EMG Plots Android Application

User's Guide

MAN-035-2-0
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TABLE OF CONTENTS

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1 Important Information

1.1 Intended Use

The EMG Plots Android Application is a software application to be used with the Trigno Wireless Biofeedback System. The function of the app is to provide control of, and feedback from, the Trigno Biofeedback System. This app is designed to work exclusively with the Trigno Biofeedback System and is not intended to be used in diagnostic or safety-critical applications.

The Trigno™ Wireless Biofeedback System is a battery-powered biofeedback device that enables researchers and clinicians to acquire EMG and related signals from subjects for biofeedback and research purposes. They are intended for relaxation training and muscle reeducation. Interpretation of the EMG and supporting signals by a qualified individual is required.

Please refer to the Trigno Wireless Biofeedback System User Guide for additional important information.

Please refer to the Trigno Wireless Biofeedback System User Guide for additional important information.

1.2 Technical Service and Support

For information and assistance, please visit:

www.delsys.com

Contact us:
E-mail: support@delsys.com
Telephone: (508) 545 8200

1.3 Android Device Requirements

- Android 6.0 and above.
- Bluetooth 4.1 and above.
- Recommended Tablet:
  Samsung Galaxy Tab S2
  8-inch screen, 32 GB, WI-FI
  (SM-T713NZKEXAR)

2 Application Overview

The EMG Plots App is an Android Tablet application created by Delsys to allow data acquisition, real-time biofeedback, and operation of the Trigno™ Wireless Biofeedback System via a mobile device. The EMG Plots is designed to provide a lightweight Trigno experience by communicating with sensors directly using a Bluetooth communication protocol.

This guide provides an overview of the application features, and instructs the user on how to interact with the application and the Trigno hardware.

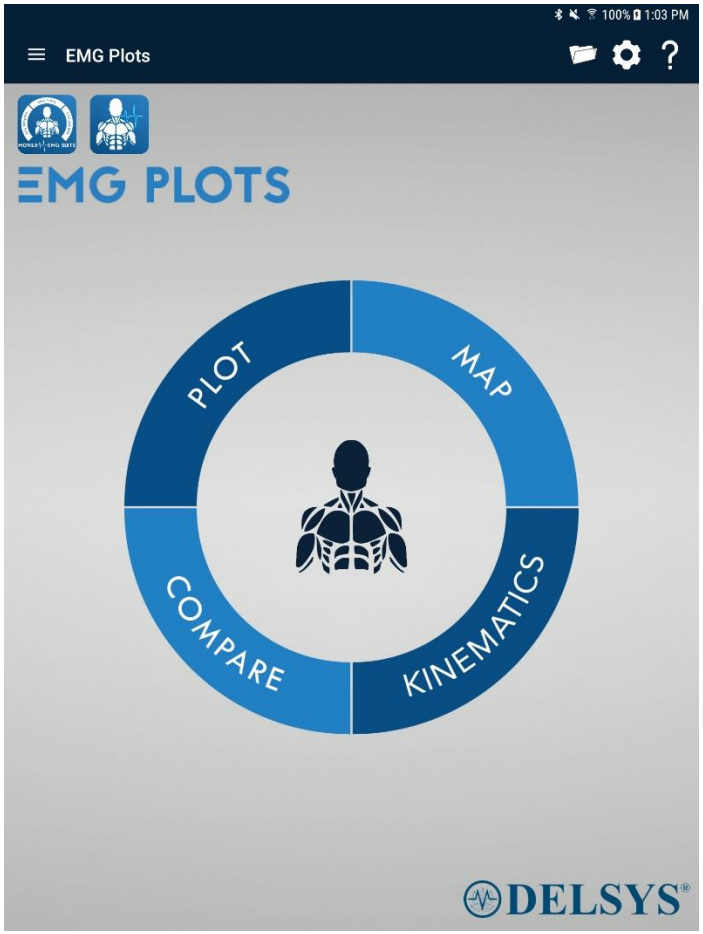


Figure 1: EMG Plots Home Page

4 Home Screen

4.1 Sensor List

Click to access sensor list, and to re-scan for sensors.

4.2 MVC Configuration

Only usable in feedback modes, use to access the MVC configuration dialog and to enable/disable MVC indicators for EMG channels.

4.3 File Browser

Click to open the file browser. See sessions and collected data files and delete or export files.

4.4 Application Settings

Click to open the applications settings page.

4.5 Plot

Display feedback as Time Series plots.

4.6 Map

Display feedback on a human body overlay.

4.7 Compare

Display feedback as bar charts to compare EMG signals.

4.8 Kinetics

Display kinetic feedback.

