

Robotic Systems Ltd

BodyLAB 1.0 Reference Manual

Operators Manual for the Leg Harness and Counterbalanced Biped Robot



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Date: 15th June 2004
Version: 1.0

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Introduction to BodyLAB

Thank you for purchasing BodyLAB, our system has been designed to provide a cost effective movement analysis and biped robot system, which meets the needs of educators in the fields of ICT and science. Users can manipulate or play their data through the counterbalanced robot. No other educational product immerses the user so completely within its embedded technology, allowing them to purposefully experiment with their captured data to produce alternative results for testing in the real world.

The leg harness can act alone to provide the user with plenty of logging features. The robot also works well by itself providing a refreshing view of robotics. When these technologies are married the mix of data acquisition and biped robotics provides users with a fascinating view of their digitised movements both on screen and interestingly, back in the real world.

BodyLAB allows the user to capture human movements from both legs and store them in a file for later use. A biped robot attached to a counterbalance can be used to replay acquired data. The first thing to do is power up the harness and robot then watch it mimic you walking in real time.

Registration

Please take time to fill in the text document registration form, named "registration.txt", located on the CD. Once completed, email it to chris@robotic-systems.co.uk. If you don't pass your details on we may not be able to inform you of free upgrades or future product releases.

Installing BodyLAB

Place the CD in a free CDROM drive, the installation screen should automatically appear, if not navigate to D:\, where D is the CDROM drive letter and double click the setup.exe application then follow the onscreen instructions. The user will be prompted to restart the machine once the installation is complete.

BodyLAB Window Overview

Start BodyLAB by clicking "Start – Programs – BodyLAB – BodyLAB", wait a few moments while BodyLAB starts. A window will completely or partly fill the screen. The window contains a menu system at the top left of the screen, beneath this is a row of buttons followed by a tab control panel on the left and stickman graphic on the right. Beneath the stickman are sets of features, which can also be controlled via the menu at the top.

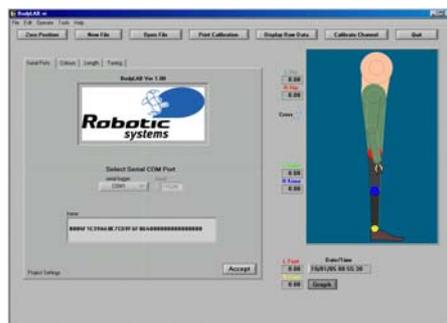


Fig 1. The BodyLAB front panel

Learning to use BodyLAB 1.0

Getting Started

The user can choose any of the tab pages to change settings. Click on the "Graph" button hide the tab pages and make the graphs appear. The user can change the height, position, colour, detail and refresh rate of the stickman using the features of the tab pages. When logging data or replaying a walking file the stickman walks realistically because a virtual floor has been built into the software. None of the changes are permanent, restarting the application resets any changes back to their default settings.

The colour of each stickman joint (discs) filters through to the graph lines and digital indicator text to provide a convenient way to aid users trying to see which joint relates to a graph line and digital indicator. It is suggested joint colours are kept different.

During replay the user will notice the 3 graphs displaying hips in the top graph, knees in the middle and ankles in the bottom graph. The hip graph has an added feature, when the hips become parallel, a dot is

position indicating the start of a step. When the hip are parallel again another dot is positioned indicating $\frac{1}{2}$ a step, the third dot indicates a step end. This feature continues throughout the entire file. It allows the software to select single steps and create a virtual artificial leg.

Between the graph and stickman are sets of digital indicators showing the instantaneous angle of each joint. The stickman shows the corresponding position of the person wearing the leg harness. All 3 display mediums relate to each with respect to time.

