Vicon Tracker Guide

Contents

Vicon Tracker Guide March 2013. For use with Vicon Tracker 2.0 and later.

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Introducing Vicon Tracker

Vicon Tracker is a motion tracking software application that is easy to learn and use. It has been designed specifically for engineering requirements, and its workflows are based on an analysis of the needs of typical engineering users. Tracker makes it easy to perform daily routine tasks while, at the same time, offering the customization and flexibility necessary to fit the situation of particular users.

Tracker license options

Important: Some of the Tracker functionality described in this document is available only if you have licensed the relevant options. To change your licensing options, contact Vicon Support (see *Contacting Vicon* on page 91).

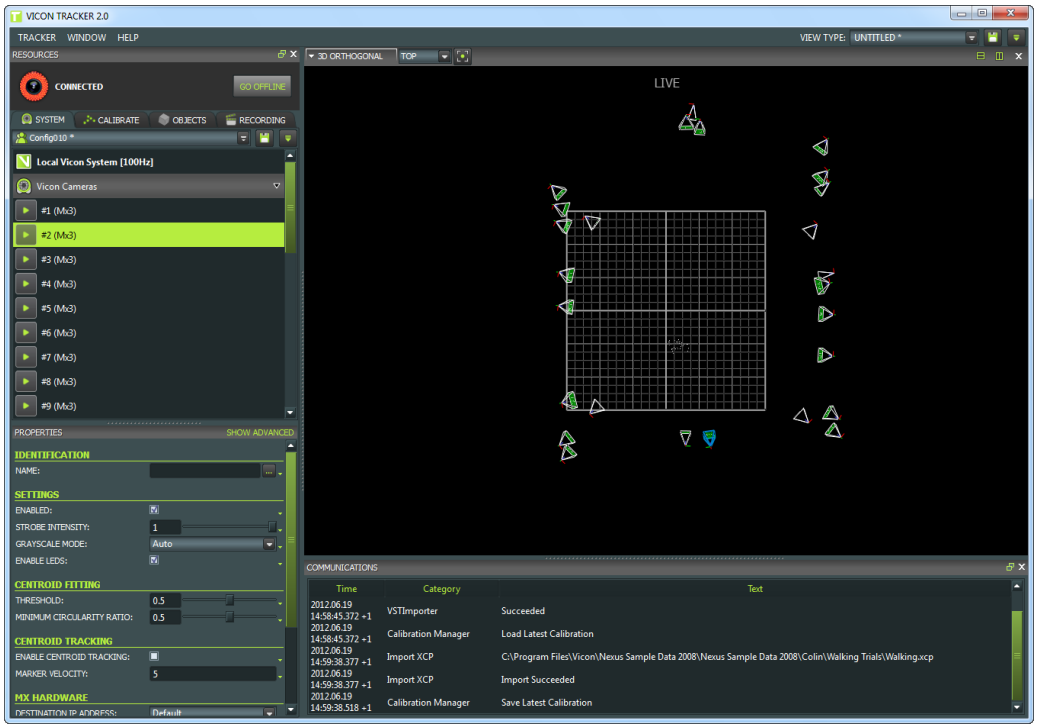
To check your currently licensed Tracker options:

1. From the **Help** menu, click **About Vicon Tracker**.
2. In the window, click the **License Info** button.

   After a few seconds, the currently licensed options are listed in the **Listed features** dialog box.
3. When you have checked the options available, click **Close**.

Tracker version information

To check the version number of Tracker, from the menu bar, select **Help** > **About Vicon Tracker**. This information may be requested if you contact Vicon Support with questions about Vicon Tracker.



About the Tracker Guide

The Vicon Tracker Guide provides product information, user assistance, and operational expertise to help you capture and analyze motion data. It will help you confirm your basic understanding of any steps; investigate a process, step, or option in more detail; try more advanced features; or pick up best practice tips.

Preparing the capture environment

Before you begin connecting up and using your Vicon system, to ensure its precision and accuracy:

- Choose an optimal measurement volume for a given experiment
- Place cameras to achieve uniform precision in all directions
- Consider the mechanical stability of the cameras and their mountings.

As the resolution of Vicon cameras has increased, mechanical stability has become increasingly important, because a very small shift in position can have an impact on system measurements, as shown in the following example.

Example of the effect of camera position on system accuracy

A Vicon T160 camera with a standard 18mm lens has a horizontal field-of-view of 54°. Each pixel subtends an angle of 0.0115° or 200 micro-radians.

In other words, a change of 200 micro-radians in the angular position of the camera and its sensor represents a one pixel shift in the system's measurements. This shift is equivalent to about a quarter of the diameter of a 12mm marker at a range of 16m.

Note: This is a 2D shift. All 3D measurements are estimated from the intersection of several 2D rays, so the resulting 3D shift may be smaller.

For further tips, see *Minimizing system inaccuracy* on page 6.

Minimizing system inaccuracy

The most common causes of inaccuracy are:

- *Mounting creep*
- *Vibration*
- *Temperature*

Mounting creep

Scenario: Cameras are often clamped onto a framework that allows their position and orientation to be easily adjusted. The framework is commonly cylindrical tube and the clamps depend on friction.

Problem: If a camera is cantilevered so that its weight may rotate the clamp, the amount of slippage or creep at the clamp/frame junction needed to introduce 200 micro-radians of angular change is tiny: about 5 microns or about 1/50th of the diameter of a human hair. This slippage is far too small to be seen.

Solution: Mount cameras so that their weight does not rotate their mounting point either by bending the mounting frame or by causing a clamp to slip or creep.

Vibration

Scenario: Many buildings are of steel-frame construction. A steel framework can transmit vibrations caused passing footsteps, elevators, and passing vehicles. Most building vibrations are locally translational and, while undesirable, have little direct effect on camera rotation.

Problem: If a camera is mounted on a bracket or cantilever, building vibration combined with the cantilevered mass of the camera can cause a rotational oscillation of the camera mount.

Solution: Ensure that camera mounting brackets, and the structure to which they are attached, are extremely stiff and cannot wobble if there is any vibration in the building frame. This applies whether the camera mounting is vertical or horizontal.

Temperature

Scenario: Thermal expansion and contraction in large structures such as a building can be very large but the temperature changes that drive them tend to be relatively slow compared with the duration of a Vicon calibration/trial cycle.

Problem: One part of the system that changes temperature much more quickly is the camera itself. The inside of a Vicon camera reaches a steady temperature of around 50° Celsius. While the camera is warming up from the ambient temperature of its surroundings, its internal components inevitably change dimension. However, when the components reach operating temperature, their dimensions remain stable.

Vicon measures the effects of warm-up and ambient temperature changes on all its cameras. All current camera models reach their steady operating temperature in approximately 30 minutes. This time is relatively independent of ambient temperature over the normal operating range of 0°–30°C. During warm-up, the equivalent positional change varies between 0.25 pixel for lower resolution cameras to approximately 1 pixel for the T160.

Solution: Allow Vicon cameras to warm up for at least 30 minutes before calibration and measurement.

Motion capture with Tracker

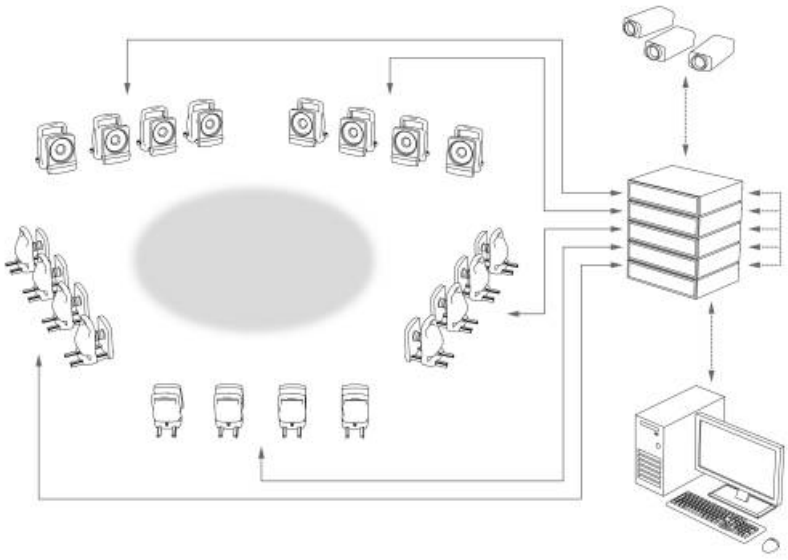
To get started with Tracker, you set up your Vicon system and then prepare the objects for motion tracking.

The user interface guides you through the various tasks. When you are familiar with the basics, you can customize Tracker to look and behave the way you want it to.

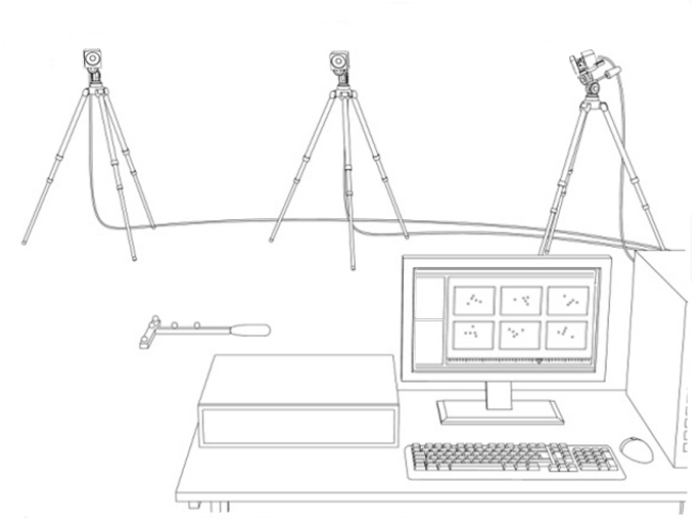
Tracker components

Tracker is part of the fully integrated and expandable Vicon system that lets you build an architecture best suited to your motion capture application.

T-Series diagram



Bonita diagram



In these architecture diagrams, Tracker is installed on the host PC.

Components of a Vicon system architecture

You can include the following components in a Vicon system architecture:

Component	Description
Bonita cameras	Bonita Optical cameras can be used with Tracker, but cannot be used simultaneously with MX cameras.
MX cameras	The following series of MX cameras can be used with Tracker: ▌ MX T-Series cameras: T160, T40-S, T20-S, T10-S, and T10 ▌ MX F-Series cameras: MX-F40 (F40) and MX-F20 (F20) ▌ MX+ cameras: MX3+ **Important:** The Tracker documentation refers to MX cameras. Unless otherwise noted, references to MX cameras also apply to T-Series, F-Series, and MX+ cameras. For additional information, see *Connecting cameras* on page 9.
MX connectivity units	Smart boxes that can be combined to create a distributed architecture, enabling you to customize the number of Vicon cameras: ▌ MX Giganet: Link between T-Series cameras and the host PC, with a 5-port Ethernet switch for connection to the host PC, other client PCs. ▌ MX Ultranet HD: Link between Vicon cameras and the host PC in earlier Vicon MX F-Series systems. ▌ The T-Series, F-Series, and MX+ hardware units are RoHS-compliant. For additional information, see *About MX connectivity units* on page 37.
Host PC	The main PC in the Vicon system architecture, with at least one dedicated Ethernet port to enable Vicon system communications (in addition to any other network ports on the PC). Vicon Tracker application software is installed on this host PC. Remote PCs may be used for other Vicon application software or third-party applications connected to the host PC via Ethernet.
MX cables	The proprietary MX Gigacable plus a commercially available Ethernet cable connect the Vicon MX T-Series system components, providing a combination of power, Ethernet communication, synchronization signals, video signals, and data. Other cables are required for earlier MX F-Series, MX+, and MX systems. For details on these cables, see the *MX Hardware System Reference* book that came with your original MX system.
Vicon Apex	Hand-held tracking device that enables you to interact with virtual objects in a 3D environment. For more information, see *About Vicon Apex devices* on page 47.

Component	Description
Vicon calibration device	Specialized device used to accurately calibrate the Vicon system.
Vicon accessories	Supplies for the Vicon system, which includes markers, tape, and Velcro.
Vicon engineering software	Vicon Tracker software, DataStream SDK and Vicon Virtual System.
Additional analog devices	Depending on your licensing options, your Vicon system may also include one or more additional devices, such as LVDTs, accelerometers, and load cells. For more information, see *Setting up analog devices* on page 43.

For further details on these components, see the *Get Going* and *Go Further with Vicon MX T-Series* reference books or the *Vicon Bonita Quick Start Guide*.

Connecting cameras

To connect cameras into your Vicon system, you must specify the correct IP address for the network card that is connected to the PoE switch or Giganet.

To connect the cameras:

1. Connect the PoE switch or Giganet to the PC.
2. Access the Windows network connections:
   - Open the **Control Panel**, then click **Network and Internet** and on the right side of the panel, under **Network and Sharing Center**, click **View Network Status and Tasks**; or
   - Click the **Network and Sharing Center** icon on the right of the Windows toolbar and then click **Open Network and Sharing Center**.
3. Right-click on the network card connected to PoE or Giganet and then click **Properties**.
4. In the **Properties** window, select **TCP/IP**.
5. Click the **Properties** button.
6. In the **Properties** window, click the **Use the Following IP Address** radio button.
7. Enter the following **IP Address** – `192.168.10.1`.
8. Enter the following **Subnet Mask** – `255.255.254.0`.
9. Click **OK**.

Vicon file types used in Tracker

During the motion capture workflow, you create and edit a number of configuration files, Vicon Tracker generates a number of data files, and you can import files from and export files to other Vicon applications or supported third-party software.

You create and edit the following Vicon configuration file types during motion capture and analysis:

File type	Saved using configuration controls in	Description
.options	**Options** dialog box	Data view options
.system	**Resources** pane, **System** tab	System settings
.ViewType	View pane	View options and layouts
.vsk	**Resources** pane, **Objects** tab	Vicon skeleton file
.xcp	**Resources** pane, **Calibrate** tab	Calibration parameters file. You can create, reset, and load an *.xcp* file but the *.xcp* file cannot be edited. You can export an *.xcp* created in Tracker to other Vicon application software and supported third-party software.

Setting properties in Tracker

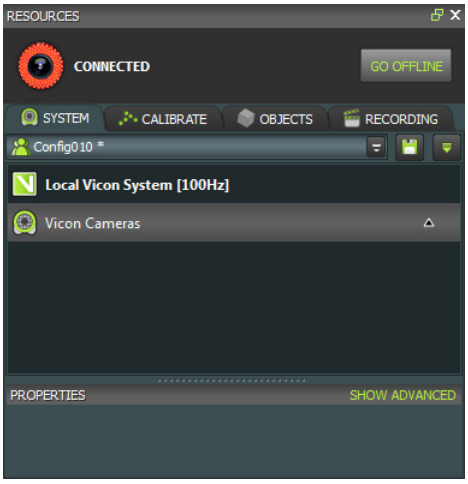
You can configure the way certain areas of Tracker look and behave by configuring settings in the **Properties** pane. The properties you can configure depend on what is selected in the **Resources** pane or the **Options** dialog box.

Some properties settings are automatically saved, so Tracker remembers them in subsequent sessions. You must explicitly save other settings using the configuration management controls for the relevant area of the Tracker window.

To configure Properties settings:

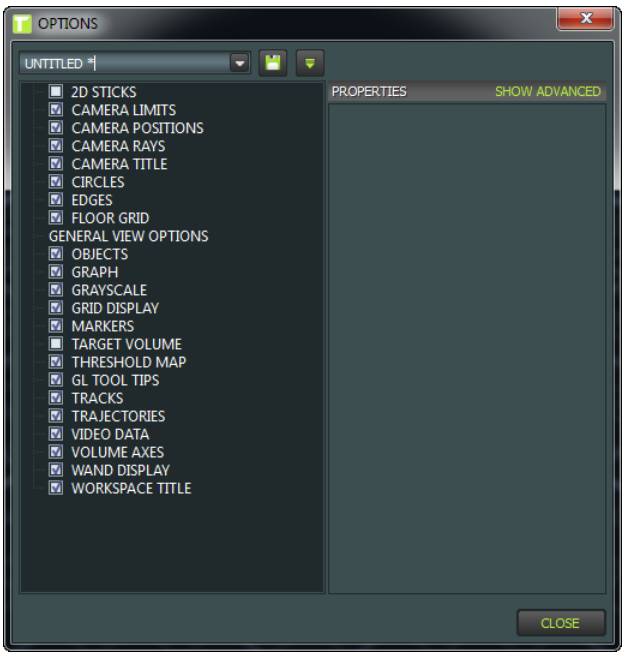
1. In the **Tracker** window, click on the relevant tab or open the dialog box containing the properties you want to configure:

- For system components, in the **Resources** pane, click the **System** tab



- For motion capture objects, in the **Resources** pane, click the **Objects** tab

- For view options, press F7 to open the **Options** dialog box



2. In the **Properties** pane, click the **Show Advanced** link to view all of the available properties.

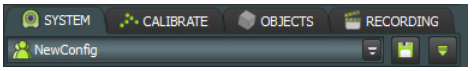
3. Click the **Hide Advanced** link to show just the basic properties.

4. In the **Properties** pane, view or change the setting for the required property using its entry field or control:

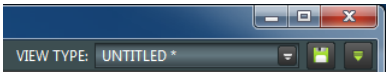
   - Select or clear a check box to switch the property on or off.
   - Click the current color in the entry field to display the **Select color** dialog box. In the **Basic colors** area, click the square for the required color, or in the **Custom colors** area, define a new color.
   - Click the drop-down arrow and select an entry from the list.
   - Move the slider to the left to decrease the value or to the right to increase the value displayed in the entry field.
   - Overtype the existing value.

5. If you are working in the following areas of the Tracker window, save your settings to the appropriate configuration file using the configuration management controls:

   - **System** tab



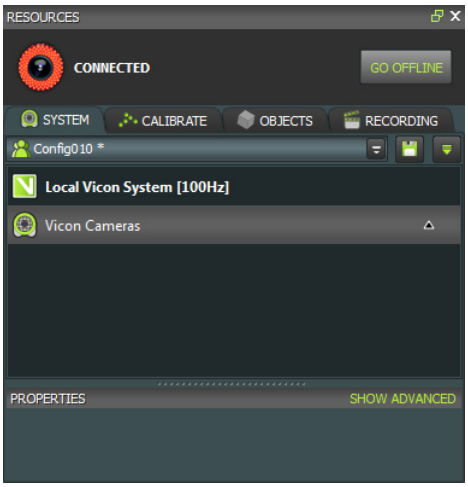
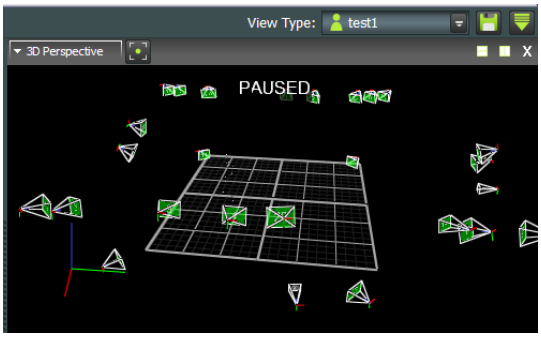
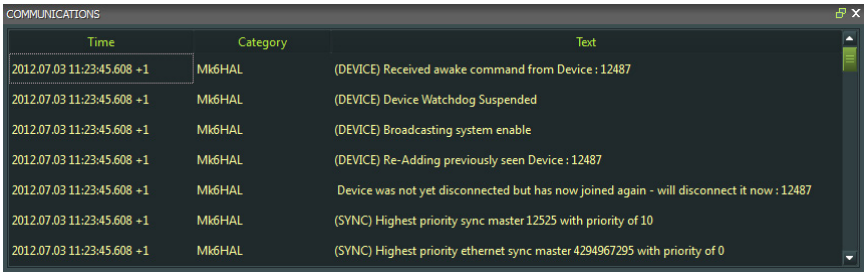
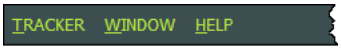
   - View pane



   - **Options** dialog box

About the Tracker user interface

The Tracker user interface is laid out so you can locate buttons, menus, and controls where you expect to find them.

Component	Description
Resources pane	Manage the different components of your Vicon system architecture and the objects whose motion is to be captured. 
View pane	Set up the way you want to visualize the capture data from one or more cameras. 
Communications pane	View log information. 
Menu bar	Exit Tracker, undo/redo, open close panels, view help, software version, and licensing information. 

In the Resources pane and view pane, you use the tabs and buttons to access the tools and options for a specific workflow.

Customizing the Tracker user interface

You can customize the appearance of the Tracker window to suit your preferences, using any of the following procedures. The Tracker window maintains these settings until you adjust them again.

To undock Resources or Communications panes:

- Click the Dock Pane button on the right side of the pane title bar.

To dock Resources or Communication panes:

- Double-click the pane title bar. The pane is docked in its last fixed position.

To change the position of the Resources or Communications panes:

1. Click and hold the pane title bar and drag the pane to the desired location in the Tracker window.
2. Drop the pane anywhere in the window to change it into a floating pane.

To resize the Resources or Communications panes:

1. Hover the mouse pointer over the inside edge of the pane or the top edge of a section so that the pointer becomes a double-headed arrow and drag to resize as needed.
2. Click and drag the arrow to move the split line left or right to resize the pane width, or up and down to resize the section height.

To hide or display the Resources or Communications panes:

1. Click the Close Pane button on the right side of the pane title bar.
2. From the Window menu, clear the required option to hide the Resources or Communications pane and select the appropriate option to display the required pane.

To hide or display sections within the Resources panes:

- Click the Hide Section arrow or the Display Section arrow to the right of the section heading.

Tip: The view pane cannot be undocked or repositioned in the Tracker window. You can open a separate floating view pane by selecting the New floating workspace option from the Window menu. This floating workspace can be repositioned and resized.

Using the mouse and keyboard

You control Tracker using the mouse and keyboard.

Controlling Tracker's appearance and behavior

Use the following keys to control the way Tracker looks and behaves.

Task	Keys
Display the Vicon Tracker help system	F1
Display full screen view for the selected view pane	F5
Display/Close **Options** dialog box	F7
Pause/Restart real-time data streaming	SPACE

Moving the camera viewpoint

Use the mouse to move the camera viewpoint in **3D Perspective**, **3D Orthogonal**, and **Camera** view panes.

Action	Description	Mouse
Dolly/Zoom	Move camera viewpoint closer to or further away from the focal point	Right-click + drag forward or backward
Orbit	Move camera viewpoint around the focal point	Left-click + drag left, right, forward, or backward
Truck/Translate	Move camera viewpoint along a horizontal or vertical axes	Click wheel button + drag left, right, forward, or backward

Viewing the X- and Y-Axis

Use the mouse to view the x- and y-axis in a **Graph** view pane.

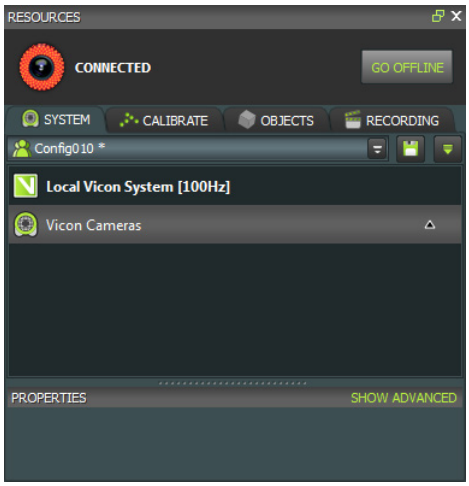
Graph Data	Keys and Mouse
Slide x-axis left	Click wheel button + drag left
Slide x-axis right	Click wheel button + drag right
Slide y-axis up	Click wheel button + drag forward
Slide y-axis down	Click wheel button + drag backward
Zoom x-axis in	Right-click + drag left
Zoom x-axis out	Right-click + drag right
Zoom y-axis in	Right-click + drag backward
Zoom y-axis out	Right-click + drag forward

Zooming an axis (x or y)

All graph components in a single workspace maintain the same scale for both the x-and y-axes. The x-axis is shared across all components, but each component has its own y-axis. The y-axis may show different ranges, but represent the same number of values.

