



VirtualHand®

v2.7

USER'S GUIDE

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CyberGlove Systems LLC
2355 Paragon Drive, Suite D
San Jose, CA 95131
Tel: (408) 451-9463
Fax: (408) 689-4362
fyazadi@cyberglovesystems.com

CONTRIBUTORS

Written by:

Ron Carmel, Chris Ullrich, Jason Silver, Ben Discoe

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CHAPTER

1

Software Installation

The Device Configuration Utility (DCU) and Device Manager (DM) are part of the VirtualHand/Driver® and ship with all CyberGlove Systems 3D products. The DCU provides a friendly and intuitive interface for configuring, calibrating and testing CyberGlove Systems 3D products as well as Polhemus and Ascension 6 degree-of-freedom (DOF) trackers. The Device Manager is an innovative “smart driver” that provides a network-transparent, homogeneous mechanism for interfacing with CyberGlove Systems' devices as well as the most common 6-DOF trackers. By *network transparent* we mean that you can use a CyberGlove® with your application in the same way regardless of whether it is connected to the computer on which the application is running, or to a different computer which is accessible via a network.¹

The DCU Serves Three Main Purposes

1. Instant access to local and remote CyberGlove, CyberTouch™, CyberGrasp™ and CyberForce™ units for visual verification of operation and data flow (most common 6 degree of freedom trackers are also supported)
2. Quick application-independent calibration of local and remote CyberGlove, CyberTouch, CyberGrasp and CyberForce units. (Polhemus and Ascension 6 DOF trackers also supported).
3. Setting default device parameters for use with the Virtual Hand Toolkit API.

1. Though using a CyberGlove (or any other device) over the Internet is also possible with the Device Manager, latency and communication speeds start to play more significant roles, and performance may suffer.



WARNING: *GesturePlus™ is not currently supported by the VirtualHand Suite.*

System Requirements

Windows NT/2000

- Microsoft Windows NT® 4.0 with Service Pack 5 required or Microsoft Windows 2000.
- 256 MB of RAM recommended
- 40 MB of disk space required
- Pentium® II 400MHz or faster (dual processors recommended)
- High-end AGP graphic card
- Microsoft Visual C++ version 6.0 (Service Pack 3) or higher

SGI

- Irix® version 6.5 or higher (n32 binaries) required
- 128 MB of RAM recommended
- 125 MB of disk space required
- Octane® workstation with single R10000 processor, or faster, recommended
- MIPS Pro compiler version 7.1.2 or higher (GNU not tested)

Installing the VirtualHand Suite

Windows NT/2000

1. From the CD, run the file called Setup.exe, which will guide you through

the installation procedure.

2. If you plan on developing software that uses VHS components, you will need to set up your development environment in such a way that the required VHS libraries can be loaded at runtime. For more information the user should refer to the VHS Programmer's Guide section on runtime libraries.



NOTE: Installation of the VHS on NT/2000 is on a user-by-user basis. Each user account that wishes to use the VHS should install it

SGI IRIX

Extract the tar file into the directory you want to store the software in. To do so, change to that directory and type one the following at the prompt:

```
tar xzvf /CDROM/VHS2000_irix_mips_6.5-Base.tgz
OR
tar xzvf /CDROM/VHS2000_irix_mips_6.5-Full.tgz
```

As an example, the rest of this document will assume you chose to install the files in:

```
~/usr/local/virtex
```

After extracting the tar file, you must make sure you have set the VTI_REGISTRY_FILE environment variable. This environment variable is accessed both by the DCU and the VirtualHand Toolkit, so we highly recommend you make sure it is set every time you log in by placing the following command either in your .login file or another script that is invoked upon login:

```
setenv VTI_REGISTRY_FILE <install_dir>\reg.vrg
```

<install_dir> is the directory into which you installed the VirtualHand Suite. For example:

```
~/usr/local/virtex/reg.vrg
```

This file does not yet exist. It will be created by the DCU when it is needed. Through it, the devices specified in the DCU as default devices can be accessed by user applications (Refer to Chapter 4 additional information on using default devices)

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NOTE: *The last version of the VHS for IRIX was 2.0. VTi has no plans to provide updates beyond this on the IRIX platform. Documentation in this manual refers explicitly to Version 2.7 for NT/2000. Please refer to the documentation included in the .tgz file for IRIX specific details.*

Getting Started

The intent of this chapter is to give the user a brief overview of the capabilities of the Device Configuration Utility (DCU) when run in conjunction with the Device Manager (DM). Prior to reading this chapter, make sure that:

- If you have not yet installed the Device Manager and DCU software, please do so by following the instructions outlined in *Chapter 1* of this manual.
- If you have not installed your CyberGlove, please refer to the *Cyberglove Reference Manual* for information on installing and connecting to the CyberGlove.
- If you are using the CyberGrasp option with your CyberGlove, please refer to the CyberGrasp User's Guide for information on installing and connecting to the CyberGrasp unit.
- If you are using the CyberForce option with your CyberGlove, please refer to the CyberForce User's Guide for information on installing and connecting to the CyberForce unit.
- If you have not installed your Ascension or Polhemus tracker, please refer to their respective manuals for information on installing and connecting to the them.



WARNING: *Make sure both hardware and software have been properly installed by carefully reading the corresponding manuals. We have attempted to include brief Getting Started sections in each of them to ensure that you can be up and running as quickly as possible. Doing so will greatly reduce the chances that problems will be encountered during initial operation.*

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Once you have installed both hardware and software, continue by following the instructions included in this chapter which should give you a quick introduction to your new software and ensure that everything is operational. More specifically, this chapter will:

1. Show you how to start the Device Manager
2. Show you how to start the Device Configuration Utility
3. Give you an overview of the DCU's main components.
4. Show you how to register devices (both VTi's and third party) with the DCU so that you can see them move in the Device Viewer part of the DCU and verify that they are functioning.

If any problems are encountered, please refer to the Troubleshooting Appendix included at the end of this manual.

Starting the Device Manager

Since the DCU is a front end to the Device Manager, we must first start at least one Device Manager in order for the DCU to be useful. Multiple Device Managers can be started on different computers (one Device Manager per computer) if you would like to access devices connected to remote computers. Details on how to access remote devices are provided later in this section.

Microsoft Windows NT/2000

Click on the Windows® **Start** button on the lower left corner of your screen. From there go to **Programs | VirtualHand | SDK | Device Manager**. At this point, a minimized console window will appear and the Device Manager will be running and be accessible by the Device Configuration Utility.

SGI IRIX

The Device Manager is located in the directory:

```
<installation path>/VHS/2.0/Applications/vtidm/irix_mips/<os-version>
```

Where <installation path> is the directory to which you extracted the installation package (e.g. /usr/local/virtex) and <os-version> is the version of Irix you are running (e.g. 6.4).

To run the Device Manager from the prompt, simply go to that directory, and type:

```
./master &
```

To have the Device Manager automatically started at boot time, you must install a start-up script. It is called `vtidm` and it is located in:

```
<installation path>/VHS/2.0/Applications/vtidm
```

Copy this script into the `/etc/init.d` directory, and link the script in the `rc2.d` or `rc3.d` directories, as with standard start/stop boot scripts. For more information about start-up scripts, refer to the `rc2` man page of the Irix operating system. Finally, you must update the `vtidm` script to use the installation directory.

Starting the Device Configuration Utility

Now that we have a running Device Manager, the DCU can be launched in a similar fashion.

Microsoft Windows NT/2000

Click on the Windows® **Start** button on the lower left corner of your screen. From there go to **Programs | VirtualHand | SDK | DCU**.

