Instruction Manual

BioWare® Software
Type 2812A…

2812A_002-312e-02.12

KISTLER

measure. analyze. innovate.

Instruction Manual

BioWare® Software
Type 2812A...

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Foreword

Thank you for choosing a Kistler quality product characterized by technical innovation, precision and long life.

Information in this document is subject to change without notice. Kistler reserves the right to change or improve its products and make changes in the content without obligation to notify any person or organization of such changes or improvements.

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Content

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1. Introduction

Please take the time to thoroughly read this instruction manual. It will help you with the installation, maintenance, and use of this product.

To the extent permitted by law Kistler does not accept any liability if this instruction manual is not followed or products other than those listed under *Accessories* are used.

Kistler offers a wide range of products for use in measuring technology:

- Piezoelectric sensors for measuring force, torque, strain, pressure, acceleration, shock, vibration and acoustic-emission
- Strain gage sensor systems for measuring force and torque
- Piezoresistive pressure sensors and transmitters
- Signal conditioners, indicators and calibrators
- Electronic control and monitoring systems as well as software for specific measurement applications
- Data transmission modules (telemetry)

Kistler also develops and produces measuring solutions for the application fields engines, vehicles, manufacturing, plastics and biomechanics sectors.

Our product and application brochures will provide you with an overview of our product range. Detailed data sheets are available for almost all products.

If you need additional help beyond what can be found either on-line or in this manual, please contact Kistler's extensive support organization.

1.1 Our Thanks

We thank you for choosing a Kistler quality product. You have chosen BioWare, a Biomechanics data acquisition, analysis, and presentation system. We think the BioWare package will be easy to learn and use, yet powerful enough for your requirements.

Please take the time to thoroughly read this operating manual. It will help you with the installation, maintenance, and use of the BioWare system. There is on-line help available by selecting the Help Menu item or pressing the F1 key at any time.

1.2 Other Kistler Products

Kistler offers a wide range of measuring instruments and complete systems:

- Quartz, piezoresistive and capacitive transducers for measuring force, pressure, acceleration, and strain
- Associated couplers, charge amplifiers and charge calibrators for industrial and laboratory uses
- Electronic control, display and evaluation equipment

In the field of Biomechanics, Kistler offers an extensive line of one-dimensional and three-dimensional force plates, accelerometers, load cells, amplifiers, and accessories for your applications.

Kistler also designs complete measuring systems for special applications, such as in the automotive industry, plastics processing industry, and research. Our general catalog will provide you with an overview of our products. Detailed data sheets are also available for all of our products.

1.3 License Agreement

Please refer to the Software License Agreement packet containing your BioWare software. This packet thoroughly details the Software License Agreement. Kistler Instruments retains ownership of BioWare software. This software is licensed to you under the following conditions:
BioWare is protected by the copyright laws that pertain to computer software. It is illegal to make copies of the software or documentation except for backup purposes. It is illegal to give software or documentation to another person or institution. The software contains trade secrets and in order to protect them you may not decompile, reverse engineer, disassemble, or otherwise reduce the software to human-perceivable form. You may not modify, adapt, translate, rent, lease, or create derivative works based upon this software or documentation.

You may permanently transfer the software to another user provided you notify Kistler in advance, transfer the documentation and all disks, and notify the new user of the terms and conditions of the license agreement.

1.4 Software Registration

Please take a moment to fill out the registration form and return it to Kistler Instrument Corporation via fax or mail. This will allow us to better serve you and notify you of new releases. Receiving software updates is contingent on returning the registration card, which is located in the packet containing the software diskettes.

1.5 Getting Software Help

BioWare software takes advantage of the Windows® on-line help system to offer you quick assistance at the touch of a button. To receive immediate help from wherever you are in BioWare, press the F1 key and a window will pop up with specific advice about the active window or control in the software (Fig. 1).

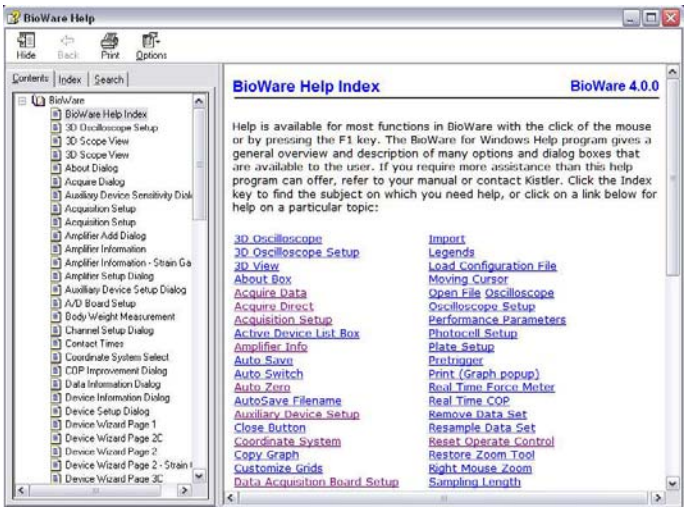


Fig. 1: Help is available by pressing the F1 key or from the Help menu bar

Help is also accessible by selecting Help Topics from the Help menu bar found at the top of the screen. If there is no help available for a specific item the default BioWare help index is displayed. Begin a search by clicking on the "search" tab in the help window. Enter the text for an item you want to search (Fig. 2) then press "List Topics". A list of topics will be displayed. When you see a specific topic of interest, Highlight the topic and click "Display".

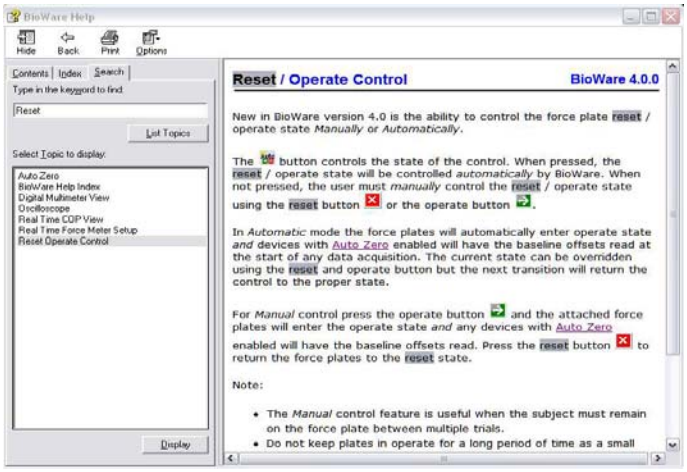


Fig. 2: The search tab is a quick way to find help on a specific topic

If you need additional help beyond what can be found either on-line or in this manual, please contact Kistler's Biomechanics support organization.

1.6 Customer Support

The worldwide Kistler service organization is available for any special questions or problems that you may have after your careful study of these instructions. Note, refer to chapter 1.7 through 1.9 for general policies on customer support. Before you call, please be ready to fully explain your problem. If you are experiencing a problem with BioWare software, please try to duplicate the problem and take a snapshot of the screen by pressing the "print screen" button. This copies the screen to the clipboard so that it can be pasted into a word processing program and printed. You can fax or mail this picture to Kistler, or e-mail the file to us via Internet.

Outside of North America and Switzerland please contact you local Kistler representative or your Kistler subsidiary.

1.7 Service and Assistance

The customer is responsible for proper BioWare installation and operation. BioWare must be installed as per instructions provided in chapter 4 and 5. If modifications to these instructions are necessary for a particular purchaser site, Kistler recommends the purchaser contact a Kistler representative for input and advise regarding these changes.

Installation problems and subsequent system performance difficulties can be adverted by timely communication.

Often, questions can be answered through email or telephone conversations. The purchaser is encouraged to email or call the appropriate Kistler organization in the event of such questions.

We welcome comments and suggestions for future features and enhancements. Please email all suggestions to biomech@kistler.com.

1.8 Warranty

Kistler Instrument Corporation warrants BioWare to be free from defects in material and workmanship as stated in the software license agreement. It is warranted only under normal use and service. The period of warranty is twelve (12) months from date of shipment.
When returning items under warranty, said equipment shall be returned to Kistler Instrument Corporation prepaid. Full details relative to the claim or malfunction shall accompany the shipment. No action will be taken until these details are received. Please contact Kistler Instrument Corporation, if BioWare was purchased in Canada, Mexico or the US, or Kistler Instrumente AG Winterthur, if BioWare was purchased anywhere else, for a RETURN AUTHORIZATION (RA) number before returning goods.

Settlement will be made at Kistler's discretion, either through repair or replacement of the item in question or through issuance of full credit. Damage occurring through misuse or mishandling, will not be covered by this warranty.

This warranty is in lieu of all warranties expressed or implied, and of all obligations or liabilities on the part of Kistler Instrument Corporation for damages following the use or misuse of items supplied. Any unauthorized disassembly or attempt at repair shall void this warranty.

No agent or representative is authorized to assume for the Corporation any liability except as set forth within this warranty document.

1.9 Claims

Claims relating to goods delivered must be made within 14 days of receipt of goods. After fault determination by Kistler, settlement will be made either by the carrier, insurer, or Kistler. Means will be through replacement, repair or credit.

2. Important Information

Please practice commonsense safety rules at all times.

2.1 For Your Safety

- Prior to any installation and repair work or cable changes, you must disconnect all power sources from the instruments
- Observe all local safety regulations concerning the handling of line-powered electrical and electronic equipment
- When it must be assumed that safe operation is no longer possible, the computer, charge amplifier, etc. must be taken out of operation and secured against unintentional use
- Whenever opening covers or removing parts, except where this can be done by hand, use caution where parts under hazardous voltage are exposed

2.2 Warning

- Any breakage of the ground conductor inside or outside the instruments, or loosening of the ground conductor connection may render the instrument dangerous
- The power plug must be inserted in to a socket with a ground connector. The protection must not be nullified by an extension line lacking a protective ground connector
- When changing the signal conditioner fuses, only the standard type with the specified amperage rating must be used. Use of repaired fuses or short-circuiting the fuse holder is expressly forbidden

2.3 How to Use this Manual

Whether you are a novice at computers or a long time programming expert, you will be pleased to learn how quickly and easily you will become familiar with the operation of the BioWare software. This manual will take you through the installation and setup of the BioWare software, and a complete reference to all of the features of BioWare.
If you are eager to begin operation of BioWare we recommend Chapter 5, the Quick Start section of this manual. Remember that on-line help is always available by pressing the F1 key from anywhere in the software.

2.4 Disposal Instructions for Electrical and Electronic Equipment

Do not discard old electronic instruments in municipal trash. For disposal at end of life, please return this product to an authorized local electronic waste disposal service or contact the nearest Kistler Instrument sales office for return instructions.

2.5 Software Upgrades and Updates

Kistler may from time to time supply upgrades or updates for embedded software. Such upgrades or updates must always be installed.

Kistler declines any liability whatsoever for any direct or consequential damage caused by products running on embedded software which has not been upgraded or updated with the latest software supplied.

3. General Description of the System

BioWare is a general-purpose biomechanics data acquisition and display software package suitable for both the clinical and research market. It is designed to combine the performance of the proven line of Kistler quartz force platforms with modern computer technology. BioWare lets you quickly setup, record, and display ground reaction forces as well as moments, center of pressure parameters and auxiliary channels. The system is easily synchronized with a kinematics system.

Fig. 3 shows an overview of the entire BioWare system. All components have been included with the system (i.e., software, cables, junction box, and A/D board). If a computer is included with your system, the BioWare software is already installed on it and you can skip the software installation portion of this manual.

Fig. 3: The BioWare splash screen appears for a few seconds when BioWare is first executed

The BioWare system can consist of many components, each specific to the user's application. These include:

- Force plates. One to Eight force plates can be connected to the BioWare system
- Charge amplifier. Either an external (Type 9865) or integrated amplifier can be used
- Computer Boards Inc. DAS-1602 or compatible A/D board
- BioWare software and manual
- All necessary cabling
- A computer can be purchased with the software and A/D board pre-configured

3.1 BioWare® System Requirements

In order to effectively use BioWare software you will need to have a personal computer that meets or exceeds the following recommendation. BioWare may not run properly if these computer specifications are not met. The overall system performance is dependent on the selection of hardware.

Recommended Computer Specifications

- Microsoft Windows® 2000 (SP3), or Windows® XP operating system
- Intel Pentium III class processor (500 MHz or higher recommended)
- 512 MB of RAM
- Video Display set to at least 800x600, 256 colors, small fonts selected.
- Disk (free) space required: 125 MB in the target directory for data storage and software installation
- One (1) available slot for the data acquisition board or one USB port (ISA, PCI, USB or Type II PCMCIA versions of the A/D boards are available).
- Microsoft compatible mouse
- Windows® Installer version 1.1 or later (note: on Windows® 2000 you may have to install the latest updates to get a newer version of the Windows® Installer)
- A color printer is recommended for creating hard copies of graphs
- A graphics card capable of running DirectX 7.0 is required for 3D Vector graphics

4. Installing BioWare® Software

This chapter will show you how to install the BioWare software, install the data acquisition board, configure the data acquisition hardware, as well as hook up the cable from the A/D board to the signal conditioner

4.1 BioWare® Software Installation

BioWare software consists of one CD-ROM media disk containing an automatic installation procedure. If a computer was purchased as part of the BioWare system, then the software is already installed and the enclosed BioWare CD should be stored in a safe place as a backup. To install the BioWare software follow the procedure:

- Insert BioWare CD into your CD-ROM drive
- From the Start menu, choose "Run"
- In the dialog box, type "D:\KistlerSetup.exe" (without the quotes) substituting your CD-ROM drive letter for "D" above
- From the installation splash program, select Install BioWare Software
- Follow the directions of the installation program
- Additional information can be found in the View Read Me and Browse Documentation selections

Proceed to the following steps and install the appropriate hardware.

To execute BioWare, open the newly created Kistler → BioWare sub-group in the Programs extension of the Start Menu and click on the "BioWare" icon

Many CD–ROM systems will have *Autorun* enabled and the installation splash program will automatically run when the CD is inserted into the drive. Continue from step 4 above.

4.2 USB Runtime License (HASP Key) – Obsolete

The runtime license key that was needed to run BioWare versions 4.x is no longer required.

4.3 Data Acquisition Board Installation

The data acquisition board should be installed by someone who is familiar with installing computer peripherals.
Installation Note The installation CD contains board specific Installation Technical Notes for the various A/D boards supplied by Kistler. See these technical notes as well as the information below. The procedure to install and configure the board is highly dependant on the specific board purchased with BioWare.

- Make sure to disconnect the power source from your computer before opening it
- Protect the system and A/D board from static discharge by touching the computer chassis to ground yourself prior to handling the A/D board

4.3.1 Type 5691A (USB-1616FS) and Type 5695 DAQ (USB-2533) Systems for BioWare

1. With the power on and Windows® running, connect the Type 5691A or Type 5695 DAQ System for BioWare to an available USB port on your computer
3. Windows® will recognize this device as a new device and will install the appropriate drives for this device. If prompted for a driver disk, insert the BioWare installation CD into the CD-ROM drive and continue
4. Windows® will load the necessary USB drivers and configure the Type 5691A DAQ System for use

Note on USB Data acquisition systems: Any time the USB device is are removed and reconnected or powered off and on again, the INSTACAL board configuration program will need to be run.

Proceed to the next step to configure the DAQ system.

4.4 Data Acquisition Board Software Configuration

The software configuration is a two-step process. First, the board and data acquisition drivers need to be configured using the driver configuration program INSTACAL (found in the Kistler → BioWare program group). This configures the hardware using the board manufacturers' routines. Second, the board settings must be set in the main BioWare application.

The Board Configuration Program, "INSTACAL", appears automatically the first time that BioWare is run and you select "Yes" when prompted if a board will be installed. To change the board or install a new one at a later point in time, locate the BioWare program group and select the INSTACAL icon to start the data acquisition board configuration program (Fig. 4).

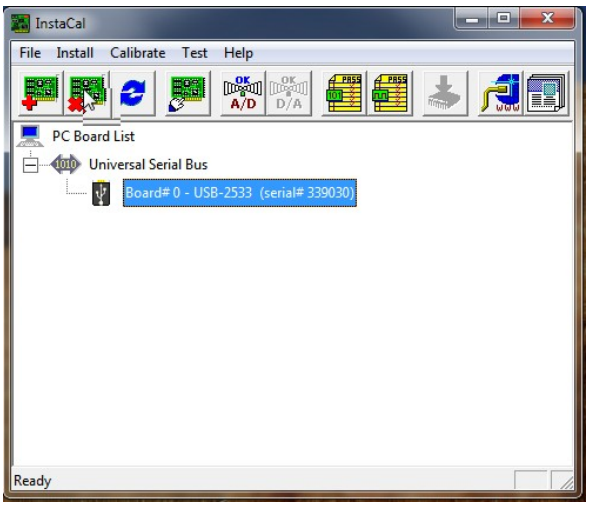


Fig. 4: INSTACAL Board Configuration Program

The Board Config program opens automatically (immediately after the registration box) the first time BioWare is run. The A/D board dialog box appears where these configuration settings from Board Config should be made in BioWare.

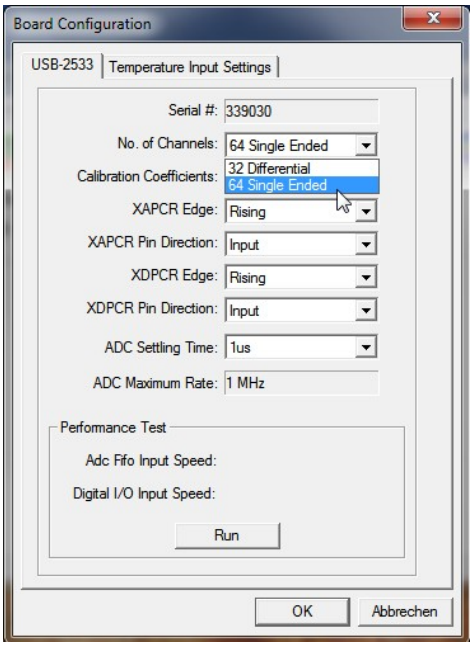


Fig. 5: Configure screen for the 5695A DAQ system

For the Type 5695… DAQ system choose the BOARD in INSTACAL and select configure. Make sure that the Board Configuration is appropriate, specifically, ensure the "No. of Channels" is set to 64 Single Ended.

Once the DAQ system is configured using INSTACAL, it needs to be selected in BioWare as well. Launch the program by selecting BioWare from the BioWare for Windows® menu. If this is the first time running the program, you will be prompted if a Data acquisitionboard will be used in BioWare, otherwise go to Setup menu→Hardware and select "A/D Board". A dialog box pops up (Fig. 6) where you can select the settings for your board. The list shows all boards that are configured in INSTACAL.

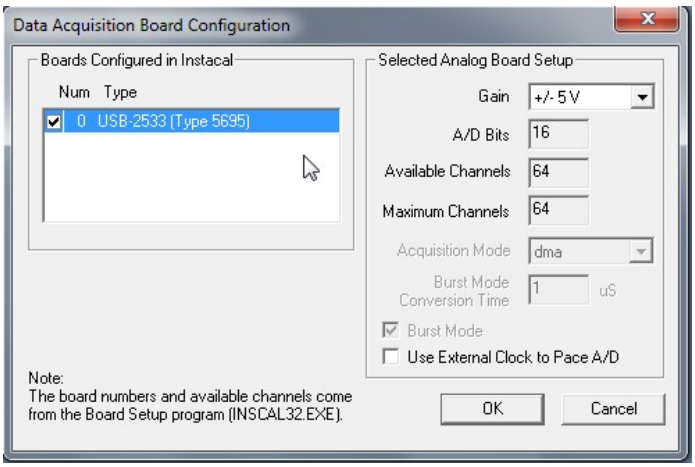


Fig. 6: BioWare Board configuration setup

The A/D bits, Available channels, and Maximum Channels will be automatically set reflecting the board type selected. The gain and acquisition mode should be set to the user's specifications. The gain setting changes the scale on the board itself, so the lower the scale means the better the resolution. However, it also means a lower force range, so the user must be careful not to choose too high of a gain such that saturation occurs (i.e., be sure the forces to be measured do not exceed the measuring range of the system. If this occurs, choose a lower gain such as +/–10 V).

The Acquisition Mode is set automatically to dma (direct memory access). This means that the board sends the acquired samples directly into the computer's memory.
The burst mode conversion time is the amount of time required to acquire one A/D sample (including settling time). It is automatically set to 1 uS.

The Burst Mode check box allows a user to enable burst mode acquisition. For the USB DAQ systems the burst mode is always on and cannot be changed

4.5 Connecting the Cables

4.5.1 Type 5691A… DAQ System

There are (2) 37-pin cables that connect the 5691A data acquisition box to the max. 2 force platforms. The connection to the user's PC (optional) is via USB. Furthermore there is a BNC female connection for an external trigger (trigger in). In addition, there is an USB extension port. To properly connect the cables:

1. Turn off the power and disconnect power cords to the computer
2. Connect the 37-pin cables from the Data Acquisition system to the force platforms. With the USB-cable connect the DAQ system to your PC.
3. By a BNC female connection the DAQ System can be connected to other measuring systems (e.g. EMG, Visual Systems). Additionnaly, a free USB extension port is available.
4. Plug in the DAQ box 12 Volt DC power to a wall socket using the provided power transformer
5. Be sure to tighten any cable-fastening screws by hand to secure the cable connections and prevent slippage (Do not over tighten)

The Type 5606A junction box should only be plugged into a wall socket if a plate with integrated amplifier is connected to the system.

If the cables are not long enough, additional cables could be connected to the original ones to extend their lengths. Excessively long cables are not recommended because insulation may not be adequate to prevent interference and loss of signal.

4.5.2 Type 5695… DAQ System

There are (2) 25-pin cables that connect Type 5695… data acquisition box to up to 8 force platforms. The connection to the user's PC (optional) is via the USB cable. Furthermore there is a 9-pin Control I/O input for connection with the adapter box Type 5767. This box allows you to connect other measuring systems (e.g. Visual Systems, EMG) via BNC. In addition, it is possible to interpose the external control unit Type 5233A2 between the force plate and the DAQ system.

1. Turn off the power and disconnect power cords to the computer
2. Connect the 25-pin cables from the Data Acquisition system to the required number of force platforms. With the USB-cable connect the DAQ system to your PC. When a manual control with analog signal output of the force platforms is required interpose the External control unit Type 5233A2 between the DAQ system and the force platform
6. Plug in the DAQ box 12 Volt DC power to a wall socket using the provided power transformer
7. Be sure to tighten any cable-fastening screws by hand to secure the cable connections and prevent slippage (Do not over tighten)

The Type 5606A junction box should only be plugged into a wall socket if a plate with integrated amplifier is connected to the system. No external power is necessary for plates with external (Type 9865) amplifiers.

If the cables are not long enough, additional cables could be connected to the original ones to extend their lengths. Excessively long cables are not recommended because insulation may not be adequate to prevent interference and loss of signal.

4.6 Important Issues Regarding Piezoelectric Force Plates

Please take care to follow these rules applying to installation and handling of plates and connections:

- Protect the signal conditioner and cable connector ends from dust and moisture. Close end caps
- Force plate mountings must be level
- Use caution connecting and removing the cables. Also take care to not step on the cable connections to avoid shearing off the cable
- Be sure to short the cable pins prior to connecting to devices to remove static charge

4.7 Charge Amplifiers

BioWare automatically controls the range selection and operate/reset functions of both integrated and Type 9865 charge amplifiers. Charge amplifiers should be allowed to warm up sufficiently for most accurate measurements, with 30 minutes being a minimum. If you are using a Type 9865 amplifier, be sure that the Operate/Reset switch is set to "Remote". Unplug the amplifier if it is not to be used for a very long time.

Charge amplifiers can be left on for extended periods of time with no adverse effects to them and with minimal power consumption. This ensures that the electronics have settled to a constant operating temperature.

5. BioWare® Software Overview

BioWare is an easy-to-use data acquisition and manipulation program. The typical Windows® controls apply to the graphs and dialog boxes in BioWare. This section will give you a quick overview of the capabilities of BioWare.

The menu bar is your access to all areas of BioWare. It is divided into sections covering specific functions such as data acquisition, data viewing, file handling, equipment control, window control, and obtaining help. In addition to the menu bar, there is a toolbar similar to those found in major word processing and spreadsheet programs. The toolbar consists of icons that execute a specific function when clicked. Examples of these functions are acquiring data, configuring devices, and obtaining help.

The user has full control over data acquisition. Sampling rate and length of trials, as well as amplifier range and trigger options are all easily accessible, along with controlling any auxiliary devices being used. The units of data acquisition can be customized, including normalizing force measurements by body weight. Normalizing force data means dividing the forces by the subject's body weight and showing the force data as a percentage of total body weight. In this way, direct comparisons are possible between a 110-lb. subject and a 275-lb. subject with respect to their typical force parameters.

The graphs are designed to be easy to read, and can be fully customized. The number of graphs to view can be chosen, along with default parameters so each trial is readily viewed in a format that is most useful to the user. Graphs can be controlled together as a group, or individually configured by right clicking on a specific graph to bring up a graph menu. The line styles and colors can be changed by the user as desired, as can font type, font size, titles, and axes labels. Graph legends and grids can be turned on or off with ease. The parameter-versus-time graphs can be viewed on a relative time axis or by contact times that are automatically calculated based on a contact threshold and can be edited by the user. In addition, stored trials can be "time-sliced", permanently eliminating unwanted sections of data and thus reducing the disk space needed to store that particular trial.

A database keeps track of all devices configured for the system. The devices (plates, amplifiers, etc.) contained within the database can be controlled effortlessly. Adding, editing, and deleting of configurations is simplified. The Device Manager shows all configured devices, and is where devices are made active or inactive. New devices are added to the system here through a handy Wizard function.

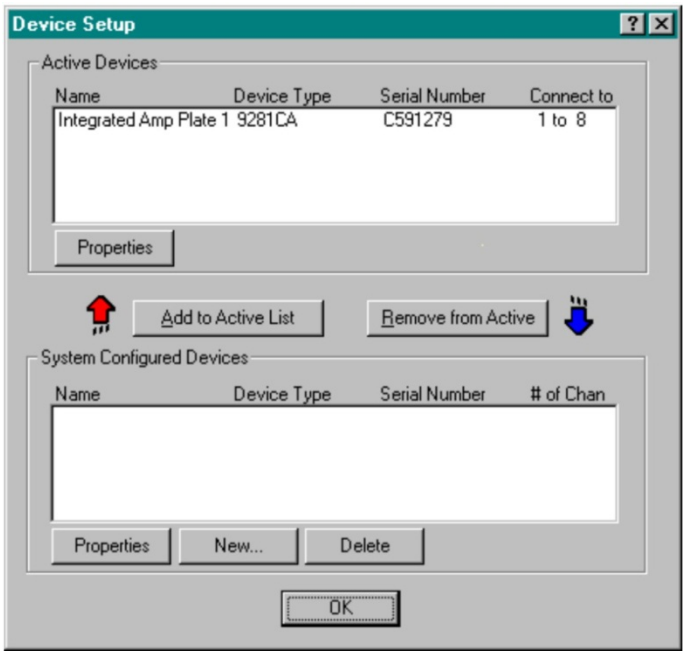


Fig. 7: The Device manager shows all configured devices, active and inactive

If you have questions at any time while in BioWare, simply press the F1 key and the BioWare on-line help window appears. Help is also available from the menu bar.

5.1 Quick Start

This section will help familiarize the new user with BioWare. Data cannot be acquired until all devices are properly configured within BioWare. This section is meant as an overview to the features of BioWare that will be applied to acquired trials and graphs once the proper configurations have been performed. For more information on configuring BioWare, refer to Section 4.

Start BioWare by choosing **Start → Programs → BioWare for Windows® → BioWare**. The splash screen (Fig. 8) appears briefly. You will be asked to register your BioWare upon first time use. Note that the menus will have different appearances (options) based on whether or not a graph is shown on the screen.

Fig. 8: The BioWare for Windows® splash screen appears for a few seconds each time the program is started

The File menu allows you to open stored trials, overlay multiple trials, print, save, and exit the program. The print setup can be customized here also. Feel free to open some of the supplied trials and manipulate them at will to help become familiar with the program's capabilities.

