Trigno Discover 2.0

User's Guide

MAN-047-1-2

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1 Important Information

1.1 Intended Use

Trigno Discover is a software application to be used with the Trigno Wireless Biofeedback System for academic and research purposes. The function of Trigno Discover is to provide visual signals from the Trigno System and save collected data to a local file system. Trigno Discover is not stand alone software and is not intended to be used in patient care, 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 participants for biofeedback and research purposes. 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.

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 Software Requirements

- Windows 11 PC
- Minimum PC Specifications
  - USB 2.0 port
  - 3.0 GHz processor clock speed, quad core
  - 16 GB system memory
  - 500 GB hard disk storage
  - 1680 x 1050 resolution
- Trigno Base Station, Trigno Lite, or Trigno Centro
- At least 1 Trigno Sensor

1.4 Optional Hardware

- Trigno Link
- At least 1 Trigno Link Sensor

2 Application Overview

Trigno Discover is a PC application created by Delsys to manage data acquisition, storage, analysis, real-time biofeedback, and operation of the Trigno® Wireless Biofeedback System. Trigno Discover is designed to provide a user-friendly experience by communicating with sensors directly using the Trigno RF communication protocol and Trigno Link BLE/ANT+ protocol.

3 Login Screen

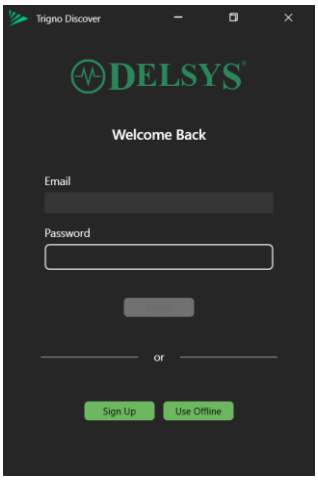

Figure 1: Trigno Discover login screen

Upon initializing Trigno Discover, license verification is required via user login. If appropriate licensing information is required, or if assistance is needed regarding the login process, please contact support@delsys.com or (508) 545 8200.

4 Home Screen

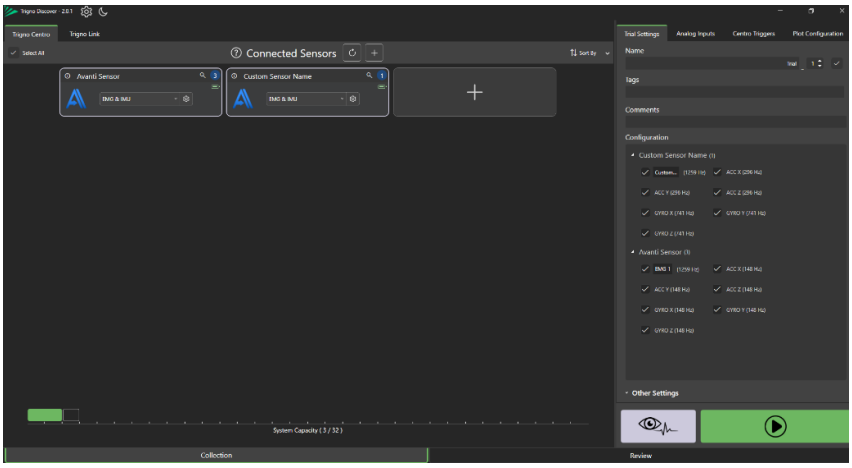

Figure 2: Trigno Discover home screen

After initialization, Trigno Discover immediately scans for and connects to available Trigno sensors using a connected Trigno Base, Lite, or Centro device. If sensors are powered on but do not appear after the scan, the sensors must be paired to the system via the Add New Sensor **(+)** button.

4.1 Sensor Configuration Panel

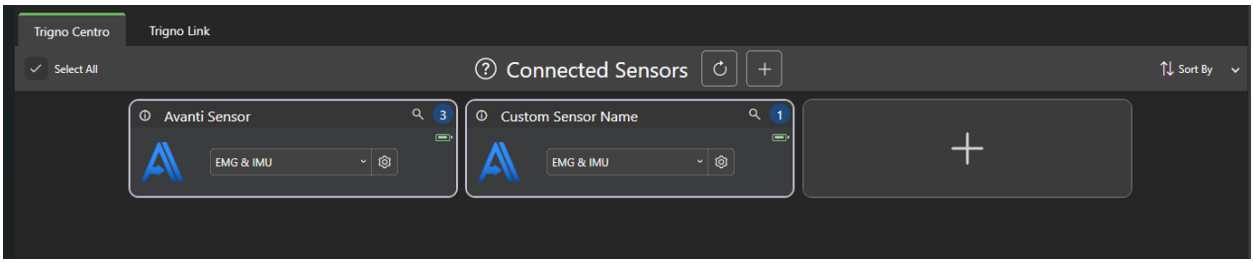

Figure 3: Sensor Configuration Panel

The Sensor Configuration Panel is a control module used to organize and configure Trigno sensors. To begin data acquisition, perform the following steps.