On the x-axis, the workspace is centered around zero, keeping the zero on the right edge of the workspace and changing the values displayed on the left.

About the Resources pane

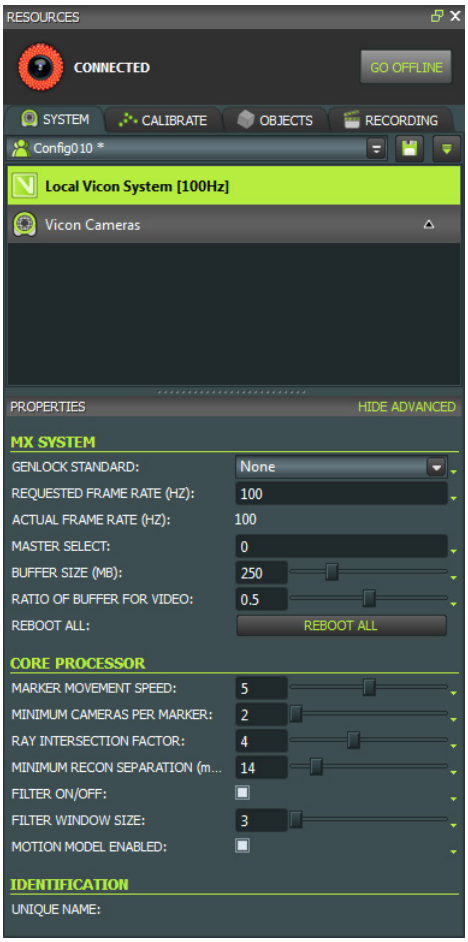


You manage the system components, calibration, objects, and recordings/playback of your Tracker system in the **Resources** pane.

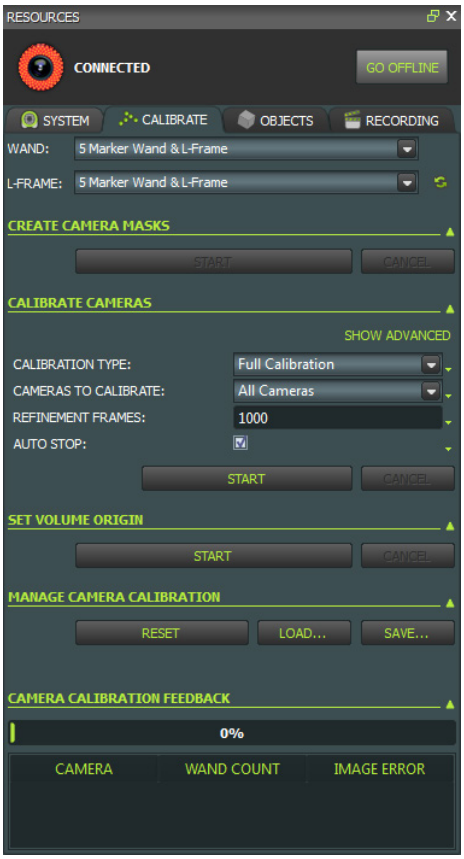
After you have prepared your Vicon system and selected the objects for motion capture in the **Resources** pane, you use the view pane to view the data.

The Resources pane contains the following components:

Component	Description
System tab	Configure the components of your Vicon system.

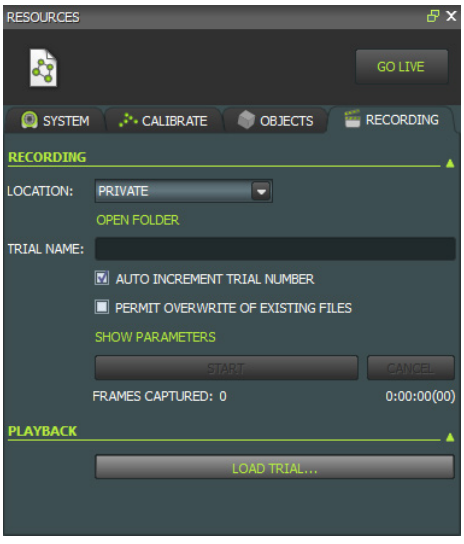


Component	Description
Calibrate tab	Calibrate your Vicon cameras.



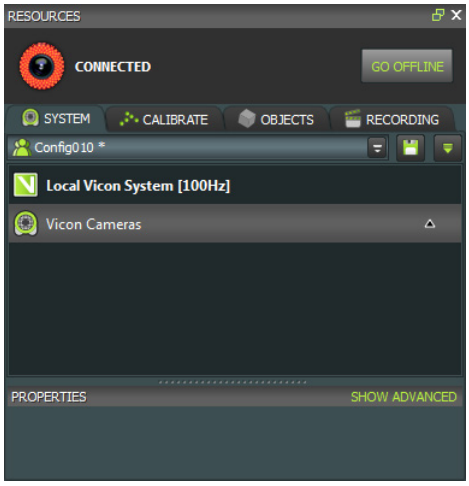
Component	Description
Objects tab	Manage object files for the objects whose motion data you want to track.

Recording tab	Save and play back recordings of trial data.



Component	Description
Resources lists	Select the nodes and any sub-nodes to be configured in the resources lists. The components of this section depend on whether you are using the **System**, **Calibrate**, **Objects**, or **Recording** tabs.
Properties pane	You view and change settings for the item selected in the resources list in the **Properties** pane. The contents of this pane depend on the node selected in the resources list.

About the System tab



You manage the components of your Vicon system in the **System** tab in the **Resources** pane. The **System** tab may contain the following components:

Component	Description
System configuration management	You create, save, and manage configurations for the settings in the **System** resources pane using the configuration management controls at the top of the pane.
System list	You select the node for the system component you want to configure in the **System** list: **Local Vicon System** — The Vicon system capture rate and the Tracker memory buffer size; real-time processing settings; and the identification and connection settings for the Tracker host PC. **Vicon Cameras** — The identification and configuration settings for each Vicon camera connected to your Vicon system. **MX Connectivity** — The identification and configuration settings for each MX Giganet, MX Ultranet, and MX Ultranet HD unit attached to your Vicon Tracker system.

Tip: You can perform commands specific to a type of system component node or sub-node by right-clicking on a node in the System list and selecting a command from the displayed context menu.

You view or modify system components in the Properties pane. The properties displayed depend upon the node selected in the System list.

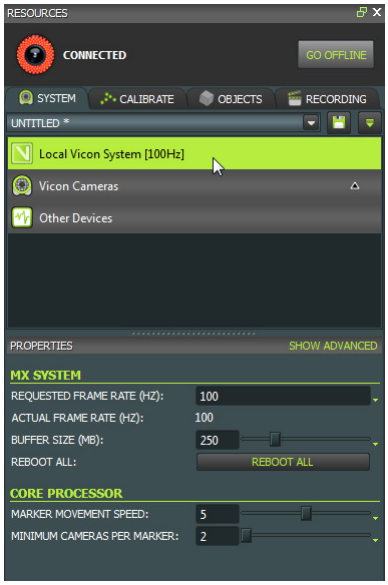
Reorder Devices dialog box

To use the Reorder Devices dialog box to change the order in which Vicon devices are displayed on the System tab in the Resources pane, right-click the Vicon Cameras node or Other Devices node and then click Reorder.

In the Reorder Devices dialog box, choose from the following options:

Option	Description
Move Up	Moves the selected item up one position in the list
Move Down	Moves the selected item down one position in the list
Sort	Sorts the list of devices according to name and type. Remembered devices are at the bottom of the list.
Clean	Removes the entries for the devices that are not used or referred to (Remembered devices) in the current session.
Revert	Undoes all the changes you have made in this dialog box since you last clicked OK.

About the Local Vicon System node



The Local Vicon System node enables you to configure the Vicon system capture rate and the amount of memory allocated to Tracker for motion capture, manage the way Tracker is to produce real-time 3D representations of the objects whose motion is being captured, and specify the identification and connection settings for the Tracker host PC.

The **Local Vicon System** node is the top-level node that is displayed for the Tracker host PC. This node contains sub-nodes for each device connected to your Vicon system under the following nodes:

- Vicon Cameras
- MX Connectivity
- Other Devices

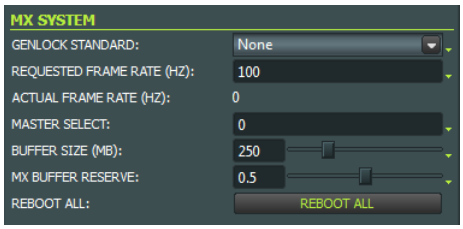
The node for the device designated as the MX system synchronization master is highlighted in bold on the **System** tab in the **Resources** pane.

To configure the Local Vicon System:

1. On the **System** tab, click the **Local Vicon System** node.
2. In the **Properties** pane, view or change settings for the desired properties to suit the needs of your motion capture application.

   When you first set up your Vicon system, you must configure at least the **Requested Frame Rate (Hz)** property.
3. In the configuration management section, enter a name and click the **Save current configuration** button  to save your system configuration settings.

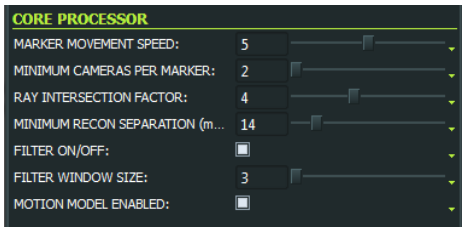
MX System section



When you click the **Local Vicon System** node in the **System** Resources pane, you can access the following system-wide settings in the **MX System** section of the **Properties** pane. These settings affect all the connected cameras and devices:

Setting	Description
Genlock Standard	The type of video standard supported by the connected video source: **None**, **PAL**, **NTSC**, or **Film**.
Requested Frame Rate (Hz)	The rate (in Hertz) at which to synchronize the MX cameras and the external video signal. Select from displayed values (multiples of the base frame rate of the **PAL**, **NTSC**, or **Film** video standard specified in **Standard**) up to a maximum of 2,000. The configured MX system capture rate is displayed in square brackets beside the node. For example, if the MX system frame rate is set to 100 Hz, the node title is displayed as **Local Vicon System [100Hz]**.
Master Select	If multiple connectivity devices are present in the system, enables you to select your preferred master connectivity device.
Buffer Size (MB)	The size (in MB) of the memory buffer on the host PC when Tracker is receiving data from MX hardware. Specify a value between 0-256. This buffer is used if data comes in faster than Tracker can process it. The optimum size of this parameter depends on the amount of memory on your PC.
MX Buffer Reserve	The proportion of the total buffer size (see **Buffer Size** above) that is reserved for Vicon video devices. The default of 0.5 results in half of the total buffer size being reserved for Vicon video devices (MX and Bonita cameras). The remaining buffer space is used by third-party video cameras. If you want to maximize the buffer space reserved for Vicon MX or Bonita video cameras, set this value to 1.0. If you are using only Basler cameras or third-party DV cameras, set this value to 0.
Reboot All	Resets all of the MX hardware devices in the MX system. Use this button if a camera has failed to boot, or if you need to reset the whole system for other reasons. Alternatively, select the **Reboot MX Hardware** command from the context menu.

Core Processor section



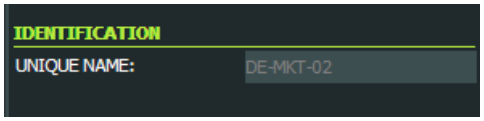
The Core Processor receives data from the Vicon cameras and transforms the data to the trajectories or segments that your MX system is tracking.

When you click on the **Local Vicon System** node on the **System** tab in the **Resources** pane, the following settings are available in the **Core Processor** section of the **Properties** pane.

Setting	Description
Marker Movement Speed	The speed of marker movement specified as a value in the range 0-10, where 0 is almost stationary (such as turtle movements), and 10 is very fast (such as a golf swing). This setting affects the Core Processor's ability to create continuous trajectories. If you use the fastest setting, you can expect continuous trajectories even for very fast moving markers, but if two markers are close to each other there is an increased chance of a crossover (where the 3D trajectory changes from one marker to the other). The default value should be sufficient for typical captures where markers move at around 1-3 m/s. Increase the value for high speed movements such as a golf swing; decrease it when markers are in close proximity but do not move very much.
Minimum Cameras per Marker	The minimum number of Vicon cameras, specified as a value in the range 2-10, that must contribute to a 3D marker position before it can be reconstructed and its trajectory tracked.
Ray Intersection Factor	The factor, specified as a value in the range 0-10, by which the reconstruction algorithm will be able to form a single reconstruction from rays from different cameras. The higher the value, the more distance is allowed between two rays that contribute to the reconstruction.
Minimum Recon Separation (mm)	The minimum distance, specified as a value in the range 0-100 millimeters, allowed between 3D marker positions for them to be considered for reconstruction. If two candidate reconstructions are closer than this minimum separation, only the most likely reconstruction (in terms of the number of cameras contributing) is reported. The other is discarded. A higher value decreases the likelihood of creating spurious reconstructions, but increases the possibility that some genuine markers will not be reconstructed.
Filter On/Off	Enables or disables the smoothing feature. The filter smooths data in real time, which affects rotation and position data of objects. This parameter uses a weighted average algorithm.
Filter Window Size	Adjusts the size of the filter window when using the smoothing feature. To increase the amount of smoothing, increase the filter window size. An appropriate value is between 3 and 10; however, this value is dependent on the frame rate at which the system is running, the type of motion the object is undergoing, and the quality of the system calibration.

Setting	Description
	Note: Longer filter windows will increase the perceived latency of the system with current data being averaged with previous data.
Motion Model Enabled	The ability to detect static objects. When enabled, Tracker outputs a constant position and orientation for an object from the time it is detected as not moving to the time it resumes motion.

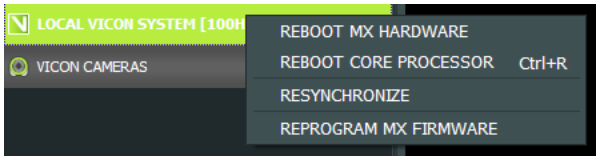
System Identification section



When you click **Local Vicon System** on the **System** tab in the **Resources** pane, you can view the following setting in the **Identification** section of the **Properties** pane:

Setting	Description
Unique Name	The Windows computer name of the Tracker host PC.

Local Vicon System context menu



When you right-click on the **Local Vicon System** node on the **System** tab in the **Resources** pane, you can select the following options from the context menu:

Option	Description
Reboot MX Hardware	Resets all of the MX hardware devices in the MX system. Use this command if a camera has failed to boot, or if you need to reset the whole system for other reasons.
	Tip: Alternatively, use the **Reboot All** button in the **MX System** section of the **Properties** pane.
Reboot Core Processor	Restarts the Core Processor and resets the labeler.
	Tip: Alternatively, press CTRL + R.
Resynchronize	Forces the MX system synchronization master to resynchronize the frame rate for all connected cameras and third-party devices.
Reprogram MX Firmware	Displays the **Reprogram MX Firmware** dialog box, in which you can view and update firmware for certain MX devices present in your Vicon MX architecture.

About the Vicon Cameras node

You manage the identification and configuration settings for each Vicon camera connected to your Vicon system with the **Vicon Cameras** node.

Configuring Vicon cameras ensures that all the camera settings are correct and appropriate for your motion capture application. You can configure the settings for an individual camera, several cameras, or all cameras at once.

This node is displayed under the **Local Vicon System** node. The **Vicon Cameras** node lists each Vicon camera connected to your system. For each camera, the node name includes:

- The device position number
- Any display name specified in the **Identification** property
- The camera type listed in parentheses, for example, **#1 Over Door (T160)**

To configure Vicon cameras for optical data capture:

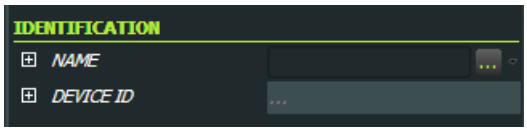
1. From the view pane tool bar, select **Camera**. The 2D data being captured by each Vicon camera selected in the **System** list in the **Resources** pane is shown in a separate **Camera** view pane.
2. View your capture volume in either of the following ways:
   - In the **Options** dialog box, under the **General View Options** section, select the **Target Volume** option. In the **Camera** view pane tool bar, from the **View** drop-down list, select **3D Overlay**. A virtual representation of your target volume is overlaid on the 2D data from the camera image.
   - In the capture volume, place a selection of static markers on the floor to roughly outline your target capture volume.
3. In the **System** list in the **Resources** pane, select the **Vicon Cameras** node whose properties you want to configure.
4. In the **Properties** pane, view or change settings for the relevant properties.
   When you first set up your Vicon system, you must configure at least the following properties in the order shown:

Section	Property	Notes
Identification	Name	Only needed if you want to distinguish it from the others
Settings	Strobe Intensity and Threshold	If adjusting these two settings does not easily enable you to eliminate reflections, create camera masks to eliminate reflections and other unwanted light sources that occur in parts of the capture volume.
	Gain	Normally, leave at the default **x1** setting, but if the markers seem faint or if the cameras have trouble distinguishing them, adjust this setting as required.
	Grayscale Mode	Normally, leave at the default **Auto** setting. However, during focusing, it can be helpful to change to **All**, then change it back to **Auto** as soon as the camera is focused.

> **Important:** These properties affect the quality of the motion capture data. Therefore, it is important to optimize them before you collect data intended for later analysis. In subsequent sessions, you may want to configure additional properties to suit the needs of your motion capture application.

5. When you have finished adjusting the **Vicon Camera** properties, in the **Settings** area, ensure that **Grayscale Mode** is set to **Auto**.
6. At the top of the **System** tab, click the **Save current configuration** button  to save your system configuration settings to a *.system* file in one of the following folders:
   - If you select **Shared** the file will be saved in *C:\ProgramData\Vicon\Tracker*
   - If you select **Private** it will be saved in *C:\Users*User Name*\AppData\Roaming\Vicon\Tracker*

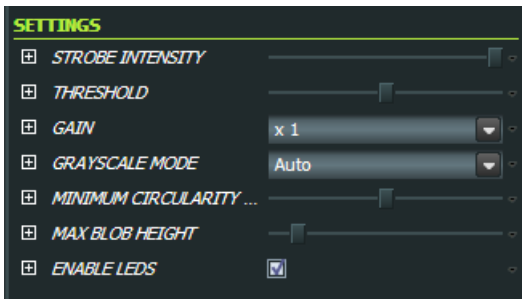
Camera Identification section



When you click on a **Vicon Cameras** node or an individual camera node on the **System** tab in the **Resources** pane, the following controls are available in the **Identification** section of the **Properties** pane:

Control	Description
Name	A user-defined display name for the entire set of Vicon cameras or for each individual Vicon camera. For example, if a camera is placed over a door, you could name it `Over Door`.
Device ID	The unique identification number Vicon assigns to each Vicon camera during manufacture. The top-level entry for all Vicon cameras is read-only.

Camera Settings section



When you click on a **Vicon Cameras** node or an individual camera node on the **System** tab in the **Resources** pane, the following controls are available in the **Settings** section of the **Properties** pane:

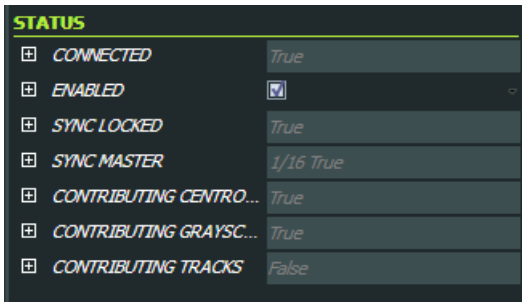
Control	Description
Strobe Intensity	The amount of light emitted by camera strobe units. This value can be set between 0-1 to minimize reflections and obtain clear marker images. The higher the setting, the brighter the markers appear, but this may cause blobs to be produced from reflections from other strobes. Lower settings make the markers themselves less visible to the cameras. You will almost always want to keep the intensity at its maximum level because the system works by recording light from the strobes that is reflected from the markers, thus the more light the strobes send out, the more light the markers reflect. However, if you are capturing a very fast moving object you may achieve better results by reducing the strobe intensity. The strobe intensity affects the time the strobe is on for each camera frame. The full strobe intensity corresponds to 1ms (0.5ms with Bonita) for normal frame rates. Lower strobe intensities mean that the markers are captured with the strobes on for less time and, therefore, have less time to move during the frame.

Control	Description
	Tip: It is advisable to use full strobe intensity and deal with reflection problems by closing the camera lens aperture. Adjust this setting and the Threshold setting until reflections are minimized or gone.
Threshold	The minimum brightness (intensity) for markers; pixels of an intensity lower than this threshold are ignored. This value can be set between 0-1 to determine the pixels to be considered for centroid fitting onboard the Vicon cameras. Lower settings enable the camera to detect lower light levels, thus making the markers appear larger, but may pick up unwanted reflections and other light sources. Higher settings reduce the noise, but make the markers themselves less visible. This setting differentiates between markers and ambient light. A Vicon camera records 10-bit grayscale data, which for each sensor pixel is a measure of how much light fell on that pixel during a given amount of time. However, the cameras will almost always pick up some ambient light in the volume. To enable the cameras to distinguish between light that comes from markers and light that does not, a threshold is applied. Anything above this threshold is deemed to be a marker, anything below is deemed to be ambient light. A value in the region of 0.2 to 0.5 is usually appropriate, but Vicon strongly recommends that you use static markers in the volume in order to establish an appropriate setting. If cameras are evenly spaced around the volume, the same threshold value is usually sufficient for all cameras. Adjust this setting, the Strobe Intensity, and the camera's aperture until reflections are minimized or gone.
Gain	The amplification of the pixel value. Select a displayed value to determine the intensity of the grayscale from the Vicon cameras: x1, x2, x4, or x8. (Note that the available values are those supported by the camera.) This setting is applied to the camera to change the dynamic range of the recorded image. Increasing the Gain means that the marker has less variation in grayscale intensity between its center and its edge, but in certain circumstances, using a higher gain yields markers that are easier for the camera to distinguish. If the markers appear too faint or if the cameras have trouble distinguishing them, adjust the Gain; otherwise, leave this property at the default x1 setting.
Grayscale Mode	The type of data for processed grayscale blobs that the Vicon cameras send to Vicon Tracker. The Vicon cameras process data to create 2D data for Vicon markers. They generate grayscale blobs for reflections from objects in the capture volume and then use centroid-fitting algorithms to determine which of these are likely to be markers by comparing the shape of the grayscale blobs to the Minimum Circularity Ratio and Maximum Blob Height settings. During this processing, Vicon cameras can produce the following types of data for grayscale blobs: centroid data (x, y coordinates and the radius of the centroid calculated), grayscale data (pixel and line information), or coordinate data (line information, that is, grayscale data without pixel values). However, Bonita cameras do not perform centroid fitting. You can specify which type of processed data Vicon cameras send to Tracker:

Control	Description	
	Auto	Send grayscale data only of the grayscale blobs for which centroids were not generated, that is, those below the threshold specified for **Minimum Circularity Ratio**. Send coordinates data of grayscale blobs for which one or more line segments, or the total number of lines in the blob, exceeds the value set for **Maximum Blob Height**. If a marker can be centroid fitted by the Vicon camera, the centroid is passed to the capture PC. If it cannot, the full grayscale of the image is sent, allowing the data to be post-processed on the PC. This is the default and recommended mode.
	None	Send no grayscale or coordinates data; send only centroid data. Any grayscale image that cannot be centroid fitted by the camera will be discarded. Select this mode if you are capturing a large number of markers and have redundancy in your capture setup (i.e. the same marker is seen by more than the number of cameras specified in **Minimum Cameras per Marker** in the **Core Processor** section of the **Properties** for **Local Vicon System**.
	All	Send grayscale data both of grayscale blobs for which centroids were generated and of those for which centroids were not generated, that is those below the threshold specified for **Minimum Circularity Ratio**. Send coordinates data of grayscale blobs for which one or more line segments, or the total number of lines in the blob, exceeds the value set for **Maximum Blob Height**. Select this setting if you need to see exactly where the camera calculates the centroid with respect to the grayscale marker image, for example when adjusting parameters. This setting results in much larger data rates and files; it may be useful for diagnostic purposes, but do not use it in normal capture situations.
	Only	Send all grayscale and coordinates data; send no centroid data. This setting is useful when focusing or making other adjustments to the cameras themselves as you see exactly the image recorded on the sensor.
	Edges	Send only edge coordinates data; send no centroid or grayscale data. If data rates are very high, for example when there are too many reflections, the camera automatically enters this mode. Use this setting to manually force the camera into this mode.
	No Edges	Send grayscale data both of grayscale blobs for which centroids were generated and of those for which centroids were not generated; send no coordinates data. Use this setting to prevent the Vicon camera from sending edge coordinates.

