PHANTOM® DESKTOP™
USER GUIDE

SensAble technologies

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Preface

About This Guide

The PHANTOM Desktop User's Guide describes the process of connecting the hardware and installing the required device drivers, and demonstration software for your new PHANTOM Desktop system.

We've worked extensively to ensure that the PHANTOM Desktop and Device Drivers install and work smoothly on your computer. If you experience any problems in the installation or use of your system or hardware, please contact Customer Support as indicated in Appendix A, “Customer Support”, of this document. Your feedback and input are essential! Please don't hesitate to contact us with technical questions and suggestions for improvement.

How This Guide Is Organized

The PHANTOM Desktop User's Guide is divided as follows:

Chapter 1, Getting Acquainted, describes the PHANTOM Desktop and many of the items that came with the system.

Chapter 2, Installing the PHANTOM Device Drivers, describes how to install the software necessary to run this product.

Chapter 3, Connecting the PHANTOM Desktop Device, describes how to connect the hardware.

Chapter 4, Device Calibration, describes how to calibrate the device.

Chapter 5, Computer Setup, describes changes that may need to be made to your computer for using the PHANTOM Desktop device via the parallel port.

Additionally, there are several appendices that include information on Customer Support, troubleshooting, configuring multiple devices, regulatory notices, device specifications and repackaging instructions.

Typographical Conventions

This guide uses the following typographical conventions:

Convention	Description	Example
Italics	First use of a new term; shows emphasis; references another document or file.	See the *User Manual.*
<*Italics*>	A variable	<*Installed Directory*>/ files.
Bold	Keywords, actual user input, directory paths, program group names or examples.	Click **Ok**.
Greater Than (>)	Indicates a menu pick.	**Tools** > **Options**
`Courier`	Identifies code samples.	
Note, Warning, Important	Calls out important information.	

1

Getting Acquainted

This chapter describes the following:

- The contents of the shipping box
- The PHANTOM Desktop haptic device

Shipping Box Contents

In your shipping box you should find the following:

- The PHANTOM Desktop 3D Touch device.
- The PHANTOM Desktop Kit: The kit includes this User Guide and a CD-ROM containing the PHANTOM Device Driver and electronic documentation.
- Parallel Port Cable: The cable is used to attach the computer's parallel port to the PHANTOM Desktop or one unit to another. The cable is an IEEE 1284 EPP cable with a ferrite bead that provides an impedance at 100mhz of 199 ohms or greater.
- Universal Power Supply: The power supply can be used on any standard circuit (an AC input of 47-63 Hz and 100-250 VAC) using the supplied power cord.
- Power Cord (if supplied): The power cord connects the Universal Power Supply to the wall outlet. If no cord was shipped with your unit, use a cable with a current carrying capacity of at least 5 Amps that satisfies national and local electrical requirements.
- A gelpad wrist rest.

NOTE: Your box may also include other SensAble Technologies software that was purchased with your order and other documentation.

If any items are missing, please call SensAble Technologies at +1-888-SENSABL (US only) or +1-781-937-8315 (US and outside the US).

Important Do NOT throw away the packaging materials. If for any reason you need to ship the device in the future, you will want to reuse these materials to reduce the risk of damage to the device. For instructions on how to properly pack the device see Appendix F, “Device Packaging Instructions”.

The PHANTOM Desktop Haptic Device

The PHANTOM Desktop enhances productivity and efficiency by enabling the most intuitive human/computer interaction possible, the ability to solve problems by touch.

For the first time, computer-generated objects can be created, manipulated, and deformed just like their real counterparts in the most natural way possible...by hand. Model makers can sculpt virtual digital mock-ups, surgeons can practice on virtual patients, molecular chemists can fit drug molecules into virtual human receptor sites, and mechanical engineers can check tolerances of virtual assemblies, all digitally, but with an incredible sense of realism.

The PHANTOM Desktop system's high fidelity force feedback senses motion in 6 degrees of freedom providing the best, most realistic 3D Touch sensation for any application. Users can feel the point of the stylus in all axes, and track its orientation (pitch, roll and yaw). The PHANTOM Desktop's portable design, compact footprint, and simple parallel port interface ensure quick installation and ease of use.

Features

- Portable design for workplace flexibility.
- Comfortable molded rubber stylus for long term use.
- Integrated momentary switch on stylus optimally positioned for ease of use.
- Wrist rest to maximize user comfort.
- Multi-function indicator light.
- Compact workspace offers better range of motion for ease of use.
- Small desktop footprint.

- Robustly constructed of metal and injection molded, carbon fiber reinforced plastics.
- Automatic workspace calibration.