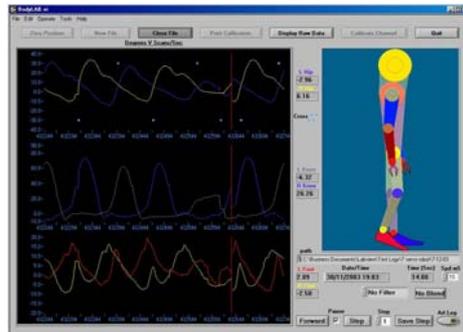


Fig 2. Replaying a walking file

Loading a walking file

Once BodyLAB has been installed you can play one of the saved files shipped with BodyLAB. To do this click “Start – Programs – BodyLAB – BodyLAB” and the application will load up. The BodyLAB application will now be seen on screen. To show the main graph click on the “Settings” button beneath the stickman graphic. You can either click the “Open File” button or click “File – Open” then navigate to a walking file. Select one of the files by double clicking or click the file once then “OK” to open the file. The file will immediately begin replay, You will see the graph, stickman and digital numbers changing in the application.

Setting the Circuitry to Operate with Mimic Man

Circuitry for the BodyLAB system will work straight from the box. The circuits are set to factory default during manufacture however they can be changed for example when 2 or more systems are used within range of each other. Please refer to the “Circuit Set-up” document, which describes how to change each of the circuit settings and can be found on this CD.

Assembling the Counterbalance T frame

Please refer to the diagram showing the parts used to assemble the T frame and check all parts are present. Screw the (60cm) plastic and metal tube into opposing arms of the metal T moulding. Screw the short (9cm) metal tube into the remaining threaded hole. Remove 1 of the screws from the T moulding and swivel the plate to expose the internal cavity. Find the cable with a serial plug and power connector on one end and a stereo jack plug (2.5mm) on the other. Guide the jack plug into the plastic (60cm) tube until it reaches the T moulding cavity, then guide it at 90 degrees so it then travels through the metal (9cm) tube. Next take the plastic (40cm) tube and insert it firmly into the plastic socket secured to the hemispherical base. Guide the T frame's protruding jack plug into the base then follow on by guiding the T frame's metal (9cm) tube into the base plastic (40cm) tube until they meet.

The entire base and T frame can now be picked up and turned upside down, the jack plug can be seen protruding into the base cavity. Insert the jack plug into the jack socket mounted directly beneath the end of the plastic (40cm) tube. Place the assembly base back on the floor.

The Mimic Man contains delicate parts and must always be handled carefully like any other scientific Instrument. All parts are replaceable though, contact Robotic Systems Ltd for availability. The Mimic Man carcass can now be connected to the robot head and T frame assembly. Using the releasable plastic rivet carefully line up the holes of the head and carcass parts before inserting the rivet. Press the rivet firmly, making sure it has engaged locking the parts together.

The Mimic Man may now begin to sag, be careful the T frame does not topple over, immediately attach the metal tube (50cm) counterweight and slide it onto the metal arm side of the T frame. This will stabilise the robot making him ready for power.

The remaining cable should have a large stereo jack plug on one end and serial plug and power connector on the other. Push the large jack plug into the jack socket mounted to the T frame base.

Connecting the Mimic Man Robot

You will notice end of the cable connected to the robot has a serial and power supply connector. Find a spare serial port on your computer and connect the serial cable to it. The power part of the cable should now be connected to the kit power supply and switch on the power supply. The robot may flinch while power is applied or removed, this is normal. If BodyLAB hasn't already been loaded, load it now. The main left-hand panel tab should now be showing "Serial Ports", click the "serial servo" button and select the serial port Mimic Man is connected to. Ensure the "serial logger" button shows a different serial port is selected then click on the "Accept" button. The robot posture will change to represent a standing person.

Load a walking file using the procedure described in the "Getting Started" section and the robot will mimic replay of the file data.

Leg Harness Handling

It is suggested that once the harness has been assembled it be stored assembled in a safe place while not in use. The device should be handled with care, the potentiometers have a rotational range of 270 degrees, travel passed the end stop will destroy the potentiometer. All leg parts are available from Robotic Systems Ltd, please contact us to check availability.

Assembling the leg harness

The leg harness is shipped nearly assembled and requires just a few minutes to set up before use. Unfold the harness legs flat on the floor so they resemble the diagram. For each leg, clamp the upper shin slider to the lower shin using the clamp plate. The clamp plate should be on the outside and the upper shin slider should be in the middle. The same procedure should be followed for the harness thighs, again with the slider part in the middle.

