# *The MotionMonitor xGen Hardware Guide:*
# *USB based Delsys EMG Device Configuration*

The following document outlines the steps required to configure and collect data from a Delsys Trigno EMG system that is connected to The MotionMonitor xGen computer via USB. Supported sensors in The MotionMonitor xGen version 3.63.3 and later includes Trigno Legacy and IM sensors, standard Trigno Avanti sensors, as well as Avanti Quattro, FSR, Goniometer, Mini and Duo sensors.

1. The Delsys Trigno USB device must first be installed on the computer before it is configured within The MotionMonitor xGen using the installer for EMGWorks 4.8.0 or later. Contact your Client Support Engineer for the latest supported EMGWorks installer. Power on the EMG unit and connect it to the computer. The device should automatically be recognized. If it is not, right-click on the unrecognized device in the device manager (on a Windows 7/10 machine the device will be labeled "USBXpressDevice") and select Properties. Go to the Driver tab and select Update Driver. Then, select "Browse my computer for driver software" and browse to the Delsys drivers. If the device is still not recognized after this process, contact a Client Support Engineer for assistance.
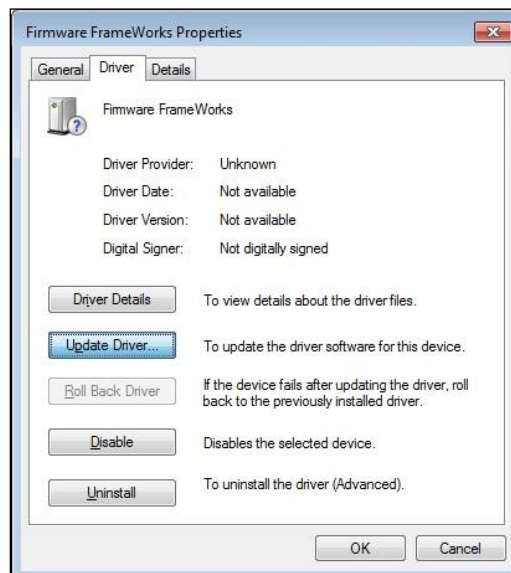
2. Turn on the Trigno sensors by removing them from the charging Base Station and pressing the ON button or swiping a magnet over it for Avanti sensors. The sensors should blink green and amber. Avanti sensors will blink blue and amber.

3. Go to the Start menu and browse to All Programs/Delsys/Trigno Control Utility and launch the application. The Utility will search for the Trigno hardware, and must be running to collect data from the Delsys Trigno in The MotionMonitor. When a sensor is located the corresponding number on the utility will report the signal strength and battery level. MotionMonitor will control the start & stop of data collection, DO NOT CLICK THE "START" BUTTON IN THIS APPLICATION!
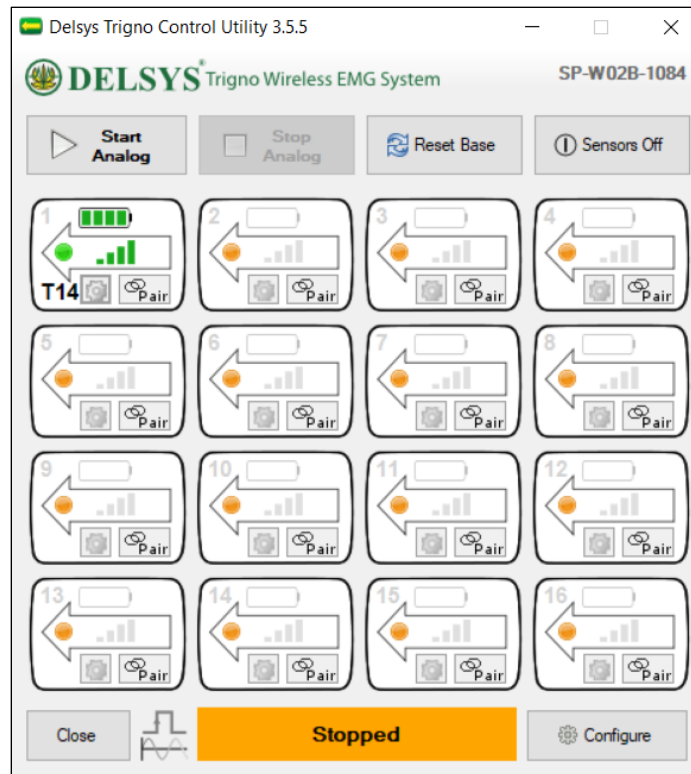

When activated in The MotionMonitor xGen, the Trigno sensors will stream to The MotionMonitor xGen based on the order they are paired in the Trigno Control Utility. Any senor positions in the Trigno Control Utility that do not have a sensor connected will be ignored in the streaming order and the next activated sensor will take the next position in the Channels or Trackers lists. For instance, if there is no sensor connected as sensor 2 in the Trigno Control Utility, the next sensor that is connected will stream to The MotionMonitor xGen as sensor 2.

