

This is a small but hopefully increasing set of information on how to use the RTLinux driver module for SensAble's PHANToM (<http://www.sensable.com>).

HOWTO-RTlinux driver for SensAble PHANToM

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1 Introduction

Initial Text.

The Phantom is an interaction device mostly used in VR environments. In addition to serving as a tracker, it also supports haptic force feedback, enabling the user to feel surfaces and structures in a virtual environment. The driver has been developed by Zdenek Kabelac at the HCI-Lab (University of Brno, Czech Republic) out of the need for a realtime OS environment. Sensable's own drivers support MS Windows NT / 2000 and IRIX only. This document should be able to help you if you think about getting your linux box to run a PHANToM. It is as of now not intended to be a complete programming reference.

Please be sure to refer to the phantom RTLinux driver website at <http://decibel.fi.muni.cz/phantom/> for future versions of the driver and this document.

1.1 Copyright

1.2 Disclaimer

Use the information in this document at your own risk. I disavow any potential liability for the contents of this document. Use of the concepts, examples, and/or other content of this document is entirely at your own risk.

All copyrights are owned by their owners, unless specifically noted otherwise. Use of a term in this document should not be regarded as affecting the validity of any trademark or service mark.

Naming of particular products or brands should not be seen as endorsements.

You are strongly recommended to take a backup of your system before major installation and backups at regular intervals.

1.3 News

Some documentation info has been released in a miniHowto on the phantom.

Get it from the phantom driver website: phantom drivers & documentation <<http://decibel.fi.muni.cz/phantom/>>

Also, the latest version of this howto might be available there in a number of formats:

- *HTML* <<http://decibel.fi.muni.cz/phantom/doc/phantomHowto.html>>.
- *plain ASCII text* <<http://decibel.fi.muni.cz/phantom/doc/phantomHowto.txt>>.
- *SGML source* <<http://decibel.fi.muni.cz/phantom/doc/phantomHowto.sgml>>.

1.4 Credits

This documentation was created in the process of getting the phantom at the VRCC of the Fraunhofer Institute, Stuttgart VRCC <<http://vr.iao.fhg.de>> to run. There are several people without this wouldn't have been possible:

`kabi (at) i.am for continuous eMail support .)`

1.5 Translations

Sorry, no translations as of yet ...

- *German Translation* <<http://linuxdoc.org/>> by someone (at) somewhere.de
- *Swedish Translation* <<http://www.swe-doc.linux.nu>> by someone (at) somewhere.se
- *French Translation* <<http://linuxdoc.org/>> by someone (at) somewhere.fr
- *Chinese Translation* <<http://linuxdoc.org/>> by someone (at) somewhere.cn
- *Italian Translation* <<http://linuxdoc.org/>> by someone (at) somewhere.it

Any comments or suggestions can be mailed to our mail addresses: jan.wurster@syrophenium.de kabi@i.am

2 Download the needed packages

First you have to get the necessary packages.

2.1 http downloads

For a basic installation, you'll need the following:

- *Linux Kernel* <<http://www.kernel.org/>> You'll need a fresh copy of a recent Linux Kernel. You can choose between 2.2.x or 2.4.x versions where we'd recommend the newer 2.4.x series. Please use a mirror close to your location.
- *RTLinux 3.0* <<http://www.rtlinux.org/>> The final version of rlinux 3.0 is out. You might either download the Kernel Patch or a prepatched kernel version. RTLinux patches apply for either 2.2.x kernels or 2.4.x ones. The patch for 2.4.1 seems to work with 2.4.2 as well.
- *RTLinux PHANTOM Kernel Module* <<http://decibel.fi.muni.cz/phantom/>> The main part :) You can either download one of the source tarballs provided or check out a cvs snapshot. If you'd like to grab a cvs version please follow the guidelines below.

2.2 CVS checkout

If you have decided to check out a recent version yourself please be sure to follow these steps closely:

- export CVSROOT=:pserver:anonymous@decibel.fi.muni.cz:/var/cvs
- Login to the server (using: `cvs login`)
- The password is empty (just hit enter when asked)
- Checkout the source (read-only) using: `cvs co phantom`
- It will create directory phantom with the source code

3 Compilation

Now on to some compilation fun!

