Stage™

organic motion

Movement without Limits
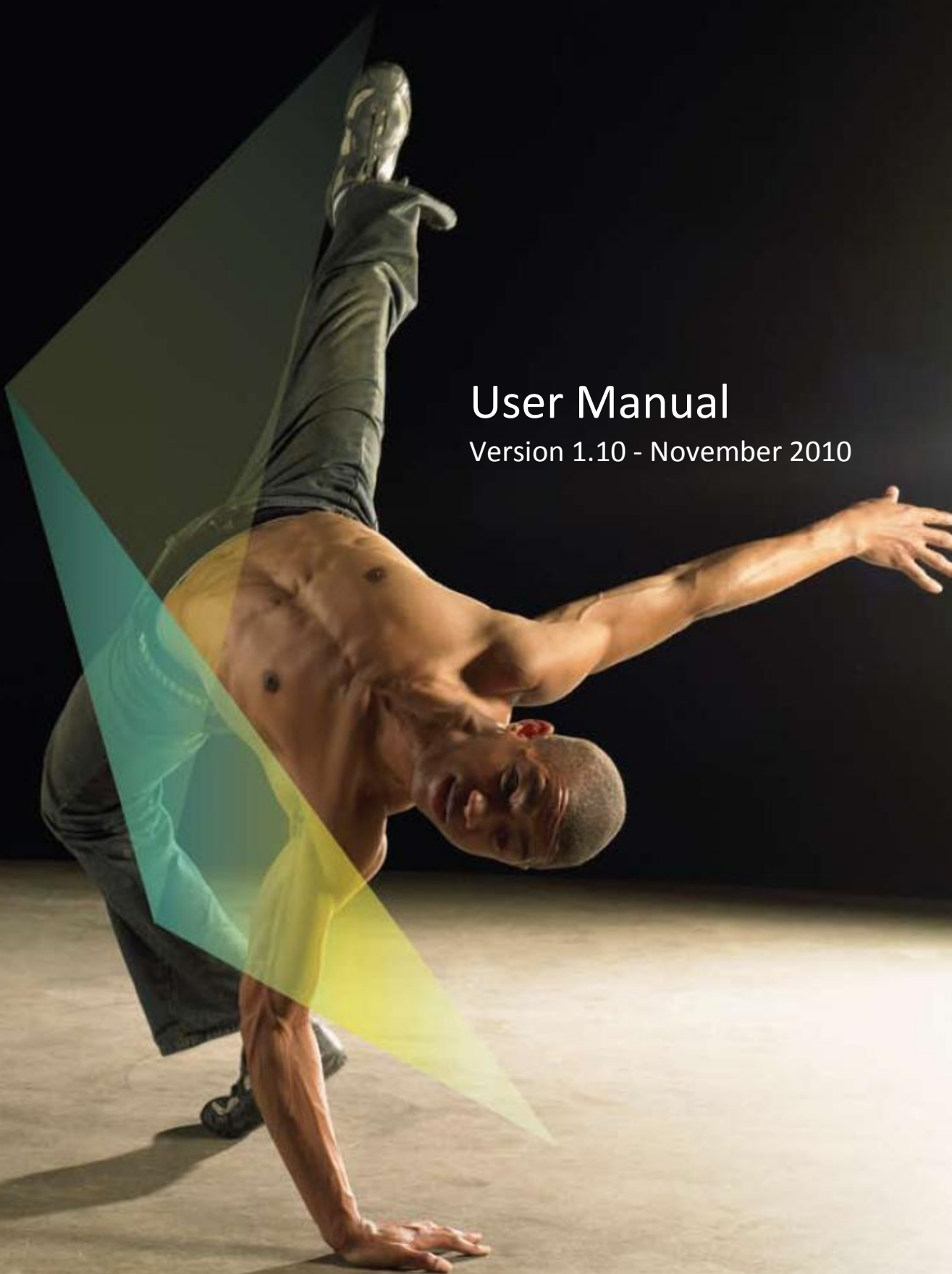
User Manual
Version 1.10 - November 2010

Table of Contents

1 Welcome

Thank you for licensing Stage™, the most advanced real-time markerless motion capture system. Stage™ will allow you to easily capture real-time motion data for a human character and integrate it into Autodesk® MotionBuilder® for animation or into your own software using our flexible software development kit (SDK).

This document will guide you through the installation process and describe how to maintain your Stage™ to preserve high quality motion capture data.

2 Product Overview

Within seconds, Stage™ views, calibrates, captures, and streams production-ready motion data directly into your favorite animation software. Stage™ is so advanced that it's transparent to the creation process. Animators can be artists, not data-cleaning technicians.

Stage™ ignites a whole new realm of content creation – now you can generate instantly clean data for the most complex motions, create real-time story boards, even photo realistic avatars, and many other unprecedented animation creations.

Unlike all other mo-cap systems, Stage™ tracks the entire human body naturally, instantly generating the most comprehensive motion data, all without markers.

Stage™ is an advanced optical tracking system that sees humans the way humans see each other. With its high level of cognition and artificial intelligence, Stage™ understands the movement it sees, rather than simply connecting the "dots" like all other conventional mo-cap systems.

Stage™ lets your team focus on content creation and delivery, not technology. Animators have the ultimate sketch pad and actors are not tethered.

In The Box

Organic Motion® Stage™ includes hardware and software components.

Hardware:

1. Vision Processor & power cable

2. 14 Organic Motion Stageview Fire-120 high speed cameras with mounts

3. All camera cables

4. 13 white retro-reflective wall panels

5. 4 retro-reflective floor panels

6. Aluminum Truss Cube

7. Calibration Wand and Calibration Triangle

Software:

1. Stage Administration^{TM}

2. Autodesk MotionBuilder 7.5 plugin

3. Autodesk MotionBuilder 7.5 ext 2 plugin

4. Autodesk MotionBuilder 2009 plugin

5. Autodesk MotionBuilder 2010 plugin

6. Autodesk MotionBuilder 2011 plugin

7. Organic Motion Stage™ Software Development Kit (SDK)

![organic motion logo]

3   Hardware

3.1   Truss

The truss is the support structure for the reflective material, the cameras, and all wires. The truss is made of an extruded aluminum alloy in 97'' pieces that is assembled together using connector triangles and 6 screw 'L's. Eight 97'' pieces are arranged in a square to enclose a total area of 194'' x 192''.

3.1.1   Parts List

1010 T-slotted Profile - 97" (x18)	1020 T-slotted Profile - 97" (x10)	7-Screw 90' Corner Joining Plate (x26)
6-Hole Inside Corner Bracket (x18)	8-Hole Joining Plate (x2)	Single T-Nut Assembly (x50)
Double T-Nut Assembly (x50)	Triple T-Nut Assembly (x65)	Economy T-Nut (x20)
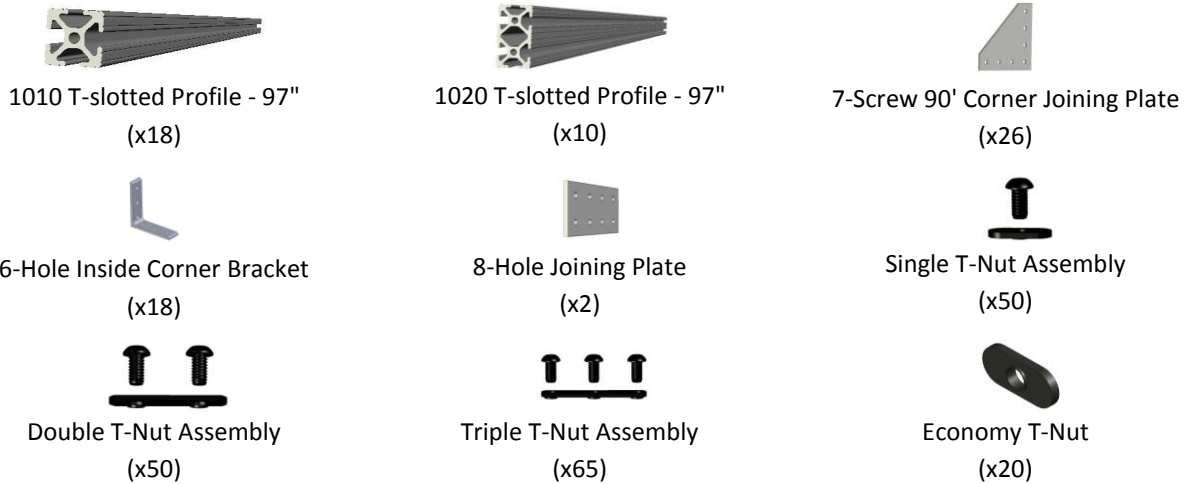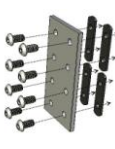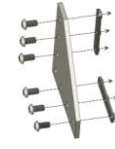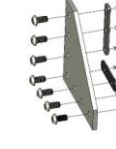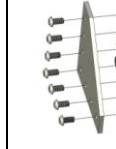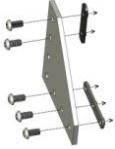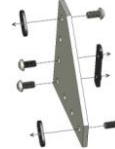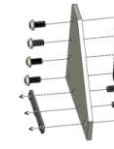
3.1.2   Assembly

Assembly of the Truss will require two sets of hands, two 8' ladders, and two 5/32" hex keys. When working with T-Nut assemblies, be sure that the protruded section of the T-nut is facing away from the screw head.

Step 1.

Begin by attaching the appropriate T-Nut Assemblies to each Joining Plate and Corner Brackets.

Assembly 1	Assembly 2	Assembly 3	Assembly 4	Assembly 5	Assembly 6	Assembly 7
x2	x18	x4	x4	x4	x2	x2
Assembly 8	Assembly 9	Assembly 10	Assembly 11	Assembly 12	Assembly 13	
x2	x2	x2	x2	x1	x1	

Step 2.   *Items Required: Assembly 2 (4), 1010 T-Slotted Profile (8)*

Once the Joining Plates and Corner Brackets have been assembled, begin to assemble the base of the truss corner by corner. Use Assembly 2 to connect two sections of 1010 T-slotted Profile at a right angle. Repeat this process for each corner of the system. Be sure to orient each junction such that the system encloses 194" from side to side and 192" from front to rear.

Orient side sections to the outside
of the front and rear sections

Front of System
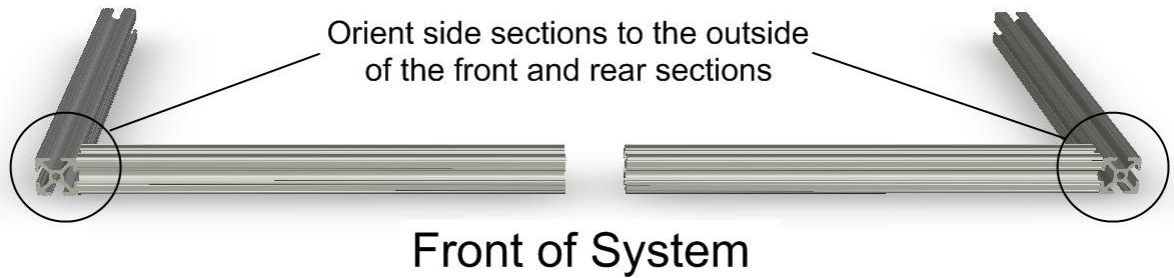
Step 3.   *Items Required: Assembly 2 (-2), Assembly 3 (4), Assembly 4 (2), Assembly 5 (2), 1010 T-Slotted Profile (4)*

After installing the corner brackets for the base, attach one section of 1010 T-slotted Profile to each the each corner using the appropriate mounting assemblies. Once the uprights have been installed, remove Assembly 2 from the rear two corners as it will interfere with Reflective Cloth.

Rear Corner (Inside View)   Front Corner (Inside View)
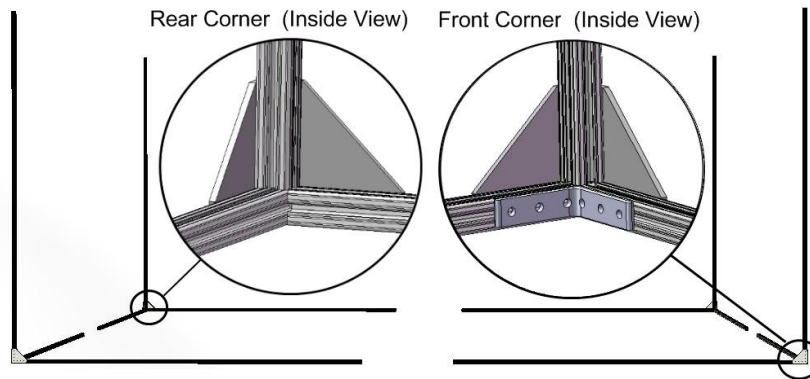
Step 4.   Items Required: Single T-Nut

Install one Single T-Nut in the top slot of each of the eight floor sections.