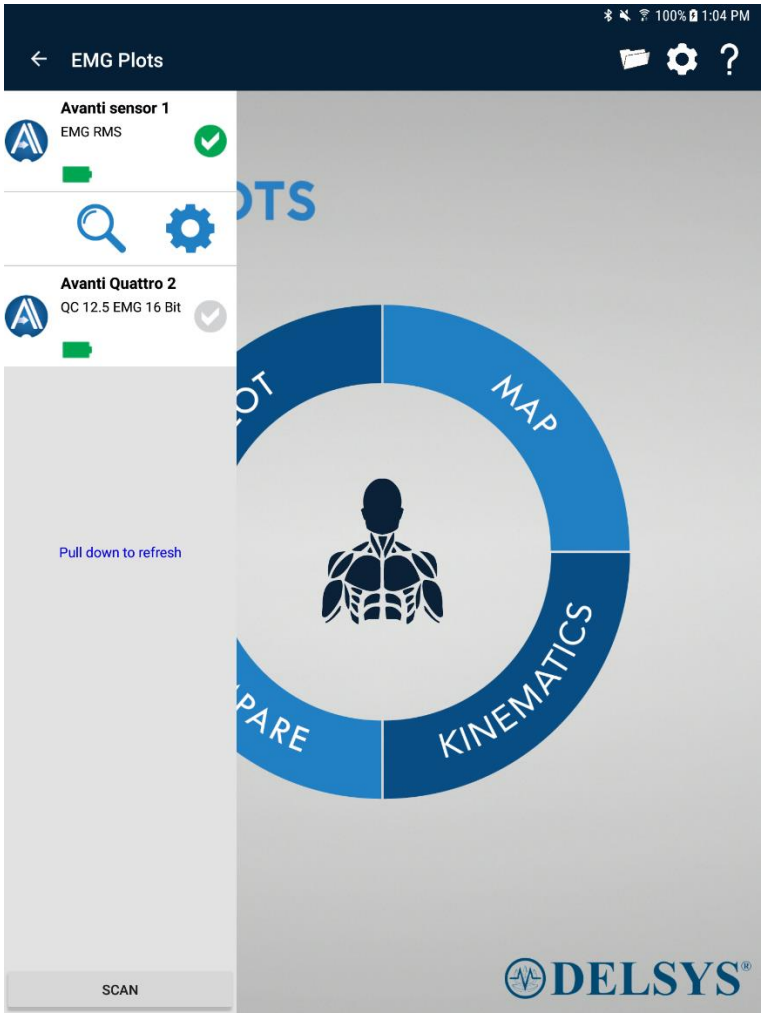


Figure 2: Sensor List on the Homepage

5 Sensor List

Swipe in from the left edge on any screen of the EMG Plots to display the Sensor List. Pull down on the sensor list to rescan for Trigno Avanti sensors.

The Sensor List will auto populate with sensors nearby, and by default will name the sensors as "Trigno Avanti N". Sensors can be renamed from either the Identify dialog, or the Sensor Settings dialog.

The following icons are used within the app to launch certain features and dialogs:

Launch the Identify dialog to blink the sensor's LED white for identification purposes

Launch the Sensor Settings dialog to configure the hardware, rename the sensor, or perform MVC or Signal Quality Check

Launch the Maximum Voluntary Contraction (MVC) dialog to collect a new MVC value.

Launch the Signal Quality Check dialog to inspect the sensor's signal.

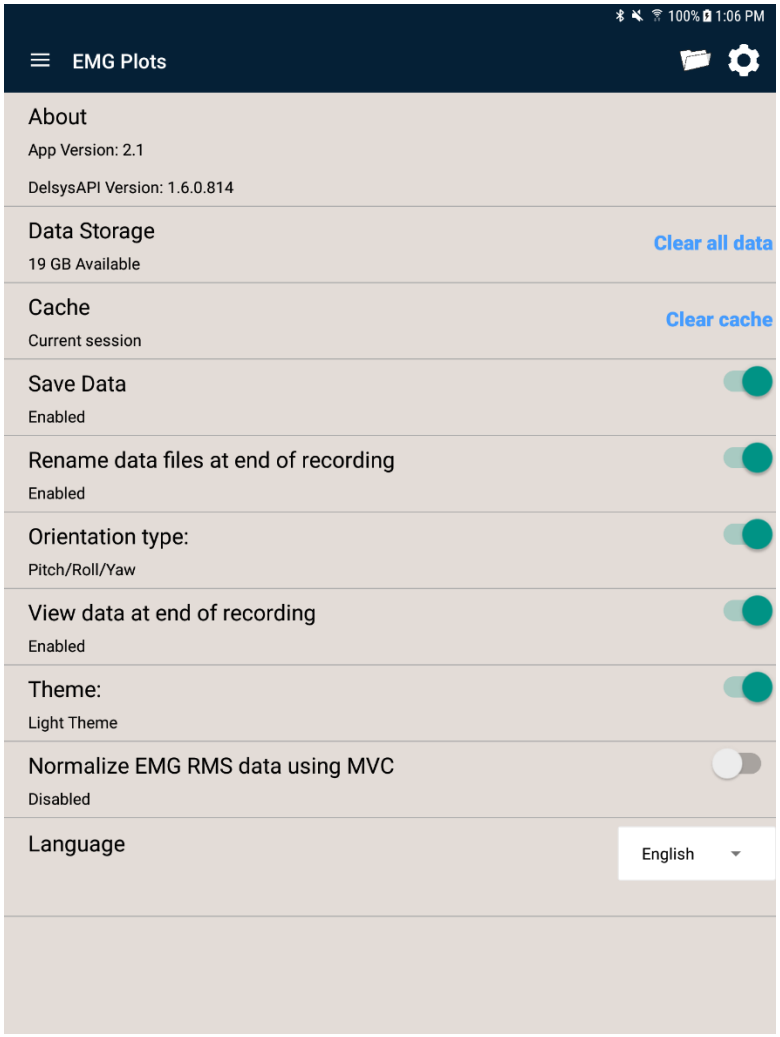


Figure 3: EMG Plots File Browser

6 Application Settings

6.1 About

Displays the version number of the EMG Plots Android Application.

Displays the version numbers of components used to build the EMG Plots.

6.2 Data Storage

Displays the amount of storage available on the tablet. Use the "Clear All Data" button to permanently delete all Trigno data files.

6.3 Cache

Click "Clear Cache" to remove all stored settings and alias names for Trigno Sensors.

6.4 Save Data

This option will enable or disable the storage of data files during feedback. If disabled, no data will be stored.

6.5 Always Rename Data Files

This option will enable or disable the prompt at the end of feedback for the user to rename the data file. If disabled, files will be automatically named "RunN.shpf", where "N" is the current run number.

6.6 Orientation Type

Orientation data can be stored as Quaternions or as Degrees in a Pitch/Roll/Yaw format. Use this option to switch between data types. By default, Pitch/Roll/Yaw is selected.

