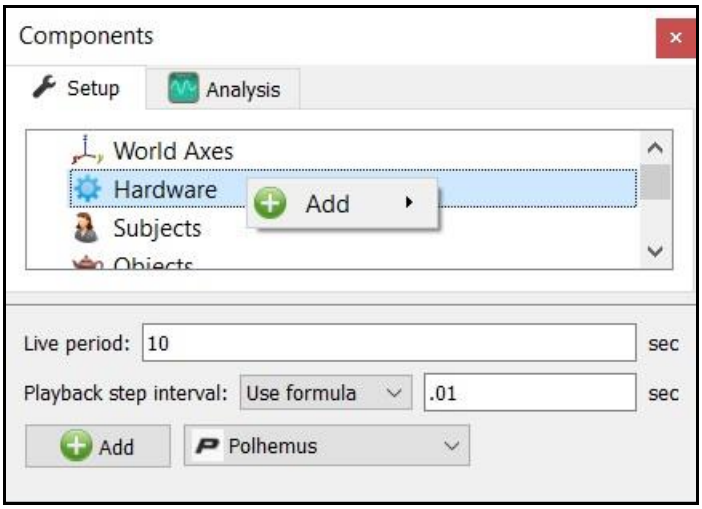
The MotionMonitor xGen Hardware Guide: The MotionMonitor xGen Interface to Polhmeus Hardware

The following document outlines the steps required to configure and collect from Polhemus Liberty, Patriot, G4, Viper or Fastrak devices that are connected to The MotionMonitor xGen computer via USB. The Polhemus drivers, Polhemus PiMgr or Viper Command manager host software should first be installed using the installation CD and instructions provided by Polhemus.

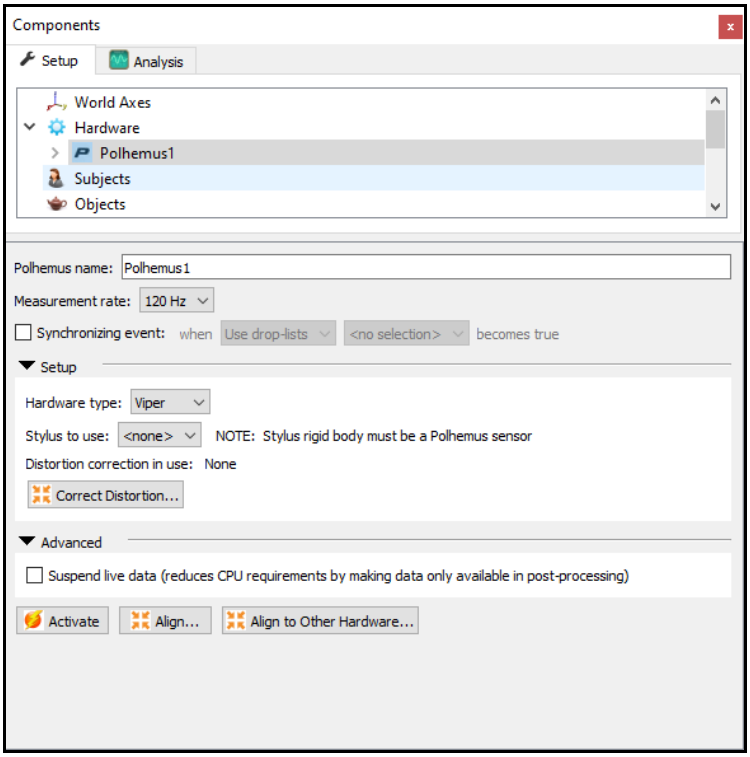
Before using the Polhemus G4 system, the RF Configuration and G4CreateSrcCfg utilities must be run to setup the system configuration and source (transmitter) setup, respectively. Please see Appendix II for more information on configuring the G4.

Please view Appendix I for more details on configuring the Polhemus Viper.

1. Start The MotionMonitor xGen and go to the Hardware node in the Setup Components window. Add the Polhemus 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.

