# Quantitative "*QMA*"
# Muscle
# Assessment

## USER GUIDE
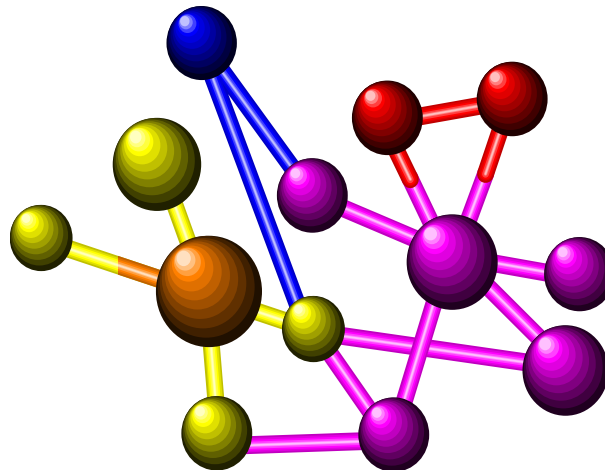
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**TCS - The Computer Source**
Quantitative Muscle Assessment   "QMA"

# Table of Contents

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## A. About this manual

This manual is topically organized, includes information for both the administrator & physical therapist, and may be updated at the discretion of The Computer Source.   This manual is written using MS Office 97.  With the manual on-line, a search may be made in MS-Word of any topic or word combination.   Go to EDIT, and then FIND,  type in your word and a search will be made of this manual.


**Organization** - This manual is compiled as an operationally progressive set of instructions, utilizing commonly accepted nomenclature for a user that is MS-Windows proficient.


**Contribution** - Those contributing to the programming and validation of this system
James Fielding - Managing Director/ Hardware Compliance/ System Assurance
Craig Petrie - Senior Programmer -
Robert Sandage - Programmer - Data Retrieval System, data transfer (Beta)


**Acknowledgment** -  Those making timely suggestions and critiquing the system include:
Charles Thornton, Shree Pandya, Karishma Manzur, and William Martens -
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 Barbara Polkinghorn, David Tierney, and Dave Mason -
 Elan Holdings   Gainesville, Georgia

# 1. Introduction

Quantitative Muscle Assessment (QMA) is an accurate IBM compatible, MS-Windows compliant Personal Computer (PC) based data acquisition system for the quantitative testing of muscle strength, muscle fatigue, and motor function.

## 1.1. Types of users

In a typical setup, the QMA system will have two different types of users: *Administrators (Admin)* and *Physical Therapists (PT)*. The Administrator has the primary responsibility of protocol setup compliance. This area is password protected in the Main Menu. The Physical Therapist is responsible for the accuracy and consistency of the data collected. These responsibilities include the verification of accuracy of the system periodically and the testing of each muscle group as directed by a protocol.

## 1.2. Types of tests

The different tests performed by QMA are categorized by the type of action required by the patient and the measurements associated with each test. Currently, there are five types of tests that can be performed with QMA:

1. Strength. The patient exerts the maximum possible force for approximately three to eight seconds. Maximum force achieved, rise time and sustain time are calculated.

2. Static Fatigue. The patient tries to sustain a maximum possible force over a longer period of time (15-40 seconds). Average force, maximum force and area are calculated for up to five different time regions.

3. Dynamic Fatigue. The patient repeatedly exerts and releases (approximately once every second) with the maximum possible force. Maximums and averages are calculated using the peaks of the exerted force. Area is also calculated. Only three time regions are analyzed.

4. Stopwatch. The patient tries to perform a task (such as walking or running a marked distance) in the least amount of time possible. Time, not force, is measured.

5. Other. Other tests allow for keyboard input that is associated with each test and is independent of the electronic data acquisition.

The first three types are performed with connectors (cables or straps) and a strain gauge assembly or hand dynamometer. The fourth type is performed by using the red button to start and stop an on-screen timer. The last type requires keyboard input only.

## 1.3. Logging in

The screen that appears upon start-up is the Login screen. The login name or initials of the person conducting the testing entered in this screen will be recorded with the data for each test. Most all tasks are initiated from the Main Menu screen, which appears after a user presses the "OK" button on the Login screen.

## 1.4. Initially Speaking - Set your parameters

1. **Setting Up the equipment hardware**

The system hardware consists of one of each of the following:

PCI Analog/Digital converter, SCSI III to DB25 cable, interface enclosure, hand dynamometer, strain gauge, and remote button.   Each piece of equipment has been equipped with *unique* connectors.   Make all connections secure.    The use of power surge protection or uninterrupted power supply (UPS) is recommended.

2. **Setting up the equipment software**

The setup disks are self extracting and will install the QMA program to the destination drive of your choice.  Default is C:\ QMA   Simply follow their prompts.