When using any of the Avanti type sensors that have multiple voltage channels available (Duo, Quattro, Goniometer and FSR), the positions in the Trigno Control Utility beneath these sensors would need to remain open in order to stream all of their data. For instance, if a Quattro was paired as Sensor 1, the positions beneath it, Sensors 5, 9, and 13, would need to remain open or unpaired. If a Duo sensor was paired as Sensor 1, Sensor 5 would need to remain open.

4. Under the Configure| Digital Output dialog of the Delsys Control Utility, it is necessary to enable the "Backwards Compatibility" checkbox to collect data from the sensors.
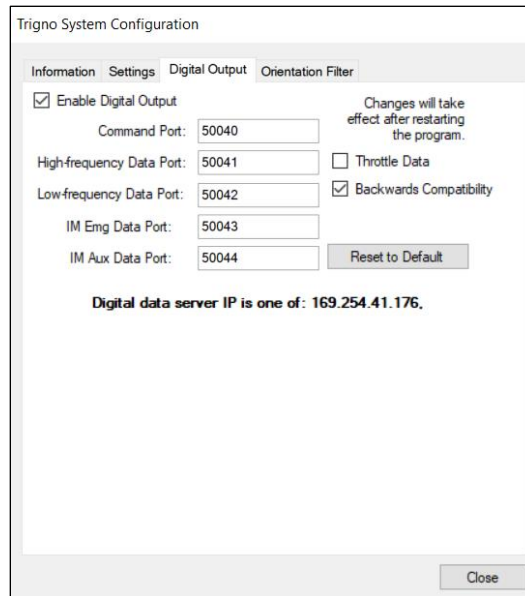
5. Start The MotionMonitor xGen and go to the Hardware node in the Setup Components window. Add a Trigno device from the Add button in the parameters panel at the bottom of the Components window or by right clicking the Hardware node and adding the device through the cascading drop list.
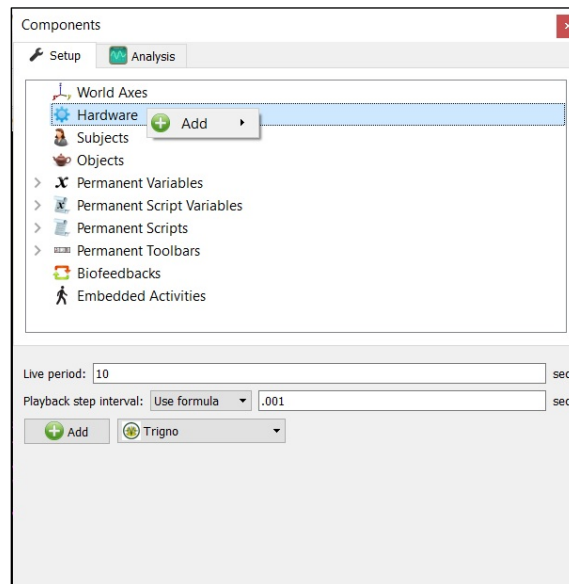
6. Click on the Trigno device to bring up the Trigno parameters panel. The EMG channel, IM tracker voltage and IM tracker voltage and auxiliary measurement rates are all fixed at 2000, 2000, 148.1481481 and 148.1481481, respectively.

   Under the Setup dropdown, the IP address for the computer running the Trigno Control Utility should be set. If it's running on the same computer as The MotionMonitor xGen, the Server's IP address should remain 127.0.0.1.

   Decimation factors can be set for each. This is a means for limiting the computer resources being used while running in the Live Window by displaying only a fraction of captured data points in real-time. This does not affect the measurement rate as data will still be captured at its full resolution. If visualizing the EMG data in real-time is not desired, the suspend live data checkbox will suppress any data from the Trigno device from being displayed in graphs or used in any equations. However, the data would immediately be available and presented in a recorded activity.