SGI IRIX

The Device Configuration Utility is located in the directory:

```
<installation path>/VHS/2.0/Applications/DCU/
```

Where <installation path> is the directory to which the installation package was extracted (e.g. /usr/local/virtex). To run the Device Configuration Utility from the prompt, simply go to that directory, and type:

```
dcu
```

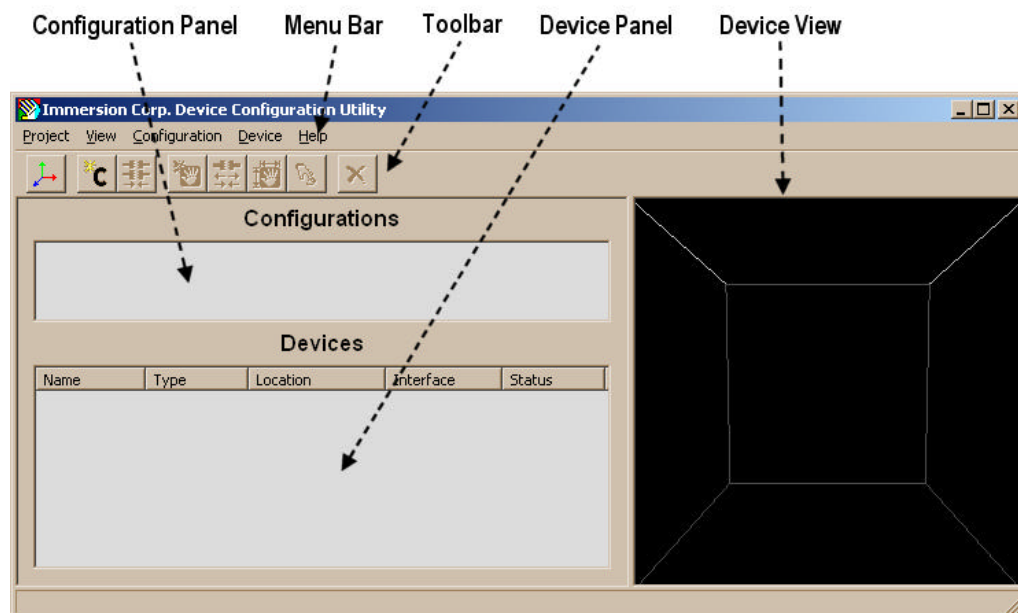
Before running the `dcu` script, please note the following:

1. The dcu script is a bash script. This means it will not run in other shells such as sh, csh, tcsh. If you are not using bash, first type **bash** and hit **<enter>**, and then run the dcu script.

DCU Components

The DCU consists of five major components: the **Menu Bar**, the **Toolbar**, the **Configuration Panel**, the **Device Panel** and the **Device Viewer**:

Figure 2-1



The Menu Bar

The menu bar provides access to all the functionality provided by the DCU. Detailed information on each menu item can be found in Chapter 3.

The Toolbar

The button bar provides access to all the functionality of the DCU through quick one-click buttons. Buttons perform exactly the same feature as the corresponding menu item and are described in detail in Chapter 3.

The Configuration Panel

The configuration panel displays the configuration that you have registered with the DCU.

The Device Panel

The device panel displays the devices that you have registered with the DCU for each configuration. The “Adding Devices” section discusses how to register different device types with the DCU.

The Device Viewer

On the right side of the window you will see a dark rectangle - this is the Device Viewer. The Device Viewer can display a 3D graphical representation of the selected device and allows you to visually inspect the data coming from this device for purposes such as calibration and connection verification. Chapter 3 further illustrates the uses of the Device Viewer.

Creating Configurations

Before adding devices to the DCU, first create a Configuration. A Configuration can contain a set of devices. If you will be switching between different machines or arrangements of your devices, you can create several Configurations.

1. From the menu bar, select **Configuration | New**

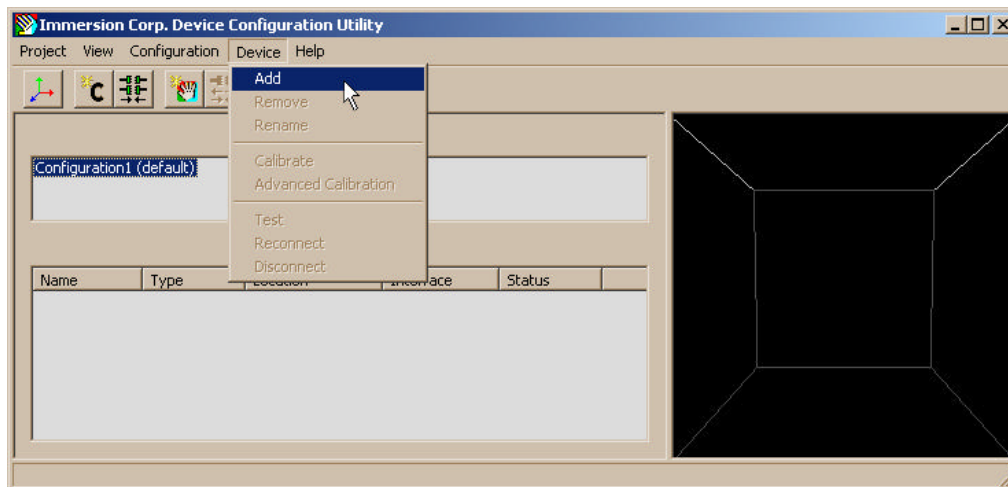
Adding Devices

Before adding a device to the DCU, make sure you have physically connected the device. See the corresponding hardware manual for further details on how to correctly set up and connect devices.

Adding a VTi Device

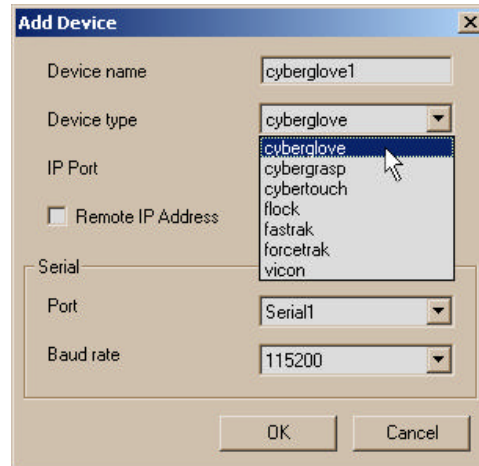
1. From the menu bar, select **Device | Add:**

Figure 2-2



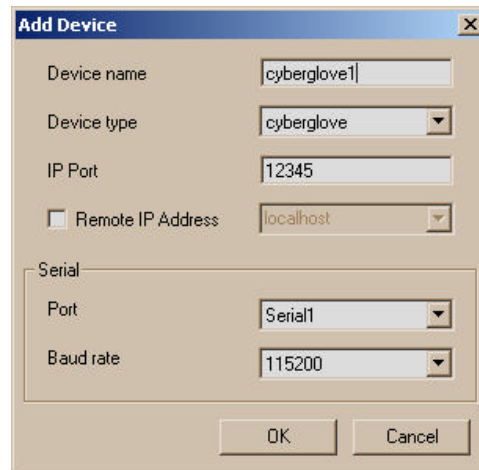
2. Select the device type you wish to connect from the drop-down list labelled **Device Type**:

Figure 2-3



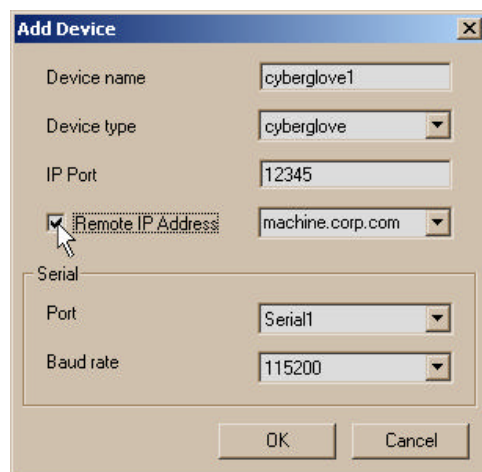
3. Type in a name for the device in the **Device name** field:

Figure 2-4



4. If you are connecting to a device located on a remote computer, select the **Remote** check box, and type in (or select from the drop-down list) the host name, or IP address, of the computer to which the device you wish to register is physically connected.