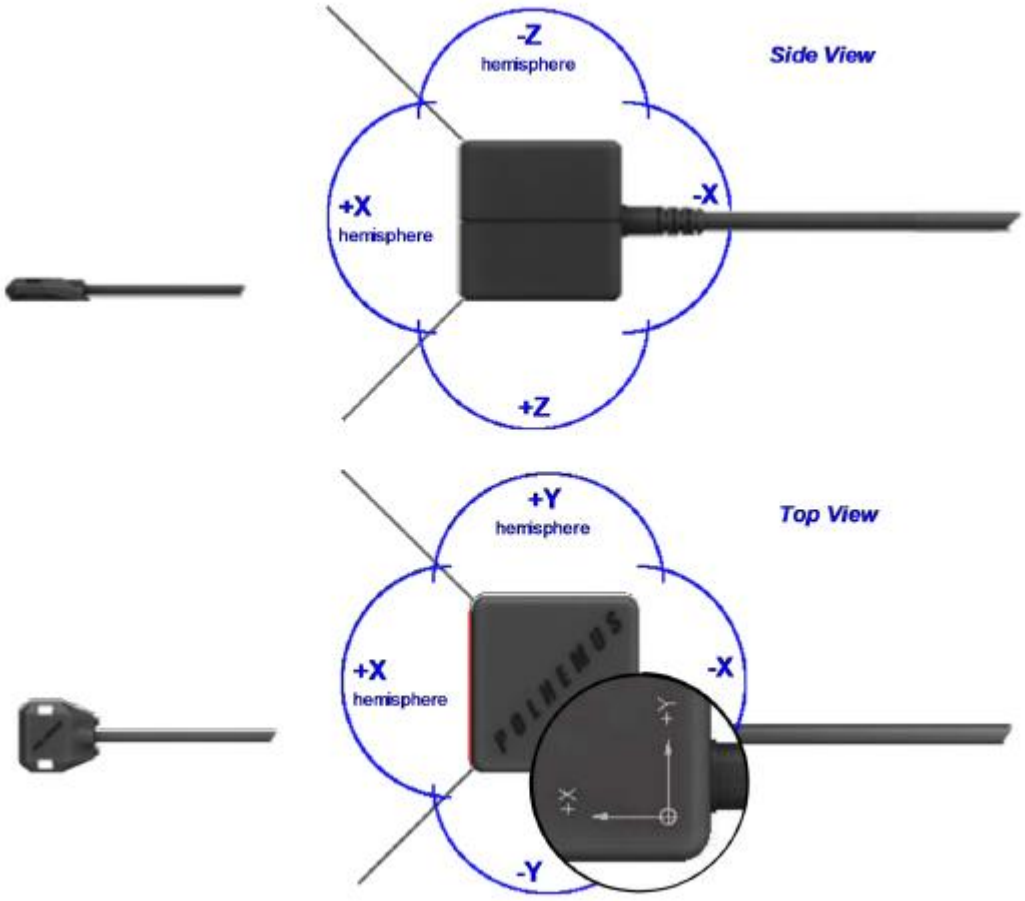


2. Click on the Polhemus device to bring up the Polhemus parameters panel. Specify the name (optional), Hardware type (Liberty, Patriot, G4, Fastrak or Viper), Measurement rate (30Hz, 40Hz, 60Hz, 120Hz, 240Hz, 480Hz or 960Hz depending on supported measurement rates for the selected Hardware type), and browse to the G4 calibration file, if using the G4 Hardware type.



The stylus that is being used for aligning this hardware device (i.e. digitizing a new world axes, unique from the default transmitter coordinate system) must be selected here for the Stylus to use. After Activating the hardware, the “Align” button will result in a sequence of prompts for digitizing a new world axes layout according to the selections for the World Axes layout in the World Axes Setup Component.

The default transmitter reference frame is depicted below. Readings from the sensors can only be accurately taken from the front (positive X) hemisphere. When using the G4 and Viper Hardware devices, data from the sensors can be taken from any side of the transmitter, but the sensors must be in a particular hemisphere when the device is Powered on and activated. Both systems also support the use of multiple transmitters. However, the settings for each system must be configured prior to activating hardware in The MotionMonitor xGen. For the G4, these settings are configured in the G4CreateSrcCfg utility. For the Viper, these settings are configured in the Viper command manager (see Appendix I).



Data in the Live window can be suspended by placing a mark in the checkbox for Suspend live data. The processing and display of data in a live mode uses computer resources, so this option allows the user to optimize computer resources and free up more processing power for data collection. This setting is independent for each hardware device and once an activity has been recorded data from the full measurement rate will be accessible for analysis.

A synchronizing Boolean event can be specified for performing an active alignment of the Polhemus data stream with synchronous events from other hardware data streams. The Synchronizing event used here must be defined from the Polhemus data (i.e. the stylus pen button or event marker interconnect provided by The MotionMonitor, which could be defined as *Polhemus1.Sensor1.Event ==1*, for instance, if the synchronizing event were connected to the first sensor). The Polhemus Viper does not support an event marker interconnect at this time.

