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Dynamic Muscle Analysis + High-Throughput 611A | 612A

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1 Introduction

The 611A Dynamic Muscle Analysis (DMA) software was designed to enable physiology researchers to study the dynamic mechanical characteristics of muscle tissue. The system is capable of analyzing data from all of our data acquisition products, including Dynamic Muscle Control (DMC) and 600A Digital Controller.

DMA has an easy-to-use graphical user interface and is written using the LabVIEW programming language. The software analyzes the data recorded by our data acquisition products, and produces muscle data, work loop data, and time derivative data. Collected data can be plotted and analyzed within the program's many windows.


2 Quick Start Guide

This guide will help you get started fast, by explaining how to complete some of the most common tasks you'll need to get the most out of your new Dynamic Muscle Analysis software.

2.1 Instrument Setup

The 611A Dynamic Muscle Analysis Software should have been shipped to you on a DVD Disc labeled "615A Dynamic Muscle Control and Analysis Software Suite".

Place the PC to be used with the DMA software wherever it is convenient for you to analyze data. The normal criteria for locating a PC should be followed including ensuring adequate ventilation for cooling along with protection from water, dust, dirt, vibration and shocks. Install the software from the DVD by inserting the DVD into the DVD drive on your PC and following the on-screen directions.

 *NOTE: If you purchased the DMA software with a 601A Windows PC then both the PC and DMA were completely configured at our factory and you do not need to install any software.*

The DMA software runs under Windows, and therefore most Windows compatible software should run without issue on the same PC with DMA. However, we do not recommend running other software at the same time as DMA due to the performance requirements of DMA.

2.1.1 Turning on the PC and Using the Desktop

Once all components of the system have been connected together in the correct manner turn on the PC (power switch is located on the front panel). Turn on the monitor as well. The PC should go through the normal power on self-tests and then the Windows operating system should be loaded.

After installing the DMA software via the DVD, you will find the following icons on the Windows Desktop:

DMCv5.500:	Used to start the Dynamic Muscle Control Software.
DMAv5.300:	Used to start the Dynamic Muscle Analysis Software.
NI MAX:	Used to start the National Instruments Measurement and Automation Explorer tool. This tool allows you to verify correct operation of the A/D Card in the event of system malfunction.
DMCv5 Example Protocols:	A file folder containing example protocols for DMC.

 *NOTE: Version numbers may not match exactly with the ones found here.*

2.1.2 Starting the 611A DMA Program

To start the 611A DMA program click on the icon labeled DMAv5.300.

When the program starts you may be asked to activate the software before continuing. If so then please see Section 4.2 *Software Activation* of this manual. Once you've activated your copy of DMA, you will be presented with the main window. This window can be repositioned, maximized, minimized and stretched using the normal Windows controls for manipulating the display window. The main page provides access to all of the menu items and also contains a large graphing area for the display of data recorded during a

test in DMC or 600A. A menu bar is located along the top of the screen that includes the following main menu headings.

File High Throughput Help

Clicking on any menu item opens a drop-down menu that lists the commands available under the selected heading. A detailed description of each command is provided in the next chapter.

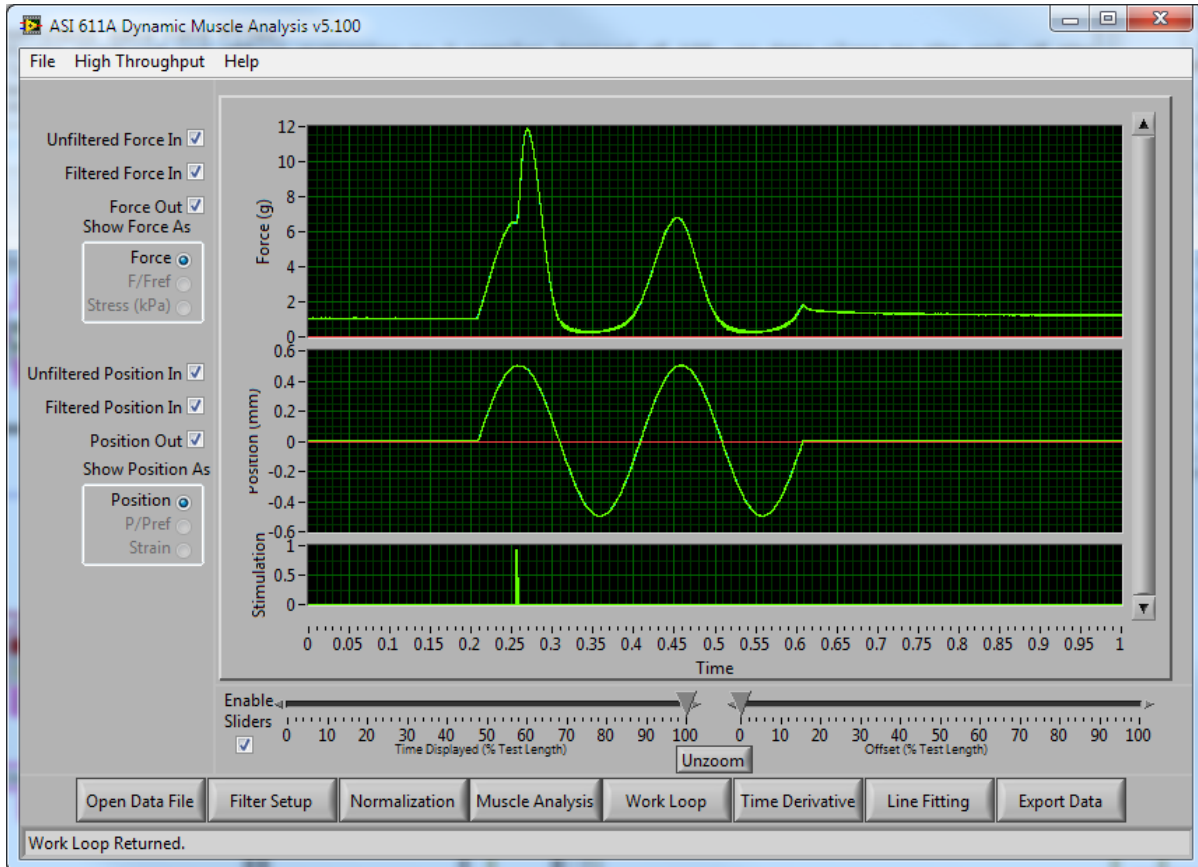


Figure 1: 611A DMA Main Window

Located near the bottom of the main screen are a series of buttons labeled: Open Data File, Filter Setup, Normalization, Muscle Analysis, Work Loop, Time Derivative, Line Fitting and Export Data. These buttons are used to open data files, setup the filter parameters, apply normalization to the data, open the Analysis window for analysis of the data on screen, do work loop analysis, do time-derivative analysis, line-fit the data, and produce text output data files, respectively. Also located at the left of the screen are several controls that select what data is displayed in the main graph area to the right.

2.2 Using the 611A DMA Program

This section will cover the main steps required to analyze test data, and export the calculated values. Once you have completed this Quick Start Guide you will be familiar with the operation of the program. More complete details about using the program are provided in chapter 4.0.