1) Pair sensors (1-32 for Trigno Base Station/Centro or 1-4 sensors for Trigno Lite)
2) Select desired sensors to be used for data collection
3) Click Start Collection (▶) to begin

4.2 Add New Sensor

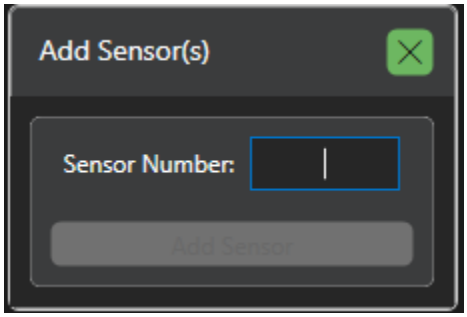

Figure 4: Add New Sensor

To add sensors to the network, click the Add New Sensor **(+)** button and a pop-up will appear. Enter the sensor number (or any number between 1-99) and click “Add Sensor”. At this point the system is ready to complete a pair operation with the new sensor. With the new sensor turned on, hold the new sensor to the magnet built into the charge station. The sensor will blink green to confirm pairing and then transition to green/orange flashing, and it will appear in the sensor connected list in the software. Pair additional sensors in the same fashion or click “X” to finish adding sensors.

Refer to the Trigno Wireless Biofeedback System User Guide for details on how to turn sensors on.

4.3 Scan For Sensors

Click the Scan For Sensors (↻) button to begin a scan. Sensors that have been previously paired will appear in the connected sensors list as long as they are powered on.

4.4 Select A Sensor

Click on the sensor to select/deselect it. The sensor pane will be highlighted and the sensor will be added to the System Capacity bar at the bottom of the application window. Click the "Select All" button to select all sensors. **Only selected sensors will be displayed and recorded for data collection.**

4.5 Sensor Configuration

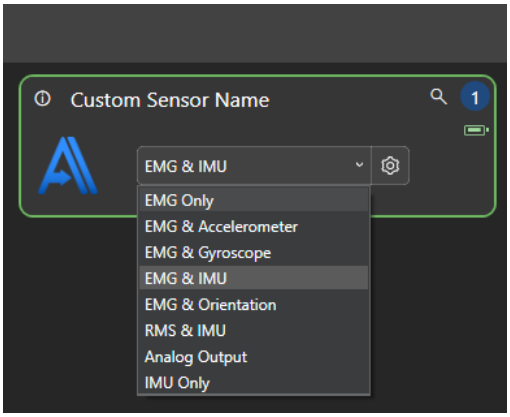

Figure 5: Quick sensor mode selection

Choose a preset sensor mode by clicking on the mode dropdown and selecting an option. The selected mode will determine what channels are displayed and recorded during data collection.

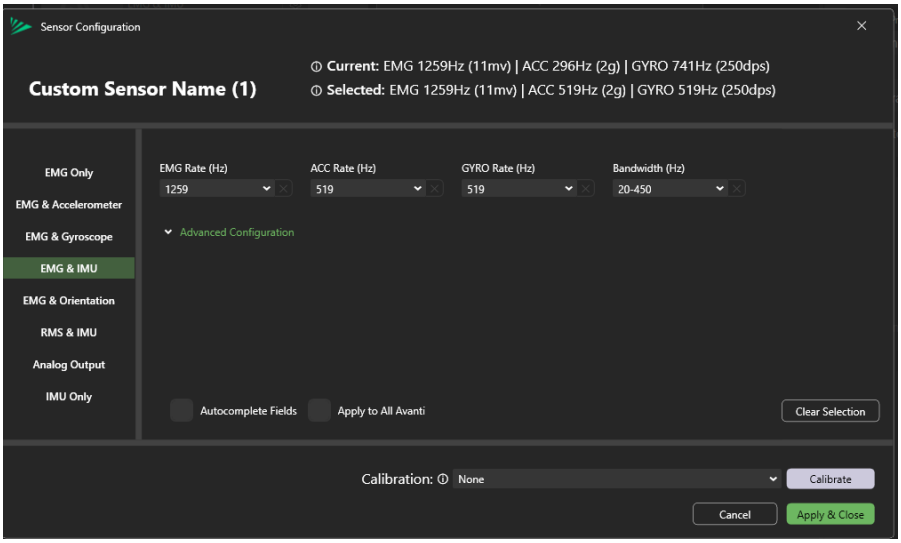

Figure 6: Sensor configuration mode parameters

Click on the gear icon (⚙) to bring up the sensor configuration popup window. Use the tabs on the left to toggle the different modes and their parameters. Click the “Clear Selection” button to clear all the selected settings. Use parameter dropdowns to choose a value. The autocomplete toggle in the bottom left can be used to populate parameters based on other parameter choices. Note that only specific combinations of parameters are allowed.

Click “Apply & Close” to set the parameters. Enable “Apply to All…” to set the parameters on all sensors of the same type. “Apply to All…” does not work across different sensor types.

4.6 Sensor Calibration

Click the “Calibrate” button from a sensor configuration menu to start a new (or apply an existing) calibration. Choose from either “Manual”, “Collected”, or “MVC (Maximum Voluntary Contraction)” and click “Begin”.