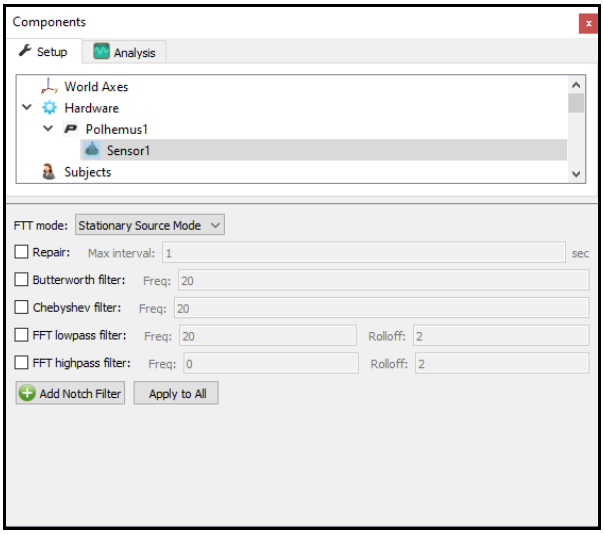
The Align to other hardware and Correct distortion buttons are advanced features for hybrid configurations and for performing metal mappings, respectively. Please contact your Client Support Engineer for more information regarding these processes.

The "Activate" button will initialize the communication between The MotionMonitor xGen and Polhemus hardware.

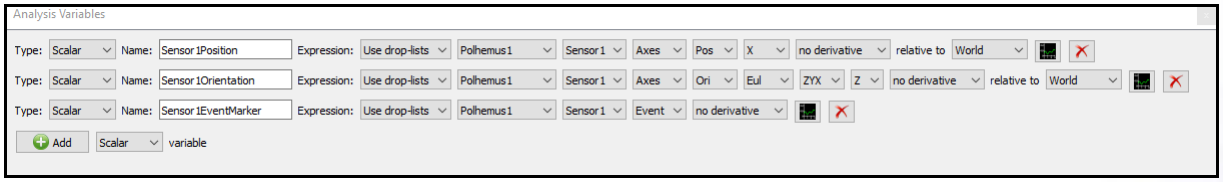
3. Expand the Polhemus node to show the activated sensors. Selecting a Sensor brings up the Sensor parameters panel. Smoothing settings can be enabled or disabled here, pre or post data collection. In this menu you can also enable Polhemus Fly True Technology (FTT) Mode for Polhemus Viper Sensors. This feature allows for real time distortion mitigation during data collection and must be enabled before data collection. Only Viper FT sensors support FTT Mode. The sensor LED on the electronics unit will turn Blue with the FTT is engaged. Please refer to the Viper User Manual or contact your Client Support Engineer for more information on using the FTT Mode. There are two settings for the FTT:

   Stationary Source Mode: Sources are mounted in a fixed position.

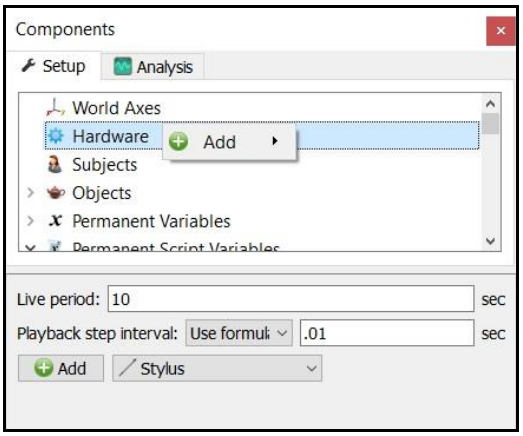
   Moving Source Mode: Sources may be used in dynamic conditions.



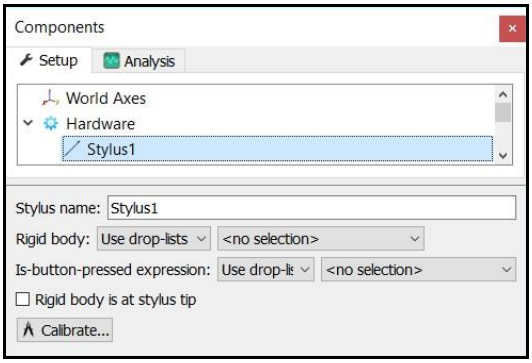
4. At this point, data available directly from the Polhemus hardware can be displayed in graphs or used in custom equations, as depicted below.