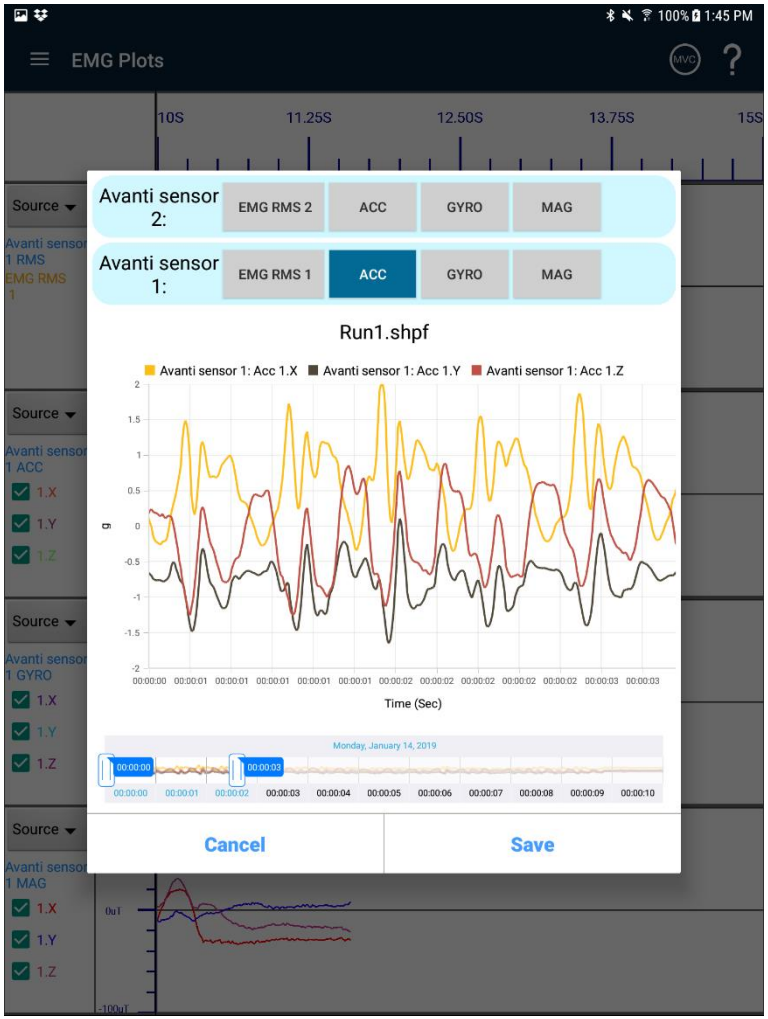


Figure 4: Data viewer dialog

6.7 View Data at end of recording

Toggle this option to ON if you wish to view the data collected at the end of the recording. A data viewer dialog box will appear where you can select the sensor and the interested channel to view the data. Click “save” to save the plot as pdf.

6.8 Theme

Toggle between Light and Dark theme in the plots while data streaming. Light theme is used by default.

6.9 Normalize EMG RMS data using MVC

Toggle this switch to ON if you wish to normalize RMS data with respect to the MVC value of that sensor during data streaming. If no MVC value is available, the plot’s Y-axis will NOT be normalized.

6.10 Language

Click to select the language in the app. Quit and Restart the app again for the changes to take in effect. Current supported languages are:

a) English
b) German
c) Dutch
d) Spanish
e) French
f) Chinese
g) Japanese

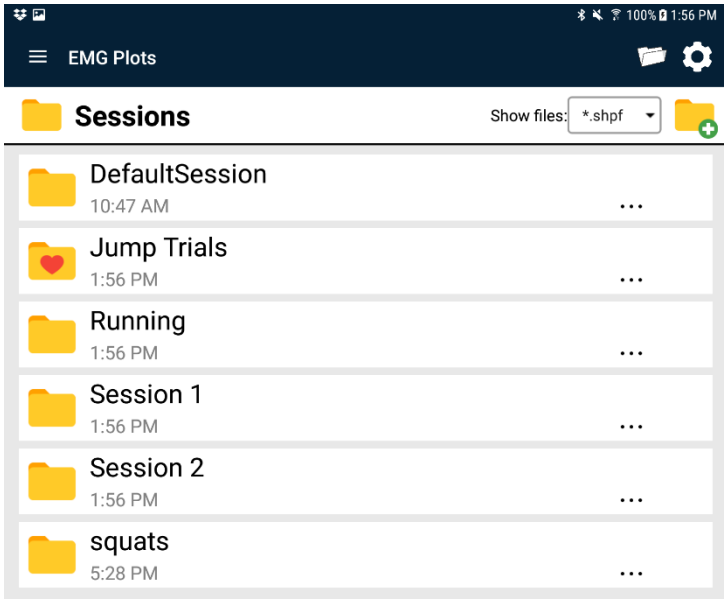


Figure 5: Example of multiple folders in file browser.

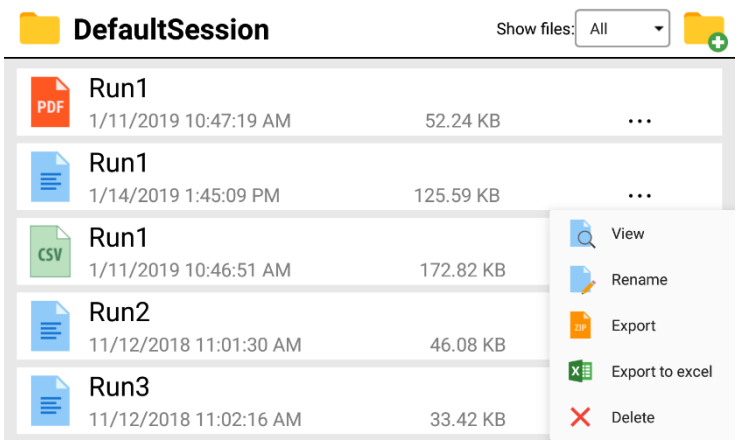


Figure 6: Example of data files in file browser.