Get Familiar with the Device

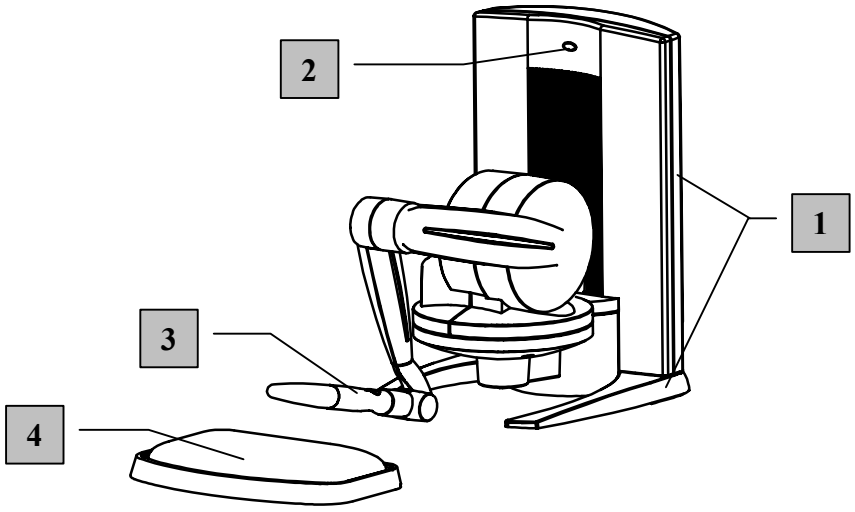

FIGURE 1-1. Front view of the PHANTOM Desktop with wrist rest

The following correspond to the call-outs in Figure 1-1 and Figure 1-2.

1 **Metal Covers and base**: hold to lift the PHANTOM Desktop device.

The PHANTOM Desktop device is a sensitive piece of electronic equipment. Lift by the metal covers and support the base [1] when moving it. Lifting by any of the moving parts may affect the unit's performance and risks damaging the device. The device has a limited range of motion. Forcing the device past these limits risks damaging the device.

2 **Status Indicator Light**: This light shows the status of the PHANTOM Desktop device as described in the following table:

COLOR	MEANING
Constant Green	Active and properly calibrated
Blinking Green	Active, but out of calibration
Blinking Yellow	Just attached or powered on
Constant Orange	Stand-by mode

Table 1: Status Indicator Light Meanings

3 **Stylus with Switch**: The stylus is the "pen" you use to interact with virtual objects. Your forefinger or thumb should rest above the raised switch when using the device. Like a mouse button, the switch is used differently in each application.

4 **Gelpad Wrist Rest**: The wrist rest helps to support your wrist while using the PHANTOM Desktop. Try it in many locations to determine which is best for you.

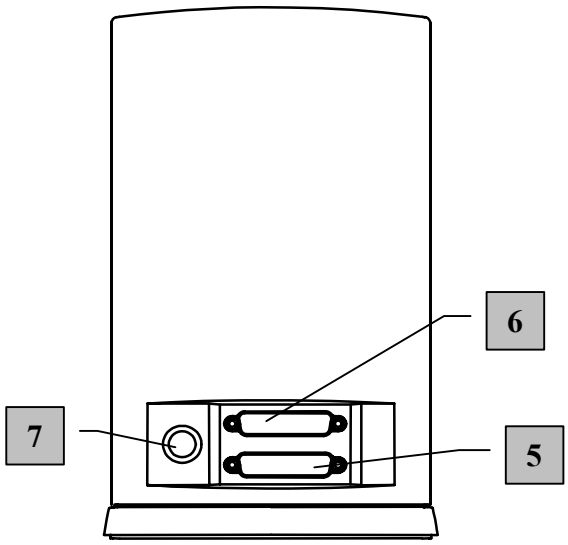

FIGURE 1-2. Connectors on the Rear of the PHANTOM Desktop

5 **Parallel Port To Computer**: The male bottom connector is connected to the computer's parallel port using the supplied IEEE-1284 rated cable.

6 **Parallel Port to Second PHANTOM Desktop**: The female upper connector is daisy-chained to a second PHANTOM Desktop when two units are used simultaneously. When daisy-chained, this connector has to be attached to the male bottom connector on the second unit.

7 **Power Plug Connector**: The power plug from the Universal Power Supply connects to this socket. Use only the Skynet Power supply provided by SensAble Technologies for the operation of this equipment.

2

Installing the PHANTOM Device Drivers

This chapter will show you step by step how to install the PHANTOM Device Driver.