   Orientation or Acceleration can be selected as a data type from the auxiliary data type drop-down menu, depending on which data type is desired to be captured for Trigno IM and Avanti sensors.
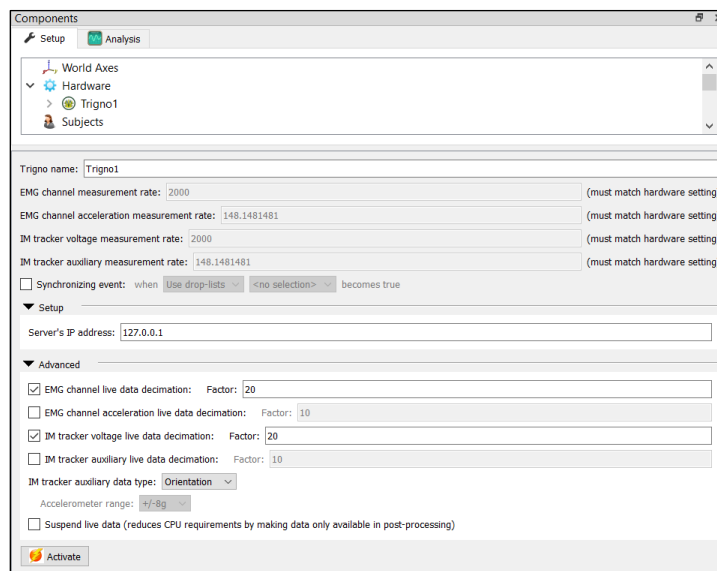
   When the "Activate" button is clicked, any devices connected in the Trigno Control Utility will be discovered and populated under either the Trigno Channels or Trackers node. Channels refer to any non-IM or non-Avanti sensor type or Avanti sensors that have not been integrated. Channels will have a single voltage available as well as acceleration data, if supported by that sensor. Trackers refer to IM and Avanti sensor types. In addition to single or multiple channels of voltage data, these sensors will also provide orientation or acceleration data. Note that IM and Avanti sensors can both be used together if only collecting voltage data. However, both sensor types cannot be used together for collecting acceleration/orientation data. IM sensors require that the orientation filter be enabled through the Trigno System Configuration Orientation tab in the Trigno Control Utility and that a valid IM Calibration file is being used. Avanti sensors have onboard orientation filters and require that this filter setting be disabled in the Trigno Control Utility.
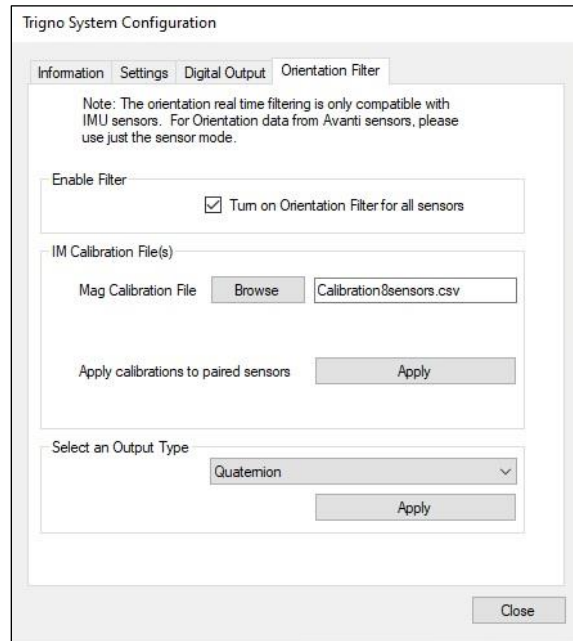
Smoothing parameters can be enabled or disabled at any time through the nodes for Channels and Trackers under the Trigno Hardware device in the Setup Components tab, as shown below.
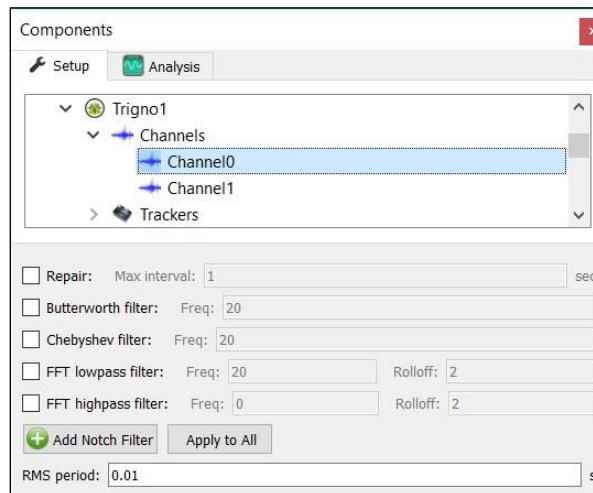

7. Click on the "Activate" button in the Trigno parameters panel or the "Activate/Deactivate Hardware" icon in the Setup toolbar to activate the Trigno hardware.