Figure 2-5



The 'Add Device' dialog box contains the following fields and controls:

- Device name: cyberglove1
- Device type: cyberglove
- IP Port: 12345
- ☒ Remote IP Address: machine.corp.com
- Serial section:
 - Port: Serial1
 - Baud rate: 115200
- Buttons: OK, Cancel



NOTE: The CyberGrasp is slightly different from other devices -- it is not connected to any one host, but rather is a host in itself. To connect a CyberGrasp you need to specify the IP address of the CyberGrasp Controller. See the CyberGrasp manual for details about how to change the controller's IP address.

5. Some devices (such as the CyberGlove) require Serial Port parameters. If they are enabled, set them as follows:

Port— select which serial port you would like to use. The DCU has abstracted the exact name of the serial port to a system independent format. Serial ports are specified in a 1-based index system. This means that **Serial 1** will be treated as **COM1** on the Windows platform and **/dev/ttyd1** on the Irix platform. Users utilizing non-standard serial port names (e.g: *expansion serial ports*) may type the serial port device name directly into the serial port field (e.g: */dev/ttya1*)

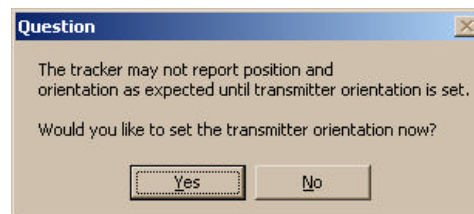
Baud Rate—Some serial devices (such as the CyberGlove and CyberTouch) allow you to set their baud rate. Refer to the appropriate hardware manual for information on how to set the baud rate of a device.



WARNING: Make sure you specify the device baud rate in the **Baud Rate** drop-down list *such that it matches the baud rate set on the device's instrumentation unit!*

6. Click to add the device.
7. You should now see the new device listed in the Device Panel. Click on your device to select it, then give the Menu command “Device: Connect”. At this time the DCU will attempt to contact the Device Manager at the appropriate IP address and port (if you did not specify a remote IP, the DCU will internally use the network name of the host on which it is running). If you get an error message, please refer to the **Troubleshooting Appendix**.
8. If you have added a tracker, the DCU will now inform you that the tracker's transmitter orientation property should be set in order to guarantee that position and orientation data are reported in the correct coordinate frame. If you wish to set the transmitter orientation now, click .

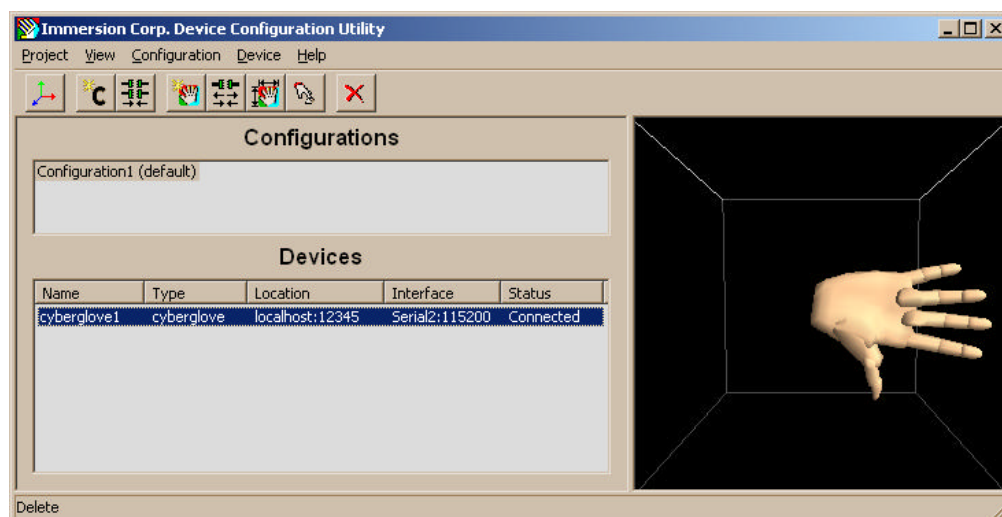
Figure 2-6



9. Looking at the device viewer, you will see a hand (or for a Tracker, a ball) that represents the device you have just added. Wearing the device (CyberGlove, CyberTouch or CyberGrasp) and moving your fingers should

cause the fingers on the graphical hand displayed in the device viewer to move accordingly. See the **Troubleshooting Appendix** if you encounter a problem.

Figure 2-7



You may repeat the process and connect to other devices, whether they are connected to your computer or a to another computer that is accessible over a network.

Adding a Polhemus or Ascension Tracker

Connecting a tracker is as easy as connecting a CyberGlove. Follow steps 1-9 in the previous section to connect your tracker. The only difference is the representation displayed in the device viewer. When viewing a 6DOF tracker you will see two sets of XYZ axes with cones at the end of each axis. These cones point in the +X, +Y, +Z directions and are coloured Red, Green, Blue respectively. One set of axes has a yellow wire-frame sphere at the origin -- this one represents the position and orientation of the receiver. The other represents the transmitter's origin. As you move the receiver around you will see the set of axes which represents the receiver move with you. See *Calibrating Polhemus and Ascension Trackers* in Chapter 3 for more information on configuring your tracker.

Adding a CyberForce Device

CyberForce is accessible as the device type “ForceTrak”. A CyberForce behaves exactly like a regular tracker except the hemisphere settings are not used.

Using the DCU

The following chapter gives a more in-depth look at the functionality of the Device Configuration Utility. It steps the user through most of the items included in the pull down menus. Users should refer to the Troubleshooting Appendix if any problems are encountered.

Configurations

A Configuration is a container which provides a convenient way to group your devices. If you have several different machines or arrangements of your devices, you can create a Configuration for each one and switch between them as needed.

Setting the default configuration.

Choosing the correct default configuration is important, because the Virtual Hand Suite will, by default, load only those devices specified under the default configuration. Therefore, when switching configurations, a new default must be specified.

To specify the default configuration, select the configuration in the Configuration Panel and give the menu command 'Configuration: Set as Default'

When no calibrations are specified in the registry, the first one added becomes the default. A subsequently added configuration must be expressly designated as the default.

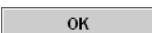
Adding and Removing Devices

The basic procedure for adding devices has been outlined in Chapter 2 (see the *Adding Devices* section). To remove a device, simply select it from the appropriate tab, and choose **Device|Remove** from the pull-down menu.



NOTE: *Removing a device does not mean that the device is no longer accessible, it simply removes it from the device list. Applications that access that device via the Device Manager API will still be able to fully communicate with it. It is recommended that you keep one entry for each of your available devices in the DCU device list - this will speed up the configuration of these devices.*

Connecting to a CyberGlove or Tracker

Most CyberGrasp systems have a CyberGlove and a 6-DOF tracker attached to them. You can register these devices with the DCU (and you may use them from your applications, even if they are not running on the CyberGrasp controller). There is always a Device Manager running on the CyberGrasp controller. You may therefore select **Device | Add**, select **CyberGlove** as the device to be connected to, specify the serial port and click . This means that the glove and tracker do not have to be dedicated to the CyberGrasp system, and can be used independently.



