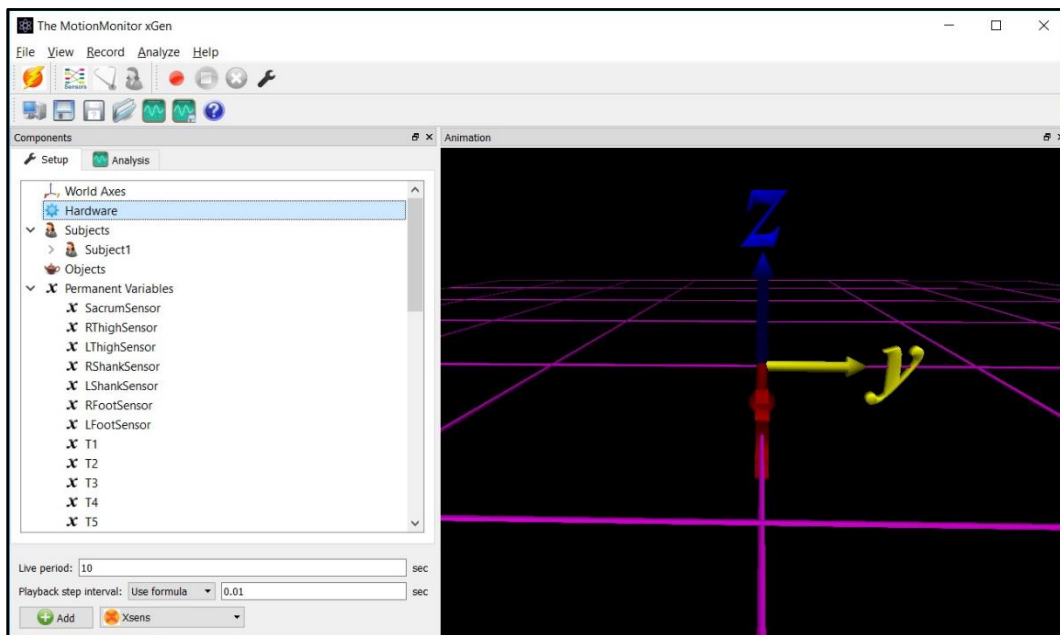


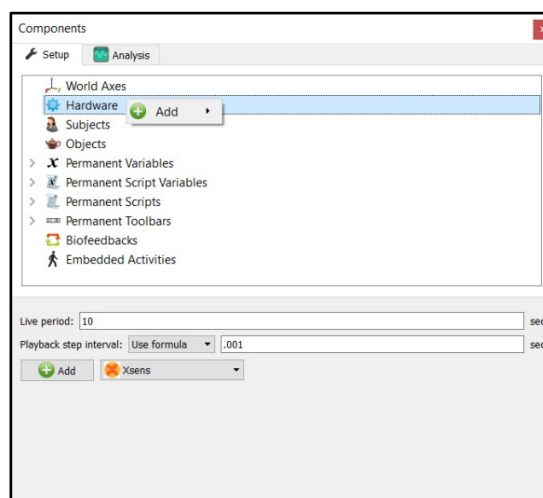
## The MotionMonitor xGen Software Guide: Standard IMU Workspace

The following guide outlines the steps for getting started with the Standard IMU workspace. If you haven't already been provided with this workspace, please contact your Client Support Engineer to request it.

1. The Live Window displayed below shows what the workspace will look like when first loaded through the File|Open Workspace menu or the Open Workspace icon.