Step 5.   Items Required: 1010 T-Slotted Profile (4), Assembly 2 (8)

Once each corner has been assembled and T-nuts have been placed, begin connecting the four sections using two units of Assembly 2 and one section of 1010 T-slotted Profile as a Midpoint Upright.
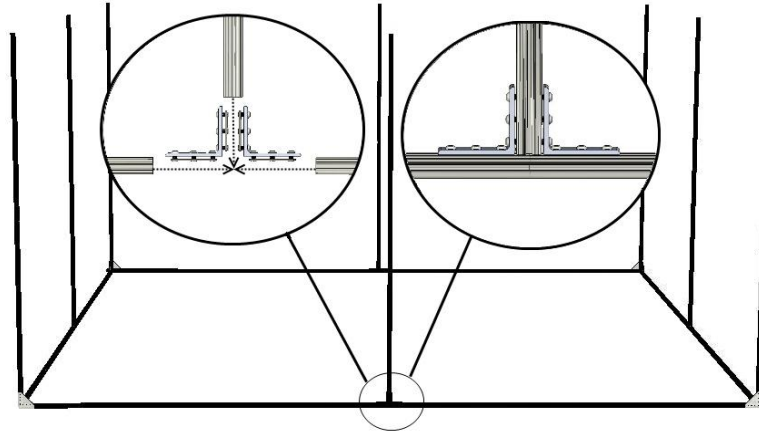
Step 6. *Required Items: Economy T-Nut (18), Double T-Nut (4)*

Before assembling the upper level of the frame it is important to install the appropriate T-Nuts into the 1020 T-slotted Profile sections. For the rear, install three single T-nuts along the top slot. For the front, install 7 single T-nuts along the top slot. For each side, install two Single T-nuts, followed by two Double T-nuts, followed by two additional Single T-nuts. *Be sure to follow the same assembly layout described in Step 2 for the upper section. For proper orientation, see image below.*

Step 7. Required Items: 1020 T-Slotted Profile (8), Assembly 3 (4), Assembly 4 (2), Assembly 5 (2), Assembly 6 (2), Assembly 7 (2), Assembly 9 (2).

Once the T-nuts are in place, begin to assemble the upper level of the frame section by section. While attaching the 1020 T-Slotted Profile sections, it will become evident where each mounting assembly should be placed.
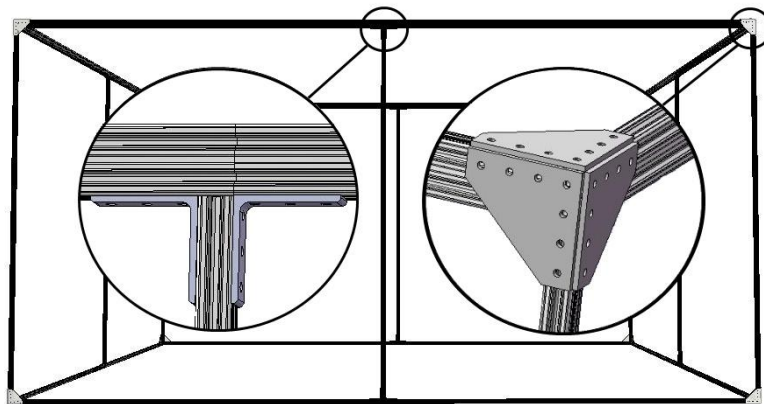
Step 8. *Required Items: 1020 T-Slotted Profile (2), Assembly 1 (2), Assembly 12 (1), Assembly 13 (1)*

Assemble the Crossbar with two 1020 T-slotted Profile sections and two 8-Hole Joining Plates. Mount Assembly 12 and 13 to the underside of the crossbar using the Triple T-nut side of the assembly. Insert three T-nuts in the top slot of the Crossbar. Mount the Crossbar to the top of the Truss, utilizing the Double T-nuts installed in step 7. Do not completely tighten the crossbar.

Step 9.   *Required Items: 1010 T-Slotted Profile (2), Assembly 10 (2), Assembly 11 (2)*

Finally, install diagonal stabilizers in each of the two front corners. Attach Assemblies 10 and 11 to opposite sides of two 1010 T-slotted Profile sections. Mount these to each of the front corners utilizing the Single T-nuts installed in Step 7. Slide the crossbeam forward until it is in contact with the diagonal stabilizers and tighten into place.
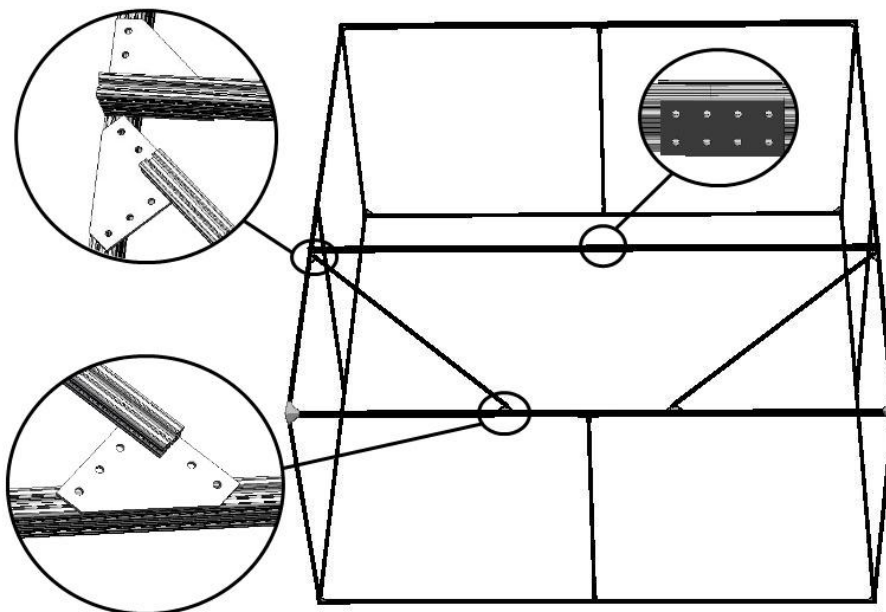
3.2   Reflective Fabric

This fabric is specially manufactured for your Stage™. The standard Stage™ comes with 4 floor panels, 17 ft long by 4 ft wide and 13 wall panels, 8 ft long by 4 ft wide. The wall panels have a 2" wide strip of loop fastener sewn at each end. We provide one extra wall panel to you in the event that one becomes damaged and is unusable.

Caring for your Fabric

 Before handling the fabric, be sure to wash your hands. Do not eat or drink or place any flammable or adhesive products near the fabric. Doing so may damage or stain the fabric. Shoes should be covered

with dark protective booties or removed before entering your capture space to help keep the fabric on the floor clean, free from debris, and prevent snags or tears. If your fabric becomes dirty you may spot clean it with a mild detergent, warm water and a sponge. Mix the detergent and warm water, dip and then wring out the sponge, then spot clean. You may also use the dry Swiffer® Sweeper for the floor panels. Following these guidelines will help prolong the life of your fabric.

3.3   Camera

Figure 1: Organic Motion StageView Fire120 Camera

Each Organic Motion StageView Fire120 Camera is focused and calibrated. There are four mounting points on each case. The camera lens should not be touched and great care should be taken to ensure that it does not get damaged or dirty. If it is dirty and artifacts can be seen in the video, you can try cleaning it with a standard micro lens brush. If it is still dirty then a lens brush with cleaning fluid can be used. Again, please try to avoid touching the lens directly.

3.3.1 Lens Markings
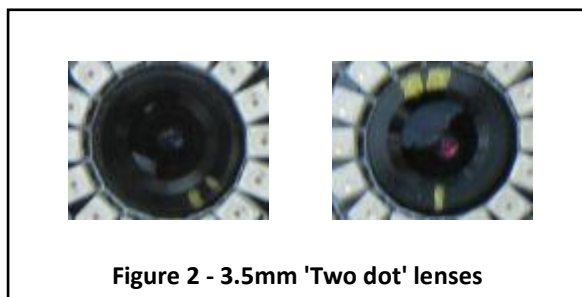
Figure 2 - 3.5mm 'Two dot' lenses	**Figure 3 - 3.9mm 'One dot' lenses**
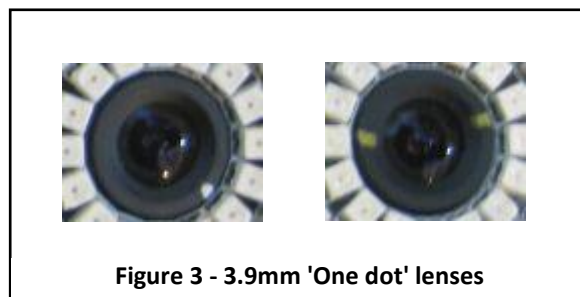
The cameras in the Organic Motion Stage™ contain two different types of lenses. The 3.5mm lenses are a wider angle lens then the 3.9mm lens. There are two variations of each lens marking but the lenses are equivalent.

3.3.2 Camera Placement
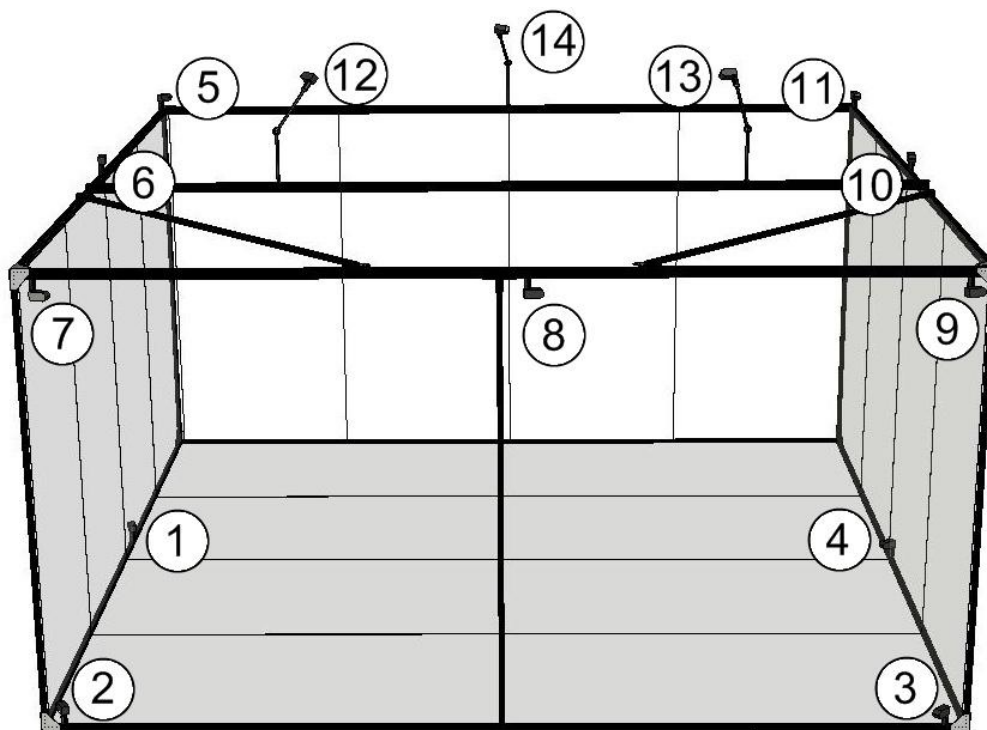
Figure 4 - Camera Placement and Numbering

The cameras are placed onto three layers.

- Bottom – cameras 1-4
- Top – cameras 5-11
- Ceiling – cameras 12-14

In general, all cameras should be placed such that they are in the upright position – the top of the image is up. This is for ease of viewing and pointing of cameras. The bottom cameras should be placed as close to the floor as possible. This can be obtained by using the mount on the top of the camera. Cameras 5 and 11 should be placed on their side. All other cameras should be mounted horizontally from the bottom.

Camera 5, 8, 11, 12, 13, 14 are 3.5mm and the rest are 3.9 mm lens.

3.3.3 Camera Pointing

Pointing, or aiming the cameras is a more involved exercise, as tracking quality heavily depends on what the cameras can see. The Organic Motion Installation Team will go through the process for each camera. When pointing, it is usually better to focus on the outside bounds of the image rather than the center

point. In general, one or two sides of each camera image are aligned with some edge of the truss or of the reflective material. The following are guidelines for specific cameras:

Camera 1, 4 – Make right/left edge parallel to the front side of the opposite wall. Ensure that the top of the wall is visible. There is no need to see any of the floor closer than 4 feet away.

Camera 2,3 – Make left/right edge look directly down toward the back wall. Move about 10 to 20 pixels extra towards the wall closest to the camera.

Once cameras are properly pointed, it is a good idea to save a screen shot of Stage Administration's 'Cameras' view for future reference. To do so, with Stage Administration activated, press Alt-Print Screen on your keyboard. This will place a screen shot of the application in your computer's internal clipboard. Open up Paint.Net and use the paste command (Ctrl-V) to bring the image into view. Save this screen shot in your favorite image format.