Several initial configurations are required to be set prior to testing initialization.
1. **Site Name**:   Identify your site.
2. Select style of  **Patient Information: English/American  or  International:** This will permit you the use of familiar formats in entering patient information,
3. Select **Units of measurement:** - LBS, . **KG**,  or Newtons
4. **Naming a New Protocol** - We recommend **copying the existing protocol**, rename your copied protocol, and use it as the default protocol for all initial familiarization.    This will expedite the creation of working protocols and diagnostic tools in the future.                                .

To begin the basic configuration of your system **Please login**.  This will take you to the **Main Menu Screen**.  Under **Setup**, type in **qma** (*default password, lower case*) & click **OK**.  This permits the opening of the Setup area.   Clicking on **General/Protocols** permits the Configuring of your Site.

1. Site Identification, Patient Information & Units of Measurement -
   A. Select **General** and change the **Test Site** as desired.
   B  Select **General** and change  **Patient Info Display** to either English-American or International.
   C. Select **General** and change as **Units for measurement** to one of the following: LBS, KG, or Newtons.

2. Protocol -
   A. Select **New -** Enter a new name for your protocol. Enter OK & OK.; then click on **Setup** & click on **logout** to leave Setup.
   B. Select **File** and click on **Change Protocol** (highlight your protocol or if the protocol is already highlighted) click **OK.**
   C. Changes in tests names, sequence, etc. that you now make, will be made to your new protocol.
   D. Always check the lower right of the testing screen to ascertain your current protocol.

3. If you encounter *any* problems, contact customer support at  770/983-1369, or through the WEB at support@QMASystem.com     We are here to assist you.

### 1.5. QMA System Tour & Tutorial

Once the Site is configured (1 thru 3) or the system is in demo mode, we can begin a tour of the system.

A. In the Main Menu screen check the protocol number. If the protocol number is your recently created protocol proceed, if not please repeat the protocol setup.

B. Under **File** select **New Patient** and **Enter Data** (*tab* between fields (white areas) Screen Number / Patient Identifier: May use up to sixteen alpha/numeric characters (Birth date, & Height require tabs between entries .

1. Now that a patient is entered you can begin testing.
   A. Select **File** and **Begin Visit.**
   B. Enter the patient's identifier - and click **OK**
   C. Forgot the screen number ? - select **View Name/Screen**, then **done**. .
   **Hint**– More detailed instructions on acquiring the patient identifier to begin a tests may be found in section 3.2
   Unload the Load Cell, Unload the Hand Dynamometer – Follow instructions
   D. You should now be viewing the **Category, Tests, and Side** for Muscle Testing. Patient information is shown to confirm the patient and visit number are correct.
   E. **Begin Test** (Manually select the test sequence by highlighting cat,test & side) **or**
   F. **Begin Sequence** (Pre-selected test sequence).
   G. A manually selected test -example, Strength - Elbow Extension - Left. If the test equipment is connected, then the resulting displays will be generated by the equipment. If test equipment is not connected, the system will be in a demonstration or teaching mode and the displays are fictitious.
   H. Click on Ready (press button), notice ready *flashing*, then Go (press button again) This starts the trace or first muscle test. Do several traces.

   I. Select different areas in this test, and accept, reject, etc.
   J. When you finish this test sequence, select **end test** or **next test,** or hold the button down for a count of seven for the next test.
   K. Notice that the LEFT Elbow Extension is no longer available for testing during this visit.
   L. You may select more tests of your choosing or continue the sequence.
   M. To end the testing and the visit - select **File**, then **End Visit**.
   N. To conclude this tour and exit the system select **File**, then **Logout**. This takes you back to the Login Screen..
   O. Select **QUIT**, this returns you to the desktop of Windows 9X or NT.

2. **NOTICE** – QMA v3.1 is a Y2K compliant 32 bit program.

# 2. Setup

**Test setup** includes tasks such as selecting test names, defining the test measurements, selecting the test order and other related tasks. These options become active after the user (Administrator) enters the system password and clicks the OK button in the Main Menu screen. Default setting for the setup password is **qma** (lower case)

**Hint**: *Always* check the site and protocol numbers when making a change to the system.

## *2.1. Test Definition*

Tests can be renamed, added or deleted by selecting **Test Names** in the **Setup** pull-down menu in the Main Menu screen. A different screen entitled **Test Definitions** appears.

### 2.1.1. Adding a test

Adding a test is accomplished from the TEST DEFINITION screen. First select the desired test category by clicking on the category name in the selection box on the left. The selection box on the right lists the tests defined presently. Your new test will be added before the highlighted test in the right selection box. Your new test will become the last test in the test sequence regardless of what is highlighted in the right selection box. With the appropriate selections made, press the ADD button.