NOTE: *By default, a CyberGlove is connected to Serial 1 on the CyberGrasp Controller, and a tracker to Serial 2, both running at 115200 baud. See the CyberGrasp manual for more details.*

CyberTouch/CyberGlove Compatibility

CyberTouch and CyberGlove units are interchangeable. You may connect a CyberTouch as if it were a CyberGlove and vice-versa. For use with the VHT C++ API, it is necessary to connect to a CyberTouch glove using the CyberGlove tab. Note that you may connect to the same device twice at the same time with the DCU from different tabs.

Reconnecting Devices

In some circumstances a connection to a device may be lost. Examples would be loss of network connection to the machine a device is connected to, loss of power to the device, or stopping the Device Manager through which the device communicates with the DCU and other applications. In such cases, after the cause of the disconnection is resolved, you may click on the disconnected device and from the Device menu, select **Reconnect**. At this point the DCU will attempt to re-establish a connection to the device. If a problem is encountered while attempting to reconnect, the DCU will display an error, otherwise you should now see the device properly functioning in the Device Viewer.

Setting Device Properties

Calibrating Devices

Devices are calibrated for different reasons. The CyberGlove and CyberTouch are calibrated in order to adjust the gains and offsets of the raw values read from the glove which result in the Device Manager returning joint angles instead of raw sensor values. Calibration is needed because human hand sizes and range of motion vary greatly. As a result, a CyberGlove cannot be shipped with a default calibration that will work well for everyone. Consider the default calibration to be a *good first guess*. The CyberGrasp needs to be calibrated for a different reason, which is beyond the scope of this manual. For more information see the CyberGrasp Manual. Polhemus and Ascension trackers also have some calibration settings, which are discussed further in this section.

Calibrating CyberGlove/CyberTouch

To calibrate a CyberGlove or CyberTouch, select the device you want to calibrate from the appropriate device list, and select **Device|Calibrate** from the main menu. Follow the on-screen instructions. If you are not pleased with the results of a step in the calibration, you may click the back button, and repeat that step. If your application requires an especially exact calibration, you may want to adjust the calibration manually. To do this, click the **Advanced** button in the CyberGlove (or CyberTouch) calibration dialogue.

Figure 3-1

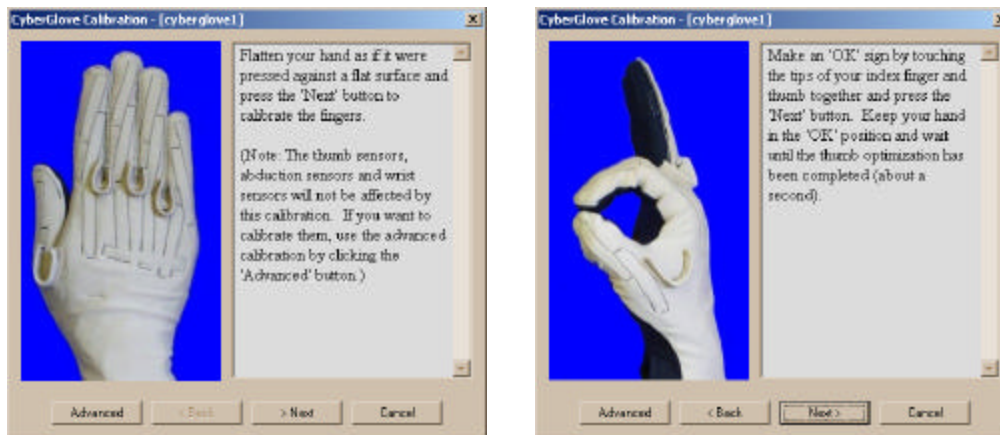


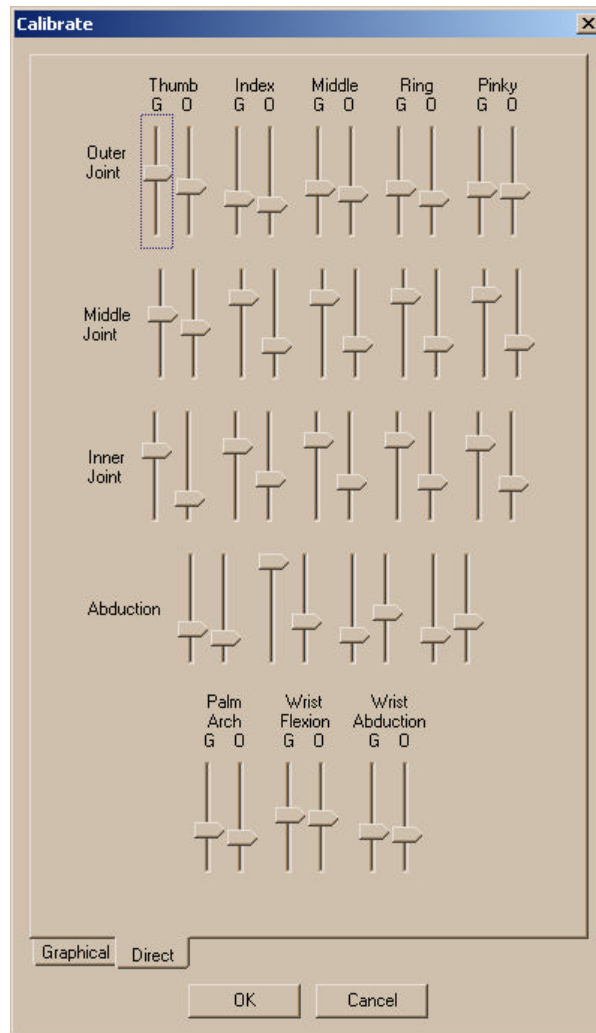
Figure 3-2



At this point, you will see the advanced calibration dialogue. You may click on the image of the CyberGlove on any of the sensors (marked with big yellow dots) and use the two sliders (one for adjusting sensor gain and one for adjusting sensor offset) to tweak the calibration. During this process you will see the result of your calibration in the device viewer in the main application window.

If you prefer a quick access to all of the sensors, you may want to click the **Direct** tab located in the lower left region of the advanced calibration dialog. You should now see a large collection of scroll bars, each corresponding to a CyberGlove sensor:

Figure 3-3



The scroll bars' finger association is labelled across the top, and the joint association is labelled on the left.



NOTE: *Adjusting gain and offset values for outer joints on an 18 sensor CyberGlove or a CyberTouch has no effect on the final joint angles since they do not possess those sensors.*



NOTE: *The calibration values set by the calibration process will persist as long as the Device Manager responsible for the calibrated device is running. If it is stopped, whatever the reason, the calibration will revert to the default. For this reason, when you click the Finish button after calibrating a glove, the DCU will also store your calibration in the Registry. This is especially useful if you've spent time generating a precise calibration for your hand using the Advanced Calibration Dialog.*

Calibrating CyberGrasp

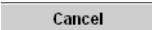
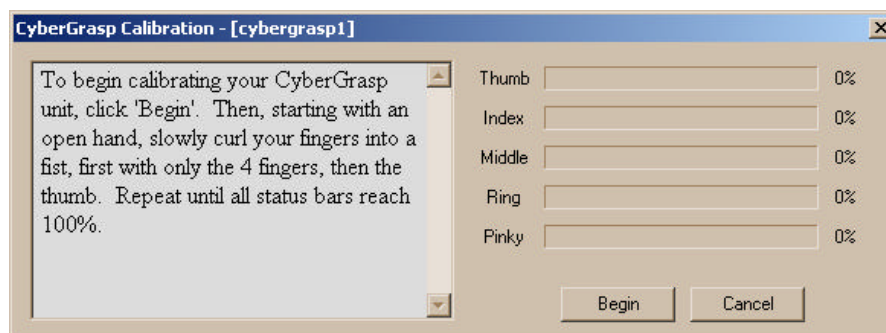