Control	Description
	Caution: Even if you have not specified a **Grayscale Mode** setting that would have coordinates data sent to Tracker, a Vicon camera automatically sends coordinates data – either temporarily or permanently – if it is overloaded with data (e.g., too many markers, too many reflections, hand or reflective objects immediately in front of the camera, too low a threshold or too high a gain). If a camera automatically starts to present coordinates data, identify the source of the overload and attempt to remedy it.
Minimum Circularity Ratio	The circularity threshold used by the centroid-fitting algorithms in a Vicon camera. This value can be set between 0-1 to determine how similar a grayscale blob must be to the internal model of a marker – that is a radially symmetric object that has smooth, sharp edges and whose pixel intensity is brightest at the center and gradually fades towards the edges. The Vicon cameras consider grayscale blobs with circularity equal to or greater than this threshold to be well-formed, circular marker images. The higher the value, the more stringent the centroid fitter is; the lower the value, the less stringent the centroid fitter is. You may want to apply higher settings for camera calibration to ensure that Tracker selects the best markers and thus provides the best possible calibration. A lower value may be appropriate for data capture.
Maximum Blob Height	The maximum number of pixels per line that a grayscale blob can contain in a horizontal line. If the number of pixels exceeds this value, the Vicon camera determines that the grayscale blob is not a marker, stops processing it, and discards the pixel values (it preserves just the coordinates data, which can be sent to Vicon Tracker, depending on the **Grayscale Mode** setting). Set this value between 0–77500 to determine how large a grayscale blob can be for a Vicon camera to consider it a candidate marker. The Vicon cameras consider grayscale blobs with horizontal lines containing this number or fewer pixels to be good-sized, circular marker images. The higher the value, the larger a grayscale blob can be; the lower the value, the smaller a grayscale blob must be.
Enable LEDs	Whether or not to use the status lights on the lower right of the Vicon camera strobe unit that provide feedback on the status of the camera (such as its enabled, connection, or selection state and any processing feedback). This is useful for motion capture applications in very dark environments (such as Virtual Reality) where the brightness of these LED status lights can cause problems. However, Bonita cameras do not have status LEDs.

Camera Status section



When you click on a **Vicon Cameras** node or an individual camera node on the **System** tab in the **Resources** pane, the following controls are available in the **Status** section of the **Properties** pane:

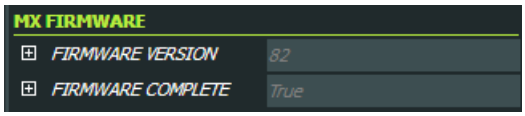
Control	Description
Connected	Whether or not the Vicon camera is currently connected to the Vicon system.
Enabled	Whether or not the Vicon camera is currently enabled for use.
Sync Master	Whether or not the Vicon camera is designated as the synchronization master for the MX system. (Not relevant to MX T-Series cameras or MX devices with an Ultranet HD.)
Contributing Centroids	Whether or not the Vicon camera is contributing centroid data during the current motion capture.
Contributing Grayscale	Whether or not there is a socket open to the Vicon camera capable of receiving grayscale. This socket may be dropped when the system is under heavy load, therefore this property is useful as a system status monitor. It is not related to **Grayscale** property in **Settings**.
Contributing Tracks	Whether or not the Vicon camera is contributing tracks (that is, labeling centroids between frames) during the current session.

MX Hardware section

When you click on a **Vicon Cameras** node or an individual camera node on the **System** tab in the **Resources** pane, the following controls are available in the **MX Hardware** section of the **Properties** pane:

Setting	Description
Type	The type of MX camera (T160, T40 or T20). The **MX Cameras** node is read-only.
Strobe Type	The type of strobe unit attached to the front of the MX camera: Visible Red (VR), Near Infrared (NIR), or Infrared (IR). MX T-Series T160, T40, and T20 cameras support only VR and NIR strobe units. Bonita cameras support NIR. For an **MX Cameras** node, this setting is read-only.
Sensor Width	The width (in pixels) of the MX camera sensor.
Sensor Height	The height (in pixels) of the MX camera sensor.
MAC Address	The Media Access Control (MAC) address assigned to the MX camera during manufacture. This is a hexadecimal value in the format ##.##.##.##.##.##. For an **MX Cameras** node, this setting is read-only.
IP Address	The Internet Protocol (IP) address assigned to the MX camera on the Vicon MX Ethernet network. For an **MX Cameras** node, this setting is read-only.

MX Firmware section



When you click on a **Vicon Cameras** node or an individual camera node on the **System** tab in the **Resources** pane, the following controls are available in the **MX Firmware** section of the **Properties** pane:

Control	Description
Firmware Version	The version number of the MX firmware currently installed on the Vicon camera.
Firmware Complete	Whether or not the currently installed MX firmware is complete. If not, you can reprogram the MX firmware.

Camera Commands section

When you click on a **Vicon Cameras** node or an individual camera node on the **System** tab in the **Resources** pane, the following command is available in the **Commands** section of the **Properties** pane:

Command	Description
Reboot	Stop and restart all cameras or the selected Vicon camera.

Vicon Cameras context menu

When you right-click on the **Vicon Cameras** node on the **System** tab, you can select from the following options on the context menu:

Option	Description
Reorder Devices	Display the **Reorder Devices** dialog box. This enables you to change the order in which Vicon cameras are displayed in the System Resources list.
Reboot All Cameras	Stop and restart all the Vicon cameras in the system.
Enable Preview Mode	Displays a 'video' image from the optical sensor of an MX T-Series camera. This enables you to aim cameras more quickly and easily during setup. **Note:** This preview feature is for system setup purposes only. You cannot capture camera data in **Preview** mode.

When you right-click on a node for a specific Vicon camera, you can select the following option from the context menu:

Option	Description
Reboot	Stop and restart the selected Vicon camera.

About MX connectivity units

You configure MX connectivity units — smart boxes that can be combined to create a distributed architecture, enabling you to customize the number of Vicon cameras and supported third-party devices in your Tracker system — with the **MX Connectivity** node on the **System** tab in the **Resources** pane.

The **MX Connectivity** node is displayed under the **Local Vicon System** node when Vicon Tracker is connected to the MX system. The **MX Connectivity** node lists each MX connectivity unit connected to your MX system.

Depending on the type of Vicon MX system under which you are running Vicon Tracker, your MX system architecture will contain one or more of the following MX connectivity units:

- **MX Giganet** – the primary connectivity unit in an MX T-Series system.
- **MX Ultranet** – the primary connectivity unit in an MX+ system.
- **MX Ultranet HD** – the primary connectivity unit in an MX F-Series system.

You can incorporate units and components from earlier MX Series systems into your MX T-Series system. See the *Go Further with Vicon MX T-Series* reference or contact Vicon Support (see *Contacting Vicon* on page 91) for details on configuring a combined architecture.

Setting up MX Giganet units

The **MX Connectivity** node is displayed under the **Local Vicon System** node when Vicon Tracker is connected to an MX system with at least one MX Giganet unit. The **MX Connectivity** node lists each MX Giganet unit connected to your MX system. For each MX Giganet, the node name includes the device position number, any display name specified in the **Identification** property, and the device type listed in parentheses, for example **#1 Name (MX Giganet)**.

To configure MX Giganet units for analog data acquisition:

1. On the **System** tab, select the node whose properties you want to configure:
   - **MX Connectivity** node for all MX Giganet units.
   - A sub node for a specific MX Giganet unit — For Vicon MX systems, the **MX Giganet** sub-nodes in the **System** list correspond to the IDs assigned by Tracker. If an MX Giganet unit has automatically been designated as the synchronization master for the MX system, its node name is displayed in bold.

     The colored icon beside an **MX Giganet** node identifies the status of the device:
     - Green play button: Component OK (active or connected). If an analog device is connected, this status does not reflect the analog device's status.
     - Yellow pause button: Component is not fully set up or device has been disabled in the **Status** section of **Properties**.
     - Red stop button: Component down (unavailable or disconnected).
2. In the **Properties** section, view or change settings for the required properties.
   When you first set up your MX system, you configure at least the **Name** property and, if you are using synchronization functionality, the **Sync Out** properties. In subsequent sessions, you may want to configure additional properties to suit the needs of your motion capture application.
3. In the configuration management area at the top of the **System** tab, click the save button  to save your system configuration settings to a *.system* file.

MX Giganet Identification section

If MX Giganets are connected to your Vicon system, when you click on the **MX Connectivity** node on the **System** tab in the **Resources** pane, the following controls are available in the **Identification** section of the **Properties** pane:

Setting	Description
Name	A user-defined display name for the entire set of MX Giganets.
Type	The **MX Connectivity** node is read-only.
Device ID	The **MX Connectivity** node is read-only.

When you click on an individual **MX Giganet** node on the **System** tab, the following controls are available in the **Identification** section of the **Properties** pane:

Setting	Description
Name	A user-defined display name for the selected MX Giganet.
Type	The MX device type.
Device ID	The unique identification number Vicon assigned to the MX Giganet during manufacture.

MX Giganet Status section

When you click on an **MX Giganet** node on the **System** tab in the **Resources** pane, the following controls are available in the **Status** section of the **Properties** pane:

Setting	Description
Connected	Whether or not the MX Giganet is currently connected to the Vicon system.
Enabled	Whether or not the MX Giganet unit is currently enabled for use.
Sync Master	Whether or not the MX Giganet is designated as the synchronization master for the MX system.

MX Giganet Sync Out section

General Purpose Outputs (GPO) allow you to configure your system to trigger external equipment on or around each camera frame sync pulse.

Other GPO functionality, available with other Vicon software, is not implemented with Vicon Tracker.

For further information, see the hardware manual for your Vicon Giganet. For up-to-date information about types of GPO triggers that are supported, contact your local Vicon Support office (see *Contacting Vicon* on page 91).

MX Giganet MX Hardware section

When you click on the **MX Connectivity** node or on an **MX Giganet** node on the **System** tab in the **Resources** pane, the following controls are available in the **MX Hardware** section of the **Properties** pane:

Setting	Description
MAC Address	The Media Access Control (MAC) address assigned to the MX Giganet during manufacture. This is a hexadecimal value in the format ##.##.##.##.##.##. The **MX Connectivity** node is read-only.
IP Address	The Internet Protocol (IP) address assigned to the MX Giganet on the Vicon MX Ethernet network. The **MX Connectivity** node is read-only.

MX Giganet MX Firmware section

When you click on an **MX Giganet** node on the **System** tab in the **Resources** pane, the following controls are available in the **MX Firmware** section of the **Properties** pane:

Setting	Description
Firmware Version	The version number of the MX firmware currently installed on the MX Giganet.
Firmware Complete	Whether or not the currently installed MX firmware is complete. If not, you can reprogram the MX firmware.

MX Giganet Commands section

When you click on an **MX Giganet** node on the **System** tab in the **Resources** pane, the following command is available in the **Commands** section of the **Properties** pane:

Command	Description
Reboot	Stop and restart the MX Giganet.

MX Giganet context menu

If MX Giganets are connected to your Vicon system, when you right-click on the **MX Connectivity** node on the **System** tab in the **Resources** pane, you can select the following options from the context menu:

Option	Description
Reorder	Display the **Reorder Devices** dialog box in which you can change the order in which MX Giganets are displayed on the **System** tab.
Reboot All MX Giganets	Stop and restart all of the MX Giganets in the MX system.

When you right-click on a node for a specific MX Giganet, you can select the following options from the context menu:

Option	Description
Reboot	Stop and restart the selected MX Giganet.
Reset Timecode	Reset the Timecode to 00:00:00:00.

About MX Ultranet units

References in this topic to MX Ultranet units also apply to MX Ultranet HD units.

You manage the identification and configuration settings for each MX Ultranet unit included in your Vicon system architecture in an **MX Ultranet** node under the **MX Connectivity** node.

Important: This information applies only to MX systems containing an MX Ultranet (generally those supplied before August 2008) or an MX Ultranet (generally those supplied before November 2007), or an MX T-Series system incorporating one of these units. Vicon MX T-Series systems use the MX Giganet as the single-unit controller for the MX system.

You can incorporate components from earlier MX systems into an MX T-Series system by connecting the MX Ultranet to the MX Giganet. For details on cameras and units that can be incorporated in your MX system, see Tracker components on page 7.

This node is displayed under the **Local Vicon System** node when Vicon Tracker is connected to a Vicon system with at least one MX Ultranet unit. The **MX Connectivity** node lists each MX Ultranet unit (as well as each MX Giganet unit) connected to your Vicon system. For each device, the node name includes the device position number, any display name specified in the **Identification** property, and the device type listed in parentheses, for example **#1 Name (MX Ultranet)**.

Tip: If you select an MX Ultranet unit in the **System** list in the **Resources** pane, the red **Selected Unit LED** on the rear panel of the MX Ultranet unit is lit. This is useful when you are connecting MX cables.

MX Ultranet Identification section

If MX Ultranets are connected to your Vicon system, when you click on the **MX Connectivity** node on the **System** tab in the **Resources** pane, the following controls are available in the **Identification** section of the **Properties** pane:

Setting	Description
Name	A user-defined display name for the entire set of MX Ultranets.
Type	The **MX Connectivity** node is read-only.
Device ID	The **MX Connectivity** node is read-only.

When you click on an individual **MX Ultranet** node on the **System** tab, the following controls are available in the **Identification** section of the **Properties** pane:

Setting	Description
Name	A user-defined display name for the selected MX Ultranet.
Type	The MX device type.
Device ID	The unique identification number Vicon assigned to the MX Ultranet during manufacture.

MX Ultranet Status section

When you click on an **MX Connectivity** node on the **System** tab in the **Resources** pane, the following controls are available in the **Status** section of the **Properties** pane:

Setting	Description
Connected	Whether or not the MX Ultranet is currently connected to the Vicon system.
Enabled	Whether or not the MX Ultranet is currently enabled for use.
Sync Master	Whether or not the MX Ultranet is designated as the synchronization master for the MX system.

MX Ultranet Sync Out section

General Purpose Outputs (GPO) allow you to configure your system to trigger external equipment on or around each camera frame sync pulse.

Other GPO functionality, available with other Vicon software, is not implemented with Vicon Tracker.

For further information, see the hardware manual specific to your Vicon Ultranet. For up-to-date information about types of GPO triggers that are supported, contact your local Vicon support office (see *Contacting Vicon* on page 91).

MX Ultranet MX Hardware section

When you click on an **MX Ultranet** node or an **MX Connectivity** node on the **System** tab in the **Resources** pane, the following controls are available in the **MX Hardware** section of the **Properties** pane:

Setting	Description
MAC Address	The Media Access Control (MAC) address assigned to the MX Ultranet during manufacture. This is a hexadecimal value in the format ##.##.##.##.##.##. The **MX Connectivity** node is read-only.
IP Address	The Internet Protocol (IP) address assigned to the MX Ultranet on the Vicon MX Ethernet network. The **MX Connectivity** node is read-only.

MX Ultranet MX Firmware section

When you click on an **MX Ultranet** node on the **System** tab in the **Resources** pane, the following controls are available in the **MX Firmware** section of the **Properties** pane:

Setting	Description
Firmware Version	The version number of the MX firmware currently installed on the MX Ultranet.
Firmware Complete	Whether or not the currently installed MX firmware is complete. If not, you can **Reprogram the MX Firmware**. If firmware is complete, **True** is displayed.

MX Ultranet Commands section

When you click on an **MX Ultranet** node on the **System** tab in the **Resources** pane, the following command is available in the **Commands** section of the **Properties** pane:

Command	Description
Reboot	Stop and restart the MX Ultranet.

MX Ultranet context menu

If MX Ultranets are connected to your Vicon system, when you right-click on the **MX Connectivity** node on the **System** tab in the **Resources** pane, you can select the following options from the context menu:

Option	Description
Reorder	Display the Reorder Devices dialog box in which you can change the order in which MX Ultranets are displayed on the **System** tab.
Reboot All MX Ultranets	Stop and restart all of the MX Ultranets in the MX system.

When you right-click on a node for a specific MX Ultranet on the **System** tab, you can select the following options from the context menu:

Option	Description
Reboot	Stop and restart the selected MX Ultranet.
Reset Timecode	Reset the Timecode to 00:00:00:00.

About the Other Devices node

The Other Devices node is displayed under the Local Vicon System node when licensed additional devices (that is, connected devices that are not cameras or connectivity devices) are connected to the Vicon system. The Other Devices node lists each additional type of device that is connected to your Vicon system.

Note: You can only use an additional device if you have the required license. To check your current licensing options, from the Help menu, click About Vicon Tracker and in the window, click the License Info button. After a few seconds, the currently licensed options are listed. To change your licensing options, contact Vicon Support (see *Contacting Vicon* on page 91).

Depending on the type of additional licenses you are using with Tracker and your Vicon system, your MX system architecture may contain one or more of the following additional devices:

- Analog device such as accelerometers
- Dikablis Eye Tracker
- Vicon Apex

Setting up analog devices

The Other Devices node is displayed on the System tab in the Resources pane under the Local Vicon System node when Vicon Tracker is connected to an MX system with at least one additional device (that is, a device that is not a camera or a connectivity unit). Analog devices such as accelerometers are connected to the Vicon system via an MX Giganet. You add analog devices to the Vicon system in Tracker by right-clicking on the Other Devices node and selecting Add Generic Analog. The Generic Analog node enables you to select the appropriate options for your device.

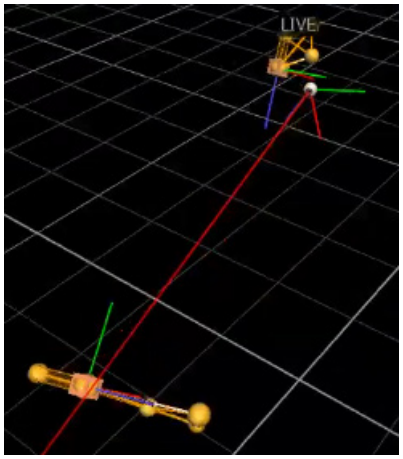
To use an analog device with Tracker:

1. Ensure that the analog device is connected to your Vicon system through a Giganet.
2. In Tracker, on the System tab, right-click Other Devices and then click Add Generic Analog. A Generic Analog device appears beneath Other Devices.
3. Right-click Generic Analog and from the list, select your analog device.
4. To add outputs for the device, on the System tab, right-click the device and click the number of components to add.
5. To change the properties of the output, edit the appropriate property in the Properties pane, for example:
   - Name
   - A scaling factor from the voltage input to desired output
   - Analog input pin
   - Channel gain
6. To change the options for viewing data in the Graph view, in the view pane, select Graph and then choose the appropriate option from the menu.

Tip: You can receive the raw analog data and relevant device information through the DataStream SDK.

About eye tracking

With Tracker, you can use the Dikablis Eye Tracking System to track movement of the eye's pupil to calculate the gaze vector.



The Dikablis Eye Tracking System is compatible with both T-Series and Bonita cameras. A minimum of two cameras are required for use with the system.

Note: Eye tracking is not available with the evaluation license, but is an optional add-on to the full version of the software and requires an additional license.

Calibrating and integrating eye tracking

To calibrate your system and use Tracker to track eye movement, complete the following procedures:

- *Calibrate the Dikablis system and connect it to your Vicon system*.
- *Calibrate your Vicon system and add in your Dikablis device*.
- *Specify the eye offsets*.
- *Calibrate the Dikablis eye tracker with Vicon Tracker*.
- *Save your settings*.

Calibrate the Dikablis system and connect it to your Vicon system:

1. Connect up the headset, transmitters and receivers that comprise the Dikablis eye tracking system.
2. Ensure the subject is wearing the Dikablis headset and some markers for head tracking.
3. Start the Dikablis Recorder software on the Dikablis system and run the calibration wizard.
4. Connect the Dikablis laptop directly to your Vicon system PC with an Ethernet cable.
5. Set the IP addresses of the Network Interface Cards to an appropriate value. These instructions use 10.0.0.1 on the Dikablis laptop and 10.0.0.2 on the Vicon system PC. (For instructions on how to set IP addresses, see the Windows online help.)

Calibrate your Vicon system and add in your Dikablis device:

1. Aim your Vicon cameras to capture the required volume.
2. Calibrate your Vicon camera system in Tracker.
3. Set your origin pointing forwards by positioning the T of the wand with the flat part (the top of the T) facing towards the front of the capture volume.
4. When you have a calibrated system, create an object in Tracker from the wand markers. To do this:
   a. In the **3D Perspective** view pane, ALT+click and drag to select the relevant markers.
   b. In the **Resources** pane, click the **Objects** tab and in the **Create Object** box, type `Wand` and click **Create**.
5. Adjust the wand's origin so it is positioned on the center marker on the cross of the T.
6. With your subject looking straight ahead, create an object from the head markers and give it a suitable name, such as `Head`. (You can give it any suitable name, but ensure you use the same name in the following steps.)
7. On the **System** tab, right-click **Other Devices** and then click **Add Dikablis Eye Tracker**.
8. Select the **Dikablis Eye Tracker** and in the **Properties** pane, enter the following values:
   - **Name**: `Eye`
   - **Head Object**: `Head`
   - **IP Address**: `10.0.0.1`
     (or the address of the PC running the Dikabilis software if different from 10.0.0.1)
   - **Calibration Object**: `Wand`
9. Make sure the **Eye Tracker** remains selected on the **System** tab, change the view pane to **Graph** view and in the **Components** list, select **Components.**

   Two graphs are shown: X and Y, representing the 2D coordinates for the eye's gaze. The values are pixel values from the eye camera.
10. Check that the eye's gaze is accurately represented by the X and Y values. To do this:
    a. Get your subject to look left. The X value decreases.

    Tip: To see all the data, you may need to click the **Scale the graph to fit the horizontal and vertical ranges of data** button  at the top of the **Graph** view pane.

    b. Get your subject to look right. The X value increases.
    c. Get your subject to look up. The Y value increases.
    d. Get your subject to look down. The Y value decreases.

Tip: The X values should not go above 640 or below 0. The Y values should not go above 480 or below 0.

Specify the eye offsets:

1. With the **Eye Tracker** selected on the **System** tab, in the **Properties** pane, enter appropriate values. The following offsets are normally suitable:

   - **X (mm)**: `-20`
   - **Y (mm)**: `-40`
   - **Z (mm)**: `-25`

2. Change the view pane to **3D Perspective** and look at the **Head** object.

   The eyeball should be approximately where the eye is, relative to the **Head** markers.

Calibrate the Dikablis eye tracker with Vicon Tracker:

1. Get your subject to stand with the wand in their hand so that both the **Head** and **Wand** objects are clearly and consistently visible in the **3D Perspective** view pane.
2. Get the subject to look at the marker at the center of the T on the wand.
3. In the **Calibration** area of the **Eye Tracker Properties** pane, click **Add**.

   The **Samples** box displays 1.

   Tip: If an error is made during calibration, you can remove the last sample you added by clicking the **Remove** button. To delete multiple samples, repeatedly click the **Remove** button.

4. Get the subject to move the wand and repeat step 3.

   The number of samples goes up to 2.

5. Repeat step 4.

   The number of samples goes up to 3 and an eye with an eye vector coming from it appears in the **3D Perspective** view pane.

   In the **Calibration** area of the **Properties** pane, a **Residual** value is displayed.

6. Get your subject to keep their head still and move the wand around, following the marker at the center of the T with their eyes.

   In the **3D Perspective** view pane, the eye vector now follows the wand.