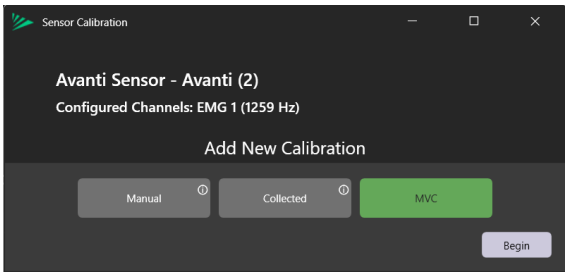

Figure 7: Sensor Calibration Selection

4.6.1 Manual Calibration

Create a new data channel based on manual input and output values. The input value from the raw data channel will be mapped to the output value specified and a new calibrated channel will be created from the selected input channel.

4.6.2 Collected Calibration

Create an input-to-output mapping from controlled conditions in a data collection. This mapping will be applied to future collections to create calibrated data sets.

4.6.3 MVC (Maximum Voluntary Contraction)

Maximum voluntary contraction is a common calibration procedure for EMG signals. It is a guided experience that involves periods of rest and maximum muscle contractions. The number of periods is dictated by the user. After completing the sequence of contractions/rest periods, two values will be chosen: the noise baseline, and the peak value. The noise baseline is an average calculation from the rest periods, and the peak value is the maximum EMG value obtained during all the contraction periods. When this calibration is applied to an EMG sensor, it will generate a new scaled signal during data collection which is represented as a percentage, where 0% represents the rest period (from the noise baseline value) and 100% represents the peak EMG value. This calibration can be used to normalize EMG signals across muscles and/or data sets.

4.7 Trigno Link

Trigno Link is an optional component of the Trigno Wireless Biofeedback System used to integrate 3rd party BLE and ANT+ compatible devices (Please see the Trigno Link User Guide for devices details and a complete list of compatible devices). When the Trigno Link device is connected, a separate tab will appear at the top of the Sensor Configuration Panel. Click on the Trigno Link tab to go to the Trigno Link Sensor Configuration Panel.

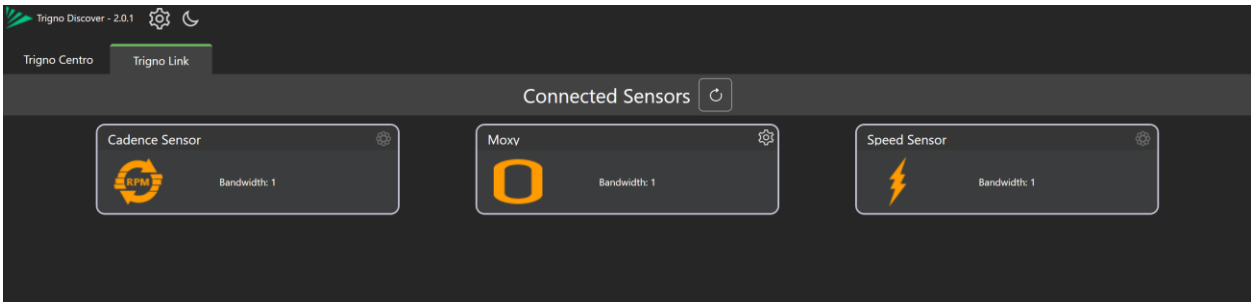

Figure 8: Trigno Link Sensor Configuration Panel

Figure 9: Trigno Link Scan Settings

To add a supported Trigno Link sensor, click the Scan for Sensors (“ C ”) button. The Scan Settings window will appear. Choose either ANT+ or Bluetooth, turn on the desired sensors, and then select (highlight) all of the devices to be connected. Click “Start Scan” to begin scanning for the selected sensors. Sensors found in the scan will appear in the Connected Sensors pane. *Note: a minimum of one Trigno sensor must be connected to a Trigno Base, Lite, or Centro device to begin a data collection.*