System Requirements

The following system requirements apply to the use of the PHANTOM Desktop and driver software:

- The PHANTOM Desktop and Device Drivers run on Intel processor PCs (and select AMD processor PCs - please see our website), Windows 2000, or Windows XP. The Desktop will also run on Red Hat Linux; for information contact Customer Support.
- When PCs are used, it is recommended that you use a 166 MHz Pentium II processor at a minimum.
- The PHANTOM Device Drivers distribution requires approximately 30 MB of disk space. The PHANTOM Device Drivers do not specify memory requirements; however, a minimum of 32 MB for PC platforms and 64 MB for SGI platforms is recommended for overall system performance.
- The PHANTOM Device Drivers are distributed on CD-ROM. The device driver may be found on the CD of any software you have purchased.

Installing the PHANTOM Device Driver

Installing on Non-Windows Operating Systems For instructions on installing on other operating systems, such as Linux, see the Installation Guide that came with your product.

To install the PHANTOM Device Drivers on a Windows platform:

1. Log in to your computer as administrator (or as a user with administrative privileges).
2. Insert the CD into the CD-ROM drive. Then run SETUP.EXE from the PHANTOM Device Drivers folder. Follow the instructions on the screen during the installation to specify the installation directory and custom installation instructions.

> If you have previously installed an older version of the PHANTOM Device Drivers on the computer, you will be prompted to remove it before proceeding with the installation. If you get this message:
>
> 1. Exit the setup program.
> 2. From the Start menu, select **Settings > Control Panel > Add/ Remove Programs**.
> 3. Find the PHANTOM Device Driver in the list and select it.
> 4. Press **Add/Remove**.
>
> **Note** If you are prompted during the uninstall to delete shared files that appear to no longer be needed, DO NOT DELETE these files unless you are absolutely sure of their use.
>
> When you have finished uninstalling, resume the installation of the new PHANTOM Device Driver.

The default directory for installing the PHANTOM Device Drivers is C:\Program Files\SensAble\PHANTOM Device Drivers. You will also find the Dice demo program executable in the C:\Program Files\SensAble\3D Touch Demos directory. You will be using this demo application to calibrate your device in a coming chapter.

At the end of the Setup process you will be presented with the PHANToM Configuration dialog box (shown below) that allows you to configure the software for your PHANTOM device.]

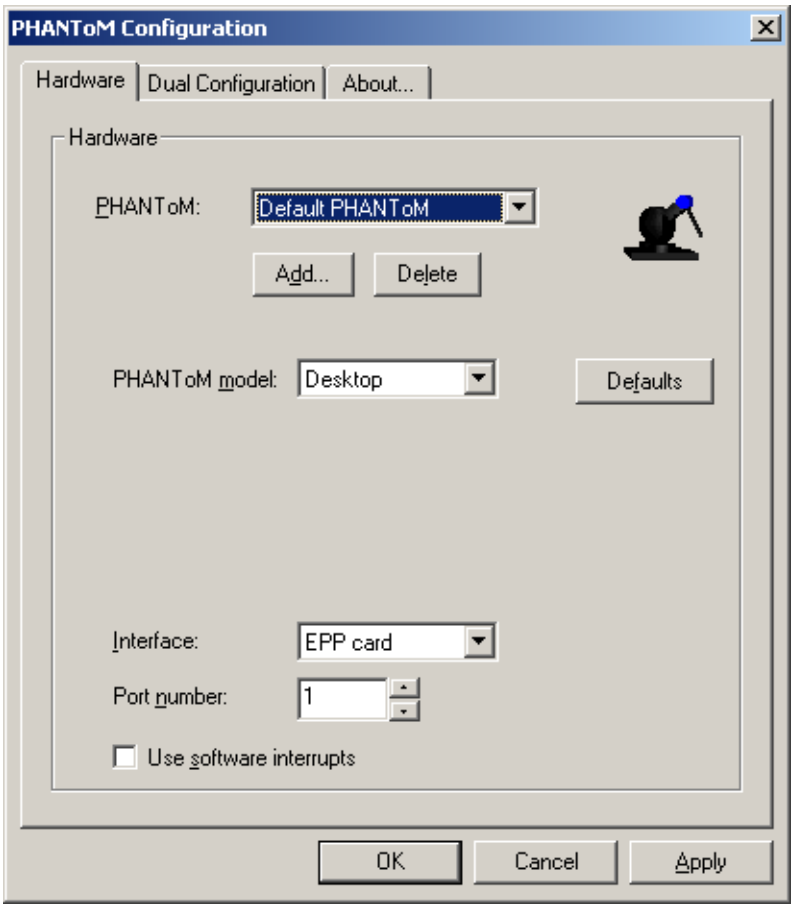

FIGURE 2-1. Selecting the Configuration

Note You can also access the PHANTOM Configuration application any time after installation through the Settings/Control Panel/PHANTOM Configuration icon from the Start Menu.