7 File Browser

The file browser allows the user to create folders for managing their data collection sessions, and to export data via various file sharing services.

To select a file or folder, long press on the file or folder row.

7.1 Navigation Bar

Click the Ellipsis button to reveal a small drop down list which have the following functionalities:

Set the current Session as the default file storage location. Use this to change which Session the data are being saved to.

Delete currently selected File or Session.

Click to rename a Session or a File.

Add a new Session to current directory.

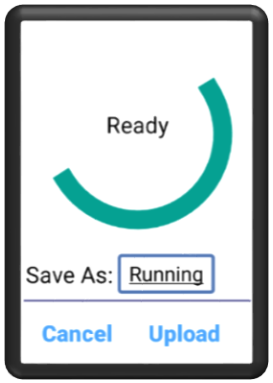
Click to export the File/Session as a zipped file

Click to view the summary of the selected file.

Click to export shpf file to xlsx file

7.2 Exporting Data

Select a file and click on the “Export” button to export. Files and folders are compressed before sending. Next, select an export method from the Android System dialog. Files are saved as .shpf and can be converted to .hpf files using the Delsys File Utility on a Windows PC.



7.3 Show Files

Click the drop down menu item to filter the files between .shpf, .xlsx, .pdf or All.

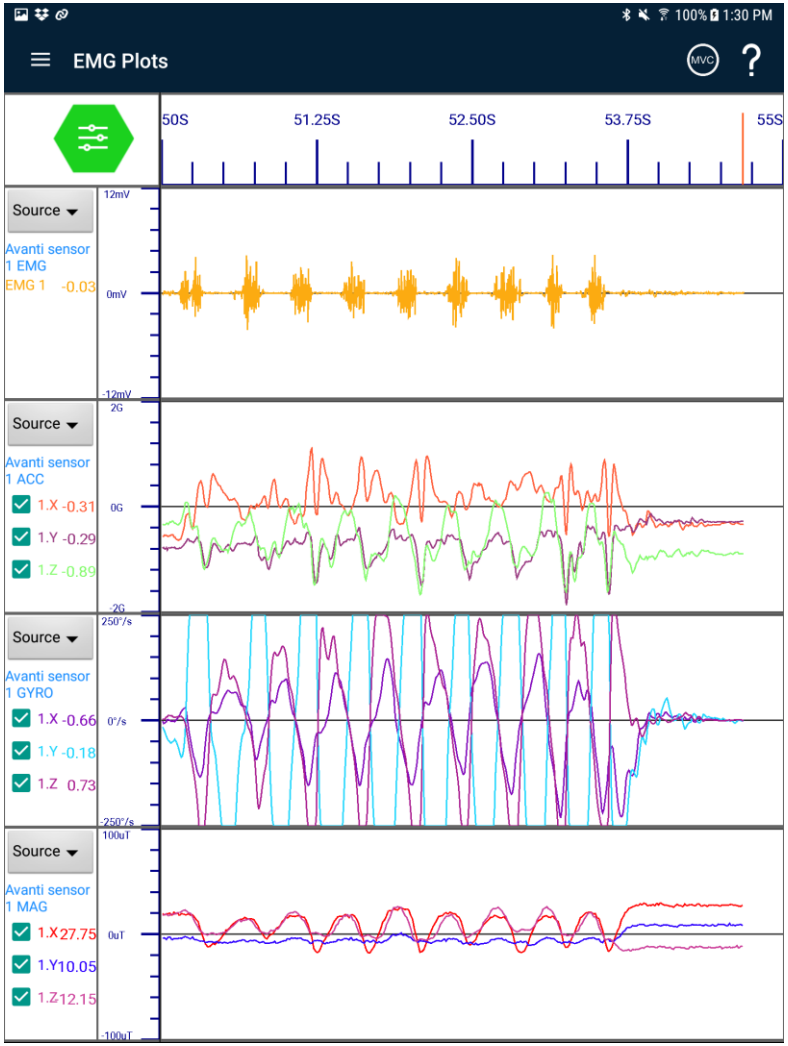


Figure 7: Plot Mode

8 Plot Mode

The plot mode feedback display shows Trigno Sensor data as time series line charts. The plotter automatically groups channels from inertial components together by component (displays all accelerometer data on same plot).

8.1 Gestures

Pinch to zoom on the x-axis to change the time scale.

Pinch to zoom on the plot area to change the y-scale.

One finger pan gesture on the plot area to pan the y-axis.

If MVC is enabled, the target line is draggable to change the ratio target.

8.2 Plot Sources

Use the "Source" button on the left of the plot area to switch the source channel for the plot.

8.3 Plot Measures

Displayed in the info area to the left of the plot area is the instantaneous value of the plot channel(s).

8.4 MVC Target

MVC can be enabled in plot mode, for EMG channels. When enabled, a target line at a % of the previously collected MVC value is displayed on the plot.