3.4   Cables

The Organic Motion StageView Fire120 cameras are connected to the Vision Processor via Firewire cables and active Firewire extenders. The Firewire cables are a 6p to 6p male to male cables. The Firewire active extender cables are 6p to 6p male to female cables. The Firewire cable connects to the camera, and then to the Firewire active extension cable then into the Vision Processor. There can be up to three extension cables and a Firewire cable for a total of 60 feet of cables. All cables are labeled 1-14 corresponding to the camera number specified in Figure 4 - Camera Placement and Numbering on page 8, and are labeled on both ends of the cable.

3.5   Networking

The Vision Processor has a Gigabit Ethernet connection and should be connected to a Gigabit switch. If it is not connected to a Gigabit network,motion streaming should work, although streaming of other data will be hampered severely.

4 Vision Processor

The Vision Processor contains an LCD menu, a power cable, 14 video cables and an ethernet cable connected to it.   It can be controlled through the LCD menu in the front panel, or using software that connects over the ethernet.

4.1 LCD Menu

The LCD menu provides status about Stage™ as well as the ability to control the Vision Processor. There are six buttons: Up (▲), Down(▼), Left(◄), Right(►), Cancel (×) and Accept (✓). The menu is organized into a tree structure. To move between sections press ▲ or ▼. Cancel can be used to return to the beginning of the menu. To select a command or move into a section press ► or ✓. To move back to a parent section press ◄ or ×.

Figure 5 - LCD Menu

Table 4-1: Organic Motion Stage™ Vision Processor LCD Menu

1. Organic Motion Stage
   a. 60 FPS Start?
   b. 90 FPS Start?
   c. 120 FPS Start?
2. Stage Status
   a. Camera Count
   b. Clients Connected
3. IP Settings
   a. IP Address
   b. Gateway
   c. Subnet
   d. DNS
4. System Info
   a. OMT Version
   b. Updater Version
   c. HW Version
5. Reboot
6. Shutdown
7. Advanced
   a. Update Camera Drivers

The **Organic Motion Stage** can start the Tracking Application in one of three modes: 60, 90, and 120 fps. There are specific reasons why you would want one mode over another, and you can speak to your OM representative about your particular situation. In order to start the Organic Motion Tracking application press the ► or ✓ while one of the modes is selected. If the application is already running you may stop the application, or just start a different mode.

The **Stage Status** provides information about the current Organic Motion Stage™. This includes the current number of cameras that are detected out of the required number of cameras by the Vision Processor and also the current number of clients that are connected to the Tracking Application (OMT).

The **IP Settings** are used to set the networking setup of the Organic Motion Vision Processor. The Vision Processor does not support DHCP and the IP address must be manually set. You may need to contact your local network administrator for a static IP address for the Stage Vision Processor.

The **System Information** provides the hardware (HW) version, Organic Motion Tracking (OMT) version, and Organic Motion Updater versions installed on the Vision Processor.

The **Reboot** and **Shutdown** options allow for the reboot and shutdown of the Vision Processor.   This is NOT the same as a restart of the tracking application, which can be done using menu 1 (Organic Motion Stage) as seen as in Table 4-1.

Lastly the, **Advanced** section contains Update Camera Drivers and is used to manually re-acquire the cameras. This is only necessary when directed by the Organic Motion Support team and should not be used during regular use. IMPORTANT: At least one camera must be plugged into the Vision Processor in order for 'Update Camera Drivers' to succeed.

4.2 Vision Processor Setup

The only setup necessary for the Vision Processor through the LCD menu is the IP address. After this all subsequent setup is using the Stage Administration software.

4.2.1 IP Address Setup

Speak to your network admin to see what IP address is allocated for the Organic Motion Stage™. You will also need the gateway, subnet mask, and DNS server. Press ▼, ➤, ✓ to start editing the IP address. Press ▲ or ▼ to modify the selected digit and ➤ or ◀ to cycle through the digits. At any time press × to cancel or ✓ to accept.   If there is an error setting the IP address refer to section 10.2.1 - Setting the IP address.

4.3 Start the Tracking Application

The Tracking Application has three different tracking modes: 60, 90, and 120 fps. The 60 frames per second (FPS) mode acquires the pose of a person at 60Hz. Best suitable for slower movements such as walking, this mode provides the best tracking accuracy. The 90 FPS mode improves tracking of fast motions, while keeping a good balance between accuracy and speed. The 120 FPS high speed mode is capable of tracking very fast movements sacrificing some tracking accuracy. You may switch between modes at any time, however, currently connected applications (MotionBuilder Plugin, custom applications etc..) must re-connect. **Note:** Once the tracking service is stopped, the cameras become inactive.

5 Client Software

Organic Motion provides a variety of flexible software solutions to control and use Stage™. The OM Stage Administration (Section 6, page 12) application provides a complete set of functionality for initial setup and optimization. The OM Stage Plugin for MotionBuilder (Section 7, page 37) is intended to be used by animators who can use Stage™ as a powerful tool to create stunning motions instantaneously. On the lowest level, the Organic Motion Software Development Kit, or 'OMSDK' (Section 8, page 37) provides programmers a robust and easy-to use C++ interface to create next-generation applications for entertainment, research and many other fields.

6 Stage Administration™

The Stage Administration application is the gateway to the Organic Motion Stage™. All functionality for maintaining and running the Stage™ is available in this application.

6.1 Requirements

The Stage Administration software has been tested successfully on Windows XP, Windows Vista, Windows Vista x64, Windows 7, and Windows 7 x64. The provided installer copies all necessary files onto the client computer. The client computer should have at least 1GB of RAM (200MB free) and a modern 3D graphics card with DirectX 9.0 capabilities. Supported platforms are MS Windows XP (32/64), MS Windows Vista (32/64), andWindows 7 (32/64).

6.2 Areas of the Stage Administration™
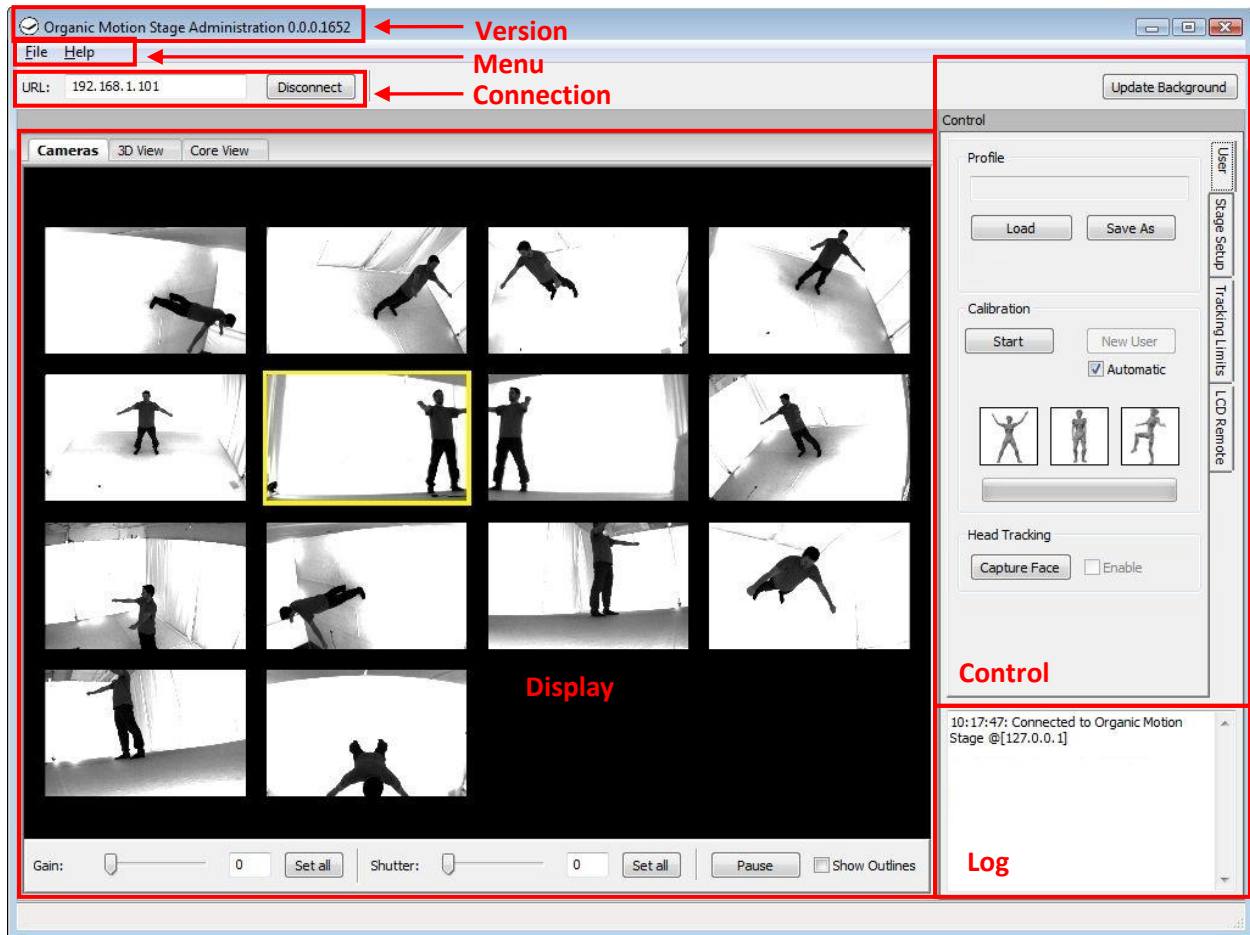
Figure 6: Stage Administration Main Window

The Stage Administration is arranged in six main areas described in Table 6-1.

Table 6-1: Stage Administration Areas
1. Version
2. Menu (File, Help)
3. Connection (URL)
4. Display
5. Control
6. Log

Version: Displays the current version of the Organic Motion Stage Administration software.

Menu: Contains access to the 'Advanced' dialog, provides the ability to update the server software and also to obtain the version of the Stage Administration Software.

Connection: Contains the URL textbox and Connect button. In the URL textbox is where the IP address of the Organic Motion Stage Vision Processor should go (ex: 192.168.5.40). You may also put in the name of the Vision Processor which is posted on the back of the machine (ex: SVP030). Connection may take up to five seconds.

Display: The display area contains three tabs; *Camera, 3D View,* and *Core View.*

Control: The *Control* area has many of the controls for setup, configuration and running of Stage™. This is described in depth in section 6.3 - Setup.

Log: The *Log* section contains status messages about the current versions of all applications (Client, SDK, Vision Processor) as well as status messages for commands sent.   If there are errors or problems with connecting the Stage Administration, or any client application the version number can help determine what could be wrong.

6.2.1 Version

The version number is displayed on the top of the Stage Administration. This is needed by Organic Motion if there is any trouble with the Stage Administration in any way.

6.2.2 Menu

6.2.2.1 Advanced Dialog

The advanced dialog provides access to advanced server functionality and experimental features:

Server Log Files: The Vision Processor contains maintains log files that can provide information to help Organic Motion Support diagnose server problems. These controls are used to retrieve them.

Stream Rate: Throttles the transmission speed of camera video from the server. Adjusting this slider may be useful for particular client HW types, but is usually not necessary.

Lens Calibration Reset and Update: Utilizing these controls is only necessary upon direction by an Organic Motion Support Professional.

Figure 7 - Advanced Dialog

Show Transport Controls: Enables controls in the 3D view that allow recording and playback of Organic Motion motion data files.

License: Use these controls to update and retrieve the license on the Vision Processor.