A box appears requesting some information. Enter a name for the new test. If the test will use the hand dynamometer for input (strength and fatigue tests only), use the word "HAND" in the name of the test. The MAX GRAPH SCALE entry is used as the maximum value for the data graph displayed on the screen during the test. Enter the maximum force expected for this test. Next, select the desired side of the body in the SUB-TESTS pull-down menu. If you select LEFT & RIGHT, two tests will be created; otherwise, only one test will be created. Finally, select an appropriate seven letter or less filename(s) for the new test(s). An example of a test could be *Left Shoulder Extension - LSE* To discard any changes you made while in the Test Definitions screen, press the blue CANCEL button. Otherwise, press OK.
**Hint** - check the test format before making new files. It is your responsibility to make certain filenames are not repeated. To view the file format and see which filenames have already been used, in explorer, examine (but do not modify) the
`C:\QMA\(protocol)\TESTINFO.TXT file` Open with WordPad or Word

### 2.1.2. Editing a test

To edit a test, first select the desired category and test in the two selection boxes in the Test Definitions screen and then press the EDIT button. A box appears with the current definitions for the selected test. Consult section 2.1.1 above for information on the entries for this box.
Once a test is constructed, the file name may not be changed. If you desire a different file name, delete the test, and add a test with the file name of your choice.

### 2.1.3. Deleting a test

To delete a test, first select the desired category and test in the two selection boxes in the Test Definitions screen and then press the DELETE button. Undo deletes (and other changes made in the screen) by pressing the CANCEL button.
**Hint:** Make certain your are in the correct protocol.

## 2.2.  Changing the test sequence

QMA can automatically sequence through the list of tests in any order you like.  To define the order of tests, select Test Order in the Setup pull-down menu in the Main Menu Screen.  A screen entitled "Test Order Definition" appears.  As you use the selection boxes on the left to select the test you want to move, the current place of the highlighted test in the test sequence is displayed.  The display on the right contains a list of all tests in order.  Change the position of the selected test by using the keyboard or up/down buttons to change the number in the ORDER control.  The display on the right is updated as you change the control.

## 2.3.  Defining the measurements

The raw data from the strain gauge or hand dynamometer is written to a file during testing. QMA will also take measurements on this data which will be shown on the screen and included in the data files and printouts.  These measurements allow for some flexibility in their definition.  To change the measurement definitions, select **Test Parameters** under **Protocol Setup** from the **Setup** pull-down menu in the Main Menu screen.  A screen entitled "Test Parameters" appears.

### 2.3.1.  Strength measurements

*Strength tests report the following three measurements:*

1. <u>Maximum</u>.  The maximum force attained.

2. <u>Rise time</u>.  The time it takes for rising edge of the data to go from 10% to 90% of the maximum.  You can change both the lower (default 10%) and upper (default 90%) threshold values.

3. <u>Sustain time</u>.  The amount of time the force remains above 70% (by default) of the maximum.  You can change the 70% default value.

### 2.3.2.  Static fatigue measurements

Static fatigue measurements operate on five different time regions of the acquired data waveform.  For each time region, the maximum value, average value and area under the waveform can be calculated.  To define a time region, click the numeric control underneath the MEASUREMENT PARAMETERS label in the STATIC FATIGUE section of the Configure Tests screen.  This control should only display a number one through five to indicate which interval you are modifying.  The controls under the INTERVAL label define the region in time.  The checkboxes indicate which analyses will be applied to this time region.  These measurements are named "W#XXX" in the data reports, where # is the interval number and XXX is either "MAX", "AVG", or "AREA"

### 2.3.3.  Dynamic fatigue measurements

Static fatigue measurements are similar to dynamic fatigue measurements with two exceptions:  1) only three time regions are allowed, and 2) only the peaks of the waveform are used to calculate the maximum and the average.

## 2.4.  Setting the length of tests

Stopwatch tests end when the button is pushed.  Strength and fatigue tests can end in two ways:  1) when the button is pushed and 2) after a user-specified time-out time.

Additionally, strength tests can end automatically after the maximum has been reached. All these test time settings are entered from the Configure Tests screen, accessed by selecting **Test Parameters** from the **Setup** pull-down menu in the Main Menu screen

### 2.4.1. Time-out time

Strength, static fatigue and dynamic fatigue tests each have a separate time-out time. The time-out time defines the maximum time a trial will run. These are changed by using the controls labeled TIME OUT in the different sections of the Test Parameters screen.

### 2.4.2. Auto-stop setting

The control labeled AUTO STOP in the STRENGTH TESTS section of the Test Parameters screen controls when the testing will stop after a maximum is reached. When the falling waveform reaches 50% of the maximum value, the trial will end automatically. You can change the default value of 50%. To turn this feature off, enter 0%.

## *2.5. Other setup parameters*

The administrator also must specify other setup parameters such as the data acquisition rate, the site and protocol numbers, the units of measurement, and patient information display. These items are selected at the Main Menu via **Setup**, and **Test Parameters**.