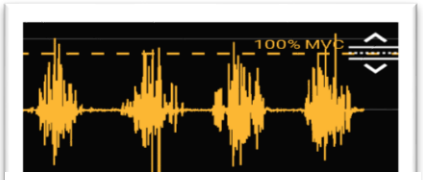


Figure 8: MVC Target Line in Plot Mode

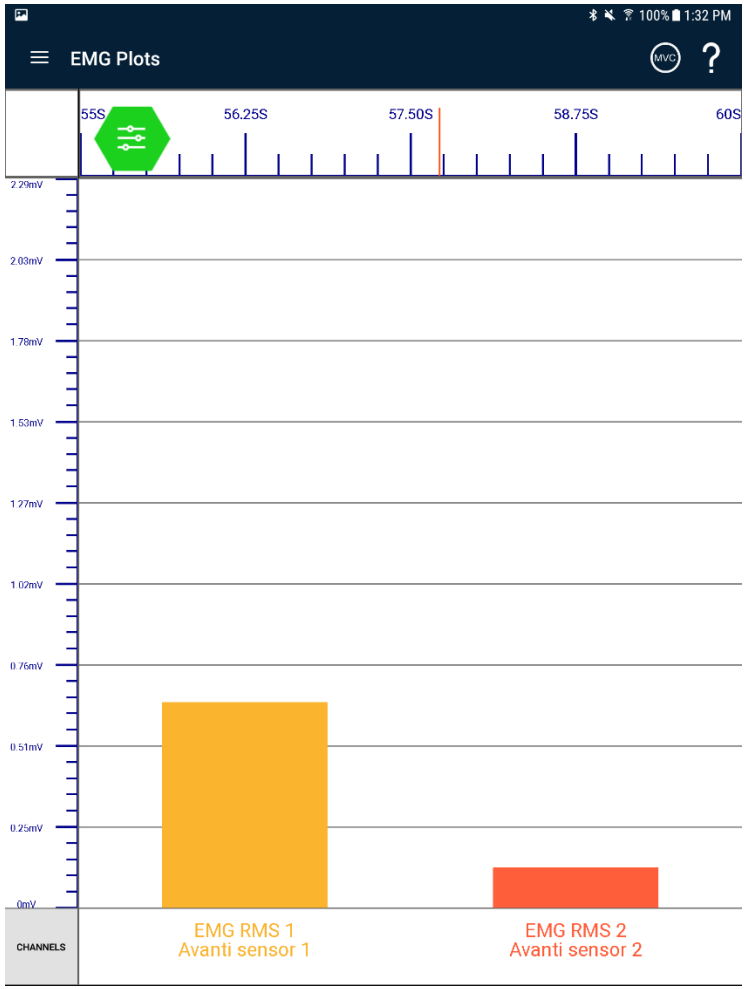


Figure 9: Bar Feedback Mode

9 Bar Feedback Mode

Bar Feedback, or "Compare", mode displays the RMS of one or more EMG channel as bar graphs to allow for a more direct comparison of two sensor outputs.

9.1 Gestures

Pinch to zoom on the plot area to change the y-scale.

If MVC is enabled, the target line is draggable to change the ratio target.

9.2 MVC Target

MVC can be enabled in plot mode, for EMG channels. When enabled, a target line at a % of the previously collected MVC value is displayed on the plot.

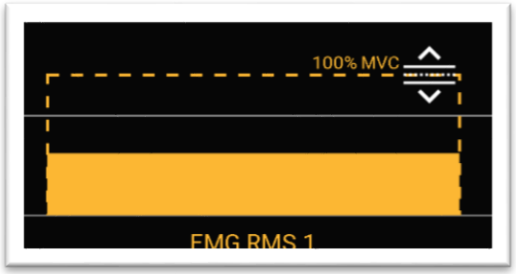


Figure 10: MVC Target Line in Compare Mode

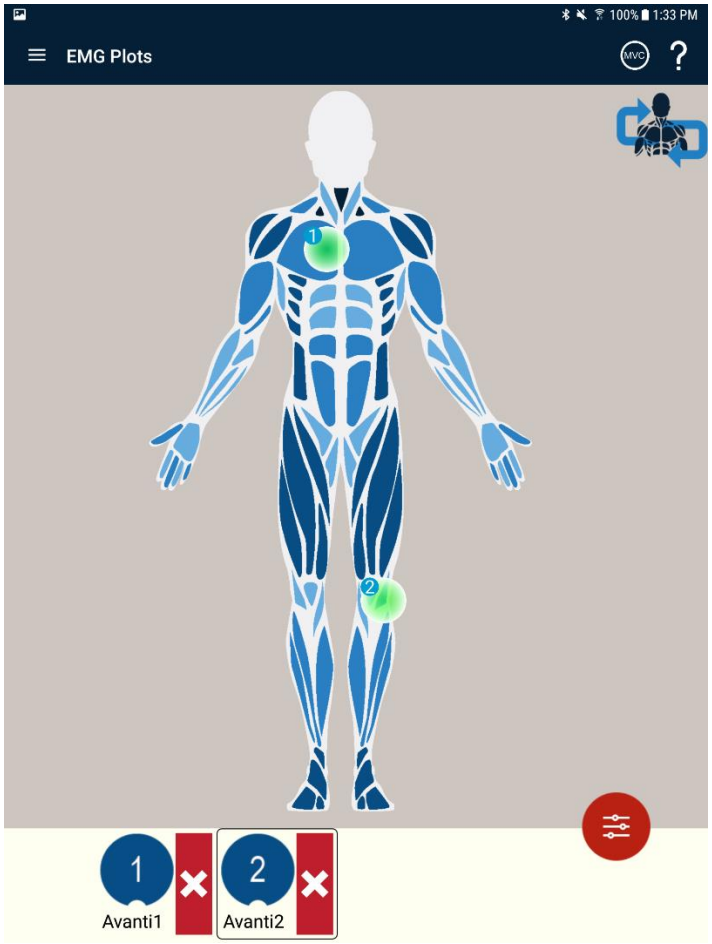


Figure 11: Body Map Mode

10 Body Map Mode

Body Map mode uses a gradient indicator to display EMG RMS as an intensity while overlaid on a muscle body map. Long press on a sensor in the list at the bottom to drag onto the body, or, tap a sensor to select it, then tap a location on the body to place it. Tap the red x-out button near sensors in the list at the bottom to remove the sensor from the body.