6.2.2.2 Update Server Software

The Stage Administration allows full control for updating Vision Processor software. The two products on the Vision Processor are the tracking software (Organic Motion Tracking) and the updater software (Organic Motion Updater).   You do not need to connect the Stage Administration to the Vision Processor in order to obtain version information or update the server. First open the Update Server Software window by going to Update → Update Server Software. The window in should pop up. Next, type in the address of the Vision Processor. This can be obtained from the LCD Screen on the Vision Processor as described in 4.1 - LCD Menu. Click 'Fetch Server Versions' and the tree will populate with the installed products, their respective versions, and the installation date of each version. The version currently running is marked in bold.
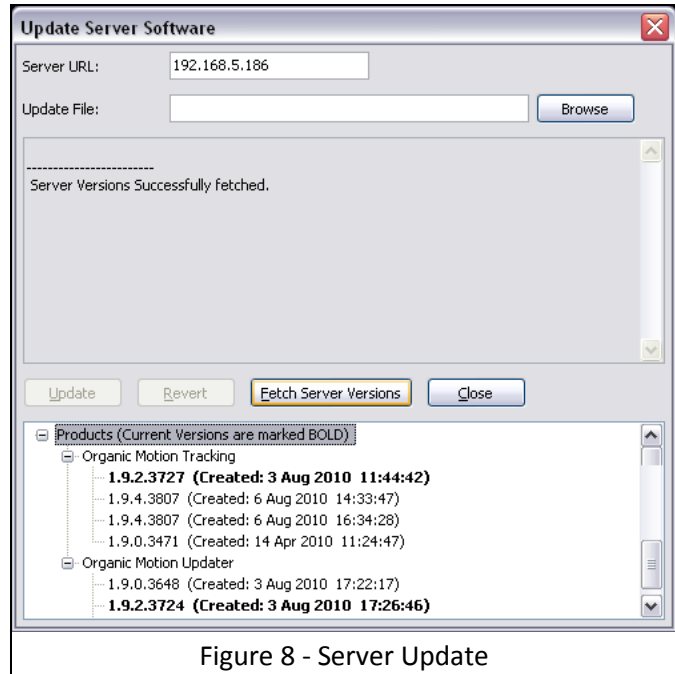
Figure 8 - Server Update

6.2.3 Display

6.2.3.1 Cameras

When connected, the *Cameras* view displays video for all of the cameras in the Organic Motion Stage™ (If any cameras are not working they will have a checkerboard pattern as in). This view allows the user to manipulate the gain and shutter of all video streams. In
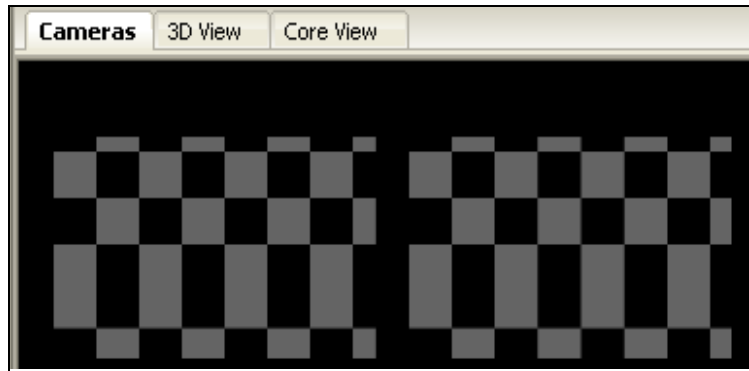
Figure 9: Stage Administration Camera Error

order to select a stream, simply click on it. Then you can manipulate the gain and shutter with the corresponding sliders under the viewport. If you double click on the video stream,it will expand, and if double clicked again, it will return. You can also view the image outlines in this view. Note that the order of the images in the *Cameras* view does not necessarily correspond to the order illustrated in Figure 4 - Camera Placement and Numbering.
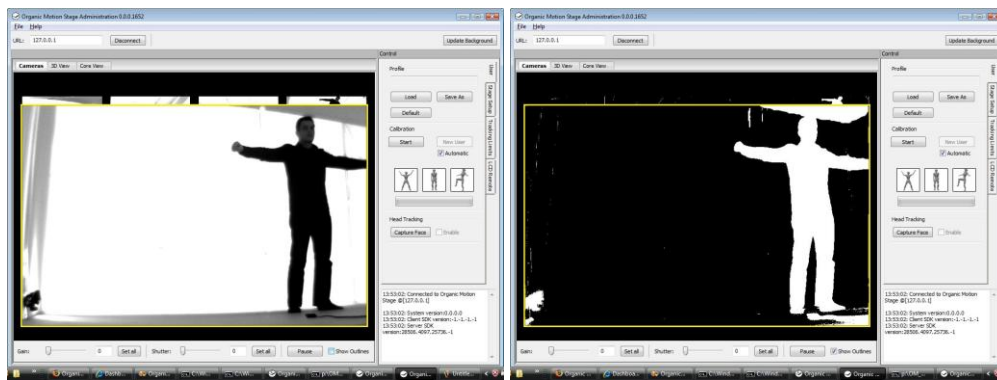
Figure 10 - Video and Image Outline

6.2.3.2 Image Outlines

In order to view the image outlines, check the 'Show Outlines' box at the bottom of the *Cameras* view. The image outlines allow you to see how the lighting affects the system. If in any of the streams you do not see the person as 'white' then the lighting, masks, or background threshold need to be modified. Also, the Background 'Threshold' in the 'Stage Setup' tab can be seen in this view. Viewing the image outlines does take extra processing power on the server, so this view should not be used while tracking for performance.

Figure 11 - Image Outlines

6.2.3.3 3D view

The 3D view provides a lightweight view of the 3D scene and the skeleton. This is where you can view the tracking limits, view the motion of the actor and choose the texture tracking cameras. The tracking limits are enabled when the box is green, and red when they are disabled. The 3D view has the following controls:

- Alt-Left click, drag to rotate
- Alt-Right click, drag up/down or right/left to zoom in/out
- Alt-Middle click, drag to pan

Figure 12 - 3D view - Tracking Limits Enabled

If 'Show Transport Controls' has been enabled in the Advanced Menu, then the transport controls toolbar will also be present. Using these controls, you can record and playback motion from within Stage Administration.
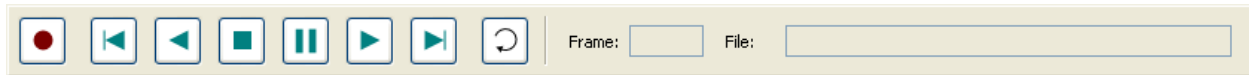
Figure 13 - Transport Controls

> NOTE: This feature records and plays files of type .om2. This file type is currently NOT compatible with Autodesk MotionBuilder or any other Autodesk software, and therefore cannot be imported and used for animation in these programs. .om2 files can, however, be read by the OM Sample Data Server, which can then stream this data to applications that have integrated the *Organic Motion SDK*.

To record, click the 'Arm Record' button and choose a file. This arms the recording session, but does not capture any data. You must then click the highlighted 'Forward' button to begin the data capture (the frame numbers will start to increase). While the data is recording, you can click the 'Forward' button again to pause the capture without ending the recording session. Clicking 'Forward' again continues the capture.

To play back, click 'Forward' and then choose the desired file from the file dialog. Once playback has commenced, you may pause, play in reverse, and jump to the beginning or end of the file with the corresponding buttons. While paused, the 'Forward' and 'Backward' buttons allow for single-frame advancement. By default, loop mode is enabled; disabling loop mode will prevent the frame counter from advancing when the end of the file (or beginning of the file for reverse playback) is reached. You need not be connected to a Vision Processor to play back motion files.

6.2.3.4 Core view

The core view provides a richer view of the running system, although it demands more resources. The core view is where you can view and manipulate the data inspector which can in turn modify the tracking limits. If there are white balls at the corner of the box then the tracking limits are enabled. The data inspector and tracking limits are described in section 6.3.5 on page 28. The Core view has the same controls as the 3D view:

- Alt-Left click, drag to rotate
- Alt-Right click, drag up/down or right/left to zoom in/out
- Alt-Middle click, drag to pan

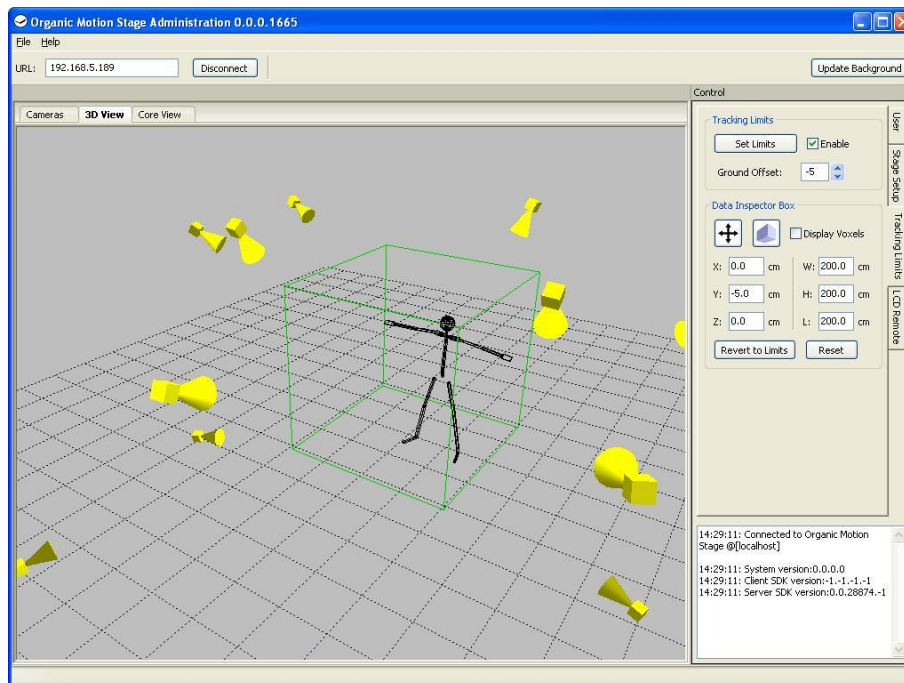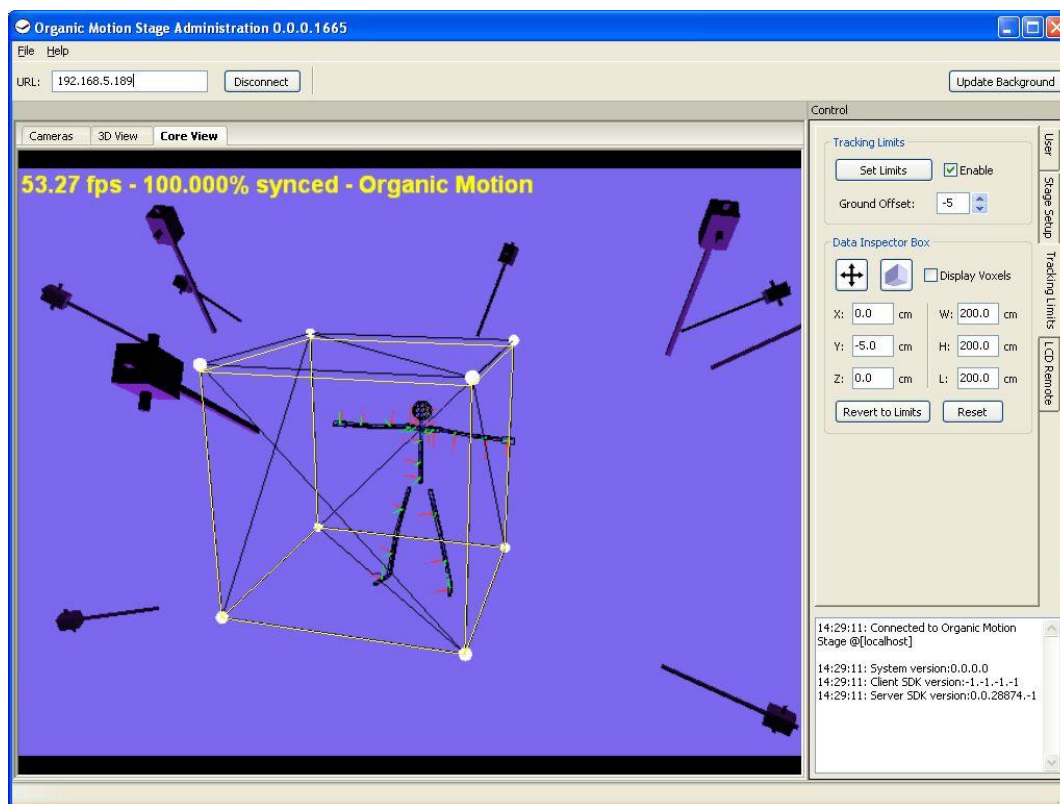**Figure 14 - Core View - Tracking Limits Enabled**

6.3 Setup

6.3.1 Connection

In order to connect to the server, simply go to the server and obtain the IP Address. Type it into the URL section. Press connect. If the system cannot connect an error dialog will appear. If the system can connect and Organic Motion Tracking is running, the videos will begin to stream and all functions will be available. If Organic Motion Tracking is not on then only the LCD Remote will be connected. Please refer to the Troubleshooting section if you cannot connect.

6.3.2 Camera Calibration

Camera Calibration (room calibration or wand calibration) is an integral part of all modern motion capturing systems. The items shown in Figure 15 – *Calibration Triangle* and Figure 16 - *Wand* are the tools that are used in order to perform the room calibration. The purpose of the room calibration is to allow the Vision Processor to determine where each camera is located in 3D space (wand) and to show the system where the floor is, what direction is

Figure 15 – Calibration Triangle

Figure 16 - Wand

forward, and also a global scale value (triangle). The first time the system is started, all cameras will be located at the origin.
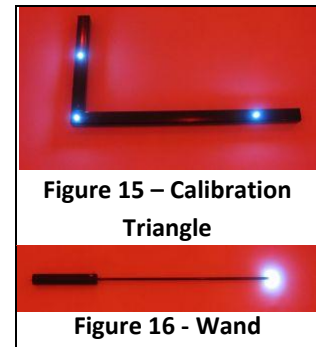
The room calibration process has four main steps and should take only a few minutes.