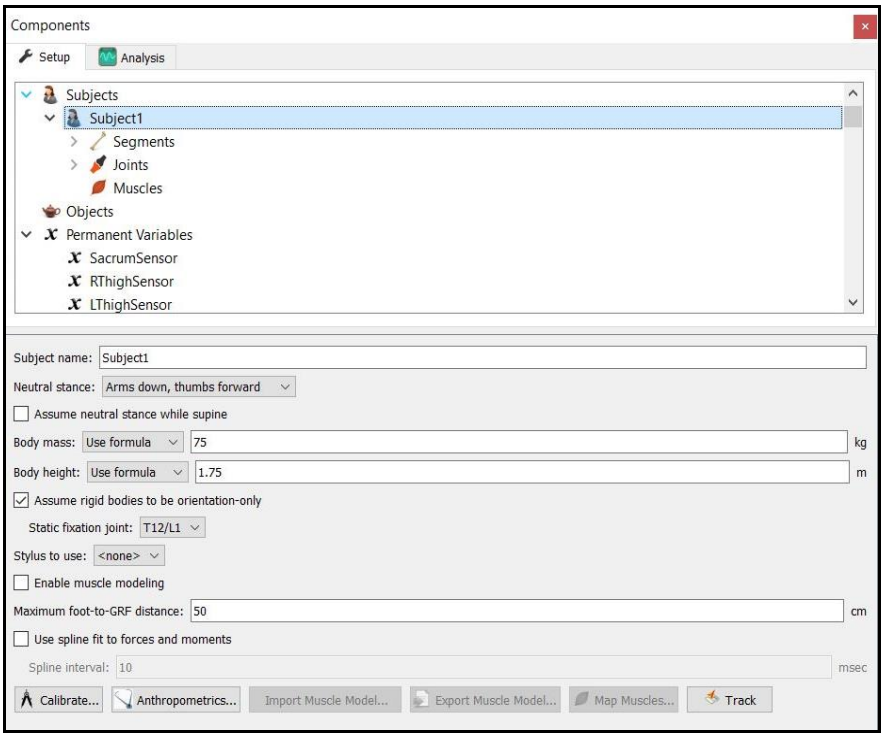
5. A Stylus will need to be configured for digitizing the alignment of the Polhemus hardware device, force plates and defining joint centers or other landmarks of interest for your subject. From the Hardware node in the Setup Components window add the Stylus device from the Add button in the parameters panel at the bottom of the Components window or by right clicking the Hardware node and adding the device through the cascading drop list.



Click on the Stylus device to bring up the Stylus parameters panel. Specify the name and Rigid body affixed to the stylus. An Is-button-pressed expression is a Boolean value that allows for an external trigger to be used in the OK messages where the stylus is being used in the setup, such as when performing the alignment of a hardware device, aligning force plates or when digitizing a subject. The Rigid body is at stylus tip checkbox can be enabled when the origin of the Rigid body specified for the stylus is already located at the tip for the stylus being used, as in the example of Polhemus Stylus Pens. The Calibrate button walks through the procedure of calculating the vector offset from the Rigid body origin to the stylus tip or captures the orientation of the stylus if the Rigid Body is at stylus tip is selected. A tutorial video for configuring and calibrating a stylus can be found at https://themotionmonitor.com/support/.

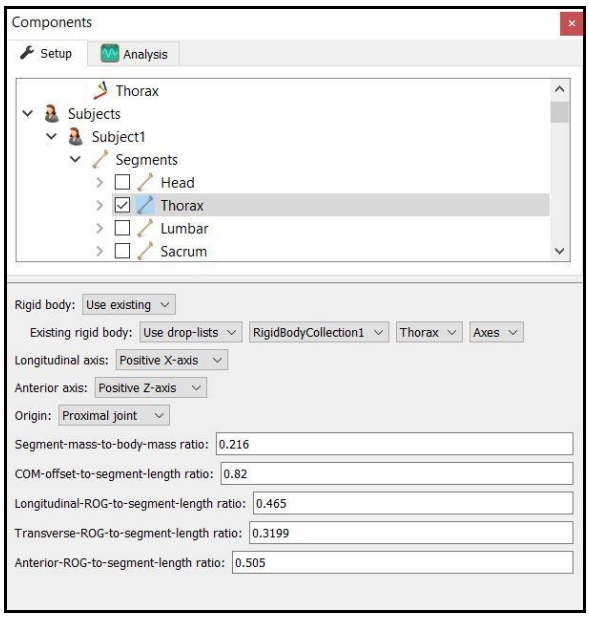


6. The next step is to define your biomechanical model within **The MotionMonitor xGen**, which entails selecting which body segments you'll be tracking, assigning rigid bodies to track each body segment, defining segment endpoints or joint centers and generating customized segment axes, if desirable. To begin this process, right click on the Subjects header within the Components Setup tab and add a new subject by clicking on the "Add Subject" button in the Subjects parameters panel or right clicking on the Subjects node and selecting Add Subject.

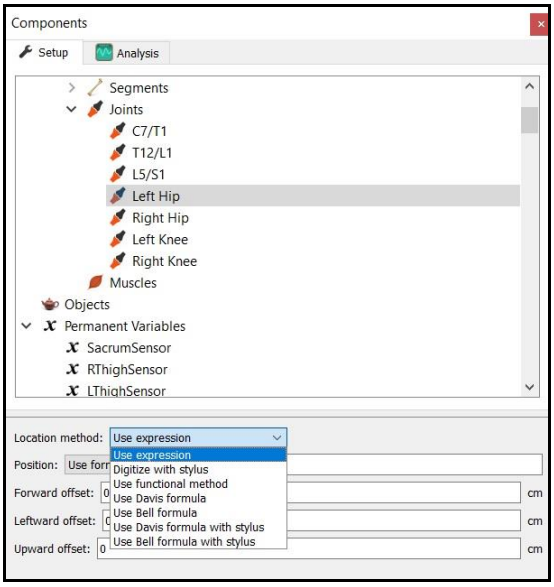


As seen above, a name can be assigned to the subject and basic anthropometric data can be entered. Confirmation for the orientation of the subject during the static reading and selection of a stylus to be used for digitizing are also selected here. The Calibrate button can be clicked after all of the required setup information has been entered.