7. On the **System** tab, select the **Eye Tracker**. Change the view pane to **Graph**.

   Ray X, Ray Y and Ray Z values are displayed, as well as X and Y values.

Save your settings:

1. In the System Resources pane, click the Configuration menu button  and select Save As.
2. Enter the name `DikablisTest`.
3. When prompted, select **Shared** or **Private**.

About Vicon Apex devices

Note: You can only use an Apex with Tracker if you have the required license. To check your current licensing options, from the **Help** menu, click **About Vicon Tracker** and in the window, click the **License Info** button. After a few seconds, the currently licensed options are listed. To change your licensing options, contact Vicon Support (see *Contacting Vicon* on page 91).

To add an Apex to your Vicon system:

1. Ensure its bluetooth dongle is plugged into the relevant computer, then switch it on in the capture volume.
2. After a few seconds, on the **System** tab, right-click the **Other Devices** node, click **Add Apex Device**, and in the **Add Apex Devices** dialog box, select the required device and click **Add**.

   On the **System** tab, the selected Apex is displayed under the **Apex Device** node.
3. To display all the Apex settings, ensure the Apex is selected on the **System** tab and if necessary, at the top right of the **Properties** pane, click **Show Advanced**.

   The following controls are available in the **Properties** pane:

Section	Control	Description
General	Name	A name that uniquely identifies the selected Apex. The default name is of the format ViconAP_*nnn*. If required, you can change the name of the Apex.
	Delay Compensation (s)	An adjustment (in seconds) to allow for any delay in the datastream. The default is 0.
	LED Intensity	Enables you to change the brightness of the LEDs. The default is 2; the brightest setting is 3.
	Continuous Mode	Enables you to change the LEDs to be on continuously, instead of being strobed. If you select this setting, to reduce power consumption, the **LED Intensity** is automatically set to 1. To further reduce power consumption, see also **Sleep** and **Sleep Timeout** (below)
	Sleep	When selected, enables the device to turn off the tracking LEDs after the number of minutes of inactivity specified in the **Sleep Timeout** box.
	Sleep Timeout (min)	If **Sleep** is selected, enables you to specify the number of minutes of inactivity by the joystick or buttons after which the tracking LEDs are turned off. To reactivate the LEDs, touch the joystick or buttons.
	Identify	Causes the selected Apex to vibrate, enabling it to be easily identified.

Section	Control	Description
Information	Serial Number	The four-digit serial number of the Apex. This number is also visible on a sticker on the device.
	Bluetooth Identity	The Bluetooth serial number of the Apex.
	PCB Revision	The hardware revision number of the Apex.
	Mechanics Revision	The mechanics code of the Apex.
	Firmware Revision	The firmware revision number of the Apex.

Setting up Vicon Apex devices

To start the Apex, ensure it is sufficiently charged (see the *Vicon Apex User Guide*) and its bluetooth dongle is plugged into the relevant computer, then switch it on in the capture volume. The LEDs on the Apex flash until it is synchronized with the cameras.

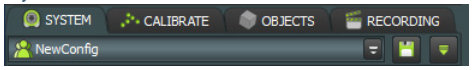
Note: You will only be able to use an Apex with Tracker if you have the required license. For more information, contact Vicon Support (see *Contacting Vicon* on page 91).

To set up an Apex to work with Tracker:

1. Complete the following steps in the order shown:
   a. Ensure the Apex is sufficiently charged (see the *Vicon Apex User Guide*) and switch it on in the capture volume,
   b. Plug the Apex's Bluetooth dongle into the relevant computer.
   c. Start Tracker.
   The LEDs on the Apex flash until the Apex is synchronized with the cameras..
2. To add the Apex to the current configuration, on the **System** tab in the **Resources** pane, right-click **Other Devices** and then click **Add Apex Device**.
3. In the **Add Apex Devices** dialog box, select the device to add and click **Add**.

   After a few seconds, the Apex appears on the **System** tab. Its name is displayed in the **General** area of the **Properties** pane.

   In the capture volume, the tracking LEDs on the device illuminate and object tracking begins.
4. To check that the Apex is working correctly, in the view pane, select **Graph** view and operate the joystick and buttons. The graphs show the current status of the joystick (the top two graphs are the x and y views) and the buttons.
5. To make the LEDs brighter or dimmer, to change the LEDs to be on continuously, or to use haptics to identify an Apex in the capture volume, use the relevant control in the **Properties** pane.
6. To enable Tracker to remember the device that you have added in future sessions, save the current configuration, using the configuration management controls at the top of the **System** tab.



Using multiple Vicon Apex devices

You can use up to seven Apex devices simultaneously: each device comes with a unique name that identifies it within Tracker. If required, you can change this name. When the device is selected on the System tab, the name appears in the General section of the Properties pane.

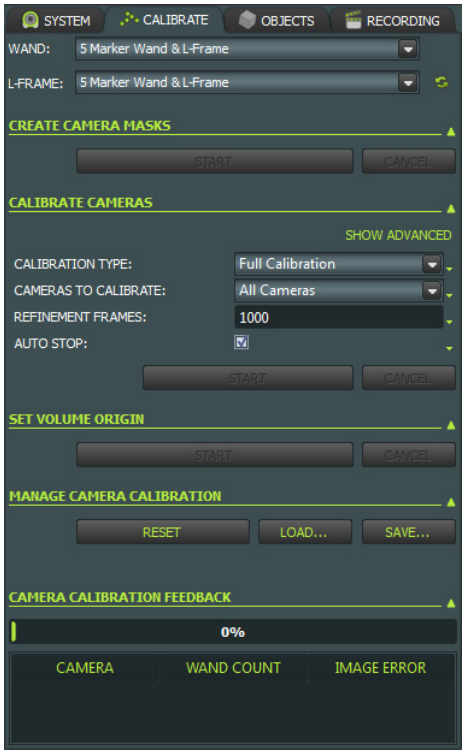
You can also use the Identify button in Tracker to quickly identify a selected Apex.

To quickly identify an Apex:

1. Ensure that the Apex is switched on and connected in the capture volume.
2. In Tracker, on the System tab, click one of the Apex devices to select it.
3. In the Properties pane, go to the General section and click Identify.

   The selected Apex vibrates, enabling you to identify it.

About the Calibrate tab



Calibration is a two-stage process by which Vicon Tracker calibrates the cameras based on specialized calibration objects (whose dimensions and relative marker positions are known):

1. Calibrating cameras During the first stage, the Tracker camera calibration process calculates the physical position and orientation of each Vicon camera in the capture volume based on the movement of the calibration object. Tracker uses this information to determine each camera's physical position and orientation in the capture volume and correct for any lens distortion.
2. Setting volume origin During the second stage, you set the volume origin in Tracker. Tracker measures the position of the calibration object and uses this information to identify

the origin of the world and its horizontal and vertical axes. These volume origin and axes are referred to as the global coordinate system. The global axes coordinates are given in the form (x, y, z), where x is a horizontal axis, y is the horizontal axis perpendicular to x, and z is the vertical axis.

The **Calibrate** tab contains the following sections:

Section	Description	
Select calibration objects	Specify the calibration objects that will be used in the two stages of the system calibration process:	
	Wand	The calibration object to be used during the camera calibration process.
	L-Frame	The calibration object to be used during the camera calibration process.
Create Camera Masks	Automatically create cameras masks to obscure all reflections visible to the Vicon cameras.	
Calibrate Cameras	Calibrate the Vicon cameras to determine their positions, orientations, and lens properties, which enables Tracker to produce accurate 3D data from motion data captured throughout the capture volume.	
Set Volume Origin	Define the global origin and the axes of the world (in the context of the capture volume).	
Manage Camera Calibration	Reset, load, or save camera calibration defining settings for the Vicon cameras in your Tracker system.	
Camera Calibration Feedback	View system calibration processing progress and status information.	

Calibrate Vicon cameras

You specify settings for the calibration of Vicon cameras in the **Resources** pane, in the **Calibrate Cameras** section of the **Calibrate** tab.

The Vicon camera calibration process describes the capture volume to the system, enabling Tracker to determine the positions, orientations, and lens properties of all the Vicon cameras. Tracker uses this information to produce accurate 3D data. During the camera calibration process, Vicon Tracker creates a calibration parameters (*.xcp*) file. This file contains the calibration settings and threshold data specified for the Vicon cameras in your Tracker system and is used when data from these cameras is processed.

Important: As part of the first stage of the daily Tracker motion capture workflow, Vicon recommends that you calibrate your Vicon cameras each day before you capture any data. This ensures that any unexpected changes in your setup that may have occurred when the system was unsupervised will not influence the quality of your data. You can perform the level of camera calibration that suits your requirements: a full camera calibration or a calibration refinement.

To perform a Vicon camera calibration, you need a dynamic calibration object, which is supplied with your Vicon system.

To calibrate Vicon cameras in Tracker:

1. In the view pane, display a **Camera** view.
2. On the **System** tab in the **Resources** pane, expand the **Vicon Cameras** node and select all Vicon cameras.
3. On the **Calibrate** tab, from the **Wand** drop-down list select the type of dynamic calibration object you are using.
4. In the **Calibrate Cameras** section, view or change settings for the required parameters (if required, click **Show Advanced** to reveal additional settings), ensuring that you select the appropriate option from the **Calibration Type** list: **Full Calibration** or **Calibration Refinement**.
5. In the **Calibrate Cameras** section, click **Start**. The camera calibration process starts, and the **Start** button switches to its **Stop** setting.
6. In the capture volume, wave the calibration wand throughout the area where you intend to capture 3D data, ensuring that the markers on the calibration object are visible to the cameras. Vicon Tracker begins to capture wand wave data.
7. In each **Camera** view pane, check the display of colored lines identifying wand frames, ensuring that a good number of wand frames are spread across the intended 3D capture volume.

   Tip: If no cameras are visible in the **Camera** view pane, make sure they are selected on the **System** tab in the **Resources** pane.

8. On the **Calibrate** tab, in the **Camera Calibration Feedback** section, check the **Wand Count** values returned for each Vicon camera.
9. In the **Calibrate Vicon Cameras** section, click **Stop**. Vicon Tracker automatically starts processing the camera calibration data.

   Tip: If you selected the **Auto Stop** option in the **Parameters** section, Tracker automatically stops the calibration process when sufficient calibration information has been acquired.

10. In the **Camera Calibration Feedback** section, monitor the progress bar until the camera calibration process is complete and review the **Wand Count** and **Image Error** data. As a general guideline, Tracker typically takes 15-60 seconds to complete its calculations for a typical Vicon system setup. When the Vicon camera calibration has successfully completed, it is automatically saved to an *.xcp* file.

Tip: Because calibration feedback values are based on factors such as the size of the capture volume and the camera lens type, it is not possible to provide general guidelines on typical or acceptable ranges. Therefore, to determine the optimal values for your Vicon system, shortly after the system is installed establish a baseline against which you can compare future daily calibration values.

Camera calibration parameters

In the Calibrate Cameras section of the Calibrate tab, you can change the following settings:

Control	Description	
Calibration Type	The level of camera calibration to be performed when the camera calibration process is started:	
	Full Calibration	A full camera calibration process enables the Vicon system to determine each camera's physical position and orientation in the capture volume and to correct for any lens distortions, and to set internal camera parameters. You must perform a full camera calibration when the system is first installed and set up or if your camera set up has changed.
	Calibration Refinement	A camera calibration refinement process enables you to correct a simple problem with a camera calibration. The Vicon system recalculates the previous calibration data based on the current location of the cameras. You can refine an existing calibration only if the camera positions have not changed significantly.
Cameras To Calibrate	A list of cameras to be included in the camera calibration process. Cameras not included in this list are not calibrated. If this field is blank, all cameras are calibrated. The selection of cameras is applied when you click the Stop button in the Calibrate Cameras section.	
Refinement Frames	With auto stop selected, the minimum coverage (in number of frames) required per camera in the final phase of the refine camera calibration process.	
Auto Stop	Whether or not Tracker is to automatically stop the camera calibration process when sufficient data has been collected.	

Camera calibration feedback

On the **Calibrate** tab in the **Resources** pane, you can view the camera calibration processing and status information in the **Camera Calibration Feedback** section. **Camera Calibration Feedback** contains the following components:

Component	Description
Progress bar	This bar displays a percentage indicating the progress of the overall camera calibration process.
Camera	This column contains the device ID for each Vicon camera being calibrated.
Wand Count	For each Vicon camera, this value identifies the number of frames it has captured containing the calibration object. Initially, the entry for the number of wand frames is displayed in red; the entry turns green when Vicon Tracker has acquired enough wand data to calibrate that camera (by default 1000 frames). Because **Auto Stop** is not selected by default, the calibration process only stops when you click the **Stop** button. If you have selected **Auto Stop**, the calibration process stops when the Vicon camera with the lowest frame count reaches the number of frames specified in the **Refinement Frames** field in the **Calibrate Cameras** section.
Image Error	This value (in RMS distance in camera pixels) indicates the accuracy of the 3D reconstruction of the markers. This value represents the difference between the 2D image of each marker on the camera sensor and the 3D reconstructions of those markers projected back to the camera's sensor. Acceptable values depend on factors such as camera type. the size of the capture volume, and the camera lens type.

Setting the volume origin

Setting the volume origin tells the Vicon system where the center of your capture volume is and what its orientation is (x, y, and z axes), so that subjects are displayed the right way up in the Tracker workspace and so that you can change the way data is visualized in the workspace. You set the global coordinate system immediately after you calibrate your Vicon cameras.

Important: Before starting the set volume origin process, remove from the capture volume all markers and the sources of any unwanted reflections that have not been accounted for by camera masks previously created. To set the volume origin, you need a calibration object, which is supplied with your Vicon system.

To set the global coordinate system:

1. Display a **3D Perspective** view pane.
2. On the **Calibrate** tab, in the **Wand** drop-down list, ensure that the same dynamic calibration object you used when you calibrated the MX cameras, is selected.

   Tracker determines the unit of length for calculating the volume based on the length of the calibration wand. If you specify a wand that is a different length from the one you used during the MX camera calibration, the volume will have the wrong unit of length, so Tracker will be unable to locate the L-frame calibration object.

3. From the L-Frame drop-down list, select the type of static calibration object you are using to set the volume origin.
4. In the capture volume, place the calibration object flat on the floor in the position and orientation that you would like to be the origin of the global coordinate system.
5. In the Set Volume Origin section, click Start.

   The calibration object tracking process starts, Tracker identifies the calibration object in the capture volume, displays a 3D representation of it in the 3D Perspective view pane, and switches the Start button to its Set Origin setting.
6. Click Set Origin to complete the calibration object tracking process.

   Tracker sets the global origin and axes to correspond to the position and orientation of the calibration object in the capture volume. In the 3D Perspective view pane, the floor grid is displayed aligned with the capture volume floor and the representations of the cameras are distributed in the position and orientation in which the physical cameras are located around the capture volume. When the global coordinate system has been successfully set, it is automatically saved to an *.xcp* file.
7. Verify that the global coordinate system was set successfully by checking that the system tracks the static calibration object.

   If it does not, check the following:

   - Was the correct dynamic calibration object selected from the Wand drop-down list at the top of the tools pane?

     If not, repeat this procedure from Step 2, ensuring that you select the correct entry for the calibration wand you used for calibrating the MX cameras.

   - Was the correct static calibration object selected from the L-Frame drop-down list at the top of the Calibrate tab?

     If not, repeat this procedure from Step 3, ensuring that you select the correct entry for the L-frame you are using.

After you have set the global coordinate system, you can display the volume axis marker in the lower-left corner of the 3D Perspective view pane.

You turn the display on or off in the Options dialog box by selecting or deselecting Volume Axis under General View Options.

Changing the volume origin

You can edit an existing calibration object to change the position of the volume origin.

To change the volume origin:

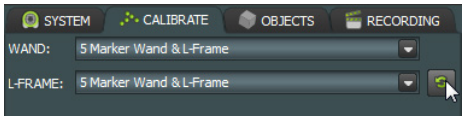
1. After you have completed the usual calibration and setting volume origin procedures, load the calibration object that you used for calibration. To do this, on the **Objects** tab, click the **Load an Object** button  and locate the relevant calibration object. The default location is:

   C:\ProgramData\Vicon\Tracker\CalibrationObjects

2. On the **Objects** tab, click the **Pause** button  .
3. Move the calibration object in either of the following ways:

   - On the **System** tab, click the object and in the **Properties** pane ensure **Show Advanced** is selected, then edit the **Global Position** fields and **Global Rotation** fields as necessary; or
   - Drag the object in the view pane.

4. When you are happy with the position of the calibration object, right-click it and click **Save Object As**. Enter a suitable name, and click **Save**.
5. On the **Calibrate** tab, click the **Reload** button next to the **L-frame** list.

6. Click the **L-frame** list and select your new calibration object.
7. In the **Set Volume Origin** section, click **Start**.

   In the view pane, the cameras move to reflect the new position of the origin.

Managing camera calibrations

In the **Manage Camera Calibration** section of the **Calibrate** tab in the **Resources** pane, you can reset, load, or save camera calibrations that define settings for the Vicon cameras in your Tracker system.

During the Vicon camera calibration process, Vicon Tracker creates a calibration parameters (*.xcp*) file. The changes in the *.xcp* file are automatically written to the calibration file, which overwrites the current file. If you want to be able to load the previous calibration in later, you must save it.

Changing a camera calibration can be useful in the following circumstances:

- To undo a poor calibration change.
- To compare calibration changes.

To manage camera calibration files in Tracker:

- On the Calibrate tab, go to the Manage Camera Calibration section and click the required button:

Button	Description
Reset	Removes all non-existing cameras, clears the calibrated position for existing cameras, and reverts all calibration parameters to their default settings. This enables you to recalibrate the system from a clean starting point.
Load	Displays the **Choose a file** dialog box, from which you can navigate to and select the required *.xcp* file and click **Open**.
Save	Saves the current calibration.

About the Objects tab

Prepare and manage the objects whose motion data you want to track in Vicon Tracker on the **Objects** tab in the **Resources** pane. Objects are a rigid, asymmetrical arrangement of at least three markers. Multiple objects can be defined to track many rigid bodies at the same time.

The **Objects** tab contains the following components:

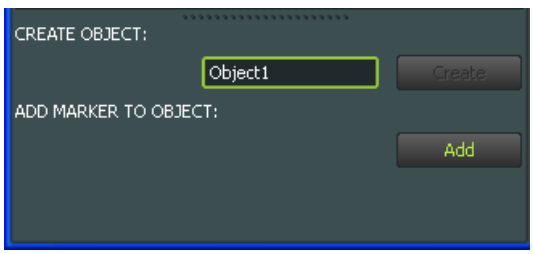
Component	Description
Objects list	Lets you enable an object for motion capture and data recording. If a working *.vsk* file exists for the object, the object symbol is orange and the object name is gray. If the name is red, the *.vsk* file is not suitable for tracking (this may be due to symmetry in the arrangement of markers, or similarity to another enabled object). To display a tool tip identifying the problem, hover the mouse pointer over the object. To display or hide the model markers defined in the *.vsk* file, expand (+) or collapse (-) the **Markers** list. **Tips** To manage specific objects, in the **Objects** list, right-click on the relevant node and from the context menu select a command. The **Open Folder** option, at the bottom of the context menu, provides a quick way to locate a relevant file. The color-coded symbols displayed for entries in the **Markers** list correspond to the colors defined for each model marker in the *.vsk* file.
Properties pane	Enables you to view or edit object properties.

Creating an object

You must create an object for motion capture and data streaming recording. Objects are a rigid, asymmetrical arrangement of at least three markers whose motion data you want to track. Multiple objects can be defined to track many rigid bodies at the same time.

To create an object:

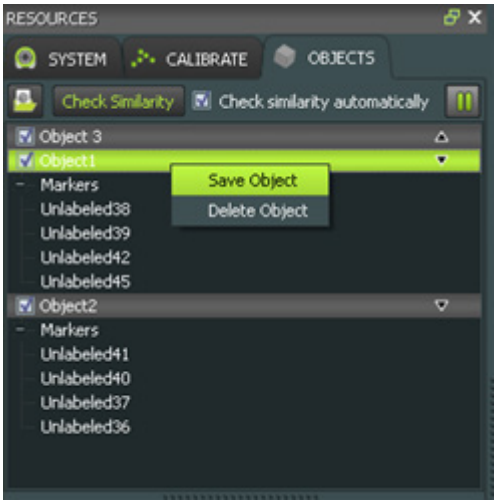
1. If you are streaming live, on the **Objects** tab in the **Resources** pane, click **Pause**  .
2. In the view pane, zoom (right-click + drag forward or backward) in on the markers to be defined as an object.
3. Select the markers you want to include by doing one of the following:
   - To select markers individually, press and hold the CTRL key while you left-click on each marker.
   - To select a group of markers, press and hold the ALT key while you drag around the markers to form a box around them.
4. With the object still selected, type a name in the **Create Object** box at the bottom of the **Objects** tab.



5. You can now make the following optional changes:

   - Left-click and drag the red, green, or blue axis lines emanating from the center of the object (translation manipulator) to translate the origin of the object to the desired position.
   - Left-click the translation manipulator to toggle it to a rotation manipulator.
   - Drag the rotation manipulator axes to orient the object to the desired pose.

6. Save the object by right-clicking it the **Objects** list and selecting **Save Object** from the context menu.



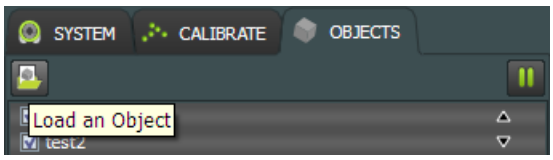
Tracker saves the contents of the object in a *.vsk* file in the *Objects* folder.

Loading an existing object

You can open or load an existing *.vsk* file (object) in Tracker.

To load a .vsk file:

1. On the **Objects** tab tool bar, click the **Load an Object** button:



2. In the **Choose an Object File** dialog box, navigate to an existing *.vsk* file, select it and then click **Open**.

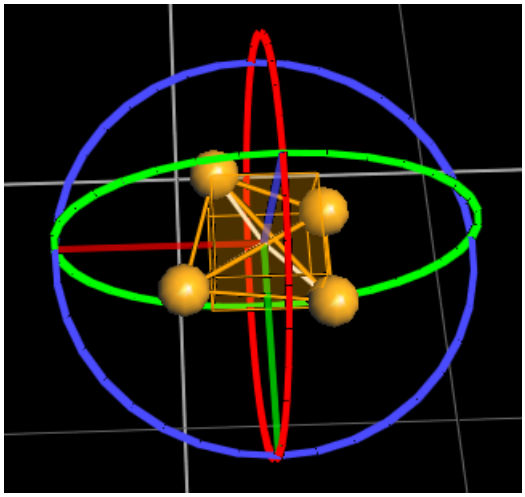
Caution: If the selected *.vsk* file has the same name as an object currently loaded in Tracker, the contents of the selected *.vsk* file replace those in the currently loaded object.

Snapping the rotation or position of an object to a marker

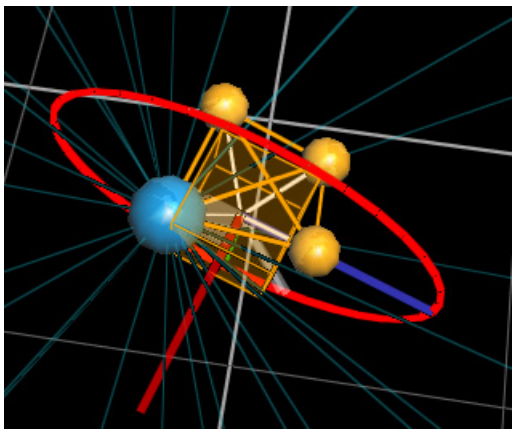
You can change the orientation of an object in real time by snapping the rotation to a marker.

To snap the rotation to a marker:

1. In the view pane, click a marker within an object.
2. Click any axis. Three circles associated with the axes are displayed.