The following procedure will guide you through the basic operation of the DMA software.

- 1) Turn on the PC, log in, and start the 611A program (see Section 2.1.1 Turning on the PC and Using the Desktop).
- 2) Click the Open Data File button to load a data file recorded previously by DMC or 600A.
- 3) Close the File Information Window which pops up to show the comments recorded with the file.
- 4) Ensure your data is shown on the graph to the right.
- 5) Using the slider controls, position your data within the window such that the signal of interest is shown with baseline data on either side.
- 6) Click the Filter Setup button.
- 7) Use the Cutoff Frequency and Falloff Order controls to adjust the filter to clean up the data. By default, the cutoff frequency is set to 1/3 of your sampling frequency.



NOTE: The filter cutoff must be less than 1/2 of sampling frequency.

- 8) Once you're happy with the settings (and the filtered signal shown in the bottom graph), click Save Changes.
- 9) Click the Muscle Analysis button.
- 10) The Muscle Analysis window shows various statistics about the displayed data, see Figure 2.

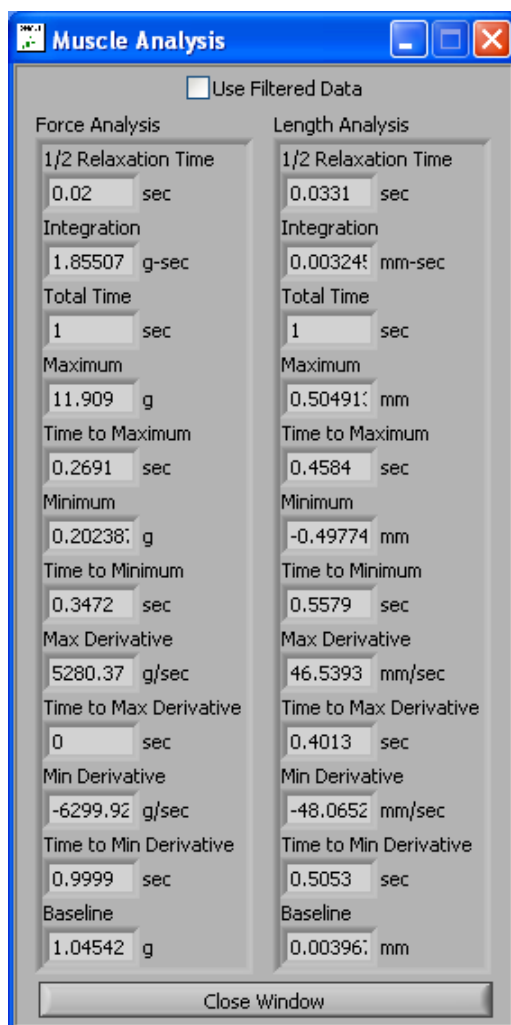


Figure 2: Muscle Analysis Window

- 11) A checkbox at the top of the Muscle Analysis window allows you to switch between statistics generated on the filtered or the unfiltered data.
- 12) The different windows of DMA are designed to be able to be left open while using other parts of the program. For example, you can adjust the sliders on the main window and immediately see the changes in the Muscle Analysis window.
- 13) The Muscle Analysis window can be closed by selecting the Close Window button at the bottom of the Muscle Analysis window, or by clicking the X in the top right corner of the window.
- 14) Click the Export Data button on the Main Window to open the Export Data window, see Figure 3.

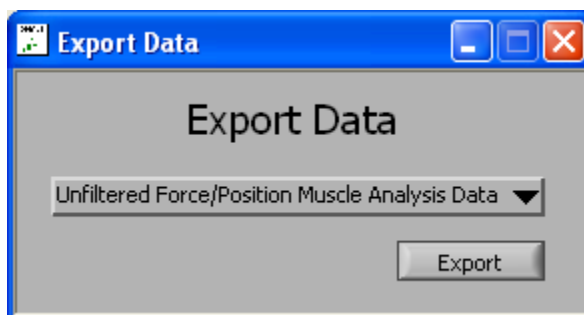


Figure 3: Export Data Window

- 15) The Export Data window is used to export the data from the various windows of DMA to an ASCII text file, which can be read by many other programs including: Excel, MatLab, Maple, SAS, or your favorite statistical analysis program. To export a particular screen, use the pull-down menu to select the data you wish to export, and then click the Export button.
- 16) You will be asked to provide a file name and path to export the data to. Select your preferred location, and click Save. The program will export your data to the selected file.
- 17) The 611A DMA Program should be closed by clicking on Exit found under the File menu.

3 General Operating Procedure

The 611A Dynamic Muscle Analysis program uses a familiar Windows-type interface that consists of a main window containing a graphics window, control buttons, checkboxes and radio buttons. The main window can be moved, re-sized, minimized, maximized and closed by clicking on the various window controls provided. In the upper right corner of the window are minimize and maximize buttons. Clicking anywhere on the window will bring focus to the window. The window can be dynamically re-sized by clicking on a border or a corner of the window. DMA can be started from the Windows file browser environment by double-clicking on a DMC Data File (*.ddf), similar to how Microsoft Word can be started by double-clicking on a Word Document. Details of the main program window and program operation will be presented in the following sections.

3.1 Main Screen

The main screen consists of a menu bar at the top, a large graphics window located in the centre, a number of control buttons, checkboxes, radio buttons, and sliders (see Figure 4).

