a measurement is in progress. (see diagram on next page)

- 1. Battery Indicator:** Indicates the remaining capacity in the charge of the battery.
- 2. Force over Time Graph Area:** The graph displays the data for the previously conducted test, and automatically populates the chart to maximize the viewing area. The Y-axis label shows the amount of force (in lbs, kg, or N), and the X-axis shows the time in seconds.

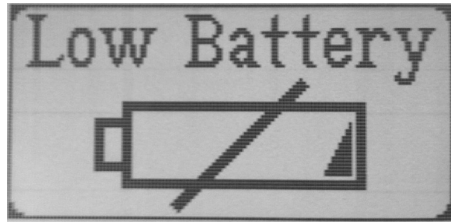
3. Ave. Force: Average force exerted over the range.
4. Total Time: The total time is the total duration of the test in seconds.
5. Time-Peak: Time to peak is the elapsed time in seconds from the start of the test until the maximum force has been reached.
 - Each of these three windows can have any of the following measurements displayed during or after a test is taken:
 - *Real-Time Force*: This displays the real time force that is measured during the test.
 - *Time in Range*: Cumulative time within the specified range
 - *Time ↑ Range*: Cumulative time above the specified range
 - *Time ↓ Range*: Cumulative time below the specified range
6. Clear (Top Button Function): This area shows the current function for the top button. In the Test screen window, shown above, the clear function clears the current test, and allows the user to take another test.
7. Wireless Communication Indicator: This character indicates when the wireless is enabled.
8. Time Display: This time is displayed and can be set manually or synced with a PC in the Options Menu.
9. Sound Indicator: Indicates whether beeper is on or off for the current test.
10. Peak Force: The peak force displays the maximum force during the test and displays what units the force is being measured in (lbs, kg, or N).



* indicates elements that will move depending on chosen button orientation - set in OPTIONS menu

Low Battery Indicator Screen & Charging

The low battery indicator screen is shown when the battery needs to be charged. The screen will appear and then the system will power off. This screen will re-appear when the power button is pressed until the unit is recharged via the USB connector. The device should take about 45 minutes to charge 80% of the capacity, or about 2 hours for a full charge.



Test Setup Menu Screen

The Test Setup menu screen allows the user to setup various test options.

START

Starting a test can either be done by passing a FORCE THRESHOLD., or after a certain amount of TIME DELAY, triggered by the top button.

START FORCE/TIME DELAY

These options allow you to select customized force thresholds and time delays.

STOP THRESHOLD

If enabled, the test will end when the force applied drops below the value set in STOP FORCE. If disabled, the test will resume for the amount of time set by the TEST TIME.

STOP FORCE

If STOP THRESHOLD is enabled, each test will be stopped when the force is less than or equal to this force. Stop force cannot exceed start force.

AUTO CLEAR

If enabled, manually clearing the data is not required prior to starting new tests.

UNITS

Allows selection of pounds (lbs), kilograms (kg), or Newtons (N).

TEST TIME

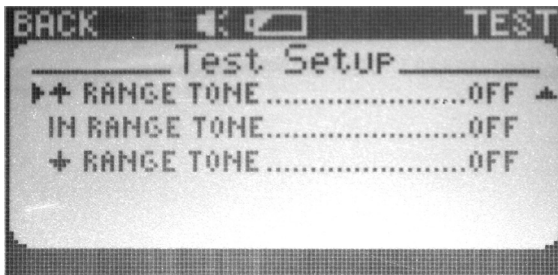
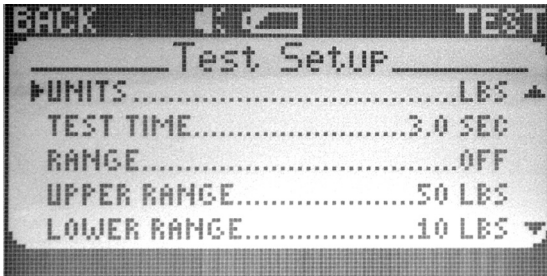
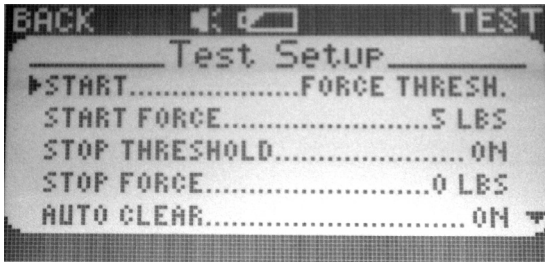
Allows users to select preset time for testing.