Now slide the belt through one of the hip plates so the buckle is at the front. The front is indicated by the direction the foot moulding points. Next slide the circuit plate onto the belt so the narrow edge point upward. The plate should be slid onto the belt taking care not to damage the circuit. The belt should end up on one side of the plate and the circuit mounted on the other. Next slide the second leg onto the belt ensuring both feet moulds point in the same direction.

The potentiometer cable connectors need to be fitted to the circuit. Each connector needs fitting to the correct circuit plug as follows:

Joint	Circuit Plug
Left Hip	1
Left Knee	2
Left Ankle	3
Right Hip	4
Right Knee	5
Right Ankle	6

Table 1. How to connect leg harness cables to the circuit

The leg harness has sliders allowing the overall length to be adjusted to suit people of different heights. If children need to wear the harness it can be shortened. Each slider assembly has 3 holes allowing the maximum length of the assembly to be increased or decreased by shifting the 2 clamping nuts and bolts from the left and middle to the middle and right holes.

Setting the Circuit to Operate with the Leg Harness

Circuitry for the BodyLAB system will work straight from the box. The circuits are set to factory default during manufacture however they can be changed for example when 2 or more systems are used within range of each other. Please refer to the "Circuit Set-up" document, which describes how to change each of the circuit settings and can be found on this CD.

Assembling the Circuitry for use on the Harness

The radio communications circuit simply connects to the main circuit by pressing the 2 devices together. The antenna supplied should then be screwed to the radio circuit base.

Fitting Batteries

Remove the battery compartment by pushing upwards and insert 3 x AAA batteries, disposable or re-chargeable batteries can be used, replace the compartment. Connect the battery connector to the circuit. Once the battery pack is switched on the harness will start to capture movements.

Connecting the Dongle

Connect the Null Modem serial cable between the dongle and PC serial port. Connect the 2.1mm power supply connector to the dongle and switch on the power. Reception may be improved by moving the dongle to a convenient location to improve line of sight between the dongle, leg harness circuit and robot.

Operating the Dongle

With the assembled leg harness running, dongle powered up and connected to the PC and BodyLAB running the user should select the BodyLAB "serial servo" port then press the "Accept" button. BodyLAB will start receiving data from the harness via the dongle, graphical, digital and stickman changes will be shown in BodyLAB indicating the system is live. If the system does not respond repeat the stages: "Connecting the Dongle" and "Operating the Dongle".

When to use a USB to Serial Cable

If BodyLAB is to be run on a laptop or PC without free serial ports the user may install a USB to serial cable.



Fig 2. USB to Serial Cable

Robotic Systems Ltd has spent considerable time testing its hardware and software systems to ensure reliability. Several different manufacturers cables were tested however the picture above shows the only USB to Serial cable that we could find capable of maintaining serial communications. For this reason we advise users who require a converter cable to purchase this item. Robotic Systems Ltd offers this product as an accessory.

Installing the USB to Serial Cable

Place your USB to Serial cable installation CD in a spare drive wait a few seconds then click on the drive which will then show several different folders. Click on the folder named "USB 2.0 TO RS232 CABLE", inside there will be several folders and a word document titled "USB 2.0 TO RS232 Cable for Windows user's manual.doc", double click this file to open it. Follow the instructions to install the converter cable. The cable can be conveniently connected and removed while the machine is switched on.

Customer Support

If problems cannot be solved please contact Robotic Systems Ltd. Further information and contact details can be found on our Website. The URL for our site is:

<http://www.robotic-systems.co.uk/>

Our company address is:

Robotic Systems Ltd
76 Kentstone Close
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United Kingdom

Working with BodyLAB

There are various features within BodyLAB to allow the user to capture, store, manipulate and replay human movements. There are 3 different ways to select a BodyLAB software feature, menu drop down list, experienced user hotkey and main window button or list box. Not all menu options have an associated hotkey. The software features will now be described using the menu options to make a selection.