To calibrate a CyberGrasp, select the unit you wish to calibrate from the CyberGrasp device list, and from the menu bar select **Device | Calibrate**. The first step is to calibrate the CyberGlove associated with the CyberGrasp system. A CyberGlove dialogue will show. You may either follow the instructions to calibrate the CyberGlove or skip this step and go directly to the CyberGrasp calibration by clicking . You will now see the CyberGrasp calibration dialogue:

Figure 3-4



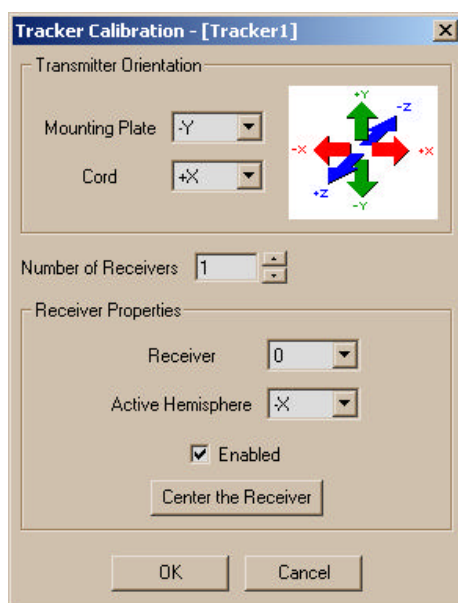
The CyberGrasp controller needs to be put into calibration mode in order to sample the CyberGlove and create an internal map of its values. Once you press the Begin button, the CyberGrasp controller will switch to calibration mode and you will need to *very slowly move your hand through its entire range of motion*. We recommend the following procedure:

1. Keeping your thumb still, slowly curl your fingers into a fist
2. Re-open your hand. You do not need to do this slowly since during calibration the CyberGrasp controller only samples when the fingers are being flexed, not when they are being straightened.
3. Repeat steps 1 and 2 until the progress bars for the Index, Middle, Ring, and Pinky fingers reach 100%.
4. Hyper-extend your thumb and then slowly move it towards the base of your pinky.
5. Extend your thumb to it's normal position.
6. Repeat steps 4 and 5 until the progress bar for the Thumb reaches 100%.
7. Click  to accept the calibration.

Calibrating Polhemus and Ascension Trackers

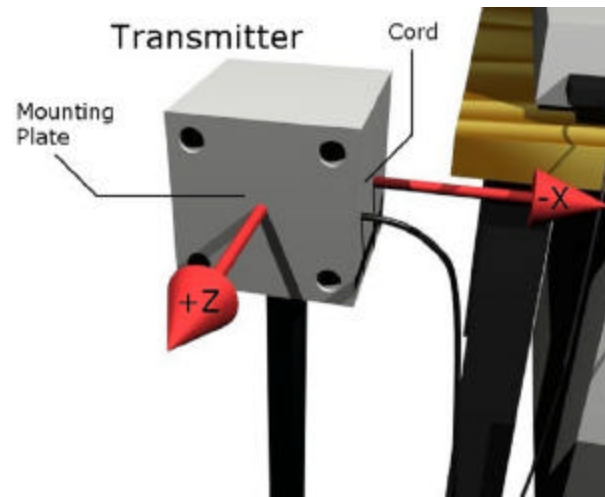
There are several configurable properties for Polhemus/Ascension trackers:

Figure 3-5



The first is the orientation of the Transmitter. Transmitter orientation is set in relative terms, by specifying what you, the user, consider to be the direction in which the transmitter's mounting plate is facing and the direction the transmitter's cord is facing. Both Polhemus and Ascension trackers have defined a **native coordinate frame** in which the mounting plate of the transmitter (the face of the transmitter that has screw holes) marks the +Z direction and the face of the transmitter from which the cord comes out of marks the -X direction (Figure 3-6). Please note that Ascension's Extended Range Transmitter (ERT) does not have a mounting plate. For the purpose of setting transmitter orientation, consider the bottom face of the ERT to be the mounting plate. There is only one face on which the ERT can stand such that the "Motion Tracking by Ascension" label on the ERT is upright -- that face is the bottom face and the equivalent of the mounting plate.

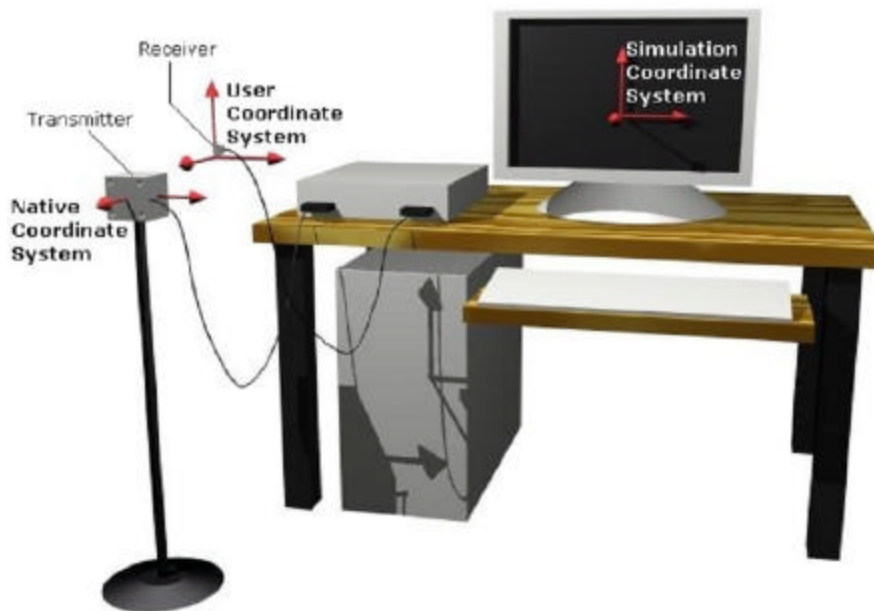
Figure 3-6



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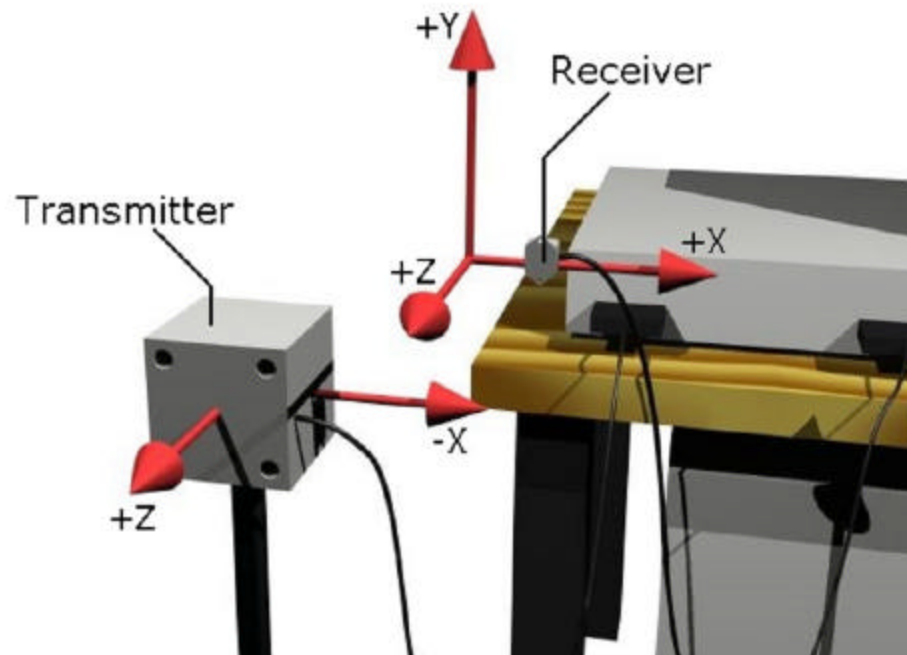
It is not always convenient to orient the transmitter to produce the “correct” results in the software simulation. The solution is to allow users to define a **user coordinate frame** by specifying the X, Y and Z axes.