RANGE

Allows an upper and lower range to be enabled for testing. These ranges are set by setting the UPPER RANGE and LOWER RANGE.

RANGE TONES (↑ RANGE TONE, IN RANGE TONE, ↓ RANGE TONE)

Range tones are enabled by turning on each corresponding tone. The ↑ RANGE TONE is a single beep. The IN RANGE TONE is two quick beeps. The ↓ RANGE TONE is three quick beeps.



Saved Data Menu Screen

The Saved Data menu screen allows users to manage tests that have been saved in the internal memory.



BACK TEST

Select to Open

TEST	PEAK	T-PEAK	TOTAL-T
▶ 10	23.0LBS	2.3 SEC	2.8 SEC ◀
09	23.2LBS	1.6 SEC	10.0 SEC
08	23.1LBS	0.7 SEC	10.0 SEC
07	8.6LBS	1.4 SEC	10.0 SEC ▼

BACK TEST

Select to Delete

TEST	PEAK	T-PEAK	TOTAL-T
▶ 10	23.0LBS	2.3 SEC	2.8 SEC ◀
09	23.2LBS	1.6 SEC	10.0 SEC
08	23.1LBS	0.7 SEC	10.0 SEC
07	8.6LBS	1.4 SEC	10.0 SEC ▼

Options Menu Screen

The Options menu allows user to customize the setup of their unit.

WIRELESS

Toggles on/off the module for wireless connection.

DISPLAYS 1, 2, 3

Correspond to the customizable measurement areas on the Test Screen

BUTTON ORIENTATION

Switches the functionality of the top buttons, allowing for use in either hand.

BACKLIGHT

Toggles unit's backlight on/off.

SOUND

Toggles unit's sound on/off.

PC TIME SYNC

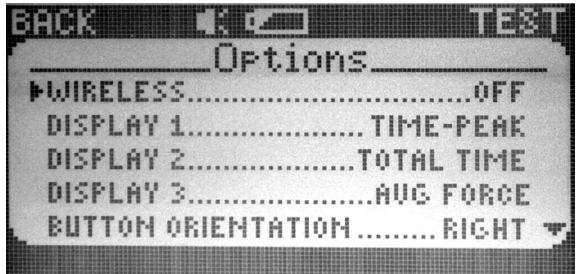
Allows the MMT to automatically set its time when connected to a PC

DATE

Updates the MMT system date.

TIME

Updates the MMT system time.



Information Menu Screen

The Information menu screen provides a contact email and various information about the MMT.

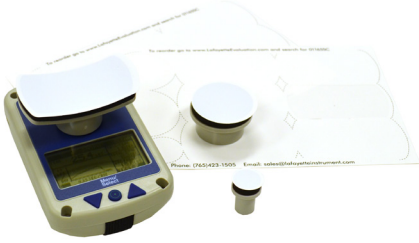


Resets

To restore MMT to factory defaults, press MENU/SELECT and navigate to the Information screen. Press and hold MENU/SELECT then press the upper left button until screen reads "Restored Defaults".

Hard Reset: If the MMT freezes press MENU/SELECT and the upper right button until the unit powers off.

Accessories



Disposable Sanitary Covers

Model 01165SC

Replacement Set of 25 adhesive Sanitary Covers for MMT Stirrups.



MMT Replacement Kit

Model 01165RK

Replacement Set of Stirrups, O-rings, and Sanitary Covers for the MMT.

Appendix A – Torque measurements with the MMT

In some research and rehabilitation applications, it is necessary to obtain torque measurements for the limb being tested. Torque is often a more accurate indicator of total strength because it takes into account the length of the muscle being tested. The Lafayette Manual Muscle Test System (MMT) can be used to obtain torque values through a series of basic calculations.

Torque is measured in units of Newton meters (Nwm) in the Metric system and in foot pounds (ftwlbs) in the English system. Torque is the product of the force applied times the distance between the force and the pivot point (usually a joint).

Equations for obtaining torque readings with the MMT using metric values:

$$\text{Torque} = \text{Force} * \text{Distance}$$

Where force equals the MMT reading converted to Newtons and distance is the length between where the force is applied and the joint being tested in meters.

Newtons conversions: 1 pound = 4.45 Newtons; 1 kilogram = 9.81 Newtons
Newtons are calculated at sea level.

Normative Strength can also be quantified as torque per kilogram bodyweight (Nwm/kg). This value is obtained by dividing the torque by the person's bodyweight in kg.

$$\text{Strength} = \frac{((\text{MMT reading in Newtons}) * \text{distance})}{\text{bodyweight in kilograms}}$$