The Data menu is where acquisition is performed. Choosing Acquire Trial will bring up the Acquire Data Dialog Box (Fig. 9) shows the active devices and configuration. Changes to the configuration can be made by pressing the Setup button in the dialog box. The Data menu also allows you to perform Time Slices and edit the start times and contact times for the currently viewed trial

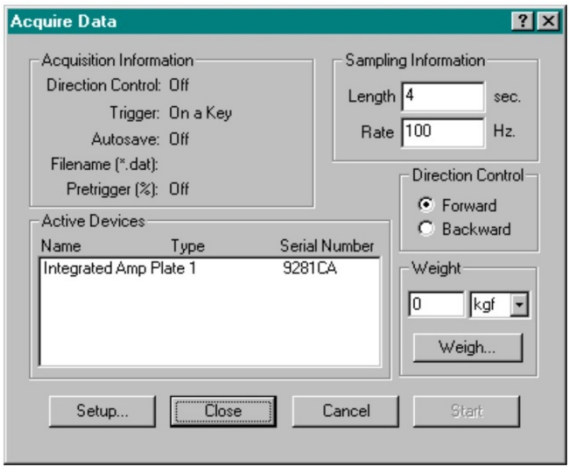


Fig. 9: The Acquire Data Dialog Box shows the current trial information

The Setup menu (Fig. 10) allows the user to configure BioWare to his/her preferences. The graph defaults apply to all graphs as they are first shown. Individual graphs can be customized further by right clicking on the desired graph (Fig. 11) to bring up a menu, or by double clicking on a specific feature of the graph (line, title, etc.) and editing it. The setup can be changed at any time without adversely affecting the data in any way.

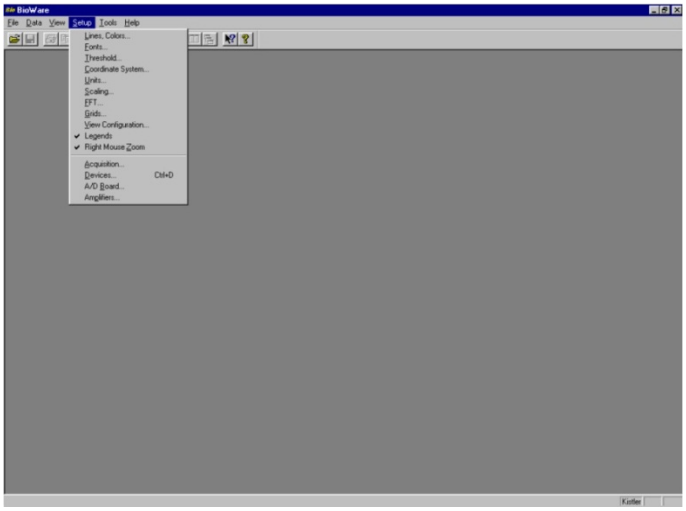


Fig. 10: The Setup menu allows the user to customize the graph defaults

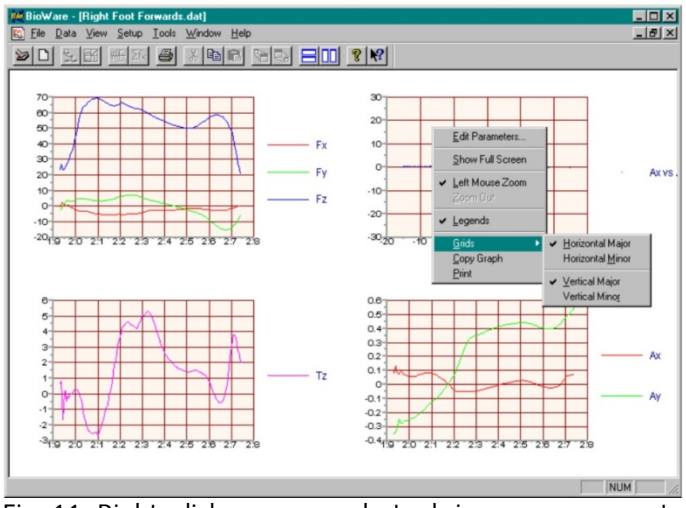
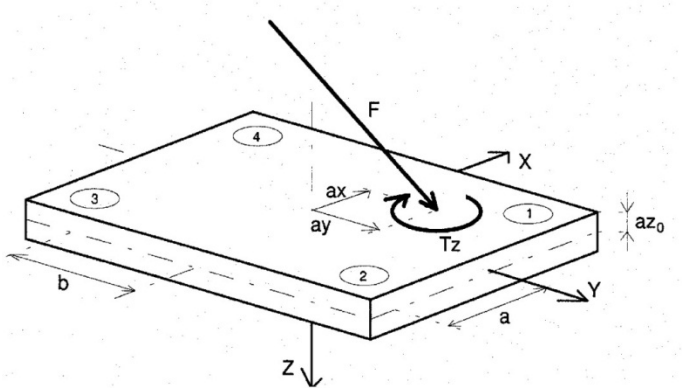


Fig. 11: Right click on a graph to bring up a menu to change its appearance or content

Two other menus appear when a graph is shown, the View menu and the Window menu. The View menu allows the user to edit the number of graphs on the screen and the default parameters to be shown on the graph. There are also commands to copy the graphs to the clipboard for pasting into other documents, and for hiding/unhiding the toolbar and status bar. The Window menu uses standard Microsoft Windows® commands to create new windows or to tile the ones on screen.

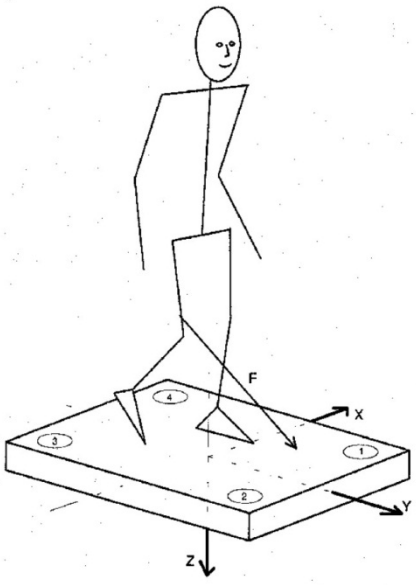
6. Kistler Force Plate Calculations

Fig. 12: The Kistler Coordinate System

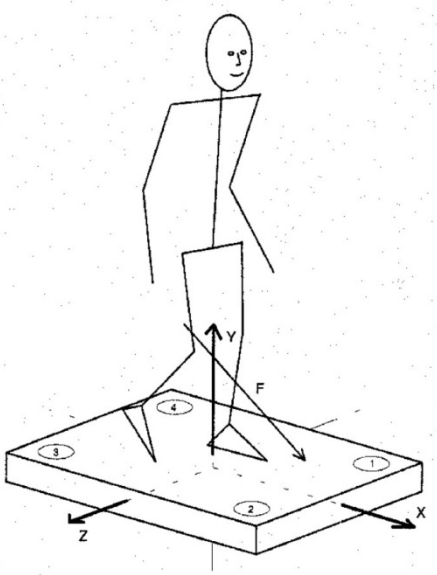


Parameter	Calculation	Description
Fx	= fx12 + fx34	Medio-lateral force
Fy	= fy14 + fy23	Anterior-posterior force
Fz	= fz1 + fz2 + fz3 +fz4	Vertical force
| Ft |	= sqrt (Fx * Fx + Fy * Fy + Fz * Fz)	Resultant force
Mx	= b * (fz1 + fz2 - fz3 - fz4)	Plate moment about X-axis
My	= a * (–fz1 + fz2 + fz3 - fz4)	Plate moment about Y-axis
Mx'	= b * (fz1 + fz2 - fz3 - fz4) + Fy*az0	Plate moment about top plate surface
My'	= a * (–fz1 + fz2 + fz3 - fz4) - Fx*az0	Plate moment about top plate surface
Mz	= b * (–fx12 + fx34) + a * (fy14 – fy23)	Plate moment about Z-axis
Tz	= Mz - Fy * ax + Fx * ay	Free moment, Vertical torque
COF x	= Fx / Fz	Coefficient of Friction in x direction
COF y	= Fy / Fz	Coefficient of Friction in y direction
| COF xy |	= sqrt(COFx * COFx + COFy * COFy)	Coefficient of Friction resultant
ax	= (Fx * az0 – My) / Fz = – My' / Fz	X-Coordinate of force application point (COP)
ay	= (Fy * az0 + Mx) / Fz = Mx' / Fz	Y-Coordinate of force application point (COP)

Kistler



ISB (Reactionary)



7. The File Menu

Depending on whether or not a graph is open on the screen, the File menu will have a different appearance. If no graph is open, there will only be commands to open, setup printing, and exit BioWare. In addition, there will be a list of recently opened trials that can be clicked on as a shortcut to reopen them.

7.1 Open… (CTRL+0)

This will bring up a dialog box (Fig. 14) where the desired trial can be selected for viewing. The default directory is the data directory, though the dialog box can be easily navigated using standard Windows® 95 techniques to browse other drives, directories, and network computers. The extension for the trials are "*.dat". Multiple files can be selected by holding the <shift> key (range of files) or the <ctrl> key (individual selection) while selecting files. Files stored in BioWare 2.x format will automatically be converted and loaded. It can be saved in BioWare 3.0 format by using the **Save As…** command.

Selecting a file and pressing F2 will allow you to rename a file. Selecting a file and pressing DELETE will allow you to delete a file.

7.2 Import Data Series…

ASCII data series can be imported by selecting the desired "*.txt" file to import. This will allow a formatted text data series to be imported into BioWare. See File Save As… (Export Data series) on formatting of the data series. Data series imported will be treated as auxiliary devices and will appear in the auxiliary device list. For example, exporting F_x, F_y, and F_z of force plate data trial, and then importing them back into a document will display them as 3 auxiliary devices F_x, F_y, and F_z. Further force plate computations (i.e.: calculation of moments, COP, etc…) is not possible.

If a trial document is open when you select import data series, a prompt will appear asking if you want to add the imported data to the current document, or to create a new document based on the imported data series.

7.3 Export Files (Convert binary files to ASCII)

This menu option appears only when *all files are closed*. The export *file* will export basic trial data to a standard ASCII text file. The standard file open dialog box will appear displaying a list of files available to open. You may select which files to convert from BioWare native binary format to the ASCII format. Multiple files can be selected by holding the <shift> key (range of files) or the <ctrl> key (individual selection) while selecting files. Files stored in BioWare 2.x format will automatically be converted and loaded.

Once the files are selected, pressing the open button will present you with the export options where you can select various options for calculating the COP data. You can choose which force plate parameters you want to convert to ASCII files. Select the desired options and press OK.

Note: The Export Data Files option will automatically convert and export "All" devices in the trial to the ASCII file. You cannot select which specific devices to export.

See chapter 7.6 for more information on exporting files and the exported file format.

7.4 Merge…

Merge… is a function that overlays multiple plots for direct comparison. To use Merge, first open a file that will be overlaid with another by using the Open… command, and then select Merge from the File menu. Select the file to merge with the current file on screen from the dialog box, and press OK. The two trials will be overlaid in the same window, where they can be directly analyzed. More than one file can be merged together one at a time. However, as more and more files are added the graphs becomes crowded and cluttered, so it is good practice to overlay a maximum of three to four files. Use the Save As… function to save a new file of overlaid trials. Doing so will keep the individual trials separate from the merged file. Saving merged files does take up additional disk space, though, so only save the overlays if absolutely necessary

7.5 Save…

Save… will save any changes made to the current trial on screen. The current name and file location are used. In essence, the file is overwritten with the data on screen. If you are not sure if you want to replace the trial with the current one, use the Save As… function instead of Save… and use a different filename.

7.6 Save As… (Export)

This allows the user to take the current graph on screen and save it under a different name and/or a different file location. This is useful when using the Merge… function, or when making changes to a trial that you would like to save without permanently altering the original file. A dialog box appears when this command is selected that allows the user to choose the file name and location. By default all files are stored with the data extension "*.dat" in BioWare's native binary format.

Files may be export to ASCII tab delimited files, DIFF format files, or DIFF+INF files. The Data Interface File Format (DIFF) is a standard used in Japan to store time series data for Gait Analysis. The DIFF format was developed by the Clinical Gait Analysis Forum of Japan and it is usable for any time series data.
The web site http://www.aist.go.jp/NIBH/ourpages/comparison99/DIFF-SPEC.pdf describes the DIFF standard.

Files may be exported to ASCII tab delimited text files by selecting "Text file (*.txt)" in the Save as Type. The exported device data will be in a "reduced" format, meaning that all forces and moments are already calculated from the raw voltages. The user can select which parameters (including performance parameters) to export and which device data to use. The Export Data dialog box (Fig. 13) is very similar to the View Manager, with a very straightforward interface. To export data, first select the device from the Device List. Next, select the desired time scale from the Time list and place a check in the boxes whose data is to be exported. If center of pressure (COP) parameters are selected, select whether or not to use COP correction and/or to Automatically center the COP values from the Center of Pressure Options. When ready, press the "Export Data" button. Choose the name (and location) for the exported file from the box that pops up, and click OK to complete the export. Another box pops up to confirm that the data was exported, showing the export path and filename. An example of an exported file is shown below. To export all devices in the trial select "All" from the device list.

BioWare 3.0 Export			
Device:	Plate 1	Plate 2	Aux
Samples (#):	251	251	251
Rate (Hz):	250	250	250
Contact period start (sample #):	8	16	0
Contact period end (sample #):	234	247	250
Contact period start time (s):	0.032	0.064	0.0
Contact period end time (s):	0.936	0.988	1.00
First sample time (s):	0	0	0
Normalized force (N):	800.6796	800.6796	1
Normalized length (m):	1	1	1
Absolute time (s)	Fx	Fx	EMG
	N	N	mV
1.864	–0.15392	0.107193	1.557735
1.868	–0.23022	0.183487	3.003304
1.872	–0.15392	0.011826	2.521448
1.876	–0.21114	0.011826	3.083614
…	…	…	…
2.852	–0.30651	–0.10262	2.682067
2.856	–0.28744	0.183487	1.156188
2.86	–0.0967	–0.06447	1.878973
2.864	–0.19207	–0.00725	1.878973
done exporting			

Similar to the Edit parameters dialog box, the export data dialog box has a "View Performance" button for selecting performance parameter data sets to export. All of the parameters are identical to those under the Edit Parameters… section of this manual, see chapter 9.2 for more information. Fig. 13 shows the Data Export dialog box with the Performance Parameters selection box opened.

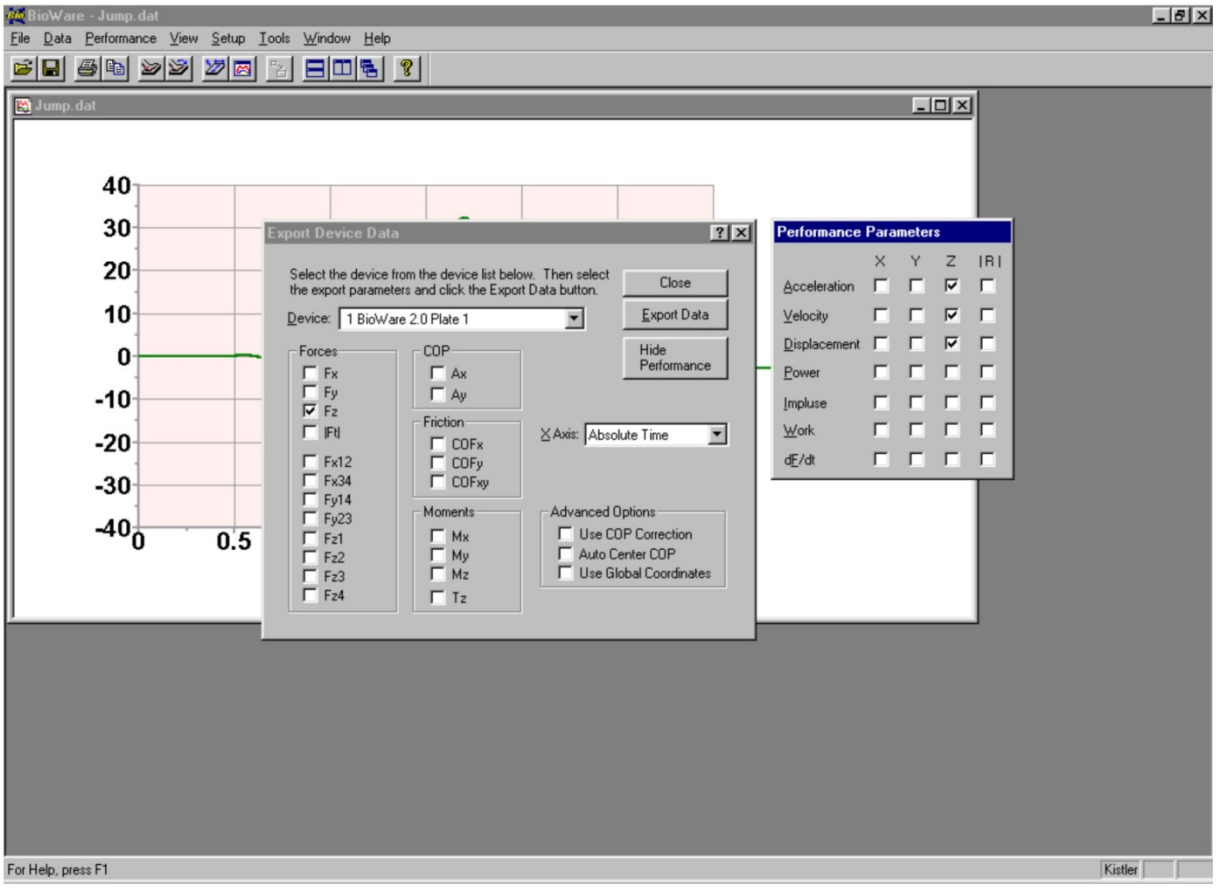


Fig. 13: Export Dialog with Performance Parameters

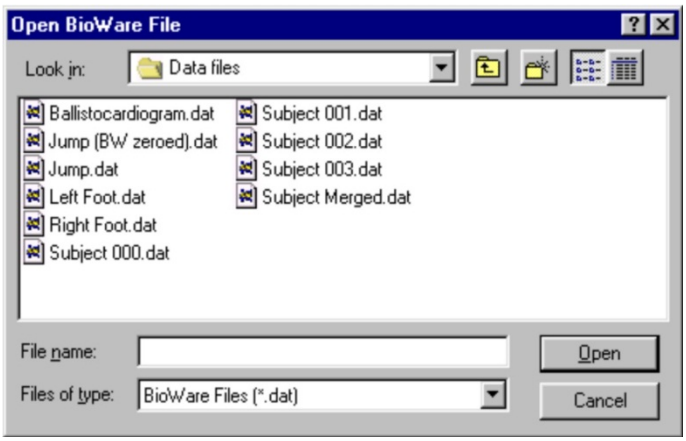


Fig. 14: The Open BioWare File dialog box

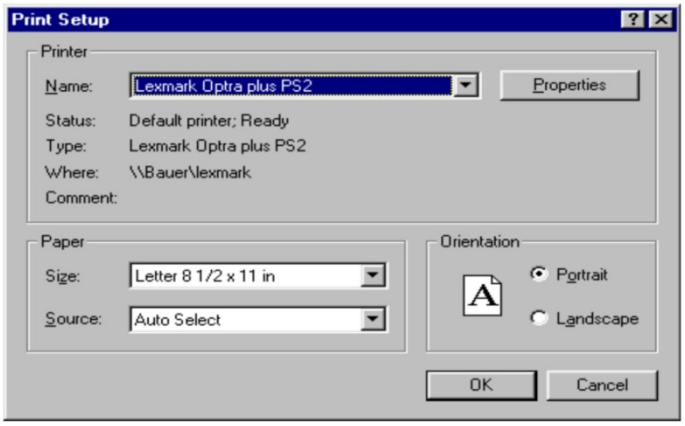


Fig. 15: The Print Setup dialog box

7.7 Close

This will close the currently selected window. If any changes were made to the file since it was opened then a dialog box will prompt you with an option to save the changes before the window is closed. If multiple windows are open, this function will only close the current (highlighted) window.

7.8 Close All

Close All performs like the Close function, but it will close all windows on the screen. If changes were made to any files, you will be prompted to save the files if you choose. This is a handy function when too many windows are open and the analysis is completed on them, but you do not wish to exit the program yet. Close All brings BioWare to its initial state, with no open windows.

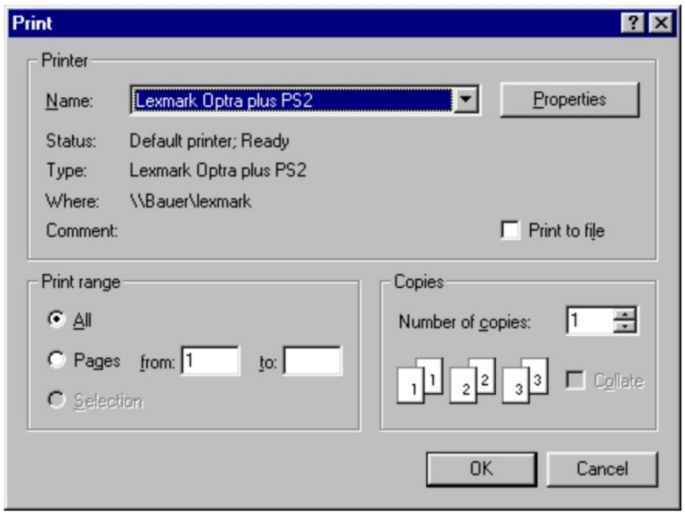


Fig. 16: The Print dialog box

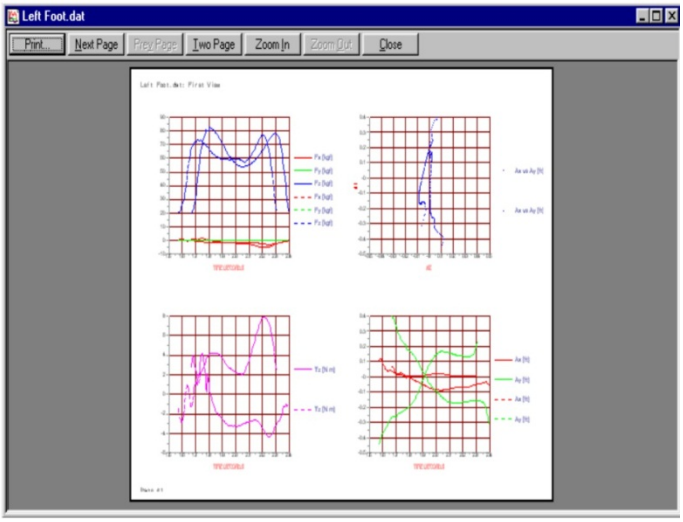


Fig. 17: The Print Preview dialog box lets you take a look at your printout before printing

7.9 Print Setup…

Print Setup… allows the user to configure the printing to his/her specifications. A dialog box (Fig. 15) appears when this function is selected. Standard setup functions are to select the printer, paper size and tray (if applicable), and the paper orientation. A Properties button allows you to further customize printer settings.

7.10 Print (CTRL+P)

Print brings up the Print dialog box (Fig. 16) that uses the default print settings. The user selects the print range and the number of copies to print. The highlighted window is the data that is to be printed, so be sure to select the correct graph window before choosing the print function.

7.11 Print Preview

Print Preview allows the user to see what the printout will look like (see Fig. 17), so that any necessary changes can be made before the print function is carried out. This is very useful in preventing unnecessary paper waste, and it lets the user make sure the printout is exactly as it is supposed to be. From this dialog box you can zoom in on the image for a closer look, view more than one page at once, and execute the Print function.

7.12 (Recently Used File List)

The previous 10 files that were opened or saved appear in reverse order of selection (i.e., most recent to least). This convenience acts as a shortcut for the user because it is often necessary to reopen trials more than once for statistics and analysis.

7.13 Exit

Exit closes BioWare. If any files are open and changes have been made, the user will be prompted to save the changes. In addition, any changes to the default setup (see the Setup Menu section of this manual) will be saved.

8. The Data Menu

The Data menu is where all data acquisition and editing are performed. Before any trials are performed or any files are open, the menu is limited to the Acquire Data and Acquire Direct functions. All other functions listed below are available once a trial is performed or a stored file is opened.

8.1 Acquire Data

The Acquire Data dialog box (Fig. 18) allows the user to customize the trial to their specifications and to configure the hardware used in the system. The trial length and sampling rate are set in the upper right corner of the box. The length is in seconds and the sample rate is in Hertz (cycles per second). The total number of samples acquired is calculated by multiplying the trial length times the sampling rate times the number of channels. The more samples acquired results in a greater amount of disk space used to store the trial.

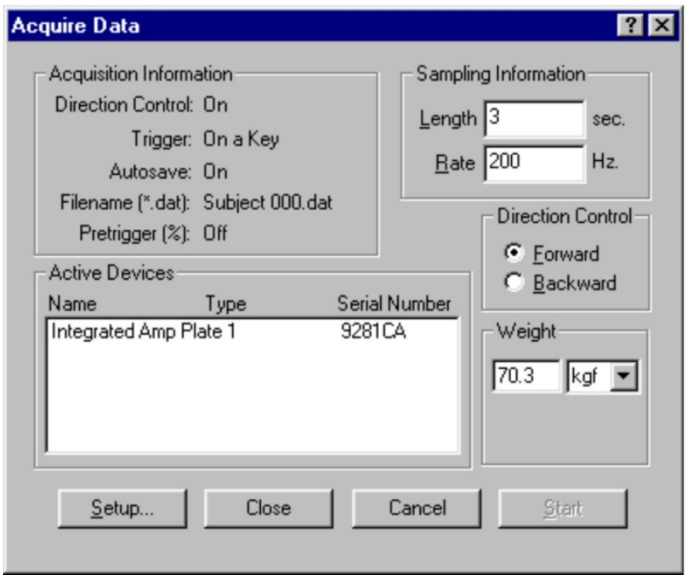


Fig. 18: The Acquire Data dialog box

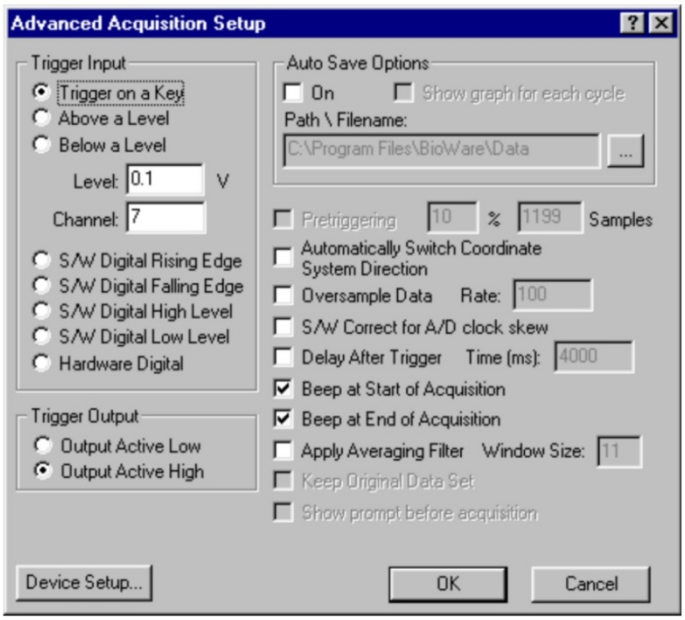


Fig. 19: Acquisition Setup dialog box

The direction is set by in the Direction Control section. Automatic direction switching can be chosen from the Acquisition Setup dialog box (Fig. 19). Pressing the Setup button from the Acquire Data dialog box (see chapter 8.2) accesses this dialog box. Direction defines the orientation the subject approaches the plate. Selecting "Backward" causes the coordinate system to be reversed after the trial is acquired. This allows direct comparison of trials taken from either direction.

The subject's weight should be entered in the Weight section of the Acquire Data box only if normalized studies are to be performed. Normalized studies are those where the measured force is divided by the body weight. This allows studies to be performed on subjects of all sizes and weight ranges. Normalized units are body weights.

To begin acquiring data, press the **Start** button. Acquisition begins when the selected trigger requirements are satisfied. To close the box and store changes without acquiring data, press **Close**. Press **Cancel** to close the dialog box without accepting any changes made.