To get started first:

- Click on the 'Cameras' tab in the display area.
- Click on the 'Stage Setup' tab in the control area.
- Click on the 'Calibration Wizard…'

Figure 17 - Control Window – Calibration Wizard
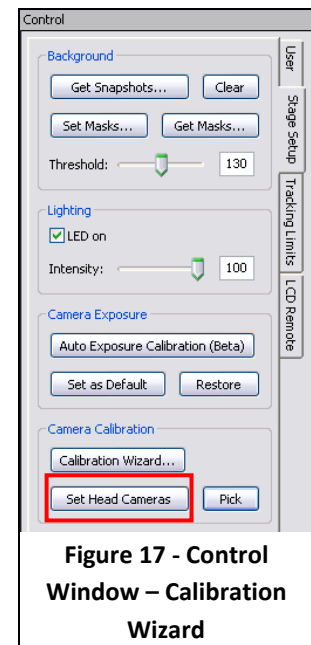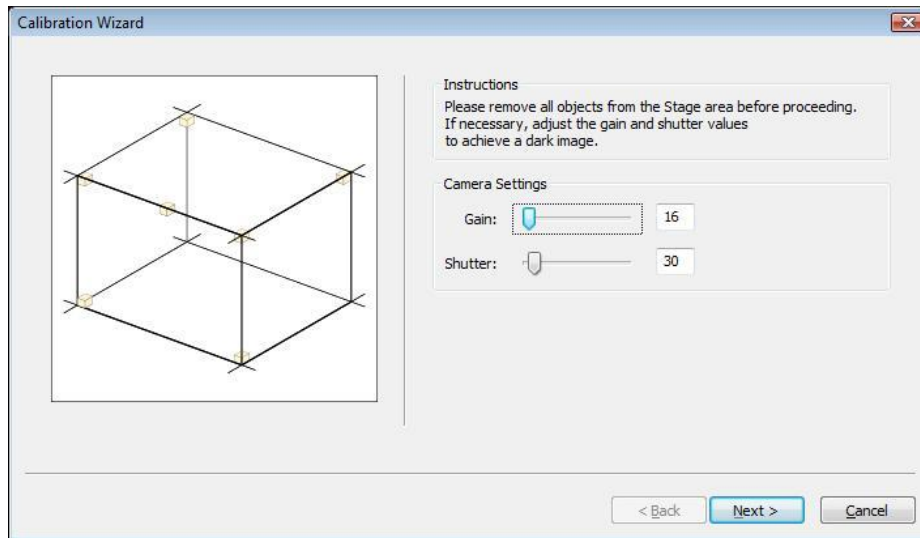
Figure 18 - Camera Calibration 1 – Choose Lighting

Step 1 – Lighting Settings: First you will choose a lighting setting which makes the cameras practically black but the wand will show up as a white dot (Figure 18 - Camera Calibration 1 – Choose Lighting). The default values should be fine. When the 'Next' button is pressed the system captures a background image. It is important that when you click 'next', the wand or any moving/changing light is not visible by any camera. If it is, then calibration may not work correctly.
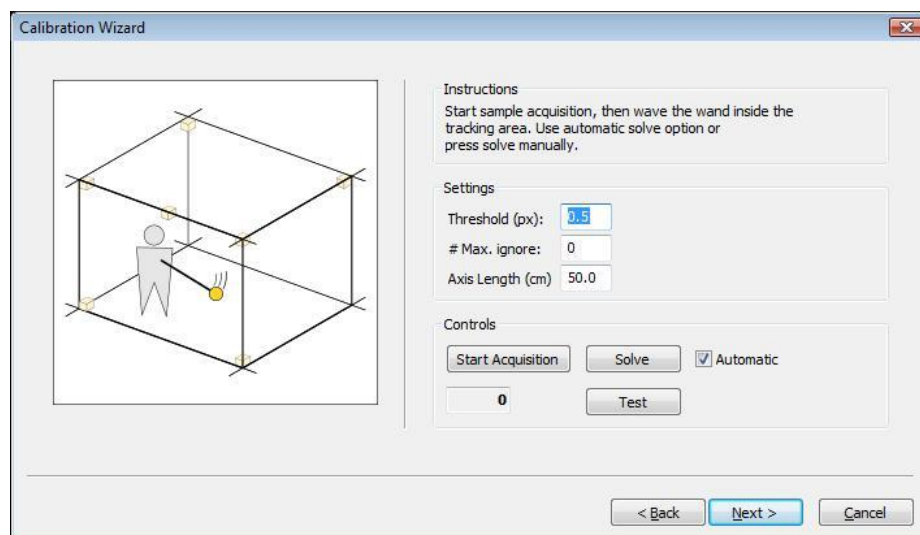
Figure 19 - Camera Calibration 2 – Acquire Wand Points

Step 2 – Acquire Wand Points: you will see Figure 19 - Camera Calibration 2 – Acquire Wand Points. This is where you will move the wand in the calibration space and the system can calibrate positions of the cameras.

- Threshold – should not need to be modified. Threshold to filter bad samples is (0.2 – 1.0). The higher number allows for more difficult calibrations.

- # Max ignore – the number of cameras that the system should allow not to calibrate.
- Axis Length (cm) – the distance between the lights on the long arm of the Calibration Triangle displayed in Figure 15 – Calibration Triangle. This should not be changed.
- Start Acquisition – start acquiring points
- Solve – Calculate the quality and generate new calibrations for all cameras
- Automatic – automatically solve as points are being acquired
- Test – test the existing calibration – It will give you a quality value of your current calibration.

The default settings do not need to be modified.
1. Click on 'Start Acquisition'
2. Walk into the space and turn on the wand.
3. Wave the wand in big circles. It is not necessary to move quickly. You should make sure that you move into the view of each camera and are at least a foot or more away from all cameras most of the time.
4. When the system is finished the lights will flash.
    a. If it is taking too long you can at any time press 'solve' to manually solve.
    b. You should have between 500 and 800 points. If there are much more then there may be an issue. You should consult section 10.3 - Tracking & Calibration or read on.
5. Figure 20 - Camera Calibration 3 – Calibration Result will appear where you can review your results.

If there are any missing cameras, the drop down will have the camera numbers of the missing cameras. These numbers start at '0' and go to the number of required cameras. If there are any missing cameras please consult Troubleshooting section 10.2.9. If you would like to continue without calibrating the missing cameras, go back to the previous screen, put in a number for # Max. ignore and click solve again. The quality of the calibration should be in the high 90's in order to be considered a working calibration. Generally, a calibration is considered good if it has a quality above 98.
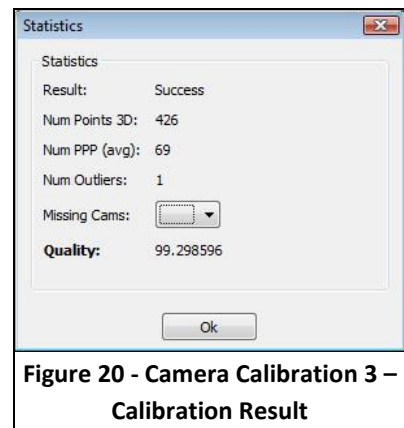
Figure 20 - Camera Calibration 3 – Calibration Result
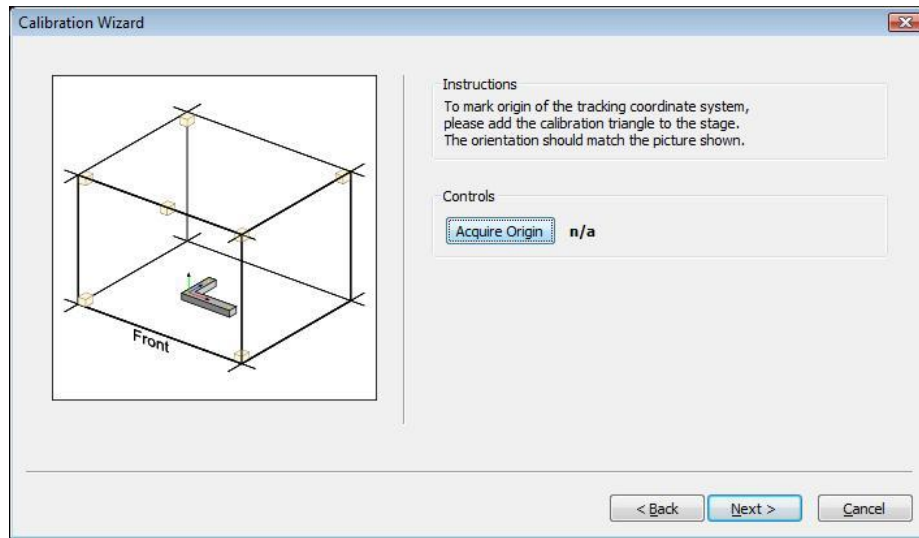
Figure 21 - Camera Calibration 4

Step 3 – Orientation and Scale: Once the cameras have been calibrated, the system must have the floor and size calibration. Place the Calibration Triangle on the floor LEDs up with the short edge facing the back of the capture space. Make sure it is on with all 3 LEDs brightly lit. Place the corner of the Calibration Triangle in the center of the tracking space. This will be the '0,0' position. Make sure that the Calibration Triangle is as square to the space as possible as you want the cut box / tracking limits to fit nicely within the tracking space. Now click 'Acquire Origin'. The system should say 'Success'. If it failed please move the Calibration Triangle slightly and try again. Press 'Next' once you receive 'Success'.
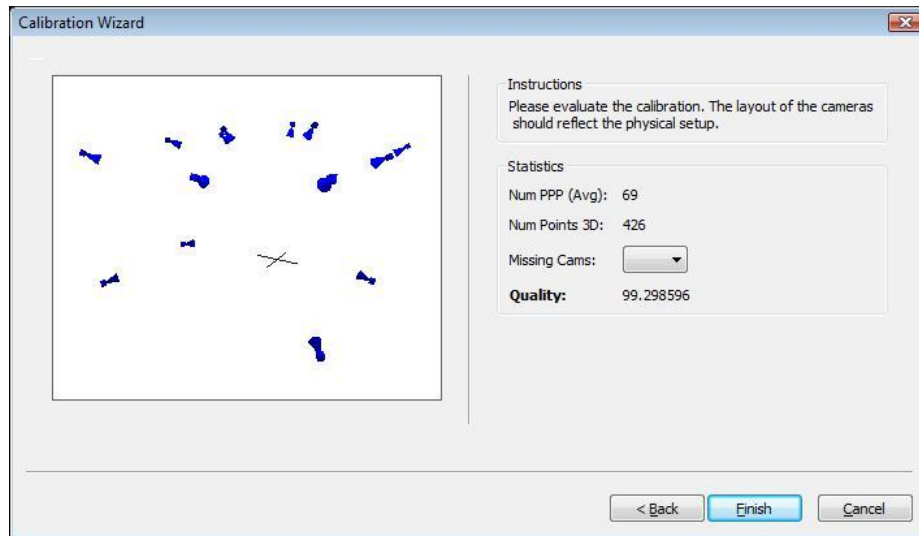
Figure 22 - Camera Calibration 5

Step 4 – Review: Now you have successfully calibrated Stage™. You may view the calibration in this window to verify that it is reasonable. In this window you can use the same mouse controls as you would use in the normal 3D view or Core view.   If you are not satisfied with the calibration you may click back and calibrate again. Otherwise, click Finish and you will be returned to the regular Stage Administration.

6.3.3 Background and Masks

Stage™ creates a background of the current scene in order to aid in motion capture. The background is sensitive to lighting conditions, so in general, each time something changes – camera position, lighting, masks – the background needs to be updated. It only takes about one second to update the background and it should be done often to guarantee high quality motion data.

In order to aid the system in differentiating between reflective material and non-reflective material, background masks are created. In order to generate background masks, first decrease the gain/shutter so that the images are not too bright and you can see all areas clearly, then click on 'Get Snapshots' and then choose a destination directory and file name. This can take 10 seconds or more. Open up the files in 'Paint .NET' (a free paint program for Windows at http://www.getpaint.net/). All areas in the image that are NOT the reflective material should be painted black

Figure 23 – Background and Masks

(0,0,0). This includes visible cameras as well as the halos from their LED lights. The only areas that are part of the 'mask' are areas that are painted black. See Figure 24 - Example Background Mask. When finished painting and saving all your masks (the original .BMP file format should remain unchanged), click 'Set Masks' and choose your first mask file. This will load all the masks of the same series (i.e. – mask0001.bmp, mask0002.bmp, etc.). Please note that this process can take 10 seconds or more.

Figure 24 - Example Background Mask

The last control in the Background group is the 'Threshold' or 'Background Threshold' control. Adjusting this value changes which color values in the image are considered as background, and which are considered as foreground. Bringing this value towards its upper bound will cause only the lightest parts of the image to be considered background, and as such, will introduce noise into the system. Conversely, bringing this value too low will remove information from the foreground, possibly placing 'holes' in the tracking subject. The best value is somewhere midrange, and depends on the lighting conditions of your scene.

6.3.4 Camera Exposure and Lighting adjustments

The lighting for the cameras is very important. There are three steps in order to achieve correct lighting.