### 2.5.1. Data acquisition rate

The data acquisition rate is set at the optimum rate of timing and synchronization for the pci analog/converter, the input devices and the qma program.

### 2.5.2 Site and protocol numbers

The site and protocol number are the underlying foundation of this information system. All data, including patient name, patient identifier / screen numbers, and test data are unique to the respective site and protocol numbers. Before you begin, create a new working protocol. This will permit you an expendable working copy.
A. Select **New -** Enter a new name for your protocol. Enter OK & OK.; then click on **Setup** & click on **logout** to leave Setup.
B. Select **File** and click on **Change Protocol** (highlight your protocol or if the protocol is already highlighted) click **OK.**
C. Changes in tests names, sequence, patient entries, etc. that you now make, will be made to your new protocol

### 2.5.3 Measuring Units

Measurement Units may be globally selected as Pounds, Grams, or Newton

### 2.5.4 Patient Information Display

Patient information may be selected as English-American and International

# 3.  Database Management

Database management involves updating, accessing, and printing patient information and data files.

## 3.1.  Entering patient information

QMA keeps track of a patient's test data and background information based on the patient's Patient Identifier / screen number.  Data on an individual patient is accessed by entering the identifier number.  If you forget the screen number, see section 3.2.3.

### 3.1.1.  Adding a new patient

From the Main Menu screen, select **New Patient** from the **File** pull-down menu.  A new screen entitled "New Patient Information" appears.  Simply enter the patient's screen number and background information in the data fields.  Move to the next field by either pressing <Tab> or clicking with the mouse.  You must enter a unique screen number for each patient.  Additionally, most of the fields are checked for errata data, such as numeric characters in the INITIALS field or characters other than "L" or "R" in the HAND DOMINANCE field.  The new patient is created and the background information stored on disk when the OK button is pressed.

### 3.1.2.  Editing an existing patient's information

To change a patients background information or to assign a randomization number to a patient, select **Edit Patient** from the **File** pull-down menu in the Main Menu screen.  A new screen entitled "Edit Patient Information" appears.  You must then key in the patient's screen number to change his or her background information.  If you do not have access to the patient's screen number, hit CANCEL and consult section 3.2.3.  After entering the correct screen number, the patient's existing background information will appear.  You can then edit this information in the same way you would enter a new patient's information as described in the previous section.

### 3.1.3.  Assigning a randomization number

A randomization number can be assigned to each patient to indicate the type of drug or treatment that is administered to the patient.  This is done by selecting **Edit Patient** from the **File** pull-down menu in the Main Menu screen.  For more information on this screen, see section 3.1.2.  After entering the screen number and pressing OK (or the <Enter> key), the RANDOMIZATION # field can be accessed quickly by pressing the <Tab> key.

### 3.2. Keeping track of visits and patients

#### 3.2.1. Updating and viewing visits

QMA will keep automatically keep track of visits. The current visit for a patient will be displayed when that patient is being tested. To quickly view the number of recorded visits and the date of each for a particular patient, select **View Visits** in the **File** pull-down menu in the Main Menu screen. Select the screen number from the provided menu using the mouse. You may also use the <Tab> key to highlight the menu and then use the up/down arrow keys to scroll through the list of screen numbers. The date and time displayed is the date and time when the visit was last modified. To finish a previously started visit, consult section 4.1.

#### 3.2.2. Deleting visits

If a user mistakenly begins a visit, he or she should immediately end the visit. However, an extra visit will be added to the screen number that the visit was initiated with. In this case, the new erroneous visit must be deleted for QMA to correctly keep track of the visit number. To accomplish this, select **Delete Visit** from the **File** pull-down menu in the Main Menu screen. You are then prompted for the patient's screen number. If you have only the patient's name, see section 3.2.3. After entering the screen number and pressing OK (or just hitting <Return>), a small window appears with a menu that contains the patient's recorded visits. After selecting the appropriate visit and recording a comment as to why this visit is being deleted, press the OK button. Any data recorded in the deleted visit is NOT removed from the hard drive and WILL be copied to floppy disk with the remaining valid visits, but is NOT accessed for analytical evaluation.

If you delete the most recent visit, QMA will "retest" that visit the next time the patient comes in. If you delete a visit other than the most recent one, that visit cannot be re-tested unless the more recent visits are also deleted.

#### 3.2.3. Listing all patients and screen numbers

A listing of each patient's common name, screen number, and initials is provided for reference. To view this list, select **View Name/Screen** from the **File** menu in the Main Menu screen. Clicking on the menu above the listing will allow you to sort the list either by screen number, name, or initials.