8.2 Acquisition Setup

The Acquisition Information section of the Acquire Data box (Fig. 18) shows the settings for data acquisition that can be configured in the Acquisition Setup dialog box (Fig. 19). The following parameters are configured:

- **Trigger Options** refers to the trigger type used when acquiring trials. There are seven options:

1. On a Key: Acquisition begins when the user presses the Start Button from the Acquire Data dialog box, or when Acquire Direct is chosen from the Data menu. If the plate/amplifier is setup to read a zero offset, then this will be done prior to acquisition and an additional prompt will appear before acquiring data
2. Above a level: Data is not acquired until the set voltage on the selected channel is exceeded
3. Below a level: Data is not acquired until the voltage measured on the selected channel falls below the set value
4. Digital Rising Edge – the trigger level goes from low to high (switch opening).
5. Digital Falling Edge – the trigger level goes from high to low (switch closing)
6. Digital High Level – triggers on first instance of a high (switch open)
7. Digital Low Level – triggers on first instance of a low (switch closed)
8. Hardware Digital – triggers using low level a/d board digital trigger capability. Requires a small modification to Type 5606A junction box. This is method has reduced latency between the trigger and the first acquired sample

- **Auto Save Options** allow the acquired data to be automatically stored as a filename with an accumulating index number. Many times a user wants to acquire multiple trials immediately and perform the analysis at a later time. By placing a check in the Auto Save "On" box, the filename box becomes enabled and the user can choose the name and location of the file. To do this, press the **Change** button and a standard Windows® box pops up where you can select the desired directory, which is shown in the box at the top of the box. Drop the directory box (by pressing the downward-pointing arrow at the immediate right of the directory box) to view the entire path to the selected directory. Once the directory is chosen, enter the filename in the box labeled "Filename2. The entire directory path does not necessarily need to be entered on this line if the correct directory had been already set. The filename will have a 3-digit index number

appended at the end, beginning with "000". For example, if the saved filename is entered as "Example", then the first trial will automatically be saved as "Example 000.dat" and the next will be "Example 001.dat", and so on. BioWare will check for the last used index number stored in the directory and will save the next trial incremented by one. The "show graph for each cycle" enables the graph to be drawn after each cycle is acquired

When Auto Save is enabled, upon acquiring the first trial BioWare assumes that more trials will follow and consequently continues to acquire trials automatically (while still waiting for the designated trigger to activate). For example, if the trigger type is "on a key" then as soon as a trial is concluded a box pops up prompting the user to press a key to acquire the next trial. This will continue indefinitely until the user presses the Escape key to cancel the Auto Save process

- **Pretriggering** – When analog triggering is enabled, pretriggering will define the percentage of the trial to appear before the actual trigger occurs. For example, specifying a 10 % pretrigger, on a 10 second trial with 0.1 volts on channel 7 will result in a trial with 1 second of data prior to channel 7 reaching 0.1 volts, and 9 seconds of data after channel 7 reaches 0.1 volts. This is useful for capturing force plate data where events leading up to the plate contact are important. The user may also enter the pretrigger in number of A/D samples. Note, the pretrigger is calculated as a percent of the total number of samples. When selecting the A/D samples option, a change in the sampling rate will change the number of pretrigger samples, as the pretrigger percentage will remain constant

- **Automatically Switch Coordinate System Direction** can be on or off, and determines whether or not the plate orientation automatically alternates for consecutive trials. When direction control is **on** the approach to the plate should be along the long axis of the plate, and for the next trial should be from the opposite side of the plate and still along the long axis. Thus, a subject on a runway can approach the plate from either direction. The intent is to shorten the time between trials and to lessen walking effort for the subject, by allowing them to walk along a runway and approach the plate from either direction without having to return down the runway to a single starting point each time. Place a check in the box to enable automatic direction control. Note: check the direction for each trial to ensure that it is correct, and manually override if it is incorrect

- **Oversample Data** – if enabled, a sample rate can be specified to acquire data, the data is later processed and

resampled post acquisition (using a spline algorithm) to the desired sampling rate in the acquisition dialog box

- **S/W Correct for A/D clock skew –** if enabled, an algorithm is used to correct for inter-channel timing differences for a single A/D scan. This is particularly useful for A/D boards that do not support "burst mode" and for lower sampling rates. The algorithm simulates a simultaneous sample and hold A/D board provided the raw data is sufficiently over-sampled. It is ideally suited to calculations based on several raw individual channels

- **Delay after trigger –** allows for a delay between the trigger event and the actual sampling time

- **Beep at End/Start Acquisition** causes the default Windows® sound to play immediately prior to / after acquisition

- **Apply Averaging Filter –** if enabled, an averaging filter is applied to the data set. See the section on digital filtering for more information

- **Keep Original Data Set –** for any of the above acquisition options that modify the acquired data (resampling, filtering, etc…) this option allows for the raw data (prior to modification) to be saved in the file as another data set

- **Show Prompt before acquisition –** enables Displaying a prompt just prior to the acquisition going into the "waiting for trigger" mode

Pressing the Device Setup button from the Acquisition Setup dialog box brings up the Device Setup dialog box. Refer to chapter 14 of this manual for a description of Device Setup.

8.3 Acquire Direct

Many times the acquisition settings do not change from trial to trial, and it is not necessary to check the settings prior to each trial. One way to get around this is to use the Auto Save feature (see chapter 8.2) to acquire trials in a nonstop manner. Another way is to use the Acquire Direct function from the Data menu. When this function is selected, the acquisition process begins immediately using the default settings (i.e., trigger type, sampling rate, sampling time, etc.), without opening the Acquire Data dialog box. This does not save trials automatically, rather it is designed as a shortcut to acquiring a trial.

8.4 General File Info…

To edit a file header (i.e., name, ID, Classification, trial description), select General File Info… from the Data menu after opening a graph of the file (Fig. 20). The date and time of the trial are shown in a box that cannot be edited. All other fields can be edited by placing the cursor in the desired box and typing in the required information. Click OK to store the changes or Cancel to close the box without saving any changes to the file header. All fields have no specific format; each user can decide what to use as ID's and Classifications to satisfy their own needs and requirements. The description should be used to illustrate any highlights of the trial, such as observations made or assistive devices used.

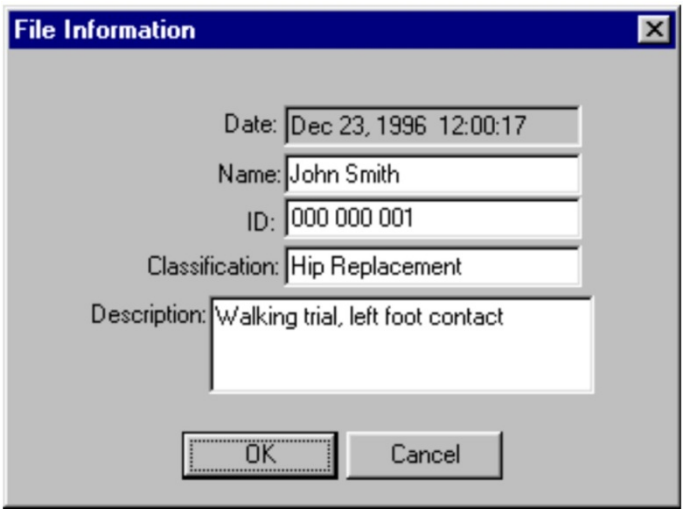


Fig. 20: The file information dialog box allows you to store information about the trial

8.5 Device Info

Each device that is used in a trial has specific settings and parameters that may need to be set or changed by the user, such as serial numbers and sensitivities. This is accomplished by selecting Device Info… from the Data menu. A dialog box pops up (Fig. 21) showing general information about the device, and buttons labeled with names of parameters that can be adjusted. For trials that had more than one device connected to the system, the device to edit should first be chosen from the list box at the top of the dialog box. The full list can be viewed by clicking on the down arrow to the right of the box. Depending on the type of device selected not all buttons may be available.

For example, force plates with integrated amplifiers – such as the one in Fig. 21 – will not have the "Amplifier" button available because amplifier ranges are combined with the force sensor sensitivities, and are set from the "Sensitivities" button.

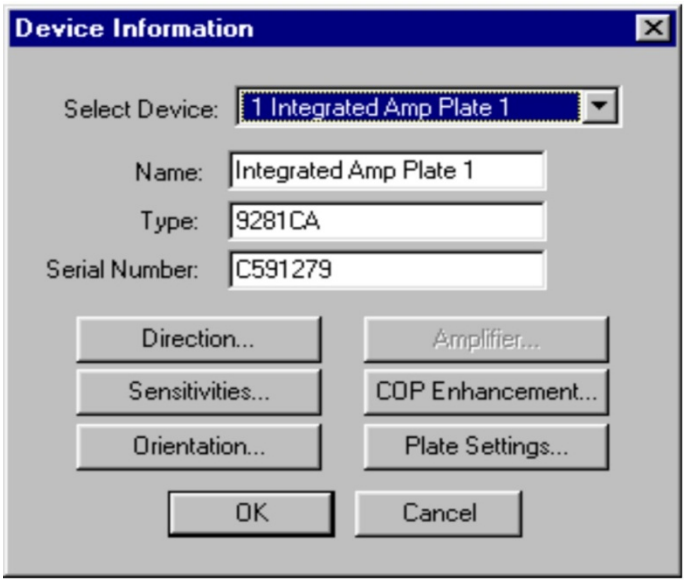


Fig. 21: The Device Information dialog box allows you to check device settings for the trial

Each device has a specific name, type, and serial number that should be entered in their respective fields. The button descriptions are as follows:

8.5.1 Direction…

Direction control is useful when doing studies that utilize a runway approach to the force plate. By being able to change the orientation of a fixed plate, the subject's approach to the plate can be from either direction on a runway. This will shorten the time between trials and shorten the amount of distance traveled by the subject, which is handy when doing studies on subjects with pathologies and/or disabilities. The Direction… button is used to check the orientation of the device, and to change the direction if necessary (see the section on Direction Control in the Setup menu part of the manual). Changing direction should only be performed if the user is absolutely sure that the incorrect direction was used for the trial. Direction selection is only available for force plate devices, and is disabled when auxiliary devices are selected.

Fig. 22: The direction dialog box

8.5.2 Sensitivities…

Pressing the "Sensitivities" button allows the user to check the sensitivities of the force plate or auxiliary device that are used for the calculations, and to edit them if necessary. It is strongly advised that these sensitivities not be changed unless the user is absolutely certain that they are incorrect. The dialog box that appears when the button is pressed will be either for an eight-channel force plate with external amplifier (Fig. 23), an eight-channel force plate with integrated amplifier (not shown) or a single-channel auxiliary device (Fig. 24).

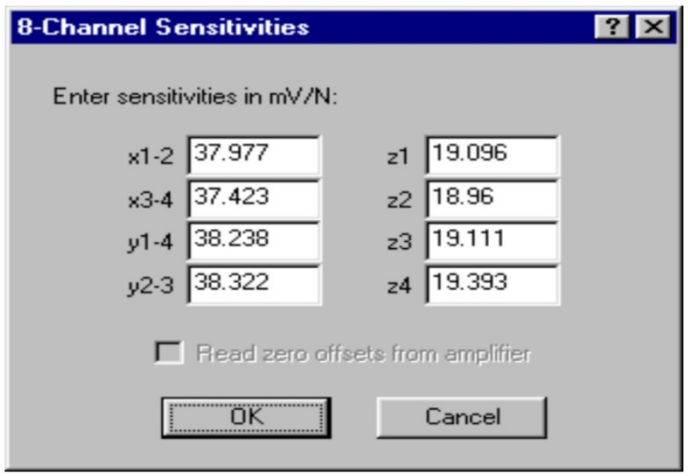


Fig. 23: The sensitivities for an eight channel force plate with Type 9865… amplifier

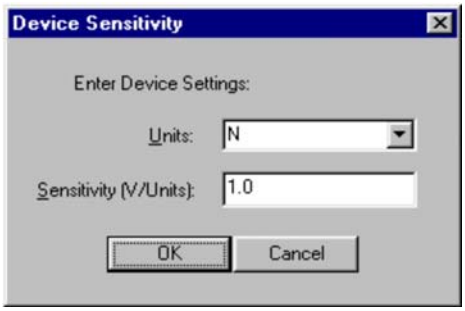


Fig. 24: The sensitivity for a single channel auxiliary device

8.5.3 Orientation…

Orientation is used when a plate is oriented with respect to a point other than its own center, such as when multiple force plates are attached to the system. It is generally not necessary when only one plate is configured. Fig. 25 shows the dialog box with the three parameters for defining the plate orientation. Alpha is the angle from the force plate's y-axis to the y-axis of the coordinate system. d_x and d_y are the distances from the center point of the reference coordinate system to the center point of the plate, in the x and y directions respectively.

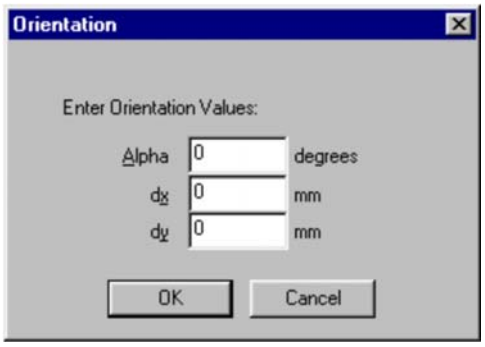


Fig. 25: The orientation dialog box

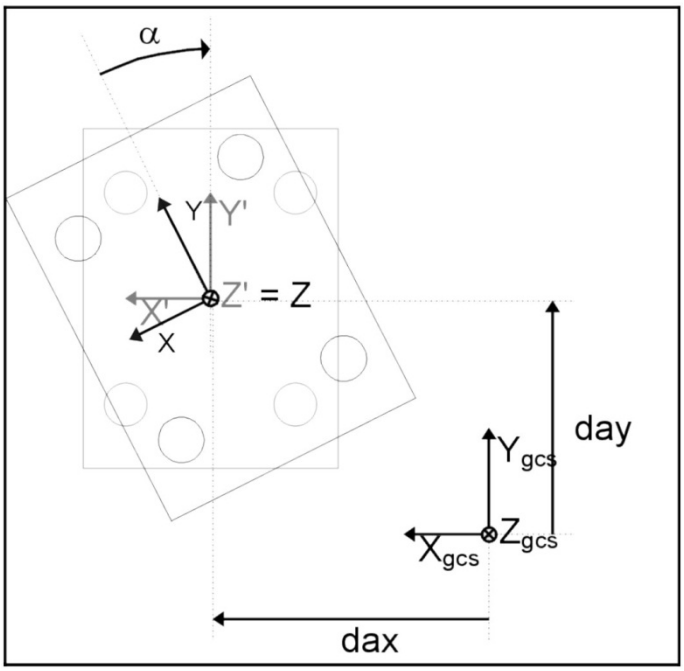


Fig. 26: Diagram illustrating the definition of force plate orientation

8.5.4 Amplifier…

Available only for plates with external amplifiers, the Amplifier Information dialog box (Fig. 27) shows the current amplifier range selected for each force sensor, as well as the name, type and serial number of the amplifier used with the device.

8.5.5 COP Enhancement…

Some eight-channel plates have Center of Pressure enhancement variables that, when activated, implement an algorithm based on these variables to more accurately calculate the center of pressure of the force plate. Fig. 28 shows the COP Correction dialog box. Default variables can be loaded by selecting the correct device from the list at the bottom of the box. Click OK to save any changes, and click Cancel to close the box without saving.

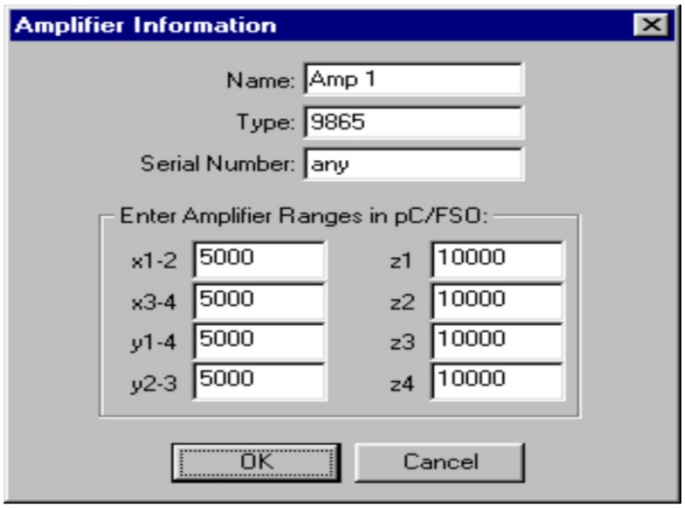


Fig. 27: The amplifier information box shows the range setting for the current trial

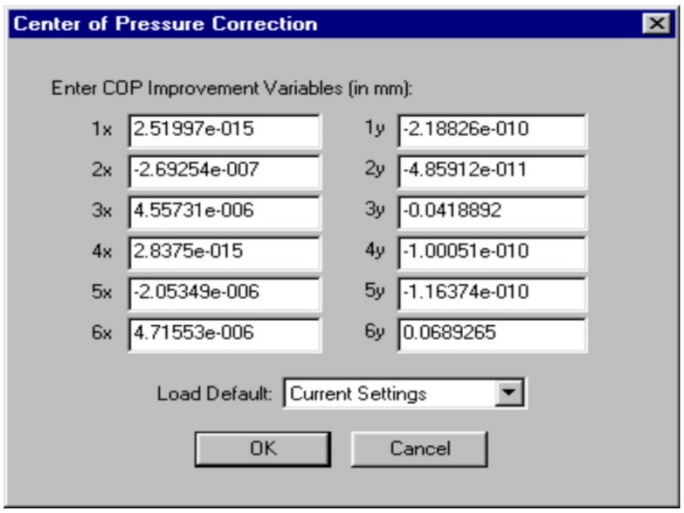


Fig. 28: The Center of Pressure correction variables for the selected device

8.5.6 Plate Settings...

Only available for force plate devices, this box shows the dimensions of the force plate in millimeters. Fig. 29 shows the Plate Settings dialog box, and Fig. 30 illustrates the setting definition.

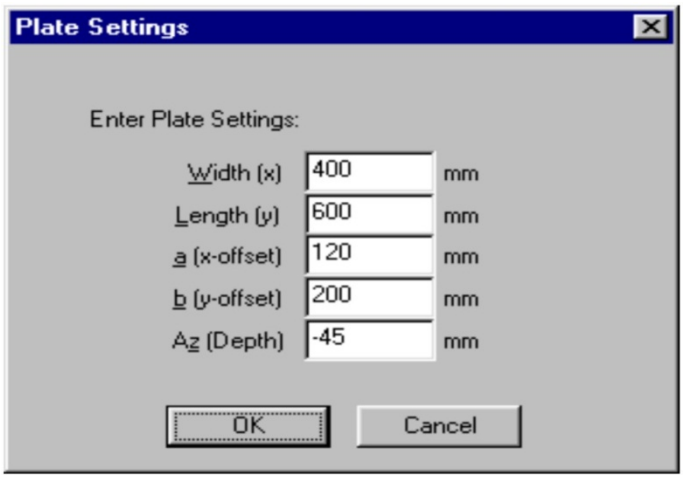


Fig. 29: The Plate Settings dialog box

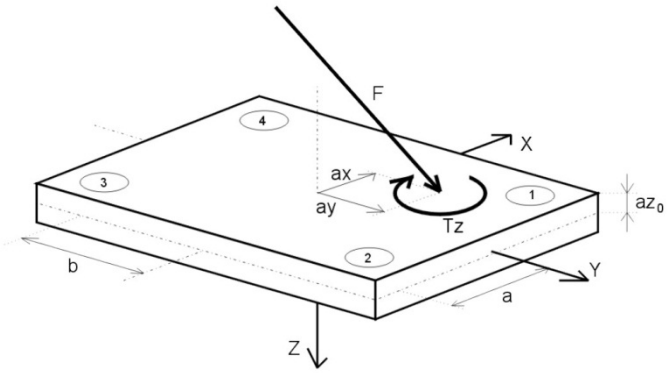


Fig. 30: The plate settings are illustrated in the above drawing

8.6 Contact Times…

This function appears whenever a graph is open in BioWare. It allows the user to set the start and finish contact times for the currently selected graph. The contact times are needed when using "Percent Contact" as the time scale. The default contact times are set based on the Contact Threshold (see Setup Menu). To edit the contact times from the dialog box (Fig. 31), simply choose the desired device from the drop box and the data gathered from that device shows up in the graph window. The default start and finish contact times are shown in their respective boxes just below the device list box.

Editing the contact or start times does not affect the data in any way. It is only used as a reference when viewing data with a time scale of Percent Contact. The default contact times are based on the Contact Threshold, from the Setup Menu.

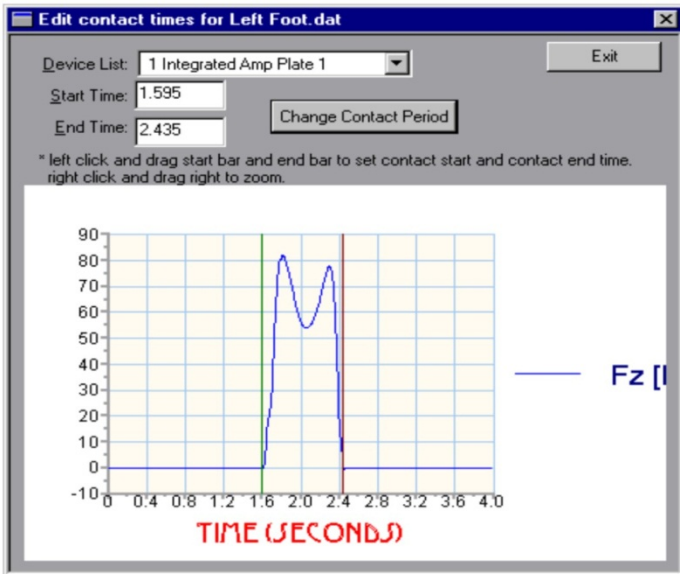


Fig. 31: The Edit Contact Times dialog box

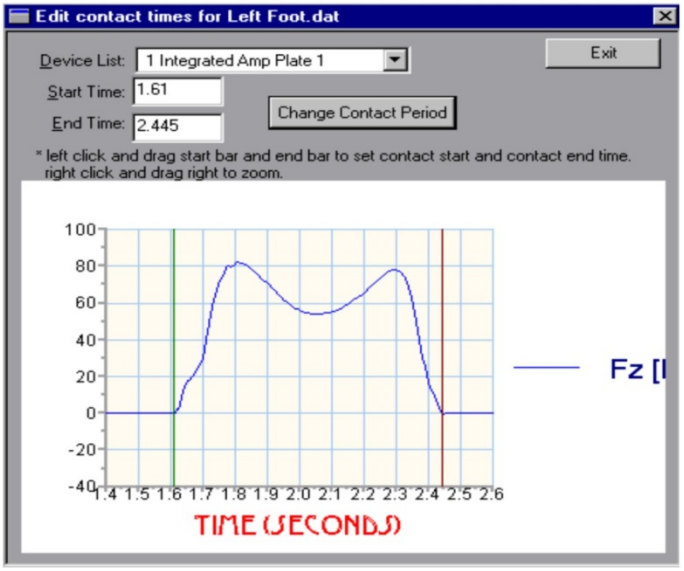


Fig. 32: The same graph as in Fig. 31, zoomed in to assist with positioning cursors

There are two ways to set the contact times; either type in new values directly or use moving cursors on the graph to set the times. In either case the user can zoom in on the data to get a closer look at the exact points of contact by right clicking the mouse and dragging a box around the desired viewing area (Fig. 32). If you choose to type in the values, look at the graph and type in the values for start

and finish and press the Change Contact Period button. To use the moving cursors click on the graph with the left mouse button and hold it down, and position the green (start) and red (finish) vertical lines in the proper positions, one at a time. The values for start and finish times change as the cursor moves about the graph, reflecting its current position. Release the mouse button when each is in position. Notice that you cannot place the start cursor beyond the finish cursor, and vice-versa. Zoom in on the graph to assist in positioning the cursors. Zoom out by clicking the corresponding toolbar icon or by choosing Zoom Out from the Window menu. Press Change Contact Period when ready. Click Exit to close the dialog box. Any changes made to the contact times cannot be undone.

8.7 Start Time…

This function allows the user to change the time scale to their preference. Often the time period of a trial that the user is interested in does not begin at zero seconds, and the user would like to change the axis so that the force data begins at "time = 0 seconds". This can be done by editing the start time of a trial. In essence, editing the start time will "shift" the time axis so that time zero occurs at the point where measurable force is first recorded, or to any other point that the user desires.

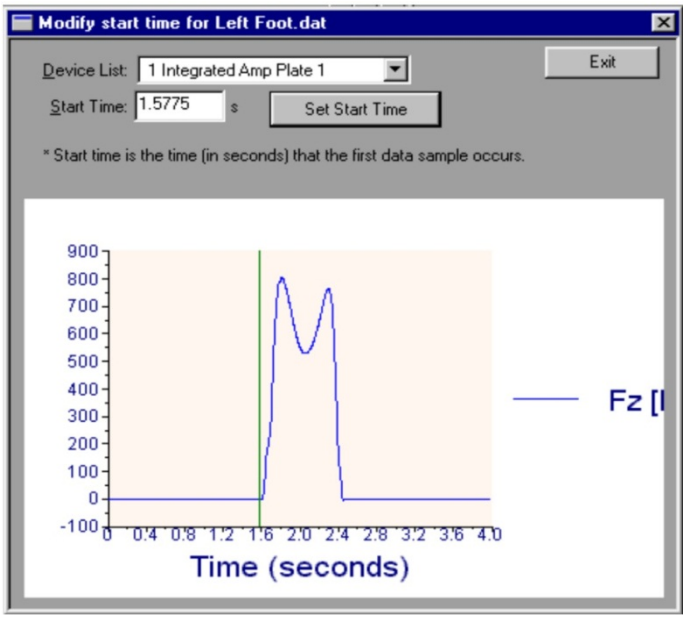


Fig. 33: Edit Start Time… dialog box allows you to choose the zero time for the trial

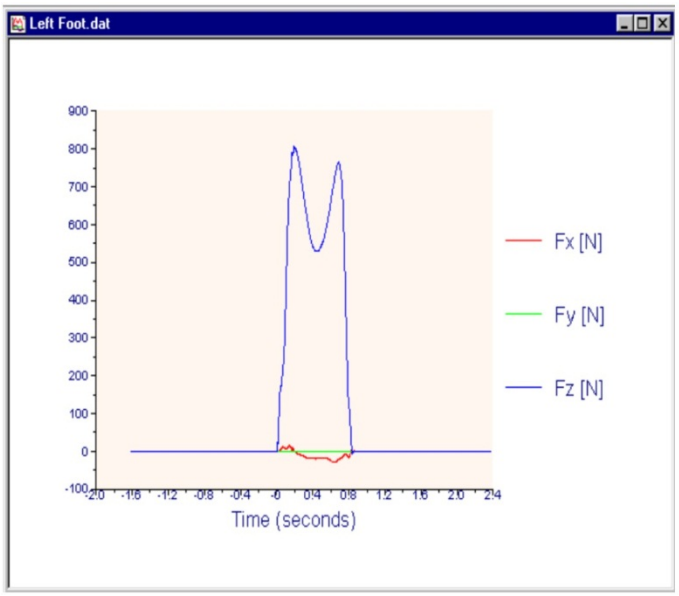


Fig. 34: The start time is now –1.61 seconds, so that the first point of control is at t = 0 sec

Fig. 33 and Fig. 34 will help illustrate the use of this function. Fig. 33 shows a walking trial where the subject first contacts the plate 1.61 seconds after acquisition begins (i.e., time = 1.61 seconds). To set this point of first contact at zero seconds we need to "shift" the time axis to the right by 1.61 seconds while "holding" the graph in place. We position the cursor where we would like time = 0. You can zoom in on the graph using the usual zooming method. Pressing the "Set Start Time" button will update the data set, including all graphs on screen (see Fig. 34). This places the zero time at first contact as we had selected Now look at the time of start of the first data set. It begins at time = –1.61 seconds. We have essentially "shifted" the time axis, without otherwise altering any data.

8.8 Normalizations…

This function will open a dialog box that allows the user to choose a device and enter a body weight and a length for normalization (see Fig. 35). Normalized force data has "Body Weights" as the unit of measure. For example, a subject who stands on a scale with units of Body Weight would read the value "1" as their weight. It is a handy unit of measure for comparing subjects of all shapes and sizes. To set the normalized value, choose Edit Normalizations… from the Data menu and select the device measuring the force or length, and enter the values to be used as normalized. Press OK when finished, or click Cancel to close the dialog box without saving any changes. You will only notice the change when viewing the data with Normalized units. This does not affect the data itself in any way.

Fig. 35: Enter the body weight and length to view the data normalized

8.9 Time Slice…

A great way to save disk space is to perform a time slice on a data file. Often a trial is taken with a wide time window to ensure that all desired data is gathered. However, this creates data files that are much larger than they need to be. For example, a 10-second trial taken at 250 Hz on an eight-channel plate would create 20 000 data points. If the actual time that the plate gathered useful data is 3 seconds, this would mean that 14 000 samples of "useless" information is stored together with the 6 000 samples of "good data". When experiments require 50 such trials, the useless information really piles up. Time slices remove unnecessary data from the file while maintaining only the pertinent data.

Great care should be taken when performing time slices. It is a permanent operation. The data that is removed cannot be restored. Please make sure that the correct data is being saved and that only unwanted data is being deleted.

A time slice is performed by defining a starting and ending time for data you wish to **keep**. All data outside the designated range will be eliminated from the file. Only one range can be defined per trial. This means that if there are two distinct regions of pertinent data from a single file that you wish to keep, then you will need to define the start of the time slice at the start of the first range, and the end of the time slice at the end of the second range. Fig. 36 and Fig. 37 will illustrate an example of a time slice.