1. LED Intensity
2. Manual Camera Exposure Calculation
3. Automatic Camera Exposure Calibration

The light intensity is the brightness of the LEDs on the cameras. Generally, the brighter the light, the brighter the background, but the subject also gets brighter, so usually something around 50% - 100% is optimal. First turn the LEDs on and set to about 75%. You can turn the lights on in the Lighting section displayed in Figure 25 - Lighting and Camera Exposure Controls.

The first time around, you must manually adjust the exposure for each camera. Adjusting the exposure involves changing the gain and shutter settings to achieve a combination of good ambient lighting and good contrast between the foreground (i.e., the user) and the background. If the user looks 'washed out' then the image is too bright, and conversely, if the user appears completely black then the image is too dark.

The figure below shows a well-lit Stage™.
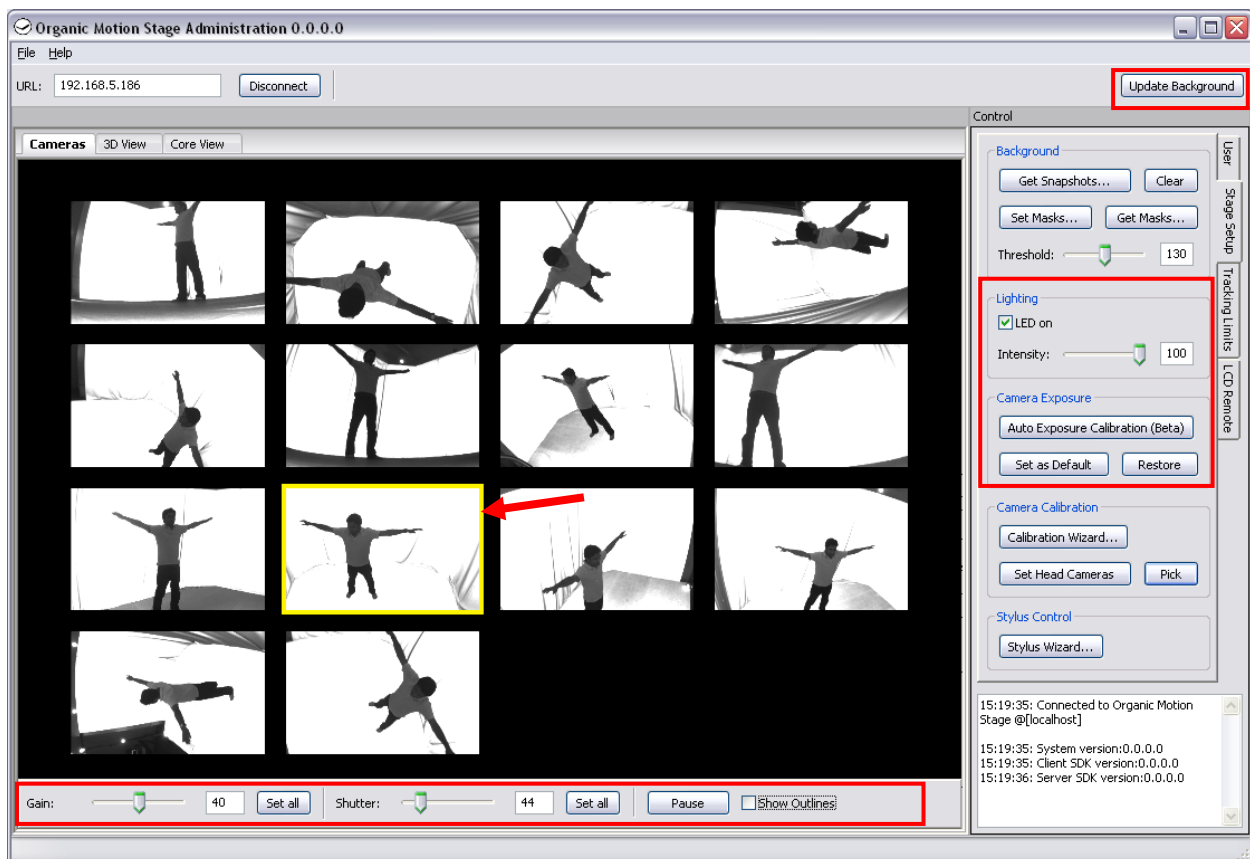
Figure 25 - Lighting and Camera Exposure Controls

Go through each image that is too dark/bright. When you click on the image a yellow box will appear around the selected camera. You may double click an image to enlarge it. Double click it again to restore it to its original size. When an image is selected you can manually modify the gain shutter for individual cameras. Below is the order to keep in mind when doing the manual lighting calibration.

1. Too bright
   a. Lower ambient light
   b. Lower camera light intensities
   c. Lower shutter, then gain
2. Too dark
   a. Raise camera light intensities
   b. Raise gain, then shutter
   c. Raise ambient light

Once the lighting setup has been finished, be sure to update the background. Click the 'Update Background' button on the Top-Right of the Stage Administration Application.

NOTE: You may notice that the lighting for higher-speed modes may be slightly darker than lower-speed modes. This is normal. The lighting should be adjusted per mode, as these settings are independent from each other at 60fps, 90fps, and 120fps. Each mode saves its own lighting settings, so you should not need to re-adjust when switching between modes

When you are satisfied with the exposure settings, click 'Set As Default.' Doing so captures a profile of the exposure of each image. Now, even if the exposure settings are adjusted improperly, you can always return to your default state. To do so, click the 'Restore button under the Camera Exposure controls. This will perform an automatic camera exposure calculation and will take a few seconds. No one should be in the system during this time.

As of version 1.9.4, Stage can perform an automatic exposure evaluation and calibration with no input from the user. During this process, Stage will choose the best LED, gain, and shutter settings. To calibrate lighting this way, simply click the 'Auto Exposure Calibration' button, as seen in Figure 25. You must be in 60fps mode for this calibration to function properly.

6.3.5 Evaluating Lighting Quality

Open the Data Inspector Box group and check 'Display Voxels' to turn on the voxel view. Have the user walk through the system and get a feel for the area. A good lighting setup will strike a balance between too much data (which will introduce noise into tracking) and too little data (which will appear as 'holes', or 'bites' out of the subject).

The 'outline' view is a powerful tool for evaluating the lighting setup. Each outline image can be thought of as a single component contributing to the synthesized 3D voxel view image. If there are sections on the user that are black in any of these outline views, those sections will cause the 'holes' or 'bites' mentioned above. In these cases, the lighting, masks, and/or background threshold should be adjusted.

You can also have the user wear darker clothes to improve the contrast between foreground and background.

6.3.6 Camera-Specific Lighting

The following guidelines are for adjusting the lighting parameters for specific camera groups.

Floor Cameras: You may notice that for the cameras close to the floor (1,2,3 and 4 in Figure 4 - Camera Placement and Numbering), the walls are easily illuminated, but the floor usually remains gray. This is because the angle between the floor and the camera is too shallow for the retro-reflective material to reflect the light back to the camera. This is fine; however, when adjusting the camera settings for these views, focus more on properly illuminating the walls, and make sure that the floor is a decently-light shade of gray. You should not mask out the floors in these cameras.

Top Edge Cameras: Some of the cameras on the top border of the truss (e.g., 6,7,9 and 10 on Figure 4 - Camera Placement and Numbering) point towards the corners of the space where, as above, the angle between the floor and the camera becomes too shallow for the retro-reflective material to reflect. The gray in these cases will affect tracking more than above (i.e., than with the floor cameras), and so care should be taken to minimize this with proper lighting settings. You can also use the background threshold control to further remove the effects of these grays on tracking.

6.3.7 Data Inspector and Tracking Limits (Cut Box)

The Tracking Limits is the volume in the capture space which defines the valid capture space. This is necessary so the system can simply exclude areas where there may be a large amount of noise. This can be enabled and disabled quickly using the 'enable' checkbox in the Tracking Limits section.

The tracking limits are shown in the 'Core' view. The tracking limits volume is the black wireframe cube. If there are white spheres on the corners,that means that the tracking limits are enabled.

The data inspector box is the yellow box. You can manipulate data inspector by using the translate ⊕ (keyboard shortcut: w) and scale ◣ (keyboard shortcut: e) buttons in the 'Data Inspector Box' area. At any time, you may press the 'Revert to Limits' which will set the data inspector to the current tracking limits, or 'Reset' which will reset the data inspector to a unit cube. The power of the Data Inspector Box comes from the 'Display Voxels' checkbox. With this you may view the 3D data inside of the Data inspector volume. This mode is very computationally intensive mode, so expect the performance speed to slow down.As such, this mode should be used for debugging or display purposes only. At any time, when you have sized the Data Inspector Box to an acceptable tracking limits you can click the 'Set Limits' button to set the tracking limits to the current data inspector. (Note: The tracking limits must be enabled in order to do this.)
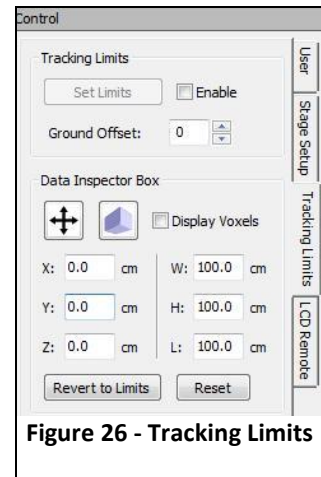
Figure 26 - Tracking Limits
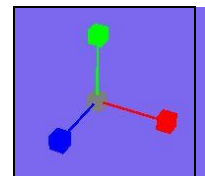
Figure 27 - Scale Widget`
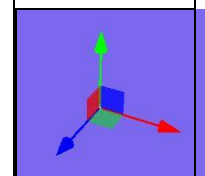
Figure 28 - Translate Widget

6.3.8 Setting the Tracking Limits

In order to set the tracking limits:

- Click on the 'Core View' then click on the 'Tracking Limits' tab.
- Check 'enable' under 'Tracking Limits' and click 'Display Voxels' in the Data Inspector. Now you are ready to place the Data Inspector Box to where you want the tracking limits.
- When the translate button is enabled, three arrows will appear along their axis as well as three planes. Each axis will translate in its individual axis, while the plane will translate along the two axis that define the plane.
    - Make sure to be perpendicular to the axis that you are trying to modify. It will make it a lot easier to set the limit
- When the scale button is enabled, three boxes will appear along their axis and one in the center. Each box will scale along its respective axis when click/dragged and the center box will scale all three.
- Walk around the area and verify that there is not a large amount of noise inside of the Data Inspector. If there is then you should shrink it so there is not a large amount of noise, or possibly consider changing the lighting conditions or moving cameras.
- When the Data Inspector is in the correct position click 'Set Limits' in 'Tracking Limits' to set the Tracking Limits to the Data Inspector.

6.3.9 Setting the Head Tracking Cameras

In order for head tracking to work correctly you must specify the head tracking cameras. The head tracking cameras should be cameras 5-11 as described in Figure 4 - Camera Placement and Numbering.
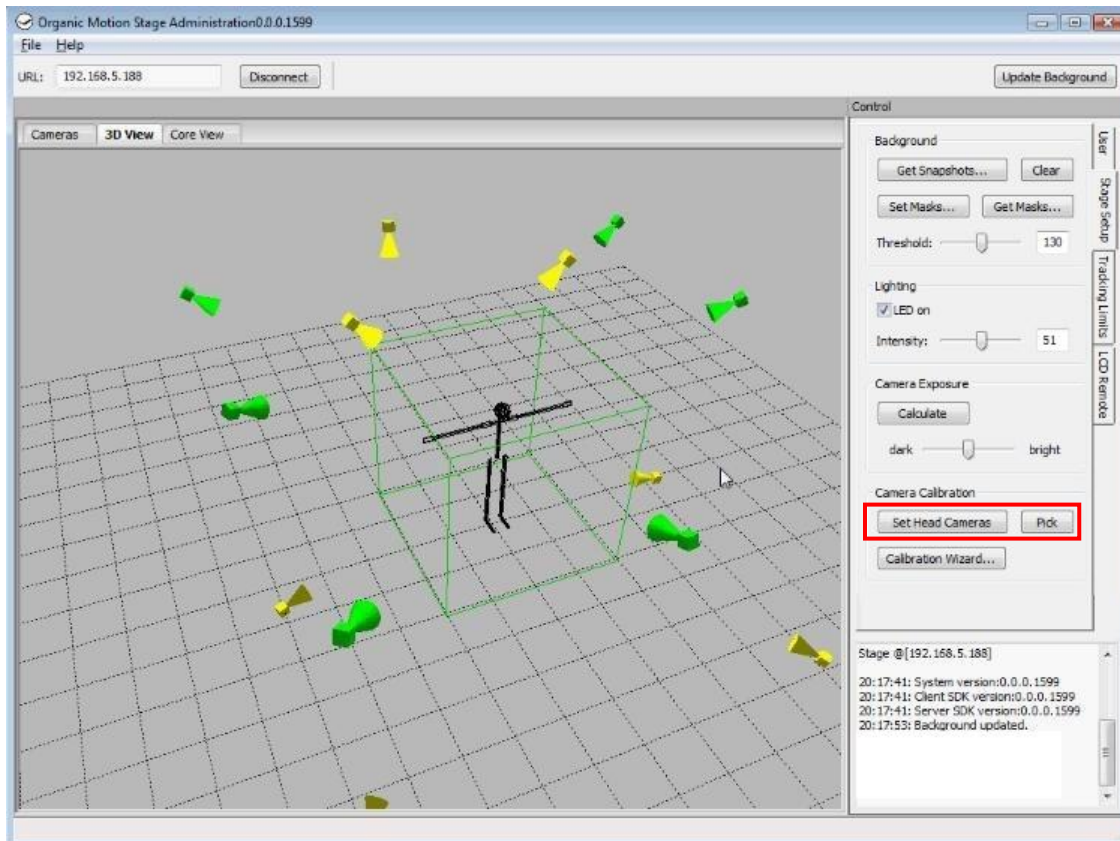
Figure 29 - Setting Head Cameras

In order to set the texture cameras:

- Click on the 3D View
- Click on 'Stage Setup'
- Click on Pick. Now you are in 'pick' mode
- Click on cameras 5 – 11. They will turn green as they are chosen. You can click them again to de-select them. You may need to zoom in/out, pan, or rotate the 3D view.
- Click on 'Set Head Cameras'

6.4 Tracking

The system must be setup before tracking. Setting up Stage™ encompasses hardware setup, camera calibration and lighting setup. Either the MotionBuilder Plugin or the Stage Administration tool may be used to track a subject.