The information may be used to begin a test as follows:
1. From **File**, go to **View Name/Screen,** locate the patient to test
2. Highlight (scroll across the selected identifier while holding down the left mouse key) and depress **Cntrl C.**
3. Proceed to begin visit, and place the identifier in the dialog box by depressing **Ctrl V** & OK

### 3.3. Printing results

QMA provides printing of acquired data in two ways: printing individual tests and printing visit summaries. Printing directly from QMA will work if the printer is correctly installed under MS-Windows. You cannot print raw data via QMA; raw data can only be sent to a floppy disk. Because printing and data acquisition both use the parallel port of the computer, **you may <u>not</u> print while a patient is being tested**.

### 3.3.1. Printing individual tests (graphical)

Printing in this manner will print the results of a single test much as it appears on the test screen. You can print many tests at the same time, but one test of a patient's visit will occupy one page. Results from strength and fatigue tests will be printed on a graph with the measurements listed below. Results from the stopwatch and other tests will look like the test screens for those tests.

To print a test, select **Print Tests** from the **File** pull-down menu in the Main Menu screen. A new screen entitled "Print Results" appears. To print a single test from a patient's visit, first select the patient's screen number in the SCREEN # menu. You can either click on the appropriate screen number or click anywhere in the list and begin typing the desired screen number to make your selection. Then select the desired visit in the VISIT menu. Finally, select the desired test to print in the TEST menu. Only the tests which were completed for the selected visit will be highlighted.

To print all the tests in a particular visit, press the ALL button underneath the TEST menu label and make sure the correct visit is selected. To print a particular test for every visit, press the ALL button underneath the VISIT menu label and make sure the correct test is selected. Be prepared for very long print jobs if you select one of the ALL buttons. Printing an entire visit will tie up the system for a good while.

Pressing OK will start the print job. Printing graphical data is relatively slow and should only be done when the system is not in use.

### 3.3.2. Printing visit summaries.

As each test is performed during a particular visit, results for each test are appended to a summary file for the entire visit. The summary file contains the date and time of each test and all the measurements associated with that test for each trial. The visit summary is available to print when the visit is started.

To print a visit summary, select **Print Summaries** from the **File** menu in the Main Menu Screen. A window appears and you are given three options: 1) printing all the visit summaries in the system (ALL PATIENTS ALL VISITS), 2) printing all visit summaries for a particular patient (ONE PATIENT ALL VISITS), or 3) printing one visit summary for one patient (ONE PATIENT ONE VISIT). If you select the second or third option, you must also specify the patient's screen number. If you select the third option, you must also specify which visit to print.

With the proper selection made, press OK to start the print job. For every summary that will be printed you will see a window of text quickly flash on the screen and then disappear. QMA calls C:\WINDOWS\NOTEPAD.EXE to call up each visit summary (a text file) and send the file to the printer. ***You must not resume testing a patient until the printer stops printing.***

 If you do not have the printer drivers for a particular printer, or you desire to print the text via MS-DOS, then drop to a DOS prompt, change to the QMA directory and correct protocol, and then select the screen number. -  To Print - type   *copy **\*.txt** LPT1:*


### *3.4. Archiving data*

Archiving data involves copying the QMA data files stored on the system's hard drive to either a floppy disk or a remote location via modem.

### 3.4.1.  Saving data on a floppy disk

To copy the acquired data from the system's hard drive to a floppy disk, select **Copy to Floppy** from the **File** pull-down menu in the Main Menu screen. A window appears and you are given three options:  1) copying all the data files in the system (ALL PATIENTS ALL VISITS), 2) copying all the data files for all visits of a particular patient (ONE PATIENT ALL VISITS), or 3) copying all the data files from one visit of one patient (ONE PATIENT ONE VISIT).  If you select the second or third option, you must also specify the patient's screen number.  If you select the third option, you must also specify which visit to print. You cannot copy individual data files.  Visit summary files will also be copied along with raw data files.  If you select the first or the second option, the appropriate files containing patient background information (e.g., name, screen number, height, weight, etc.) will be copied as well.

With the appropriate selections made and a disk inserted into the A: drive, press OK to start copying.  If the disk has been used for a previous copy, the disk will be overwritten if the same visits are requested.  Copying new visits only will not overwrite the old data on the floppy disk. Using a clean floppy disk is faster.

In this version of QMA, there is no provision to copy a collection of data files larger than the space available on the floppy disk.  If you run out of floppy disk space, you must either 1) copy less data files at a time (only one patient or only one visit) or 2) use DOS or Windows to delete old or unwanted data files from the system's hard drive. For a description of the QMA file structure, see section 6.

### 3.4.2.  Transferring data via modem  (Beta Only)

The Data Retrieval System (DRS) permits the transferring of raw data in a tab delimited format from a site to a central host location, or site to site, via modem. .    Both sites must have the QMA Data Retrieval System, and the Polled site must have their system on and resident in the Login Menu..    Please refer to section 1.4.1,  to select the correct port and baud rate for the modem.