3 Select the **Default PHANToM** item from the PHANToM drop-down list.

4 Select the **Desktop** in the PHANToM model drop-down list.

5 The Port Number field specifies the port that will be used by the PHANTOM Desktop. In most cases, this field should be set to **1**. If you have installed an additional parallel port card for use with your PHANTOM Desktop, you will need to check your system settings to determine the correct value. For an add-on card, this value will most likely need to be set to 2.

6 After the installation completes you will be prompted to restart the computer. Rather than restarting your computer, you should shut it down and turn it off to connect the PHANTOM Desktop. To do this, choose **restart later**, then shut down your computer normally and turn off the power to your computer. Leave the power off and proceed to Chapter 3, "Connecting the PHANTOM Desktop Device".

3

Connecting the PHANTOM Desktop Device

This chapter will show you:

- How to connect a PHANTOM Desktop device to your computer
- The limits to the range of motion of the PHANTOM Desktop device.

Connecting the Device

Warning Lift by the metal covers and support the base when moving the PHANTOM Desktop. Lifting by any of the moving parts may affect the unit's performance and risks damaging the device. The PHANTOM Desktop device has a limited range of motion. Forcing the device past these limits risks damaging the device.

1 With the computer still turned off, attach the male end of the supplied IEEE-1284 rated cable to your computer's parallel port.

The high demands of the PHANTOM Desktop device on the parallel port require the device to have a dedicated parallel port for its use. If you are currently using your parallel port for a printer, dongle or other peripheral, you will need to install an additional parallel port card in your system. You can choose whether to connect the PHANTOM Desktop device or the other peripherals to the additional card.

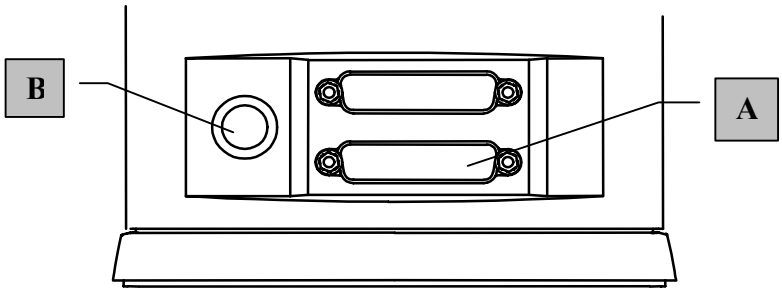

FIGURE 3-1. Detail of Connectors

2 Plug the female end of the cable to the male bottom connector (A) of PHANTOM Desktop.

3 Hook up the Skynet Power Supply (use only the supplied power supply with the PHANTOM Desktop device):

Plug the power cord into the power supply. Plug the power cord into an available outlet (for 110V the outlet must be rated for at least 2 Amps, for 220V: 1 Amp). The green status light on the power supply indicates that it is working correctly. Finally plug the power connector into the connector (B) on the back of PHANTOM Desktop device.

4 Ensure that the PHANTOM Desktop Status Indicator Light is lit (it will either be blinking yellow or solid orange if working properly). If it is not, check all of the connections. If the problem persists, contact SensAble Technologies.

5 Position the PHANTOM Desktop device.

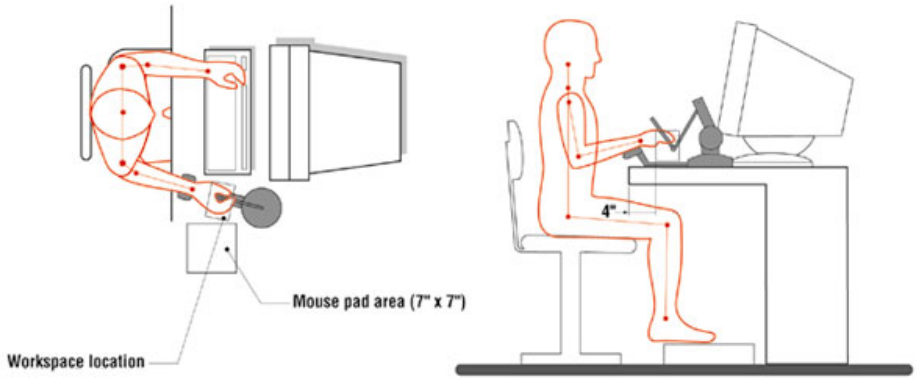

FIGURE 3-2. Suggested Position of the PHANTOM Desktop

Place the PHANTOM Desktop device to the inside of your mouse; place the gelpad wrist wrest directly in front of the PHANTOM Desktop. (This should place the device in a comfortable position). In certain applications, the PHANTOM Desktop device can be used in place of the mouse.