6.4.1 Acquisition

The user that is to be tracked should move into the capture space. As they enter, the acquisition process should begin. This process consists of a special sequence of measurements to determine specific information about the subject. You can open the 'Core View' to see the acquisition process in action, as in the 'before' image of Figure 30.

NOTE: During the acquisition process, you will notice voxel data in the Core View. This voxel data is a visualization of the acquisition process, and should not be confused with the voxel data shown when you use the 'Display Voxels' feature of the Data Inspector Box. The latter feature visualizes everything within the data inspector box, while the acquisition engine visualizes only a small subset for efficiency, and therefore may appear to have missing data. This is normal behavior.
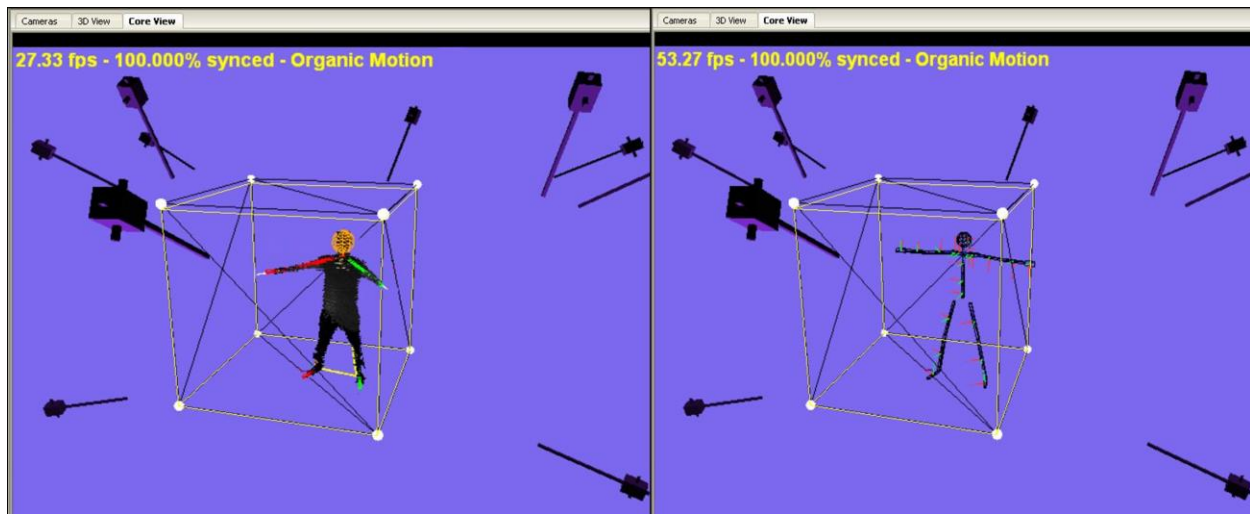
Figure 30 -- Acquisition Process: During and After

Once the user is in the area, he or she should stand shoulder width apart, with arms out to the side, about shoulder height. This is the 'T' pose. Once the user is in 'T' pose, a tracking figure should snap into place and the acquisition voxels disappear, as in the 'after' image of Figure 30.

6.4.2 New User & User Calibration

Each time a new user steps in the space, you may click 'New User' to tell the system that there is a new subject in the system. Doing so reverts the bone sizes to the default proportions, and scales them based on the height of the user. You may optionally check the 'Auto' checkbox to perform this function each time it acquires a person. This is useful if you have many different users constantly entering the system, and if tracking accuracy is not of utmost importance.

Leaving 'Auto' unchecked is useful in circumstances where you do not want the bone sizes to change very often, if at all. This is usually true in cases where accuracy is of utmost importance, or where a client application is making certain assumptions about the bone sizes.

Figure 31 - User Calibration

In general, accurate bone sizes allow for better tracking. To have the system more finely measure the user's bone sizes and proportions, you must perform a user calibration.

6.4.2.1 Calibrating a user

In order for the system to calibrate specifically for a user:

- You must be tracking the user
   - ○ The user should step into the capture space
- Click on 'Start'
- The user should stand in the three poses specified by the three pictures. The order does not matter. As the system 'sees' the pose it will turn green.

Figure 32 - Calibrating User

   - ○ The 'X' – hold in that pose until green
   - ○ Standing up straight and arms by your side – slowly swivel from side to side.
   - ○ Leg at 90 degrees – slowly move the leg up and down
- You may stop the user calibration at any time and the parts that were calibrated will be applied

6.4.2.2 Saving/Loading a user calibration

After calibrating a user, you can click 'Save As' to save to your local hard drive. Then, before or during tracking, you can click 'Load', browse to a previously saved calibration, and apply that user calibration.

6.4.3 Head tracking

Head tracking allows Organic Motion to track the direction of the subject's face. In order to enable head tracking, do the following

- Make sure that the texture cameras have been set up.
- Make sure that the video has enough contrast on the face
- The person in the capture space should look forward. Ensure the head is not tilted.
    o Click 'Capture Face'.
- Check 'Enable'.

If the head is tracking, please refer to section 10.3.4 on page 42.

6.4.4 Spine tracking

Enabling spine tracking allows Stage to more accurately model the curvature of the bones in the user's torso.

If a straighter spine model works better for your application, you can disable spine tracking by unchecking the corresponding checkbox on the User tab.
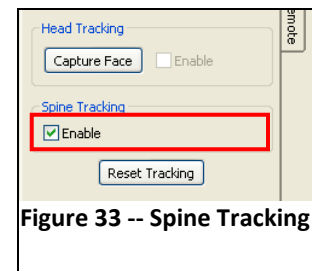
Figure 33 -- Spine Tracking

6.5 Video Recording (optional)

Vision Processors with the optional recording feature are capable of recording the video of all cameras at 60 fps to an internal mass storage. The stored videos can be used to re-process a tracking session with future versions of Stage.

6.5.1 Video Controls

The video controls dialog is accessible via the File menu. In order to record the current video, specify the video name in the "Video name" text box, and click on the record button.

Previously recorded videos are shown in a list along with their extended information. To play back a video, select the desired video and press the playback button. By default, videos are played back in a continuous loop. This behavior can be disabled by toggling the 'loop' option.
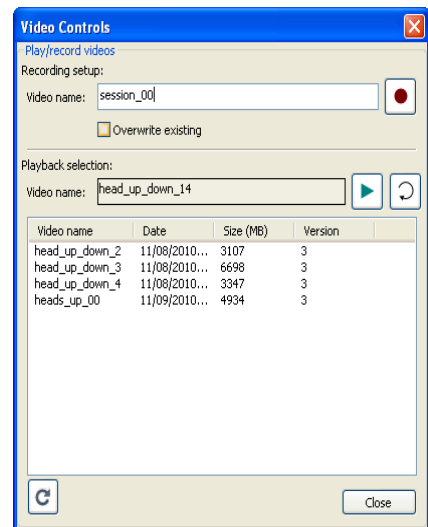
6.5.2 Video Manager

Videos recorded by Stage are stored on the Vision Processor, much like a home DVR system. For backup purposes, and because the storage space is limited, videos can be transferred to a removable storage device (USB) attached directly to the Vision Processor.

The video manager is accessible via the Stage Administration File menu. Use this dialog to delete videos and/or to move them between the Vision Processor and the removable storage.
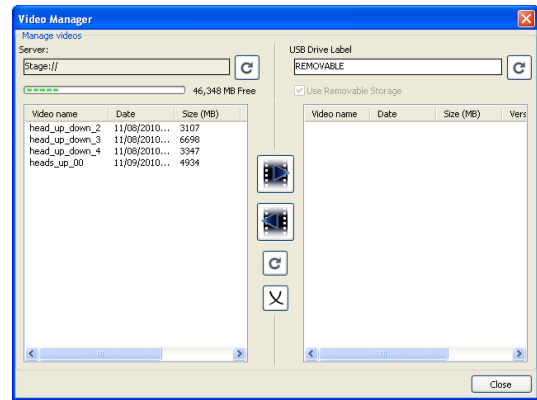
Removable storage devices identify themselves to the Vision Processor by their labels. To specify your own, enter its drive label in the dedicated text box and press the refresh button. Any existing videos on the drive will be shown in the list below. You can move videos between the Vision Processor and the user-supplied storage by selecting them and pressing the button indicating the direction to copy. Note that transferring a large amount of data may take several minutes.

6.6 Stylus

Organic Motion Stage now allows tracking of a stylus. In this mode, Stage tracks a stylus as a single-segment, 6 DOF rigid body. This feature is typically used by third-party software applications to co-locate Stage's coordinate system with that of their own. In doing so, Stage's motion data can be spatially aligned with data from other measurement devices, such as force plates. For more information on obtaining and using a stylus, please contact an Organic Motion service representative.

To enable stylus tracking, you must be in 60fps mode. Click the 'Stylus Wizard' button. The camera LEDs should turn off. Adjust the gain and shutter settings on the first page of the wizard. With the stylus turned off, click 'next.'

A 3D view should now appear. Turn on the stylus and wave it around in the space. You should see the 3D avatar move correspondingly.

NOTE: Stage cannot perform stylus tracking and human tracking simultaneously.
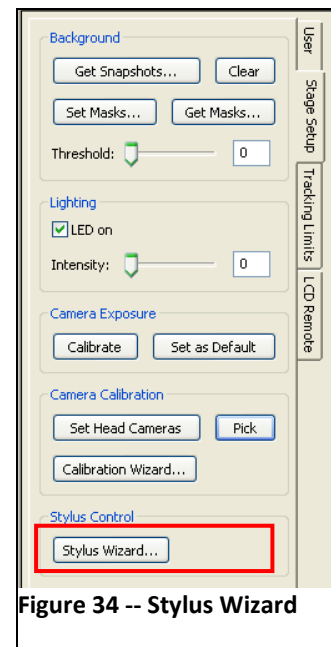
Figure 34 -- Stylus Wizard

6.7 LCD Remote

The LCD Remote, displayed in Figure 35 - LCD Remote, gives full control over the Vision Processor. The controls on the remote are identical to the controls on the physical Vision Processor.   Please refer to the Section 4.1 - LCD Menu on page 10 for a description of features.
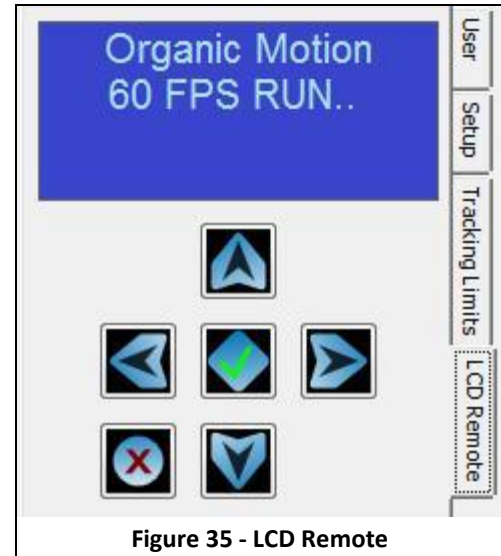
Figure 35 - LCD Remote

7   MotionBuilder® Plugin

Organic Motion's Plugin for MotionBuilder exposes all Stage™ functionalities to create stunning motion capture animations in real-time. MotionBuilder's advanced re-targeting technology allows the tracking data to be applied directly to any other bipedal model. For more information about the MotionBuilder Plugin, please refer to Stage Plugin for Motionbuilder User's Guide.pdf.