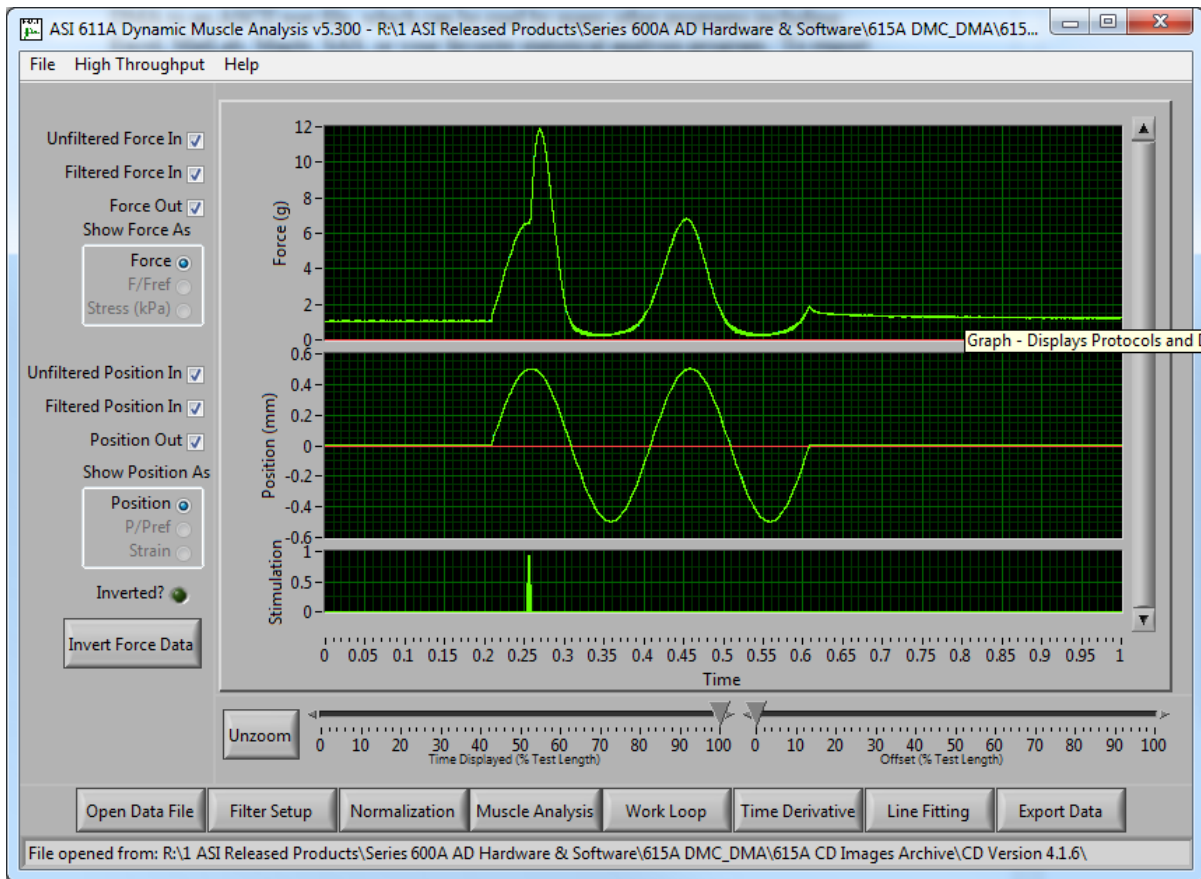


Figure 4: 611A DMA Main Window

3.1.1 Graphics Window

The graphics window is used to plot length, force and stimulation measured from the muscle tissue. The graph consists of time along the x-axis, force on the upper graph, length on the centre graph, and stimulus on the lower graph. The filtered input, unfiltered input, and output traces are plotted in

different colours. The appearance of the graph can be changed by: dragging the horizontal grey bars between the graphs to resize them, by clicking the Show/Hide trace checkboxes, and by using the sliders located below them to pan and zoom the window to get a better look at the data. The program automatically scales the display axes to the range of the collected data.

3.1.2 Control Buttons

The main screen includes ten control buttons. These buttons are: Open Data File, Filter Setup, Normalization, Muscle Analysis, Work Loop, Time Derivative, Line Fitting, Export Data, Invert Force Data and Unzoom (see Figure 4).

3.1.2.1 Open Data File Button

The Open Data File button is used to open a file selection window to choose the data file you wish to analyze. You can open data files from DMCv4.x, DMCv5.x, 600A v2.x, and 600A v3.x.

3.1.2.2 Filter Setup Button

The Filter Setup button is used to open the Filter Setup window. This window is used to set the cutoff frequency and falloff order of the 2-pass Butterworth filter.

3.1.2.3 Normalization Button

The Normalization button is used to open the Normalization setup window. This window is used to set the reference values for calculating L/L_{ref} , F/F_{ref} , Stress and Strain. It will be prepopulated with values from the data file if they're available, otherwise, they can be entered here manually.

3.1.2.4 Muscle Analysis Button

The Muscle Analysis button is used to open the Muscle Analysis window. This window provides various statistics about the data selected on screen in the main window.

3.1.2.5 Work Loop Button

The Work Loop button is used to open the Work Loop window. This window is used on sinusoidal data to calculate a work loop. It is described in more detail in Section 3.3 *Work Loop Analysis*.

3.1.2.6 Time Derivative Button

The Time Derivative button is used to open the Time Derivative window. This window is used to calculate rate-of-change data from your test. It is described in more detail in Section 3.4 *Time Derivative Window*.

3.1.2.7 Line Fitting Button

The Line Fitting button is used to open the Line Fitting window. This window is used to fit a linear or exponential curve to a selected section of your test data. It is described in more detail in Section 3.5 *Line Fitting Window*.

3.1.2.8 *Export Data Button*

The Export Data button is used to open the Export Data window. This window is used to export data from each of the processing windows to a data file. These data files can be read by Excel, MatLab, Maple, SAS, or other statistical analysis software packages.

3.1.2.9 *Invert Force Data Button*

The Invert Force Data button is used to invert the force data. The DMA software will automatically invert the Force Data if a negative direction contraction is detected. You can click this button to manually return it to the original or invert if the algorithm has done the wrong thing.

3.1.2.10 *Unzoom Button*

The Unzoom button is used to return the pan and zoom sliders to their default position to view the entire data file.

3.1.3 Checkboxes and Radio Buttons

Six checkboxes and six radio buttons can be found on the main screen.

The six checkboxes provide the user with the ability to switch on and off the display of each trace. The user may find it easier to see the traces they're interested in by turning off the visibility of the others.

The six radio buttons only become active after the normalization parameters are set using the Normalization window. The radio buttons allow the user to select how to display the Force/Position data, as unitized Length, unitized Force, normalized Length, normalized Force, Stress, or Strain.

3.2 Main Menu

The main menu consists of the following three headings which will be described in the rest of this chapter.

File High Throughput Help

3.2.1 File Menu

The File menu contains commands to open data files, show file information, and exit the program.

3.2.1.1 *Open ASI Data File*

Opens a file dialog to select an Aurora Scientific data file to analyze. This file can come from DMCv4.x, DMCv5.x, 600Av2.x, or 600Av3.x.

3.2.1.2 *Open ASCII Data File (disabled)*

This item is currently disabled and will be added in the future.

3.2.1.3 *Show File Info*

Opens the file information window. This window displays information collected with the data including: the data rate, and comments recorded at the time of the test.

3.2.1.4 *Exit*

Closes the 611A DMA Program.

3.2.2 High Throughput Menu

The High Throughput Menu is unique. Until the user has licensed their copy of High Throughput, the menu will contain only a single item, which allows them to license High Throughput. Once High Throughput has been licensed, the menu contains the following five items.

3.2.2.1 *Force-Frequency Analysis*

Opens the High Throughput window in Force-Frequency analysis mode.

3.2.2.2 *Force-Time Analysis*

Opens the High Throughput window in Force-Time analysis mode.

3.2.2.3 *Position-Time Analysis*

Opens the High Throughput window in Position-Time analysis mode.

3.2.2.4 *Fatigue Analysis*

Opens the High Throughput window in Fatigue analysis mode.

3.2.2.5 *About DMA-HT*

Provides information about the 612A DMA-HT module including contact information for Aurora Scientific and the program version number.

3.2.3 Help Menu

The Help menu contains two commands: Topics and About.

3.2.3.1 *Topics*

Opens the 611A DMA Help File.

3.2.3.2 *About*

Provides information about the 611A DMA Program including contact information for Aurora Scientific and the program version number.