Limits to the Range of Motion of the Device

It is important to understand the physical limitations of the PHANTOM Desktop device so that you do not inadvertently damage the device by forcing it past its designed limits.

The device has six degrees of motion. All the degrees of motion have their limits, so when you reach one of these limits you'll feel a sudden stop. That is the mechanical stop designed into the device. Forcing the device past any of these stops risks damaging the device.

To become more familiar with the physical limits of the PHANTOM Desktop device, follow these steps before using the device:

1 Grasp the black rubber grip of the stylus as you would a pen, with the free end of the stylus (what would be the non-writing end of a pen) pointing toward you and the point of the stylus (the end connected to the arm) pointing toward the unit. Using the following illustrations as a guide, gently move the stylus in all directions to locate the mechanical stops.

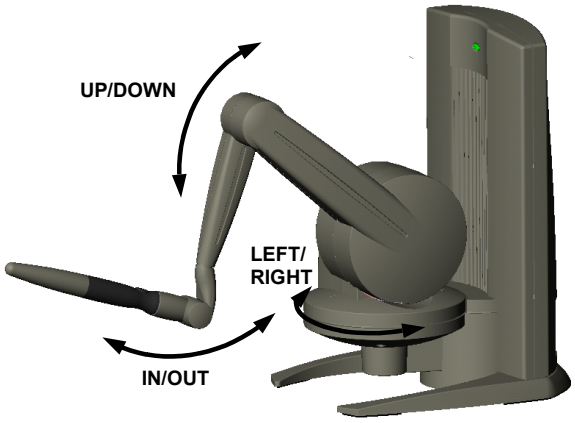

FIGURE 3-3. Moving with the arm

2 Using the above figure as a guide, start with large-but gentle-movements. Move the stylus left/right, up/down, and in/out. The segments of the PHANTOM Desktop device will move. When you reach a limit, you'll feel one of the device's mechanical stops. Don't force the device past any of these stops.

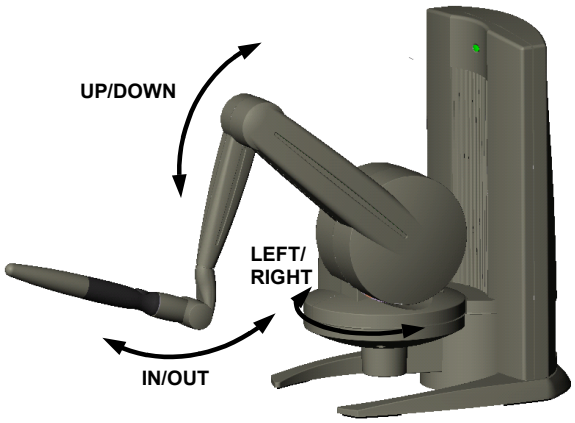

FIGURE 3-4. Moving from the wrist

3 Hold the arm attached to the stylus with one hand and gently rotate the stylus back/forth, up/down, and left/right with your other hand. Again, when you encounter a limit, the motion will be stopped.

Now you have a feel for the range of motion of the PHANTOM Desktop device and where its limits are.

Important When you're using the device, never force it past its limits. Be especially careful never to turn the stylus so that the connected end faces you.

Now that the PHANTOM Desktop device is properly positioned and you have a feel for its range of motion, you may continue with the final steps of installation and calibrate your device.

4

Device Calibration

The PHANTOM Desktop device automatically maintains proper calibration when plugged in. Since you have just supplied power to the device for the first time, however, you will need to calibrate it as described below. Once this procedure is complete, you should not need to execute it again unless you unplug or otherwise lose power to the PHANTOM Desktop device.

> If your computer is unable to communicate with the PHANTOM Desktop device you may have to configure your System's BIOS for communicating to the parallel port via the ECP or EPP communication protocols. For instructions, see Chapter 5, "Computer Setup".

The Dice Demo The Dice demo consists of a single cube bounded by a box-shaped haptic workspace. This program makes use of more advanced dynamics and collision detection. When used with a 6 DOF PHANTOM device this demo demonstrates GHOST SDK's ability to generate both forces and torques. There are options for enabling/disabling gravity, adjusting dynamic properties of the cube, and if you click the stylus while touching the die, you can pick it up.