3. Click on a circle and rotate it until you see a gray rectangular shape snap into place .



To snap the position of an object to a marker:

1. In the view pane, click a marker within an object.
2. Click any axis and drag towards the marker until it snaps into place.

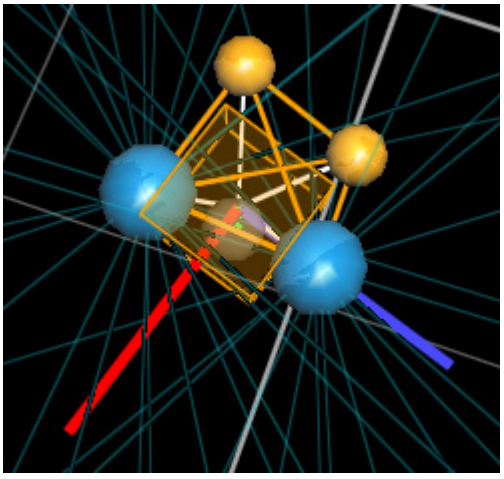
Snapping a midpoint between markers

You can snap two markers together to measure the distance between the markers.

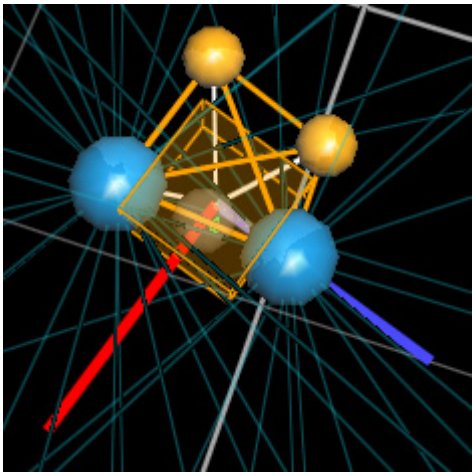
To snap a midpoint between markers:

1. In the View pane, select two markers by pressing CTRL while left-clicking each marker.

   A gray, projected marker is displayed at the midpoint between the two markers .



2. Left-click on the desired axis and move it towards the gray projected marker until it snaps into the midpoint .

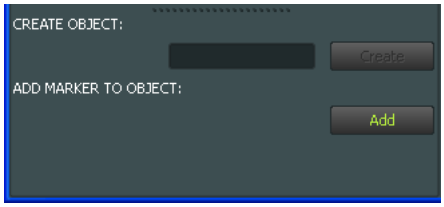


Adding and detaching markers

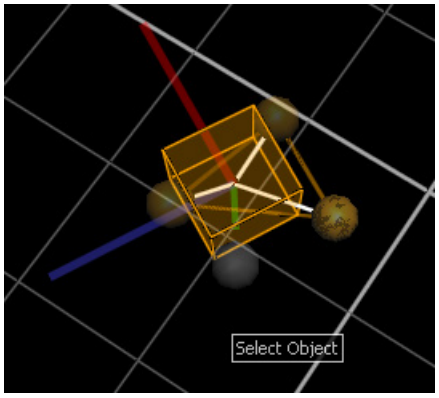
You can easily add a marker to an existing object or detach a marker from an object.

To add a marker to an object:

1. In the view pane, click the marker to add to select it.
2. At the bottom of the **Objects** tab, click **Add** next to **Add Marker to Object**.



   The mouse pointer now displays **Select Object**.



3. Click in the view pane.

   The marker is now part of the object and is displayed in the **Object** list.

To detach a marker from an object:

1. In the view pane, right-click the marker to detach.
2. Select **Detach Marker** from the context menu.

   The marker becomes disabled and is deleted from the object in the **Object** list.

Managing objects

After you have loaded an existing *.vsk* file or created a new object, you can save or delete the object, or move its centroid.

To save an object as .vsk file:

1. On the **Objects** tab in the **Resources** pane, right-click the object.
2. Select **Save Object** from the context menu.

   Tracker saves the contents of the object in a .vsk file in the Objects folder.

To delete an object:

1. On the **Objects** tab, right-click the object and select **Delete Object** from the context menu.
2. In the **Warning confirmation** message, click **Yes** to proceed.
3. Tracker deletes the object from the **Objects** tab, unloads the .vsk, removes the labels from the trajectories associated with that object, and permanently deletes it from the Objects folder.

To move the centroid of an object:

- In the view pane, click an axis and move along that axis until you reach the location you want. Repeat for the other axis until your desired location for the centroid is reached.

You can also position an object in the global coordinate system (see *Positioning an object in the global coordinate system* on page 63).

Snapping an object to the global coordinate system

Tracker enables you to snap an object's axes to the global coordinate system, for accurate positioning and aligning of objects.

To snap an object to the global coordinate system:

1. On the **Objects** pane, click the **Pause** button  .
2. On the **Window** menu, click **Options** and in the dialog box, click **Objects**. Ensure **Snap Global** is selected. If required, you can also change the **Snap Distance (mm)**.
3. Ensure nothing is selected and then in the view pane, drag or rotate the object axes to enable them to snap to the grid.

Tip: To change the distance between the lines of the grid to which objects can snap, in the **Options** dialog box, select **Floor Grid** and adjust as required.

Positioning an object in the global coordinate system

Tracker enables you to view and specify the values that determine the position of an object within the global coordinate system.

To precisely position an object:

1. On the **System** tab in the **Resources** pane, click the object and then in the **Properties** pane, click **Show Advanced**.
2. In the view pane, drag or rotate the object's axes and observe the change in the values in the **Global Position** fields (the location of the object within the global coordinate system in millimeters) and **Global Rotation** fields (the orientation of the object within the global coordinate system in degrees).
3. If required, enter new values in the **Global Position** and **Global Rotation** fields.

   The position of the object changes in the view pane.

Tip: To set the current position of the object to the global position of 0, 0, 0 (that is, the origin), click the drop-down arrow to the right of the **Global Position** fields and select **Set to Default**.

Reorder Markers dialog box

The **Reorder Markers** dialog box enables you to change the order in which markers are displayed in the **Objects** list in the **Resources** pane.

To change the order in which markers are displayed:

1. On the **Object** tab, if necessary, expand the node of the object whose markers you want to change.
2. Right-click the **Markers** node and then click **Reorder**.
3. In the **Reorder Markers** dialog box, click to select the marker whose position you want to change and choose from the following options:

   - **Move Up**
   - **Move Down**

Working with object properties

When you click on an object on the **Objects** tab in the **Resources** pane, you can configure the following setting in the **Properties** pane.

Setting	Description
Name	The name of the selected object. This name is used when the Vicon Skeleton is saved in a *.vsk* file.

To change the name, do any of the following:

- In the **Name** box in the **Properties** pane, select the current name and enter a new one; or
- Click the button next to the **Name** box to display the **Name** dialog box, select the existing object name and enter a new one; or
- On the **Objects** tab, double-click the current name and enter a new one.

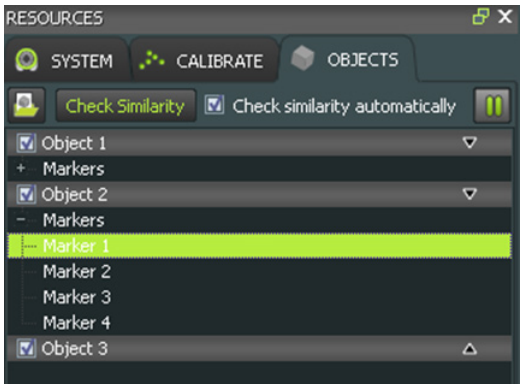
Changing marker color

You can change the color of object markers.

To change color properties:

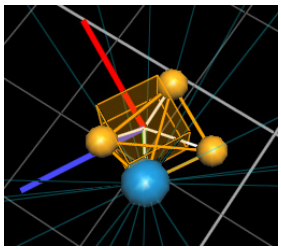
1. Select the marker in either of the following ways:

   - Select the marker in the **Marker** list:



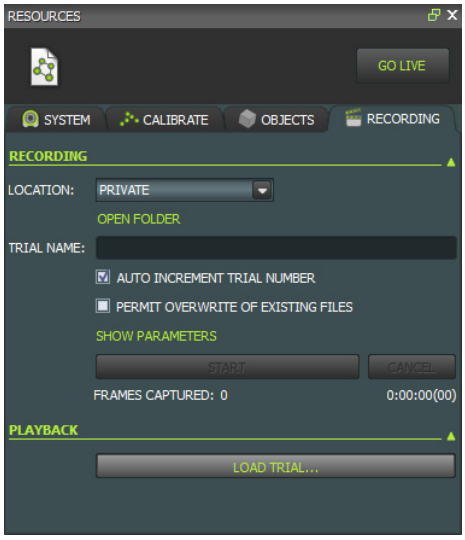
   or

   - Click on the marker in the view pane:



2. In the **Properties** pane, click the currently displayed color in the **Color** box.
3. In the **Select Color** dialog box, assign a color in the **Basic colors** area, or define a new color in the **Custom colors** area and then click **OK**.

About the Recording tab



Save and play back recordings of trial data, using the controls on the **Recording** tab in the **Resources** pane.

> **Note:** You will only see the **Recording** tab if you have the required license. For more information, contact Vicon Support (see *Contacting Vicon* on page 91).

The **Recording** tab contains the following components:

Component	Description
Recording section	In the **Recording** section, specify your requirements for recording live trials. When you have finished specifying your requirements, click the **Start** button to begin recording.
Location	Select **Private** or **Shared**, depending on your requirements.
Open Folder	View the location of the saved files. The default file location depends on whether the files are saved as **Shared** or **Private** data:

File Type	File Location (English language version)
Private	*C:\Users\UserName\AppData\Roaming\Vicon\Tracker\CapturedTrials*
Shared	*C:\ProgramData\Vicon\Tracker\CapturedTrials*

> **Note:** For each trial recorded, at least three files are saved: *.x2d*, *.system*, and *.xcp* files. If you are using an analog device to capture data, an *.x1d* file is also saved.

Trial Name	Enter a name for the new trial.

Component		Description
	Auto Increment Trial Number	When selected, the trial number is automatically appended to the file name.
	Permit Overwrite of Existing Files	When selected, existing captured trial data in the same folder (see above table) is overwritten when the new file is saved.
	Show/Hide Parameters	Displays or hides additional controls, such as those for remote triggering.
	Start/Stop on Remote Trigger	When selected, a remote trigger can be used to control capturing start and stop times. The remote device must be connected to your Vicon system.
	Capture Before Start (secs)	To capture data before the capture start is triggered either manually (by clicking **Start**) or automatically (based on a remote trigger), select this check box and enter the required number of seconds.
	Stop after Duration (secs)	To end the trial automatically after a specified number of seconds, select this check box and enter the required number of seconds.
	Broadcast Start/Stop	To make a UDP broadcast to a third-party application that capture has started or stopped, specify the port number in the box and then select the appropriate option from the list on the right (either **All** or a specified IP address).
	Arm button	To perform an Arm trial capture (that is, to enable the system to accept a trigger signal for automatic capture based on a remote control device), click this button.
Playback section		In the **Playback** section, click the **Load Trial** button to select the trial you want to play back.

Tip: Before attempting to load a trial, in the **Recording** section, ensure that the relevant **Location** setting is selected (**Shared** or **Private**), depending the option chosen for the trial you want to load.

Recording live trials

You specify your requirements for recording live trials on the **Recording** tab. If you use the same setup each time, you can make subsequent recordings just by clicking the **Start** button.

To record trial data:

1. Ensure your system is connected and calibrated and that Tracker is in **Live** mode.
2. In the **Resources** pane, click the **Recording** tab.
3. In the **Location** area, select whether your trial will be saved as **Shared** or **Private** files.
4. In the **Trial Name** box, enter a name for the new trial. If you want a number to be automatically appended to the file name, ensure **Auto Increment Trial Number** is selected.
5. If you want existing captured trial data in the same folder to be overwritten when a new trial is saved, select the **Permit Overwrite of Existing Files** box.
6. Do one of the following:

   - If you don't want to select any further parameters, go to step 7; or
   - If your trial requires any further setup, for example, if you are using remote triggering, click **Show Parameters** and supply the necessary information:

     – **Start/Stop on Remote Trigger** To use a remote trigger to control capturing start and stop times, select this check box. The remote device must be connected to your Vicon system via a Giganet.

     – **Capture before Start (secs)** To capture data before the capture start is triggered either manually (by clicking **Start**) or automatically (based on a remote trigger), select this check box and enter the required number of seconds.

     – **Stop after Duration (secs)** To end the trial automatically after a specified number of seconds, select this check box and enter the required number of seconds.

     – **Broadcast Start/Stop** To make a UDP broadcast to a third-party application that capture has started or stopped, specify the port number in the box and then select the appropriate option from the list on the right (either **All** or a specified IP address)

     – **Arm** button To perform an **Arm** trial capture (that is, to enable the system to accept a trigger signal for automatic capture based on a remote control device), click this button.

7. When you are ready to begin recording, click **Start**.

   The **Frames Captured** number increases as frames are captured.

   If you did not specify a number of seconds in the **Stop after Duration** box or if you decide to end the capture before the specified time, click **Stop** when you have finished capturing.

   To abandon the trial without saving any data, click **Cancel**.

You can play back the captured trial immediately.

Playing back recorded trials

You load and play back recorded trials using the **Recording** tab and the view pane.

To play back recorded data:

1. On the **Recording** tab, in the **Recording** area ensure that the relevant **Location** setting is selected (**Shared** or **Private**), depending on the option chosen for the trial you want to load.
2. In the **Playback** area, click **Load Trial** to access the location of the last saved trial. If you want to load a different trial, browse to the appropriate location. Click **Open**.

   The recorded trial is loaded, a time bar appears beneath the view pane and Tracker automatically enters **Offline** mode (if this was not already selected).
3. To play the recorded trial, click the **Play** button on the time bar. To stop or pause the replay, click **Stop** or press the space bar on the keyboard. To view a particular part of the trial, drag the slider along the time bar, or to move through the trial, press the forward or back arrow keys.

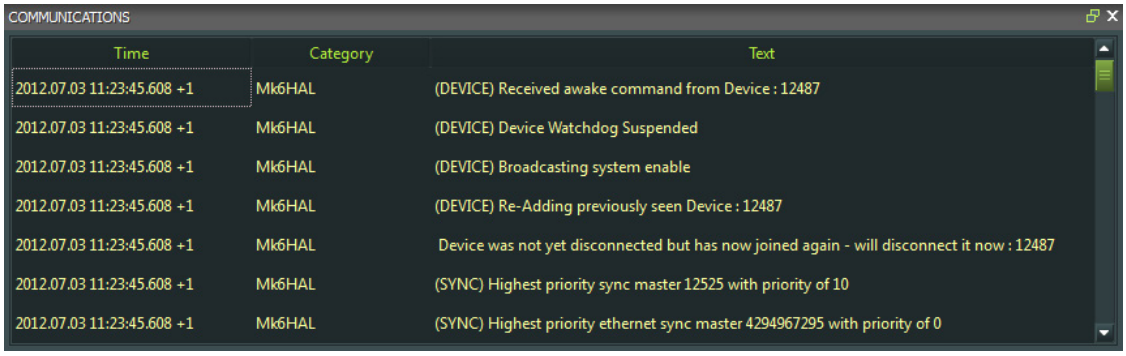
   To select from further options for examining the recorded data, click the **More** option beneath the **Play** button on the time bar.

   - **Zoom to Trial** – After zooming in to a selected range, resets the time bar scale to include the whole trial
   - **Zoom to Region-of-Interest** – After zooming out, resets the time bar scale to zoom in to the selected range
   - **Replay Speed** – Enables you to select from preset options (in multiples of real time) or to specify your own custom speed

Tip: To select a region of interest, drag the beginning and end markers (small green triangles) to the start and end of the required range on the time bar. To return the markers to their original positions at the start and end of the trial, double-click them.

About the Communications pane

Monitor the activity of your Vicon system in the **Communications** pane. You can view the updates in the **Communications** pane during any stage of the Tracker motion capture workflow. The **Communications** pane contains a single window, which displays a continual update of Tracker system activity since start up as well as feedback on some motion capture and processing operations.



Tip: Vicon Support may ask you for log information if you contact them to report a system problem.

The default position of the **Communications** pane is at the bottom of the Tracker window. You can resize this pane, detach it from its current location, and move it to another location within the Tracker window.

The **Communications** pane contains the following information:

Information type	Description
Time	The timestamp for the operation being executed in the hh:mm:ss format.
Category	The general Tracker function being performed, for example Calibration Manager.
Text	The specific action and its success or failure.

Working with the Communications pane

To filter the log, right-click in the **Communications** pane.

You can choose to view or hide the following types of entries:

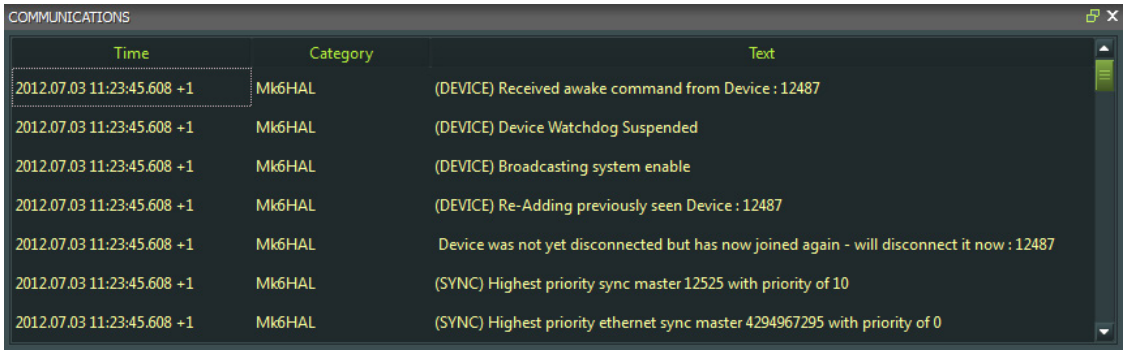
- **Info** – Information entries
- **Warn** – Warning entries
- **Error** – Error entries

You can also change scrolling behavior and delete and restore entries:

- **Auto-scroll** – Automatically scrolls to the bottom of the list of entries
- **Clear** – Deletes all entries from the **Communications** pane
- **Recover** – Restores previously deleted entries.

Monitoring system activity

You can monitor the activity of your Vicon system in the **Communications** pane. Its default position is at the bottom of the Tracker window.



A new log is written each time you start Tracker. New entries recorded during the current session are appended at the bottom of the log. You can copy all or part of the information in the log and save it to an external file, such as a Rich Text Format (*.rtf*) or plain text (*.txt*) file.

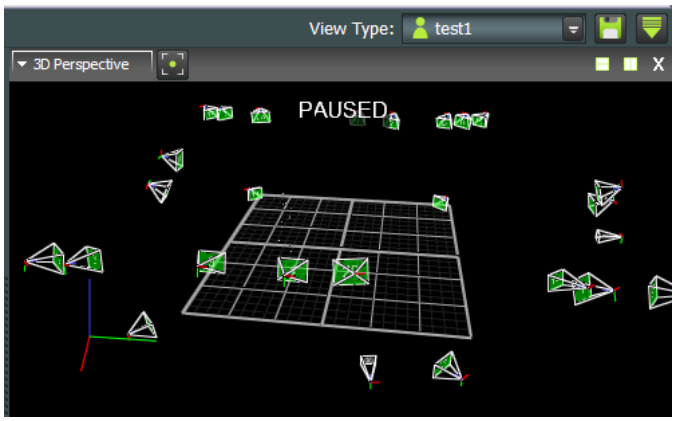
To monitor system activity:

1. In the **Communications** pane, view the entries for system activity and processing operations.
2. Use the scroll bar to move down or back up the displayed entries.

To copy entries to external files:

3. Drag the cursor across the required entries.
4. Right-click and in the context menu click **Copy**. Tracker copies the text to the clipboard.
5. Open a text editor, such as Microsoft Notepad, and paste the copied text.

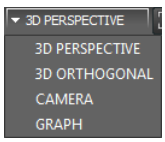
About the View pane

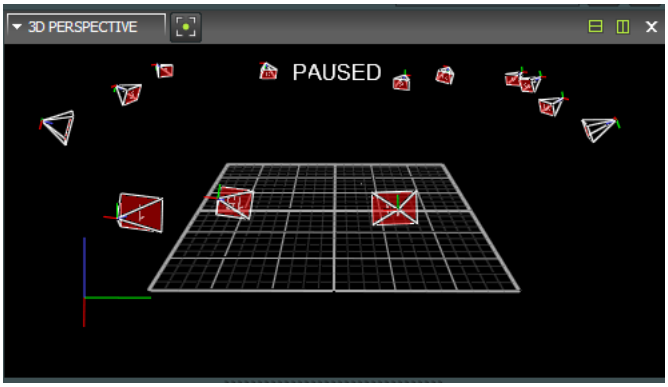
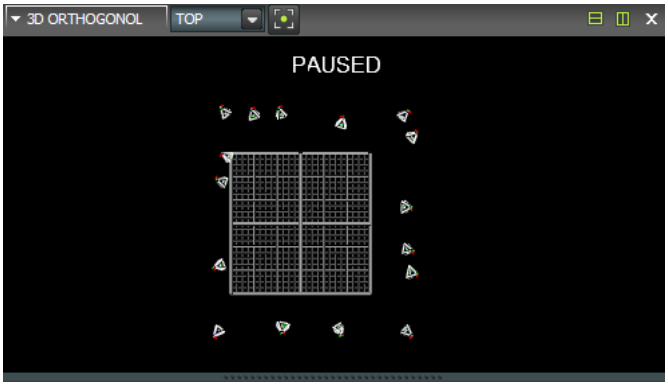
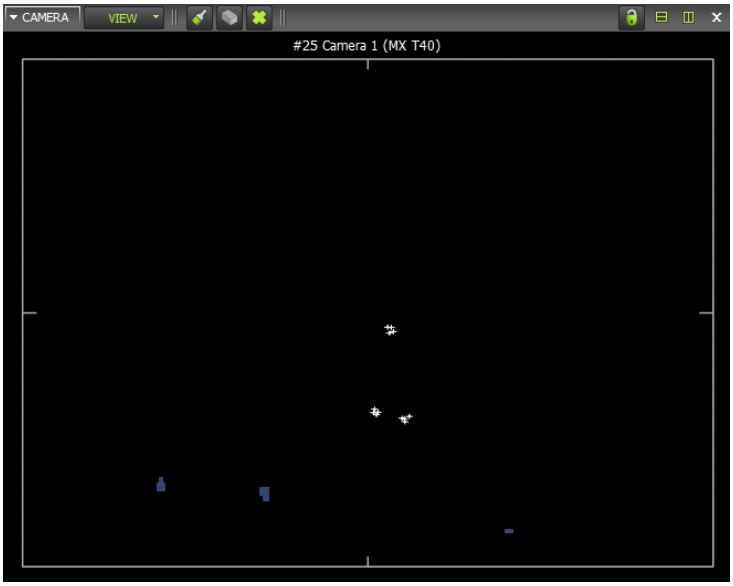


The view pane allows you to view the data of one or more cameras. In the view pane, you view the objects selected in the **Resources** pane during any stage of the Tracker workflow. Depending on the type of view pane selected, there are additional lists and buttons available to you to manage the display options for that type of view pane.

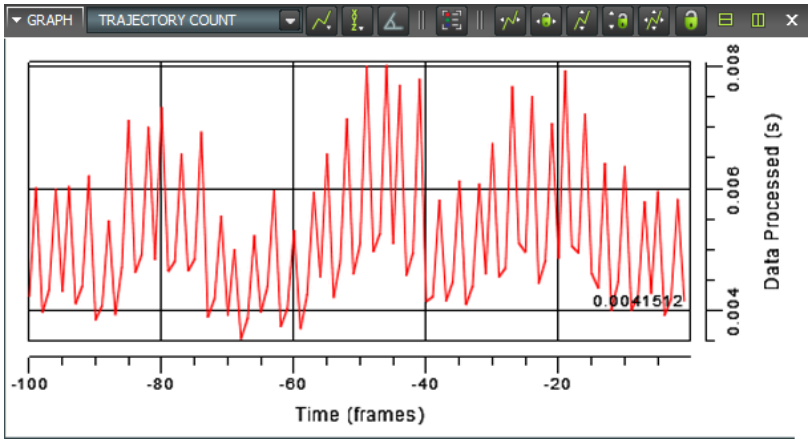
Tip: By default, the view pane is above the **Communication** pane and to the right of the **Resources** pane. You cannot detach or change the position of this pane, but you can resize it. In addition, you can open a new floating workspace that can be displayed on a second monitor, if required.