Figure 3-7



Naturally, the user coordinate system will correspond to the simulation coordinate system. For example, if your transmitter is positioned as follows:


Figure 3-8



and you would like the movement of the receiver to the right to be considered as a movement in the positive X direction, a movement upwards to be considered a movement in the positive Y direction and a movement backwards (away from the screen) to be considered a movement in the positive Z direction (see illustration), set the mounting plate direction to $+Z$ and the cord direction to $+X$. In the native coordinate system, a movement to the right would have been interpreted as a movement in the negative X direction, but in the user coordinate system, a movement to the right is interpreted as a movement in the positive X direction.

For each receiver:

Active hemisphere: Both Polhemus and Ascension trackers triangulate the position of each receiver. Using triangulation results in two possible position solutions: (x,y,z) and $(-x,-y,-z)$ which both satisfy the triangulation constraints. In order to choose one, the tracker must know which hemisphere the receivers position must

be in. Selecting one hemisphere eliminates one of the possible triangulated positions. To set the active hemisphere, select the appropriate major axis for the hemisphere (+X, -X, +Y, -Y, +Z or -Z) from the hemisphere drop-down list, and click .

Hemisphere specifications, as well as transmitter orientation specifications are done using the +X, +Y, +Z, -X, -Y and -Z notations. These are relative axes, corresponding to the user coordinate frame, not to the native coordinate frame.



NOTE: *Some Polhemus trackers automatically detect when a receiver crosses a hemisphere boundary and adjust accordingly. If you set the hemisphere on such a tracker, automatic hemisphere detection is deactivated until the tracker is re-booted. Consult your tracker manual to see if you need to be concerned with setting the hemisphere on your tracker.*

Persistence of Calibrations

CyberGlove and Tracker calibrations are saved and loaded to the registry because they are repeatable (unlike CyberGrasp). This means that if you take the time to fine-tune the glove calibration to fit your hand and save that calibration, the next time you use the glove, you won't have to repeat the procedure. The calibration parameters reside with the Registry and Device Manager. When a calibration is loaded, the DCU sends the calibration values to the Device Manager so that all applications communicating with that device manager get consistent CyberGlove/CyberTouch data.

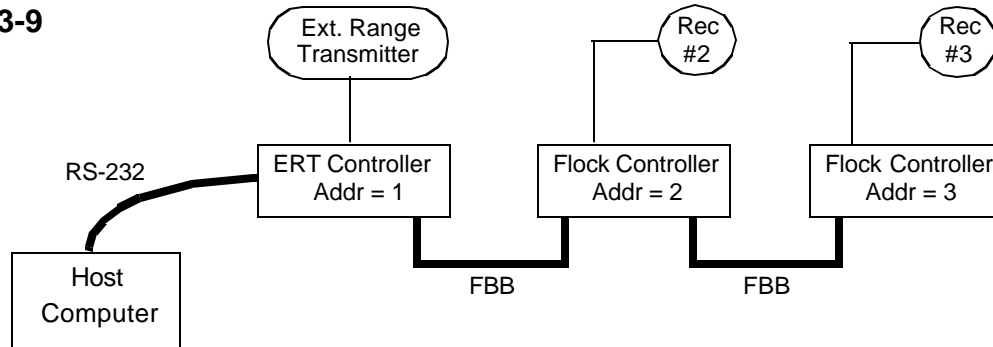
Using the Ascension Extended-Range Transmitter

Special care must be taken when using the Ascension Extended-Range Transmitter (ERT). Since the controller for the ERT does not have receiver connectors, but still requires a bus address, you have to set the number of receivers in the DCU to be one higher than the actual number of receivers being used. When daisy-chaining controller units using the Flock of Birds Bus (FBB) the ERT's controller should

receive address #1, and additional controllers should be given addresses number 2, 3, 4 and so forth. Therefore, the first receiver in the DCU should be disabled or ignored as it corresponds to a non-existing receiver on the ERT's controller.

Finally, connect the RS-232 serial port of the ERT's controller to the host computer.

Figure 3-9



Refer to the Ascension Flock of Birds user manual for additional information on daisy-chaining Ascension trackers and using the ERT.

Example: If you are connecting a single Flock controller with an ERT to serial port 1 on your computer, follow these steps:

1. Make sure you have correctly connected all the cables and assigned the correct bird bus address to both the flock controller and the ERT controller (see you Ascension manual for more details)
2. From the menu bar, select **Device | Add.**
3. Select "Flock" as the device type
4. Set the serial port to 'Serial1'
5. Set the receiver count to 2, click OK. Remember: Set the receiver count to one more than you actually have.



WARNING: *Make sure the unused transmitter connector on the Extended Range Controller is capped.*

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6. The first time you connect, a dialog will pop up asking if you want to set the transmitter orientation. Click 'Yes' and the tracker calibration dialog pops up.
7. Uncheck the “Enable” property for Receiver 0, and make sure Receiver 1 is checked (enabled).
8. Click OK, and your Flock should be ready for use.

Testing Devices

The device test dialogue can be a useful debugging tool. It allows you to see the data coming from each of the supported devices and also provides facilities to test the hardware of feedback devices such as CyberTouch and CyberGrasp.

Testing a CyberGlove

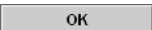
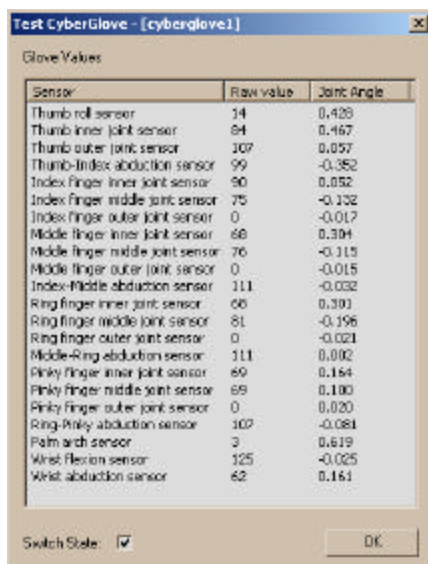
In the Device Panel, select the CyberGlove you wish to test. From the menu bar, select **Device | Test**. The CyberGlove Test dialogue will appear. You will be able to see the gain and offset for each sensor, as well as the raw data coming from the CyberGlove. When done, you can click the  button to close the dialogue.