1 Start the Dice demonstration available in *SensAble Install directory*/3D Touch Demos. [On a Linux workstation, the demos are located in the /usr/bin directory.]

The Dice demo will start and you will be presented with a room with a single die in it. At this point, the light on your PHANTOM device should be blinking green, indicating that it awaits calibration. If you receive an error or the application does not start for any reason, please see Appendix B, "Troubleshooting".

2 To calibrate the PHANTOM Desktop device, pick up the stylus as you would a pen, but with the free end towards you. Now, move the yellow probe around in the virtual room. Because your device is uncalibrated, you will be able to pass through the walls of the room. Move the yellow probe about in the room,

passing fully through the side walls, ceiling and front and back of the room. If you feel resistance, don't force the device. Excessive force will break the stops and damage the device.

At some point during this exploration, the light on the PHANTOM Desktop light should stop flashing and stay a constant green. The walls will now become fully touchable. This indicates that it has acquired the appropriate information and automatically calibrated the device.

3 Feel free to fully explore the room using your sense of touch. Touch the die and push it around. Feel the edges and corners of the room.

When the PHANTOM Desktop arm is fully extended such as when touching the nearest corners of the room, it may buzz a bit. This is normal.

If the light never stops flashing or you never feel the walls of the room, see Appendix B: Troubleshooting.

4 Exit the Dice demo by clicking your mouse on the X in the upper right corner of the window.

The device is now fully calibrated and should not need re-calibration unless it is unplugged. If you do need to re-calibrate the device, repeat the above procedure.

5

Computer Setup

Some computers require that you configure your System's BIOS for communicating to the parallel port via the ECP or EPP communication protocols. If your computer is unable to communicate with the haptic device and you have checked that all cables are properly connected, you may need to reconfigure your computer's BIOS as explained below.

> **Warning** Please refer to your computer's user manual for specific instructions. The following instructions are generic and may not pertain exactly to your situation.

To change the BIOS settings:

1. Turn on your computer and get ready to enter BIOS setup. On most systems, a message such as "Hit F2 for Setup" will appear shortly after power-up. The most common key to hit for your system is listed in the table above in parentheses in the List B column. However, you should double-check your computer manual to be sure what key to hit and when.
2. Enter the peripheral setup options.

   Once you have entered the BIOS setup, you need to access the BIOS page for configuring peripherals. On most systems, these options are presented in the advanced page or a peripheral page of the BIOS setup.
3. Set the parallel port to the correct mode (ECP or EPP).

If your system does not have an ECP or EPP setting, please contact Customer Support as indicated in Appendix A, "Customer Support", of this document.

4. Save your changes and exit the BIOS setup. This will reboot your system automatically and it should now be set up for working with the PHANTOM Desktop device.

Appendix A Customer Support

Warning DO NOT OPEN THE UNIT. There are no serviceable components in the PHANTOM Desktop device or power supply. Return to SensAble for servicing. See Appendix F, "Device Packaging Instructions".

If you encounter any difficulties, you can obtain Customer Support through the following three channels:

- If you purchased your PHANTOM Desktop from a distributor, please contact them first.
- SensAble Technologies Customer Support can be reached via e-mail at support@SensAble.com.
- SensAble Technologies Customer Support can also be reached via telephone:
  - Inside the United States: 1-888-SENSABL (1-888-736-7225).
  - Outside the United States: +781-939-7444.

A CUSTOMER SUPPORT

Appendix B
Troubleshooting

This section provides tips for correcting some common PHANTOM Desktop device problems. If after following these steps, you cannot resolve the problem, please contact Customer Support (see Appendix A).

The PHANTOM Desktop light does not come on at all. The light on the PHANTOM Desktop device should be on if it is receiving power. Check that the power supply is plugged into a working outlet (the light on the power supply should be green if it is). Then check that the connection between the power supply and the PHANTOM device is made correctly.

The light on the PHANTOM Desktop device is orange. This is not a problem. When the device is plugged in, but not currently being used by an application, it will be orange to let you know that it is receiving power.

The light on the PHANTOM Desktop device is flashing yellow. This is not a problem. This indicates that the power to the device and the parallel port have just been initially connected. Once you successfully run an application with the device, such as one of the provided demonstrations, the light should no longer be this color.

When running a demonstration or application, the light on the PHANTOM Desktop device flashes green. This indicates that your PHANTOM Desktop may not be properly calibrated. This can happen if you unplug it. To re-calibrate the device, follow the steps outlined Chapter 4, "Device Calibration". If you are unable to calibrate the device using these steps, please contact Customer Support as explained in Appendix A.