8. Sample data definitions for Channel and Tracker sensor types are displayed below.

    The following image shows the Raw Voltage being defined for Channel 0.
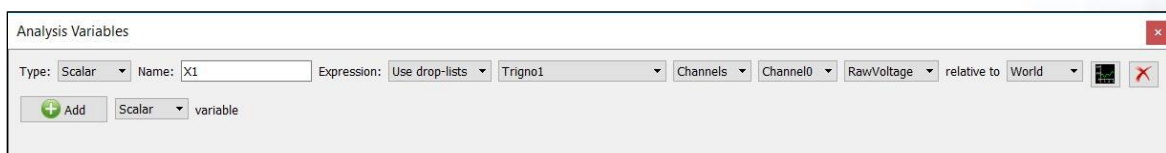
RMS Voltage, Raw Voltage and Voltage can be selected from the drop-list. RMS voltage calculates the RMS for the defined variable using the smoothing settings enabled for that Channel or Tracker under the Setup Components Hardware node. Raw Voltage will always return the raw voltage, regardless of any enabled smoothing parameters. Voltage will report the voltage including any smoothing, if enabled. Mean Frequency and Median Frequency for the voltage and Acceleration for the sensor can also be selected for Channel sensor types.

The following image shows the Raw Voltage and an Euler rotation sequence relative to the World axes for Tracker 1.
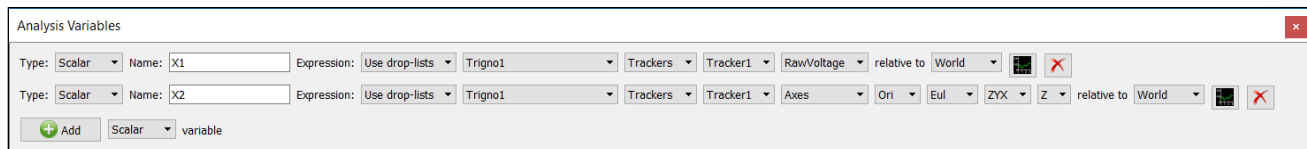
In addition to the data types available for Channel type sensors, Tracker type sensors have the option of Orientation or Acceleration data, depending on the IM tracker auxiliary data type selected in the parameters panel.

Other supported Avanti type sensors, including the Duo, Quattro, Goniometer and FSR have multiple channels available in the drop-list to select from.

The following image depicts data defined from the goniometer sensor which outputs 2 voltages corresponding to angle measurements in two orthogonal planes, Voltage/Raw Voltage 0 and 1.
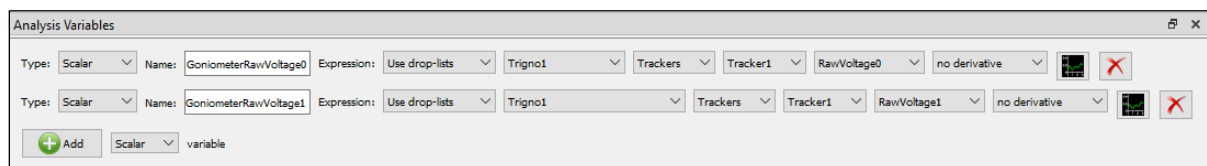
Goniometer voltage data can be converted into angles using a formula where the voltage and a voltage-to-degrees ratio are multiplied together. This ratio needs to be determined experimentally. Alternatively, a Transducer hardware device can be used to perform the conversion from volts to degrees using the same ratio described above. The Transducer hardware device can be advantageous because it also provides a means for calibrating the voltage to a "zero" reading. For more information on Transducers refer to the Knowledge based article found in https://themotionmonitor.com/support/.

