



# UPhil Installation Guide

Document Version 2.0

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If you are utilizing the UPhil 1.X series of adapters, you **MUST** update to the new drivers. The new drivers support both the 1.X and 2.X series.

Note: You do not need to uninstall 1.X drivers before installing the new drivers.

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# 1 UPhil Features

UPhil is a USB to DS-101 / DS-102 / RS-232 adapter designed specifically for the EKMS and KMI community.

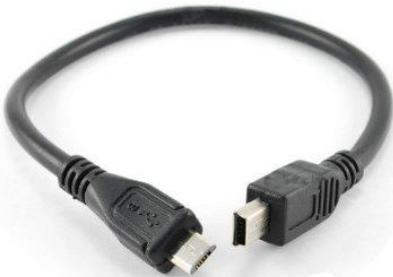
UPhil features include:

- DS-101, DS-101 with wake-up, and DS-102 modes, including Clear-to-Send (CTS)
- Can be used as a primary (sender) or secondary (receiver) station
- Optical switching for maximum signal isolation and security
- Can be utilized for TEMPEST or TRANSEC testing
- Allows control and data to be sent using standard byte level serial communications (e.g., COM4)
- Ability to change protocol modes on the fly with simple programming commands or included application
- Supports RS-232 speeds up to 115,200 baud and above; and DS-101 speeds over 64K baud
- Simple, well-defined API
- Optimized for use with existing programs such as ACES, DMD, iApp, and the SKL Update Wizard to significantly reduce database, audit, or software transfer times
- SKL UAS upload transfer times via fill port are reduced from 5 hours to 50 minutes
- Passively zeroizes firmware and memory when disconnected
- Allows for UAS uploads to the SKL and other EKMS fill devices in SCIFs where USBs are not authorized
- Adapter supports all current Tier 3 Fill Devices and is compatible with next generation Fill Devices, such as the Air Force Portable Key Loader (PKL)
- OS support includes Windows, Linux, and Android

## 2 (U) UPhil Configuration

The standard UPhil Configuration includes the following:

1. UPhil Dongle
2. Standard USB Type A to Mini B cable
3. UPhil Software (CD-ROM)



## 3 PC System Requirements

UPhil requires the following minimum PC features:

- Windows®7 or 8, 32-bit or 64-bit operating system; or Windows® 10 64-bitPentium or higher processor
- One USB-C, USB 3.0 Super Speed, or USB2.0 High Speed enabled port. UPhil will not run on USB 1.1 Full Speed ports
- 50MBytes of Hard disk space
- 32MBytes of RAM

## 4 UPhil Installation for Windows

Follow the steps below to install the drivers (UPhil and COM) and to run the UPhil Configuration Application.

UPhil works with USB-C, USB 3.0, and USB 2.0.

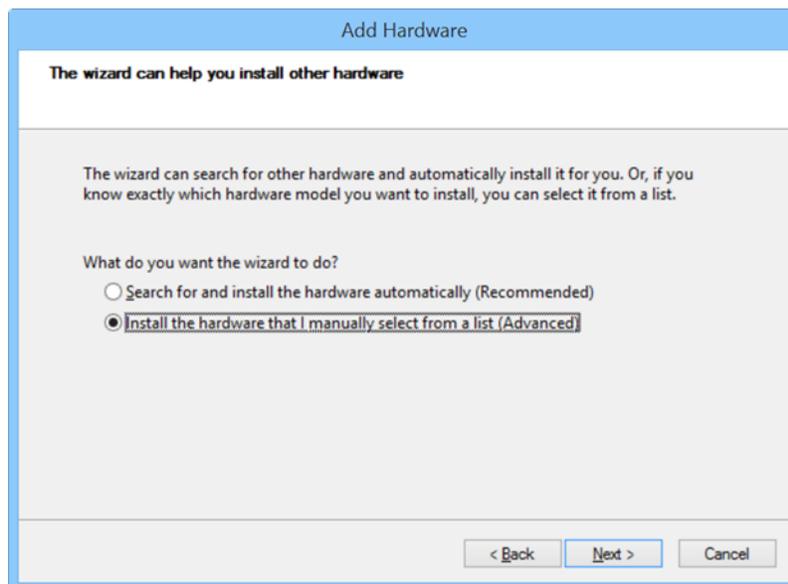
**Note: Do not connect UPhil to PC until drivers have been installed.**

### 4.1 Installing the UPhil Drivers

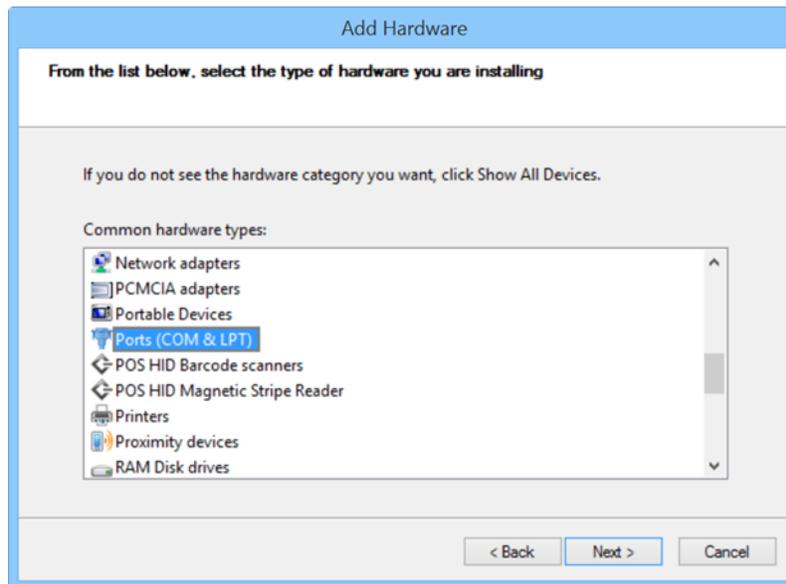
1. Copy the contents of the CDROM or extracted zip file to a directory on the PC. All references to folder will be in reference to the install location.
2. Install UPhil driver: (This driver allows communication to UPhil)

Windows 7/8/10 x64	Windows 7/8 x86
Navigate to the Drivers directory. Run the program <i>dpinst64.exe</i> .	Navigate to the Drivers directory. Run the program <i>dpinst32.exe</i> .