7. The Segments header located under the Subject node is where the desired segments to be tracked can be enabled as well as where the assignment for which rigid body will be used to track the segment is defined. Additional basic anthropometric information can be defined here for each segment as well.



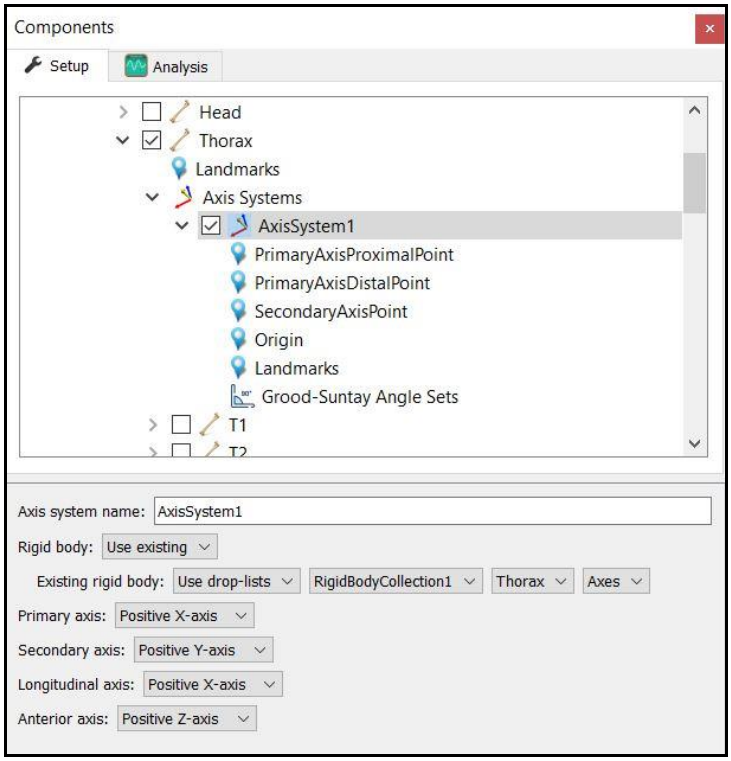
8. Each body segment which is enabled will require the definition of a proximal and distal endpoint or joint centers. The required joint centers will be automatically populated based on the selection of segments.



9. As seen above, each joint center can be defined using a digitizing method or expression based on marker positions. Alternatively, the hip and shoulder joints can be defined using linear regression algorithms or functional (rotational) methods.

10. Once these definitions are completed, the Subject Calibrate button can be clicked. A warning message will be displayed for any definitions that have not been appropriately defined.

11. Additionally, if alternative or anatomically based local coordinate systems are desired, they can be defined by right clicking on a segment and selecting Add Axis System. First, the Rigid Body axes tracking the segment and general axes layout are selected. Then, points can be defined for the proximal and distal endpoints of the primary axis, a point along the secondary axis and a point for the Origin. The default local coordinate axes generated by **The MotionMonitor xGen** are defined as having a long axes through the joint centers and A/P and M/L axes being orthogonal to the long axes and parallel to the world when the subject was standing in the neutral position.



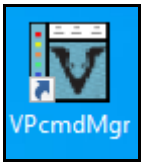
12. At this point, the **The MotionMonitor xGen** subject is fully defined and can be used for **biomechanical models, recording activities, performing computations and reducing data**.

    See our "Getting Started Biomechanics Guide" for more information on these aforementioned topics. For further configuration of your software, visit https://themotionmonitor.com/support/ where you can…