Fig. 36 shows an example of a 3-second gait trial, of which there is less than one second of useful data. We would like to perform a time slice to eliminate the unwanted data and cut down on used disk space. From the Data menu we select Time Slice… and choose the selected device from the Device List. Then we position the moving cursors at the start and finish of the gait cycle. The green cursor is positioned at the start and the red at the finish, by holding down the mouse and dragging the cursors into position. We can zoom in for a closer look by right clicking and dragging a box around the zoom window. Once the cursors are in position we click on the button labeled "Time Slice Data Set". A confirmation box reminds us that the data outside the selected range will be permanently eliminated, and we click Yes to continue. Fig. 37 shows the newly time-sliced data. We click exit to close the dialog box.

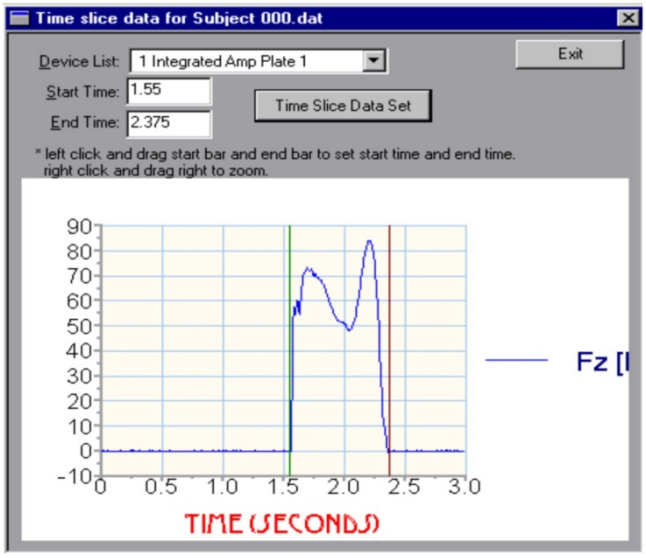


Fig. 36: The time-slice function eliminates unwanted data…

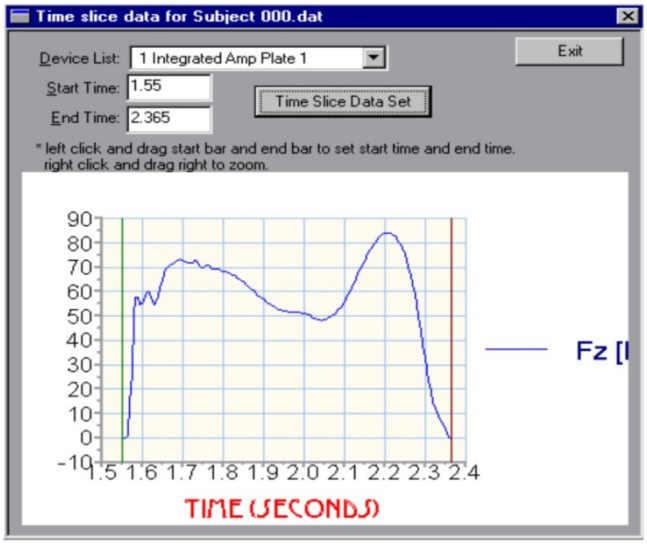


Fig. 37: The same data set with unwanted data time-sliced out of the file

It is a good idea to edit the start time after performing a time slice, to make the first data point occur at time = 0 seconds (see chapter 8.7).

8.10 Filter…

Filtering is used to "smooth" a data set or to remove some frequency content. The type of filter to use depends upon the type of modification required. The filtering options are: 1) Moving Mean, 2) Moving Median, and 3) Digital Filtering. Each is discussed in the following paragraphs. To access the filtering dialog box (Fig. 38), choose "Filter…" from the Data menu. Select the device to filter from the device list, and choose the type of filter to use. Click Apply to apply the selected filter, and click Done to close the dialog box.

8.10.1 Moving Mean (Average)

A moving mean filter is used to smooth an entire data set when no particular frequencies are to be filtered out. This type of filter generates a moving average data set from the original one, based on a user-specified "window size". The window size specifies how many values to the left and right of the current value are averaged. **The window size must be an odd number**, because the current value must fall in the exact center of the window, with an even number of points to the left and right of it. The average of all values in the window is calculated, and this number is used to replace the current value. The larger the window size, the more the resulting data set is smoothed. Fig. 39 illustrates both the moving mean and the moving median filters.

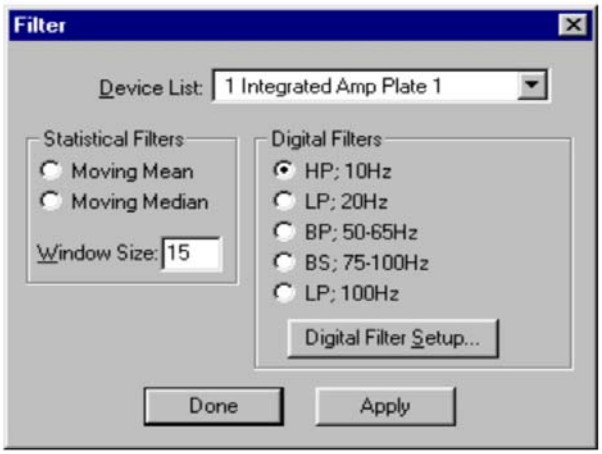


Fig. 38: The Filter dialog box

8.10.2 Moving Median

The moving median filter is similar to the moving mean in that it also uses a moving window. However, this method sorts the values within the window and replaces the current value with the median value (i.e., the middle value in the sorted data window). The moving median type filter is good for removing sharp spikes in the data. Refer to Fig. 39 to see an example of how the moving median filter works.

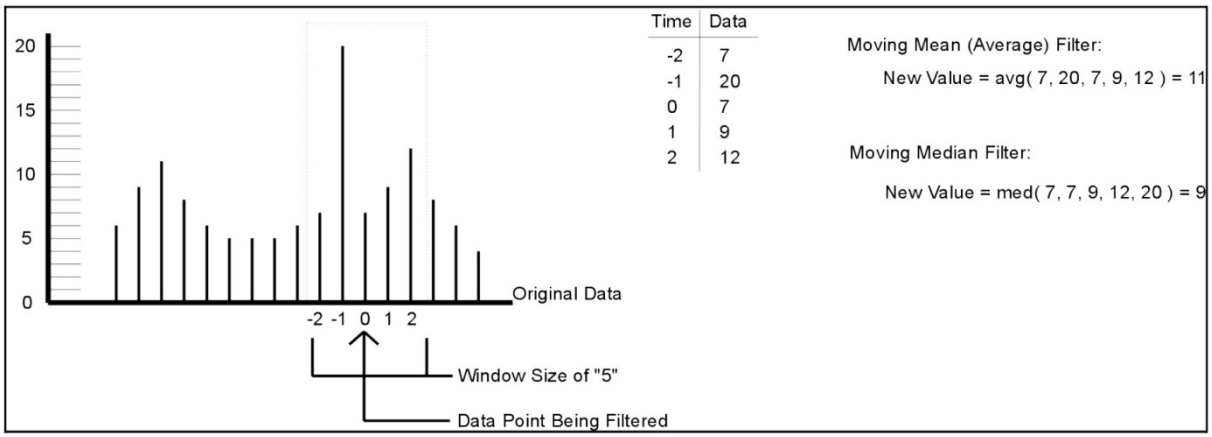


Fig. 39: Illustration of Moving Mean and Moving Median filters

When using either a moving mean or moving median filter, be sure to enter the desired window size before applying the filter. The window size must be an odd number to keep the current data value centered in the window.

8.10.3 Digital Filters

Digital filters are to be used when it is known which frequencies are to be removed from a data set. BioWare allows the user to define his/her own filters or to use ready-made default filters. A separate Filter Setup dialog box
(Fig. 40) helps the user create a custom filter and also shows the current filter configuration. Each part of the Filter Setup dialog box will be discussed individually. Prior to filtering, an artificial data set is created by extending the beginning and ending of the data set by the computed filter length and filling these extensions with the first data sample and the last data sample respectively. This eliminates the sharp corner frequencies at sample zero and at the last sample and will result in better filters in most cases.

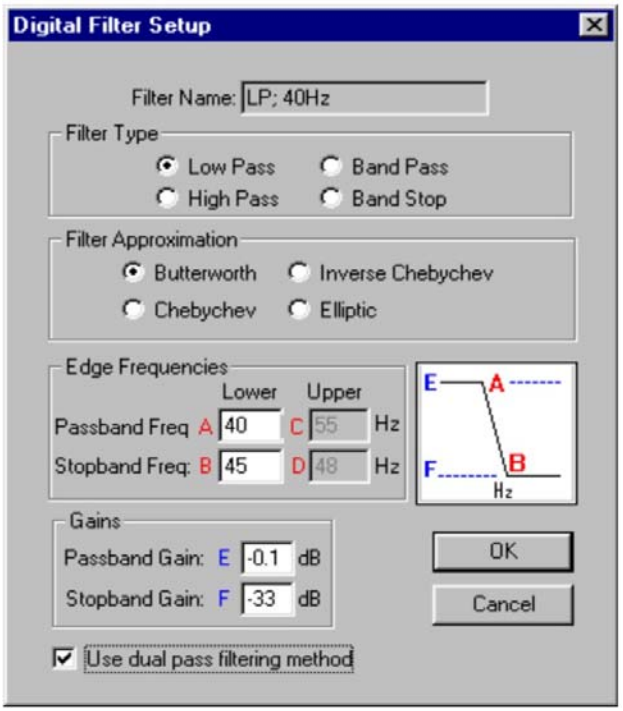


Fig. 40: The filter setup dialog box

- The **Filter Type** defines the range of frequencies to pass or stop. Low Pass filters remove the high frequencies and pass the low frequencies, while High Pass filters pass the high frequencies but stop the low frequencies. Band Pass filters allow a finite range of frequencies to pass and stop all others, while the Band Stop filters will stop a finite range of frequencies and allow all others to pass
- **Filter Approximation** defines the filter equation used. There are four different filter approximations: Butterworth, Chebychev, Inverse Chebychev, and Elliptic. These approximations are explained in Appendix A
- **Edge Frequencies** must be defined for each filter type. For each filter type there is a passband and stopband frequency along with a passband and stopband gain, which define the limits of the filter. The definition of passband and stopband differ with filter type:

1. For a **low pass** filter, the passband is the frequency above which all frequencies are filtered to some degree, and below which all frequencies pass unfiltered. The stopband in this case is the lowest frequency where the signal is completely filtered out, everything above this stopband frequency is completely eliminated from the data. The stopband is always a higher frequency than the passband for low pass filters. Between the passband and stopband the frequencies become progressively more filtered out as the frequency increases from passband to stopband

2. A **high pass** filter is exactly the reverse of a low pass filter. The passband frequency is higher than the stopband frequency. All data above the passband goes unfiltered and everything below the stopband frequency is eliminated
3. Both band pass and band stop filters are nothing more than a combination of high pass and low pass filters. The **band pass** filter allows a certain range of data to pass through and eliminates all frequencies outside the range. Therefore, the low pass frequency is actually higher than the high pass frequency. For example, a band pass filter that wants to only allow data with frequencies in the range of 500 to 750 Hz would combine a high pass filter of 500 Hz with a low pass filter of 750 Hz. The high pass filter eliminates everything below 500 Hz, and the low pass filter eliminates everything above 750 Hz
4. A **band stop** filter is the reverse of the band pass. It allows all frequencies to pass through except for a defined range somewhere within the frequency spectrum of the data. For example, to design a band stop filter of 500 to 750 Hz would mean to apply a low pass filter of 500 Hz and a high pass filter of 750 Hz. Only the data with frequencies between 500 and 750 Hz are eliminated

- The filter **Gains** are the ratio of the signal output level to the signal input level. A gain greater than 1 means a higher output while a gain less than 1 means a lower output than input. The gain in the stopband is typically very small (e.g., 0.0001), and is often converted to decibels because they are much more manageable for very small gains. The equation is: $\mathbf{gain_{db} = 20 \bullet log(gain)}$. For example, a stopband gain of 0.0001 is equal to –80 dB. A typical passband could be 0.707, or –3.0103dB

Sometimes a time shift occurs when applying a filter, which shows up by overlaying filtered and unfiltered data. To compensate for this, place a check in the box at the bottom of the Digital Filter Setup box to enable **Dual Pass**. This function filters the data once from start to finish, and then reverses the data set and performs the filtering again. When complete, it reverses the data set once again to put it back in the right order. Doing this minimizes any time shifting that may be caused by the filter.

A filter is defined by specifying the passband frequency and the gain at which this frequency occurs, and the stopband frequency and the gain at which its frequency occurs. The diagram in the filter setup dialog box illustrated the filter being designed, and shows the passband and stopband frequencies and gains to help assist in the filter design. BioWare will not allow invalid filter settings, and will explain any errors in design.

8.11 Resample Data Set…

Being able to resample a data set can be useful when comparing data that was sampled at different rates. This function will take a selected data set and resample it at the rate specified by the user. To set a new rate, choose "Resample Data Set…" from the Data menu and select the data set to resample from the list. The current rate will be shown in the dialog box (Fig. 41) along with a box to enter the new rate, whose default is the current sampling rate. Enter the new rate and click the Resample button. The graph will be updated and the Current Sample Rate in the dialog box will change to reflect the new rate. Click close when finished. The resampling algorithm uses a spline algorithm to estimate signals.

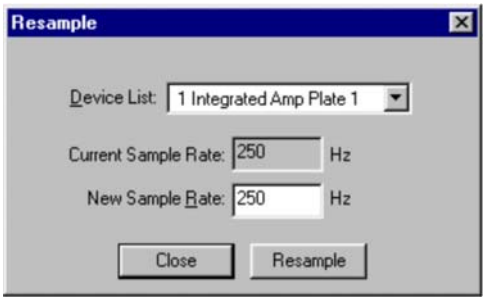


Fig. 41: Data sets can be re-sampled at different rates

8.12 Remove Data Set…

Sometimes a file has some unwanted data attached; either a device that did not measure properly or a filter that did not perform correctly, or for some other reason there are data sets that are doing little more than taking up space. These data sets can be removed from the file by selecting "Remove Data Set…" from the Data menu. A dialog box appears (Fig. 42) with a list of data sets that are associated with the current file. The entire list can be viewed by pressing the down arrow to the right of the list box. Select the data set to be eliminated and press the Remove button. If there is only one data set associated with the device then the Remove button will be disabled (If this is the case then the entire file should simply be deleted entirely from the computer). Press the Close button when finished.

Fig. 42: It is possible to remove an unwanted data set from the file

Device data can be exported to a tab-delimited text (*.txt) file in "reduced" format, meaning that all forces and moments are already calculated from the raw voltages. The user can select which parameters to export and which device data to use. The Export Data dialog box (Fig. 43) is very similar to the View Manager, with a very straightforward interface. To export data, first select the device from the Device List. Next, select the desired time scale from the Time list and place a check in the boxes whose data is to be exported. If center of pressure (COP) parameters are selected, select whether or not to use COP correction and/or to Automatically center the COP values from the Center of Pressure Options. When ready, press the "Export Data" button. Choose the name (and location) for the exported file from the box that pops up, and click OK to complete the export. Another box pops up to confirm that the data was exported, showing the export path and filename.

Changes made to the data files are not permanent until the file is saved. If a file was altered in any way, when it is closed or when BioWare is exited a message box will pop up asking the user whether or not to save the changes.

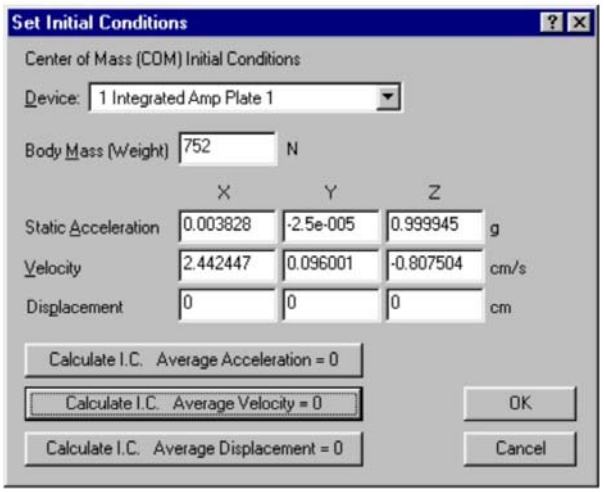


Fig. 43: Initial Conditions dialog box

8.13 Initial Conditions…

All initial conditions required for Performance calculations can be set by the user in the Initial Conditions... dialog box. The components of the Initial Conditions... dialog box include:

- **Device Selection –** Allows the selection of the device for which the initial conditions to be set. Only force plate devices will appear in the selection list
- **Body Mass (Weight)** – This entry boxes allow the entry of the subjects body mass for the currently selected device. The current units for body mass are displayed to the right of the entry box

The body mass is the *most important* parameter. All calculations performed in BioWare Performance are based on Body Mass. The weight should be measured on the force plate(s) before starting power measurements. Weight and Mass are used "interchangeably" with the gravitational constant take into affect.

The X, Y, Z Columns define the separate initial conditions for each of the orthogonal components X, Y, and Z in the chosen coordinate system.

- **Static Acceleration Row** – This row allows for the entry of the static acceleration parameters used in the computation of acceleration, and all subsequent acceleration based computations. 9.80665 m/s/s is the default vertical acceleration of gravity. Note, the units for acceleration are defined in the Units dialog box located under the setup menu. The static acceleration allows for the removal of earth's gravity from all performance calculations

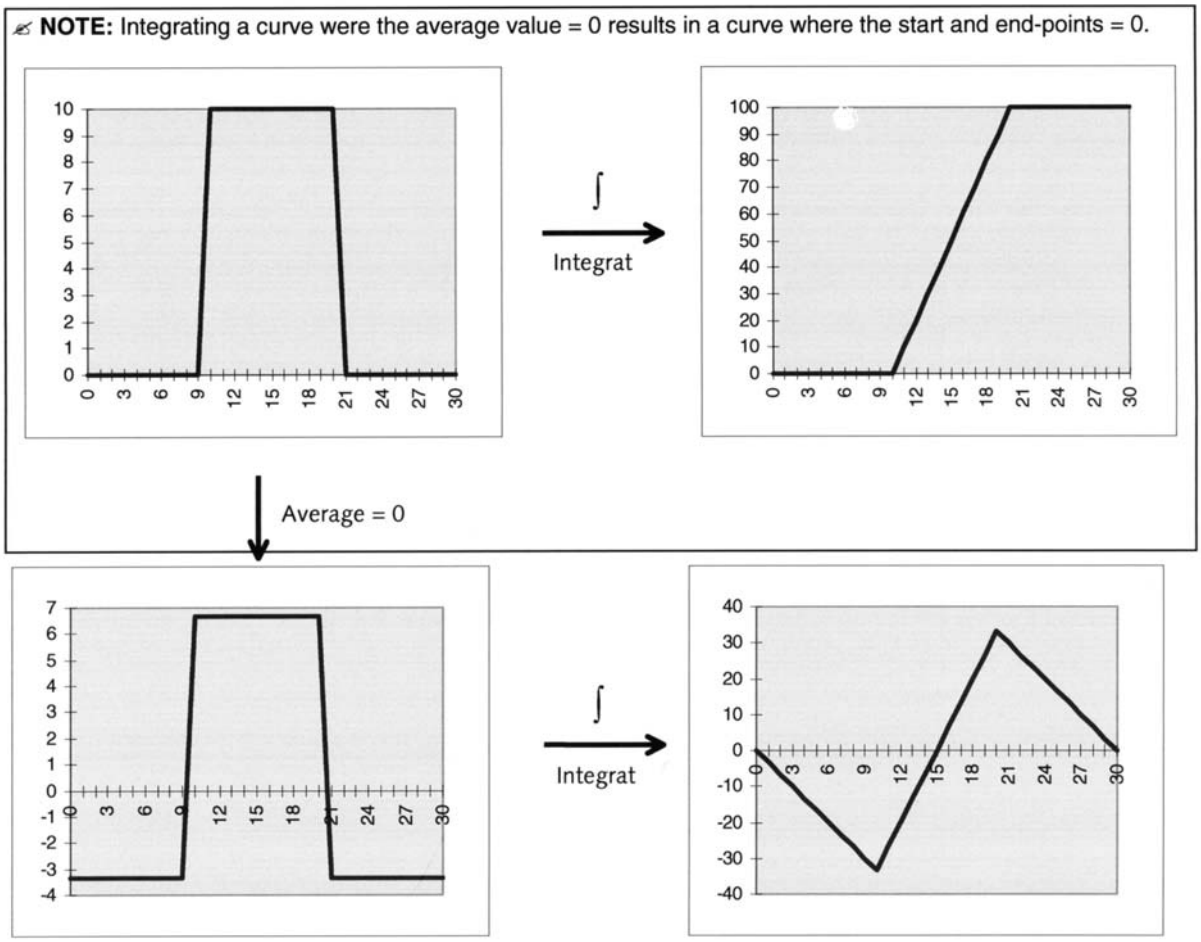
- **Velocity Row** – This row allows for the entry of the initial velocity parameters used in the computation of velocity, and all subsequent velocity based computations. Note, the units for velocity are defined in the Units dialog box located under the setup menu

- **Displacement Row** – This row allows for the entry of the initial displacement parameters used in the computation of displacement, and all subsequent displacement based computations. Note, the units for displacement are defined in the Units dialog box located under the setup menu

- **Calculate I.C. Average Acceleration = 0** – The Calculate Initial Conditions Average Acceleration = 0 button is used to automatically calculate the static accelerations for the selected device. If this button is selected, BioWare Performance will compute the appropriate static accelerations for the force plate which will cause the average acceleration over the complete trial to be equal to zero. The computations are performed separately for all three orthogonal components, X, Y, and Z. This is useful when it is known that the subjects acceleration was, on average, zero

- **Calculate I.C. Average Velocity = 0** – The Calculate Initial Conditions Average Velocity = 0 button is used to automatically calculate the initial velocities for the selected force plate. If this button is selected BioWare Performance will compute the appropriate initial velocities for the selected device which will cause the average velocity over the complete trial to be equal to zero. The computations are performed separately for all three orthogonal components, X, Y, and Z. This is useful when it is known that the subjects velocity was, on average, zero

- **Calculate I.C. Average Displacement = 0** – The Calculate Initial Conditions Average Displacement = 0 button is used to automatically calculate the initial displacements for the selected force plate. If this button is pressed, BioWare Performance will compute the appropriate initial displacements for the selected force plate which will cause the average displacement over the complete trial to be equal to zero. The computations are performed separately for all three orthogonal components, X, Y, and Z. This is useful when it is known that the subjects displacement was, on average, zero


NOTE: Integrating a curve were the average value = 0 results in a curve where the start and end-points = 0.
Integrat
Average = 0
Integrat

9. The View Menu

The features of the View menu are directly related to the look of the screen along with any graphs that may be open. If no graphs are open then the View menu does nothing more than toggle the Tool Bar and the Status Bar on and off (a check mark before the Tool Bar or Status Bar in the menu means that it is active). If a graph is open, additional features appear that are related to the current file open. Right-clicking the mouse button on the graph to open a popup menu can duplicate many of the View Menu features. It is up to the user to decide which is the more comfortable method.

9.1 Edit Parameters... (Alt+E)

The Graph Setup Dialog Box (Fig. 44) is displayed by selecting Edit Parameters from the View Menu. It lets the user customize the look of each graph. The number of graphs (1, 2, or 4) as well as the contents of each graph are set here.

At the top of the dialog box icons of five different graph views are shown. Select the number and format of the graphs by clicking on the desired view. One to four tabs appear corresponding to the number of graphs selected, and each tab marks a page for formatting the parameters on that particular graph. Each page is identical in appearance. The numbering system of the graphs is left to right, top to bottom.

To change a graph's parameters, select the tab of the corresponding graph (if more than one graph is displayed) to bring up the parameter page. The page is separated in to two sections – plates and auxiliary devices. If any auxiliary devices were used, they are placed in the Auxiliary Device list at the right of the page and can be selected for viewing simply by placing a check in the box next to the corresponding device.

A list of any plates used is in the Plates selection box. The list can be viewed by pressing the down arrow at the end of the box. Individual plates or all plates can be selected. Place check marks in the boxes next to the parameters to be viewed. The parameters are separated in to Forces, COP, Friction, and Moments.

If the COP parameter Ax vs. Ay is enabled, any other selected parameters will be disabled. This is because the x-axis is different for Ax vs. Ay. Similarly, selecting any other parameter will disable Ax vs. Ay if it has been previously enabled.

The x-axis can be changed to view the data in different ways. Choose the x-axis view from the drop list next to the plate list. The parameters are as follows:

- **Absolute Time –** The default axis, displaying data as it was gathered without manipulation
- **Relative Time –** sets time=0 at the point of first contact (i.e., force above the contact threshold)
- **Percent Contact –** also based on the contact threshold, sets point of first contact at 0% and point of last contact as 100%
- **A/D Samples –** uses the raw sample numbers for the x-axis
- **Frequency –** converts the data from the time domain to the frequency domain via a Fast Fourier Transform

Repeat these steps for all pages. Click OK when finished to close the dialog box and update the graphs, or click Cancel to close the box without making changes.

9.2 Performance Parameters…

The Graph Setup Dialog Box (Fig. 44) is displayed by selecting Edit Parameters from the View Menu. It lets the user customize the look of each graph.

The "Show Performance" button will appears in the upper right hand corner of the Graph Setup dialog box.

Selecting the "Show Performance" button displays the Performance Parameters selection box (Fig. 45). The three orthogonal components (X, Y and Z) of 7 different performance parameters can be selected as well as the resultant magnitude of each parameter. You may hide the performance parameter dialog box by selecting the "Hide Performance" button at any time.

You may select normal BioWare parameters as well as Performance parameters to be displayed on the same graph.

Fig. 44: Graph Setup dialog box

A list of any plates used is in the Plates drop box. The list can be viewed by pressing the down arrow at the end of the box. Individual plates or all plates can be selected. You cannot select all plates as one when viewing a performance parameter.

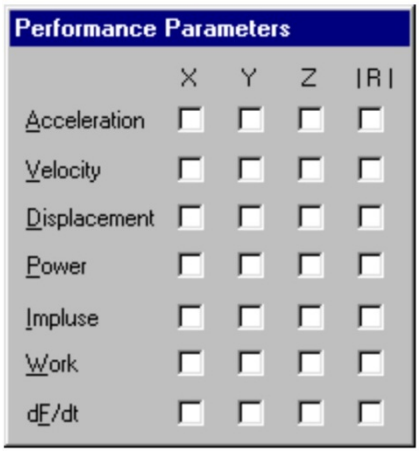


Fig. 45: Performance Parameters

If the COP parameter Ax vs. Ay is enabled, any other selected parameters will be disabled. This is because the x-axis is different for Ax vs. Ay. Similarly, selecting any other parameter will disable Ax vs. Ay if it had been previously enabled.

9.2.1 Notes on Performance Calculations

9.2.1.1 Calculation of Resultant Values

The resultant |R| component is the magnitude of the vector comprising the three orthogonal components, X, Y, and Z. The magnitude is computed using:

$$|R| = \sqrt{X^2+Y^2+Z^2}$$

9.2.1.2 Numerical Integration

The calculation of velocity, displacement, power, impulse, and work require numerical integration to be performed on the force data. Numerical integration for BioWare Power uses Simpson's rule because it represents a reasonable balance between accuracy and simplicity. Simpson's rule is:

$$\int_0^{N-\Delta t} f(x)\cdot dx = f_0 + \frac{1}{\Delta t}\sum_{i=0}^{N-2}(f_i + 4f_{i+1} + f_{i+2})$$

Where: $\Delta t =$ distance between samples

$N =$ Number of samples

The accuracy of the integration depends primarily on successfully choosing the initial condition, f_0. The user must determine initial conditions. Initial conditions highly depend on the peculiarities of the test being performed. It is imperative that the user understands the basic equations and the physical phenomena for the test being performed in order that the initial conditions can be chosen properly. Chapter 8.13 discusses the meaning of the initial conditions in more detail and provides a simple example to help aid in the understanding the underlying equations.

9.2.2 Acceleration

Acceleration Graphs: The Acceleration choice in the Performance Parameters dialog box allows the display of acceleration of center of mass data in graphical form. Acceleration, a, is computed from the force data, body mass information, and static acceleration using Newtons equation $F = ma$. The vertical acceleration needs to be compensated by the static gravitational acceleration, g, where $g = 9.80665$ m/s^2. The static accelerations for all three components can be entered in the Setup:Initial Conditions... dialog box. Generally, the static Y acceleration is 9.81 m/s^2, while the static X, and Z accelerations are zero. Provisions are given to enter static X, Y, and Z accelerations to accommodate special setups and actions.

$$F = m \cdot a \quad \text{Newtons Equation}$$

$$a = \frac{F}{m}$$

$$a_X(t) = \frac{F_X(t)}{m} - a_{0X}$$

$$a_Y(t) = \frac{F_Y(t)}{m} - a_{0Y}$$

$$a_Z(t) = \frac{F_Z(t)}{m} - a_{0Z}$$

$$|a(t)| = \sqrt{a_X^2(t) + a_Y^2(t) + a_Z^2(t)}$$

where: m = Body Mass

a_{0X} = Static X acceleration $\quad F$ = Force

a_{0Y} = Static Y acceleration $\quad a$ = Acceleration

a_{0Z} = Static Z acceleration

Body mass and static accelerations are entered in the Initial Conditions… dialog box. See chapter 8.13 for more information on entering the initial conditions.