3.3 Work Loop Analysis

The Work Loop window provides an interface for instantly calculating work loop data from sinusoidal tests. The Work Loop window populates its topmost graph with the currently loaded test data from the main window. Using the cursors on the graph, and the pull down menus below the graph, the user can select what portion of the test data to use to create the work loop graph. The work loop graph updates instantly when the cursors are moved.

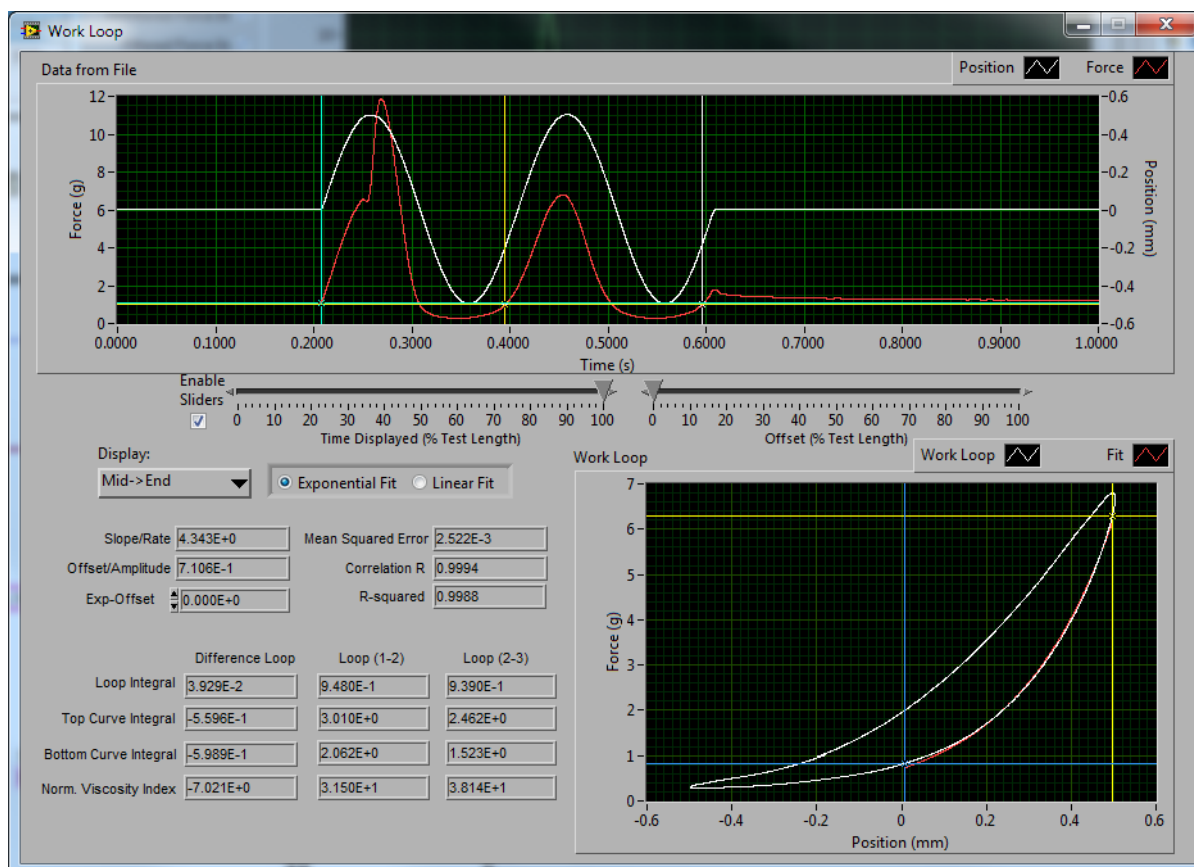


Figure 5: Work Loop Window

3.3.1 Calculating Work Loops

The following procedure will guide you through using the Work Loop window.

- 1) Load a data file, and click on the Work Loop button.
- 2) The Work Loop window will open and data will be preloaded on the screen.
- 3) Set the three cursors to enclose your data of interest. Blue is the start cursor, Yellow is the mid cursor, and White is the end cursor.
- 4) Notice that the Work Loop graph on the bottom right updates as you drag the cursors around, and the calculated numbers shown on the left side of the window are updated to reflect your selection.
- 5) To export work loop data first close the Work Loop window and then click Export Data. The calculated work loop data will be stored in the text file.

3.4 Time Derivative Window

The Time Derivative window is used to calculate the first derivative of the Position and Force signals. Using the cursors in the data, and the controls at the left, the user can control what data the derivative is being calculated on, as well as what type of derivative. Setting the segment length to a non-zero number and using a linear fit in segments may aid in getting a cleaner derivative signal given noisy input data.