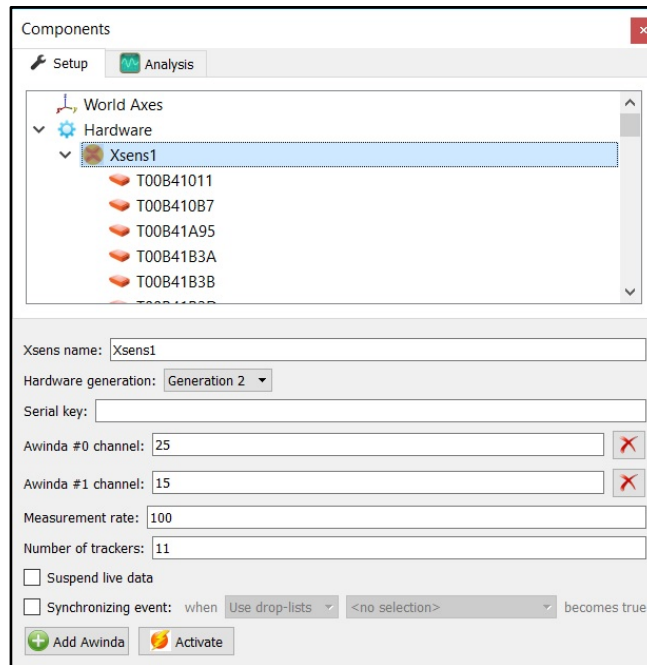


2. After loading the workspace, your IMU hardware will need to be added through the Hardware node in the Setup Components window. For purpose of this guide, we'll add an Xsens device from the "Add" button in the Hardware parameters panel at the bottom of the Components window or by right clicking the Hardware node and adding the device through the cascading drop list.

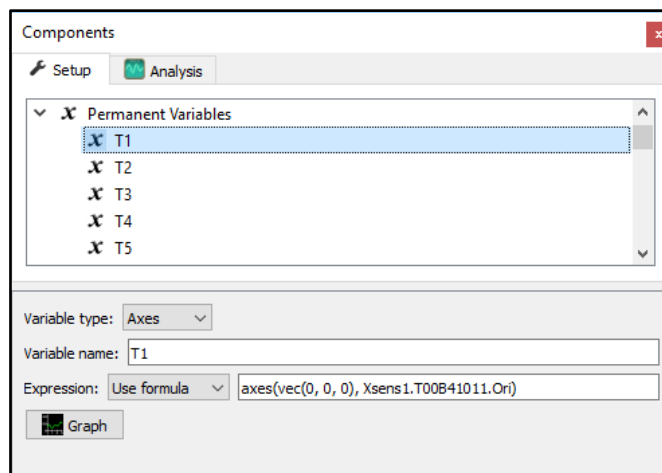


Please refer to the hardware guide for your IMU system for detailed instructions on configuring the parameters panel and activating the device.

- After the IMU hardware has been activated, the connected IMUs should be listed under the IMU device in the Hardware node. In the case of XSens, each IMU sensor is identified by its serial number. The identification here will be different for each IMU hardware type.



- Next, the IMU sensors above need to be mapped to the Tx Axes variables under the Permanent Variables node or Permanent Variables sub-node. We've assigned axes(vec(0, 0, 0), Xsens1. T00B41011.Ori) to the Permanent Variable T1 below.



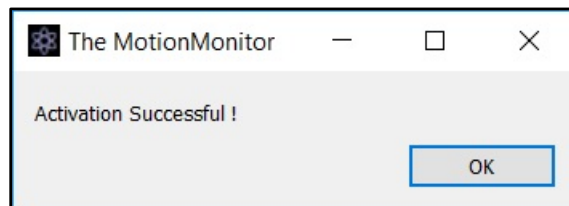
Since IMUs do not provide position data, they don't have an Axes (Position, Orientation) that can be selected from the drop list. However, an Axes will ultimately be required for defining a biomechanical model, which is where these Tx Axes variables will be used. So, an Axes was constructed by formula using a position vector [axes(vec(0, 0, 0), Xsens1. T00B41011.Ori)] and the orientation from the IMU [axes(vec(0, 0, 0), Xsens1.T00B41011.Ori)]

For however many IMU sensors there are, this process will need to be repeated until each IMU sensor is mapped to a Tx Permanent Axes Variable.