Fig. 46 shows the vertical force vs. time for an example force "jump" trial. With the proper body mass entered and earth's gravitational acceleration removed, the resulting acceleration of center of mass can be computed, shown in Fig. 47.

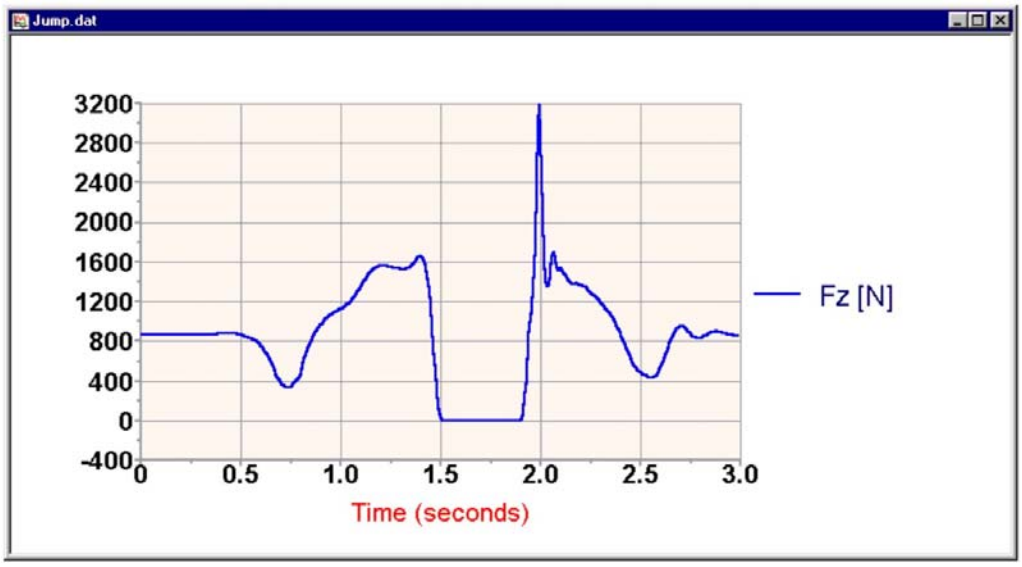


Fig. 46: Force vs. Time

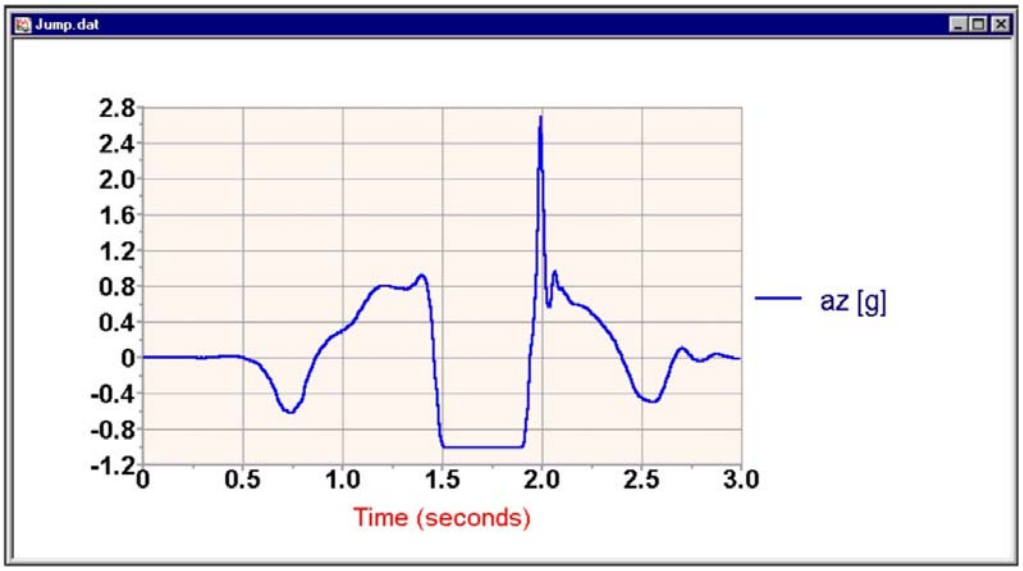


Fig. 47: Acceleration vs. Time

9.2.3 Velocity

Velocity Graphs: The Velocity choice in the Performance Parameters dialog box allows the display of velocity of center of mass data in graphical form. Velocity is computed from the force data, body mass information, static acceleration, and initial velocity by first calculating the acceleration and then performing integration.
The velocity, v, computation is based on acceleration being the rate of change of velocity. Solving for velocity yields:

$$a = \frac{dv}{dt}$$

$$v = v_0 + \int a \cdot dt$$

The equations used for velocity are:

$$v_X(t) = v_{0X} + \int a_X(t) \cdot dt$$

$$v_Y(t) = v_{0Y} + \int a_Y(t) \cdot dt$$

$$v_Z(t) = v_{0Z} + \int a_Z(t) \cdot dt$$

$$|v(t)| = \sqrt{v_X^2(t) + v_Y^2(t) + v_Z^2(t)}$$

where: v_{0X} = Initial X velocity a = Acceleration

v_{0Y} = Initial Y velocity v = Velocity

v_{0Z} = Initial Z velocity

See chapter 8.13 for more information on entering the initial conditions.

Fig. 48 shows an example vertical velocity of center of mass graph from a "jump" trial.

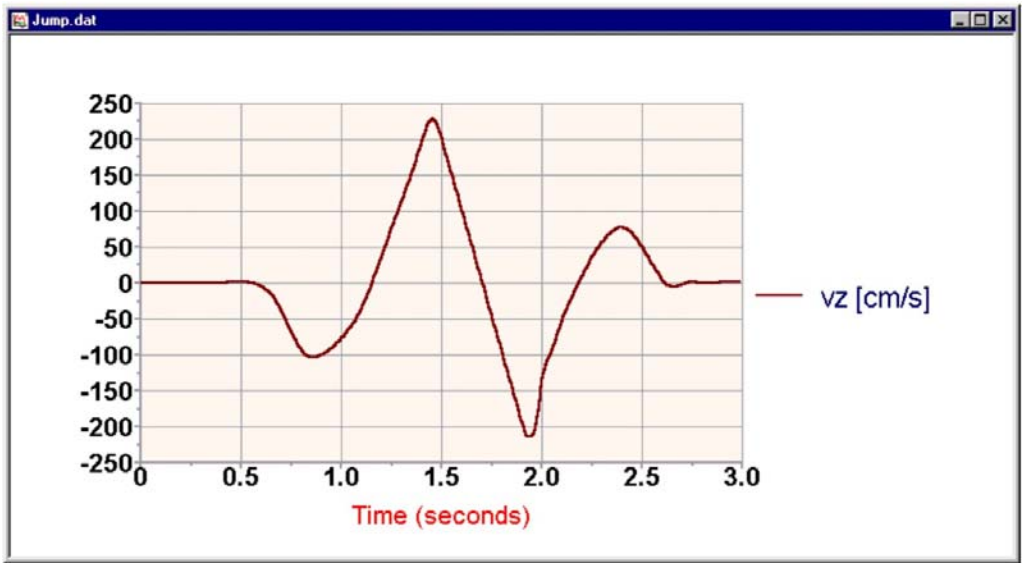


Fig. 48: Velocity vs. Time

9.2.4 Displacement

Displacement Graphs: The Displacement choice in the Performance Parameters dialog box allows the display of displacement of center of mass data in graphical form. Displacement of center of mass is computed from the velocity data and initial displacement by performing integration. The displacement, s, computation is based on velocity being the rate of change of displacement. Solving for displacement yields:

$$v = \frac{ds}{dt}$$

$$s = s_0 + \int v \cdot dt$$

The equations used for displacements are:

$$s_X(t) = s_{0X} + \int v_X(t) \cdot dt$$

$$s_Y(t) = s_{0Y} + \int v_Y(t) \cdot dt$$

$$s_Z(t) = s_{0Z} + \int v_Z(t) \cdot dt$$

$$|s(t)| = \sqrt{s_X^2(t) + s_Y^2(t) + s_Z^2(t)}$$

where: s_{0X} = Initial X displacement v = Velocity

s_{0Y} = Initial Y displacement s = Displacement

s_{0Z} = Initial Z displacement

See chapter 8.13 for more information on entering the initial conditions.

Fig. 49 shows an example vertical displacement of center of mass graph from a "jump" trial.

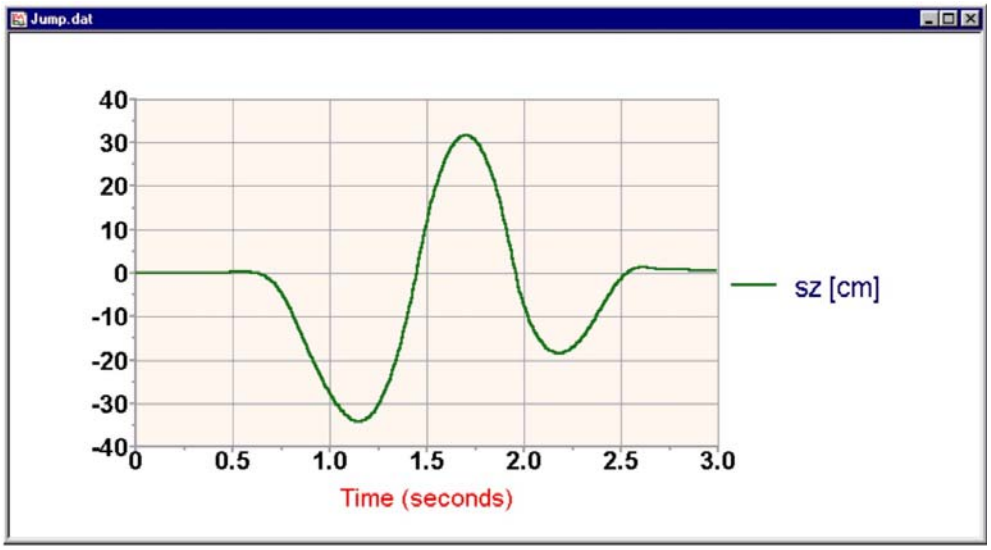


Fig. 49: Displacement vs. Time

9.2.5 Power

Power Graphs: The Power choice in the Performance Parameters dialog box allows the display of power data in graphical form. Power, P, is computed from the force data and velocity data. The equations used for power calculations are:

$$P_X(t) = F_X(t) \cdot v_X(t)$$
$$P_Y(t) = F_Y(t) \cdot v_Y(t)$$
$$P_Z(t) = F_Z(t) \cdot v_Z(t)$$
$$|P(t)| = \sqrt{P_X^2(t) + P_Y^2(t) + P_Z^2(t)}$$

where: P = Power
F = Force
v = Velocity

Fig. 50 shows the vertical power graph from an example "jump" trial.

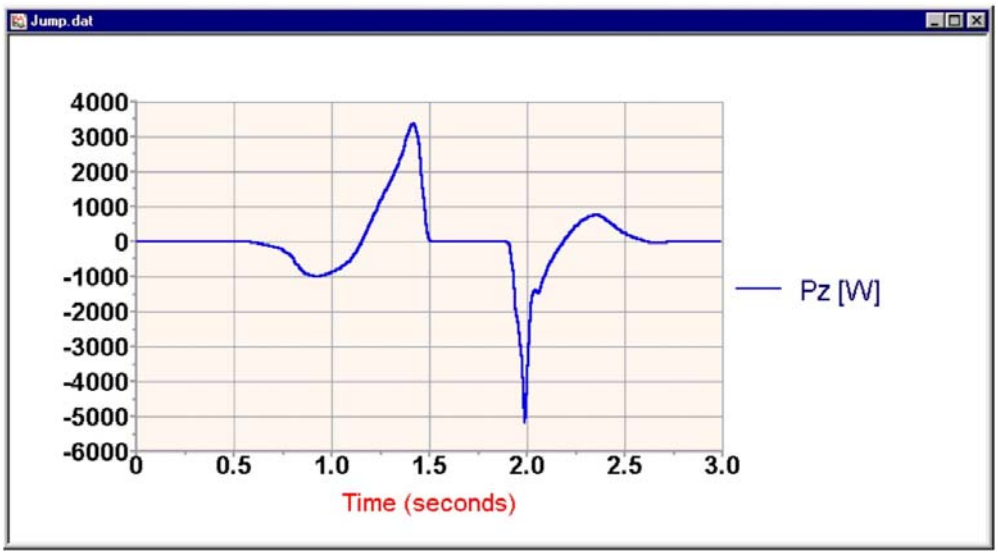


Fig. 50: Power vs. Time

9.2.6 Impulse

Impulse Graphs: The Impulse choice in the Performance Parameters dialog box allows the display of impulse data in graphical form. Impulse, p, is computed from the body mass and velocity data. The equations used for impulse calculations are:

$$p_X(t) = m \cdot v_X(t)$$
$$p_Y(t) = m \cdot v_Y(t)$$
$$p_Z(t) = m \cdot v_Z(t)$$
$$|p(t)| = \sqrt{p_X^2(t) + p_Y^2(t) + p_Z^2(t)}$$

where: p = Impulse
m = Body Mass
v = Velocity

Fig. 51 shows an example vertical impulse graph from a "jump" trial.

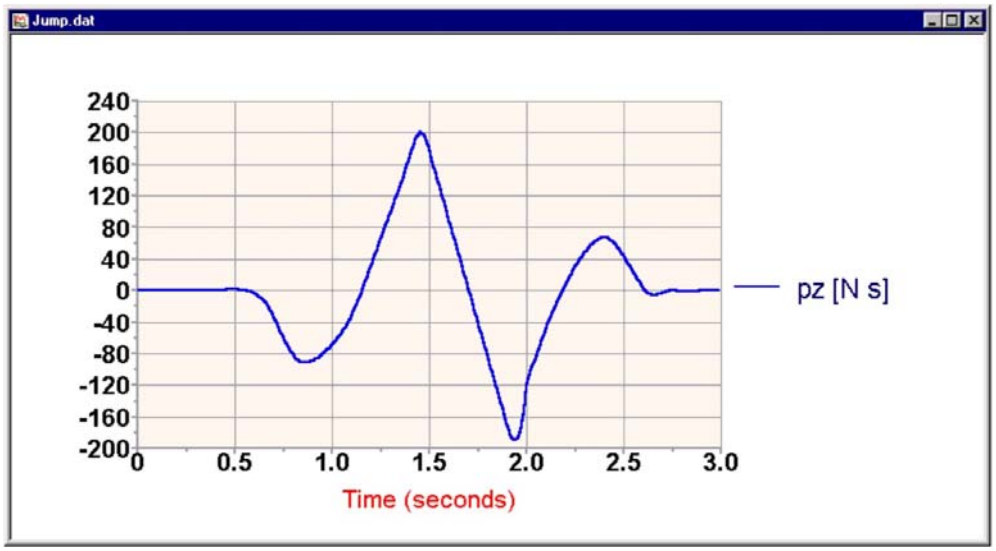


Fig. 51: Impulse vs. Time

9.2.7 Work

Work Graphs: The Work choice in the Performance Parameters dialog box allows the display of work (or often referred to as Kinetic Energy) data in graphical form. Work, W, is computed from the Power data. The equations used for work calculations are:

$$W_x(t) = w_{0x} + \int P_x(t)$$

$$W_y(t) = w_{0y} + \int P_y(t)$$

$$W_z(t) = w_{0z} + \int P_z(t)$$

$$|W(t)| = \sqrt{W_x^2(t) + W_y^2(t) + W_z^2(t)}$$

where : $P(t) = Power$ see section 5.6

$$w_0 = \frac{mass \cdot v_0 \cdot v_0}{2}$$

$v_0 =$ initial velocity

Fig. 52 shows an example vertical work graph from a "jump" trial.

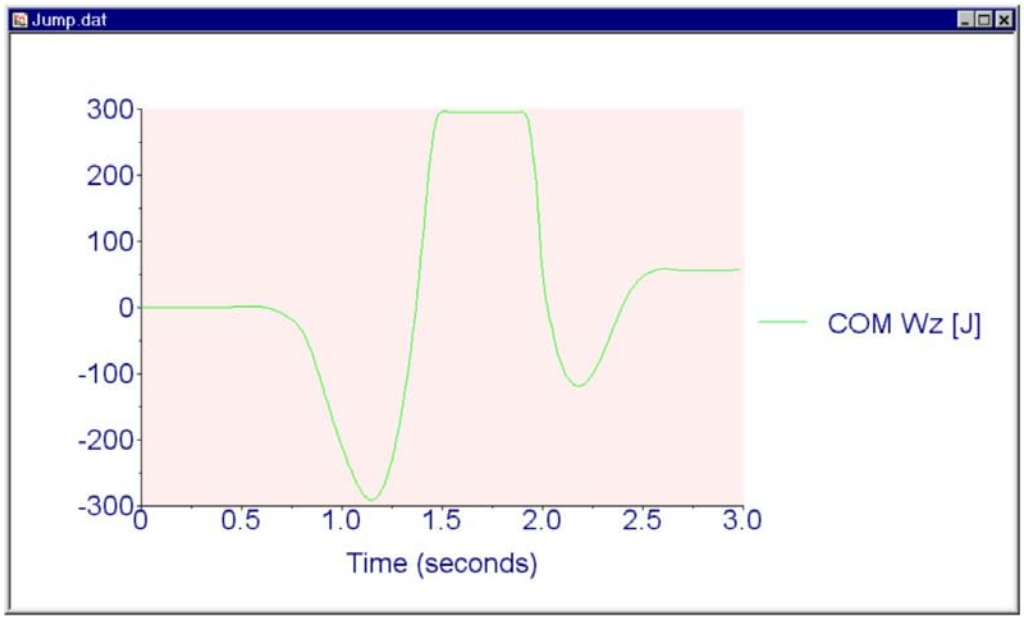


Fig. 52: Work vs. Time

9.2.8 dF/dt (Force Gradient)

Force Gradient, dF/dt Graphs: The dF/dt choice in the Performance Parameters dialog box allows the display of force gradient data in graphical form. Force gradient, dF / dt, is computed from the force data. The equations used for force gradient calculations are:

Fig. 53 shows an example vertical force gradient (dF/dt)

$$\frac{dF_X}{dt}(t) = \frac{F_X(t+1\ \text{sample}) \cdot F_X(t-1\ \text{sample})}{2 \cdot \Delta t}$$

$$\frac{dF_Y}{dt}(t) = \frac{F_Y(t+1\ \text{sample}) \cdot F_Y(t-1\ \text{sample})}{2 \cdot \Delta t}$$

$$\frac{dF_Z}{dt}(t) = \frac{F_Z(t+1\ \text{sample}) \cdot F_Z(t-1\ \text{sample})}{2 \cdot \Delta t}$$

$$\left| dF / dt(t) \right| = \sqrt{dF_X^2 / dt(t) + dF_Y^2 / dt(t) + dF_Z^2 / dt(t)}$$

Where: dF / dt = Force Gradient

Δt = sampling interval = $1 /$ Sampling Rate

graph from a "jump" trial.

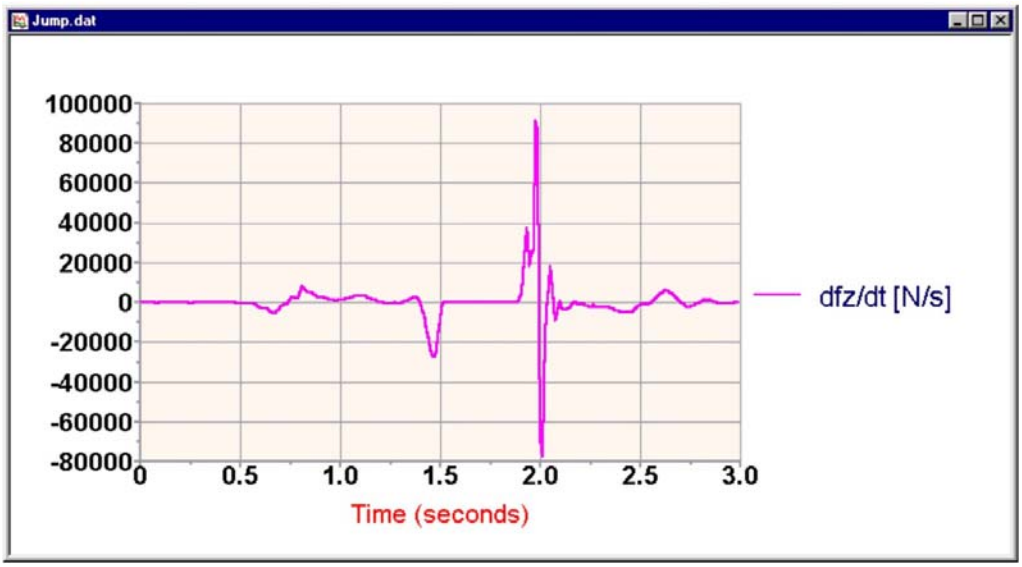


Fig. 53:Vertical force Gradient

9.3 Threshold (F5)

There are two threshold settings, one for view and one for contact, available from the Threshold dialog box (Fig. 54). The View Threshold is the lower limit for viewing data on a graph, and the Contact Threshold is the lower limit for setting the contact area, or the area where the device measures a nonzero value. Both threshold values must be entered as greater than or equal to zero, though the absolute value is considered when viewing the data (i.e. if the View threshold is set at 5N, then a force of –2N will not be shown, but a force of –7N *will* be shown). The units for the threshold are the default Force units (see section 10.2.1 for information on units). Pressing the F5 key will also setup the threshold.

Fig. 54: The Threshold dialog box

The View Threshold is often set just above the zero range, to eliminate noise data from cluttering up the graph. If the threshold is zero, then all gathered data points are shown without exception.

The Contact Threshold is used to determine the start and finish times for plate contact. It is useful for gait analysis and other studies where the data is sometimes viewed with "% contact" as the time units. The contact threshold should be set just above the noise range (i.e., just above zero). Data above this threshold is considered to be "in contact" with the device. The actual contact times can be edited for greater accuracy at a later time (see section 8.6 on editing contact times).

9.4 3D View

The 3D view allows the viewing of data as 3D vectors using DirectX 7. The computer you are using must support Microsoft DirectX7 and hardware video acceleration. If the drivers for DirectX 7 are not installed this menu choice will be disabled.

See chapter 11.6 for information more information on 3D view. The static playback of 3D vectors is identical to the realtime acquisition implementation, available under the Tools menu.

9.5 View Configuration

9.5.1 Default View…

The user can specify his/her own default graph configuration, or use the BioWare default each time. The user must have previously saved a configuration file prior to using it as default. To choose a configuration file to use when loading a graph, select View Configuration… from the Setup menu to bring up the Select View Configuration File dialog box. Place a check in the box to use the BioWare default configuration, or remove the check to enable the Default View Configuration field. Press the Select button and select the file from the browse box, and click Open. Press OK when finished.

9.5.2 Load… (F8)

View configurations can be recalled by choosing this menu item. A dialog box pops up (Fig. 54) with a list of any stored configurations. The extension for view configuration files is "vcf". View configurations can be stored by using the Save Configuration File… command (see the next section). Default configuration files can be set from the Setup → Default Graph → Default View… or View → View Configuration → Default View menu.

9.5.3 Save…

Use this command to store the current configuration to a file. Be sure that the graphs are set to your specifications before executing this command. A dialog box pops up (Figure 9.3) asking for the name and location to store the file. View Configuration files have the "vcf" extension. To use the configuration as default, see chapter 9.5.2 above.

9.6 Zoom Out (F2)

If a graph has been zoomed for a closer view of a particular area of data, this feature restores the graph to its full view. It is disabled if no zoom has been performed. Pressing the F2 function key also performs the Zoom Out function.

Dragging the zoom box down to the left during a right mouse zoom will also perform zoom out.

9.7 Statistics (F3)

Basic statistical analysis can be done to graphed data by pressing the F3 function key or by selecting Statistics from the Data menu. A dialog box (Fig. 56) pops up containing statistics for each parameter in the associated graph. The time period can be changed by manipulating the cursors on the graph (Fig. 55) and placing them at the desired start (green cursor) and stop (red cursor) times. To move the cursors simply click on the graph and hold down the mouse button and drag the cursor to the desired position. The Start or End time in the dialog box changes as its corresponding cursor is moved to reflect the current position of the cursor. The start and end times can also be directly entered into their respective boxes, and the cursor will move to the new time specified by the box once focus is shifted away from it.

Selecting the graph and using the *numeric* pad left and right arrows will move the start time cursor one sample to the left and right respectively. Similarly, the numeric pad down and up arrows will move the end time cursor one sample to the left and right respectively.

The statistics table can be saved to a file by entering a filename into the "File" box and clicking the Save button. The current default path is used to store the file. To select a different path, click the button immediately to the right of the File name box ( ). A new box pops up where you can specify the path and filename. Click Open to accept the settings and return to the Statistics box, then click the Save button. The file is saved in tab-delimited text (*.txt) format. The same file can be saved again and again, with the newest statistics being appended to the end of the file. Click "Done" or press the F3 key when finished using the statistics to close the box.

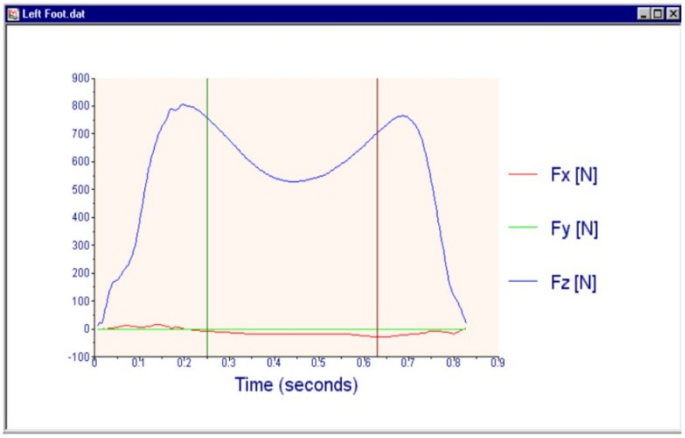


Fig. 55: The red and green cursors can be moved to set new start and end time for the statistics, respectively

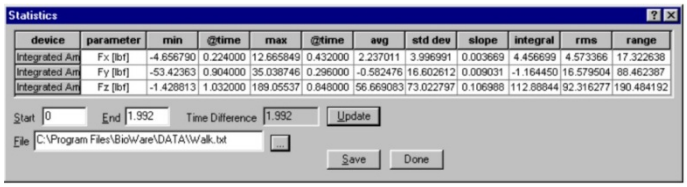


Fig. 56: The statistics dialog box updates automatically as the start and end times are changed

9.8 Moving Cursor (F4)

The Moving Cursor function allows a quick view of the graph parameters at any given time. Press the F4 key of choose "Moving Cursor" from the Data menu, and a dialog box pops up (Fig. 58) with the parameters shown on the associated graph. A green cursor shows up on the graph (Fig. 57) that can be dragged along the time axis, while the dialog box updates the current time reflected by the cursor position, as well as the parameter values at that time. Click F4 or the "Done" button a second time to close the box.

Selecting the graph and using the *numeric* pad left and right arrows will move the cursor one sample to the left and right respectively.

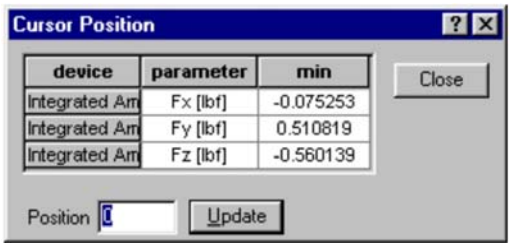


Fig. 57: The moving cursor dialog box

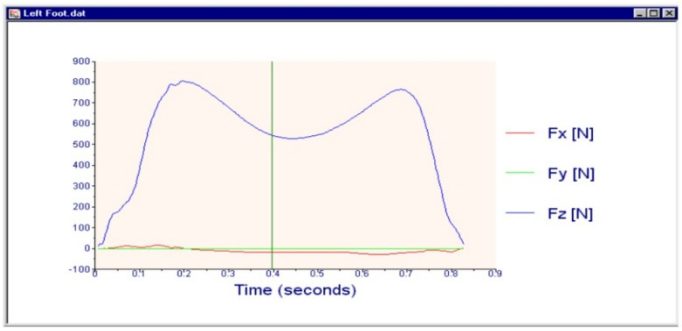


Fig. 58: Move the cursor along the graph to see the corresponding data values

9.9 Copy Page (Ctrl+C)

Use this command to save a copy of the current graph to the clipboard for pasting into other documents. This is a handy feature when creating technical papers or reports on your data. You can customize the graph to your liking and then paste it directly into your document.