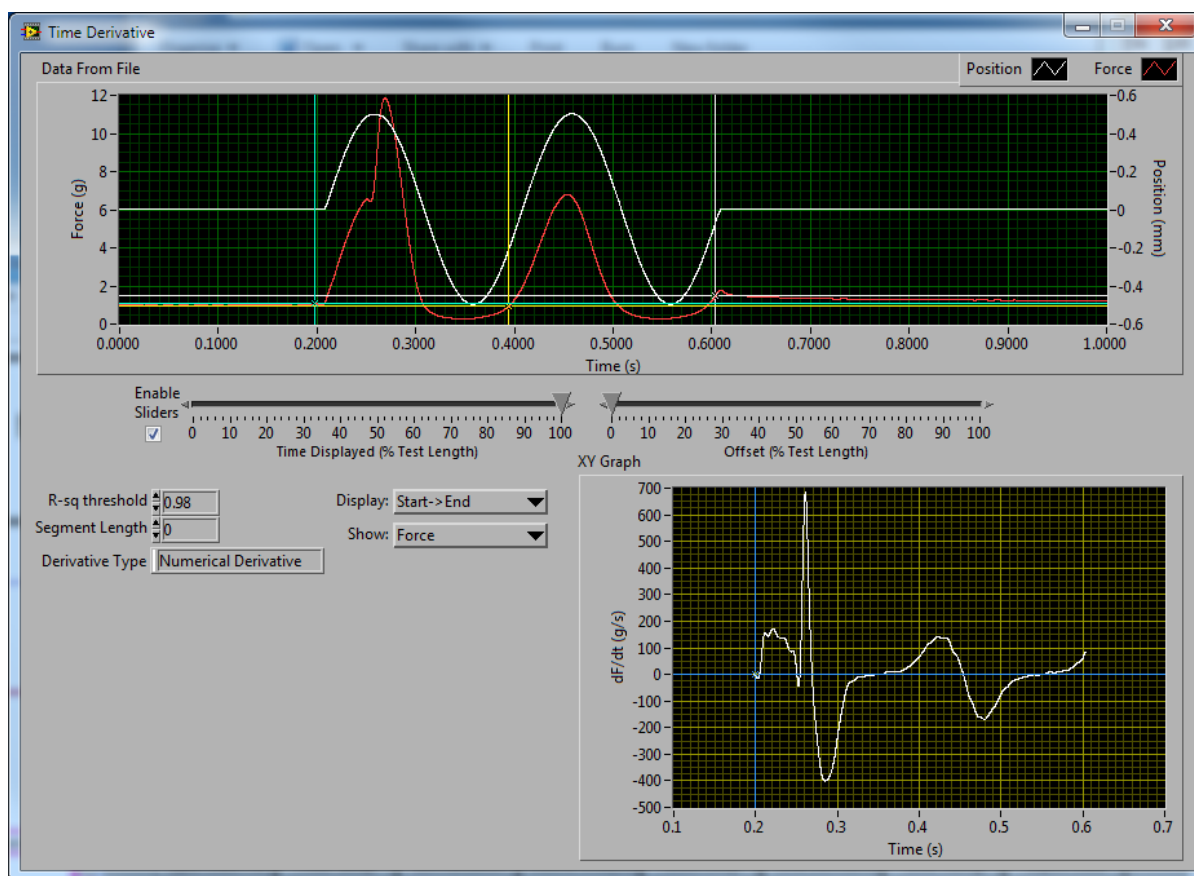


Figure 6: Time Derivative Window

3.4.1 Calculating Time Derivatives

The following procedure will guide you through using the Time Derivative window.

- 1) Load a data file, and click on the Time Derivative button.
- 2) The Time Derivative window will open and data will be preloaded on the screen.
- 3) Set the three cursors to enclose your data of interest. Blue is the start cursor, Yellow is the mid cursor, and White is the end cursor.
- 4) Notice that the Time Derivative graph on the bottom right updates as you drag the cursors around, and as you change the controls at the left.
- 5) Closing the window and clicking Export Data will allow you to Export all of the data values from this window to a text file.

3.5 Line Fitting Window

The Line Fitting window is used to fit a linear or exponential fit to the Force or Position traces. Using the cursors in the data, and the controls at the bottom, the user can control what data the fit is being calculated on, as well as the type of fit. Position traces can only be fitted with a linear fit.

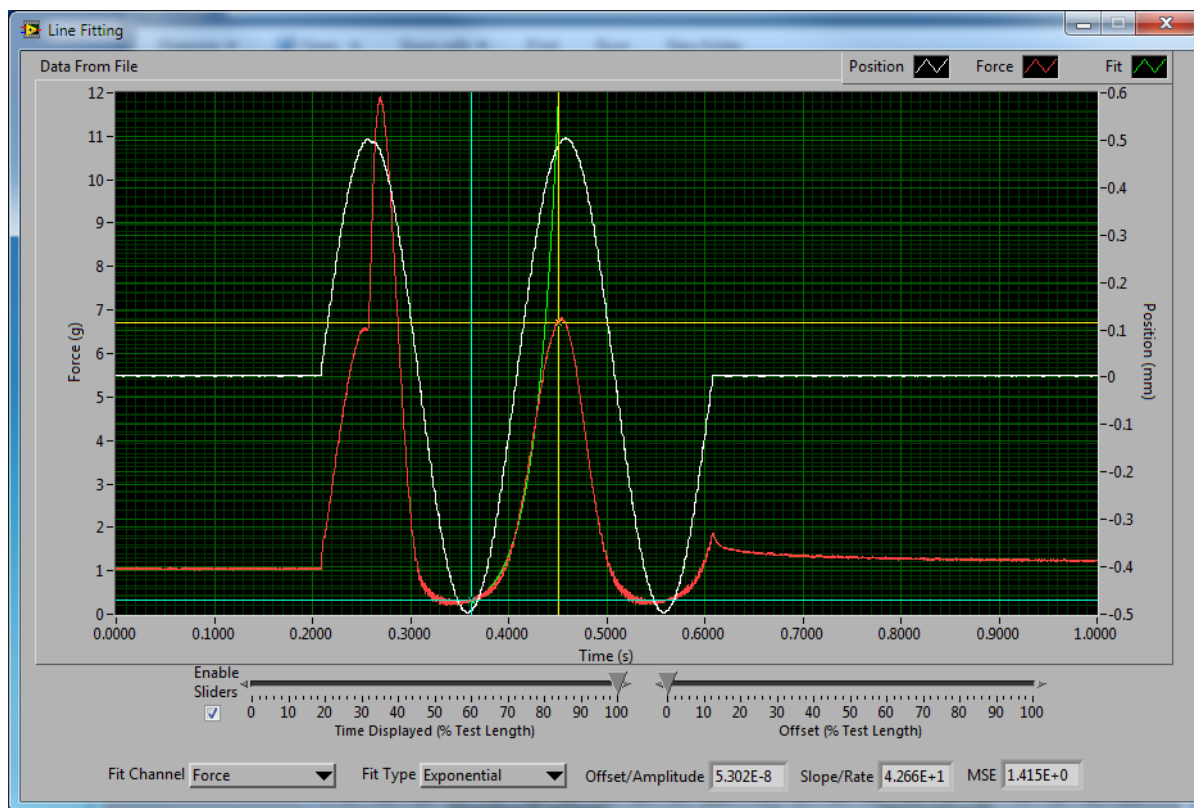


Figure 7: Line Fitting Window

3.5.1 Calculating a Line Fit

This procedure will guide you through calculating a line fit.

- 1) Load a data file, and click on the Line Fitting button.
- 2) The Line Fitting window will open and data will be preloaded on the screen.
- 3) Set the two cursors at the points you wish the fit to start and end. Blue is the start cursor, Yellow is the end cursor.
- 4) Notice that the green fit trace on the graph updates as you drag the cursors around, and change the controls at the bottom.
- 5) Closing the window and clicking Export Data will allow you to Export the fit data from this window to a text file.

3.6 High Throughput Module – 612A

The High Throughput module is used to analyze a large number of data files at one time. High Throughput automatically places cursors in your data files, calculates muscle analysis data for a list of files and displays the results in a tabular format. Each file's cursors can be manually adjusted afterwards, or the user can optionally disable automatic cursor placement instead opting to manually set the cursors for all data files in the experiment. The columns calculated can be selected from a list of possible columns. Lines are colour-coded in the results to signify failures of different types.