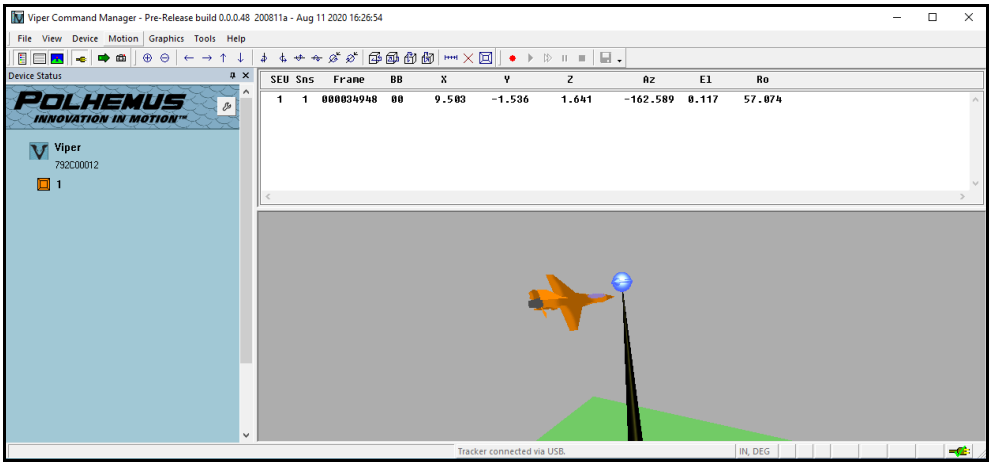
    - Download The MotionMonitor xGen Elements PDF, a written manual explaining key features of the software
    - Review tips for Best Practices in configuring your MotionMonitor xGen software for optimal performance
    - Take a video tour of The MotionMonitor xGen basic elements.
    - Review training and tutorial videos, including basic software functionalities.

Appendix I: Viper Hardware Configuration

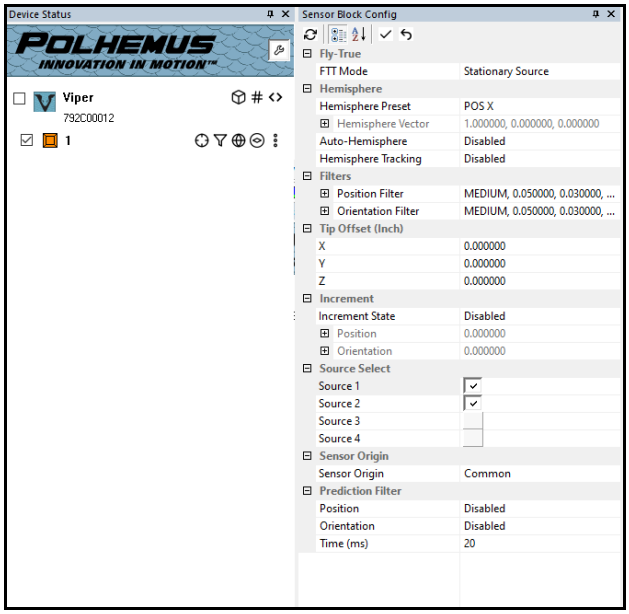
The *VPcmdMgr* software should be installed on the computer which Viper is connected to. Contact your Client Support Engineer if you require this installer.



Sensor data can be streamed and visualized (as a plane) within the command manager by selecting the “Continuous mode” stream icon ( ). Clicking the “Edit Tracker Configuration” icon ( ) will bring up the up the settings options for the sensors.



Click on the “All Sensor Settings” icon ( ) to bring up the Sensor Block Configuration menu. Here the settings for the Viper can be configured. Settings that need to be configured before collecting data in The MotionMonitor xGen are described below. For a full description of this menu, please see the Viper User Manual.



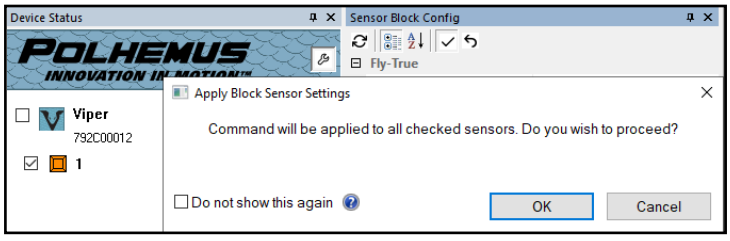
FTT Mode: This mode is set through Sensor parameters panel in The MotionMonitor xGen, as described previously in Step 3.

Source Select: The Source Select command is used to override the default Source Selection when multiple Sources are used. Typically, all present sources can be selected.

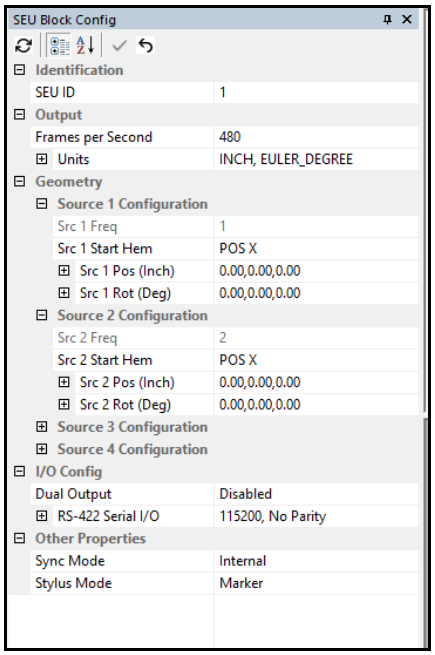
Hemisphere settings: Hemisphere tracking allows for tracking coverage around all sides of the source/s.