9.10 Tool Bar

The tool bar, along with the status bar, can be toggled on and off by selecting it from the View menu. A check mark in the left column means the tool bar is active. The toolbar items and their functions are listed below:

-  **Open File**.
  Brings up a dialog box to select a stored data file for viewing.
-  **Save**.
  Saves the current file and any changes made to the data.
-  **Print**.
  Opens Print dialog box to set up and print the current graph.
-  **Copy**.
  Same as the View→Copy Page command, saves a copy of the current graph to the clipboard.
-  **Acquire Data**.
  Opens the Acquire Data dialog box.
-  **Acquire Direct**.
  Begins data acquisition using current settings. Bypasses the Acquire Data dialog box.
-  **Devices**.
  Opens the Device Manager to configure or add new devices.
-  **Edit Parameters**.
  Same as the View →Edit Parameters command, opens the Graph Setup box.
-  **Automatic Reset / Operate control**.
  Sets Reset / Operate control to occur automatically when data acquisition begins and ends..
-  **Operate Mode**
  Manually places plates in Operate mode and reads base line offsets if Auto Offsets are enabled.
-  **Reset Mode**.
  Manually places plates in reset mode.

-  **Zoom In**.
  Rescales a graph to a new size.
-  **Zoom Out**.
  Restores a zoomed graph to its original full size.
-  **Tile Horizontally**.
  Places all graphs one above the other on screen.
-  **Tile Vertically**.
  Places all graphs side by side on screen.
-  **Cascade**.
  Organizes graphs in cascading format, showing all graph title bars with active graph on top.
-  **Help**.
  Opens the Help dialog box with a list of help topics. Same function as pressing the F1 key.

9.11 Status Bar

The status bar runs along the lower edge of the BioWare screen. It is separated into four sections. The left side of the status bar offers information on a topic selected when the mouse is moved over a menu bar or tool bar item. The other three sections are located on the right side of the status bar. The first of these shows the coordinate system currently being employed, either Kistler or ISB. The next one shows the letters CAPS if the Caps Lock key is pressed. The last section shows the letters NUM if the Num Lock key is toggled on.

10. The Setup Menu

10.1 Current Graph

The parameters for the current graph will be changed to the newly selected settings. Only the current graph changes, this does not affect any default settings. Newly created graphs will revert to the default settings.

10.1.1 Units…

The default units of measure used for graphing are selected from the Units dialog box (Fig. 60) in the Setup menu. Choose the desired units from each list for the corresponding parameter, and click OK when finished to save any changes. Click Cancel to close the box without saving any changes. To use the *Système Internationale d'Unites* (SI) units as a global default, click the "SI Units" button and the default SI units will be set for each type. A table of all units follows, with the SI units in **boldface**:

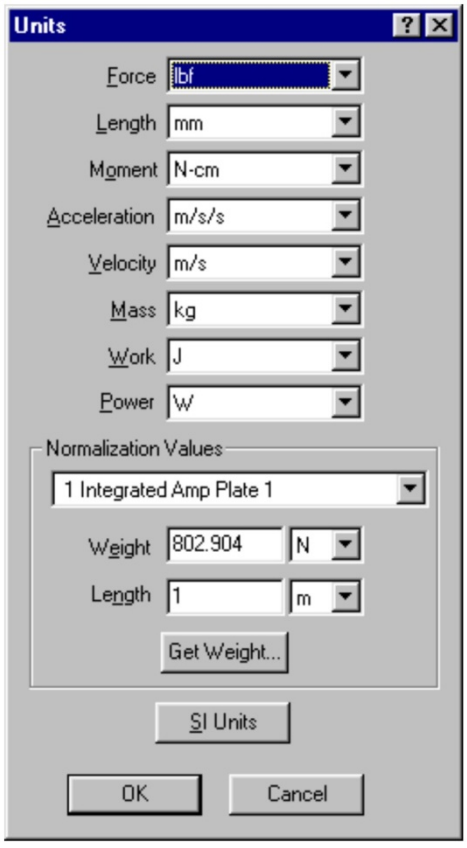


Fig. 59: Unit selections

Parameter	Unit	Full Name
Force	**N**	**Newton**
	lbf	pound (force)
	kgf	kilogram (force)
	%bw	percent body weight
Length	**m**	**meter**
	cm	centimeter
	mm	millimeter
	ft	foot
	in	inch
	normalized	normalized
Moment	**N·m**	**newton – meter**
	N·cm	newton – centimeter
	N·mm	newton – millimeter
	lbf·ft	pound – foot
	lbf·in	pound – inch
Acceleration	**m/s/s**	**meters/s/s**
	g	1 gravitational constant
	cm/s/s	centimeterss/s
	mm/s/s	millimeters/s/s
	ft/s/s	feet/s/s
	in/s/s	inch/s/s
	norm/s/s	normalized/s/s

Velocity	**m/s**	**meters per second**
	cm/s	centimeters per second
	mm/s	millimeters per second
	ft/s	feet per second
	in/s	inches per second
	km/h	kilometers per hour
	mi/h	miles per hour
	norm/s	normalized per second
Mass	**kg**	**kilogram mass**
	lbm	pound mass
Work	**J**	Joules
	J/kg	Watts/kg (normalized)
Power	**W**	Watts
	W/kg	Joules/kg (normalized)

10.1.2 Scaling…

Graph scaling can either be automatic or manual. Automatic scaling means that BioWare will choose a set of axes that encompass the full range of data. Manual scaling allows the user to set the minimum and/or maximum value(s) for either axis. Place a check in the appropriate box in the Scaling dialog box (Fig. 60) for automatic scaling. Press the "Autoscale Both Axes" button and checks is placed in all boxes. If an axis is to be autoscaled, the box next to it is disabled. When manually scaling (i.e., box not checked), the max/min value should be entered in this box. For example, to force the minimum y value to zero, do not place a check in the box and enter 0 (zero) in the box. Press OK to close the box and save changes, or Cancel to close without saving.

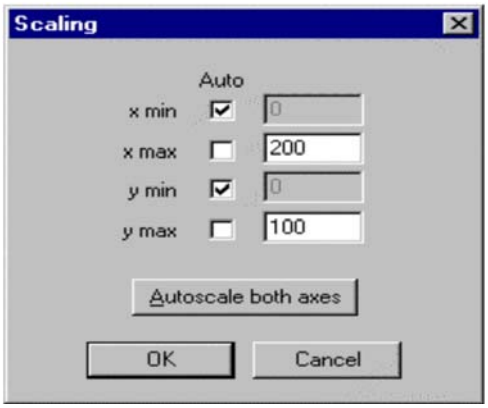


Fig. 60: The scaling dialog box

10.1.3 Legends

Legends can be turned on and off by choosing Legends in the Setup menu. Each time it is selected, a check is either placed next to, or removed from, the word Legends. When a check is present the legends will be shown on the graph, and when it is absent then no legends are shown.

10.1.4 Right Mouse Zoom

This option, when selected, allows the user to zoom an area of the graph. This is accomplished by clicking and holding down the right mouse button and dragging a box around the desired zoom area, and then releasing the right mouse button. The Zoom option is active when a check is next to the words Right Mouse Zoom. To activate/ deactivate the option, select it from the Setup menu. See Fig. 61 and Fig. 62 for an illustration.

Dragging the zoom box down to the right during a right mouse zoom or dragging the zoom box up to the left during a right mouse zoom will perform zoom in.

Dragging the zoom box down to the left during a right mouse zoom will perform zoom out. Also, pressing F2 will perform a zoom out.

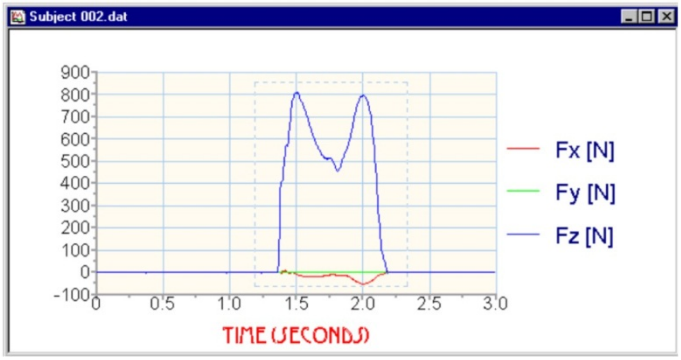


Fig. 61: To zoom, drag a box around the region, and release the right mouse button…

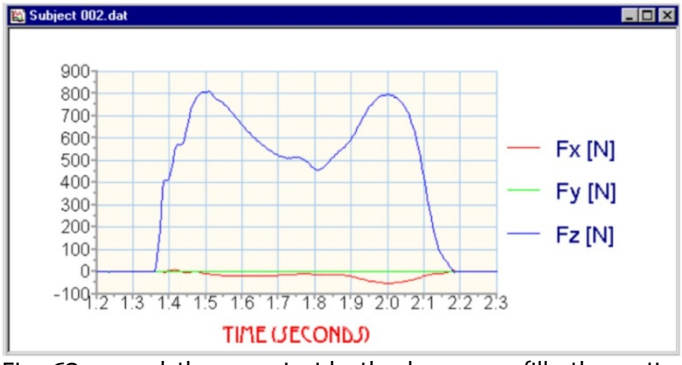


Fig. 62: …and the area inside the box now fills the entire graph region

When "zoomed in", left clicking on a graph and dragging will scroll the graph in the direction of the mouse movement.

10.1.5 Grids

The gridlines on the graphs in BioWare are fully customizable. Major and minor grids can be turned on or off, and their line style, thickness, and color can be user-defined. To customize the grids, choose Grids… from the Setup menu, and the Grids dialog box (Fig. 68) pops up. Place a check in the boxes where you want to see gridlines on the graphs, and leave the boxes blank where you do not wish to see gridlines. To change the look of the gridlines, click the "Customize Grids" button. A second dialog box pops up (Fig. 69) where you can choose the look of major and minor grids. The lists for choosing line type, width, and color are seen by pressing the arrow at the right side of each box. Press OK in the dialog boxes when finished to save the changes, or press Cancel to close the boxes without making any changes.

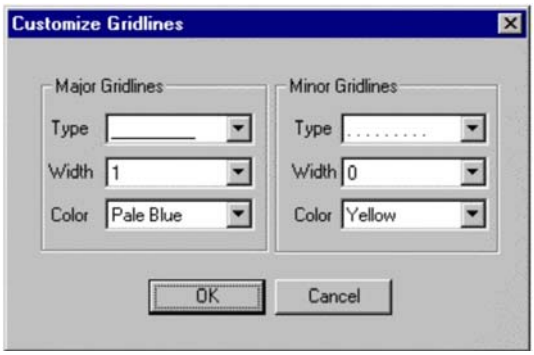


Fig. 63: Gridlines can be customized for style, thickness and color

10.1.6 Titles

Selecting titles allows customization of the X axis, Y axis and Graph main title. The user may also edit these items by double-clicking the items on the graph. If a item does not appear on the graph, double clicking on the area where the item would normally appear will bring up the Graph titles dialog box.

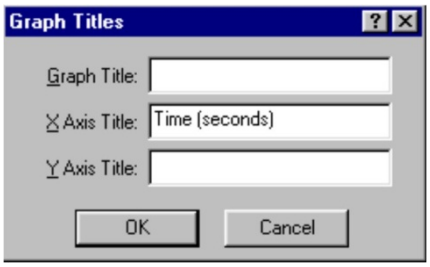


Fig. 64: Edit Graph Titles

10.2 Default Graph

The parameters for the default graph will be changed to the newly selected settings. A graphs subsequently created will display the default settings. This will not effect any of the graphs currently being displayed.

10.2.1 Units…

See chapter 10.1.1 for information on selecting default units.

10.2.2 Scaling…

See chapter 10.1.2 for information on selecting default scaling options.

10.2.3 Legends

See chapter 10.1.3 for information on selecting default legends.

10.2.4 Right Mouse Zoom

See chapter 10.1.4 for information on selecting right mouse zooming options.

10.2.5 Grids

See chapter 10.1.5 for information on selecting default grids.

10.2.6 Default View

See chapter 9.5 for information on selecting and saving a default view.

10.3 Global Settings

The globals settings choices will cause modifications to program settings which may include currently open graphs, and all graphs subsequently created.

10.3.1 Acquisition

See chapter 8.2 for information on setting global acquisition parameters.

10.3.2 Coordinate System

There are two coordinate systems supported by BioWare, the Kistler Coordinate System and the International Society of Biomechanics (ISB) Coordinate System. They are shown, and can be selected, in the Coordinate System dialog box (Fig. 65). The Kistler coordinate system is oriented to show the force as it was applied to a plate while the ISB system is reactionary, meaning that it shows the forces as the plate reacts to the force applied. Choosing one coordinate system over the other is the user's preference, and does not affect the data in any way. Hence, the coordinate system can be changes at any time and the graph will reflect the currently selected coordinate system. Note that the y-axis in Kistler coordinates and the x-axis in ISB coordinate system both point in the direction of forward movement.

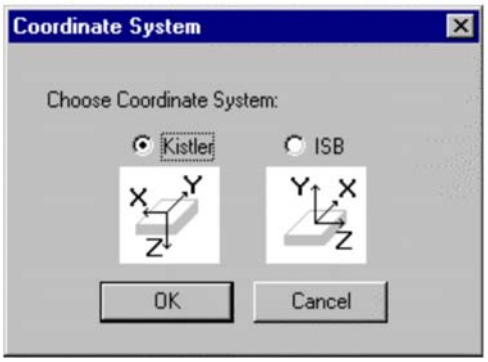


Fig. 65: The Coordinate System dialog box

10.3.3 Filters

See chapter 10.3.3 for information on filters.

10.3.4 Fonts

The Fonts dialog box (Fig. 66) lets the user change the size, color, and style of the graph fonts. To change a specific graph title or label, first choose it's name from the list labeled "Adjust the font of…" and then customize it as desired using the available options; style, color, size. Place a check in the appropriate box to make the font boldface, italicized, or underlined. The Font Style list is unique to each user's computer, as this list is filled from the Fonts folder located in the user's Windows® directory. Click OK to accept any changes made and close the dialog box, or click Cancel to close the dialog box without making any changes.

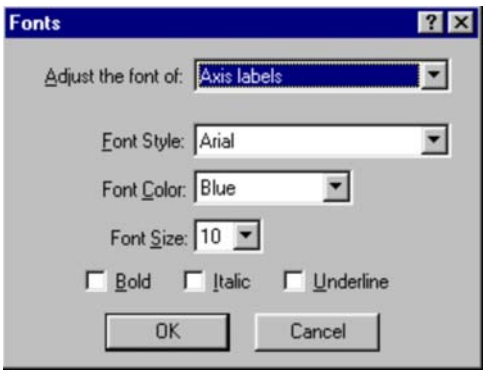


Fig. 66: The Fonts dialog box

10.3.5 FFT

Fast Fourier Transforms (FFT's) transform the data set from the time domain to the frequency domain. The FFT Setup dialog box (Figure 10.8) lets the user specify the window function and the data set length for Fast Fourier Transforms. Refer to Fig. 67 for the explanation of different window types. The length of the data must be a power of 2 to perform a FFT, so it is usually necessary to manually adjust the length of the set. This can be accomplished by either truncating the data back to the nearest power of 2, or by adding zeroes to the set until it reaches the next power of 2. A good rule of thumb to use when deciding which adjustment to use is to calculate the length of the data set and figure out the nearest power of 2, and either truncate or pad with zeroes to get there.

When performing an FFT analysis the algorithm assumes that the data is a continuous periodic data set, meaning that the beginning and end points of the data set match. Since this is not the case most times, a "window" is applied to the data, multiplying the data by a half-sine wave, thus making the endpoints both zero and therefore a match. The price for this is that the magnitude of the frequency components is altered. The window functions in Fig. 67 are shown in the order of least magnitude distortion to most.

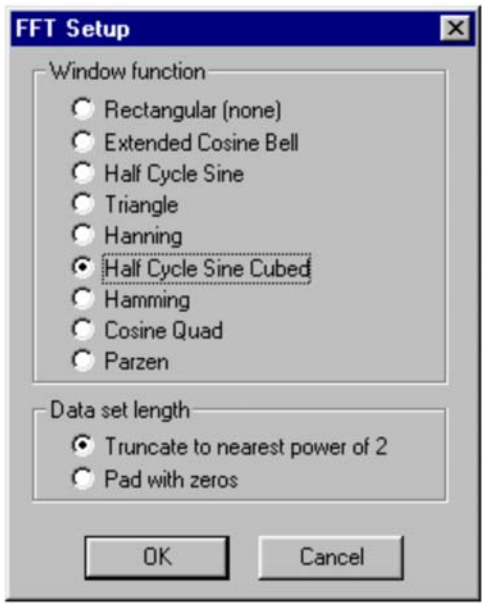


Fig. 67: The FFT Setup dialog box

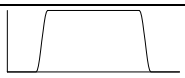
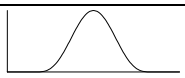
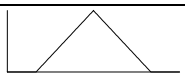
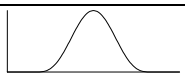
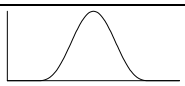
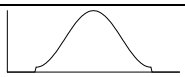
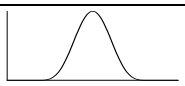
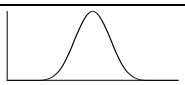
Window Type	Equation	Time	Graph
Rectangle	A = 1	t = 0 to T	
Cosine Bell	A = 0.5 (1 - cos(2π5t/T)) A = 1	t = 0 to T/10 and t = 9t/T to T t = T/10 to 9T/10	
Half Sine	A = sin(2π0.5t/T)	t = 0 to T	
Triangular	A = 2t/T A = 2 - 2t/T	t = 0 to T/2 t = T/2 to T	
Hanning	A = 0.5 (1 - cos(2πt/T))	t = 0 to T	
Half Sine^3	A = (sin(2π0.5t/T))^3	t = 0 to T	
Hamming	A = 0.08 + 0.46(1-cos(2πt/T))	t = 0 to T	
Cosine^4	A = (0.5 (1-cos(2πt/T)))^2	t = 0 to T	
Parzen	A = 1 - 6 (2t/T - 1)^2 + 6 (2t/T - 1)^3 A = 2 (1 - (2t/T - 1))^2	t = T/4 to 3T/4 t = 0 to T/4 and t = 3T/4 to T	

Fig. 68: FFT Windows® Types, in the order of least magnitude distortion to most.

10.3.6 Lines, Colors…

This allows the user to customize the graphs for up to 22 auxiliary channels and parameters for up to 6 force plates. Fig. 70 shows the Lines and Colors dialog box, which contains 7 pages separated by tabs. The first page is for the auxiliary devices, and the remaining are for force plate parameters. To change a line style or color, click the label for that parameter to pop up the Customize Lines dialog box. Choose the desired look from the drop boxes – the boxes drop by clicking the arrow at the right side of a box to expose a list – and click OK to set. Click Cancel to close the dialog box without making any changes.

An option to configure the line styles and colors for the Performance parameters is included. For each force plate tab, select Normal Parameters to set the line styles for the force and center of pressure parameters, and select the Performance Parameters button to set the line styles for the performance parameters.

Keep in mind when setting the lines and colors that the background is off-white, so lighter colors may not show up well. Also remember that too thick of a line can interfere with other data when more than one data set is plotted on a graph.

To restore the factory default settings at any time, click the "Restore Global Defaults" button. This restores defaults for **every** page, not just the current page.

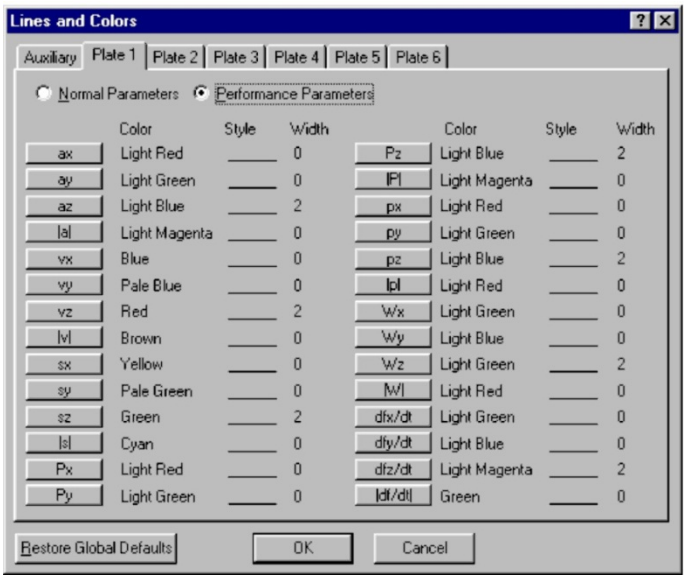


Fig. 69: The default lines and colors are customized from this dialog box

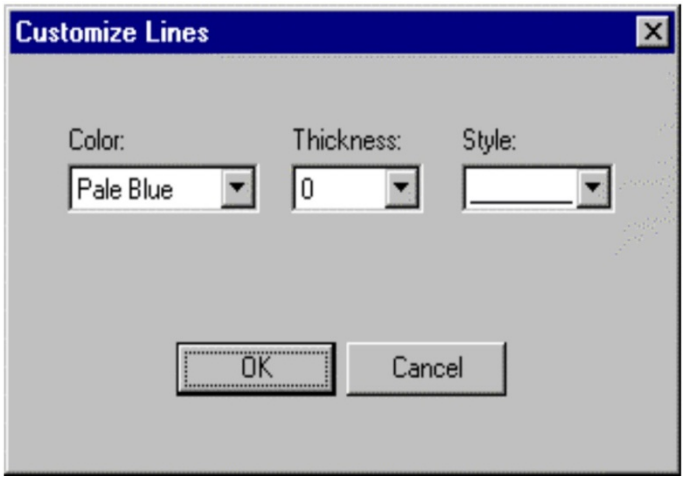


Fig. 70: The line color, thickness and styles are chosen from the lists in this box

10.3.7 Threshold

See chapter 9.3 for information on setting a view threshold.

10.4 Hardware

10.4.1 A/D Board…

This is a shortcut to the configuration dialog box for your data acquisition board. Typically, once the board is installed there is little need to access this setup routine except to check the settings or change the acquisition mode. Refer to chapter 4.3 for information on setup of the A/D board.

10.4.2 Amplifiers…

The Amplifier Setup dialog box (Fig. 71), available from the Setup menu, is for installing and configuring amplifiers and for removing amplifiers from the database. When an acquisition device – force plate, accelerometer, EMG, etc. – is deleted from the database via the Device Setup dialog box, any associated amplifier is not deleted along with it because that amplifier may be configured with one or more other devices besides the deleted one. An amplifier can be used with more than one device (provided they are both not active at the same time), but a device cannot be used with more than one amplifier. However, if an acquisition device is deleted and the amplifier was only used with that particular device, then the user may want to delete the amplifier as well.

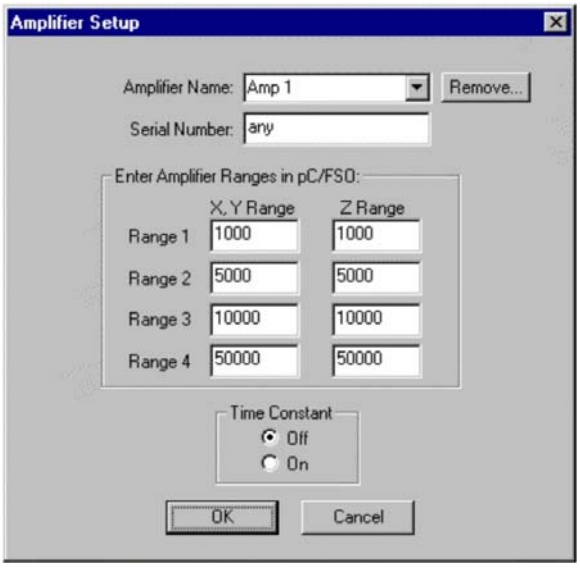


Fig. 71: The Amplifier Setup dialog box

To delete an amplifier from the database, select its name from the drop box and click the Remove button. If the amplifier Is not configured with any installed acquisition device then it will disappear from the database. If it is part of a configured device, then a dialog box will pop up telling you which device the amplifier is needed for, and will not allow the deletion until the acquisition device is first deleted.

To add a new amplifier to the database, type the name in to the Amplifier Name list, and use the Tab key or the mouse to move the cursor to the Serial Number box. Notice that the ranges all reset to zero when this happens. Enter in the amplifier's serial number, and use the mouse or Tab key to move through the boxes while entering the ranges and turning the time constant on or off. Press OK when finished, and a box will ask you for confirmation before creating a new amplifier record.

The Amplifier Setup dialog box also allows the user to verify any amplifier's range settings, and make any changes as necessary. To change a range setting or to toggle the time constant on and off, first choose the amplifier from the list and then make the necessary edits. Press OK to save the changes (another confirmation box will make sure of your decision). Press the Cancel button to close the dialog box without saving any changes.

10.4.3 Amplifier Gains (CTRL+G)

The amplifier gains selection allows quick and easy selection of the available amplifier gains. This applies to strain gage amplifiers only. If no strain-gage plates are configured in your system, this menu option is disabled. Select the plate for which you wish to see the gains, then select the gains for each channel.

Fig. 72 shows the range selection dialog box.

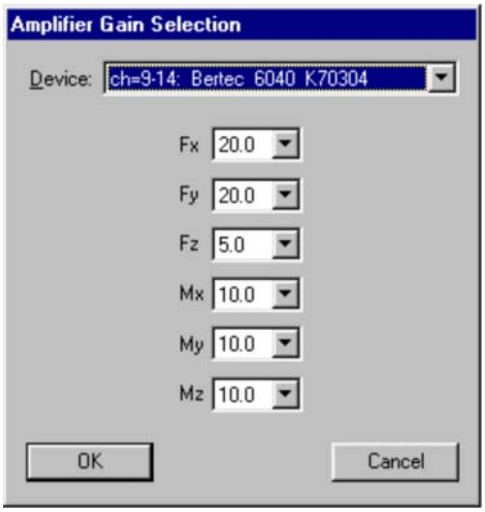


Fig. 72: Amplifier Gains Selection

10.4.4 Amplifier Ranges (CTRL+R)

The amplifier range selection allows quick and easy selection of the available amplifier ranges for piezo-electric force plates. Select the plate for which you wish to see the ranges, then select the ranges for the shear, or vertical directions.

Ranges are displayed in Newtons and represent the maximum force per channel of the force plate.

Fig. 73 shows the range selection dialog box.

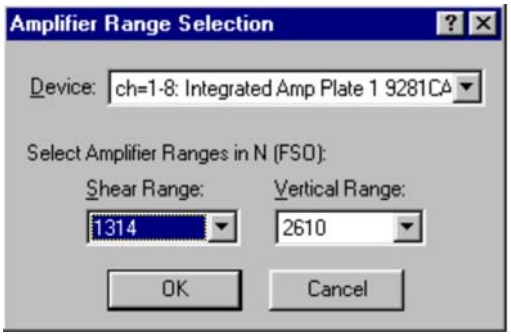


Fig. 73: Amplifier Range Selection

10.4.5 Devices… (CTRL+D)

Device configuration is accomplished via the Device Setup dialog box (Fig. 74). This is a very important dialog box, because devices are installed, configured, and activated here. To install a new device, click the New… button at the bottom of the dialog box to start the Device Wizard, which will guide you through the installation process. See Chapter 14, the Device Wizard, for more information on the Device Wizard.

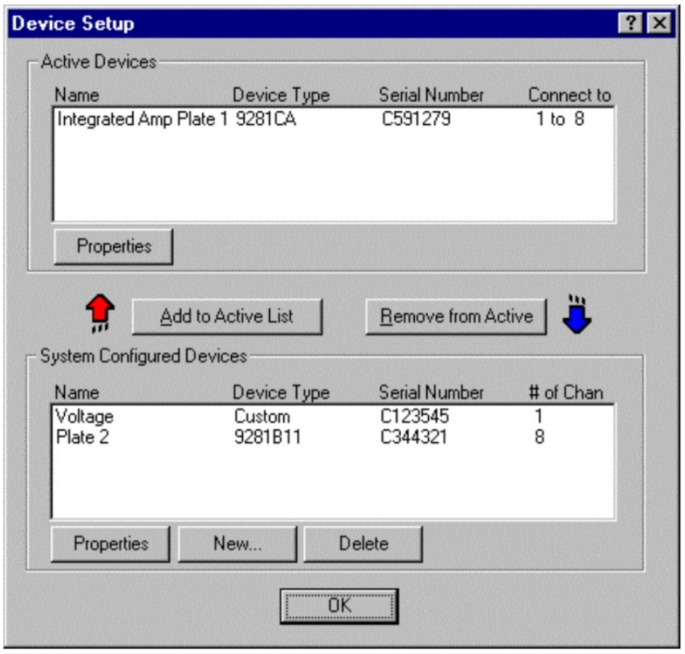


Fig. 74: The Device Setup dialog box, where all devices are installed, configured and activated

The Device Setup dialog box is divided into two sections, Active Devices and System Configured Devices. Active devices are those that are currently connected to the BioWare system and are ready to acquire data. System configured devices are all other installed devices that are not currently being used for acquisition, but are ready to be activated when needed. There is no limit to the number of devices that can be installed in the system. However, only 16 channels are available for acquisition (up to 64 channels on custom systems), so the active devices cannot exceed this limit. A device can only be present in one list any at any time.