Figure 3-10



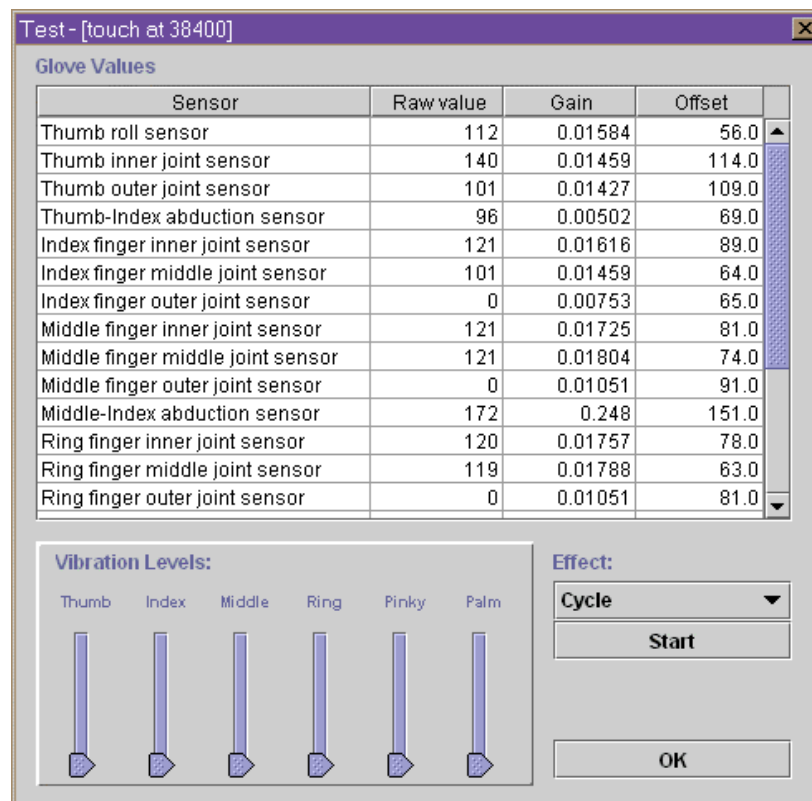
| Sensor | Raw value | Joint Angle |
|-----------------------------------|-----------|-------------|
| Thumb roll sensor | 14 | 0.429 |
| Thumb inner joint sensor | 84 | 0.467 |
| Thumb outer joint sensor | 107 | 0.057 |
| Thumb-Index abduction sensor | 99 | -0.352 |
| Index finger inner joint sensor | 90 | 0.052 |
| Index finger middle joint sensor | 75 | -0.132 |
| Index finger outer joint sensor | 0 | -0.017 |
| Middle finger inner joint sensor | 68 | 0.304 |
| Middle finger middle joint sensor | 76 | -0.115 |
| Middle finger outer joint sensor | 0 | -0.015 |
| Index-Middle abduction sensor | 111 | -0.032 |
| Ring finger inner joint sensor | 66 | 0.301 |
| Ring finger middle joint sensor | 81 | -0.196 |
| Ring finger outer joint sensor | 0 | -0.021 |
| Middle-Ring abduction sensor | 111 | 0.002 |
| Pinky finger inner joint sensor | 69 | 0.164 |
| Pinky finger middle joint sensor | 69 | 0.100 |
| Pinky finger outer joint sensor | 0 | 0.020 |
| Ring-Pinky abduction sensor | 107 | -0.081 |
| Palm arch sensor | 3 | 0.619 |
| Wrist flexion sensor | 125 | -0.025 |
| Wrist abduction sensor | 62 | 0.161 |

Switch State: ☒ OK

Testing a CyberTouch

A CyberTouch Test will display all the information explained in the CyberGlove section. It also adds controls to test the 6 actuators of the CyberTouch - one on each finger, and one on the palm. By adjusting the 6 vertical sliders you can set the feedback level of each of the actuators. Also, there are pre-programmed “effects” that can be activated by selecting the desired effect from the drop-down list and clicking the **Start** button. You can stop the effect by clicking the same button, which is now labelled **Stop**.

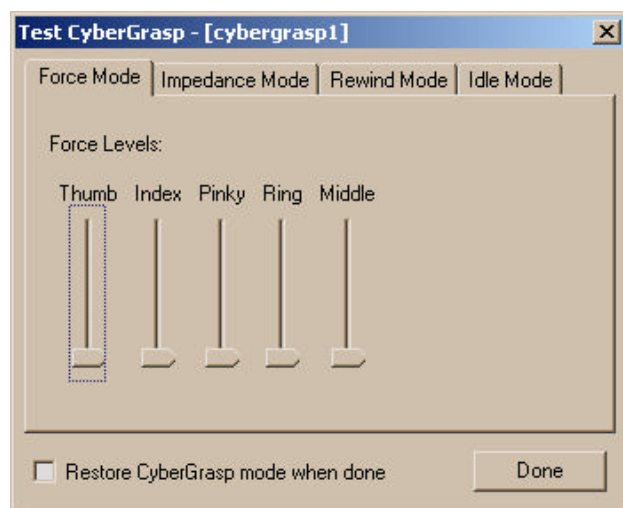
Figure 3-11



Testing a CyberGrasp

The CyberGrasp test dialogue contains all of the functionality of the CyberTouch test dialogue except for the palm actuation slider -- the CyberGrasp does not currently support palm actuation. It also displays the encoder count of the motors in the CyberGrasp motor box (this feature is not implemented in the current release). The tabs at the bottom of the dialogue represent the different modes the CyberGrasp Controller can be in, and the selected tab is the current mode of the CyberGrasp Controller. For example, if you select a CyberGrasp device in the main window and then, from the menu bar, select **Device | Test**, the CyberGrasp test dialogue will appear, and the **Idle Mode** tab is selected, this means that the CyberGrasp Controller is in Idle Mode.

Figure 3-12

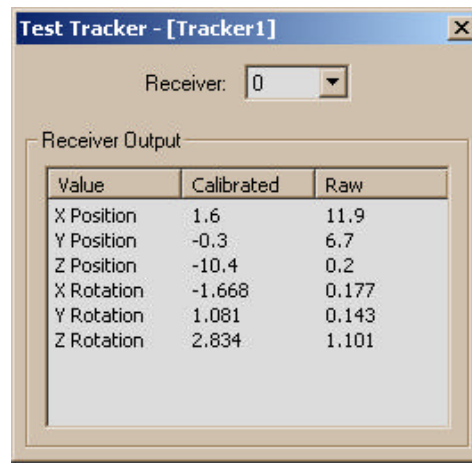


You may click on each of the four tabs to change the CyberGrasp Controller mode to Force Mode, Impedance Mode, Rewind Mode and Idle Mode. For more information on these modes see the CyberGrasp User's Guide. At the bottom left corner of the dialogue you can see a check box labelled **Restore CyberGrasp mode when done**. When checked, the DCU will restore the CyberGrasp Controller's state once the dialogue is closed. For example, if the CyberGrasp Controller is in Idle Mode, and by bringing up the CyberGrasp test dialogue a user changes the CyberGrasp Controller's mode to Force Mode, when the user clicks **Done** the CyberGrasp Controller's state will return to Idle if this box is checked, OR it will remain in Force Mode if the box is un-checked

Testing a Polhemus or Ascension Tracker

Testing a tracker allows you to see the raw and calibrated data coming from the selected receiver. To view data from another receiver of the same tracker, select the desired receiver from the drop-down list at the top of the dialogue.

Figure 3-13



| Value | Calibrated | Raw |
|------------|------------|-------|
| X Position | 1.6 | 11.9 |
| Y Position | -0.3 | 6.7 |
| Z Position | -10.4 | 0.2 |
| X Rotation | -1.668 | 0.177 |
| Y Rotation | 1.081 | 0.143 |
| Z Rotation | 2.834 | 1.101 |

The Device Panel

The device panel lists the devices registered with the DCU. The device lists are not generated automatically and the user is responsible for registering the devices s/he wishes to interface with. For more information on how to register a device, see *Adding Devices* in Chapter 2.

Most users will only have one glove and one tracker, so the device lists will be very short. But some have more than one glove and more than one tracker available to them, whether connected to the same computer, or distributed on different computers across a network. In the latter case, the DCU is an even more valuable tool.

The device panel displays the same information about all devices: The device's name, model, location, and interface.

The following is an explanation of each of the device panels' columns:

Name: A user-specified name for the particular device.

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Type: The type and model of the device (e.g: CyberGlove, Fastrak)

Location: The IP address of the computer the device is connected to, and the port the remote Device Manager is listening on. (e.g: server.virtex.com:12345).

Interface: The device-host interface type (e.g: Serial 1)

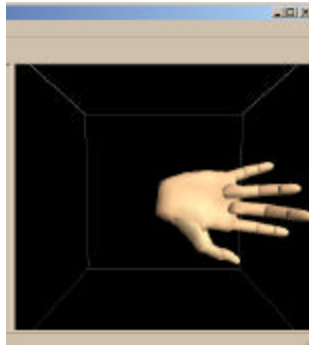
Status: Indicates whether the DCU is currently connected to the device.