Filters and Prediction Filter settings can be enabled or disabled for Position and Orientation readings.

Once settings are configured, press the “Apply Changes” ( ) icon to save the settings for these menus. The settings will be applied to any sensor with a check box next to it in the Status pane.

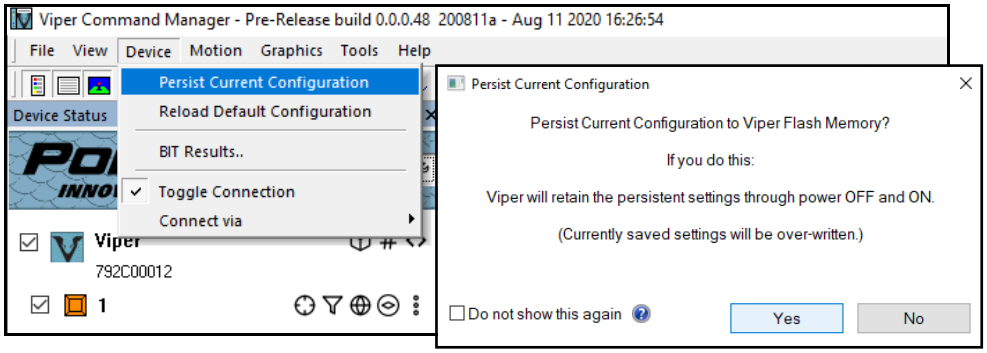


In SEU Block Configuration menu (<>), this is where the position and orientation of the transmitters is defined when using multiple source configurations. For a full description of this menu, please see the Viper User Manual.



For the Output Units section, the Position Units must be set to “CM” and the Orientation Units must be set to “QUATERNION”.

Prior to exiting the Viper Command Manager, the configuration settings should be saved using the *Device*| *Persist Current Configuration*. This will prevent the settings from being overwritten when the console is power cycled. When prompted to confirm Persist Current Configuration to Viper Flash Memory, click Yes.



You are now ready to exit and collect data in The MotionMonitor xGen.

Note: The tracker will stop updating a sensor when its signal-to-noise ratio gets too small. That is, when it is too far away from the source and the signal is weak. With a micro sensor this will happen closer than with a FT sensor.

When the sensor is detected by the source again, there is a brief pause in all sensor data before resuming the data acquisition.

Appendix II: G4 Hardware Configuration

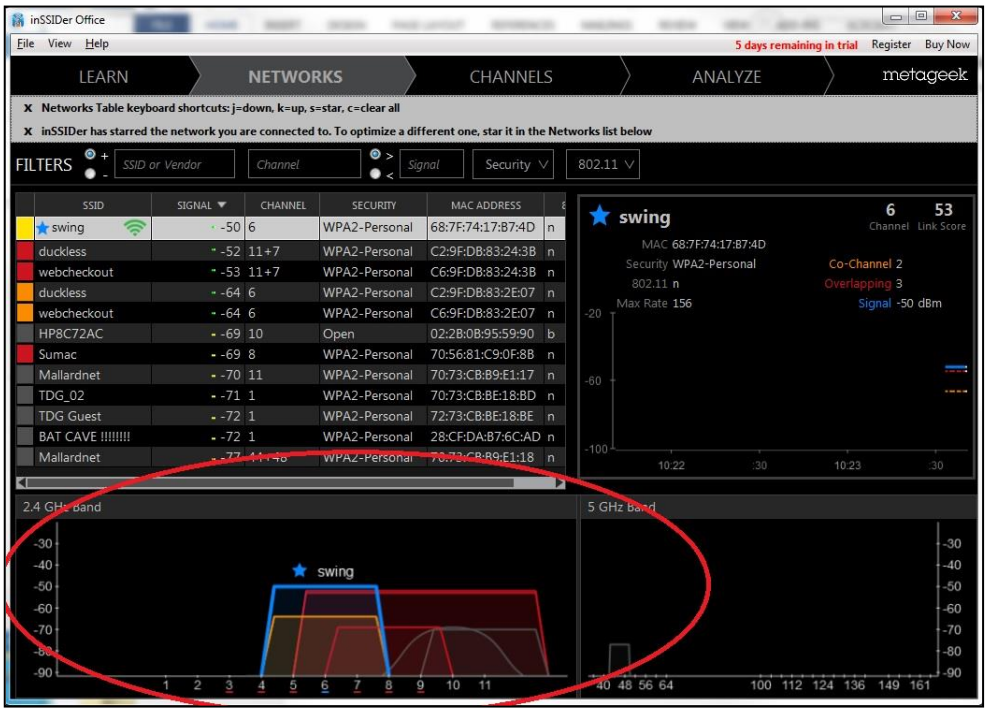
Shown below are the main components for a Polhemus G4 system with USB interface. Components of note include transmitter(s), wifi receiver, sensors and G4 hub.