10.1 Gestures

Pinch to zoom in or out on the body map.

Pan with one finger to pan the image.

10.2 Anterior/Posterior Flip

Tap the "Flip" button to toggle between Anterior and Posterior body map images.

10.3 Maximum Contraction

If enabled for a sensor, the maximum intensity of the gradient indicator is set to the target ratio of the previously collected MVC value. If MVC is not enabled, the maximum intensity is set to either 5.5mV or 11mV depending on the sensor range.

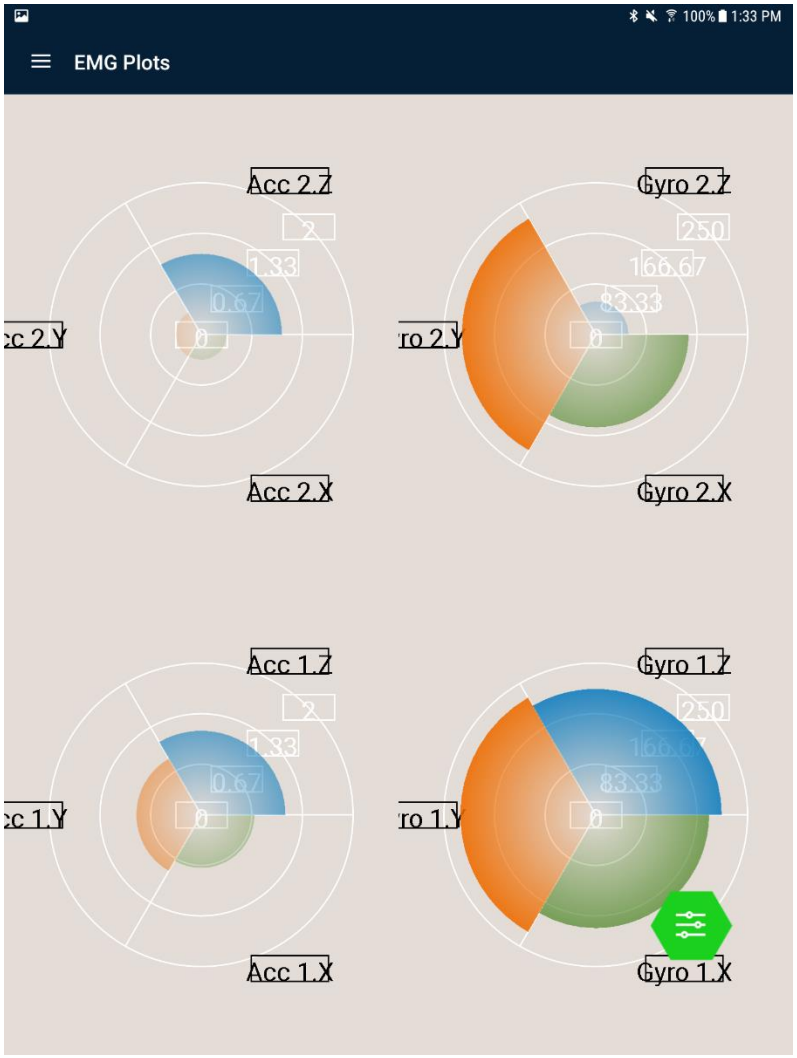


Figure 12: Kinetics Mode

11 Kinetics Mode

Kinetics mode provides an overview of the inertial activity of the sensor.

11.1 Accelerometer Data

The root mean square of the accelerometer data for each axis is displayed on a three-dimensional pie chart, with each axis as one dimension.

11.2 Gyroscope Data

The root mean square of the gyroscope data for each axis is displayed on a three-dimensional pie chart, with each axis as one dimension.

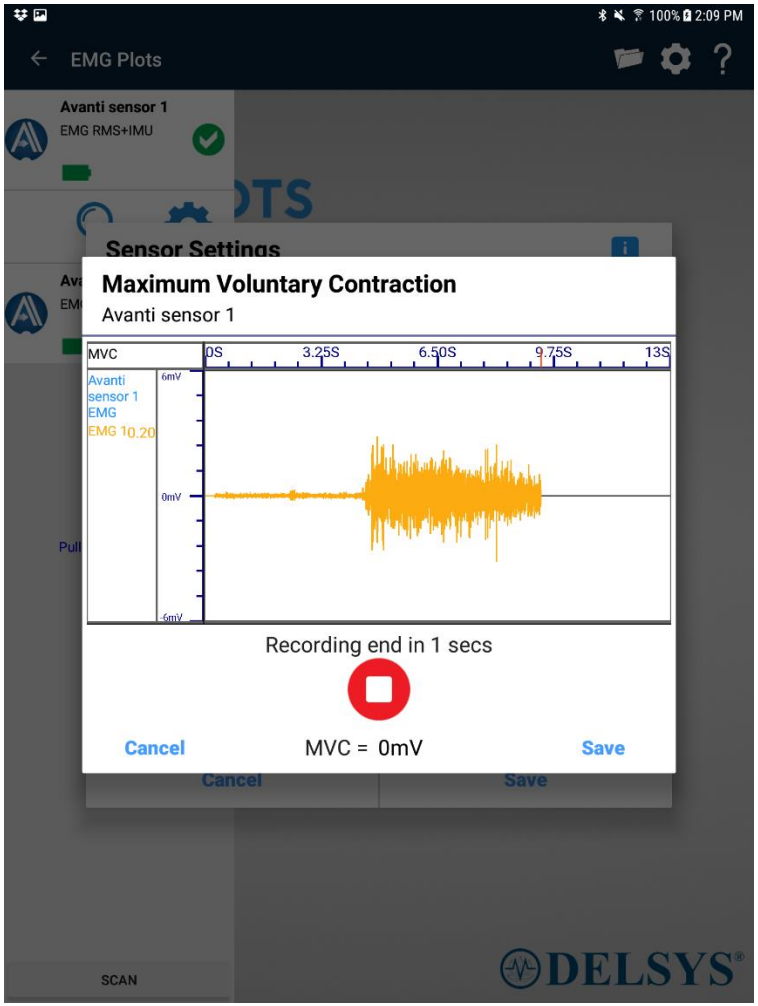


Figure 13: Maximum Voluntary Contraction Collection Dialog

12 Maximum Voluntary Contraction

This dialog allows the user to collect a maximum voluntary contraction (MVC) value from a given sensor. When collecting, EMG data is being streamed at 2000Hz, and the maximum RMS value is stored as the MVC value at the end of collection.