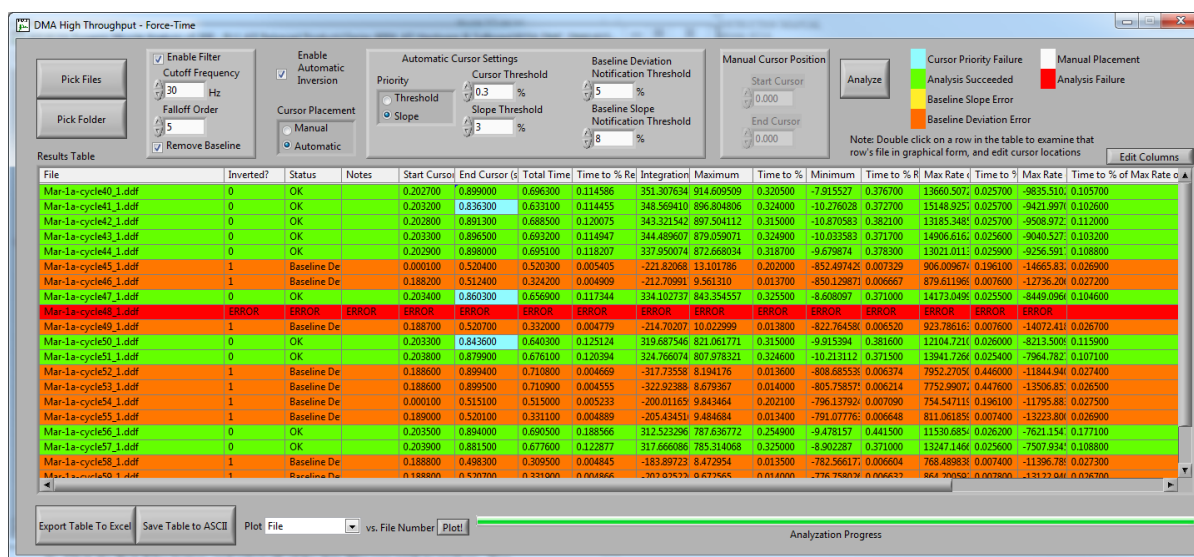


Figure 8: High Throughput Window

3.6.1 Using High Throughput

The following procedure will guide you through using High Throughput to analyze your data.

- 1) Use the High Throughput menu to select the appropriate high throughput module for your analysis.
- 2) The High Throughput window will open.
- 3) Click the Pick Files button, and select all of the data files you wish to analyze. You can use your mouse to click and drag over a group of files, or you can hold the Ctrl button on your keyboard while clicking individual files to build your selection. Click Open when you've selected all of the desired files. Alternatively, you can use the Pick Folder button to select all .ddf files in a given folder.
- 4) You will notice the table will populate with your data files. You may need to use the scroll bars to see all of the files you have selected.
- 5) Set your desired filter cutoff frequency and falloff order. Be sure to observe Nyquist.
- 6) Select your cursor placement method. Automatic will attempt to place the cursors within your file so as to enclose your data, while Manual will enable the two Cursor boxes to the right. Entering a timestamp in those boxes will fix the cursors in all files to that specified start and end times.

- 7) If you've selected to use automatic cursor placement, you can set the threshold values that control the start and end cursors. Using higher percentages will move the cursors toward your contraction, and lower percentages will move the cursors away from your contraction. Setting these values too low or too high will result in unreliable automatic cursor placement.
- 8) You can also use the Edit Columns button to define the desired column order, as well as to define how those columns should be calculated. In addition, you can use custom columns based off of subsections of the file name for sorting purposes. For example, if your file name contains the animal identifier, you can pull that out as a separate column.
- 9) Click Analyze.
- 10) You will see the progress bar at the bottom advance as each file is analyzed, and once complete, you will see that the table has populated itself with the calculated numbers for each file you selected. If the automatic cursor placement fails, or your manual placement is invalid, the line will turn red to show the error, and not calculate data.
- 11) You can edit the cursor locations in a single file, or simply view a single file's traces by double clicking on its row in the table.
- 12) Using the Plot spin control at the bottom of the screen, you can select a field from the table, and click the plot button to plot a graph of the table in terms of that field vs row number.
- 13) You can use the button labeled Export Table to Excel to open an Excel window which will be pre-populated with all of the data from the table. Note: this function only works if you have Microsoft Excel on your PC.
- 14) If you do not have Excel, you can use the button labeled Save Table to ASCII to save the table to an ASCII text file. This file can then be imported into statistical analysis programs such as Maple, MatLab, etc.

3.6.2 Editing Columns

The Edit Columns window allows the user to edit how their columns are calculated, and which columns to display in what order. Some columns are mandatory and cannot be removed. The rest are optional, and many have options available for how to calculate them. In general, most columns allow you to select the range on which they are calculated by the Start Cursor, Start of Stim, Peak Force, End of Stim or End Cursor. Some columns allow you to set threshold percentages for the value computed. Columns can be reordered by simply dragging and dropping them into the desired order.

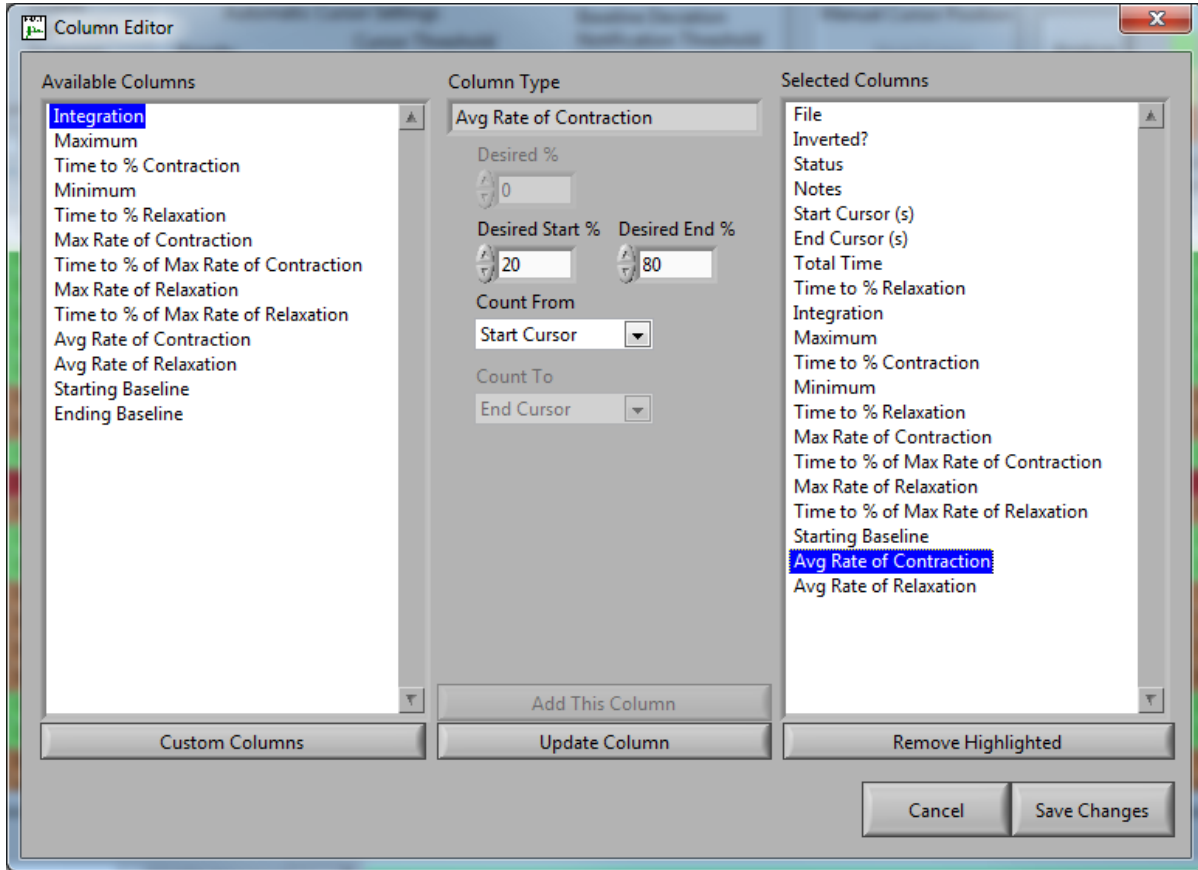


Figure 9: Edit Columns Window

4 Calibration, Instrument Tuning and Maintenance

4.1 Calibration

See the 610A Dynamic Muscle Control Manual for details on Calibrating your instruments for use with DMC/DMA.