5. At this point, the IMU workspace can be re-saved or saved with a different name to retain these updates. Go to the File|Save Workspace As menu or click on the “Save Workspace As” icon.
6. Starting from this step are the procedures that you would perform for each data collection session. Click on the “Activate/Deactivate Hardware” icon. Again, refer to the instructions for your specific hardware system for their activation procedures, as the data reported by an IMU sensor can be sensitive to the manner in which it was activated.



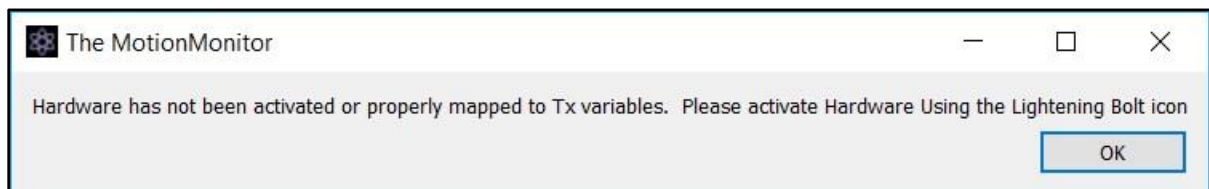
The exact messages displayed during the activation sequence will differ for each IMU hardware type but should result in an “Activation Successful!” message.



7. Next, click on the “Sensor Assignment” icon.



If IMU sensors have not been properly mapped to the Tx Permanent Axes Variables or the hardware has not been successfully activated, the following message will be presented. Confirm that these procedures have been successfully completed before proceeding to the “Sensor Assignment” icon again.



If the IMU sensors have been properly mapped to the Tx Permanent Axes Variables and the hardware has been successfully activated, the Sensor assignments dialog will open.

Enter the Sensor number attached to each segment.  
Click 'OK' when done.

Head Sensor:	0
Thorax Sensor:	0
Lumbar Sensor:	0
Sacrum Sensor:	1
LThigh Sensor:	0
LShank Sensor:	0
LFoot Sensor:	0
RThigh Sensor:	0
RShank Sensor:	0
RFoot Sensor:	0
RScapula Sensor:	0
RUArm Sensor:	0
RFArm Sensor:	0
RHand Sensor:	0
LScapula Sensor:	0
LUArm Sensor:	0
LFArm Sensor:	0
LHand Sensor:	0
Stylus Sensor:	0

Enter '0' for any segments that are not being tracked.

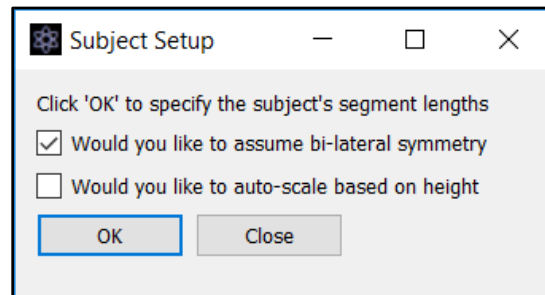
OK Close

The Sensor Assignments dialog is where the sensor numbers are mapped to the body segments. Any segment that is not being tracked should be set to “0”. The sensor number here refers to the Tx Permanent Axes Variables that were previously assigned an IMU sensor. T1 would correspond to the number 1, T2 would correspond to the number 2, and so on. Click “OK” when all the IMU sensors have been assigned to a body segment. **Note:** IMU subjects (orientation only subjects) are built using a chain setup, meaning that the location of the proximal point for a distal segment is dependent on the distal point of the proximal segment. So, segments cannot be skipped. However, the same sensor can be assigned to multiple segments. For instance, if tracking the upper extremities, the same sensor could be assigned to the Thorax and Scapula even if the Scapula isn’t being directly tracked by the IMU sensor. The Scapula will just track rigidly with the Thorax segment. If the Scapula was set to “0”, then we wouldn’t be able to proceed and setup the Upper Arm because our chain would have been broken.