DRS setup:
1.   The Host site must be setup with the following information:
     A.   Site name, Protocol Number, Administrator name, & modem information
2..   The Host must enter the following information for the polled site:
     A.   Site name, protocol number, phone number, and contact name.
     B.   Assign a two-letter prefix to the site.  This will eliminate duplicate screen #s.


 The Host site has the following options available in setup:
1.  Sites to call - Host Administrator can list the sites to contact
2.  Time to initiate call - An automated dialing system permits calls to begin at a
     predetermined time.    Ie - Calls can begin at 2 am without an attendant.
3.  Protocol to access - Host administrator can select the protocol to access.
4.  Data to access - Host Administrator can request all, or define files to access

# 4. Performing Tests

## 4.1. Beginning a visit

To start the testing procedure for a patient, you can either begin a new visit or finish a previous visit.

### 4.1.1. Beginning a new visit

When a patient is ready for a new visit, select **Begin Visit** from the **File** pull-down menu in the Main Menu screen.  In the box that appears enter the patient's screen number and then press OK (or just hit <Return>).  If the patient's screen number is not available, consult section 3.2.3.  If the patient's background information has not been added to the system, see section 3.1.1.

If you entered a valid screen number, a large box listing the different muscle tests should appear.  You are then stepped through a no-load calibration for the load cell and the hand dynamometer.  Due to infinitesimal changes in the electronics of the data acquisition equipment, the system should undergo a no-load calibration check before each visit.  The no-load calibration check can also be executed between tests during a visit (see section 5.2).  First, you are prompted to unload the load cell (or strain gauge).  Make sure that there is no force pulling on the load cell and then press OK (or hit <Return>).  You are then asked to do the same for the hand dynamometer.

Once the no-load calibration check is finished, you are ready to select a test.  See section 4.2 for information about selecting a test to perform.

### 4.1.2. Finishing a previous visit

If a patient's visit must be interrupted or the therapist finishes a visit prematurely, it may be necessary to go back and finish a previous visit.  To do this, select **Finish Prev. Visit** from the **File** pull-down menu in the Main Menu screen.  In the box that appears enter the patient's screen number and then press OK (or just hit <Return>).  If the patient's screen number is not available, consult section 3.2.3.

If you entered a valid screen number, you will be prompted with a menu of previously recorded visits for that screen number.  Select the visit you want to finish and then press OK.

See section 4.1.1 about stepping through the no-load calibration check before a visit.  After the accuracy of the calibration is confirmed, the tests that were already performed during the previous visit will be disabled in the test selection boxes.  See section 4.2 for information about selecting a test to perform.

## 4.2. Selecting which test to perform

Once a visit has begun, the therapist can perform any of the tests defined by the administrator (see section 2.1).  The tests can be hand-selected in any order or they can be performed in the order defined by the administrator (see section 2.2).

### 4.2.1. Selecting Tests Manually

To hand-select a test, click on the appropriate test category in the CATEGORY selection box in the Main Menu screen. Then select the name of the test and the side of the body in the TEST and SIDE selection boxes. These selection boxes are visible only if you have begun a visit as described in section 4.1. If a certain test or category has been completed, the corresponding text in the selection boxes will turn gray and cannot be selected. With the desired test selected, press the button labeled BEGIN TEST beneath the selection boxes. Either the Strength and Fatigue Test screen, Stopwatch Test screen or Other Test screen will then appear depending on your test selection. See sections 4.3 through 4.5 for more information on these screens.

### 4.2.2. Following a Test Sequence

The administrator can define a test sequence to ensure all visits follow the exact same test procedure. To start the test sequence, press the button labeled BEGIN SEQUENCE beneath the selection boxes in the Main Menu screen. The button and selection boxes are visible only if you have begun a visit as described in section 4.1. QMA then starts the first test in the sequence regardless of what is highlighted in the selection boxes. If certain tests in the sequence were completed by hand, they are skipped in the sequence.

Each test screen has a button labeled NEXT TEST. For strength, fatigue and stopwatch tests, *holding down the red button* on the remote switch to a count of three, at the appropriate time is equivalent to pressing the NEXT TEST button. Pressing this button and holding it down for a count of three will end the current test and initiate the next test in the sequence even if there is an unfinished test that is earlier in the sequence.

### 4.3. Strength and fatigue tests

The graphical test screen is similar for strength tests, static fatigue tests, and dynamic fatigue tests. See section 4.2 on how to initiate the test screen.