File Menu

New

New, "File – New", this feature is used to create a new file to store movements from the leg harness. Opens the new file dialog box, prompting the user to enter the name of a new file. Pressing OK starts the movement capture algorithm which passes data to the file on the Hard Disk Drive (HDD). 100 lines of time stamped movements are stored in the file each second. When enough movements have been captured the user can stop the feature by selecting "File – Close"

Open

Open, "File – Open", this feature is used to open files of recorded movements. It opens the "Choose File to Open" dialogue allowing the user to navigate to the desired file. Selecting the file with a click and pressing OK will open the file, which then runs automatically. Selecting "File – Close", will stop replay of the file. Each time a running file reaches the end of its data it simply continues replay from the start of the file again and loops continuously.

Close

Close, "File – Close", can be used to stop recording leg movements to a file or replay of a recorded file.

Print

Print, "File – Print", this option prints the current calibration file.

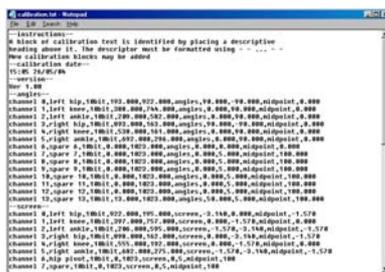


Fig 3. The calibration file stored at C:\robotic systems

Exit

Exit, "File – Exit", the user selects this option when they want to automatically close the application regardless of the current features running. Clicking on the window top right hand X has the same effect.

Edit Menu

Zero Position

Zero Position, "Edit - Zero Position", The PC needs the test subject wearing the harness to stand bolt upright and select "Zero Position" so it can acquire a point of reference. The zero position can be used for the entire session but the process can be repeated to allow fine-tuning. The zero position is lost each time the harness is taken off and put back on.



Fig 4. before zeroing

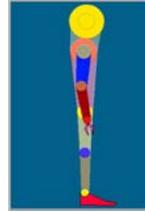


Fig 5. after zeroing

Calibrate

Calibrate, “Edit – Calibrate”, Calibration is required to convert raw digital data from the microprocessor circuit into voltages, angle, screen angle and servo positions. The calibration application provides a number of features and for this reason has a dedicated panel. Typically, 2 points of digital data at convenient positions are captured and plotted with corresponding values of angle.

The 2 points are then used to calculate the gradient and intercept representing the straight line between the 2 points. The process is fully automatic except for moving the harness joint and choosing the angles. The gradient and intercept are then calculated by the software, displayed on the screen and saved to the calibration file.

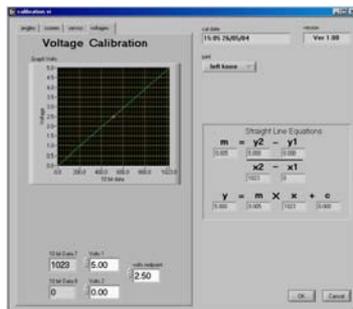


Fig 6. Calibration front panel

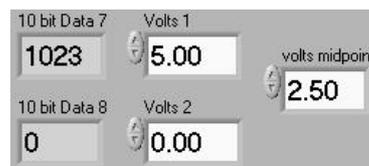


Fig 7. 2 points and midpoint data

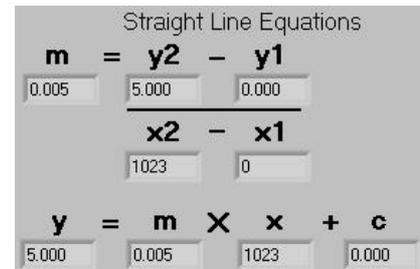


Fig 8. Gradient and intercept calculated

Settings

Settings, “Edit – Settings”, Select Settings to toggle between displaying the graphs and showing the Project Setting pages. The pages available from the Project Settings are: Serial Ports; Colours; Length; Tuning.

Operate Menu

Forward

Forward, “Operate – Forward”, When replaying a walking file, forward is selected by default, movements can be replayed either forward or backward. The “Forward” and “Backward” menu options use a tick to show which of the options is live.

Backward

Backward, “Operate – Backward”, Selecting Backward during replay reverses the order movements are replayed, this has the effect of making the stickman appear as though he were walking backward.

Pause

Pause, “Operate – Pause”, With a walking file loaded the user may stop replay by selecting “Pause” option. The option can be toggled on and off, a tick is used to indicate when the when pause has been selected.