The view pane contains the following components:

Component	Description
Configuration management controls	Enable you manage the configurations that you create in the view pane. Saved configurations include the layout of view panes as well as any cameras, hardware devices, and object components selected in the **Resources** pane, on the **System** tab, the **Calibration** tab, the **Objects** tab, and/or the **Recording** tab when the configuration was created. 
View pane list	The view pane list allows you to configure the way in which you view Tracker data. Select from the following types of view panes: 

Component	Description
3D Perspective	Reconstructed motion capture data from all active Vicon cameras in 3D. 
3D Orthogonal	Motion capture data in 3D viewed from a specified point of sight or direction of the capture volume. 
Camera	Raw 2D motion capture data from an individual Vicon camera. 

Component	Description
Graph	Various values of one or more selected items, such as the x, y, and z components of a marker trajectory, plotted against each other or against time.



By default, a single view pane is displayed in the workspace. Specify the number of view panes using the following buttons:

Horizontal 	Split the current view horizontally into two view panes.
Vertical 	Split the current view vertically into two view panes.
Close 	Close the current view pane. You cannot close the default view pane in the center of the Tracker window.

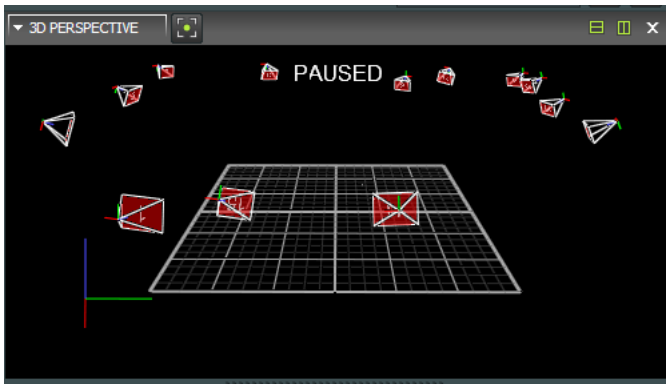
View pane workspace	The workspace enables you to view and manipulate data displayed in the view pane.
View pane time bar	Enables you to play back recorded trials. Click **More** or right-click the time bar to access further options for examining recorded trial data:

Zoom to Trial	After zooming in to a selected range, resets the time bar scale to include the whole trial
Zoom to Region-of-Interest	After zooming out, resets the time bar scale to zoom in to the selected range
Replay Speed	Enables you to select from preset options or to specify your own custom speed

Tip: To select a region of interest, drag the beginning and end markers (small green triangles) to the start and end of the required range. To return the markers to their original positions at the start and end of the trial, double-click them.

About the 3D Perspective view pane

You view the reconstructed motion data from all active Vicon cameras in 3D.



The **3D Perspective** view pane contains the following components.

Component	Description
3D Perspective view pane tool bar	You manage the display of 3D data in the active workspace by selecting the following button:
	Center camera on selection  Position the currently selected data in the center of the view pane. This option does not automatically zoom in on the selected data. When selecting an object to "follow", the camera also rotates with the object.
3D Perspective view pane workspace	You view and manipulate 3D data in the workspace. For example, the view can be oriented (see *Using the mouse and keyboard* on page 16), so you can focus on items of interest.

Viewing data in 3D Perspective view

View reconstructed motion capture data from all active Vicon cameras.

When you have displayed a **3D Perspective** view pane:

- You can highlight the representations of specific cameras by selecting one or more cameras under the **Vicon Cameras** node on the **System** tab in the **Resources** pane.
- You can configure display options in the **Options** dialog box.

To view data in a 3D Perspective view pane:

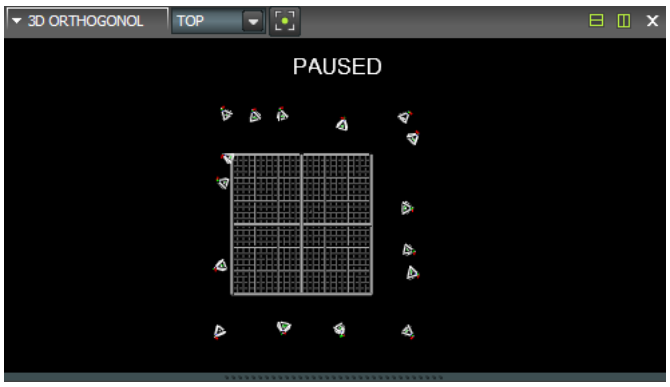
1. Stream live camera data.
2. From the view pane tool bar, select **3D Perspective**. The reconstructed 3D data from all cameras is displayed in a single **3D Perspective** view pane.
3. Select a marker and perform an action on it in either of the following ways:
   - On the **Objects** tab, examine the reconstruction and labeling and edit any errors or inconsistencies.
   - Right-click and select an option from the context menu.

Tips
To select multiple objects, hold down the ALT key and drag around the objects you want to select.

To detach a marker, in the **3D Perspective** view pane, right-click the marker and in the context menu, click **Detach Marker**.

About the 3D Orthogonal view pane

View motion capture data in 3D perspective viewed from a specified point of sight, or direction, of the capture volume.



The **3D Orthogonal** view pane contains the following components:

Component	Description
3D Orthogonal view pane tool bar	Manage the display of data in the active workspace with the following list and button in the 3D Orthogonal view pane tool bar:
	Orthogonal view — Set the point of sight by selecting one of the following orthogonal projections (also called orthographic projections): ▌ **Top** (default) ▌ **Bottom** ▌ **Left** ▌ **Right** ▌ **Front** ▌ **Back**
	Camera Centered on Selection — Position the currently selected data in the center of the view pane. This option does not automatically zoom in on the selected data.
3D Orthogonal view pane workspace	View and manipulate 3D data in the workspace.

Viewing data in 3D Orthogonal view

View motion capture data in 3D perspective viewed from a specified point of sight, or direction, of the capture volume. You can view 3D data from an orthogonal perspective live in real time or from a previously saved trial.

When you have displayed a **3D Orthogonal** view pane, you can:

- Manage the visualization of graph data in the workspace.
- Highlight the representations of specific cameras in **3D Orthogonal** view pane workspace by selecting one or more cameras.

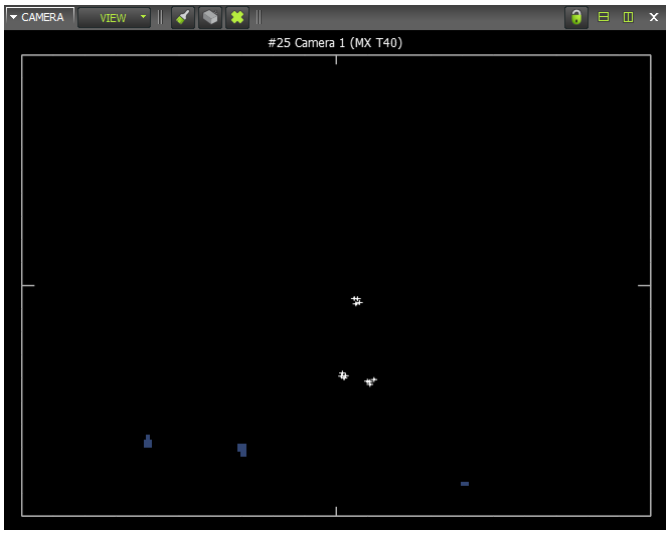
To view data in a 3D Orthogonal view pane:

1. Stream live camera data.
2. From the view pane tool bar, select **3D Orthogonal**. The reconstructed 3D data from all cameras is displayed in a single **3D Orthogonal** view pane, initially from the **Top** view.
3. From the **View** list in the **3D Orthogonal** view pane tool bar, either leave the default or select another orthogonal projection to set the view to a different point of sight:
   - **Top** (default)
   - **Bottom**
   - **Left**
   - **Right**
   - **Front**
   - **Back**
4. In the **3D Orthogonal** view pane, select a marker and perform an action on it in either of the following ways:
   - On the **Objects** tab, check the reconstruction and labeling and edit any errors or inconsistencies.
   - Right-click and select a command from the displayed context menu.

Tip: You can select the **Detach Marker** command from the context menu displayed when you right-click on a marker in the **3D Perspective** view pane.

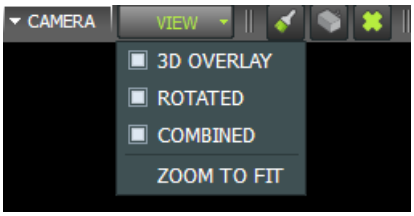
About the Camera view pane

View raw 2D motion capture data from an individual Vicon camera.



The **Camera** view pane contains the following components:

Component	Description
View	Manage the way camera data is viewed in the active **Camera** view pane by selecting the following options on the **View** drop-down list:



3D Overlay	Overlay multiple **Camera** view panes on top of each other, so all camera views are displayed in a single view pane. Each camera is rendered in a unique color.
Rotated	Rotate the camera view, so it is corrected to the vertical axis defined in the system calibration (which corresponds to the earth's vertical axis). It also enables you to manually rotate the view by dragging the view left or right. Information from the camera calibration is required to present the rotated view.
Combined	Correctly model lens distortions and display a corrected camera view with the 3D workspace rendered underneath the camera view.
Zoom to Fit	Zoom the selected **Camera** view pane to fit the full workspace.

Component	Description
Masks	You can create a mask to hide any unwanted reflections and light sources visible to an Vicon camera (such as stray reflections from other objects or surfaces in the capture volume, opposing strobe units, and direct light sources) with the following buttons in the **Camera** view pane tool bar: **Paint a mask onto the camera**  Paint over any cells in the camera grid (displayed when the button is clicked) that contain unwanted reflections. When a cell is painted, its background color changes from black to blue. The camera mask consists of all blue cells obscuring unwanted reflections. **Erase a mask from the camera**  Erase a previously painted cell from a mask. When an individual cell is erased, its background color changes from blue to black, and any reflection that had previously been obscured is visible again. **Clear the mask from the camera**  Automatically remove a previously painted mask. When the mask is cleared, the background color of any previously painted cells changes from blue to black, and any reflections that had previously been obscured are visible again.
Lock / Unlock Selection Set 	Lock the current **Camera** view pane, so that it is effectively detached from the selection set and is not affected by any subsequent selections in other open view panes. This is useful for displaying views from different cameras in multiple **Camera** view panes.
Camera workspace	You view and manipulate 2D data in the workspace. You can manage the visualization of camera data, for example, you can orbit, truck, dolly, and zoom the displayed data.

Viewing optical data in Camera view

View 2D optical data from Vicon cameras in the **Camera** view pane.

To view data in a Camera view pane:

1. Stream live camera data.
2. On the **System** tab in the **Resources** pane, select one or more cameras.
3. Expand the **Vicon Cameras** node and then click on the sub-node for one or more specific Vicon cameras.
4. From the view pane tool bar, select **Camera**.

   The 2D data from each camera selected on the **System** tab is displayed in a separate **Camera** view.

Creating camera masks automatically

You can automatically create camera masks in the **Create Camera Masks** section on the **Calibrate** tab in the **Resources** pane.

The automatic camera mask creation tool automatically creates masks to eliminate any reflections in the capture volume that are visible to the cameras. You can subsequently create masks manually to eliminate any remaining or additional reflections.

Important: Before using the automatic mask creation tool, ensure that you remove from the capture volume any unnecessary objects, such as calibration objects. For best results, the capture volume should be entirely free from objects likely to cause background interference.

To automatically create camera masks:

1. On the **System** tab, select all Vicon cameras.
2. On the view pane tool bar, select **Camera** to display the 2D data being captured by each selected Vicon camera in a separate **Camera** view pane.
3. From the **View** drop-down list at the top of the **Camera** view pane tool bar, ensure that the **3D Overlay** and **Combined** options are cleared.
4. Press F7 to open the **Options** dialog box and under **General View Options**, ensure that **Threshold Map** is selected.
5. Any reflections are visible in the **Camera** view pane, typically as non-circular areas of grayscale or edge data. Note that reflections can severely affect the camera data rates, and you may find that the camera overloads. In this case, the camera automatically sends edge data instead of full grayscale data.
6. On the **Calibrate** tab, in the **Create Camera Masks** section, click **Start**.

   The **Start** button changes to display **Stop**. Tracker starts recording the data visible to each of the Vicon cameras connected. Any camera masks that are created are displayed as blue cells in the **Camera** view panes for the affected cameras. If there is no data visible to a particular camera, Tracker does not create any masks for it. About 30 seconds of recording is generally sufficient to enable Tracker to collect the data visible to the cameras.
7. If you have selected **Auto Stop**, the calibration process ends when the maximum number of refinement frames has been reached for each camera, otherwise click **Stop** when Tracker has collected sufficient data.

Creating camera masks manually

You can manually create camera masks (a technique used to obscure selectively or hold back parts of an image while allowing other parts to show) with the **Masks** buttons in the **Camera** view pane tool bar, which eliminate any reflections in the capture volume that are visible to the cameras. If you have a large number of reflections in your capture volume, it is a good idea to initially create camera masks automatically.

Important: Before manually creating any masks, ensure that you remove from the capture volume any unnecessary objects, such as calibration objects. For best results, the capture volume should be entirely free from objects likely to cause background interference.

To manually create camera masks:

1. On the **System** tab in the **Resources** pane, select all Vicon cameras.
2. On the view pane tool bar, select **Camera** to display the 2D data being captured by each selected Vicon camera in a separate **Camera** view pane.
3. From the **View** drop-down list in the **Camera** view pane tool bar, make sure that the **3D Overlay** and **Combined** options are cleared.
4. Press F7 to open the **Options** dialog box and under **General View Options**, make sure that **Threshold Map** is selected.

   Tip: The **Threshold Map** default color is blue, but you can change the color in the **Options** dialog box.

   ---

5. Remove any unnecessary objects, such as calibration objects, from the capture volume. For best results, the capture volume should be entirely free from objects likely to cause unwanted reflections.

   Any reflections are visible in the **Camera** view pane, typically as non-circular areas of grayscale or edge data. Note that reflections can severely affect the camera data rates, and you may find that the camera overloads. In this case, the camera automatically sends edge data instead of full grayscale data.
6. From the **Camera** view pane tool bar, use the following buttons to hide any unwanted reflections that are visible from the selected camera. (When you click any of these buttons, a grid of small blue tiles is superimposed over the camera image in each **Camera** view pane.)

Button	Usage
Paint a mask onto the camera 	Click an individual tile, click and drag across multiple consecutive tiles, or hold down ALT and click while dragging the mouse across an entire area of unwanted reflections visible in the camera grid. You can drag the mouse horizontally, vertically, or diagonally. When a cell is painted, its background color changes from black to blue. The camera mask consists of all blue cells obscuring unwanted reflections.
Erase a mask from the camera 	Click an individual tile, drag the mouse across multiple tiles, or hold down ALT and click while dragging the mouse across an entire area of blue cells in the camera grid. You can drag the mouse horizontally, vertically, or diagonally. When an individual cell is erased, its background color changes from blue to black, and any reflection that had previously been obscured is visible again.
Clear the mask from the camera 	Click the button to automatically remove the entire mask from the camera. When the mask is cleared, the background color of any previously painted cells changes from blue to black, and any reflections that had previously been obscured are visible again.

Tip: To zoom in on the view pane, right-click and drag the mouse pointer forward (to zoom in) or backward (to zoom out). To pan the image, click both mouse buttons and drag. The camera masks are applied in real time and are saved along with your camera calibration.

To save a configuration:

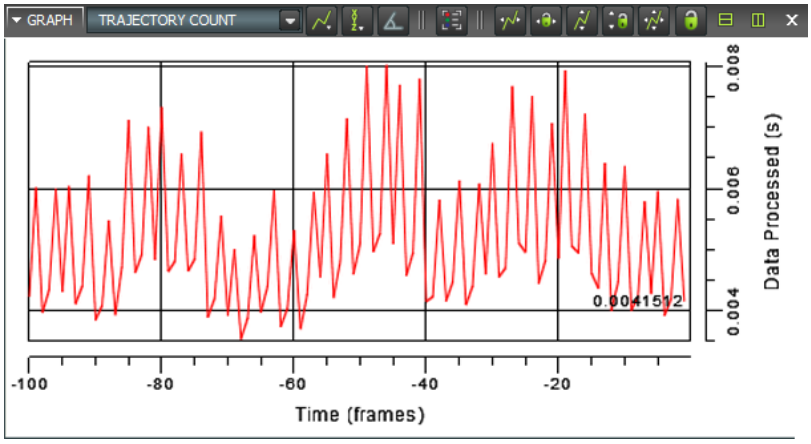
- In the configuration management section at the top of the **System** resources pane, click the **Save**  button to save your system configuration settings to a *.system* file in one of the following systems configurations folders:

  If you select **Shared** the file will be saved in *C:\ProgramData\Vicon\Tracker\Configurations\Systems.*

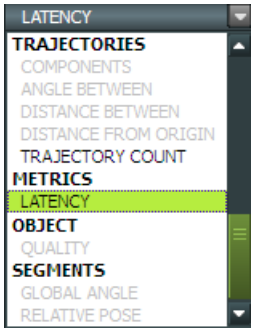
  If you select **Private** it will be saved in *C:\Users*UserName*\AppData\Roaming\Vicon\Tracker\Configurations\Systems.*

About Graph view pane

You view and manipulate various values of one or more selected items (such as the x, y, and z components of a marker trajectory) against time.



The **Graph** view pane contains the following components.

Component	Description
Graph view pane tool bar	You manage the display of graph data in the workspace with the following controls and buttons on the **Graph** view pane tool bar at the top of the view pane. The **Graph** view pane tool bar is designed to lead you left to right through the normal flow of operations required to plot a graph for the selected elements.
Graph type	You select the type of graph to be displayed in the workspace from under the categories in this drop-down list (graph types that are not available for the current selection are dimmed): 
Devices	**Components** - Displays graphs for the components of analog signals from force plates, or other analog devices, such as EMG devices or accelerometers.

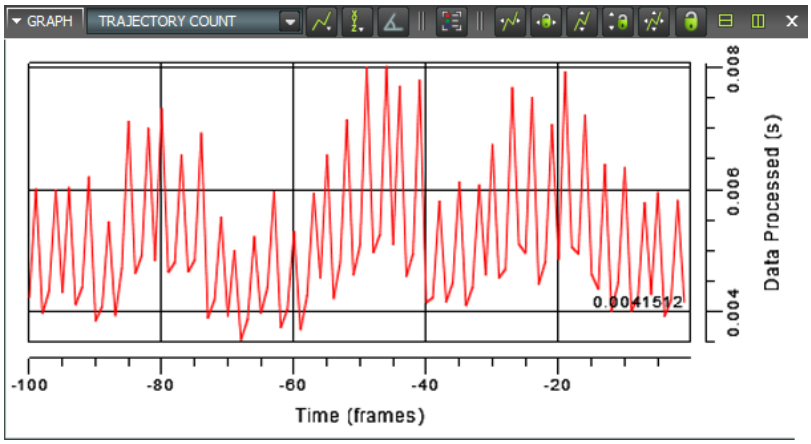
Component	Description	
	Trajectories	▪ Components - The X, Y and Z position of a trajectory over time. ▪ Distance From Origin - The linear distance between a trajectory and the origin. ▪ Distance Between - The distance between two selected trajectories. ▪ Distance Between (xyz) - The absolute distance (as a vector) between two selected trajectories. ▪ Angle Between - The angle between three selected trajectories. ▪ Trajectory Count - The number of trajectories being reconstructed.
	Metrics	▪ Latency - A measure of the time taken by Tracker to perform some task. As data is received from the hardware and is processed, Tracker takes timestamps that are used to calculate the latency estimate. There are two different kinds of latency that are graphed if you are using Firmware 222. ▪ Data Delivered – The amount of time taken between the sync packet being received and the data for that frame being delivered from the hardware. This is the integration period of the camera - the time that it takes the camera to process the sample and any Ethernet overheads. ▪ Data Processed – The amount of time between the sync packet being received and the completion of data processing.
	Object	Quality - The RMS error of a rigid body compared to its model (VSK).
	Segments	▪ Global Angle - The global position and orientation of a rigid body. ▪ Relative Pose - The difference in orientation between two objects. The relative pose graph shows the transformation from object A (the first object selected) relative to object B (the second object selected).
Differentiate the Graph 	You specify for the displayed graph the current variable, its first derivative (velocity or angular velocity), or its second derivative (acceleration or angular acceleration) by selecting the desired options from this drop-down list: ▪ x (none) ▪ x' (velocity) ▪ x" (acceleration) A graph of a trajectory will have X, Y, and Z axes, but when differentiated to x' (velocity) will change to X', Y', and Z' axes.	

Component	Description
Graph Components 	You specify the components of the selected graph type to be plotted in the active **Graph** view pane by selecting the required options from this drop-down list (only components that you have selected for graph view are available): ▌ **Components** - Dependent on the type of graph you have chosen. For example, the count for the **Trajectory Count** graph. ▌ Select None ▌ Select All This option enables you to focus on a component of particular interest, which occupies more of the workspace. When multiple components are plotted, each is always shown on a separate axis, and the components shown are applied to all channels visible in the workspace. The number of vertically stacked graphs displayed in the workspace depends on the type of graph selected and the number of components selected from this component list.
Rotation Order 	If you select an object on the **Object** tab in the **Resources** pane, you can select **Global Angle** from the **Graph** view tool bar. This enables the **Rotation Order** button. Clicking on the **Rotation Order** button lists the angle convention choices of **Helical** (default), **XYZ**, **XZY**, etc. This essentially allows you to choose either a Helical axis angle definition or an Euler angle convention. The Euler angle convention itself has multiple rotation order conventions represented by **XYZ**, **XZY**, etc.
Show Legend 	This button allows you to show a legend to the right of the graph trace for each component being plotted.
Scaling	You manage the scale of the graph to ensure that the desired portions of the selected traces are visible using the following buttons: Fit Horizontally  — Zoom out the x-axis to show the complete range of the trace for 100 frames. This is useful if you have zoomed in a long way and now want to see the entire graph again. Lock Horizontal Axis  — Lock the horizontal graph axis so that the current zoom level is maintained. Fit Vertically  — Scale the y-axis so that all the data in selected traces for the currently visible x-axis is visible. If there are multiple traces in the selected components, they are all set to the same range required to show all the data for all traces. Lock Vertical Axis  — Lock the vertical graph axis so that the current zoom level is maintained. Fit Both Horizontally and Vertically  — Scale the x and y axes simultaneously to fit the horizontal and vertical ranges of data.

Component	Description
Lock/Unlock Selection Set 	Lock the current **Graph** view pane, so that it is effectively detached from the selection set and is not affected by any subsequent selections in other open view panes. This is useful for displaying different elements in multiple **Graph** view panes.
Graph view pane workspace	You view and manipulate graph data in the workspace. The workspace contains rulers and axes along the right and bottom edges and graph traces for the item being plotted. The y-axis vertical ruler is on the right side of the graph and the x-axis horizontal ruler is below the graph. The y-axis represents the selected component. The x-axis represents the time (in frames). It starts on the right side, which is labeled 0 (current frame) and is labeled from right to left with decreasing negative values to reflect the number of frames away from the live frame. **Tips:** To change the default number of samples to display when a new real-time graph is opened, press F7 to open the **Options** dialog box, click **Graph** on the left, and on the right side, change the **Default X-axis length** value. When zooming into or out of graph data, the display of grid lines in the workspace can be set to guide the eye toward the selected area of focus. Major grid lines remain at their normal weight, while any minor grid lines gradually fade. To obtain this behavior, press F7 to open the **Options** dialog box, ensure **Graph** is selected and in the **Properties** area, select **Show Minor Grid Lines**.