4.8 Trial Settings Tab

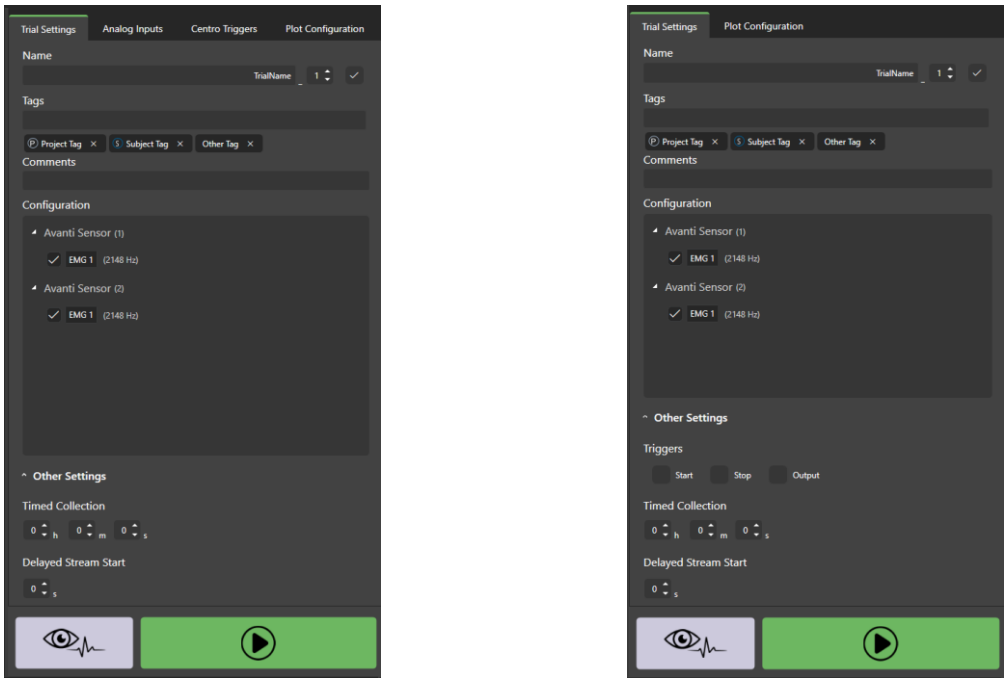

Figure 10: a) Trial Settings tab with Trigno Centro, b) Trial Settings tab with Trigno Base

4.8.1 Trial Name & File Storage

During a data collection, the Trial Name will be saved in the format *[*name*]_[*trial#*]*. All trials collected in Trigno Discover will be written to a **.delsys* file stored in the "Users" database directory. A **.delsys* file can contain one or multiple trials.

If the "Auto-Increment" checkbox is enabled the trial number will increase by one each time a trial is collected. If "Auto-Increment" is not enabled, it is the responsibility of the user to ensure unique trial names and numbers to prevent data being overwritten.

4.8.2 Trial Tags

Trials can be tagged so that a user can easily organize trials across projects, subjects, or other user-defined types. "Projects" and "Subjects" are specific tag types that are represented in the software as a "P" and "S" respectively and grouped accordingly. User-defined tags are of the type "Other" and display with this group. Users can filter using tags when reviewing their data from the "Review" tab.

4.8.3 Comments

Comments are user-defined notes that can be modified before the trial or after the trial from the "Review" tab.

4.8.4 Configuration

The "Configuration" panel lists all the connected sensors and their channels based on the selected mode. EMG channels can be renamed, selected, and deselected prior to data

acquisition. *Note: if a channel is deselected in the "Configuration" panel, it will not be collected or saved to the file for review. Please refer to the "Plot Configuration" tab (4.9) for viewing options on collected data.*

4.8.5 Triggers (Trigno Base Only)

A trigger initiates data collection based on an external event or a user-initiated action. Please refer to the Trigno Wireless Biofeedback System User Guide for additional details. To use a trigger with a Trigno Base station, a Trigger Module is necessary. Select the "Start", "Stop", and "Output" options to arm the corresponding trigger function.

For Trigno Centro triggering, see section 4.11 below.

4.8.6 Timed Collection

Data collection duration can be preset by using the "Timed Collection" fields. If all entries are '0', data will be collected until the user initiates (or triggers) a stop. A timed collection can be stopped before the time has elapsed by clicking the "Stop" button or if a Stop Trigger event occurs.

4.8.7 Delayed Stream Start

A countdown can be displayed (in seconds) before the trial begins by specifying the desired time delay in the "Delayed Stream Start" fields. The countdown begins when the "Start Collection" button is clicked. Once the countdown reaches 0, the data collection begins.

4.9 Plot Configuration

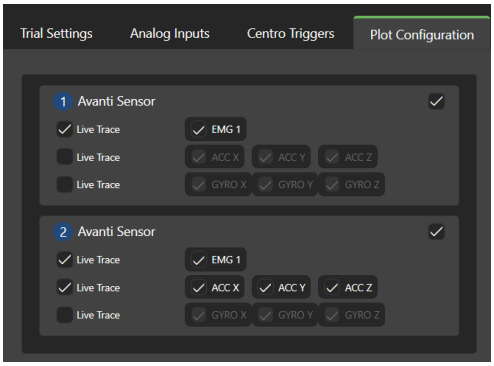

Figure 11: Plot Configuration tab

The "Plot Configuration" tab allows users to choose which channels to display when collecting and reviewing data. *Note: the data from the deselected channels in the "Plot Configuration" tab will be available when exporting the data after collection.*

4.10 Analog Inputs (Centro Only)

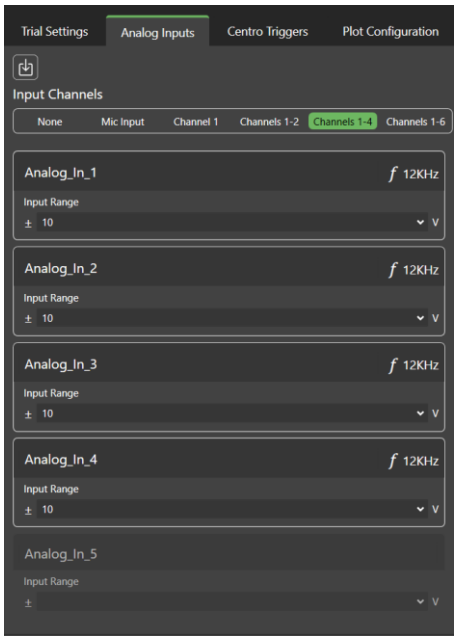

Figure 12: Analog Inputs tab

Input ranges and the number of channels are configured in the “Analog Inputs” tab when connecting analog signals to the Trigno Centro device. Refer to the Trigno Wireless Biofeedback System User Guide for details on selecting appropriate ranges and related parameters. The selected channels will be displayed and stored alongside data from sensors.