Synchronizing the EMG Device with Analog Data

1. To synchronize the EMG Device with other data, you will need an Event Marker provided by your Client Support Engineer and Delsys Smart Sensor hardware. The Event Marker will vary based on the configuration of your MotionMonitor xGen unit; the image below shows a battery operated Event Marker that is being used with the Trigno. In the configuration below, one BNC cable is connected to the Delsys Smart Sensor and the other BNC cable will be connected to a BNC A/D board.
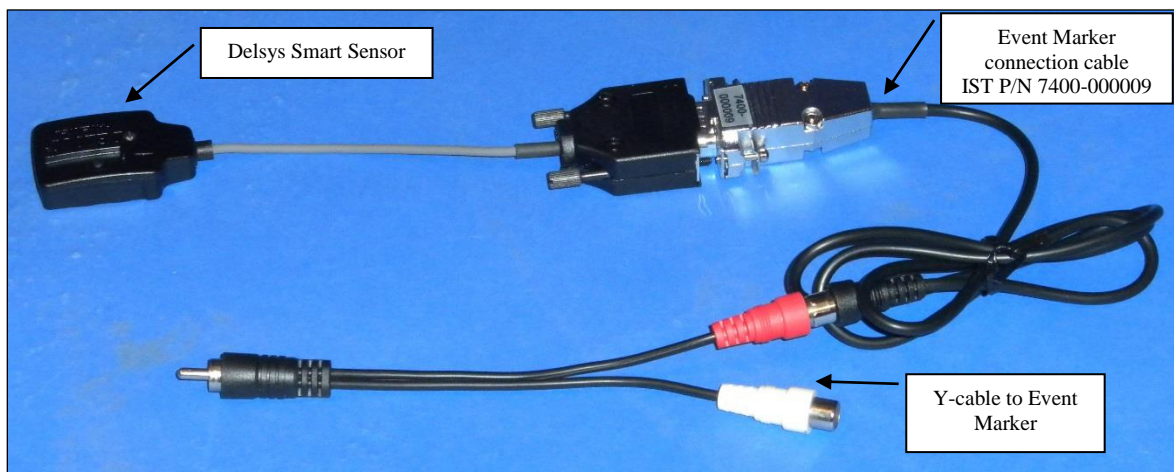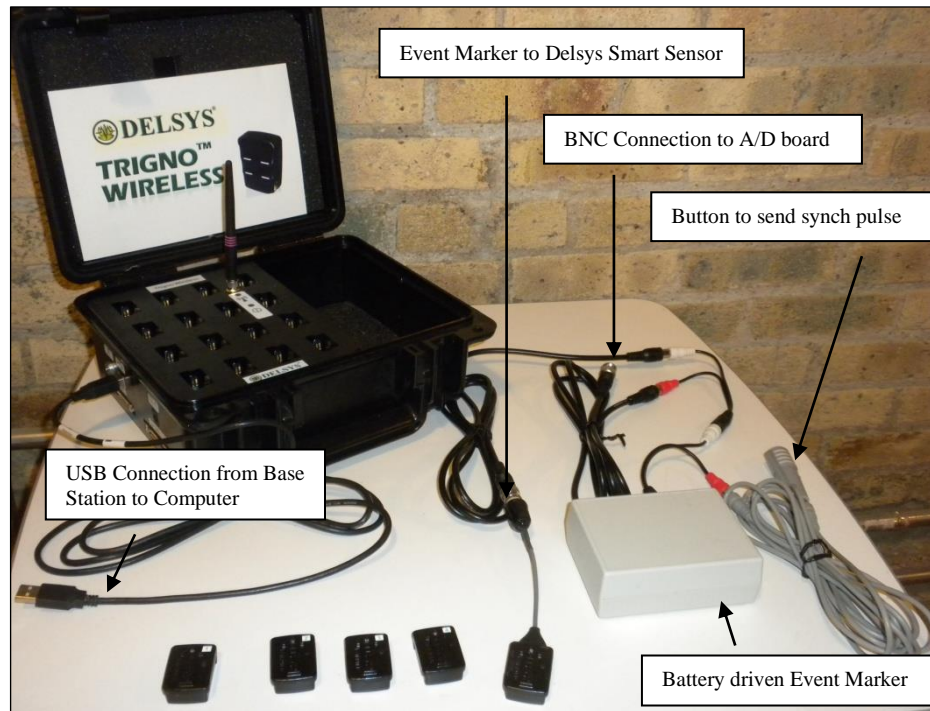
2. The Synchronizing event will be based on the channel that the Delsys Smart Sensor is attached to. In the picture above, the Smart Sensor is connected to EMG Sensor #5 so The MotionMonitor xGen settings for the Synchronizing event might be as seen in the image below.

    __Note:__ Remember that the first Channel for Delsys hardware is always Channel #0. The first Tracker is always Tracker #1. In our example described here, we should expect to see the synch pulse come in on Trigno Channel #4.

    ☑ Synchronizing event: when | Use formula ▼ | if(Trigno1.Channels.Channel4.Voltage<2.5,TRUE, FALSE) | becomes true

    Similarly, the common event marker signal should be configured for each applicable hardware's Synchronizing event Boolean expression. These events will then be used to force an alignment between the hardware devices.