<u>The MotionMonitor xGen Software Guide:</u> <u>Hand Detail Digitization</u>

The MotionMonitor xGen provides the user with the ability to track relative carpal, metacarpal, and phalanx bone movements or movements relative to a proximal segment such as the forearm or shank. The following is a step-by-step procedure that will guide the user through the process of setting up a subject for collection with the hand detail feature:

Please see *Getting Started Biomechanical Session* for configuring hardware, world axes, calibrating stylus, and other basic setup functions of the software.

For this guide, it's assumed that the same sensor has been assigned to the Right Hand and Right Hand Carpus and that sensors are also assigned to the Right Hand 1st Distal Phalanx and Right Hand 2nd Distal Phalanx segments.

 Once a subject has been added under the Subjects header in the Components Setup tab, enable the bone segments on the hand that are to be tracked by the sensors, as seen below. From the dropdown down menus, select the corresponding sensor assigned to each segment, also shown below. Note: The Hand Carpus must be enabled and tracked if any interpolation of finger segments are to be performed. The Hand segment and Hand Carpus can share the same sensor assignment.

omponents	× .
🗲 Setup 🥂 Analysis	
>□ Left Hand	^
✓☑ Right Hand	
Axis Systems	
> Right Hand Carpus	
> Right Hand 1st Metacarpal	
> Right Hand 2nd Metacarpal	
> Right Hand 3rd Metacarpal	
> Right Hand 4th Metacarpal	
> Right Hand 5th Metacarpal	
> Right Hand 1st Proximal Phalanx	
Right Hand 2nd Proximal Phalanx	
>Right Hand 3rd Proximal Phalanx	
> Right Hand 4th Proximal Phalanx	
Right Hand 5th Proximal Phalanx	
Right Hand 2nd Middle Phalanx	
Eight Hand 3rd Middle Phalanx	
Eight Hand 4th Middle Phalanx	
> Right Hand 5th Middle Phalanx	
> Right Hand 1st Distal Phalanx	
> 🖂 Right Hand 2nd Distal Phalanx	
> Right Hand 3rd Distal Phalanx	
> Right Hand 4th Distal Phalanx	
> Right Hand 5th Distal Phalanx	
>Left Thigh	
> Right Thigh	
> Left Shank	
> Right Shank	
> Left Foot	
≥ Right Foot	
▼Joints	
Left Wrist	~
Left Hand 1st CMC	•
gid body: Use existing ·	
Existing rigid body: Use drop-lists · Ascension · Sensor1 · Axes ·	
Sensor1	
Sensor2	



2. The segment endpoints to be defined will auto populate under the Joints sub-header for your Subject based on the segments that were enabled in the previous step. Digitize with stylus should be chosen as the location method. An optical based system could also use an expression to define joint locations, if markers can define these positions. When digitizing with a stylus, the number of points to digitize can be selected with a centroid calculation used when more than one point is digitized. Alternatively, joint center offsets can be applied in the Forward, Leftward, and Upward direction. The settings must be individually set for each segment endpoint.

Component	ts	×
🗲 Setup	Malysis	
✓Joints		^
Righ	ıt Wrist	
Righ	it Hand 1st CMC	
Righ	it Hand 3rd CMC	
Righ	it Hand 2nd MCP	
Righ	it Hand 3rd MCP	
Righ	it Hand 4th MCP	
Righ	it Hand 5th MCP	
Righ	it Hand 1st IP	
Righ	it Hand 2nd DIP	
Righ	it Hand 1st Distal Phalanx Tip	
Righ	it Hand 2nd Distal Phalanx Tip	
Righ	it Hand 3rd Distal Phalanx Tip	
Muscl	es	*
Location me	ethod: Digitize with stylus	
Number of	points to digitize: 2	
Forward off:	set: 0	cm
Leftward of	fset: 0	cm
Upward offs	set: 0	cm

Note: A centroid method or joint center offsets should be applied for accurate measurements of intersegment calculations.

3. After clicking "Calibrate" in the subject properties pane, the user will be guided through a series of digitizing segment endpoints. If segments other than the hand are tracked, a neutral stance configuration must be selected. Furthermore, the mass of the subject can be input for anthropometric assumptions. The stylus used for digitizing is also selected here.