4.11 Centro Triggers

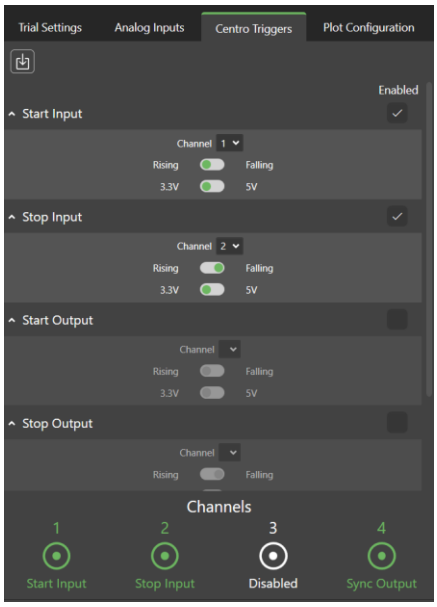

Figure 13: Trigno Centro Triggers tab

Centro has a rich set of trigger options that can be configured from Trigno Discover. Start/Stop inputs will wait to receive the signal at the specified rising/falling edge. Start/Stop output will generate a signal when the start or stop event occurs. The beacon sync will produce a rising edge signal at the specified signal rate. Please refer to the Trigno Wireless Biofeedback System User Guide for additional details on triggering options and specifications.

5 Signal Preview

Signal preview is intended for viewing real-time signals without saving the data. Select sensors in “Sensor Configuration Panel” and click the “Signal Preview” button. Return to the home screen by clicking the “Back” button. Collect data to be saved with the current sensor configuration by clicking “Start”.

6 Data Collection

Select sensors from the home screen and press the Start Collection (“▶”) button. If a “Start Trigger” is enabled, data will not appear until the trigger event occurs. If “Delayed Stream” is enabled, a countdown will occur prior to data collection for the time specified by the user. Otherwise, data will automatically begin streaming and displaying on the plots after the green “▶” button is clicked.

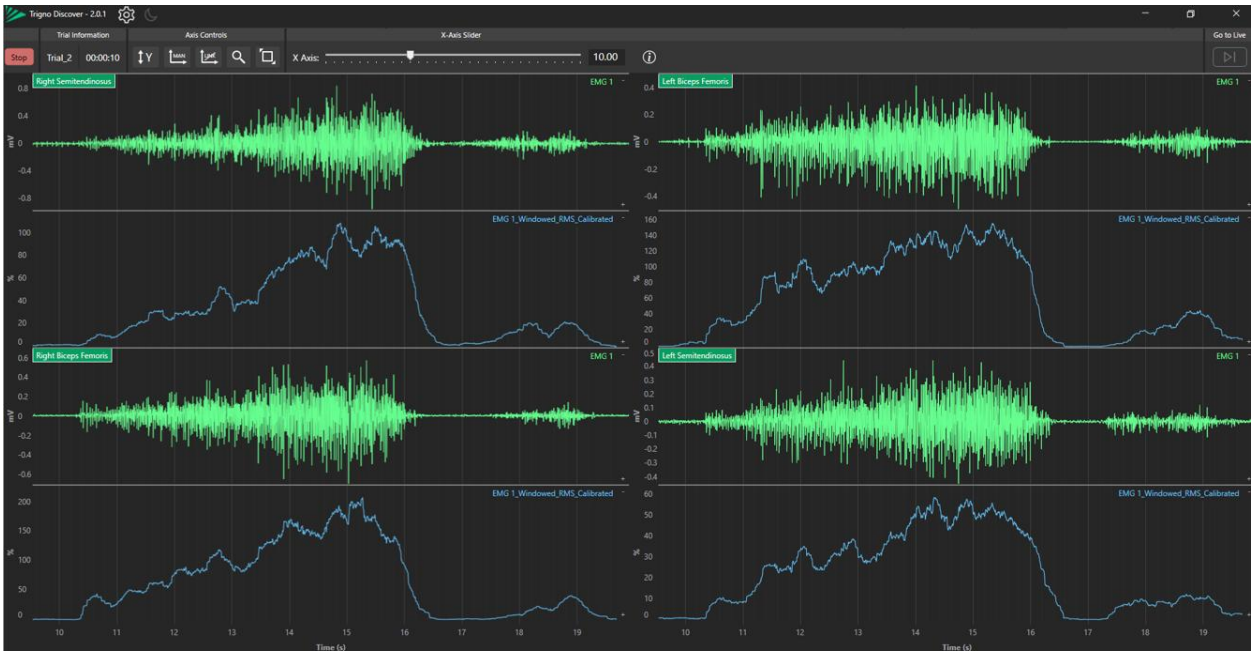

Figure 14: Live Data Collection

6.1 Plot Control

Figure 15: Plot Axis Controls

Icon Legend

Go to Y Bounds: Adjust the y-axis for every plot to the maximum range for the channel(s).