The Device Viewer

The device viewer is a graphical representation of the state of the device.

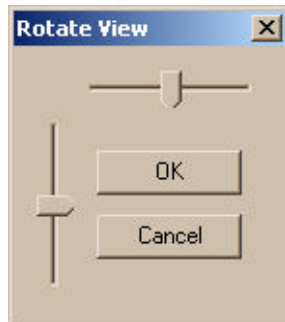
Glove Representation

Figure 3-14



A CyberGlove and CyberTouch are visually identical: a simple 3D representation of a hand.

Figure 3-15

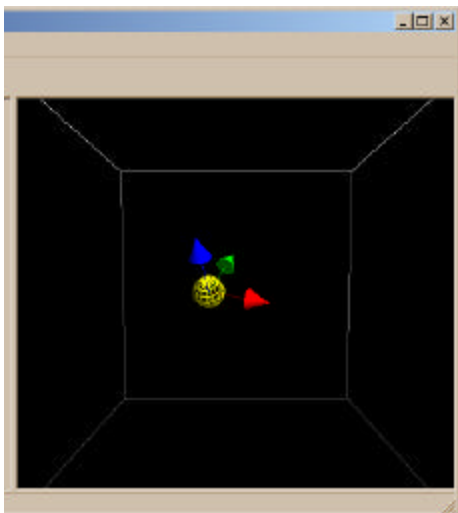


You can rotate the hand by selecting a custom viewing angle. First, under the View menu, make sure that the **Use Tracker Orientation for Glove** item is unchecked. Then, from the menu bar, select **View|Settings**, and use the slider bars to rotate the hand.

If you have a tracker you can use it to move the hand. Under the View menu, check the **Use Tracker Orientation for Glove** item (if it is not already checked). The hand will be rotated using the first receiver of the default tracker (if it exists).

Tracker Representation

Figure 3-16



When viewing a tracker, you will see at least two items in the device viewer (If you only see one set of axes, consult the Troubleshooting Appendix). First, you will see a set of axes representing the origin. The red, green, and blue axes point in the +X, +Y and +Z directions respectively. Second, for each active receiver you will see an additional set of axes (again, red, green and blue represent the receiver's +X, +Y and +Z axes) which is free to move around and rotate.

CHAPTER

4

Accessing Devices From C++ Code

The DCU provides an easy way to associate your application with a specific CyberGlove (CyberGlove and CyberTouch units are interchangeable) and/or tracker, which is external to the application you write. This means that when you write an application which uses a glove and tracker, it can use ANY glove and ANY tracker, simply by adding a device to the DCU.

Naming Devices

Each configuration and device registered with the DCU is given a unique name. The user may then request the IO Connection object associated with a device of a given name. This allows the user to connect to a device of a given name without having to specify its location in C++ code.

Using Default Devices

The VHS also allows you to access the default CyberGlove, CyberTouch, CyberGrasp or 6-DOF Tracker. This is simply the first device of the desired type in the default Configuration.

You may use the default IO Connection object for each of those device types to allow your application to access the default device of a specified type. For more details on the default IO Connection object, please see the VHS Programmer's Guide.

Changing Devices Used by Your Application Without Modifying Your Code

There are two ways to change the devices used by your application without recompiling it:

1. If you are getting an IO Connection object to a device by specifying it's name (see VHS Programmer's Guide for more information on using named devices), let's assume your application is using a glove name “myGlove” and a tracker named “myTracker”:
 - Run the Device Configuration Utility (if it is not already running)
 - Change the devices named “myGlove” and “myTracker”, either by changing the devices or by removing and re-adding them.
 - Run your application. Your application should now be running with the newly defined “myGlove” and “myTracker”
2. If you are using a the default IO Connection object:
 - Run the Device Configuration Utility (if it is not already running)
 - Select the default Configuration.
 - Add the CyberGlove you want your application to use (let's assume you name it “myGlove”)
 - Add the 6-DOF Tracker you want your application to use (let's assume you name it “myTracker”)
 - Run your application. Your application should now be running with the newly defined “myGlove” and “myTracker”



NOTE: *For more information on accessing devices from C++ code see the VHS Programmer's Guide.*

Chapter 4 - Accessing Devices From C++ Code

APPENDIX

A

The Java Runtime Environment on IRIX

This part only addresses issues of the Java Runtime Environment (JRE) directly related to the DCU on IRIX. All material not covered here can be accessed on-line at Javasoft's web site located at www.javasoft.com.

If you do not have JRE version 1.1.6 or newer, you will need to install it. If you have JDK version 1.1.6 or newer, you most likely have the appropriate JRE also installed, in which case you do not need to install the JRE.

JRE version 1.1.6 for Irix 6.x is distributed on the VHS installation CD. The file is named '6.x_java_eoe_3.1.1.tardist..tardist'.

An Irix version of the JRE is available for download, also free of charge, from SGI's web site at www.sgi.com.

Installation instructions for your JRE are available from the JRE's distributor (either Javasoft or SGI).

Troubleshooting

PROBLEM: When trying to register a device with the DCU, the following error message appears:

Figure B-1



SOLUTION: Make sure that:

- The Device Manager is running on the computer you are trying to connect to.
- The computer you are trying to connect to is reachable via the network (try pinging it)
- You have specified the correct interface parameters (such as serial port number)

PROBLEM: I cannot connect successfully to a Tracker.

SOLUTION: Make sure the Device Manager is running on the computer to which the tracker you are trying to view is connected. Also, make sure that the tracker is properly connected to the computer. Move the receiver close to the transmitter. If you are still unable to connect, try re-booting the tracker and follow the procedure outlined in this paragraph again.

PROBLEM: The following error is displayed when running the DCU on Irix:

Xlib: unexpected async reply (sequence 0x????)!

SOLUTION: This error is caused by the fact that Xlib is not thread-safe. It occurs when the DCU is running on a different X server than the one used by the machine running the application. Breaking the execution (^C) and restarting the application usually solves the problem. This issue will be addressed in an upcoming release.

Tip: Mouse movements during application start-up seem to be related to this problem, so do not move your mouse when you start the application from a remote X server.

PROBLEM: When selecting **Views | Use Tracker** and clicking the **Select Tracker** combo box, no drop-down list appears and **View Tracker** cannot be selected.

SOLUTION: This problem occurs only on Irix, and will be addressed in an upcoming release. The drop-down list actually does appear, only it appears outside the drawable area of the dialogue. Simply enlarge the dialogue window to about double its original size by dragging its lower right corner. The drop-down list should then become visible and usable.

PROBLEM: When calibrating a CyberGlove or CyberTouch, after going through the OK gesture, the index finger and thumb don't match up exactly.

SOLUTION: If your application requires an exact calibration, you are better off using the Advanced Calibration Panel (click the Advanced button in the Glove Calibration Dialog). The rapid calibration process of flattening your hand and making an OK gesture is meant as a quick solution when people with different hand sizes/proportions need to use the glove one after the other and don't have a personal calibration. If the thumb and index finger tips are very far away from each other, try clicking the Back button and repeating the OK gesture step.

PROBLEM: One or more devices is not properly updated in the DCU graphical display window.

SOLUTION: The device or the device manager may be in an error state. First try rebooting the device and selecting Device | reconnect on the DCU. If the problem persists, restart the device manager and reboot the device, then reconnect. If the problem still persists, there may be a hardware problem. Run the device manager manually by opening a shell window (or DOS prompt) and change to the Applications/vtidm/<os> directory. Run the command "master -v=3 >log.txt" and

Appendix B - Troubleshooting

attempt to connect to the device from the DCU. If this fails, kill the master process and check the log.txt file for obvious error codes. If the problem still persists, please mail support@virtex.com and attach the log file.