8. Next, click on the “Anthropometry” icon.



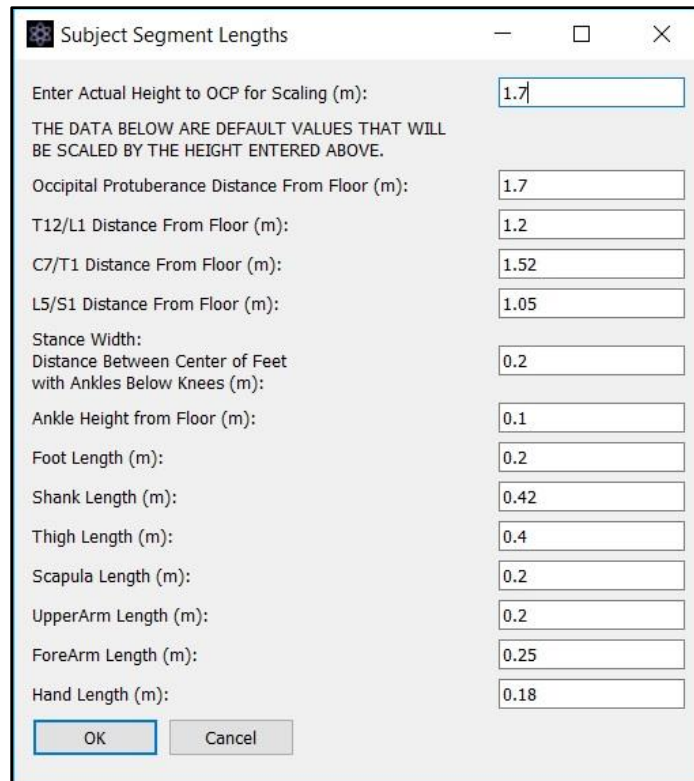
This will result in the Subject Setup dialog being presented. This dialog presents several options for specifying the anthropometrics or segment lengths for the subject. The options include whether to assume bi-lateral symmetry or whether to auto-scale the segment lengths based on the Subject's height.



When the auto-scale checkbox is unchecked, you will be prompted to enter segments lengths, based on whether assume bi-lateral symmetry is enabled or not. If assume bi-lateral symmetry is enabled, only 1 length for both right and left segments will need to be specified. If assume bi-lateral symmetry is disabled, the lengths for both right and left segments will need to be specified. Assume bilateral symmetry was enabled for the dialog below.

Segment	Length (m)
Occipital Protuberance Distance From Floor	1.7
T12/L1 Distance From Floor	1.2
C7/T1 Distance From Floor	1.52
L5/S1 Distance From Floor	1.05
Stance Width: Distance Between Center of Feet with Ankles Below Knees	0.2
Ankle Height from Floor	0.1
Foot Length	0.2
Shank Length	0.42
Thigh Length	0.4
Scapula Length	0.2
UpperArm Length	0.2
ForeArm Length	0.25
Hand Length	0.18

If the auto-scale based on height checkbox is enabled, the only value that needs to be updated is the Actual Height to the occipital protuberance (OCP) from the floor. This value will then be used to scale each segment length based on the existing values for the other segment lengths listed in the dialog. The individual segments do not need to be modified here.



Subject Segment Lengths

Enter Actual Height to OCP for Scaling (m):

THE DATA BELOW ARE DEFAULT VALUES THAT WILL BE SCALED BY THE HEIGHT ENTERED ABOVE.

Occipital Protuberance Distance From Floor (m):

T12/L1 Distance From Floor (m):

C7/T1 Distance From Floor (m):

L5/S1 Distance From Floor (m):

Stance Width:  
Distance Between Center of Feet with Ankles Below Knees (m):

Ankle Height from Floor (m):

Foot Length (m):

Shank Length (m):

Thigh Length (m):

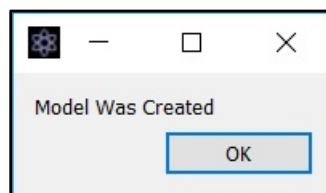
Scapula Length (m):

UpperArm Length (m):

ForeArm Length (m):

Hand Length (m):