Step

Step, “Operate – Step”, Once a walking file has been paused the user may wish to single step through the movements a frame at a time repeatedly. Selecting step advances replay by the number of scans set in the “graph numeric” on the “Tuning” tab of the “Project Settings” panel. A scan is a record of all leg joint positions for a given moment in time, The legs are “scan”ned 100 times a second. This value is set to refresh the graph with 5 scans by default but the user can change the value.

Filter

Filter, “Operate – Filter”, These features have been designed to show users how to acquire and save single steps from a file then apply mathematics to the information. Looping single steps could be used to drive a balancing biped robot. This option is the heading for a submenu containing 2 mathematical smoothing features. These features have been designed for use with single steps saved from multiple step walking files replayed in a loop. Smoothing movements allows the user to experiment by introducing mathematical functions to saved steps. A tick is used to indicate selected options from the submenu.

No Filter, “Operate – Filter – No Filter”, No Filter is the default and has no effect on recorded data

Polynomial, “Operate – Filter – Polynomial”, The feature applies a 6th order polynomial function to movements, the effect is to filter out the high frequencies from the single step. The polynomial smoothes the data too much although the stickman still moves in a realistic manner.

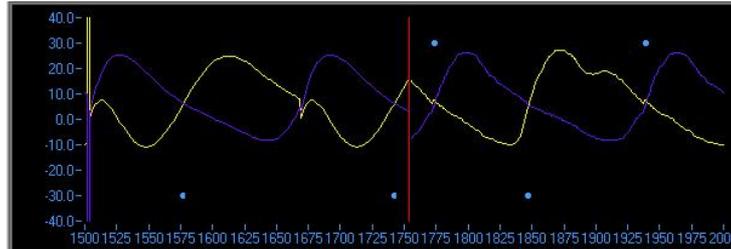


Fig 9. Hip graph, the left side has been filtered using a polynomial and the right side has not

Low Pass Filter, “Operate – Filter – Low Pass Filter”, This feature uses a low pass, 3rd order filter whose low cut off frequency has been set to 25Hz. It provides gentle smoothing of the original movements.

Blend

Note: the blend feature does not function correctly for this version of BodyLAB

Blend, “Operate – Filter – Blend”, Select this option to blend the start and end of movements from a step file. When a single step has been saved the data can be viewed by opening the saved document in a text editor. A typical step will contain 120 scans (or lines). If the user looks at the first and last values from 1 column they will notice the start and end values are rarely the same. By choosing to apply the blend feature, the first and last few scans are blended toward each other, so that when replayed in a loop there should be no noticeable jump in movements from the last scan looping back to first scan. This feature can be toggled on and off, on is indicated by a tick.

Tools Menu

Raw Data

Raw Data, “Tools – Raw Data”, This feature toggles the raw data panel, This panel shows channel numbers, channel names the current 10 bit data and voltage of each of the 14 channels. A tick next to this menu option indicates the raw data panel is currently showing.

No	Channel	10 bit Data	Volts
1	) Chan 0 R Foot	= 510	1.64
2	) Chan 1 R Knee	= 394	1.27
3	) Chan 2 R Hip	= 261	0.84
4	) Chan 3 L Foot	= 607	1.95
5	) Chan 4 L Knee	= 295	0.95
6	) Chan 5 L Hip	= 689	2.22
7	) Chan 6 hip piv	= 339	1.09
8	) Channel 7	= 278	0.90
9	) Channel 8	= 0	0.00
10	) Channel 9	= 0	0.00
11	) Channel 10	= 0	0.00
12	) Channel 11	= 0	0.00
13	) Channel 12	= 0	0.00
14	) Channel 13	= 0	0.00
15	) Spare	= 0	0.00
16	) Spare	= 0	0.00

Fig 10. Panel showing raw digital data and voltages from all 14 channels.