Components	×
🗲 Setup 🔤 Analysis	
 Ascension Stylus1 Subjects HandDetail Segments Head Thorax Lumbar Sacrum Left Scapula 	
 Right Scapula Left Upper Arm Right Upper Arm Left Forearm Right Forearm Left Hand Right Hand Axis Systems Right Hand Carpus Right Hand 1st Metacarpal Right Hand 3rd Metacarpal Right Hand 4th Metacarpal Right Hand 5th Metacarpal Right Hand 5th Metacarpal Right Hand 1st Proximal Phalanx 	~
Subject name: HandDetail	
Neutral stance: Arms down, thumbs forward • Assume neutral stance while supine •	
Body mass: 75	kg
Assume rigid bodies to be orientation-only	
Static fixation joint:	
Stylus to use: / Stylus1 ·	
Maximum foot-to-GRF distance: 50	cm
A Calibrate Import Muscle Model Track	



Please use the diagram below as a guide for locating points:

4. The first step of locating segment endpoints begins with the proximal segment endpoint of the hand at the wrist. The pictures below demonstrates a centroid method of locating the joint center.

The Motion	Monitor	?	×
Place Stylus1 on the right wrist, position 1 of 2.			
OK Back Cancel			



The Motion	Monitor	?	×
Place Stylus1 on the right wrist, position 2 of 2.			2 of 2.
OK Back Cancel			



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5. Next, the Right Hand 1st Carpometacarpal joint is digitized using the centroid method.

The MotionMonitor ?	×	
Place Stylus1 on the right hand 1st CMC, position OK Back Car	n 1 of 2. ncel	
The MotionMonitor ?	×	

6. Then, the Right Hand 3rd Carpometacarpal joint is digitized using the centroid method.

🍲 The N	lotionMonitor		?	×
Place Sty	lus1 on the righ	t hand 3rd CMC,	positior	n 1 of 2.
OK Back Cancel				ncel

🎯 The N	lotionMonitor		?	×
Place Sty	lus1 on the righ	t hand 3rd CMC,	position	n 2 of 2.
OK Back Cancel				





7. Next, the Metacarpophalangeal joints are digitized using the centroid method. The images below show the Right Hand 2nd Metacarpophalangeal joint being digitized.

The MotionMonitor ? ×	
Place Stylus1 on the right hand 2nd MCP, position 1 of 2.	
The MotionMonitor ? ×	
Place Stylus1 on the right hand 2nd MCP, position 2 of 2.	

8. Then, the Right Hand 1st Interphalangeal joint is digitized using the centroid method.

The MotionMonit	or	?	×
Place Stylus1 on the r	ight hand 1st IP	, positior	n 2 of 2.
ОК	Back	Car	ncel

Star The	e MotionMonit	or	?	×
Place	Stylus1 on the r	right hand 1st IP	, positior	n 1 of 2.
OK Back Cancel				





9. Next, the Right Hand 2nd Distal Interphalangeal joint is digitized using the centroid method.

The MotionMonitor	? ×	
Place Stylus1 on the right hand 2nd DIP,	position 1 of 2. Cancel	
Step The MotionMonitor	? ×	
Place Stylus1 on the right hand 2nd DIP, OK Back	position 2 of 2. Cancel	

10. Then, the Right Hand 1st Distal Phalanx tip is digitized.

Search The MotionMonitor			?	×						
Place Stylus1 on the right hand 1st distal phalanx tip, position 1 of 1.										
	OK	Back	Cancel							



11. Next, the Right Hand 2nd Distal Phalanx Tip is digitized.





12. Then, the Right Hand 3rd Phalanx Distal Tip is digitized to scale the length of the hand.

Steven Motion Monitor			?	×					
Place Stylus1 on the right hand 3rd distal phalanx tip, position 1 of 1.									
	OK	Back	Cancel						



13. Finally, the subject is prompted to place their hand, palm-down, on a flat surface with the middle finger directed towards the world axis direction specified through World Axes properties pane.

ĺ	See The MotionMonitor		?	×
	ve the subject place their right hand palm-down on a flat surface, with the middle finger pointing towards the negative X-axis. After hitting OK, have them remain still for the			
	ОК		Ca	ncel

14. The hand detail setup is now complete. The visualization for the hand detail animation is controlled through the Animation header in the Analysis Components tab. Analysis variables can be defined and graphed through the Analysis and Graphs headers in the Analysis Components tab, respectively. The workspace containing your Subject setup definitions can be saved as well as any Analyses containing variable definitions, graphs, export reports and animation window settings.