Viewing data in Graph view

You can display graphs of motion capture data in the Graph view pane .



The Graph view pane displays graphs for the types of data that can be produced in a motion capture trial.

Graphs of trajectories data display three graphs of the X, Y, and Z components of trajectories for two or more selected 3D markers, or a single graph of the trajectory count for all 3D marker trajectories, against time. This is useful for analyzing 3D marker trajectories and identifying gaps to be filled.

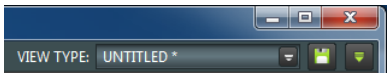
To view 3D trajectories in a graph:

1. Stream live camera data.
2. Select the markers to be graphed in either of the following ways. (The number of markers you select depends on the type of graph you want to view, as described in step 3 below.)
   - On the Objects tab in the Resources pane, expand the required Object node, expand the Markers node, and then select one or more markers; or
   - In a 3D Perspective view pane, select one or more markers.
3. From the view pane tool bar, select Graph. A single Graph view pane is displayed with the default Components graph type plotting the X, Y, and Z components of each selected marker.

> Tip: When you have displayed a Graph view pane, you can select additional markers to add to the Graph view pane. Each trajectory is displayed in a different color trace. To identify the color trace used for each trajectory, click the Show Legend button (or hover the mouse pointer over it) in the Graph view pane tool bar. If the trace for any additional markers is not visible, use the Fit Horizontally, Fit Vertically, or Fit Both Horizontally and Vertically buttons.

4. From the **Graph Type** list in the **Graph** view pane tool bar, select another option under the **Trajectories** section to plot the selected marker trajectories in a different type of graph:
   - **Distance From Origin:** Plots the distance from the capture volume origin to each selected marker. This is useful for later plotting velocity or acceleration of markers.
   - **Distance Between:** Plots the absolute distance between two selected markers. This is useful, for example, for seeing how the distance between two markers that are assumed to have a rigid relationship, changes over time.
   - **Angle Between:** Plots the angle between the two vectors formed by three selected markers. This is useful for seeing how the group of markers move over time.
   - **Trajectory Count:** Plots the total number of trajectories over time visible to the MX cameras (if streaming Live data in real time) or processed in trial (if viewing previously captured data in a file).

5. If you want to save a particular graph view (for example, specific trajectories that you have selected), save your configuration using the view pane configuration management controls.



About the menu bar

The Vicon Tracker menu bar contains the following menus.

Menu	Options	Description
Tracker	Undo	Undoes the last action. This command is available only after a relevant action has been performed.
	Redo	Reinstates the previously undone action. This command is available only after an Undo command has been performed.
	Exit	Closes the Tracker application window. If you have not saved any changes, Tracker displays a prompt to enable you to save changes before it closes.
Window	New Floating Workspace	Opens a separate floating view pane.
	Resources	Displays or hides the **Resources** pane in which you manage the components of your Vicon Tracker system and the objects whose motion is to be captured. To display the pane, select the check box next to the option.
	Communications	Displays or hides the **Communications** pane in which you view the state of your Vicon Tracker system. To display the pane, select the check box next to the option.
	Options	Displays the **Options** dialog box in which you control the way data is displayed in view panes. The **Options** dialog box can also be displayed by pressing F7.
Help	Contents	Opens the Vicon Tracker Help system.
	About Vicon Tracker	Displays the Vicon Tracker startup screen, in which you can view version information about the installed release of Tracker.

About the Options dialog box

To control the way data is visualized in the view panes, you use the controls in the **Options** dialog box.

You access this dialog box from the **Window** menu or by pressing F7. You can save the settings that you make in this dialog box, which enables you to customize sets of options to use for different types of motion capture projects.

To configure settings in the Options dialog box:

1. Press F7 or from the **Window** menu, select **Options**. The **Options** dialog box is displayed.
2. In the **Options** list on the left, select or clear the relevant check box(es), depending on the functionality you require.
3. To view or change the settings for an option, click on the option to select it. The properties for that option are displayed in the **Properties** section.

   Tip: To see any available additional settings, click **Show Advanced**. To show basic settings only, click **Hide Advanced**.

4. In the **Properties** section, change the settings for the properties, as needed.
5. To save the changes you have made in the **Options** dialog box:
   a. Go to the configuration management area: 

   b. Click the Save button  .
   The **Save As** window is displayed.
6. Enter a name for the configuration and click **OK**.

Tip: To indicate that you have made changes to a configuration but the changes have not yet been saved, an asterisk (*) is displayed after the configuration name in the configuration management list.

Working with VRPN

The Virtual-Reality Peripheral Network (VRPN) is a library that provides an interface between 3D immersive applications and tracking systems used for Virtools. Vicon Tracker has a built-in VRPN server that will stream data natively into these applications or will allow for the development of simple interfaces using VRPN.

Using VRPN within Virtools

Virtools, a commercial application, has support for VRPN and can be configured to connect with Vicon Tracker as follows.

A full VRDevice.cfg file is included below.

Note: `Head@TrackerPC` is the way Virtools connects to the VRPN server within Tracker. The format is `object_name@PC_Name`. This configuration file will look for an object called "Head" on the Tracker server called "TrackerPC."

```
=====================================
vrpnTracker_0               Head@TrackerPC
neutralPosition_0     0.0 0.0 0.0
neutralQuaternion_0 0.0 0.0 0.0 1.0
axisPermute_0 0 2 1
axisSign_0 1 1 1
trackerScale_0 1
TrackerGroup_0 T0:0:6
```

This VRDevice.cfg also contains other directives that:

- Map the Vicon coordinates properly to the Virtools coordinates:

  ```
  axisPermute_0 0 2 1
  axisSign_0 1 1 1
  ```

- Add a tracker group with:

  ```
  TrackerGroup_0 T0:0:6
  ```

Do the following to complete the process:

- Add the VRPN settings to a VRPack.cfg file, which is in the same folder as the .cmo. That way it can be tested with Virtools Dev.
- For versions of Tracker before 1.2 in the composition, activate the "Use Scale" option and change the value of trackerScale_0 in your VRDevice.cfg file to 0.001 (converts Vicon mm to Virtools m).

Please refer to the Virtools documentation for a full description of any of these configuration options.

For sample files that use VRPN to connect Virtools to a tracked object within Vicon Tracker, please contact Vicon Support (see *Contacting Vicon* on page 91) or download from the *Vicon Support website*.

Contacting Vicon

For further information on Vicon Tracker and other Vicon products, please contact your nearest Vicon office or email *info@vicon.com*.

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8 Cross Street #11-00
PWC Building
Singapore 048424

Tel: +65 6400 3500

Vicon Motion Systems is an OMG plc company.

Vicon Support resources

Vicon offers telephone, email, and online technical support where you can discuss feature requests, bugs, and other support issues.

Telephone support

You can speak with Support engineers in our UK and US offices:

Location	Contact Details
OXFORD	Tel: +44 (0) 1865 261800 09:00 to 17:00 Greenwich Mean Time
DENVER	Tel: + 1 303.799.8686 Tel: + 1 800.745.7325 09:00 to 5:00 Mountain Time
LOS ANGELES	Tel: + 1 310.306.6131 Tel: + 1 800.745.7325 09:00 to 5:00 Pacific Time

Email support

support@vicon.com

Vicon website support

To access support areas and FAQs in the Vicon knowledge base, visit Vicon Online Support:

http://www.vicon.com/support/

Vicon online support

If you are a licensed user and have a valid Vicon System Maintenance Agreement, you can access the Vicon Support knowledge base at *www.vicon.com/support/*.

Tip: To access Vicon online support, you must have a Vicon online support User ID and password. If you do not have a User ID and password, or need assistance with logging in to Vicon online support, contact Vicon Support.

Online support resources

The following resources are available from Vicon online support:

Resource	Description
Downloads	Obtain latest firmware and other software patches, models and scripts, and product documentation.
FAQs	Locate topics providing answers to frequently asked questions about Vicon hardware, software, plug-ins, and licensing as well as third-party software.
Submit questions or report problems	If you cannot locate the information you need in the FAQs, submit your own question or report a problem. You can then track responses to your questions and updates to your problems.

To log in to Vicon online support

1. Enter the URL for Vicon online support:

   http://www.vicon.com/support
2. The **Vicon Support + Services** page is displayed.
3. In the **Log-in** area, enter your Vicon online support **Username** and **Password**.
4. After reviewing the terms and conditions, select the **Agree to terms and conditions** check box and click **Enter**.
5. The online support page is displayed.

Vicon error reporting

The Vicon error reporting system provides a quick and convenient way for you to contact Vicon in the event that your Vicon application software stops responding. It enables Vicon to investigate particular problems and to take your feedback into consideration in further product updates.

Using the Vicon error reporting system

If an error occurs that causes the Vicon application software to stop responding, two events are triggered:

- A Vicon error report file (named *OMG*.tmp*) is automatically created in the *Temp* directory (by default, *C:\Users*< User_Name> *\AppData\Local\Temp*)

  This file contains information including the operating system version and the state of the application when it stopped responding. It does not contain any personal information.
- The Vicon Error Reporting dialog box is displayed.

You can choose to do one of the following:

- Continue with your work without sending a report. Make a note of the Incident ID number in case you want to report the incident later.
- Send an automatically generated report, which is the most efficient way to report an error, and is the method recommended by Vicon.
- Email an error report, if you cannot send an automatically generated report, for example if you do not have internet access from the Vicon host PC.

To continue without sending a report:

1. Take a note of the number in the **Incident ID** field in the Vicon Error Reporting dialog box.
2. Click **Don't Send** to close the dialog box.
3. After the Vicon software has completely closed, restart the application.

To send an automatically generated error report:

1. In the **Comments** field, enter the following details:
   - A brief description of the problem, including steps to reproduce the problem if possible.
   - Clear step-by-step details on the actions leading up to the application closing helps Vicon to isolate the probable cause of the problem and identify a solution.
   - Your name and/or organization name to enable Vicon to contact you if additional information is needed to investigate the problem.
2. Make a note of the **Incident ID** for future reference.
3. Click **Send Report**.

   The automatically generated error report is sent to Vicon, where it is processed and forwarded to the appropriate engineer for investigation.

To email an error report to Vicon:

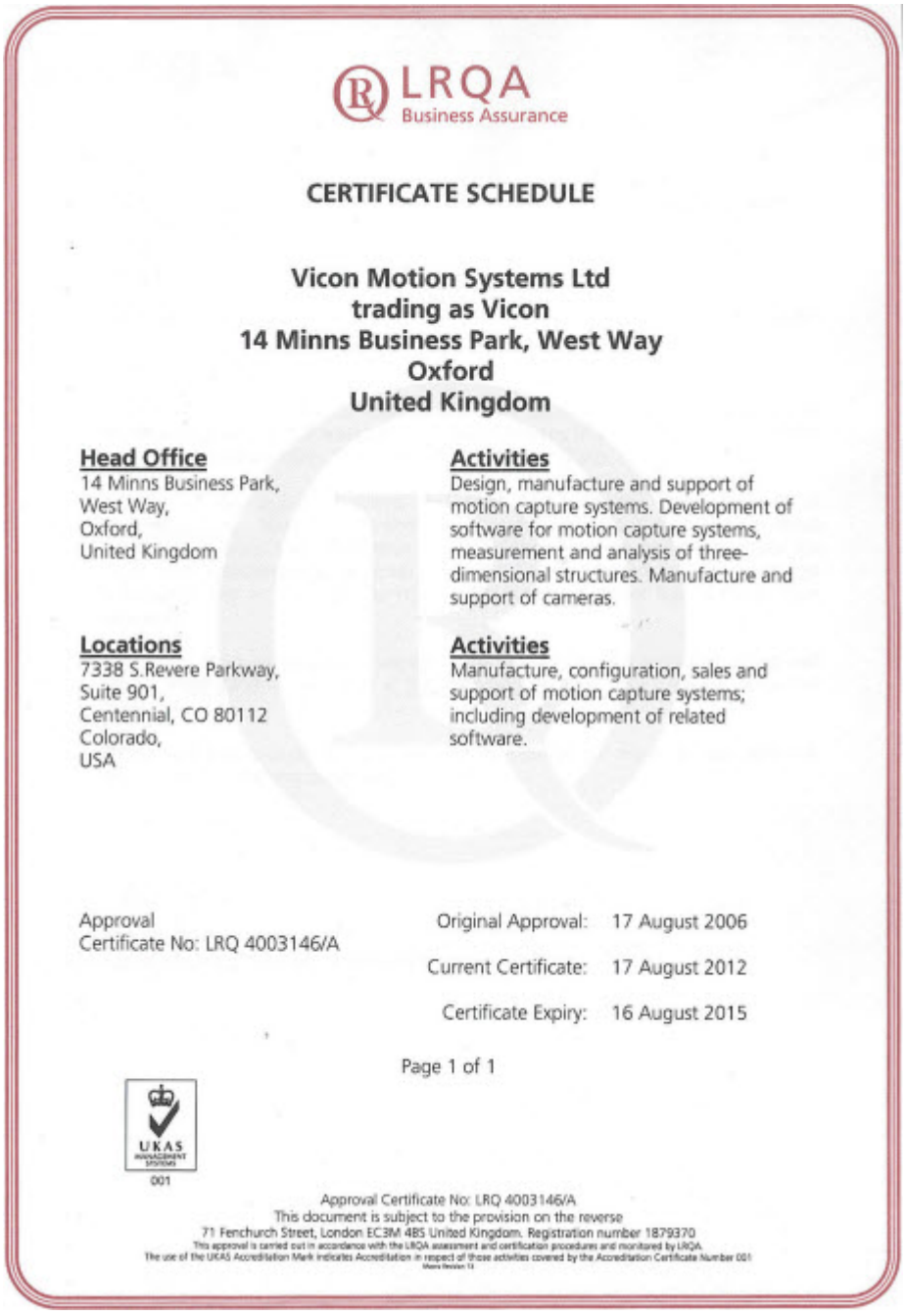
1. In the **Subject** line, include **Vicon Error Report**.
2. In the body of your email, include the following details:
   - **Incident ID** from the **Vicon Error Reporting** dialog box.
   - A brief description of the problem, including steps to reproduce the problem if possible.
   - Clear step-by-step details on the actions leading up to the application closing helps Vicon to isolate the probable cause of the problem and identify a solution.
   - Your name and/or organization name to enable Vicon to contact you if additional information is needed.
3. Attach the Vicon error report file (OMG*.tmp) to your email.

   By default, the Temp directory is *C:\Documents and Settings\<User_Name>\Local Settings\Temp*.
4. Send your email to ***support@vicon.com***.

Regulatory information

ISO Certification

Certificate Schedule



LRQA
Business Assurance

CERTIFICATE SCHEDULE

Vicon Motion Systems Ltd
trading as Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

Head Office
14 Minns Business Park,
West Way,
Oxford,
United Kingdom

Activities
Design, manufacture and support of motion capture systems. Development of software for motion capture systems, measurement and analysis of three-dimensional structures. Manufacture and support of cameras.

Locations
7338 S.Revere Parkway,
Suite 901,
Centennial, CO 80112
Colorado,
USA

Activities
Manufacture, configuration, sales and support of motion capture systems; including development of related software.

Approval
Certificate No: LRQ 4003146/A

Original Approval: 17 August 2006
Current Certificate: 17 August 2012
Certificate Expiry: 16 August 2015

Page 1 of 1

UKAS MANAGEMENT SYSTEMS 001

Approval Certificate No: LRQ 4003146/A
This document is subject to the provision on the reverse
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001

ISO 9001: 2008 Certificate of Approval

LRQA Business Assurance

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Vicon Motion Systems Ltd
trading as Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

Design, manufacture and support of motion capture systems.
Development of software for motion capture systems,
measurement and analysis of three-dimensional structures.
Manufacture and support of cameras.

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

This certificate forms part of the approval identified by certificate number LRQ 4003146

Approval
Certificate No: LRQ 4003146/A

Original Approval: 17 August 2006
Current Certificate: 17 August 2012
Certificate Expiry: 16 August 2015

J.K. Andrews

Issued by: Lloyd's Register Quality Assurance Limited

UKAS MANAGEMENT SYSTEMS 001

This document is subject to the provision on the reverse
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001

CE Declaration of Conformity

CE

Declaration of Conformity

We, Vicon Motion Systems Limited
Unit 14 Minns Estate
Oxford OX2 0JB
United Kingdom

declare that the VICON Tracker Software Version 2.0 designed and supported by VICON MOTION SYSTEMS LIMITED using an ISO9001:2008 Quality Management System certified by Lloyd's Register Quality Assurance, for the design and support of motion capture software. The Software is tested to the following minimum performance:

Environmental Measurement Criteria

- Independent of the lens fitted to each camera.
- Controlled lighting (no greater than 100 lux) and temperature (17–25°C)

Rigid Bodies

The mean position of a standard Vicon cluster origin from a sample size no less than 1000 samples shall not exceed 1mm away from its known position. The standard deviation of this position will be no more than 1mm. The orientation of the standard Vicon cluster origin from a sample size no less than 1000 samples shall not exceed 1 degree from its known orientation. The standard deviation of this position shall be no more than 1 degree. Tests are performed using a minimum of four supported cameras(1), at a range of 3 meters. The volume exercised shall be no greater than 1 meter cubed. The 70mm sided cluster shall be fitted with a minimum of 4 markers.

T.M.L. Shannon PhD FIE (Aust), CPEng (Biomedical)
Director of Regulatory Compliance
1st March 2013

Not suitable for use in life- or safety-critical environments, or applied as a medical device.
1) No fewer than two supported cameras (T-series, F-series, MX3+, Bonita).

Glossary

3

3D Workspace: A type of view pane in a Vicon application software window in which reconstructed data from all active cameras is displayed in 3D. Also see View pane.

A

Accessory kit: A collection of specialized Vicon accessories for use with its motion capture systems. The kit typically contains items such as marker fixing tape, licensing dongles, Velcro™, Lycra™ suit, and retroreflective markers.

Algorithm: A well-defined procedure that transforms one or more given input variables into one or more output variables in a finite number of steps.

Angle of view: The total area, expressed as an angle, that the camera lens can reproduce as a sharp, focused image. Also see Field of view.

Aperture: The diameter of the camera lens opening, which determines the amount of light that can pass through the lens in a given time. The size of the lens opening is controlled by an iris and is expressed in f-stop values (f1.4, f2, f2.8, f4, f5.6, f8, f11, f16, f22). Smaller f-stop values represent wider apertures that allow more light to pass through. Larger f-stop values represent narrower apertures that allow less light to pass through. Also see Depth of field and Field of view.

Aspect ratio: The proportional width and height of a picture, expressed in the format w:h.

B

Blob: In Vicon V-series systems, a continuous area of above-threshold data from the camera. Blobs are submitted as candidates to Vicon circle-fitting algorithms to determine which are likely to be markers. Also see Grayscale blob.

Blooming: The defocusing of a picture due to excessive brightness. This can occur when a Vicon marker is close to a camera with high sensitivity or whose aperture is too wide. This can be resolved by altering sensitivity and/or the aperture or possibly by moving the camera. Also see Aperture and Marker.

Bounding box: A semitransparent 3D box drawn around each segment defined in the kinematic model for a subject (as specified in the .vsk or .vst file). This display is optional and is used for visualization purposes only. Also see Object and .vsk file,

C

Calibration: See camera calibration.

Calibration kit: A collection of specialized Vicon calibration objects for use in the Dynamic Calibration (DynaCal) process for calibrating Vicon systems and cameras. Also see Calibration object and Camera calibration.

Calibration object: A specialized piece of equipment used to calibrate the capture volume and Vicon cameras. There are two basic types of calibration object: a frame and a wand. Both types are typically made of metal and have retroreflective markers attached. The Vicon application software uses the known physical dimensions and distance between the markers on a calibration object to calculate calibration parameters. Also see Calibration kit, Calibration wand, Camera calibration, and Static calibration object.

Calibration volume: The three-dimensional area of the capture space (length, width, and depth) calculated by the camera calibration process. This volume can be visualized in the 3D Workspace in Vicon application software. Also see 3D Workspace, Capture volume, and Reconstruction volume.

Calibration wand: A calibration object used in the camera calibration process. Pieces for constructing different types of calibration wand are supplied in the Vicon calibration kit. Also see Calibration kit, Calibration object, and Camera calibration.

Camera calibration: Also known as system calibration and dynamic calibration (DynaCal). The two- stage process by which Vicon application software calibrates the system. During the dynamic stage, a calibration wand is used to measure the physical position and orientation of each Vicon camera in the system and determine any lens linearization correction required. During the static stage, a static calibration object is used to set the global coordinate system for the capture or tracking volume. The camera calibration is used in reconstructing the 3D motion from all the cameras. Also see Calibration wand, Capture volume, Global coordinate system, Static calibration object, and Tracking volume.

Camera mask: In Tracker, a grid of small blue tiles superimposed over the camera image in a Camera view pane, each cell of which can be set to obscure raw 2D camera data, such as unwanted reflections, opposing camera strobe units, and direct light sources that are seen by a camera. In Vicon V-series systems, a simple shape that is used to obscure raw 2D camera data, such as unwanted reflections, opposing camera strobe units, and direct light sources that are seen by a camera. You can have Vicon application software automatically create camera masks, or you can create them yourself. The equivalent functionality for Vicon MX systems is generally provided by threshold grids. Also see .msk file, Tracker, Vicon MX, Vicon V-series system, and Threshold grid.

Camera ray: A line displayed in the 3D Workspace identifying the Vicon camera that contributed to the reconstruction of a marker. Also see 3D Workspace, Marker, and Reconstruction.

Camera video sensor: A device that measures illumination and converts it to a digital signal. Also see MX Camera, Sensor, and Vicon V-series system.

Camera view pane: A type of view pane in a Vicon application software window in which raw, 2D camera data for an individual camera is displayed. Also see View pane.

Capture: See Motion capture.

Capture data: A single, contiguous period of motion capture data acquired by a Vicon system. This can include video data from Vicon cameras.

Capture space: The full dimensions (length, width, and depth) of the room being used as a Vicon motion capture studio (for entertainment applications) or laboratory (for life sciences applications).

Capture volume: The area of the capture space in which Vicon cameras are able to capture the motion of trial subjects. Also see Capture space, Calibration volume, Reconstruction volume, and Subject.

CCD: Charge Coupled Device. An image sensor consisting of a grid of pixels made up of capacitors sensitive to light. An image is projected through a lens onto the capacitor array, causing each capacitor to accumulate an electric charge proportional to the light intensity at that location. This charge is subsequently converted into a voltage, and the voltage for each pixel is read out from the sensor. Also see CMOS and Sensor.

Center of Mass: The theoretical point of a segment or body at which the whole mass may be considered as concentrated. Also see Segment.

Centroid: In Vicon MX, a 2D circle with cross-hairs for the horizontal and vertical radii fitted around the center of intensity calculated for a grayscale blob viewed by an MX camera. The equivalent for Vicon V-series systems is a circle. Also see Circle, Centroid fitting, and Grayscale blob.

Centroid fitting: In Vicon MX, the process by which algorithms in MX cameras or in Vicon application software calculate the center of intensity for a grayscale blob and fit a centroid around it. The equivalent functionality for Vicon V-series systems is provided by circle fitting. Also see Centroid, Circle fitting, and Grayscale blob.

Centroids data: In Vicon MX, the x,y coordinates and the radius of the centroid calculated for a grayscale blob. Also see Centroid and Grayscale blob.

CG plug-in: Computer Graphics plug-in. A software module that facilitates the import of Vicon data into a third-party animation package. Also see Plug-in.

Circle: In Vicon V-series systems, a 2D circular shape fitted to a series of horizontal video lines for a blob. Also see Blob and Circle fitting. For Vicon MX systems, see Centroid.

Circle fitting: In Vicon V-series systems, the process by which algorithms in Vicon application software calculate a central coordinate for a marker based on three or more horizontal video lines. The equivalent functionality for Vicon MX systems is provided by centroid fitting. Also see Algorithm, Centroid fitting, and Circle.