Artificial Leg

Artificial Leg, “Tools – Artificial Leg”, This feature shows the user how their walking data could be used to control an artificial leg. Data from the good leg is used to control the virtual artificial leg, and displayed using the graph, stickman and digital display. The original walking data from the leg now replaced by the artificial

leg is still displayed on the graph to provide a comparison between the original leg movements and those suggested by the computer. The graph shows the original traces plus the artificial leg movements as a dotted line using the same colour as the good leg the data has been copied from. This feature displays a tick when the artificial leg has been selected.

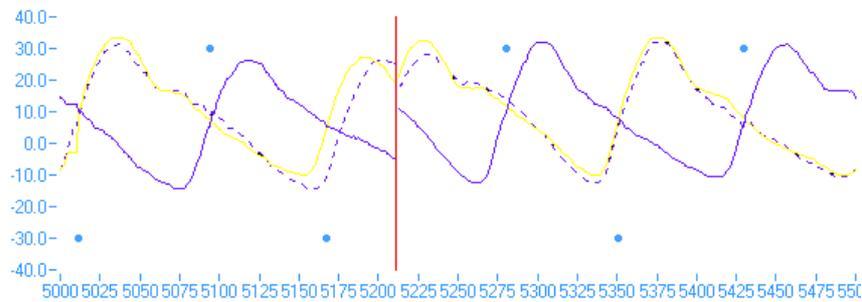


Fig 11. Dotted line shows the computer predicting the virtual artificial leg position

Help Menu

About BodyLAB, “Help – About BodyLAB”, This feature display a panel showing the application name, version number and various other information.

Advanced BodyLAB features

Project Settings Tab Pages

The “Project Settings” Pages have been constructed to provide the user with numerous settings and features to enhance the function of BodyLAB and customise it for use with PC’s whose processors are faster than 500MHz. The “Serial Ports” tab has already been described in the “Getting Started” section.

Colours Tab

The purpose of the “Colours” tab is to allow users to view and edit the colours for each of the stickman body parts and view the current rotational position of each joint measured in radians. The user can change the colour of the particular body part by clicking on it. A colour panel suddenly appears showing a wide spectrum of colours, any of which can be chosen as the new colour for the selected body part.

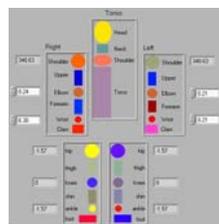


Fig 12. Colours page of the Project settings

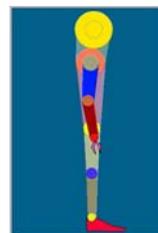


Fig 13. Stickman showing corresponding colours

Length Tab

The “Length” tab shows 2 columns of sliders, the left hand column lets the user control the length stickman limbs while the right hand column controls the angular offset of the stickman neck and torso. Typically the length of the shins and thighs can be dynamically increased and decreased from the default setting during replay to produce a visually unusual effect. Torso lean can also be added to enhance the effect.

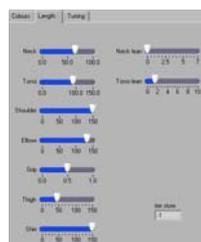


Fig 14. Project Settings, Length Tab

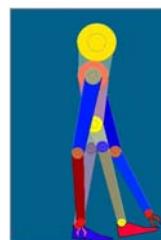


Fig 15. Stickman showing elongated limbs

Tuning Tab

Tuning allows user to fine tune BodyLAB to their machine to enhance performance.

“Light Direction”, this slider allows the user to select a direction for the light source striking the stickman.

“Body Height”, this slider lets the user move the position of the stickman up and down. BodyLAB requires a minimum PC speed of 500MHz to run.

“Style”, The Style button controls a feature to remove detail from the stickman, freeing the processor for other tasks because performance can differ from machine to machine.

“graph buffer”, this feature sets the number of scans to place on the graph during each loop. If the graphs, stickman and digital displays were set to display each scan separately most machines would lock up, replay would appear slow and glitchy. To free machine resources the graph is refreshed with a specific number of scans, the default being 5. The stickman and digital numbers show the last scan from each block of scans. For slower machines the user may find stickman movements become blocky using the preset buffer size of 5, however by increasing the buffer value to 10, enough processor resources may be freed to allow smooth movements for the stickman. This trade off loses its effect once the buffer reaches approximately 25 which means the stickman will only move 4 times per second.