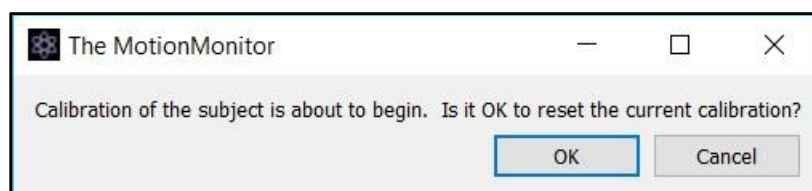
Click “OK” when this dialog has been completed. You will receive a message indicating that your model has been successfully created. **Note:** Any segment lengths that are not applicable for the segments that have a sensor assigned to them can be ignored.



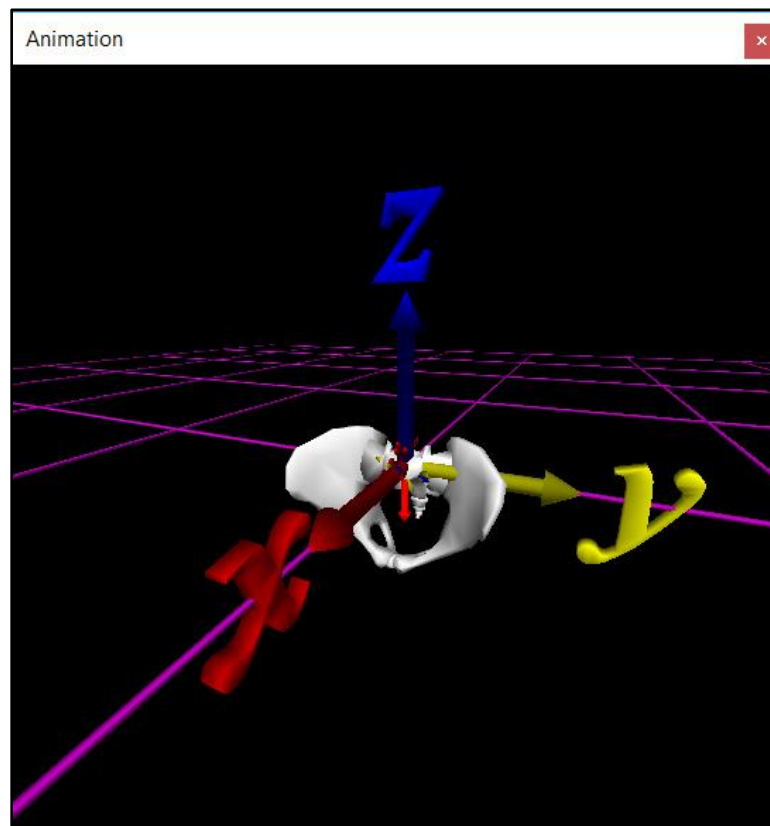
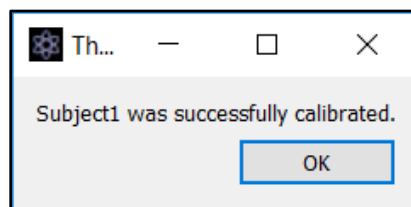
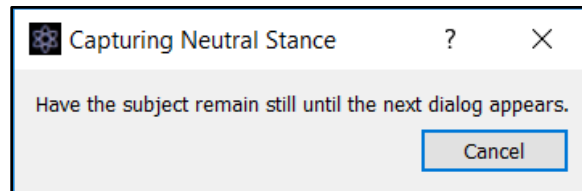
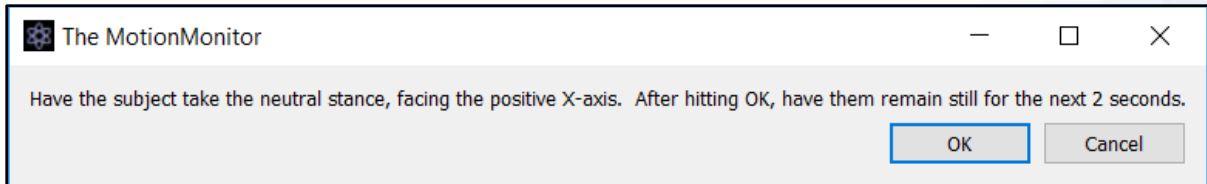
- Finally, click on the “Setup Subject” icon.



