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.

General	Driver	Details	
17	Fimwa	ire Frame'	Works
	Driver	Provider:	Unknown
	Driver	Date:	Not available
	Driver	Version:	Not available
	Digital	Signer:	Not digitally signed
Dr	įver Detai	ls	To view details about the driver files.
Upo	date Drive	:r	To update the driver software for this device.
Roll	Back Dri	ver	If the device fails after updating the driver, roll back to the previously installed driver.
	Disable		Disables the selected device.
	<u>U</u> ninstall		To uninstall the driver (Advanced).

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.

sounds - 9	tal Output Orienta	tion Filter
Enable Digital Output		Changes will take
Command Port:	50040	the program.
High-frequency Data Port:	50041	Throttle Data
Low-frequency Data Port:	50042	Backwards Compatibility
IM Emg Data Port:	50043	
IM Aux Data Port: Digital data se	50044	Reset to Default
IM Aux Data Port: Digital data se	50044 rver IP is one of	Reset to Default

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.

/ Setup	Analysis		
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 Hardwa Subject Subjects X Permar X Permar Permar Permar Biofeed 	are Script Variables ent Variables ent Script Variables ent Scripts ent Toolbars thacks	s	
K Embed	ded Activities		
Playback step inter	val: Use formula	• .001	
🕁 Add	🛞 Trigno	•	

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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 dropdown menu, depending on which data type is desired to be captured for Trigno IM and Avanti sensors.

Components	8 ×
🖌 Setup 🛛 Maalysis	
, , World Axes ✓ ⇔ Hardware	^
> 🛞 Trigno1	
Bubjects	~
Trigno name: Trigno1	
EMG channel measurement rate: 2000	(must match hardware setting)
EMG channel acceleration measurement rate: 148.1481481	(must match hardware setting)
IM tracker voltage measurement rate: 2000	(must match hardware setting)
IM tracker auxiliary measurement rate: 148.1481481	(must match hardware setting)
Synchronizing event: when Use drop-lists <no selection=""> becomes true</no>	
▼ Setup	
Server's IP address: 127.0.0.1	
▼ Advanced	
 Auvaliced Fortage Sector 20 	
EMis channel live data decimation: Pactor: 20	
EMG channel acceleration live data decimation: Factor: 10	
✓ IM tracker voltage live data decimation: Factor: 20	
IM tracker auxiliary live data decimation: Factor: 10	
IM tracker auxiliary data type: Orientation \sim	
Accelerometer range: +/-8g \vee	
Suspend live data (reduces CPU requirements by making data only available in post-processing)	
9 Activate	

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 sensor types cannot 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.

nromation	Settings	Digital Output	Orientation Filter	
Note IMU use j	e: The orien sensors. F just the sen	tation real time f for Orientation d isor mode.	iltering is only com ata from Avanti ser	patible with nsors, please
Enable Fil	ter			
		Tum or	Orientation Filter	for all sensors
IM Calibra	ition File(s)			
Mag	Calibration	File Brows	e Calibration	8sensors.csv
Apply	calibration	is to paired sens	ors	Apply
Select an	Output Tv	ne		
Select an	output 13	Quatemic	n	×
				Apply

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.

🗲 Setup 🛛 🔤 Analysis		
✓ 🛞 Trigno1		
Channels		
Channel0		
Channel1		
Traditions		
Repair: Max interval: 1		
Repair: Max interval: 1 Butterworth filter: Freq: 20		
Repair: Max interval: 1 Butterworth filter: Freq: 20 Chebyshev filter: Freq: 20		
Repair: Max interval: 1 Butterworth filter: Freq: 20 Chebyshev filter: Freq: 20 FFT lowpass filter: Freq: 20	Rolloff:	2
Repair: Max interval: 1 Butterworth filter: Freq: 20 Chebyshev filter: Freq: 20 FFT lowpass filter: Freq: 20 FFT highpass filter: Freq: 0	Rolloff: Rolloff	2

- 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.

Analysis Variables											×
Type: Scalar Vame Add Scalar	X1 Expression: variable	Use drop-lists 💌	Trigno1	T	Channels 🔻	Channel0 -	RawVoltage	▼ relative to	World	•	×

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.

Analysis Variables	×
Type: Scalar 🔻 Name: X1	Expression: Use drop-lists 🔹 Trigno1 🔹 Trackers 🔹 Tracker1 🔹 RawVoltage 🔹 relative to World 🔹 🧱 🗙
Type: Scalar Vame: X2	expression: Use drop-lists 🔹 Trigno1 🔹 Trackers 🔹 Tracker1 🔹 Axes 🔹 Ori 🔹 Eul 🔹 ZYX 👻 Z 💌 relative to World 🔹 🎆 🗡
🕒 Add Scalar 🝷 variable	

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.

Analysis Variables	₽×
Type: Scalar V Name: GoniometerRawVoltage0 Expression: Use drop-lats V Trigno1 V Trackers V Trackers V RawVoltage0 V no derivative V	
Type: Scalar V Name: GoniometerRawVoltage1 Expression: Use drop-lists V Trigno1 V Trackers V Tracker1 V RawVoltage1 V no derivative V	×
Add Scalar V variable	

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.