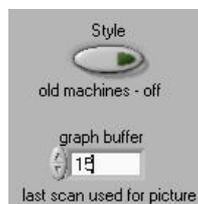


Fig 15. Shows Style (detail) is off and buffer = 15 scans

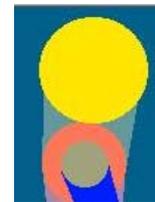


Fig 16. Shows the stickman without detail

“Picture”, allows the user to change the height and width of the stickman picture. This may be useful when users want the stickman torso to lean forward although ideally the video resolution should be set to resolution higher than 1024 x 768 to prevent the extra picture width being clipped

Select a Step

Users can set BodyLAB and the robot to play 1 step continuously. A step can be captured from a walking file by carrying out the following instructions. Load a walking file, this procedure is described in the “open” section. View replay of the given file, decide upon a suitable step to save and note roughly the time the step occurs in the file. Pause replay of the file and highlight or use the up/down arrows to select a step number in the “step” numeric then press enter. Provided the step number is less or equal to the number of steps in the file the replay now starts in slow motion until the end of the step. If the number entered exceeds the number of steps the numeric defaults to the last step in the file. Once replay has finished the user may continue selecting then replaying steps until they find the desired step.

Capture a Step

To capture a step click on the “save step” button which displays the save as dialogue box. The user can choose a directory, specify a filename then click ok to save the single step.

Replay a Step

If BodyLAB has just saved a step a walking file will still be loaded and require shutting down, do this by clicking on “Close File” Then click the same button now displaying “Open File”. Find the single step file, click on it then press ok to load. The single step will run and loop continuously.

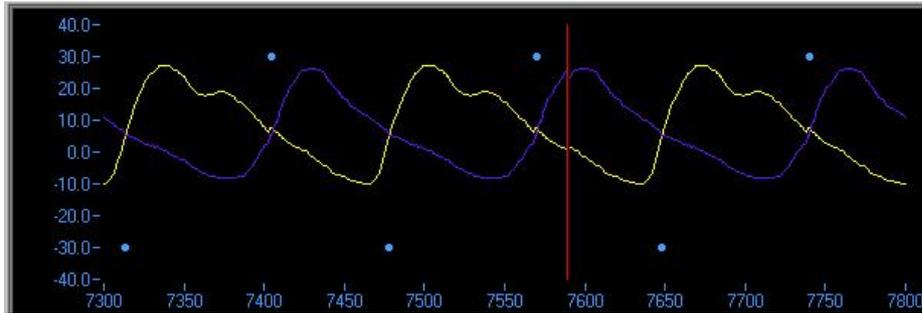


Fig 17. Graph of hip angles while running 1 step as a loop

Changing the Replay Speed

To enhance viewing of walking data the user may change the rate the data replayed, although data defaults to replaying at the rate it was originally captured, 100 scans per second. If the user makes the default “Spd mS” value of 10mS smaller, replay will speed up, values greater than 10mS will cause replay to slowdown. This same effect can also be seen in the robot.

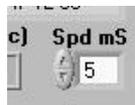


Fig 18. Change the Spd mS value to 5 to make it run at twice normal speed

Calibration

A separate window has been dedicated to calibrating the 14 channels used to represent angles, screen positions, servos and voltages. The panel is split into a page selection Tab Control on the left and calibration dates, version number and channel calibration results on the right. The right of the screen shows the date of the last calibration and current calibration version number. Beneath this is the joint (channel) select list box. The user can select any of the 14 channels to calibrate. As soon as a particular joint has been selected, stored calibration values from the calibration file filter through to populate the 5 digital values on the left-hand side.

Next down are the straight-line equations indicating the current gradient, m and Y axis intercept, c . These values are refreshed as soon as the data becomes live as soon as one of the “Angles” have been selected for change. New values are overwritten once the user chooses to exit and save changes.

The Angles page shows a graph of angle plotted against 10 bit data. Beneath the graph are 5 digital values, These values represent the X (10 bit data) and Y co-ordinates of 2 points conveniently chosen to represent the extremes of movement required of a particular joint. The “angle midpoint” indicator is chosen as a reference when BodyLAB zeros the leg harness to its known standing position. The other tab pages follow the same format except for the stickman, which replaces the graph with the stickman from the BodyLAB panel.