Any existing subject calibration will first be reset. Click “OK” to continue.



The subject will then be asked to take the neutral stance (Arms down, thumbs forward), facing the positive X-axis (magnetic North) and remain still.

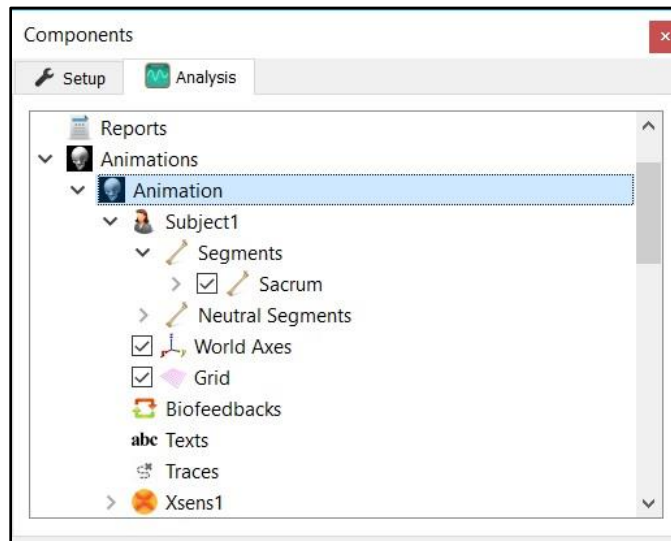


The subject should now be successfully calibrated and visible within the Animation window. Recordings and biomechanical analyses can now be performed.

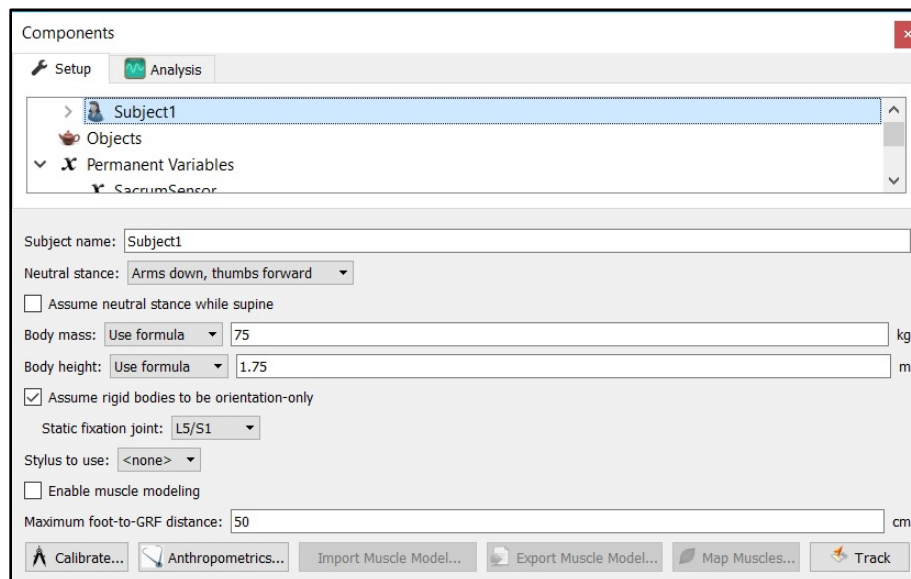


If the subject is not appearing in the Animation window at this point, check the following items:

- 1) Review the settings for the Animation component in the Analysis Components window and confirm that your segments are enabled.



- 2) In the Subject parameters panel within the Setup Components window, confirm that “Assume rigid bodies to be orientation-only” is enabled and that a valid “Static fixation joint” is selected for the segments that have a sensor assigned to them.



If necessary, re-save the workspace if modifications are made to these settings.