12.1 Saving the MVC Value

At the end of collection, the calculated MVC value is displayed at the bottom of the dialog.

Click cancel to abort the collection without saving the new value.

Click the Play button to collect the MVC again.

Click Save to exit and save the new MVC value.

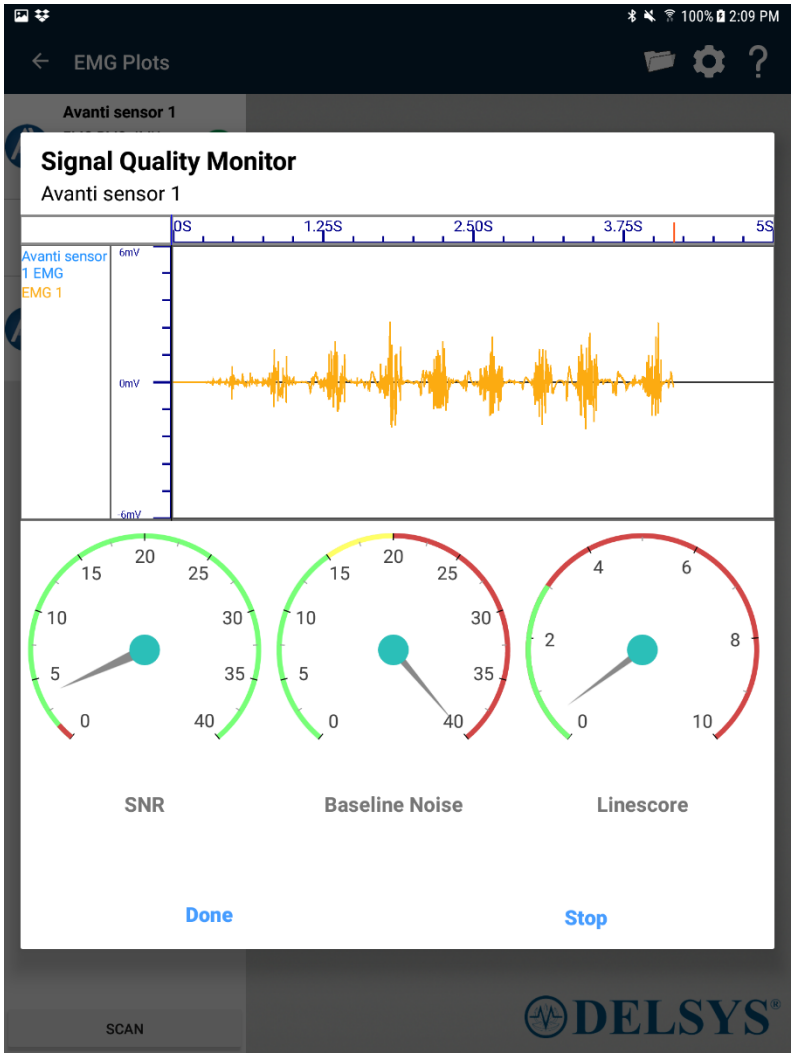


Figure 14: Signal Quality Monitor

13 Signal Quality Monitor

The signal quality monitor is a tool for monitoring each sensor's signal quality, which can be affected by a variety of things. For more information on how to improve signal quality, please visit the Delsys website.

The Signal Quality Monitor measures and displays four signal components:

13.1 Signal to Noise Ratio

The SNR is the amplitude of the EMG signal recorded during muscle contraction relative to the electrical noise recorded when the muscle is not contracting.

13.2 Baseline Noise

The baseline noise represents the amplitude of the electrical signal that is recorded when the muscle is not contracting. It reflects the stability of the skin-electrode interface.

13.3 Line Score

The line interference is the electrical noise from power lines (50 or 60 Hz) and electrical devices that is present in almost all environments and that may contaminate the recording of EMG signals.

13.4 Clipping

Clipping occurs when the amplitude of the sEMG signal goes beyond the range that can be reliably recorded by the sensor technology. It may occur if the signal amplification is excessive or if the recording sensor is not properly attached to the skin.