Calibration File

The calibration.txt data file is in the C:\robotic systems directory. When BodyLAB is started for the first time the file does exist, BodyLAB detects this, creates the C:\robotic systems directory and fills it with a factory default file allowing the user to get running with quickly. The default calibration is accurate relative to potentiometer tolerances however the calibration window has been supplied for tuning purposes. It is possible to corrupt the calibration file using BodyLAB’s calibration feature but this can be corrected by changing the name of the current C:\robotic systems directory to something like “C:\robotic systems bak”. When restarting BodyLAB, it detects the calibration file is missing, forcing it to reinstall the directory and default file.

If the user wishes to view the calibration file, run BodyLAB at least once then navigate to C:\robotic systems then double click the calibration.txt to open it. Do not make any changes, when closing the file if prompted to “save changes”, choose “no”.

Calibration Procedure

The following calibration procedure describes how to calibrate a channel to output a range of angles, which correlate to the position of a potentiometer. The “angles” tab page should be selected.

First the user needs to select one of the “Angle” indicators which makes the corresponding “10 bit data” indicator become live, as the joint sensor is moved the user will see changes to the digital “10 bit data” indicator. Now the user can change the position of the leg harness joint to one representing extreme position one. The user then needs to swing the harness leg forward until parallel with the ground. The “Angle” indicator can then be adjusted to the desired value, in this instance 90 degrees. The user will notice the graph refreshes dynamically as values of “Angle”, “10 bit data” and “angle midpoint” are changed. This procedure needs carried out on both sets of indicators, finally the user should choose a value to represent the midpoint in this case 0 degrees. Calibration of this channel is now complete.

The user should press the “OK” button on the right hand side and click “OK” again when prompted to save the changes.

Walking File Structure

Walking files are saved with a .rob suffix. Different machines with BodyLAB installed will probably contain different calibration files. These calibrations differences would cause problems when opening files recorded on a different machine unless the current calibration set up were saved along with the walking data. The means walking files recorded using one machine can be run on any other machine regardless of the other machine calibration set up. Once the walking file is closed BodyLAB reinitialises using its calibration.txt file.

A typical walking file has several headings appearing in the following order:

Instructions

- instructions – typically, brief explanation of the file structure
- calibration date – typically, 13:35 26/11/03
- version – typically, Ver 1.00
- angles – typically, channel 0,left hip,10bit,193.000,922.000,angles,90.000,-90.000,midpoint,0.000
- screen – typically, channel 0,left hip,10bit,922.000,195.000,screen,-3.140,0.000,midpoint,-1.570
- servos – typically, channel 0,left hip,10bit,194.000,791.000,servos,50.000,780.000,midpoint,540.0
- voltages – typically, channel 0,left hip,10bit,1023.000,0.000,voltages,5.000,0.000,midpoint,0.000
- angle offsets – 7.28,6.57,1.69,7.40,4.77,3.64,0.0,-98.65,-100,-100,-100,-100,-100,-100
- screen offsets – 0.13,-0.07,-0.04,0.12,-0.16,-0.02,-98.31,-98.65,-100,-100,-100,-100,-100,-100
- servo offsets – -81.59,-24.35,77.22,42.87,22.32,-55.17,-106.23,-98.65,-100,-100,-100,-100,-100,-100
- model – typically, false
- acq freq hz – typically, 100
- data – typically, 30/11/2003 19:03:46.27 514 459 192 578 503 682 339 276

Multiple and single step walking files have the same file structure except single step files tend to be around 15 Kilo bytes in size whereas multiple step files can be any size. The last item of the above list shows a line of data from a file, it shows a date and time stamp followed by 8 numeric values representing the digital position of the potentiometer. These values are 10 bits and can represent numbers in the range 0 to 1023.

File Size

To provide a guide, a recording of 10 seconds will generate a file size of 74KB and a recording of 60 seconds produces a file size of 437KB (nearly ½ Megabyte).