Auto-scale toggle: Toggle between auto-scale or manual setting of y-axis range.

Link Axes: Link y-axes of the same data type (i.e. EMG or ACC). Modifying one y-axis will modify all the others of the same type.

Y-Axis Pan/Zoom Toggle: Toggle axis controls between panning the y-axis up/down or zooming the y-axis in/out.

Reset Plot Sizes: If plot sizes were adjusted, this button will reset them back to the default layout.

Hot Keys

Mouse wheel: X Zoom

Ctrl + Mouse wheel: Y Pan

Shift + Mouse wheel: X Pan

RMB Drag: X/Y Zoom

F2: Go to Live Trace

F5: Add Event Marker

F6: Add Event Marker Pair

6.2 Event Markers

During data collection or review, individual event markers can be generated by pressing F5 and event marker pairs can be generated by pressing F6. Pan backwards to review event marker placement. Hover over an event marker, left-click hold, and drag to the left/right to adjust the position.

When in data review, open the event marker pane by clicking the flag icon in the top toolbar. Use the "+" button to add a new event marker or pair. Select a pair (or any two individual markers) and click the add to metrics table button to add a row to the metrics table. Use the "…" menu to manage event marker groupings and marker visibility.

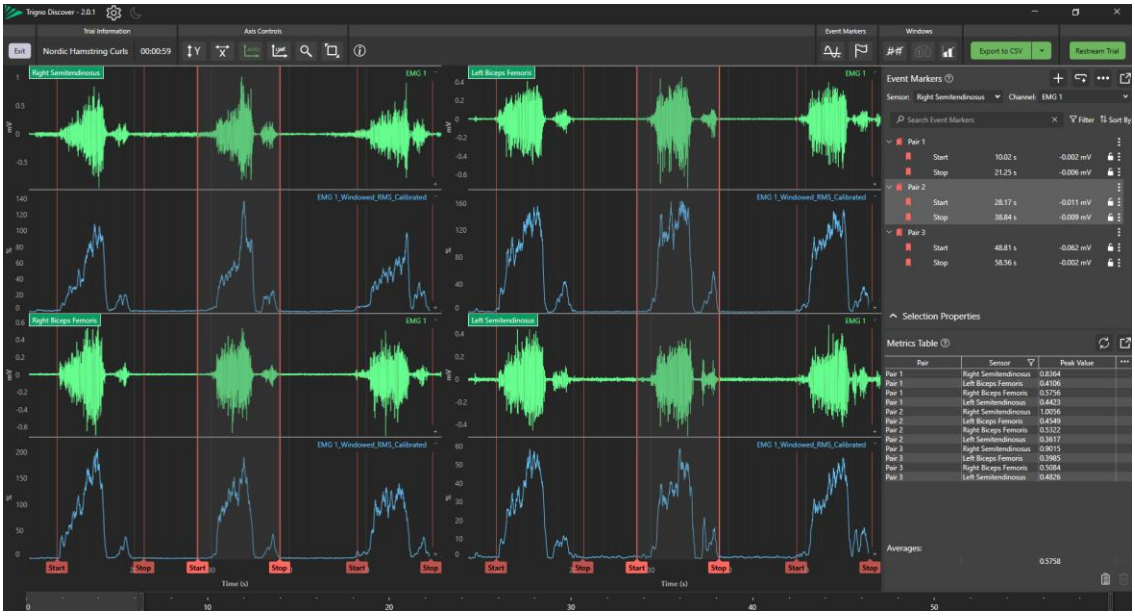

Figure 16: Post-Collection Event Markers

6.3 Event Threshold

Figure 17: Event Threshold Menu

Automatically generate event markers based on a threshold value. First specify the channel to use as reference for the threshold calculation. Next, slide the horizontal indicator line (or enter a value manually) to where the threshold occurs. Provide a hold off time and time offset as necessary. Specify a direction

such as ascending, descending, or both. If both is chosen, the user will have the option to generate event marker pairs (one for ascending and one for descending). Then, users have the option to apply these markers to all channels (default) or to specific channels only. Advanced configuration options include event count limit, which will only generate n number of event markers; tags, which can also be applied to these generated markers; and range selection to omit threshold calculations outside of the specified start/end times.

7 File Management

Upon completion of collection, data are immediately presented for review. Alternatively, previously recorded files can be loaded for review via the “Review” tab on the home screen.