4.2 Software Activation

The 611A Dynamic Muscle Analysis software must be activated before it can be used. Activation allows us to provide you with superior service and product updates.

To activate the software, you will need your serial number, and product key. These can be found on the foil S/N tag affixed to the PC or to the jewel case containing the software DVD. Below is an example of these.

Serial: 1501001

Product Key: A4AWOP

Upon starting the software for the first time, you will be presented with the software activation window.

Please complete the following procedure to activate your Aurora Scientific software.

- 1) Enter the Serial number and Product Key. The program will return a 15 character activation key, copy or write this down.
- 2) On a PC with internet access, point your web browser to:
<http://www.AuroraScientific.com/activate>
- 3) Enter the Activation Code unique to your computer returned by the program, your contact details and then click on the Activate! Button.
- 4) Copy or write down the 16 character license code returned by the webpage. The code is unique to your computer and cannot be used on another machine. Additional licenses must be purchased for use on multiple machines.
- 5) Enter the license code on the activation window to complete the activation process.
- 6) Once complete, exit and reopen the application.
- 7) Repeat as required for additional Aurora Scientific software.

Should you encounter any issues with this procedure, please contact Aurora Scientific by phone or email, and we will be happy to help you with this process.

4.3 Updating to a New Version of the 611A DMA Program

This section provides a brief description of the procedure required to update to a newer version of the 611A program.

Aurora Scientific is striving to make 611A the best program for the analysis of muscle mechanics experiments. We are pleased to receive user comments about the program and suggestions for new functions. As a result of this pursuit, we periodically release new versions of the software.

New versions of 611A are available from our website at <http://www.aurorascientific.com/update/>.

Once you have received a new version of the program please follow the procedure listed below to update your program.

- 1) Close all open programs.
- 2) Copy the supplied update file to the PC to be updated
- 3) Run the setup.exe file found in the update package.
- 4) Follow the on-screen directions to complete the installation process.
- 5) You may be asked to reboot the computer upon completion. Do so if requested.

This completes the update procedure. In order to check that the update has been installed correctly start the program and click on Help > About. Compare the version number listed on the About screen with that shown in the update file name. If they are the same then you have successfully updated to the latest program version. If you experience any difficulties while updating your system please contact Aurora Scientific.

5 Performance Guarantee, Technical Support, Warranty and Repair Information

Aurora Scientific is dedicated to providing you with products that allow you to meet your research goals. For this reason we offer a performance guarantee, technical support and a new product warranty. Our performance guarantee ensures you purchase the correct instrument for your research. Technical assistance is always free and will be available for the life of your product. If you do have a problem with a product then please know that all Aurora Scientific products are covered by a three-year warranty covering both parts and labour. If you need to return a product to us for repair then consult the final section of this chapter for returns information.

5.1 Performance Guarantee

Our performance guarantee states: if for any reason a new product does not meet your research needs then you can return it to Aurora Scientific for exchange or a full refund. The performance guarantee only applies to new products and must be exercised within 60 days of receipt of the instrument.

5.2 Technical Support

Technical assistance is always free and will be available for the life of your product. Please don't hesitate to contact us if you have any technical support issues. Contact us by telephone, email, fax, or regular mail.

5.3 Technical Support Contact Information and Return Shipping Addresses

Canada, USA, South America, Middle East, Africa

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L4G 1X6

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Web Site: www.AuroraScientific.com

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Web site: <http://www.kantoh-elec.co.jp>

5.4 Warranty

Products manufactured by Aurora Scientific Inc. are guaranteed to the original purchaser for a period of three (3) years. Under this warranty, the liability of Aurora Scientific is limited to servicing, adjusting and replacing any defective parts that are of Aurora Scientific manufacture. Aurora Scientific is not liable to the customer for consequential or other damages, labour losses or expenses in connection with or by reason of the use or inability to use the products manufactured by Aurora Scientific.

Guarantee of parts and components not manufactured by Aurora Scientific shall be the same as the guarantee extended by the manufacturer of such components or parts. Where possible such parts returned to Aurora Scientific will be sent to the manufacturer for credit or replacement. Ultimate disposition of these items will depend upon the manufacturer's decision.

All shortages must be reported within ten (10) days after receipt of shipment.

Except where deviations are specified in literature describing particular products, the limited warranty above is applicable to all Aurora Scientific products, provided the products are returned to Aurora Scientific and are demonstrated to the satisfaction of Aurora Scientific to be defective.

Transportation costs of all products returned to Aurora Scientific must be borne by the customer and products must be returned to Aurora Scientific within three years after delivery to the original purchaser. Aurora Scientific cannot assume responsibility for repairs or changes not authorized by Aurora Scientific or damage resulting from abnormal or misuse or lack of proper maintenance.

Repair or service work not covered under the limited warranty will be billed at current service rates.

NO EXPRESS WARRANTIES AND NO IMPLIED WARRANTIES WHETHER FOR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE, OR OTHERWISE OTHER THAN THOSE EXPRESSLY SET FORTH ABOVE WHICH ARE MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, SHALL APPLY TO PRODUCTS SOLD BY AURORA

SCIENTIFIC INC, AND NO WAIVER, ALTERATION OR MODIFICATION OF THE FOREGOING CONDITIONS SHALL BE VALID UNLESS MADE IN WRITING AND SIGNED BY AN EXECUTIVE OFFICER OF AURORA SCIENTIFIC INC.

5.5 Returning Products to Aurora Scientific for Repair

There are a few simple steps that must be completed before returning your product to Aurora Scientific.

1. Obtain a Return Material Authorization number (RMA#).

Contact our technical support department to obtain a RMA #. We require the serial number of the product along with your contact information, i.e. your name, institution, phone number and email address.

2. Package your instrument.

Use the original packaging materials if available. If you do not have original packaging then ensure that the product is wrapped in bubble pack and placed in a sturdy corrugated cardboard box. If you are returning a force transducer please place the transducer head in the plastic protective box and then wrap the plastic box in bubble pack and place it in a small cardboard box which can then be placed in the larger box along with the electronics. For force transducer repairs we require both the transducer head and the control electronics. Please don't send the power cord. When returning a muscle lever system wrap the motor in bubble pack and place it along with the lever arm in a small cardboard box and then place that box in the larger shipping container along with the controller. For muscle lever repairs we require the motor, lever arm, motor cable and control electronics. Please don't send the power cord.

3. Prepare Customs documents.

Canadian Clients: no customs documents are required, skip to step 4.