To add a device to the Active List, select the device in the System Configured Devices list, and click the "Add to Active List" button. A box pops up asking you which channel to connect the device to. If no channels, or not enough channels, are available then a warning will be issued. Piezoelectric Force plates must have 8 consecutive open channels, and auxiliary devices normally need 1 channel, though there are exceptions. It's good practice to start at channel 1 and use consecutive channels, rather than choosing channels arbitrarily.

It is sometimes necessary to remove a device from the Active List before another device can be added. To remove a device, highlight it in the Active List and click the "Remove from Active" button. The device will show up in the System Configured Devices list, and the channels that had been reserved for the device become open.

A device must be in the System Configured Devices list in order to be deleted. To remove the device permanently, highlight it in the System Configured Devices list and click Delete. You will be prompted for confirmation before deletion takes place. Once confirmed, this function cannot be undone.

Tip: You can configure the same device several times with different options. For example, make one force plate device "Normal Range" (with the amplifier set to ranges 2, and 3) then make a second device "High Sensitivity" (with the amplifier set to ranges 1, and 1). When you wish to use the force plate for high sensitivity work, make the "High Sensitivity" plate active. When you wish to use the force plate for normal work, make the "Normal Range" plate active. All other parameters (calibration information, etc…) will remain the same.

Only delete a device if you are sure you will never use it again. There is no limit to the number of System Configured Devices. If an error was made when first installing the device, try editing the configuration before deleting it permanently.

To view the properties of a device, either double click on its name or highlight it in the list and click the Properties button.

Click the OK button to close the dialog box.

10.4.6 Photocell/Speed Calculation

Using a series of two photocells a user can estimate subject velocity using a simple distance / time calculation. To do this configure each photocell as a single channel device and enable them in the Device Manager (CTRL+D). The select the Setup -> Hardware -> Photocell / Speed Calculation menu choice.

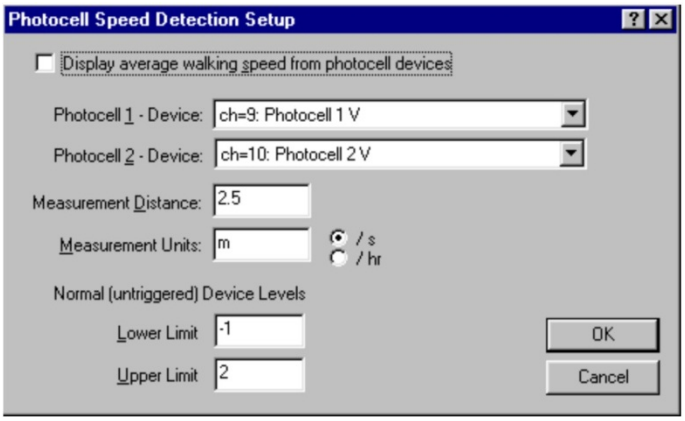


Fig. 75: Photocell Speed Detection Calculation Setup

In the setup dialog, select the device which is Photocell 1, and the device which is Photocell 2. Also, enter the measured distance between the two photocells and the measurement units. The speed time base can be selected as "per second" or "per hour". The example in Fig. 75 shows a setup where distance between photocells is 2.5 meters. The calculated speed will be shown in "m/s".

The next step is to determine the normal "untriggered" state of the photocell. Assuming the conversion factor for the device was setup as 1.00 sensitivity, you can use the oscilloscope tool (See chapter 11) to determine the normal untriggered and the triggered voltage levels. Select a reasonable range of values for the "untriggered" state. In the example in Fig. 75, the range is –1 to 2 volts, anything outside this range will be considered a "triggered" photocell. The software will look for the time difference between the first trigger occurance of photocell 1, and the first trigger occurance of photocell 2 (this time difference could be negative, resulting in a negative velocity) and compute the average velocity.

Enabling the "Display Average Walking Speed from Photocell devices" will display the speed in the upper left corner of each time based plot.

11. The Tools Menu

11.1 Body Weight

This is a scale (Fig. 76) that reads the real time vertical forces from a force plate. The units of force are Newtons. To use the Body Weight function, have the plate unloaded and select Body Weight from the Tools menu. The scale automatically begins reading forces. Perform any weight measurements, then press OK or Cancel to close the dialog box.

Fig. 76: Body Weight Measurement Tool

11.2 DVM… (Digital Voltmeter)

The Voltmeter is used to analyze the voltages seen at the input to the A/D board in a continuously updated numerical display. It is used for troubleshooting purposes. To use the voltmeter, choose DVM from the Data menu to open the Digital Voltmeter dialog box (Fig. 77). Select the voltage scale (volts or millivolts). To start the voltmeter set it to Operate and press the Run button. The voltages are continuously updated. Reset the voltmeter as necessary by pressing Stop, Reset, Operate, then Run.

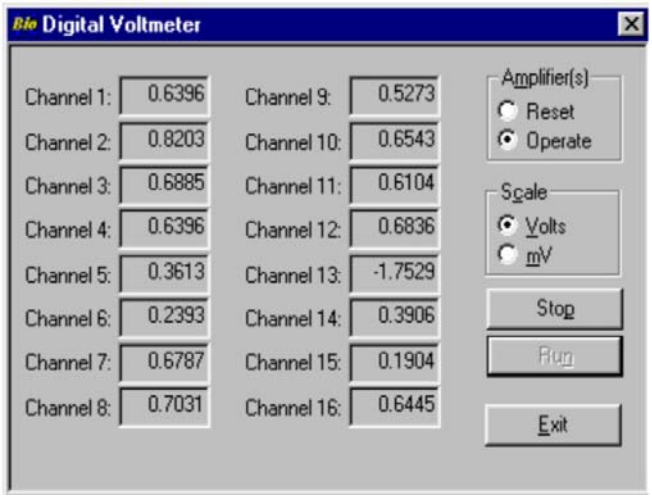


Fig. 77: The Digital Voltmeter is a useful troubleshooting tool

11.3 Scope…

The Oscilloscope (Fig. 78) is another useful troubleshooting tool that graphically displays the voltages at the inputs to the A/D board. It is accessed by selecting Scope from the Tools menu. The oscilloscope can display the voltages in strip chart or oscilloscope format. Strip chart has a scrolling x-axis while the oscilloscope format plots from left to right in the display window over and over without scrolling. To start the oscilloscope set the amplifier to Operate, and press Run. To stop the scope, press the Stop button. Reset the amplifier if it is used for an extended period of time.

The oscilloscope is configurable. Pressing the Setup button opens the Oscilloscope Setup window (Fig. 79).
. Place a check in the boxes for the channels to display on the scope. Select the sampling rate and the length of the x-axis scale in seconds. Then select the minimum and maximum voltages for the y-axis.

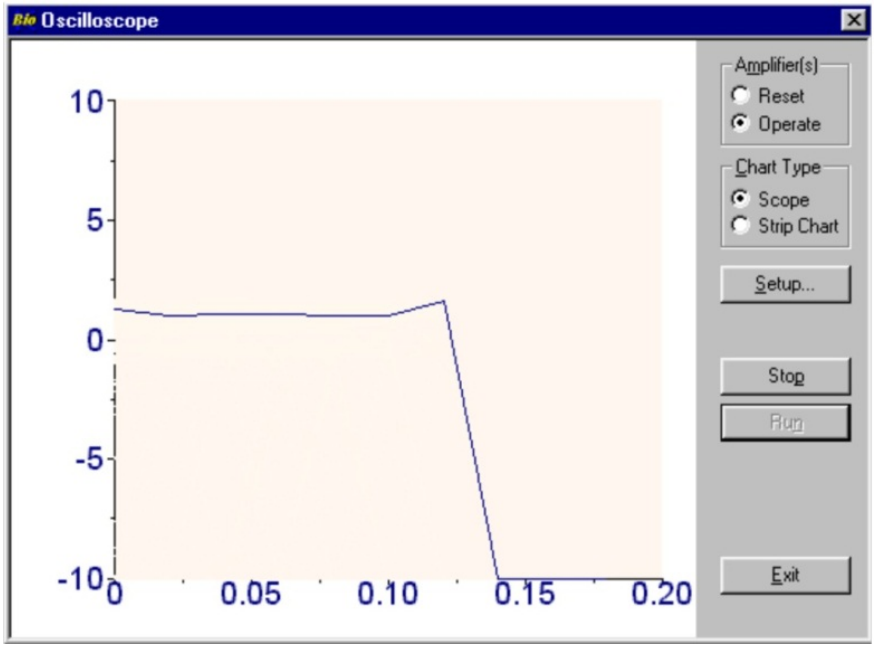


Fig. 78: The Scope window

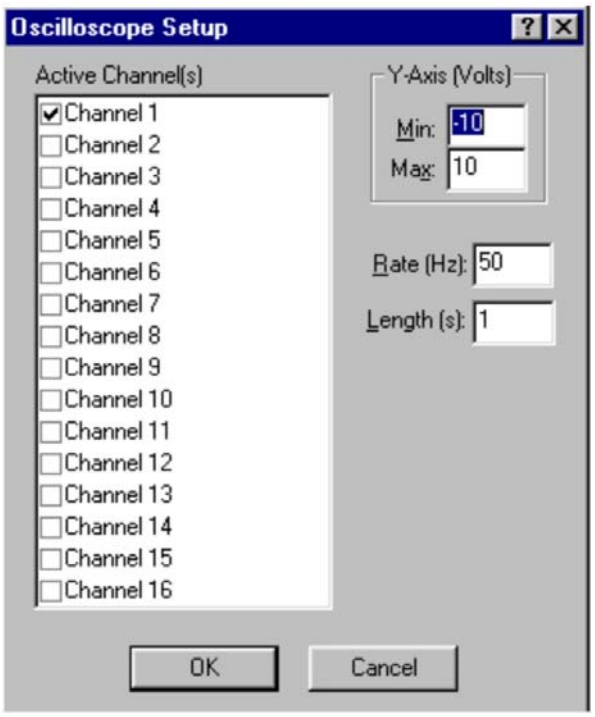


Fig. 79: Scope Setup

11.4 Force Meter…

The Force Meter is a real-time data acquisition tool. Forces for the selected plates are display in real-time. The force meter can display the forces in strip chart or oscilloscope format. Strip chart has a scrolling x-axis while the oscilloscope format plots from left to right in the display window over and over without scrolling. To start the force meter, place the amplifier in operate, and press start. To stop the meter, press the Stop button. Reset the amplifier if it is used for an extended period of time.

The force meter is configurable. Pressing the Setup button opens the Force Meter Setup window (Fig. 80). Place a check in the boxes for the plates to display on the scope. Only force plate devices that are configured and made active in the Device Setup will be displayed here. Select the sampling rate and the length of the x-axis scale in seconds, and the minimum and maximum values for the y-axis. Force units are displayed in the units configured for default graphs. The user has the choice of displaying Fx, Fy, Fz, and resultant force Ft.

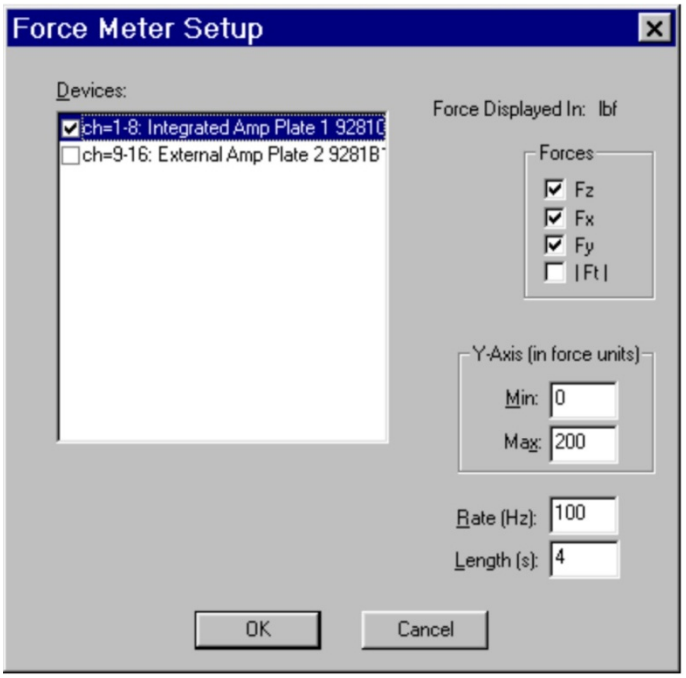
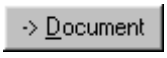


Fig. 80: Force Meter Setup

The  button will convert the current display to a document for normal post processing. While only the force plate device(s) chosen to be displayed will show on the screen, **All active devices** configured in the system will be converted and stored in the document.

11.5 Real Time COP…

The Real time COP is a real-time center of pressure acquisition tool. COP for a single selected plate is display in real-time. The COP tool is configurable. Pressing the Setup button opens the COP Meter Setup window (Fig. 81). Place a check in the box for the plate to display on the scope. Only force plate devices that are configured and made active in the Device Setup will be displayed here. Select the sampling rate and the length of time to display COP data for, and the minimum and maximum values for the both axes. COP units are displayed in the units configured for default graphs.

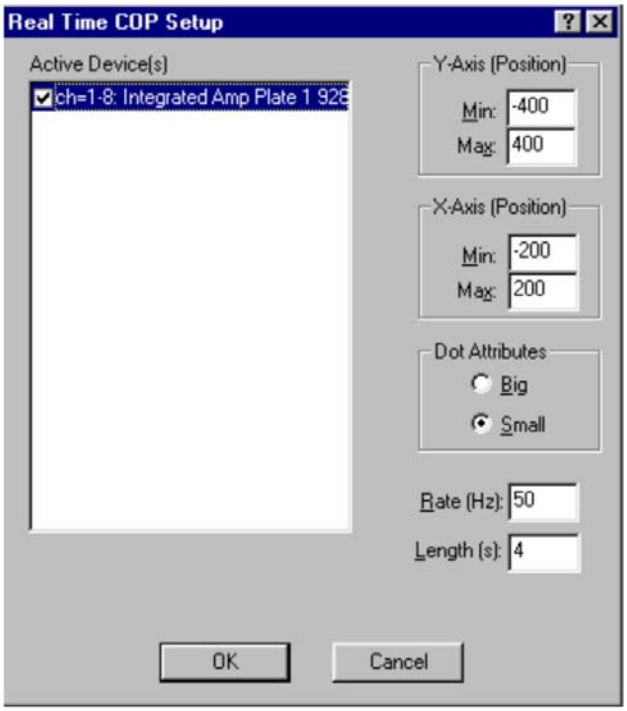
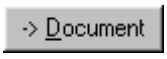


Fig. 81: Real Time COP setup

The  button will convert the current display to a document for normal post processing. While only the force plate device chosen to be displayed will show on the screen, **All active devices** configured in the system will be converted and stored in the document.

11.6 3D Scope View

The 3D view allows the viewing of data as 3D vectors using DirectX 7. The computer you are using must support Microsoft DirectX7 and hardware video acceleration. If the drivers for DirectX 7 are not installed this menu choice will be disabled.

The 3D View is a Real time 3D vector tool. Data is displayed in a DirectX view port showing the 3 Component vector for each force platform. Pressing the Setup button opens the Setup window. Place a check in the box for each plate to display on the 3D scope view. Only force plate devices that are configured and made active in the Device Setup will be displayed here. Select the sampling rate and the length of time to display data.

To begin acquisition press the "Run" button. To end acquisition press the "Stop button".
The camera height, distance, and vector length scaling can be set using the slider controls on the bottom of the screen. The Angle, and plate position can be set using the "pitch" and "yaw" control in the center of the view.

Each vector component can be individually "scaled" to emphasize a particular component using the vector scaling slider controls.

Other options are: Enable drawing the actual plate models, fading vectors at (time selectable), and drawing vector plots or COP only traces.

The 

button will convert the current display to a document for normal post processing. While only the force plate device chosen to be displayed will show on the screen, **All active devices** configured in the system will be converted and stored in the document.

The statistics indicate the sampling duration and the DirectX update rate.

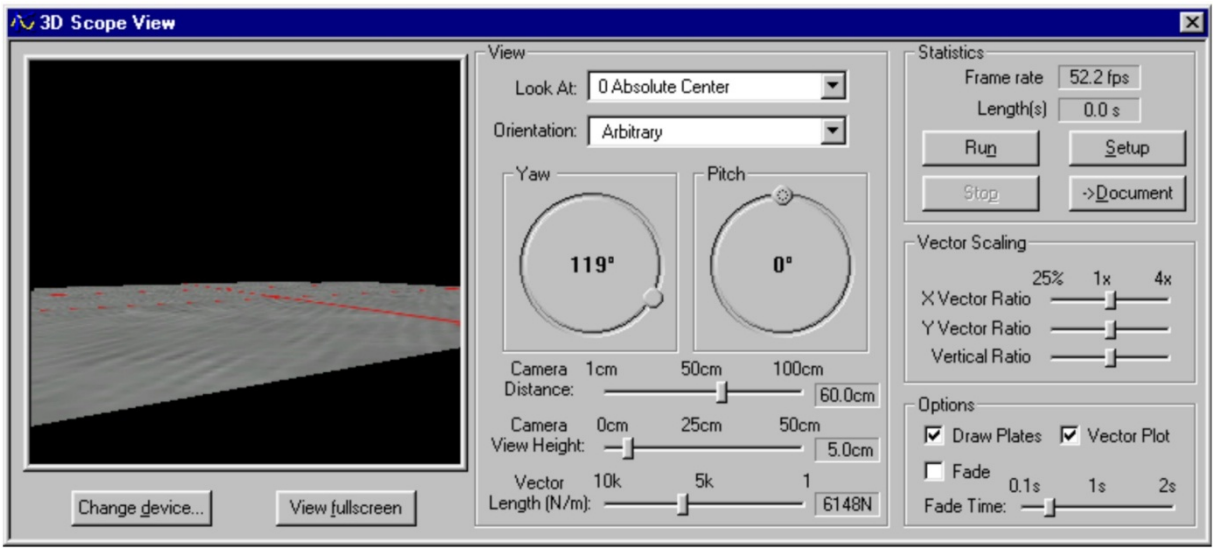


Fig. 82: 3-D Real time Vector View

12. The Window Menu

Whenever a graph is open, the Window menu appears in the menu bar. The Window menu is for controlling the position of the graphs, and is useful when many different graphs are open on the screen. There are three different commands; New, Tile Horizontal, and Tile Vertical. The New command opens a default view of the currently active graph in a separate window. If the original graph has been zoomed or if the parameters viewed have been changed from default, then the new graph will not look like an exact duplicate of the active graph, however, the title bar will show that the new graph is using the same data file.

Tile Horizontal (Fig. 83) places the active graphs one on top of the other. If four graphs are open, then it creates a grid of four equally sized graphs. Tile Vertical (Fig. 84) places the graphs side by side. Depending on the type of data files being viewed, there are advantages and disadvantages of viewing graphs using either window format.

Below the three Window commands, there is a list of all graphs that are open on the screen, with a check mark placed beside the name of the currently active graph. Select a different graph name from the list to make that window active, and the check mark will move along with the selection.

12.1 Debug View

This feature opens a window with information about the current trial. The main file header is followed by individual headers with information on each device that was used, along with the first ten raw data samples. This is a quick that adversely affect the data. These features are not editable in this format, but any features that can be edited are available from the Data menu (see chapter 8) way to view the settings that were used for acquisition, or to check if there were any errors made.

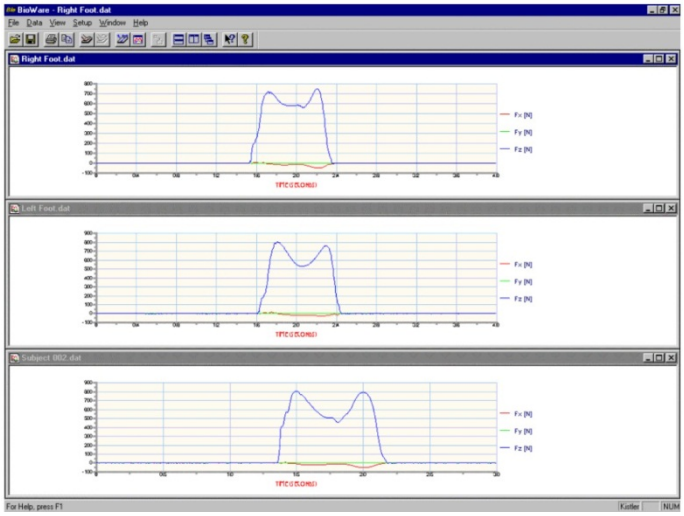


Fig. 83: Example of the tile Horizontal command from the Window menu

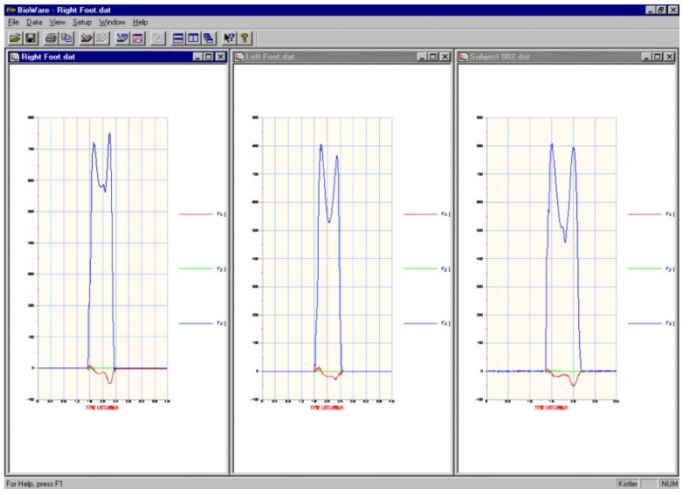


Fig. 84: Example of the Tile Vertical command. The windows are placed side by side.

13. The Help Menu

The BioWare help menu is available by selecting Help Topics from the Help, or if a Dialog box is open pressing Help button at any time. It uses the standard Windows® help format.

While browsing through the help topics, you may encounter words that are blue in color. These are called "hot links" which will either jump you directly to that specific topic when pressed. Press the Back button to return to the previous page read. Some of the hot links are to Kistler specific Web pages available only when online.

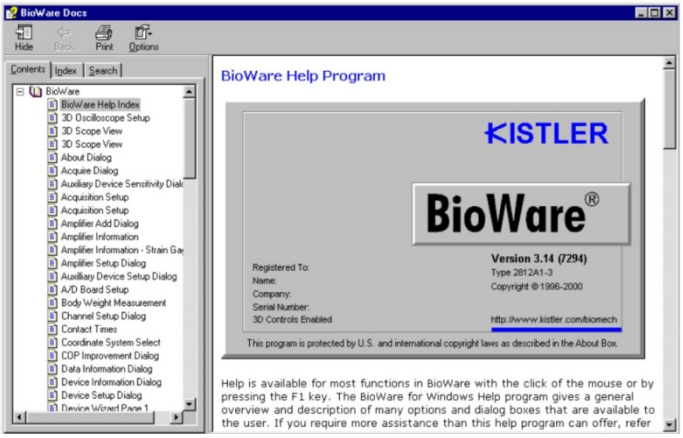


Fig. 85: The list of help topics available in BioWare

14. The Device Wizard

Installation of new devices is accomplished through the Device Wizard, which takes the user step-by-step through the installation process. Wizards are a series of dialog boxes that are tied together with "Next" and "Back" buttons, designed to guide the user through a series of steps. To begin the Device Wizard choose New from the Device Setup dialog box, which is available from the Setup menu. There are two different types of devices that can be installed, 8-channel force plates and auxiliary devices. These will be discussed separately.

14.1 Installing 8-Channel Kistler Force Plates

Page 1
Start the Device Wizard by choosing New… from the Device Setup dialog box, which is available from the Setup menu. Select "8-Channel Force Plate" from Page 1 of the Wizard (Fig. 86) and press the Next button to move on to page 2 (Fig. 87).

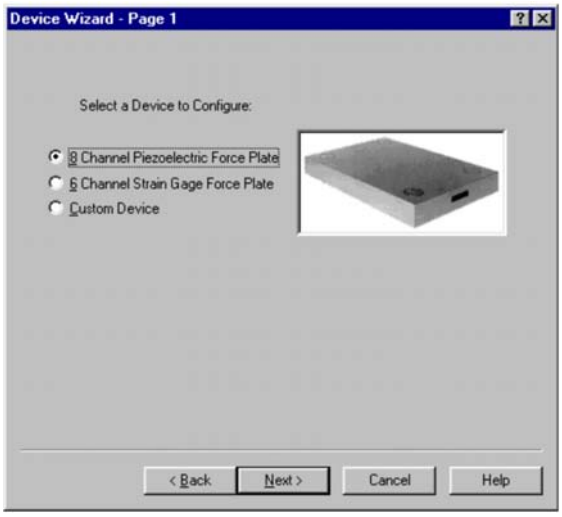


Fig. 86: The Device Wizard Page 1

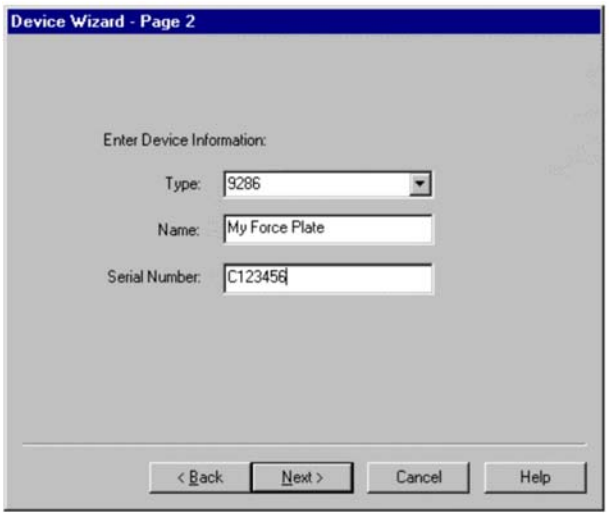


Fig. 87: Page 2 of the Device Wizard

Page 2
Choose your plate type from the list, and enter a name and the plate serial number. Enter a name that will help you identify that plate easily, in case there are more than one plate at your location. Some examples of names are: "Runway Plate 1", "Diving Platform", "Long Jump Pit", etc. Press the Next button to move on to Page 3 (Fig. 88).

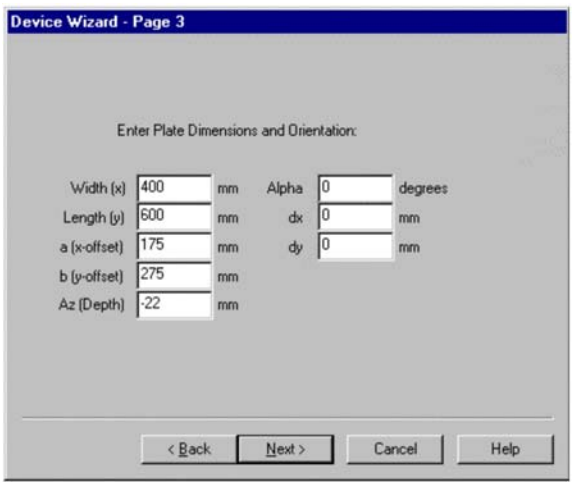


Fig. 88: Page 3 of the Device Wizard

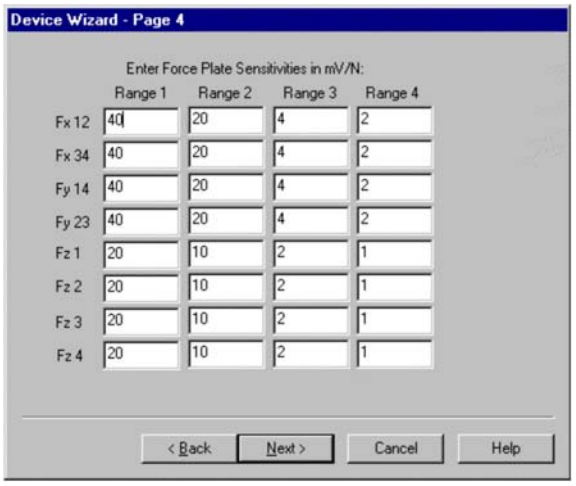


Fig. 89: Page 4 of the Device Wizard for plates with integrated charge amplifiers

Page 3
Enter the plate dimensions on page 3. The default dimensions for your force plate type are already entered in the left column, and may not need editing. Compare the values in the Wizard with actual values sent with your force plate, and change if necessary. The plate orientation values in the right column (Alpha, dx, dy) are reserved for future use. After entering the dimensions, click the Next button.