### 4.3.1. Beginning a trial

Before beginning a trial, it is important to make sure the title of the screen matches the test you intend to perform. The current trial number is displayed underneath the TRIAL label at the bottom of the screen. Before preparing the patient for the trial, press the hand-held button once to enter into ready mode. You can also press the READY button in the bottom left corner of the screen or simply press <Enter> to enter into ready mode. The ready button will blink slowly and, for all trials except the first, the trial indicator will increment by one. The patient should be prepared for the test at this time by placing the patient, hand grip, and/or connectors and strain gauge in the appropriate position. The therapist then exclaims, "GO!" and presses the hand-held button at the same time to start the data acquisition. Clicking in the small circle labeled GO in the bottom right corner of the screen or simply pressing <Enter> will also start the data acquisition. Slight variations to this beginning sequence may be made to begin the test on "SET", with the patient stating his pull on "GO".

   This would permit the trace or wave to begin, with a solid zero baseline, prior to the patients efforts being displayed. This may be helpful in tests that do not measure from the first second, but within the test itself.

### 4.3.2. Ending a trial

Under normal circumstances, the trial or data acquisition will stop automatically. However, a trial can end in a variety of ways:

- when the therapist again presses the red hand-held button (only try to stop with the button after a few seconds into the trial),
- when the end of the graph has been reached (this is the time-out time; see section 2.4.1),
- when the therapist clicks in the circle labeled STOP in the bottom right corner of the screen,
- when the therapist again presses <Enter>, or
- for strength tests, when the falling edge of the acquired data waveform reaches 50% of the maximum (the 50% value is changeable by the administrator; see section 2.4.2)

After the acquisition has ended, the measurements for that trial are displayed at the bottom of the screen. For definitions of these measurements, see section 2.3. Only three values are displayed at one time. If there are more than three measurements for the fatigue tests, you can scroll through the list by pressing the on-screen left- and right-arrow buttons immediately above the numeric displays. At this point you must either accept or reject the trial before proceeding.

### 4.3.3. Accepting or rejecting a trial

You can accept or reject a trial only immediately after the acquisition for that trial has stopped. Click the hand-held button once to accept the trial and double-click to reject it. Additionally, pressing the on-screen ACCEPT button or simply pressing <Return> will accept the trial and pressing the on-screen REJECT button will reject the trial. If you accept the trial, the trial indicator will increment by one and you are now ready to begin a new trial or end the test. If you reject the trial, a new window appears requesting the reason for the rejection and any additional comments. After pressing OK in this window, you are now ready to begin a new trial or end the test. You should see a red "X" to the right of the trial indicator denoting a rejection for that trial.

### 4.3.4. Displaying all trial measurements

Normally, only the measurements for the current trial are displayed on the test screen. Measurements for all trials can be displayed by pressing the ALL button to the right of the READY button. A new window appears with the measurements for all trials displayed. If there are more than three measurements for the fatigue tests, you can scroll through the list by pressing the on-screen left- and right-arrow buttons immediately above the numeric displays.

If there are more than seven trials, you can scroll through the trials by pressing the on-screen up- and down-arrow buttons to the left of the numeric displays. Press OK to close the window.

After displaying all the trial measurements, you cannot enter ready mode by simply pressing <Enter>; you must either press the hand-held button or press the on-screen READY button.

### 4.3.5. Ending the test

After accepting or rejecting a trial (or before starting the first trial), you can either start another trial or end the test. There are three ways to end the current test:

1. <u>Begin the next test in the sequence</u>. This is done by either double-clicking or pressing the NEXT TEST button. Make sure to double-click; a single-click will

begin a new trial.  See section 4.2.2 for more information on following the test sequence.

2. <u>End the test and return to the Main Menu screen</u>.  This is done by pressing the END TEST button.  This will save all the trial data on the hard disk and close the test screen.  From the Main Menu screen you can either choose the next test, end the visit or perform other QMA tasks.

3. <u>Cancel the test and return to the Main Menu screen</u>.  This is done by pressing the CANCEL button.  The data will not be saved and the test can be retaken later.

Once the test has ended, there is no way to retake the test or change the test data (except if the test was canceled).  If the data was taken under the wrong test name, the mistake must be caught before the test is finished and the test should be canceled.

## 4.4. Stopwatch tests

### 4.4.1.  Beginning a trial

Before beginning a trial, it is important to make sure the title of the screen matches the test you intend to perform.  The current trial number is displayed underneath the TRIAL label at the bottom of the screen.  Before preparing the patient for the trial, press the hand-held button once to enter into ready mode.  You can also press the READY button or simply press <Enter> to enter into ready mode.  The ready button will blink slowly and, for all trials except the first, the trial indicator will increment by one.  The patient should be prepared for the test at this time.   The therapist then exclaims, "GO!" and presses the hand-held button at the same time to start the data acquisition.  Clicking in the small circle labeled GO in the bottom right corner of the screen or simply pressing <Enter> will also start the data acquisition.    .

### 4.4.2.  Ending a trial

The test can be ended by either depressing the red button, or click on "end test".