European Clients: no customs documents are required, skip to step 4 and ship to Aurora Scientific Europe.

Asia, Australia and New Zealand Clients: no customs documents are required, skip to step 4 and ship to Aurora Scientific Asia.

USA and Rest of the World Clients: You must include a Commercial Invoice (CI) with the shipment. Please click this link to download a blank CI.

You can also prepare the commercial invoice yourself instead of using the downloadable form. Print the document on your company's letterhead and include the following information: Date, Shipper's Name, Address and Phone Number (your company information), Consignee's Name, Address and Phone Number (Aurora Scientific Inc. is the Consignee), Country of Origin of Goods (this will be Canada if you purchased the instrument from Aurora Scientific or USA if your product was purchased from Cambridge Technology), Conditions of Sale (include the following statement: GOODS RETURNING TO FACTORY FOR REPAIR, TEMPORARY IMPORT), Number of Packages (normally 1), Description of Goods (e.g. Model 300B Muscle Lever System, Serial Number 1111), Quantity of Each Item (normally 1) and Value for Customs Purposes (the original purchase price of the instrument).

Place three (3) copies of your CI in an envelope and mark the outside CUSTOMS PAPERS ENCLOSED. Attach the envelope to the outside of the box.

4. Choose a shipper and prepare the waybill.

European Clients: ship your instrument to Aurora Scientific Europe in Dublin, Ireland.

Asia, Australia and New Zealand Clients: ship your instrument to Aurora Scientific Asia in Hong Kong.

Canadian, USA and all other Clients: ship your instrument to Aurora Scientific in Ontario, Canada.

You may ship your instrument back to us via the courier of your choice or via parcel post. If possible we prefer that you ship via FedEx. You are responsible for both the shipping and brokerage charges so please mark the waybill accordingly. Please don't ship freight collect. Shipments sent freight collect will be received but you will be invoiced for the shipping charges when your instrument is returned.

5. Prepare and send a purchase order.

After we receive the instrument we will evaluate it and contact you with the estimated repair cost. We require a purchase order before we can repair and return your instrument. Please fax or email us the purchase order at your earliest convenience.

6 Specifications

Minimum Requirements for the PC

Processor: Dual-core Intel or AMD
RAM: 2 GB
Hard Disk: 40 GB
Operating System: Windows XP

Recommended PC Specifications

Processor: Quad-core Intel or AMD
RAM: 4 GB
Hard Disk: 500+ GB
Operating System: Windows 7, 64 bit

Operating System

Type: Windows XP/Vista/7/8

7 Appendices

7.1 Appendix A – 611A Muscle Analysis Data File Structure

```
DMAv5.0 Muscle Analysis Data File
Source Data File: C:\Documents and Settings\ASI\Desktop\dcmsin1.dat
Filtered Data?: N
Start Sample: 0
End Sample: 10000
Data:
Force 1/2 Relaxation Time: 2.000000E-2 sec
Force Integration: 1.855068E+0 g-sec
Force Total Time: 1.000000E+0 sec
Force Maximum: 1.190900E+1 g
Force Time to Maximum: 2.691000E-1 sec
Force Minimum: 2.023875E-1 g
Force Time to Minimum: 3.472000E-1 sec
Force Max Derivative: 5.280370E+3 g/sec
Force Time to Max Derivative: 0.000000E+0 sec
Force Min Derivative: -6.299924E+3 g/sec
Force Time to Min Derivative: 9.999000E-1 sec
Force Baseline: 1.045422E+0 g
Position 1/2 Relaxation Time: 3.310000E-2 sec
Position Integration: 3.245193E-3 mm-sec
Position Total Time: 1.000000E+0 sec
Position Maximum: 5.049133E-1 mm
Position Time to Maximum: 4.584000E-1 sec
Position Minimum: -4.977417E-1 mm
Position Time to Minimum: 5.579000E-1 sec
Position Max Derivative: 4.653931E+1 mm/sec
Position Time to Max Derivative: 4.013000E-1 sec
Position Min Derivative: -4.806519E+1 mm/sec
Position Time to Min Derivative: 5.053000E-1 sec
Position Baseline: 3.967285E-3 mm
```

7.2 Appendix B – 611A Work Loop Data File Structure

```
DMAv5.0 Work Loop Data File
Source Data File: C:\Documents and Settings\ASI\Desktop\dcmsin1.dat
Cursor 1 Index: 2.074000E+3
Cursor 2 Index: 3.951000E+3
Cursor 3 Index: 5.963000E+3
Top Loop Integral (1-2): 3.191071E+0
Bottom Loop Integral (1-2): 2.291138E+0
Loop Integral (1-2): 8.999330E-1
Norm. Viscosity Index (1-2): 2.820160E+1
Top Loop Integral (2-3): 2.609667E+0
Bottom Loop Integral (2-3): 1.612270E+0
Loop Integral (2-3): 9.973971E-1
Norm. Viscosity Index (2-3): 3.821933E+1
Top Loop Integral (Difference): -6.123944E-1
Bottom Loop Integral (Difference): -6.149121E-1
Loop Integral (Difference): 2.517745E-3
```

Norm. Viscosity Index (Difference): -4.111312E-1
Start Cursor Position X: 1.921772E-3
Start Cursor Position Y: 8.699905E-1
End Cursor Position X: 4.956930E-1
End Cursor Position Y: 6.268855E+0
Offset/Amplitude: 7.119231E-1
Slope/Rate: 4.338897E+0
Mean Squared Error: 4.044522E-3
R-squared: 9.969249E-1
Correlation R: 9.984613E-1
Exp-Offset: 0.000000E+0

7.3 Appendix C – 611A Time Derivative Data File Structure

DMAv5.0 Time Derivative Data File
Source Data File: C:\Documents and Settings\ASI\Desktop\dcmsin1.dat
Cursor 1 Index: 2.000000E+3
Cursor 2 Index: 4.000000E+3
Cursor 3 Index: 6.000000E+3
Segment Length: 0.000000E+0
R-sq Threshold: 9.800000E-1
Cursor Position X: 2.952000E-1
Cursor Position Y: -6.026811E+2
Derivative Type: Numerical Derivative
Time Derivative:
Time Rate of Change
0.200000 -86.242633
0.200100 94.627664
0.200200 87.799456
0.200300 -174.977359
0.200400 -159.319234
0.200500 123.520838
0.200600 129.751522
0.200700 -44.558292
0.200800 -30.840407
0.200900 -2.748792
0.201000 -61.224085

7.4 Appendix D – 611A Line Fit Data File Structure

DMAv5.1 Line Fitting Data File
Source Data File: C:\Users\ASI\Desktop\test.dat
Start Cursor Index: 3.621000E+3
End Cursor Index: 4.510000E+3
Fit Channel: Force
Fit Type: Exponential
Offset/Amplitude: 5.301594E-8
Slope/Rate: 4.265648E+1
MSE: 1.415042E+0
Line Fit:
28.803840
28.595227
28.388124
28.182521
27.978407
27.775771
27.574603
27.374892