Use the Back and Next buttons to maneuver through the wizard and check settings as needed. Click Cancel from any page to end the setup process.

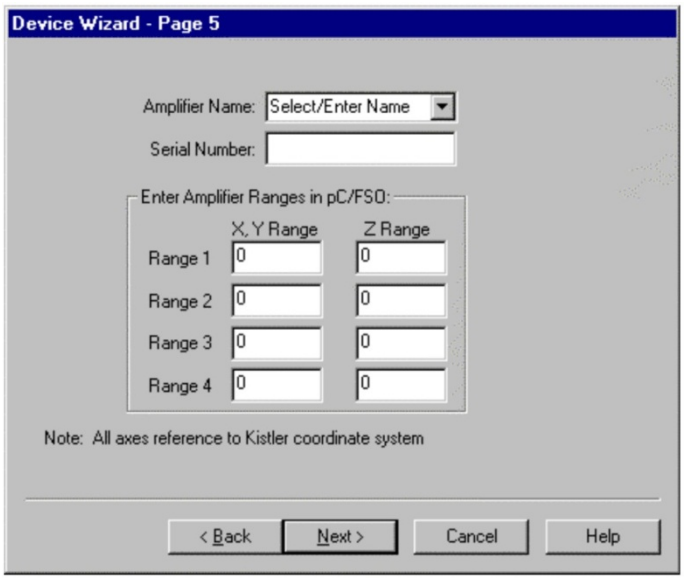


Fig. 90: Amplifier selection page for plates with external amplifiers only

Page 4
This page will have one of two looks depending on whether or not the plate type has a built-in (integrated) charge amplifier. Fig. 89 shows the wizard page 4 for integrated amplifiers. The force plate sensitivities should be entered with mV/N as the units, taking into account both the sensor and charge amplifier. Fig. 91 shows page 4 for force plates with external amplifiers. These sensitivities are for the sensors only, and use pC/N as their units. A separate page is needed for entering the amplifier ranges in this case (Page 5). The Kistler coordinate system is referenced here. Default values for your force plate are already entered for either case, but will need editing because every force plate has unique sensitivities. Enter the sensitivity values that were sent with your force plate. Click the Next Button to continue.

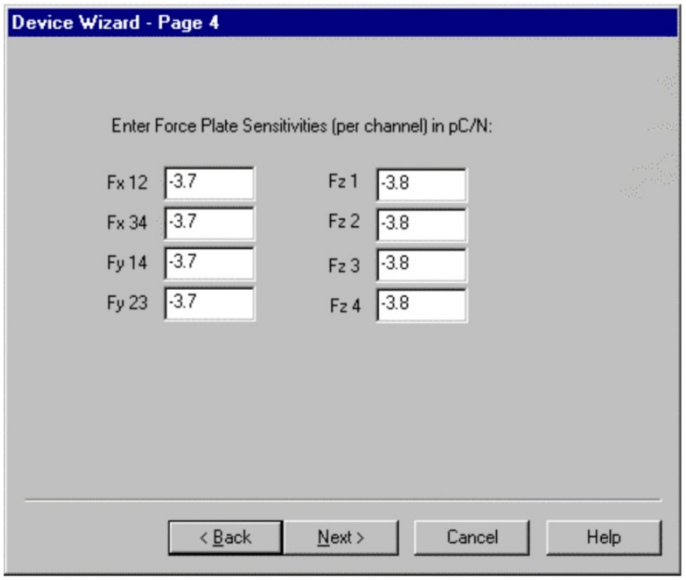


Fig. 91: Page 4 of the Device Wizard for plates with external charge amplifiers

Page 5
If the system has an external amplifier(e.g. Type 9865), then this is the next page in the wizard. It is skipped for plates with integrated amplifiers. Choose an amplifier from the list on page 5 (Fig. 90), or enter a new amplifier name in the list. Enter the plate serial number and ranges in pC/FSO, and click Next.

Range Selection Page
The user should select the initial per channel force range for both the shear and vertical directions. These ranges are calculated from the force plate sensitivities and amplifier ranges and Full Scale Output (FSO). A good rule of thumb is to choose the lowest range that will not be exceeded during the intended trials. This range selection can be changed as needed to handle a wide variety of applications, so it is not critical to know exactly which range to enter at this time. A check box is also on page 5 for enabling the automatic reading of amplifier offsets prior to acquisition. Place a check in the box to enable this function. This is the last setup page in the wizard, and is a good time to go back and double check the selections up to this point. When ready, click Next to go to the finishing page of the wizard.

Finish Page
The setup is complete. All that remains is to choose whether to place this device in the Active list or not. To activate the device now, choose Yes and click the Finish button. A box pops up asking which channels to connect the device to. Choose the correct start channel and click OK. If the device cannot be made active for any reason, it is placed in the System Configured Devices list in the Device Setup dialog box, where it can be made active at a later time. To cancel the setup process, click the Cancel button and the entire process is ended.

14.2 Installing 6-Channel Strain-Gage Force Plates

Page 1

Start the Device Wizard by choosing New… from the Device Setup dialog box, which is available from the Setup menu. Select "6-Channel Strain Gage Force Plate" from Page 1 of the Wizard (Fig. 92) and press the Next button to move on to page 2 (Fig. 93).

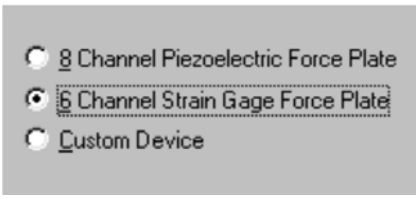


Fig. 92: The Device Wizard Page 1

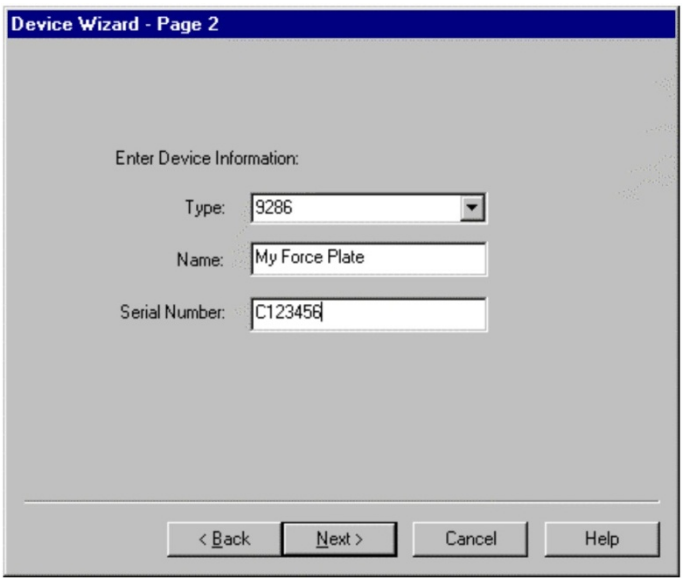


Fig. 93: Page 2 of the Device Wizard

Page 2
Choose your plate type from the list, and enter a name and the plate serial number. Enter a name that will help you identify that plate easily, in case there are more than one plate at your location. Some examples of names are: "Runway Plate 1", "Diving Platform", "Long Jump Pit", etc. Press the Next button to move on to Page 3 (Fig. 94).

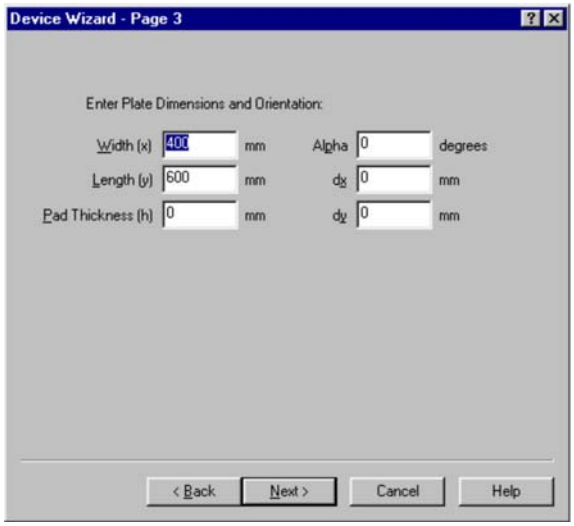


Fig. 94: Page 3 of the Device Wizard

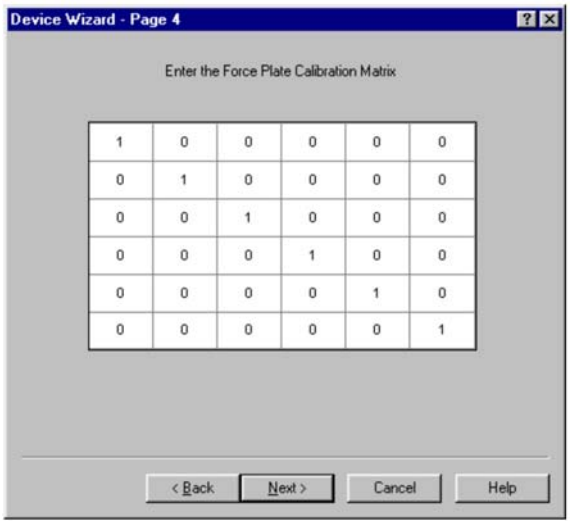


Fig. 95: Page 4 of the Device Wizard for strain gage plates. The calibration matrix.

Page 3
Enter the plate dimensions on page 3. The default dimensions for your force plate type are already entered in the left column, and may not need editing. Compare the values in the Wizard with actual values sent with your force plate, and change if necessary. The plate orientation values in the right column (Alpha, dx, dy) are reserved for future use. After entering the dimensions, click the Next button.

Page 4
The calibration matrix for the force plate is entered on page 4. Refer to the calibration sheet supplied with your platform for the 36 values that should be entered here. Fig. 96 shows and example calibration matrix. Every force plate has unique sensitivities. Click the Next Button to continue.

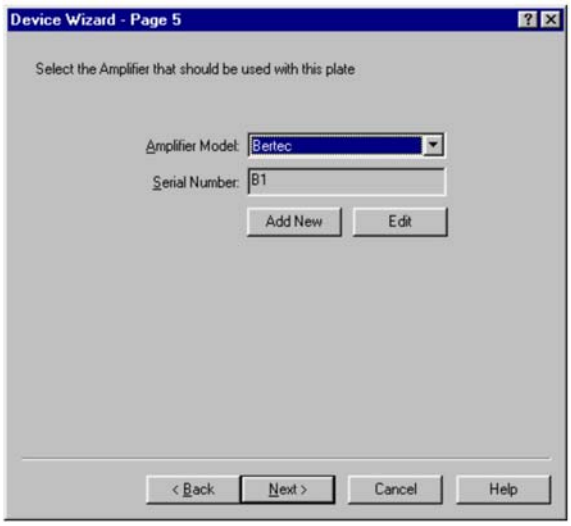


Fig. 96: Amplifier Selection

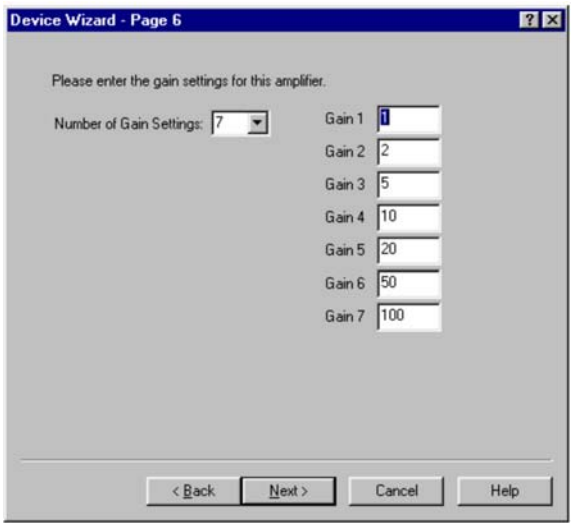


Fig. 97: Amplifier setup page for strain gage plates with external amplifiers

Page 5
If the system has an external amplifier then this is the next page in the wizard. Choose an amplifier from the list or select "Add New" to create a new amplifier.

Page 6
Fig. Fig. 98 shows the amplifier configuration page. Select the number of gains available for the amplifier and the gains values for each of the choices.

Page 7
Select the desired gains for each of the 6 channels. These gains must be the same as the switch settings on the front of the amplifier.

Finish Page
The setup is complete. All that remains is to choose whether to place this device in the Active list or not. To activate the device now, choose Yes and click the Finish button. A box pops up asking which channels to connect the device to. Choose the correct start channel and click OK. If the device cannot be made active for any reason, it is placed in the System Configured Devices list in the Device Setup dialog box, where it can be made active at a later time. To cancel the setup process, click the Cancel button and the entire process is ended.

14.3 Custom Device Setup

Page 1
Custom devices are defined as any devices other than force plates, that are connected into BioWare via BNC cables into the Type 5606A junction box. To set up a custom device using the Device Wizard, choose Custom Device from page 1 (see Fig. 92) and click the Next button.

Page 2
Choose the device type from the list on page 2 (Fig. 98), or type in a new device type if necessary. Give the device a name, and enter the serial number. Click Next to continue.

Page 3
Fig. 100 shows page 3 of the custom device setup process. Choose the units that the custom device uses, and enter the device sensitivity in (Volts/Device Units). If you would like the system to read the voltage offsets immediately prior to acquisition, then place a check in the check box. This is the last setup page in the wizard, so it is a good time to go back and check the settings. Click Next when ready to go to the finish page.

Finish Page
The setup of the custom device is complete. Choose Yes to make the device active and then choose the channel to connect the device to, or choose No to place the device in the System Configured Devices list. Click the Finish button and the Wizard box closes, and the device appears in one of the two lists. Click Cancel to end the setup process without installing advice.

Fig. 98: Page 2 of the Device Wizard for custom devices

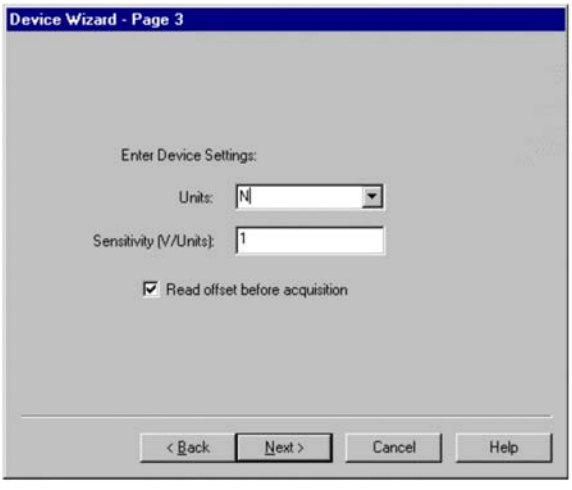


Fig. 99: Page 3 of the Device Wizard for custom devices

14.4 Auto Offsets

Each configured devices has an option to *Read zero offsets from amplifier*. When enabled (check box is checked), BioWare will read a base-line voltage reading for each channel of the device immediately after the device is placed into Operate mode.

At the end of each data acquisition period these offsets are then subtracted from the data set.

14.5 Reset / Operate Control

BioWare has the option to automatically or manually control the Reset or Operate state of attached devices.

The Reset/Operate controls are available only on the toolbar. The controls are:

-  **Automatic Reset / Operate control**.
  Sets Reset/Operate control to occur automatically when data acquisition begins and ends.
-  **Operate Mode**
  Manually places plates in Operate mode and reads base line offsets if Auto Offsets are enabled.
-  **Reset Mode**.
  Manually places plates in reset mode.

In Automatic mode the force plates will automatically enter operate state and devices with Auto Zero enabled will have the baseline offsets read at the start of any data acquisition. The current state can be overridden using the reset and operate button but the next normal transition will return the control to the proper state.

For Manual control press the operate button and the attached force plates (amplifies) will enter the operate state and any devices with Auto Zero enabled will have the baseline offsets read. Press the reset button to return the force plates to the reset state.

- On startup, BioWare will always be in the Automatic control mode
- The Manual control feature is useful when the subject must remain on the force plate between multiple trials
- Do not keep plates in operate for a extended periods of time as a small amount of drift will appear in the signals

15. Graphs

Manipulating data using graphs is simple and quick with BioWare. When a trial is opened a graph appears using the default configuration. The graphs can be edited for content, titles, scales, fonts, lines, and colors. A popup graph menu will appear when the right mouse key is clicked. For multiple graph configurations, this popup menu controls the features for the graph over which the mouse arrow is positioned. The features of the popup menu are:

Changing the graph units, scaling, grids, titles, and legends from the popup menu will change the current graph only. Use the Setup menu to globally make changes.

- **Edit Parameters**.
  The same as the Edit Parameters command from the View menu. See chapter 9.1 for an explanation of the Edit Parameters dialog box
- **Show Full Screen**.
  Used for files with multiple graphs in the same window. When selected, the active graph is enlarged to cover the entire window, covering all other graphs. When selected again, the graph returns to its original size and all other graphs are seen. This is handy to take a quick look closer at a particular graph without having to change the configuration
- **Right Mouse Zoom**.
  When a check is placed next to this menu item, the graph can be zoomed by holding down the right mouse button and dragging a box around the area to zoom. To disable zooming, remove the check
- **Zoom Out**.
  If a graph is zoomed, use this menu item to restore the graph to its original scale. The command is disabled unless a graph has been zoomed. F2 also restores the graph
- **Legends**.
  Legends are toggled on or off by placing or removing a check next to the Legends menu item
- **Scaling…**
  Allows the user to configure the axes for automatic or manual scaling
- **Titles…**
  The graph title and axis titles can be entered here. They can also be edited by double clicking the title on the graph directly

- **Units…**
  The units for the selected graph can be changed by selecting Units… from the popup menu. Changing units from the popup menu affects only the current graph and not all graphs
- **Grids**.
  The grids can be enable or disabled by selecting the grids option. Major and minor grids can be selected fro the grids dialog box then pressing OK
- **Copy Graph**.
  The current graph is copied to the clipboard for pasting into other documents. If more than one graph is configured in the window, only the graph under the mouse arrow is copied. To copy all graphs in such cases it is necessary to choose Copy Page from the View menu
- **Print**.
  Prints out a copy of the entire graph. The Print dialog box first appears allowing for changes to the printer setup, pressing OK will start the printing. The printout includes all graphs in a single window, not just the current graph

To get information on a specific data set on a graph, double click the mouse directly on the desired curve. A box will pop up with information about the data set. The data itself can be viewed by clicking the View Data button from this box. This is helpful when a graph has multiple data sets that can make it difficult to tell one set from another.

To see which trial a data set is associated with, double click the curve in the graph. An box will appear with information on the data set, along with a button that you can press to see the data values directly.

Similarly, the graph appearance can be directly edited by double clicking the mouse on a graph feature. For example, the scale of a graph can be edited by double clicking along an axis. Doing this opens the Scaling dialog box where auto scaling can be toggled on and off, and where minimums and maximums can be set.

16. Tutorials

16.1 Installing a Force Plate with the Device Wizard

The following tutorial will demonstrate how to use the Device Wizard to install and configure a Kistler force plate. The plate in this example is a portable Type 9286 with an external Type 9865… charge amplifier. This tutorial assumes that the data acquisition board has been configured and the plate and amplifier are connected to the system. Follow along with the steps and feel free to substitute your own force plate for the example.

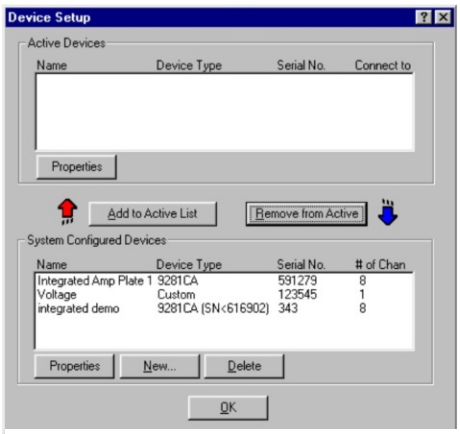


Fig. 100: Device Setup

- Launch BioWare and select Devices from the Setup menu, or press the  button in the toolbar to open the Device Setup dialog box (see Fig. 101). Ctrl+D also accomplishes this.
- Press **New…** to start the Device Wizard
- Select "8-Channel Force Plate" and press the Next button
- From the drop list, select "9286". Enter the name "Tutorial" and the serial number "123456". This will make it easy to identify and remove later. Remember that you can substitute your own force plate for the example. Press the Next button when finished
- The plate dimensions and orientation are acceptable as is. We can go on to the next page by pressing Next
- If you are installing an actual force plate, enter your force plate sensitivities from the literature that was shipped with the plate. For this example, we can leave the sensitivity values as they are. Move on to page 5 by pressing the Next key
- Enter the amplifier name as "test 9865". Press the Tab key and notice that the fields all go blank, as BioWare senses a new amplifier is being installed. Use the tab key or the mouse to move around and edit the other fields. Enter "4321" for the serial number. Use the values 1 000, 5 000, 10 000, and 50 000 for ranges 1 to 4, respectively for both xy and z. Press Next to move on, and click "Yes" when prompted to create the new amplifier in the database
- Page 6 is the Range Selection page. Select a shear range of 641 and a vertical range of 1515. These values reflect amplifier range 2. If you are configuring your own plate or if you entered in different sensitivity or range values earlier, then these values will be different. Place a check in the box to correct for amplifier offsets if one is not already there. Press Next to continue

Fig. 101: Start channel

- Our plate is now configured. Select "Yes" to add the device to the Active List (in the Device Setup box). You can press the Back button to verify selections on previous if you wish. When ready, press the Finish button
- The Wizard box closes and another small box pops up asking us to select a channel to start the acquisition (Fig. 102). Channel 1 is acceptable, so we can press OK. The box disappears and we see our plate in the Active Devices list in the Device Setup dialog box. We are connected to channels 1 through 8. We can check the plate settings by highlighting the plate and pressing Properties. Press OK to close the dialog box

This concludes the tutorial on using the Device Wizard to install devices. The procedure is the same for plates with integrated amplifiers or for auxiliary (single-channel) devices, although some of the wizard dialog boxes may change. To remove the plate, perform the following steps:

- Highlight it and remove it from the Active Devices list by pressing the Remove form Active button
- The device is now in the System Configured Devices list. Highlight it again and press the Delete button. A box pops up asking you to confirm the deletion. Press "Yes" to confirm the removal and it will disappear from the list
- To remove the amplifier that was installed, close the Device Setup dialog box and choose **Amplifiers…** from the Setup menu
- Select the "Test 9865" amplifier from the list and press the "Remove" button. If no configured plate is associated with the amplifier (as is the case here) then the record is eliminated. Press OK to close the box

16.2 Standing Jump Height Calculation

The following tutorial will demonstrate how to use the BioWare Performance to calculate the jump height of the center of mass for a standing jump.

- Configure the force plate device per the BioWare manual to acquire data
- Select Data: Acquire Trial. Set sampling rate to 250 Hz, and length to 4 seconds. Set trigger to "trigger on a key"
- Press the "Weigh" button in the Acquire Trial dialog box, and measure the subjects body weight (Mass)
- With the subject standing off of the force plate, Press the "Start" button. When the "Press Enter to Begin" message appears, have the subject stand on the force plate. Instruct the subject to perform a vertical jump on your signal. Press the "OK" button and tell the subject to begin

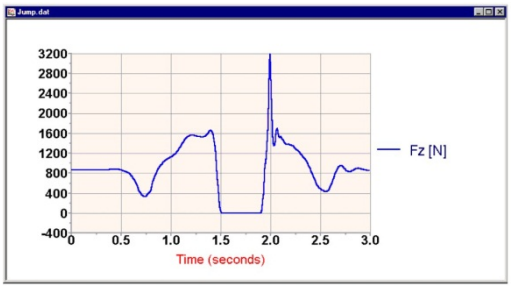


Fig. 102: Vertical Force Jump Trial

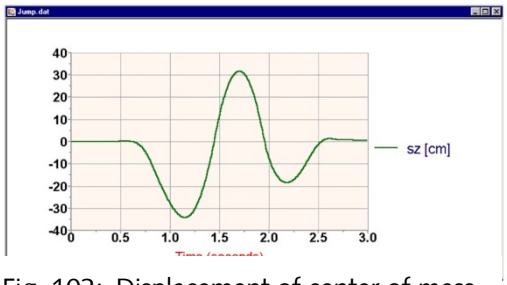


Fig. 103: Displacement of center of mass

- The default graph will appear. Select View: Edit Parameters from the main menu. In the edit parameters dialog box, select "Clear All", then select a single graph, Fz (vertical force). Your graph should appear similar to Fig. 102
- Select the Performance: Initial Conditions… menu choice. Press the "Calculate I.C. Average Acceleration = 0" button, the Static Acceleration Values should be set to approximately 0 for the two shear components and 1 *g* for the vertical component
- Press the "Calculate I.C. Average Velocity = 0" button, the Initial Velocity Values should be set to approximately 0 for the two shear components and the vertical component. These values may not be identically zero because the subject's center of mass is in continuous motion (balancing) even when standing "still"
- Enter 0 for the three initial displacement values. Then press OK to exit the Initial Conditions dialog box
- Select View: Edit Parameters from the main menu again. Press the "Show Performance" button and select Vertical Displacement (Z in Kistler coordinate system). Deselect the vertical force curve and select OK to graph the vertical displacement of center of mass (Fig. 103)
- Click once on the graph then press F3 (statistics). The statistics dialog box will appear showing the maximum displacement of the center of mass. This is the desired jump height
- Try selecting different initial conditions to see how it can affect the graph
- End of tutorial

Other suggestions:

- Use statistics on the first portion of the jump trial (quite standing) to measure the average body weight. Enter this value in the Initial Conditions dialog box for the body mass
- Try entering the know assumptions for initial conditions, 0 shear accelerations, 1 g vertical acceleration of gravity, and zero's for the remaining velocities and displacements

Use the Data:Edit Contact times and set the starting contact time to the time when the subject leaves the plate and set the ending contact time to when the subject returns (lands) to the plate. Return to the View:Edit Parameters dialog and change the X axis to Percent Contact. Verify that peak displacement occurs near time = 50%, and that velocity of center of mass crosses zero at this time. This is not necessarily a requirement of jumping, can you determine why?

17. Shortcut Key Summary

Key	*Command*
F1	Help
F2	Zoom Out
F3	Statistics
F4	Moving Cursor
F5	Threshold
F8	Open / Load View Configuration File
Ctrl+O	Open File
Ctrl+S	Save File
Ctrl+P	Print File
Ctrl+C	Copy to Clipboard
Ctrl+D	Device Manager
Ctrl+R	Amplifier Range Selection
Ctrl+TAB	Cycle through Open Windows® (forwards)
Ctrl+SHIFT+TAB	Cycle through Open Windows® (backwards)
Alt+A	Acquire Data Direct
Alt+E	Edit Parameters (Setup Graph)
Alt+I	Initial Conditions
Right Mouse Click on graph	Shows Pop Menu Graph Edit Choices
Right Mouse Drag on graph (down-left)	Zoom Out (if previously zoomed in)
Right Mouse Drag on graph (excluding down-left)	Zoom In on graph
Left Mouse Drag on graph	Scroll Graph (if previously zoomed in)

18. Example Files

Filename	*Description*
Balance Eyes Closed.dat	Balance Trial (eyes closed) – 30 seconds, 100 Hz
Balance Eyes Open.dat	Balance Trial (eyes open) – 30 seconds, 100 Hz
Ballistocardiogram.dat	Ballistocardiogram – Plate set to highest sensitivity, A/D Board Gain set to 8X (+/-1.25 Volts). Vertical force shows blood flow dynamics of heart, approximately 120 beats per minute (2 per second). FFT show heart frequency at 2 Hz.
Jump (BW Zeroed).dat	Subject standing on plate, Amplifier is reset nulling body weight. Force's shown are the variations from initial operate level.
Jump.dat	Amplifier is reset, set to operate, then subject stands on plate. Force's shown are the variations from including the subjects body weight.
Left Foot.dat	Single plate, left foot strike
Right Foot.dat	Single plate, right foot strike
Run 2 Plate.dat	Two plate, running trial
Subject 000.dat	Autosave trial, One plate active, left foot strike forwards direction
Subject 001.dat	Autosave trial, One plate active, right foot strike backwards direction
Subject 002.dat	Autosave trial, One plate active, left foot strike forwards direction
Subject 003.dat	Autosave trial, One plate active, right foot strike backwards direction
Subject Merged.dat	Merged file of Subject 000.dat through Subject 003.dat data files
Sweep.dat	No force plates active, Auxiliary device connected to function generator creating a sine wave sweep from 50 to 250 Hz. Useful for testing FFT and filters.
Walk 2 Plates (rotated).dat	Two plates active, Global Coordinate system defined with plate 2 rotated 315 degrees to the global coordinate y axis.
Walk 2 Plates.dat	Two plates active, Global Coordinate system defined.

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