7.1   Installation

The provided installer copies all necessary files to the Autodesk Motion Builder installation directly. Example scenes in the /samples/OrganicMotion/ folder contain pre-configured models to start the tracking process right away. Currently supported MotionBuilder versions are 7.5, 7.5 Ext2 32-bit, 2009 32-bit, 2010 32-bit, and 2011 32-bit for the MS Windows platform. To find out whether your computer meets the minimal requirements, please refer to the Autodesk MotionBuilder instructions.

8   SDK

The SDK opens Stage™ to custom applications. More information about how to use the SDK can be found in OMSDK Documentation.pdf

9   Stage™ Quick Start

The previous section describes the Stage Administration software and how to perform many tasks. In this section we describe the most common tasks associated with the system.

9.1   Tracking Setup

- Turn on the Vision Processor.
- Connect to the system with the Stage Administration tool.
- If you do not see video, go to the LCD remote and turn on either 60, 90, or 120fps.
- Go to the camera tab and verify that the video is running and is of good lighting.
- Update the Background.
- Go to the 3D view and make sure that you see cameras in the correct positions.
- Once tracking, go to the 'User' tab in the 'Control' area. Click 'New User'.
- Step into the capture space.
- If tracking quality is acceptable, you are finished.
- Otherwise, under 'Calibration' click 'Start'. Proceed through the user calibration steps. You may save the user calibration if desired.
    - You should click 'Default' before tracking the next subject.
- Head Tracking:
    - Make sure that the texture cameras have been set up.
    - Make sure that the video has enough contrast on the face.
    - The person in the space should look forward with their face perpendicular to their shoulders. Click 'Capture Face'.
    - Now check 'Enable'.

9.2   MotionBuilder® Setup

- Start MotionBuilder.
- Drag an instance of OM Device into your scene.
- Connect the device to the Stage™ system.
- Create a model binding.
- Place this model binding in +z T-stance, characterize it, and then undo +z T-stance.
- Import your own characterized model into the scene.
- Set your character's Input Type to 'character' and Input Source to the character associated with the Stage™ Plugin's model binding.
- You should now be tracking and driving your character with Stage™'s tracking data.

If there is a problem at any time please refer to Section 10 on page 39. If your problem is not described there, please e-mail support@organicmotion.com for technical support.

10 Troubleshooting

Please report problems to support@organicmotion.com as we are very interested in the quality of the system you are working with.

10.1 Hardware

10.1.1   The wall panels are not on tightly

Please pull the wall panels off of the truss slowly and put back on, keeping them tight. This is easier if done with two people.

10.1.2   The wall panels are falling – Velcro® coming off

Please obtain 8-inch cable ties or zip ties. Secure the Velcro that is stuck onto the truss where it is coming off.

Please report this problem to support@organicmotion.com.

10.1.3   The floor is stained or severely soiled

Please contact Organic Motion at support@organicmotion.com.

10.2 Vision Processor

10.2.1   Setting the IP address

1. Make sure that the Vision Processor is plugged into the network

10.2.2   Camera is not on during startup (checkerboard)

1. Restart Organic Motion App (Stop/Start the App and NOT the Vision Processor or Stage Administration). If the camera is on after startup this is normal operation.
2. Check in the LCD Menu or LCD Remote how many cameras are connected (System Info→Camera Count). Make a note of this
    a. Check to make sure the cameras are plugged in
    b. Identify the bad camera and unplug/replug it. or
    c. Unplug / replug all cameras into the system
    d. During each unplug / replug verify that the camera flashes. If it doesn't then check all wires en-route to the camera
    e. If you have all required cameras and there is still a checkerboard please follow directions in 10.2.3 - Camera consistently drops out (checkerboard)
    f. If you do not have all required cameras please restart the Vision Processor
    g. If this works or not, please collect logs and e-mail to support@organicmotion.com .

10.2.3   Camera consistently drops out (checkerboard)

1. The camera needs to be restarted. Identify which camera is not working correctly and identify the wire number. Unplug, wait 5 seconds, and plug back in the camera. The camera should

flash when plugged in. The camera should re-initialize. If it does not, then start/stop the app. If the camera is on after startup, then you are done.

2. Check all connections along the wire. Unplug/replug all extenders en-route to the camera, as well as the Firewire cable into the camera. The camera should re-initialize. If it does not then start/stop the app. If the camera is on after startup, then you are done.

3. Check the extenders for a faulty wire. Please take a spare Firewire extender that was left on site. Replace all extenders one at a time. If the camera re-initializes and runs, then that extender is faulty. If not then check the Firewire cable connected to the camera. If the camera runs, then you are done.

4. Swap the Firewire port on the Vision Processor of the non-working camera with a working camera. If the non-working camera works, and the one that you swapped with does not, then there is a hardware problem with Stage™. If the camera still does not work, it is likely a faulty camera. Please e-mail support@organicmotion.com with the results of these tests and a hardware fix is needed.

10.2.4   Camera does not work

1. Take note of the number of cameras the system recognizes by navigating to Stage Status → Camera Count on the LCD menu.

2. Isolate the non-working camera. This can easily be done by turning on the lights of all cameras and identifying the one that does not light up.

3. Once you have identified the camera, follow the corresponding cable to the plug (they are numbered) and make sure that the cable connection is working properly. The best way to do this is to unplug the camera's cable from the back of the system and then plug it back in.

4. Restart the computer.

5. If the camera still does not work, it could be a faulty Firewire cable, or that the camera itself has malfunctioned. Please contact support@organicmotion.com.

10.2.5   Cannot update the Stage Software

1. Check the LCD Menu or LCD Remote to ensure that the Updater SW version is the same as the Stage Administration software version.
    a. If not please run the identical Stage Administration as the Update SW version. You may update the updater to match the Stage Administration version using the UpdaterUpdate***.omf that came with your distribution.
    b. If it is the same please contact support@organicmotion.com with the Update Version, HW version, OMT version, and Stage Administration Version found in Figure 5 - LCD Menu.

10.2.6   Cannot connect to the Vision Processor via Stage Administration™

1. 'Ping' the Vision Processor
    a. Click Start->Run
    b. Type cmd <enter>
    c. A command prompt will open
    d. Type 'ping <Vision Processor ipAddress>' <enter>
    e. If 'Destination host unreachable.' Please check the IP address

f. If you obtain a reply please check to make sure the Stage Administration version (printed on top of the Stage Administration or Help->About) is the same version as the OMT version listed in the Vision Processor System Menu (System Info → OMT version)

2. Restart the Vision Processor via the menu
3. E-mail support@organicmotion.com

10.2.7   The menu is not responding

1. Turn off the Vision Processor using the power button. Hold it for 10 seconds. If that doesn't work then unplug the Vision Processor. Please report this error.
2. Please extract logs and e-mail support@organicmotion.com .

10.2.8   The Tracking Application will not start in any mode

- Did you just update Organic Motion tracking?
    - o If so, revert to the previous version of Organic Motion Tracking.
    - o Contact support@organicmotion.com for a new version
- Did you just 'Update Camera Driver'
    - o Make sure that at least one camera is plugged in and update the drivers again.
    - o If it still doesn't work, plug in all cameras and update

10.2.9   When I turn the lights up to 100% some cameras flicker

Turn the lighting down a bit. The maximum intensity of the light is too high and is maxing out the power. Please report to Organic Motion – what mode (60,90,120) and how many cameras.

10.3 Tracking & Calibration

10.3.1   Camera Calibration shows a missing camera

- Make sure all cameras see the wand when you calibrate.
- Verify that all of the cameras are on and working correctly.
- If it is always the same camera that is out, then it may be the internal calibration.   Please e-mail the camera serial number (located on the back of the camera) to support@organicmotion.com and the Organic Motion Support team will walk you through the update.

10.3.2   Camera Calibration doesn't work at all

Make sure that there aren't any changing lights that the camera sees. You can simply turn the shutter down and watch the video. If the video sees lights, especially if those lights flash on/off, then this could be causing a problem. Please turn off all external flashing lights. Try to calibrate again.

10.3.3   Trouble Acquiring a subject

If you have trouble acquiring a subject

- Try loading one of the user calibrations provided by the Organic Motion support team.
- Recalibrate the system – check the voxel view to make sure you see the 3D representation of the person

10.3.4   Head Tracking does not work

- Try capturing the face again.
- Verify that the camera lighting is bright enough to see the subject's face in all texture cameras, and also that it is consistent.
- Verify that the head tracking cameras are set.
- Restart the Tracking Application and try again

10.3.5   Low Quality Tracking

Signs of poor data or a poor calibration are noisy data or "holes" in the voxel rendering of the Core View. If any of the cameras have shifted position, then they will no longer line up with the original calibration and so they will cut out data which will thin the limbs, or completely cut out parts as they come into the camera's view.   If you believe a camera to be bad, turn the shutter and/or gain to their lowest setting to make the camera image black in order to disable a camera. The voxel view will show how much signal and noise are being used in the tracking based on the current settings. If a camera has moved, a room calibration is necessary.

Next view the outlines. In the 'Cameras' view, click on 'Outlines' in the bottom-right corner. Here you can see a background subtraction. If there are holes, then you either need to adjust the lighting, update the background, change the background threshold or paint the masks.

10.3.6   Stage™ is not as fast as it used to be

Ensure that you are not viewing the voxels or outlines. The least intrusive window in the Stage Administration is the 3D view. Also ensure that there are not unnecessary clients connected to the Vision Processor. Otherwise please report the frame rate to support@organicmotion.com .

10.4 Stage Administration™

10.4.1   Stage Administration crashes or locks on connect

Please verify that the version of the Stage Administration and the version of Organic Motion Tracking (OMT version) are the same. You can find the Stage Administration version in the title bar of the application or go to Help -> About. You can find the OMT version by going to the Help -> Update Firmware, type in the IP address of the Vision Processor and click 'Fetch Server Versions', or you can find it in the LCD menu on the Vision Processor.

10.4.2   The Outlines are all white

Does tracking work? If so, please try the Stage Administration on another client machine. If not please contact the Organic Motion Support team at support@organicmotion.com .

10.4.3   I don't see the masks in the outlines

Make sure that you edited the masks in Paint .Net and not mspaint. Also, the masks must be saved as bmp files.

10.4.4 I cannot rotate/view/pan the 3D view or Core view in the Stage Administration™

Make sure you are holding the 'Alt' button as you are clicking and moving the mouse.

11 Definitions

Background	Snapshot of all video streams without any objects in the tracking space.
Background Mask	Image of the background where all non reflective material, or occluding material is painted black. This is edited and saved in Paint .Net.
Background Threshold	Threshold used in the background to allow the system to see more data (possibly more noise).
Background Update	Process where the system takes a new Background
Calibration Triangle	See Figure 15 – Calibration Triangle on page 21
Calibration Wand	See Figure 16 - Wand on page 21
Camera Calibration	Calibrating Stage™ so that each camera knows where they are in relation to the system as a hole.
Cut Box	Same as Tracking Limits (deprecated)
Data Inspector	View where raw 3D data can be viewed. Previously known as voxel view.
DHCP	Dynamic Host Configuration Protocol - allows computers to dynamically obtain an IP address.
Gain	Scale factor used in the camera to vary the range of the image
LCD Menu / Menu	The physical LCD menu on the front of the Vision Processor
LCD Remote	The virtual LCD menu in the Stage Administration
Lighting	Refers to all parameters involved in changing the illumination of the final camera images, including the ambient room lighting, the brightness of the lights, and the gain and offset of each camera
Lighting Calibration	Method of system to automatically determine proper gain and shutter values
OMT	Organic Motion Tracking. Same as Tracking Application.

Shutter	Amount of time the camera is open to integrate lighting. The longer the brighter the image
Stage	The entire system including Vision Processor, Truss, Fabric, Cables and Cameras
Stage Administration	Software used to connect to and control Stage™
Tracking Application	The tracking application which can be started via the Stage Administration or Menu in 60, 90, or 120fps modes
Tracking Limits	The area in which it is valid to track a subject. This was previously known as the cutbox
Vision Processor	The physical black box. It is connected to all cameras, has an LCD remote and is connected to the network.
Voxel	3D equivalent of a pixel

12 Supporting Documents

ChangeLog.pdf	Describes changes between different versions of Stage™
Stage Plugin for Motionbuilder README.pdf	Describes installation of plugin, connecting to Stage™, characterization of skeleton, driving a model using Stage and saving motion data.
OMSDK Documentation.pdf	Describes how to connect to Stage™ using the SDK (written in C++)
MB_to_3dsMax_Maya_Import_ Instructions.pdf	Instructions for converting motion captured in Motionbuilder to 3d Studio Max and Maya

13 Feedback and Comments

We appreciate the opportunity to receive feedback and are excited to make Stage™ the best tracking system on the market. Please feel free to e-mail us with your comments, questions, or suggestions at support@organicmotion.com.

14 Legal Notice

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16 Notes