When I start a demo I get an error. This can happen if the device is not plugged in properly or is not configured properly. Execute the following steps, checking at each point for proper operation:

1. **Verify power supply** - Check to make sure the PHANTOM Desktop device is plugged in properly. The light on the device will be lit (and possibly flashing) if power is being supplied.
2. **Verify parallel port connection** - Make sure that you have the parallel port cable plugged into the LOWER port on the PHANTOM Desktop device. Make sure you have the other end plugged into the parallel port on your computer.
3. **Verify matched settings** between the PHANTOM Desktop device and computer:
   - **a** From the Start menu, select **Settings** > **Control Panel**. Within the control panel window, select **PHANTOM Configuration**. You will be presented with a dialog box for configuring your device. Ensure that PHANTOM Desktop is chosen as the model. Check and write down the parallel port mode and base address (for example, "ECP" and "x378").
   - **b** Restart your computer and prepare to enter the BIOS setup. (If you are unfamiliar with configuring a BIOS, get assistance from a system administrator or other computer professional.)
   - **c** Enter BIOS setup (how this is done varies by machine, but the key to hit will usually be listed immediately upon the start of the re-boot sequence - usually F1, F2 or DEL. On some machines, you may have to turn the computer fully off and on again to reach the BIOS configuration utility).
   - **d** While you are in the peripherals configuration page, check to see what alternate settings are available for the parallel port (for example, check to see if both ECP and EPP are available). If the device does not run with one setting you can try another using the steps below.

4 If the device still does not run and you have more than one setting available in your BIOS setup (see "d" above), then re-enter the PHANTOM Configuration utility and set the port mode to one of the other modes available in your BIOS. Then, restart and re-enter the BIOS setup and set it to the same settings.

If, after following the above steps, you are still unable to start a demonstration application, please contact SensAble Customer Support.

I am able to start a demonstration application; but even though the light is solid green, the device behaves strangely when I move it around in a scene. It is possible that there is a defect or a loose connection inside the PHANTOM Desktop device. DO NOT ATTEMPT TO OPEN THE DEVICE. Contact SensAble Customer Support. When contacting Support, you may be asked to run the "PHANTOM Test" application to help with diagnosis. This application can be found in the directory where you installed the PHANTOM Device Drivers.

The following describe the basic features of this test application which you should be prepared to run.

Select - Select the PHANTOM device which you want to test. Usually this will be "Default PHANTOM".

Read Encoders - The values being sensed for the positions and rotations of the device are dynamically displayed in the window. It additionally will display whether the stylus switch is pressed or not and whether you are holding the device (presence switch=on). The picture of the PHANTOM Desktop device should change dynamically as you move the stylus around.

Cycle Amps - This will simply turn the amplifiers off then on again repeatedly to test their functioning. You should hear the device clicking on and off.

Test Forces -.

IMPORTANT

Hold on to the stylus when executing this test. Perform this test deliberately and slowly to avoid sudden movements.

Move the Move the sliders with your mouse to generate forces which push against your hand. X controls force parallel to the table. Y controls force up and down. And Z controls force in and out.

Box Test -- Provides a box which you can feel with your PHANTOM Desktop. The sides of the box should feel flat and the corners sharp.

Quit - Quits the test application.

Appendix C Configuring Multiple Devices

Multiple Devices

If you want to use more than one PHANTOM device with your computer, you can create as many as 20 uniquely named PHANTOM configurations. Each named PHANTOM configuration can refer to a particular system configuration that you use frequently. Which device to use is defined by the software application which uses it. All demonstrations installed with the PHANTOM Device Drivers use "Default PHANToM" as the configuration.

To create a new PHANTOM configuration, simply select the Add button and key in a name to call that device. Then, follow the instructions previously given for defining the configuration for that device.

Dual Configurations

The Dual Configuration settings only apply if you want to set up a pair of PHANTOM devices to work in tandem with each other. You must have created at least two PHANTOM devices as described above before the Dual Configuration tab becomes useful. Once you have created at least two devices, go to the Dual Configuration area and select the PHANTOM devices you would like to use in a paired configuration. Then, enable the check box to turn the dual configuration on.

Appendix D Regulatory Notices

FCC Notice (U.S. Only)

The PHANTOM Desktop is classified by the Federal Communications Commission (FCC) as a Class B digital device.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult a customer service representative of SensAble Technologies or an experienced radio/ TV technician.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1 This device may not cause harmful interference.

2 This device must accept any interference received, including interference that may cause undesired operation.

The following information is provided on the device covered in this document in compliance with FCC regulations:

Product Name: PHANTOM Desktop

Model Number: 01352

Company Name: SensAble Technologies

NOTES:

Any changes or modifications to the hardware not expressly approved by SensAble Technologies could void the user's authority to operate this equipment.