CMOS: Complementary Metal-Oxide-Semiconductor. An approach to the design and implementation of digital circuits on silicon chips. Image sensors produced by the CMOS process are an alternative to CCD sensors and offer the advantage of requiring less power. CMOS sensors consist of a grid of pixels each made up of a photodetector and several transistors. An image is projected through a lens onto the sensor, and a voltage is read from each pixel proportional to the light intensity at that location. Also see CCD and Sensor.

conf file: An XML file with extension .conf which contains Vicon Tracker configuration settings. This file is created by Tracker. Also see Tracker.

Constraint: The mathematical relationship between one element in a kinematic model and another element whose behavior it controls. For example, a segment may be constrained by a marker, the path a muscle takes over a segment may be constrained by a wrap object, or the position of a segment or model marker may be constrained in the local coordinate system. Also see Local coordinate system, Marker, and Segment.

Context: The condition or circumstance that relates data in an event (e.g. left and right foot events in gait analysis). Also see Event.

Coordinates data: In Vicon MX, the x and y location of the start and end points of a line of illuminated pixels in a grayscale blob; it is the grayscale data without the pixel values. Coordinates data can be displayed as just the start and end edges of each line of grayscale, or with connecting lines between the start and end edges. The latter looks similar to edge data from Vicon V-series cameras. Also see Edges and Grayscale blob.

cp file: Calibration Parameters file. A text file with extension .cp, which contains the calibration parameters specified for a set of Vicon cameras. This file is created during the camera calibration process and used when data from these cameras is processed. A copy of the .cp file is saved to the active Session folder of the open database. Similar functionality is provided by the .xcp file in Vicon Tracker application software. Also see Camera calibration, Tracker and .xcp file.

D

Data acquisition: The process by which Vicon motion capture and analysis systems convert information from real-world sources to digital form in which it may be stored, manipulated, analyzed, and displayed. Also see Data streaming and Motion capture.

Data file: Related pieces of data organized in a specific manner. Data files contain information but not instructions or programs.

Data streaming: The passing of real-time motion data from some Vicon application software to Vicon or third-party visualization software. Also see Data acquisition, Motion capture, and Visualization software.

Depth of field: The distance between the nearest object in focus and the furthest object in focus within a scene as viewed by a particular camera lens. Outside this area, moving towards or away from the lens, the focus becomes progressively less sharp and the image appears out of focus. Depth of field varies with subject-to-camera distance, lens focal length, and lens aperture. Also see Aperture and Focal length.

Dolly: The moving of a camera along a horizontal axis closer to (dolly in) or further from (dolly out) the subject. Also see Pan, Tilt, and Truck.

Driver: A hardware device or software program that controls a specific hardware device, such as a video driver.

E

Earth: See Ground.

Edges: In Vicon V-series systems, the start and end points of horizontal lines of video data for a blob. This looks similar to the display of Vicon MX coordinates data with connecting lines. Also see Blob and Coordinates data.

Edit options: A dialog box in which users can configure parameters to control the behavior of a specific feature or function in Vicon application software.

Ethernet network: A local area network (LAN) architecture based on the IEEE 802.3 standard for contention networks. Standard Ethernet supports data transfer rates of 10 Mbps. 100Base-T (or Fast Ethernet) supports data transfer rates of 100 Mbps. Gigabit Ethernet supports data transfer rates of 1 Gigabit. A Vicon system runs over its own dedicated Ethernet network; Vicon MX uses Gigabit Ethernet communications. Also see LAN.

Euler angles: The three angles defining the three rotation matrices of an object about an axis. These angles are used to relate two orthogonal coordinate systems in a kinematic model for a motion capture subject. Also see Kinematic model and Rotation.

F

F-20: See MX-F20.

F-40: See MX-F40.

F-series Camera: A range of high-resolution, digital, motion capture cameras: MX-F40 and MX-F20. This range of Vicon cameras was supplied with Vicon MX systems after April 2007. F-series Cameras provide high-speed, low-latency motion capture. F-series Cameras are made of lead-free components to comply with environmental regulations. Each F-series Camera is fitted with the proprietary Vicon Vegas CMOS sensor and a strobe unit with surface-mount LEDs. Each is programmed with Vicon application firmware to control its operation and enable it to perform its own onboard processing. Also see MX-F20, MX-F40, Firmware, MX Camera, MX+ Camera, RoHS compliant, and Vegas sensor.

F-stop: See Aperture.

Field: An assembly of alternate lines of video information. For interlaced video, an interlaced frame is composed of two fields (odd and even scanning lines of the picture). Also see Frame and Frame rate.

Field of view: The total area that can be seen through the camera lens. Also see Aperture and Depth of field.

Firmware: A set of software routines stored in the read-only memory (ROM) of MX cameras and of some MX hardware units to control their operation and enable them to perform their own processing. Also see MX Bridge, MX Camera, and MX Control.

Focal length: The distance from the center of the camera lens to a focused image with the lens focused on infinity. Short focal lengths offer a broad field of view, while long focal lengths offer a narrow field of view. Zoom lenses have variable focal lengths.

G

Gain: A multiplicative increase (or decrease) in a voltage or digital signal by a specified magnitude. Adjusting the gain in a Vicon camera increases or decreases the intensity of a marker displayed in the workspace. Also see Marker and Workspace.

Ghost marker: Also known as ghost trajectory. A spurious marker trajectory produced by the reconstruction process. A ghost marker is a false reconstruction that appears as an additional trajectory very close to an existing one over a short duration. Also see Reconstruction and Trajectory.

Global coordinate system: The coordinates defining the origin (0,0,0) and the axes (x,y,z) of the world in the context of the Vicon capture volume. Also see Capture volume, Volume origin and Workspace axes.

gpo file: General Purpose Output file. An XML file with extension .gpo, which specifies the characteristics of a synchronization signal through the GPO ports of an MX Control or MX Ultranet HD unit. For example, .gpo files supplied with the Vicon Reference Video system option specify the relationship of the frame rate of a connected reference video camera with that of the MX cameras. Also see Frame rate, MX Camera, MX Control, MX Ultranet HD, and Reference video.

Grayscale blob: In Vicon MX systems, the raw, 2D grayscale data MX cameras generate for reflections from objects in the capture volume. Such data is submitted as candidates to MX centroid-fitting algorithms to determine which are likely to be markers. Also see Blob and Centroid fitting.

Grayscale data: In Vicon MX, the complete pixel and line information for a grayscale blob. Also see Grayscale blob.

Ground: Also known as earth. A point that is assumed to be at a zero voltage potential.

H

Host PC: The computer in a Vicon system architecture that contains a dedicated Ethernet port for Vicon system communications and on which the core Vicon application software is installed. The host PC enables communications between the Vicon application software and other Vicon system components. Additional network ports and Vicon application or third-party software may be installed on the host PC, depending upon the computer specification. Also see Vicon application software.

I

Image circle: The diameter of the sharp, circular image that the camera lens casts onto the sensor. This indicates the maximum area of usable quality image that the lens can produce.

Impedance: The total opposition to the flow of alternating or direct current specified for signal input/output connections.

Interpolation: The process by which Vicon application software fills a gap in a trajectory by calculating a smooth curve between the broken ends. Also see Trajectory.

Iris: The device inside the camera lens that controls the aperture size. Also see Aperture.

K

Kinematic fitting: The process by which Vicon application software positions the segments in the kinematic model so that segments on the model fit to the labeled trajectories. Also see 3D Workspace, Kinematic model, Segment, Trajectory, and .vsk file.

Kinematic model: A mathematical description of a moving object. Kinematic models for objects whose motion is being captured or analyzed in a Vicon system are contained in Vicon Skeleton (.vsk) files. A representation of the kinematic model for a subject can be displayed in the 3D Workspace. Also see Kinematics, Kinematic fitting, and .vsk file.

Kinematics: The study of motion without reference to its cause or its mass. Vicon application software is concerned with angular and linear displacements, velocity, and acceleration. Also see Forward kinematics and Inverse kinematics.

L

L-frame: A type of static calibration object. Also referred to as an ergo calibration frame. Also see Static calibration object and Ergo calibration frame.

Label: A name by which a point or the trajectory of a marker is identified in Vicon application software. The labels to be used to identify the reconstructed 3D markers are defined in kinematic model (.vst or .vsk file) for the subject or in the associated marker (.mkr) file. Also see Marker, .mkr file, Trajectory, and .vsk file.

LAN: Local Area Network. A short-distance data communications network—typically within a single building or group of buildings—used to connect computers in order to share data and peripheral devices (such as printers, CD-ROM drives, and modems). Each device on a LAN is known as a node; nodes are connected by cables through which messages are transmitted. Also see Ethernet network.

LEMO® connector: An electronic connector for attaching electro-optic devices. Connects with a push-pull self-latching mechanism. Also see BNC connector.

Live 3D Workspace: See 3D Workspace.

Local coordinate system: A coordinate system whose origin (0,0,0) and axes (x,y,z) are fixed with respect to a particular segment or element in a kinematic model, as opposed to the global origin and axes directions. Also see Capture volume, Global coordinate system, Kinematic model, Volume origin, and Workspace axes.

M

Marker: 1) A sphere, hemisphere, or disk coated with a highly retroreflective material which is attached to a subject or object whose motion is being captured or analyzed in a Vicon system. The Vicon cameras are designed to capture the pattern of light reflected from such a marker and convert it into an image that represents the position and radius of the marker. Also see Subject and Object. 2) The 3D representation of a retroreflective marker generated by Vicon application software (also referred to as a model marker). The expected location of all markers attached to a subject whose motion is being captured or analyzed in a Vicon system is defined in the kinematic model .vsk file) for the subject or in the associated marker (.mkr) file. These can be visualized as elements of the 3D representation of the subject. Also see Kinematic model, .mkr file, Object, and .vsk file.

Marker covariance: A 3D representation in Vicon application software of how much a marker is allowed to move in relation to its associated segment or joint, based on the subject's RoM trial. Also see Marker, Range of Motion (RoM) trial, and Segment.

Mask: See Camera mask.

MCam: A high-resolution, high-speed digital CMOS sensor camera used in a Vicon V-series system. Also see CMOS, Vicon MX, and Vicon V-series system.

MCam2: A high-resolution, high-speed digital CMOS sensor camera used in a Vicon V-series system. Also see CMOS, and Vicon V-series system.

Model marker: See Marker definition 2.

Motion capture: The recording of motion data with a Vicon system from retroreflective markers attached to a subject or object. Also Marker and Object.

MX Camera: A range of high-resolution, digital, motion capture cameras: MX40, MX13, and MX3. This range of Vicon cameras was supplied with Vicon MX systems before July 2006; MX Cameras were superseded by MX+ Cameras. MX Cameras provide high-speed and low-latency motion capture. Each MX Camera is fitted with a commercially available CMOS sensor and a strobe unit with through-hole LEDs. Each is programmed with Vicon application firmware to control its operation and enable it to perform its own onboard processing.

MX Ultranet HD: An MX hardware unit that supplies power, synchronization, and communications for up to 10 connected MX F-series, MX+, and MX Cameras (or optionally subordinate MX Control units) and the host PC. It also supplies direct powered and unpowered synchronization out functionality to connected Gigabit Ethernet cameras. It provides the interface between Vicon MX and third-party capture or remote control devices. The MX Ultranet II replaces the MX Control, MX Ultranet, and MX Sync units available in Vicon MX systems before November 2007. Also see F-series Camera, MX+ Camera, MX Camera, MX Control, MX Sync, and MX Ultranet.

MX-F20: An F-series camera providing 2 megapixel resolution used in Vicon MX systems from April 2007. Also see F-series Camera and Vicon MX.

MX-F40: An F-series camera providing 4 megapixel resolution used in Vicon MX systems from April 2007. Also see F-series Camera and Vicon MX.

MX+ Camera: A range of high-resolution, digital, motion capture cameras: MX40+, MX20+, MX13+, and MX3+. This range of Vicon cameras was supplied with Vicon MX systems after July 2006; MX+ Cameras were superseded by MX F-series cameras in April 2007. MX+ Cameras provide high-speed, low-latency motion capture. MX+ Cameras are made of lead-free components to comply with environmental regulations. Each MX+ Camera is fitted with a commercially available CMOS sensor and a strobe unit with surface-mount LEDs. Each is programmed with Vicon application firmware to control its operation and enable it to perform its own onboard processing.

MX3+: An MX+ Camera providing 0.3 megapixel resolution used in Vicon MX systems after July 2006. Also see MX+ Camera and Vicon MX.

mxe file: A file with extension .mxe, which contains updates to the Vicon MX firmware in MX cameras and certain MX hardware units. Also see Firmware, MX Camera and MX Ultranet HD.

N

Noise: Random or systematic background interference that is unrelated to the data being collected (such as hum or hiss in audio data, or snow or graininess in video data), or random spikes or jitters in motion data. Some noise is generally present in most data collected. Typical examples are noise caused by human error in digitizing, electrical interference in EMG, mechanical vibrations in force plates, or non-seamless camera tracking of markers during motion capture. Different types of noise require different techniques to eliminate it.

O

Object: The target of a trial, usually a single-segment inanimate article, to which Vicon markers are attached and subsequently tracked by a Vicon system. Also see Trial and Tracking volume.

Occlusion: The state of a marker that has been completely obstructed from the view of one or more cameras. This is generally caused by the marker being covered by a body part or by another motion capture subject. Also see Marker.

Operating mode: A window in some Vicon application software that provides access to the activities required during a specific stage of motion capture and processing.

Options file: An XML file with extension .Options, which contains configuration settings for view options created in the Options dialog box in Vicon Tracker. Also see Tracker.

Origin: See Volume origin.

Ortho view pane: A type of view pane in a Vicon iQ or Tracker application software window in which the point of sight, or direction, from which to view the capture volume (or tracking volume) in the workspace can be set. The available views are based on orthographic projection (also called orthogonal projection): top, bottom, front, back, right side, and left side. Also see View pane, Capture volume, Tracking volume, and Workspace.

Orthogonal axes: Three axes which are at right angles to each other. Vectors may be analyzed into components in any orthogonal system of axes, and the components added according to normal vector algebra.

P

Pan: The rotation of a stationary camera in a horizontal plane about a vertical axis (pan left or pan right). Also see Dolly, Tilt, and Truck.

Parameter links: A visual representation in Vicon application software of the parameter associations between specified markers and segments in a subject.

Pixel: Picture (pix) element. The smallest unit of the composition of an image capture or display device.

Point: A location in space specified by 3D coordinates. A trajectory (or segment of a trajectory) consists of a time-series of points. A point is stored in a .c3d file as three spatial coordinates and a residual, identified by a label. Points may represent the measured positions of real markers. In some Vicon application software, points may be virtual (created by modeling). The terms point and marker are often used interchangeably. Also see .c3d file, Label, Marker, and Virtual point.

R

Real-time processing: The process of converting raw, 2D motion data being streamed live by Vicon cameras into 3D data. Also see RealTime Engine (RTE).

RealTime Engine (RTE): Vicon application software that produces 3D data based on the raw motion data acquired by Vicon MX or V-series cameras. The RTE (known as Tarsus in Vicon V-series systems) reconstructs, labels, and optionally kinematically fits this real-time motion data, which can then be viewed and incorporated in Vicon iQ, Polygon, or third-party visualization software. Also see Polygon, Tracker, Vicon iQ, and Workstation.

Reconstruction: The process by which Vicon application software calculates the position of markers in three-dimensional space and links these points frame-by-frame into a trajectory. Also see Frame, Marker, and Trajectory.

Reconstruction entity: A 3D representation generated by Vicon application software showing the reconstructed markers. Also see Marker and Reconstruction.

Reconstruction volume: The 3D representation of the capture volume displayed in some Vicon application software. This enables the user to visualize the space within which the Vicon system attempts to reconstruct marker data. The dimensions of this volume are user configurable. Also see Calibration volume, Capture volume, Marker, and Trajectory.

Resolution: A measure of the fineness of detail with which a camera or monitor can produce an image with good definition. This measurement is based on the total number of pixels displayed horizontally and vertically on the camera video sensor or the video monitor. Also see Camera video sensor and Pixel.

Retroreflective marker: See Marker definition 1.

Rigid body: A virtual object formed from a specified group of markers with a relatively fixed proximity to one another. Also see Object.

RoHS compliant: Vicon hardware that complies with Directive 2002/95/EC concerning the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS). This European Commission Directive provides that new electrical and electronic equipment put on the market for the first time from 1 July 2006 should not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). Also see WEEE compliant.

Rotation: A movement about a specified axis. In Vicon application software, the rotation of a kinematic model element can be manipulated to change its displayed orientation in a 3D Workspace. Also see 3D Workspace, Scale, and Translation.

S

Scale: 1) The enlargement or reduction of an image by proportionally adjusting its size. In Vicon application software, the scale of a kinematic model element can be manipulated to change its displayed size in a 3D Workspace. Also see 3D Workspace, Rotation, and Translation. 2) The alteration of values from one unit of measure to another. Vicon application software can scale incoming voltage signals (e.g. from a force plate) from bits to Newtons (N) for forces and Newton millimeters (Nmm) for moments.

Sensor: A device that measures or detects a physical quantity such as pressure, motion, sound, or light and converts it into an analog or digital representation. Also see Camera video sensor.

Static calibration object: A calibration object used for setting the global coordinate system in the capture volume. An ergo calibration frame is one type of static calibration object. Also see Calibration kit, Calibration object, Calibration volume, Ergo calibration frame, and Global coordinate system.

Stick: A visual aid to illustrate the connection between reconstructed marker positions or between virtual points in a kinematic model for a subject whose motion is being captured or analyzed in a Vicon system. This can be visualized as an element of the 3D representation of the subject. Also see Kinematic model, Marker, and Subject.

Strobe unit: A specialized piece of illumination equipment attached to the front of a Vicon camera. The strobe unit generates a bright flash of light, which illuminates the retroreflective markers attached to the subject or object whose motion is being captured or analyzed in a Vicon system. The strobe unit's flash coincides with the time the camera's shutter (if present) is open. Strobe units can be fitted with Visible Red (VR), Near Infrared (NIR), or Infrared (IR) Light Emitting Diodes (LEDs).

Synchronization: The process by which a signal change common to all camera view used to match them in time. This causes analog and/or video data from different sources to match exactly. Also see Analog, Datastation, and MX Control.

System calibration: See Camera calibration.

System file: An XML file with extension .System, which contains configuration settings for Vicon system hardware managed by Tracker application software. This file is created in the System resources pane in Tracker.

T

Threshold grid: In Vicon MX, a grid superimposed over the image displayed in a camera view pane in which raw, 2D camera data can be manually marked to be used for processing or to be discarded. This enables grayscale blobs generated from unwanted light sources such as stray reflections from other objects or surfaces in the capture volume and opposing strobe units to be ignored. You can have Vicon application software automatically create threshold grids, or you can create them yourself. The equivalent functionality for Nexus and for Vicon V-series systems is provided by camera masks. Also see Camera mask, Capture volume, Grayscale blob, Vicon MX, Vicon V-series system, and .vtt file.

Tilt: The rotation of a stationary camera in a vertical plane about a horizontal axis (tilt up or tilt down). Also see Dolly, Pan, and Truck.

Tracker: Vicon application software for 3D optical tracking in virtual environments, simulators, and visualization systems. Tracker is the core motion capture and processing software for engineering applications.

Tracking volume: The area of the capture space in which Vicon cameras are able to capture the motion of specified tracking objects. Also see Reconstruction volume, Calibration volume, and Capture volume.

Translation: The movement of an object along a specified axis. In Vicon application software, the translation of an object can be manipulated to change its displayed position in a 3D Workspace. Also see 3D Workspace, Rotation and Scale.

Truck: The moving of a camera side to side along a horizontal axis (truck left or truck right). Also see Dolly, Pan, and Tilt.

V

Vector: A quantity that has both direction and magnitude. For example, velocity is a vector quantity whose magnitude is a body's speed and whose direction is the body's direction of motion. Vicon application software uses vectors to describe and analyze elements of kinematic models of subjects or objects whose motion is being analyzed. Also see Kinematic model.

Vicon application software: Software for motion capture, processing, and analysis by Vicon systems. A range of software is available for use in a variety of engineering, entertainment, and life sciences applications. Also see BodyBuilder, Plug-in, Polygon, Tracker, Vicon iQ, and Workstation.

Vicon MX: Vicon integrated system for digital optical motion measurement and analysis, based on video cameras that perform centroid processing. It consists of specialized cameras, illumination equipment, controlling hardware units, application software, and a host PC. MX network equipment, accessories, calibration apparatus, and cables are supplied with the system. Third-party devices can be integrated with the system. Also see Accessory kit, Host PC, Calibration kit, MX Bridge, MX Control, MX Link, MX Net, MX Sync, MX Camera, and Strobe unit.

View pane: The area in the middle of a Vicon application software window that enables users to specify the type of data from one or more Vicon cameras to be viewed. Each type of view pane may contain its own menu bar, toolbar, and workspace. Also see View pane menu bar, View pane toolbar, and Workspace.

View pane menu bar: A set of menus from which the type of view pane to display in the workspace is selected. Also see 3D Workspace, Camera view pane, Frame rate view pane, Fullscreen preview, Ortho view pane, View pane, and View pane button bar.

View pane toolbar: A set of buttons with which the number and arrangement of view panes displayed in the workspace is specified. Also see View pane and View pane menu bar.

ViewType file: Vicon Tracker view pane layout configuration file. An XML file with extension .ViewType, which contains configuration settings for view pane layouts in the Tracker window.

Virtual point: A virtual marker that is derived through calculations based on a specified group of markers—or other virtual points—whose proximity to one another is relatively fixed.

Visualization software: Vicon or third-party application software in which motion data can be visualized and manipulated in real time.

Volume: See Capture volume, Calibration volume, Reconstruction volume, and Tracking volume.

Volume origin: The coordinates (0,0,0) identifying the origin of the world in the context of the capture volume or tracking volume. The volume origin is specified during the system calibration process. Also see Capture volume, Tracking volume, and System calibration.

vsk file: Vicon Skeleton file. An XML file with extension .vsk, which contains a kinematic model that describes the relationships between the segments, joints, and Vicon markers for a specific subject or object of the type described in the associated Vicon Skeleton Template (.vst) file. For example, if the .vst file represents a human being, the .vsk file contains a kinematic model of an individual person. The Vicon application software uses the .vsk file to track and label markers and segments for that subject. By default, .vsk files are saved to the active Session folder of the open database. Also see, Kinematic model, Marker, and Object,.

W

Wand: See Calibration wand.

WEEE compliant: Vicon hardware that complies with Directive 2202/96/EC concerning the disposal of Waste Electrical and Electronic Equipment (WEEE). This European Commission Directive provides for the disposal of certain equipment that may not be treated as household waste. Also see RoHS compliant.

Workspace: The area in the view pane in which data can be viewed and manipulated. The type of workspace displayed depends on the type of view pane selected. Also see View pane and 3D Workspace.

Workspace axis: A visual representation in some Vicon application software of the X, Y, and Z axis in the global coordinate system. These axis are specified as part of the system calibration process. They can be visualized in the 3D Workspace. Also see 3D Workspace, Global coordinate system, and System calibration.

X

xcp file: An XML file with extension .xcp, which contains the calibration parameters and threshold data specified for Vicon cameras in Vicon Tracker. This file is created during the MX camera calibration processes and used when data from these cameras is processed. A copy of the .xcp file is saved to the active Session folder of the open database. Similar functionality is provided by the .cp and .vtt files in earlier Vicon application software. Also see .cp file, and Tracker.

xml file: eXtensible Markup Language file. A condensed form of SGML (Standard Generalized Markup Language) which defines a language standard used to create customized tags for organizing and presenting types of information in documents that can be published on the World Wide Web. A number of Vicon file types are in XML format. Also see .vsk file.

Z

Zoom lens: A camera lens with a variable focal length and whose angle of view can be changed without moving the camera. See MCam2, MX13/MX13+, and MX40/40+.

Zoom ratio: The ratio of the longest and shortest focal length of a zoom lens. Also see Focal length and Zoom lens.

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