### 4.4.3.  Accepting or rejecting a trial

See 4.3.3 on accepting or rejecting options.

### 4.4.4.  Displaying trial data

Trial data can be observed by selecting the trial number  or depressing the scroll bar.

### 4.4.5.  Ending the test

See 4.3.5 on ending and continuing a test.

## 4.5. Other tests

Other tests results or simple data entry that will be associated with the visit can be made by utilizing this area.    See "adding a test" 2.1.1.

## 4.6. Correct a Test or a Visit

While visits are updated automatically and cannot be tampered with the QMA system is capable of handling or correcting problems encountered in muscle testing and the acquisition of data.     In the File menu, select Fix Tests, Finish Previous Visit or Delete Visit depending on the problem experienced in gathering information and the following examples.

***4.6.1.  A <u>muscle test</u> was completed erroneously, or perhaps no data was collected,   and    you
want to discard the data.***

.   You must be in the visit number containing the bad test.  In the main menu screen
select  **File** and then **Fix Tests**.   In the windows that appears, select the bad muscle
test using the selection box on the left.  Then press the <u>DELETE</u> button on the right.
This muscle can now be re-tested from the main menu screen.

***4.6.2.  A <u>muscle test</u> was completed (with valid data) under the wrong muscle name.***

You must be in the visit number containing the misnamed test.  In the main menu
screen select  **File** and then **Fix Tests**.   In the windows that appears, select the wrong
muscle name that the test was completed under using the selection box on the left.
Then press the <u>MOVE</u> button on the right.   Then, using the selection box on the right,
select the proper name for the test.  The second name you select must <u>NOT</u> have been
tested already in this visit.

***4.6.3.  Two <u>muscle tests</u> were completed (with valid data) under the wrong muscle names, and the
data must be swapped.***

Same as example #2- with the following exception:  select <u>SWAP</u> instead of
MOVE after the first test has been selected.

***4.6.4   A <u>visit</u> was completed accidentally with erroneous (or no) data and it needs to be deleted.***

If you are in the visit you want to delete, first end the visit.  Then select **File** and
then **Delete Visits**.  Select the screen number and the visit number of the bad visit and
press OK.  If the deleted visit is the most recent visit for that patient, that patients
visit number will be properly updated.  If the deleted visit is not the most recent, the
more recent visits will not be renumbered.

***4.6.5.  A visit was partially completed (with valid data) but ended prematurely, and needs to be
fully completed***

Select File and then Finish Previous Visit.  Enter the screen number of the patient
in the prompt that appears.  Then select the visit that needs to be completed in the
screen that appears.

***4.6.6.  Our Tech support is on call for those problems we have not encountered - 800/ 909-0158.***

## *4.7  Errata Sheets*

***4.7.1.  Areas are available throughout the tests for the physical therapist to make comment.
These comments are made a part of the visit the specific test and the acquired data.***

***4.7.2.  Notes can be attached to visits by setting up a test in the protocol under the fifth test
category (OTHER).  This would permit keyboard entry for each visit, and is not muscle specific.***

# 5. Checking / Performing Calibration - Select *Check Calibration*

## 5.1. Performing a simple measurement

To make a simple measurement, first release any stress or weight and select *Check Calibration*, then *No-Load*, this will zero the system.   Then select *measure*, and place the load to measure appropriately.

## 5.2. Performing a no-load calibration

To zero the system, remove all stress or weights. and select  *No Load*.

## 5.3. Checking and Altering ("Tweaking") the calibration

To permit fine tuning of the system, "Tweaking" may be  selected.
1. Unload the Load Cell.
2. Hang an accurate weight & enter its value.  (the heavier, the better)
3. The *measured weight* then can be adjusted to the exact value of the hanging weight.

## 5.4. Reverting back to the default calibration

In the event entries have been made that are totally erroneous, the original settings of the system can be retrieved by selecting *Back to Default* .

## 5.5. Full calibration for the strain gauge (administrators only)

The accuracy of the system has been certified by an agent of the GA Dept. of Agriculture -Scales and Weight.    The functionality of this section currently remains, and is self explanatory in its method of action, but its utilization should be used with caution.

Calibration Problem - We suggest you call the TCS help desk – 770/ 983-1369 or leave a message on the WEB at   support@QMASystem.com.

## 6. File Structure and Format

Each Patient has a unique information directory sorted by screen number under the **DATA** directory, found within the **QMA** directory, and can be accessed through **Notepad, Wordpad, and MS Word**.

Each visit of that patient opens a new directory under his screen number, with the data of that visit building individual files and a summary file of the requested data of each test. All files are stamped with time and date.

NOTICE: The current protocol in use by QMA may not be transferred or replaced.  Make a new protocol, close QMA, & then copy desired protocols.