Use of an IEEE-1284 parallel port cable with a ferrite bead is required to comply with the Class B limits of Part 15 of FCC rules. This cable is provided with the hardware; additional cables are available directly from SensAble Technologies.

CE Notice

Marking by the symbol indicates compliance of SensAble Technologies' PHANTOM Desktop device to the EMC (Electromagnetic Compatibility) and Low Voltage directives of the European Union. Such marking is indicative that this SensAble Technologies system meets or exceeds the following technical standards:

- EN 55022 1998 Class B
- EN 555024 1998
- EN 61000-3-2 2001
- EN 61000-3-3 1995 with A1 (2001)
- EN 60950

These regulatory notices were current at the time of printing. Consult the separate regulatory notice documentation that was shipped with your device to obtain the most up to date information.

Appendix E Device Specifications

Nominal Position Resolution >1100 dpi (~0.023 mm)
Workspace 6.4 w x 4.8 h x 4.8 d in (160 w x 120 h x 120 d mm)
Backdrive Friction <0.23 oz. (0.06 N)
Maximum Exertable Force 1.8 lbf. (7.9 N)
Continuous Exertable Force (24 hrs) 0.4 lbf. (1.75 N)
Stiffness X axis > 10.8 lb/in (1.86 N/mm)
Y axis > 13.6 lb/in (2.35N/mm)
Z axis > 8.6 lb/in (1.48 N/mm)
Inertia (apparent mass at tip) ~0.101 lbm. (45 g)
Footprint 5 5/8 w x 7 1/4 in d (~143 w x 184 d mm)
Weight* 6 lb 5 oz.
Operating Temperature 50° to 95°F10° to 35°C
Storage Temperature -40° to 149°F-40° to 65° C
Relative Humidity 20% to 80% (noncondensing)
Force Feedback 3 degrees of freedom (x, y, z)
Position Sensing x,y,z (digital encoders); [stylus gimbal - pitch, roll, yaw (+/- 3% linearity potentiometers)]
Input Voltage 100-250 VAC
Input Frequency 47-63 Hz
Input Current 2A @ 115 VAC1A @ 230 VAC
Warranty Three months
*Does not include power supply or cables.

Product specifications are subject to change without notice

E DEVICE SPECIFICATIONS

Appendix F Device Packaging Instructions

If you need to transport or ship the device, please follow these packaging guidelines to reduce the risk of damage.

Important

Remember, the PHANTOM Desktop device is a sensitive piece of electronic equipment. Lift by the metal covers and support the base when moving it. Lifting by any of the moving parts may affect the unit's performance and risks damaging the device. The PHANTOM Desktop device has a limited range of motion. Forcing the device past these limits risks damaging the device.

Shipping Checklist / Packing Materials:

- 1 Small cardboard box (internal box)
- 1 Large shipping box (external box)
- 1 Set of white foam inserts (for internal box)
- 1 Set of gray foam inserts (for external box)
- Thin, clear, plastic wrapping material
- 1 Accessory Tray
- 1 Roll of packing tape

Packing the Device and Accessories

First package up the PHANTOM Desktop device:

1. If necessary, assemble small shipping box and place bottom half of the white foam insert into the box.
2. Lay plastic wrapping into the foam insert.
3. Hold the PHANTOM device by base and support the stylus as shown in image below.
4. Orient the PHANTOM device with the foam cutout as shown below
5. Gently lower the PHANTOM device into the foam insert while maintaining alignment of the PHANTOM arm to the cutout.

FIGURE A-5. Place the device into the bottom insert over the plastic.

6 Ensure that the PHANTOM device is fully seated by pressing firmly at point 1, shown in the following image.

7 Check to see that the PHANTOM arm is fully seated by carefully pressing at point 2, shown in the following image.

FIGURE A-6. Press carefully to ensure the device is secure.

8 Fold plastic over the PHANTOM device.

9 Place top half of foam insert over the PHANTOM device.

10 Close the box and tape it closed.

11 Place gray foam bottom into large shipping box and place small box (with PHANTOM device inside) into foam.

12 Place gray foam top over small (internal) box and place accessory tray on top of the foam.

13 Place the power supply, power cord, EPP cable (if any are needed) into accessory tray.

14 Fill extra space in accessory tray with bubble wrap or other packing material so that flaps on the outer box slightly compress the packing material. Close large box, and tape closed.

Note The accessory tray may be left empty, but must be included to ensure package integrity.

F Device Packaging Instructions