3.1 RTLinux installation

We suggest you install a fresh copy of your favourite kernel in `/usr/src`. You'll probably want to leave your original kernel alone to fall back to if you'd like to return to a non-RTLinux system. There's a good installation guide supplied with RTLinux so we'll not re-invent the wheel here. Come back to this howto once you got RTLinux up and running. There are a few test applications provided. Please check these to see if your installation has been successful.

3.2 phantom driver compilation

Change to the location where you checked out or decrunched the driver sources to. Edit the Makefile in the source directory: The root directory of the `rt_linux` installation (`RTL_DIR`) should point to the place `rtlinux` sets a link to to (usually `/usr/rtlinux` in default configuration). Point `RTLINUX` to your `rtlinux` kernel directory (if you've set a link to it it would most likely be `/usr/src/linux`).

Now you will have to configure your phantom model. Currently there are several models supported, including the 1.5 premium model with 6DOF position sensing and 3DOF force feedback. 6DOF force feedback models currently are **NOT** supported - please write in if you'd like to change this :) Standard setting is the 1.0 version, so if you own the 1.5 or 3.0 hardware version, change to the kernel subdirectory and edit `phantom_float.c`. There's a line right at the bottom of the file, the parameter to change is `&1_0` in default.

Type `make` and the sources and test applications should compile. If this is your first-time installation you need to run `make dev` as well (This will create the necessary devices in `/dev`).

If you've not already started RTLinux - do it now. To do that, call (*the location where you installed it to*)/`bin/rtlinux start`. RTLinux should 'boot' with the usual messages. There's a convenient script called `in` in the kernel subdir of your phantom driver module installation for you to use to insert the necessary RTL modules and the phantom module. Please be sure to change the module parameter to the value that applies to your hardware installation.

Examples for the DIP switches on the card. Switches read from left to right while viewing the card such that the text of the silkscreen is upright. Off Off Off Off = 0x0200 Off Off Off On = 0x0220 Off Off On Off = 0x0240 Off On Off Off = 0x0280 On Off Off Off = 0x0300 - recommended location On On On On = 0x03E0

PCI interface cards are autodetected.

You might also like to write a short startup script that you could also use to start your phantom at bootup time. I've included my solution as a guideline only (I know it's pretty lame - but hey - it works).

```
# small script to start phantom modules PHANTOMLOC="/home/jan/phantom_cvs/phantom"
RTLKERNEL="/usr/src/rtlinux-3.0/"      RTLINUX="/usr/rtlinux"      # starting rtlinux
$RTLINUX/bin/rtlinux start # enabling phantom module echo "Inserting modules" grep rtl_time
/proc/modules || insmod rtl_time grep rtl_sched /proc/modules || insmod rtl_sched grep phantom
/proc/modules && rmmmod phantom insmod $PHANTOMLOC/modules/phantom.o ISA_base_0=0x300 #
ISA_base_0=0x320 echo echo "mhm. probably went ok. Please check if phantom module is loaded:" echo
lsmod
```

You could easily insert the necessary stuff to use it as a start|stop script, just look at e.g. the apache startscript in `/etc/init.d/httpd` ...

4 Testing your Installation

If everything compiled alright and if you followed all the previous steps, you should now be able to test your phantom module. Please be sure to have the 'kill switch' at hand as we cannot accept responsibility for any damages you cause to the phantom or the phantom causes to you *eg*.

Before you start any programs, you might want to calibrate your phantom using the `ph_reset` application in the tests subdirectory of your phantom driver module installation. You also might have to create an alias to the correct phantom device: `ln -s /dev/phantomISA0 /dev/phantom`. Please be sure to replace

'phantomISA0' with the device corresponding to your model. Also be sure that you have inserted the phantom module using the correct parameters (iobase corresponding to the DIP-Switch on your interface board, as mentioned before).

Some demo applications are located in the *tests* subdirectory of the phantom driver package. A good starting point probably is 'dr_test'. Please run it as root, as the priority change routines for the RTLinux thread require root rights. Be sure to play around with the various #defines in the source. Initially, you should be able to feel a sphere rendered right at the [0 0 0] coordinates of your phantom.

5 Finish :)

Congratulations! You know are the proud possessor of a PHANToM working with Linux (RTLinux, that is). Isn't that cool?

Please bear in mind that you have to re-calibrate your phantom after each system restart (or anytime you might like to). Grab the phantom stylus and hold it in a neutral position, then call `ph_reset`.