The following images are meant to be used as a guide for the setup of your G4 system. The images and text to follow may also become helpful if the need for troubleshooting should ever arise.

The following image depicts the G4 hub connections. The indicator light on the side of the hub will be solid blue when the hub is successfully communicating with the wifi receiver. The “D-Input” port allows an event marker to be connected to the system, sensors can be connected to the “Sensor 1”, “Sensor 2” and “Sensor 3” ports.

The “G4 User Manual”, provided by Polhemus, contains step by step instructions for setting up and configuring your G4 transmitters. See the section on Source Configuration File for detailed instructions.

The G4 system communicates with the computer by WiFi and as such its sensor data is sensitive to wifi interference in the environment. To achieve the best quality of data, it is recommended that the system be configured to run on the wifi channel with the least amount of 3rd party traffic. To determine which wifi channels are unused in your environment, you can run a wifi analyzer or scanner program which will read the signals and report usage and signal strength. There are several free applications for this available on the web, one such program is called inSSIDerOffice, an image of which is shown below. You can see in the image that in this environment Channels 1, 2, and 3 of the 2.5 GHz band are available, while Channels 4-11 are in use by other wifi devices.



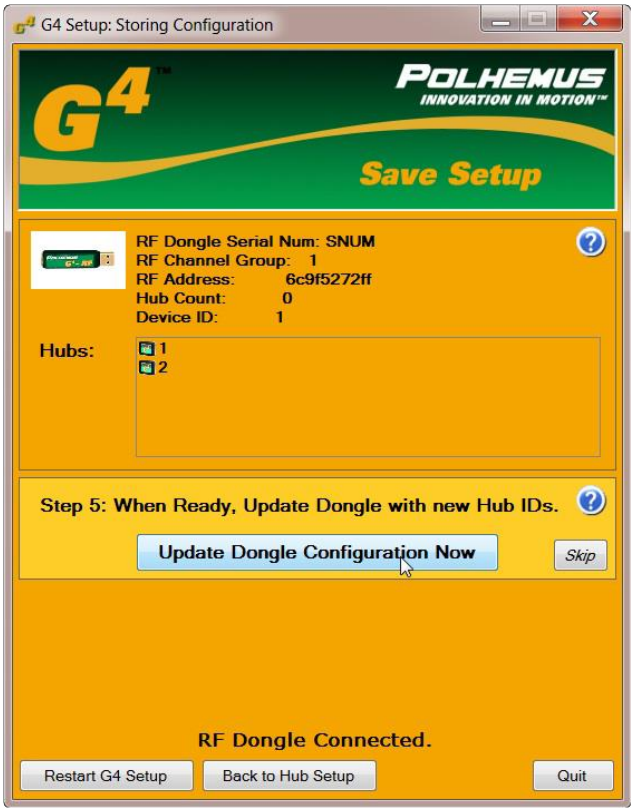
After determining the appropriate wifi channel for your system, connect the G4 receiver to the computer. All hubs should be powered off. Launch the “G4 System Setup” utility. Select the RF Channel Group from the radio button or dropdown menu. The one hundred series corresponds to Channels 1-11 of the 2.4 GHz band. Using the example above, the RF Channel Group could be set to Group 101, 102 or 103. When you have made the appropriate selections, click “Next” and then “Continue to Hub Setup.”

The hubs now need to be associated with the dongle. During this process you can leave the G4 receiver connected to the computer. Connect the first hub to the computer using a USB cord and turn it on.

Once the Hub is found, the utility will report the Hub Serial Number. Click “Join Hub 1.”

For your remaining hubs, you will repeat the process. Power down the first hub, connect the next hub and power it on. Select “More Hubs” and repeat the process until all hubs have been configured. After the last hub is configured select “Finished”

Once the hubs are all configured, you can select “Update Dongle Configuration Now,” this will send the configuration information to the dongle & propt the user to also save a *.g4d file on the computer.



You are now ready to run your G4 system with The MotionMonitor xGen. Close the “G4 Utility” and launch The MotionMonitor software. Under the Setup tab in Components, right click on the hardware node to add the Polhemus device. Select G4 from the Hardware type dropdown and specify the measurement rate, 120 Hz. Browse to the Calibration file (*.g4c) which was setup through the G4 Create Source Configuration utility. The Calibration file refers to the source/transmitter calibration and so is different from the *.g4d file saved above. Finally, enter the number of sensors that will be used for the session. You are now ready to activate your G4 system and collect data. For more information on experiment setup and analysis, please refer to **The MotionMonitor xGen – Elements** and **Data Capture with Polhemus Devices** documents.