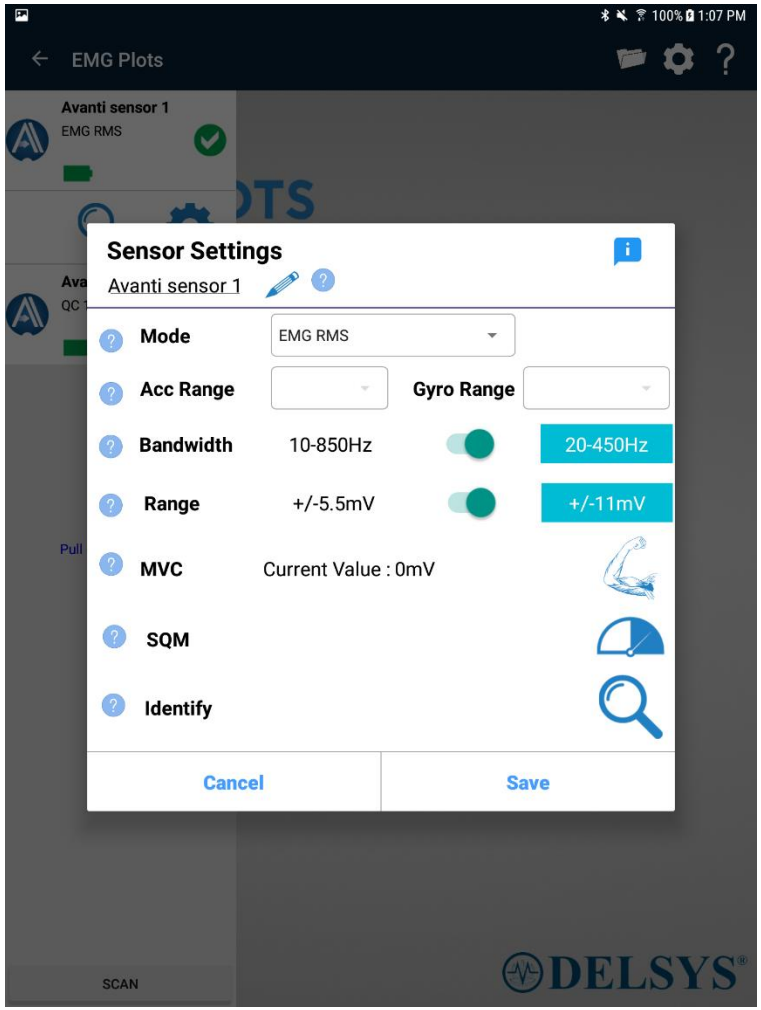


Figure 15: Sensor Settings Dialog

14 Sensor Settings

The sensor settings dialog is used to configure the sensor collection mode.

14.1 Mode

Select sensor mode in the dropdown list. Note: some feedback modes require certain sensor modes.

Please see Appendix I for more details on sensor modes.

14.2 Acc Range

If the inertial component is selected via the sensor mode, use the Acc Range dropdown to configure the accelerometer sensitivity.

14.3 Gyro Range

If the inertial component is selected via the sensor mode, use the Gyro Range dropdown to configure the gyroscope sensitivity.

14.4 Bandwidth

Use the Bandwidth toggle switch to configure the input bandwidth of the sensor from narrow (20-450Hz) to wide (10-850Hz) bandwidth.

14.5 Range

Use the Range toggle switch to configure the input range of the sensor from low (+/- 5.5mV) to high (+/-11mV) range.

14.6 MVC

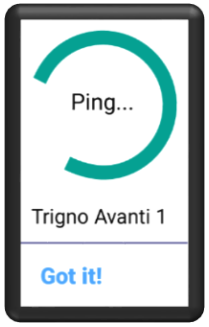
Displays the current MVC value for the sensor. Click the MVC icon to collect a new value.

14.7 SQC

Click the Signal Quality Check icon to launch the Signal Quality Check dialog to inspect the sensor signal prior to data collection.

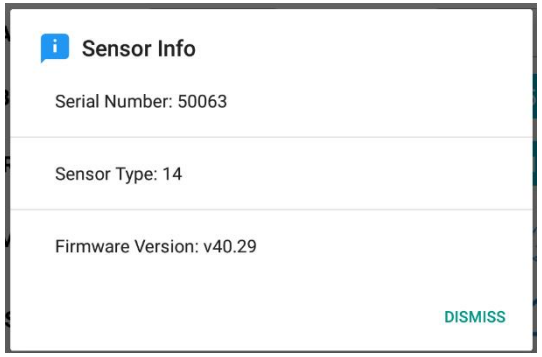
14.8 Identify

Click the Identify Icon to trigger the sensor LED to blink white repeatedly for sensor identification purposes. Renaming of the sensor is also possible on this screen by clicking the sensor name. Click "Got it!" to exit this dialog.



14.9 Sensor Info

Click "i" to get the Sensor Info dialog box.



15 Appendix I: Sensor Modes

Mode Name	Channels	Sample Rate	Details
EMG	EMG	1000Hz	
EMG RMS	EMG RMS	333.3Hz	125ms Window Width, 122ms overlap
IMU	ACC_x ACC_y ACC_z	133.3Hz	
	$GYRO_x$ $GYRO_y$ $GYRO_z$	133.3Hz	
	MAG_x MAG_y MAG_z	66.7Hz	
EMG + IMU	EMG	1000Hz	
	ACC_x ACC_y ACC_z	133.3Hz	
	$GYRO_x$ $GYRO_y$ $GYRO_z$	133.3Hz	
	MAG_x MAG_y MAG_z	66.7Hz	
EMG RMS + IMU	EMG RMS	333.3Hz	125ms Window Width, 122ms overlap
	ACC_x ACC_y ACC_z	133.3Hz	

	$GYRO_x$ $GYRO_y$ $GYRO_z$	133.3Hz	
	MAG_x MAG_y MAG_z	66.7Hz	
Orientation	$QUAT_w$ $QUAT_x$ $QUAT_y$ $QUAT_z$	66.7Hz	If Pitch/Roll/Yaw is enabled as orientation output type, these four channels are replaced with Pitch, Roll, and Yaw (3 channels)
EMG + Orientation	EMG	1000Hz	
	$QUAT_w$ $QUAT_x$ $QUAT_y$ $QUAT_z$	66.7Hz	If Pitch/Roll/Yaw is enabled as orientation output type, these four channels are replaced with Pitch, Roll, and Yaw (3 channels)
EMG RMS + Orientation	EMG RMS	333.3Hz	125ms Window Width, 122ms overlap
	$QUAT_w$ $QUAT_x$ $QUAT_y$ $QUAT_z$	66.7Hz	If Pitch/Roll/Yaw is enabled as orientation output type, these four channels are replaced with Pitch, Roll, and Yaw (3 channels)