7.1 Review

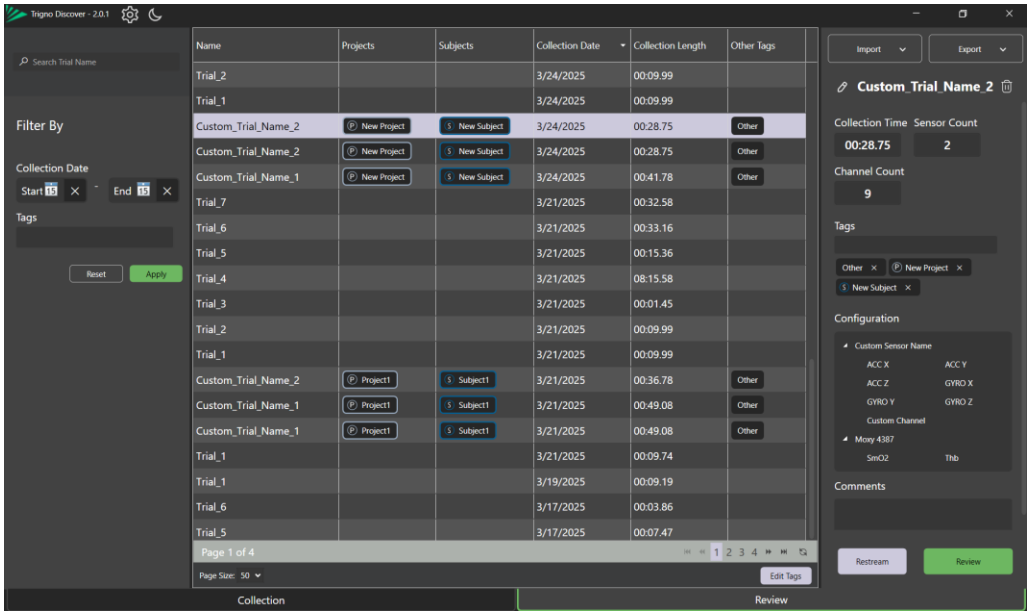

Figure 18: Review tab

The “Review” tab is used for browsing and loading previously recorded data. When clicking on the “Review” tab from the home screen, the program will default to the current database (see section 9.2 below). Click on a trial to select it. Metadata from that trial will be displayed on the right-side pane. Click the “Review” button on the bottom to load the data into the review plots.

8 Data Export

Trigno Discover allows users to export their data to CSV, C3D, **.delsys*, or HPF (for EMGworks Analysis). Data can be exported from either the “Review” tab or the Trial Data Review window. When selecting from the “Review” tab, it is possible to select multiple files at a time for export. Users may also use Delsys-provided file reading APIs to read **.delsys* files directly into their programs. Reading **.delsys* files is

available in Python, MATLAB, and C#. These APIs and example scripts can be found on the Delsys Github repository.

8.1 CSV Export

There are two options for exporting CSV – with or without timestamps. If you are using a Trigno Link, timestamps are necessary for timing information of the BLE or ANT+ data. Timestamps will be saved in a separate column for each data channel available.

8.1.1 File Info Headers

The first three rows are designated for the file headers. The 1st row contains the application and version. The 2nd row is the date/time of the trial. The 3rd row is the duration of the trial (in seconds).

8.1.2 Sensor/Channel Info Headers

The next five rows (4-8) are designated for sensor/channel info. The 4th row contains the sensor name and serial number. The 5th row contains the sensors mode number. The 6th row contains the channel name and channel unit. The 7th row contains the channel sample rate and the 8th row contains the sampling period. *Note: Link device channels will indicate a sample rate as "-1Hz"*

1	Applicatic	Trigno Discover (2.0.1.2)														
2	Date/Time	5/9/2025 12:44:59 PM														
3	Collection	13.878														
4	Avanti Sensor 5 (57590)															
5	sensor mode: 153															
6	EMG 1 Tim	EMG 1 (m	ACC X Tim	ACC X (G)	ACC Y Tim	ACC Y (G)	ACC Z Tim	ACC Z (G)	GYRO X Ti	GYRO X (c	GYRO Y Ti	GYRO Y (c	GYRO Z Ti	GYRO Z (deg/s)		
7		4000 Hz		74.0741 H		74.0741 H		74.0741 H		74.0741 H		74.0741 H		74.0741 Hz		
8		0.00025 s		0.0135 s		0.0135 s		0.0135 s		0.0135 s		0.0135 s		0.0135 s		
9	0	0.040116	0	-0.80029	0	-0.57813	0	0.07959	0	10.68702	0	-4.76336	0	2.564885		
10	0.00025	0.055558	0.0135	-0.80029	0.0135	-0.57813	0.0135	0.082031	0.0135	10.87023	0.0135	-4.82443	0.0135	2.564885		
11	0.0005	0.073014	0.027	-0.80469	0.027	-0.58008	0.027	0.081543	0.027	11.1145	0.027	-4.27481	0.027	2.80916		
12	0.00075	0.095171	0.0405	-0.8042	0.0405	-0.57959	0.0405	0.082031	0.0405	10.99237	0.0405	-3.96947	0.0405	2.992366		
13	0.001	0.125048	0.054	-0.80371	0.054	-0.58008	0.054	0.07959	0.054	10.87023	0.054	-4.39695	0.054	2.687023		

Figure 19: CSV file with timestamps

8.2 C3D Export

Export to C3D for file compatibility with Visual3D. *Note: all channels will be up-sampled to the highest sampling rate based on C3D file standards (C3D.ORG - The biomechanics standard file format).*

8.3 *.delsys Export

*.delsys is a Delsys file format that can contain one or more trials along with other metadata related to each trial.

8.4 HPF Export

Export to HPF for file compatibility with EMGworks Analysis.

8.5 Advanced Export Options

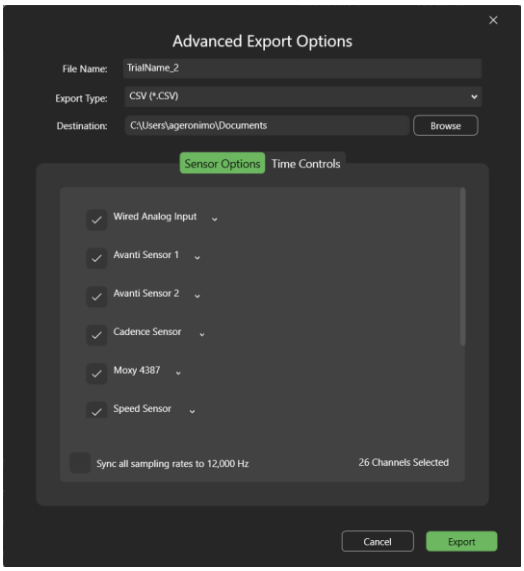

Figure 20: Advanced Export Options

When exporting a single trial from the review tab, users are given sensor options and time controls to customize the data export. The sensor options include selecting/deselecting specific channels and an up-sampling option to the highest sample rate. The time controls include a start and end time to specify the range of data to be exported.

9 Discover Settings

The “Settings” (⚙) menu contains information related to the Trigno System, Database, User License information, and other general information.

9.1 Trigno System

The “Trigno System” tab contains information related to the hardware connections for the Trigno Base, Trigno Lite, or Trigno Centro devices. It may also contain a tab for Trigno Link if one is connected. These menus will display the IDs of the devices and their firmware versions. Users also can set the Frequency Set of the communication signal. While frequency set “A” is recommended for most situations, users can choose “B”, “C”, or “D” as alternative frequencies to use in crowded RF environments.

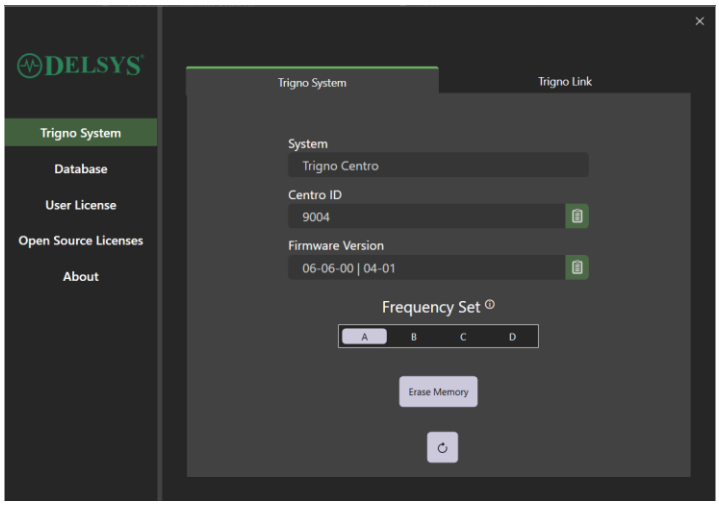

Figure 21: Trigno System tab

9.2 Database

The “Database” tab contains information regarding the data repository for Trigno Discover. Users can choose to use the default database, or create additional databases.

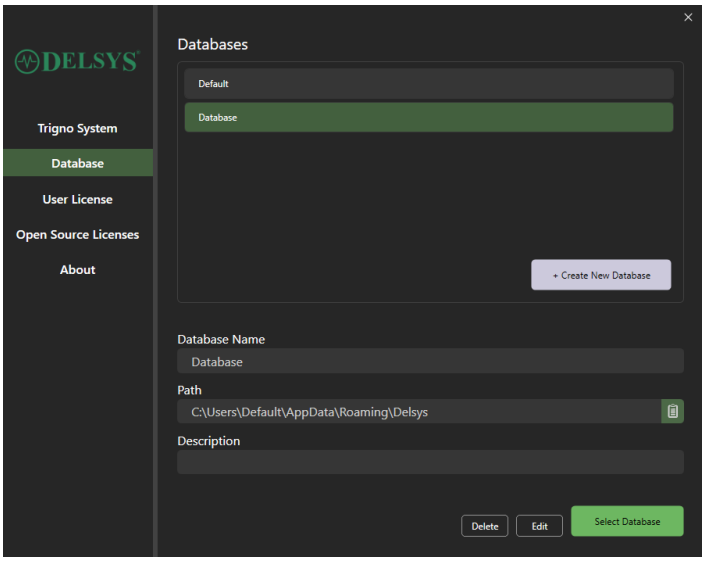

Figure 22: Database tab