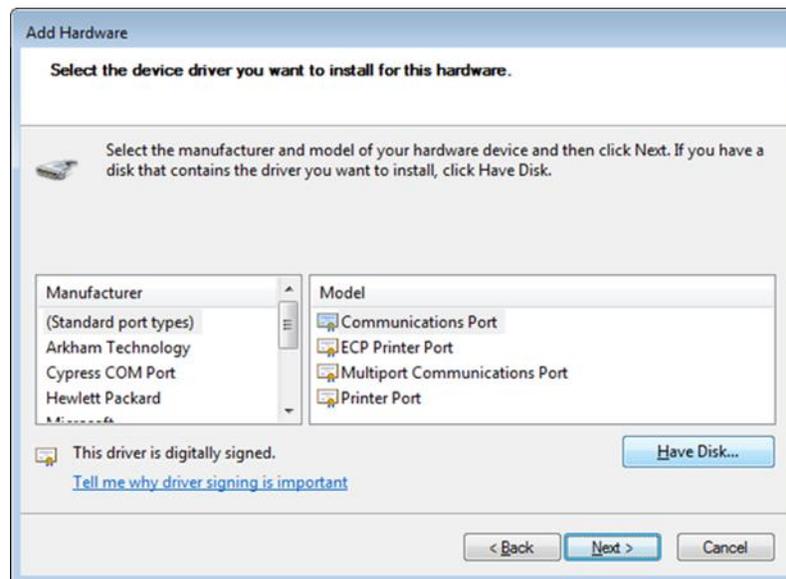
3. Install COM driver: (Same steps for x64 and x86) **(Note – it is best to have local admin privilege)**
  - a. Open the Device Manager
  - b. Select Ports (COM & LPT)
  - c. From the Menu bar, select your computer name at the top, and then click **Action> Add legacy hardware**
  - d. Click **Next >**
  - e. Select Install the hardware that I manually select from a list (Advanced), and then click Next >



- f. Select **Ports (COM & LPT)** in the Common hardware types list and click **Next>**

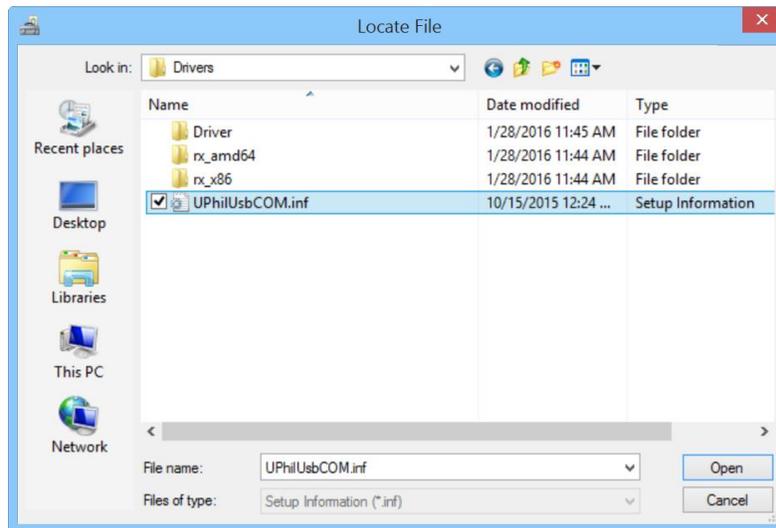


- g. Click Have Disk...

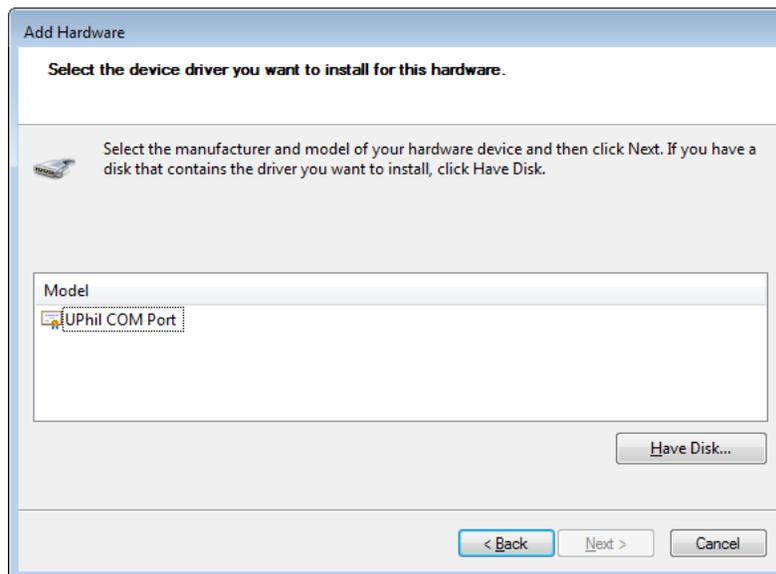


- h. Click Browse...

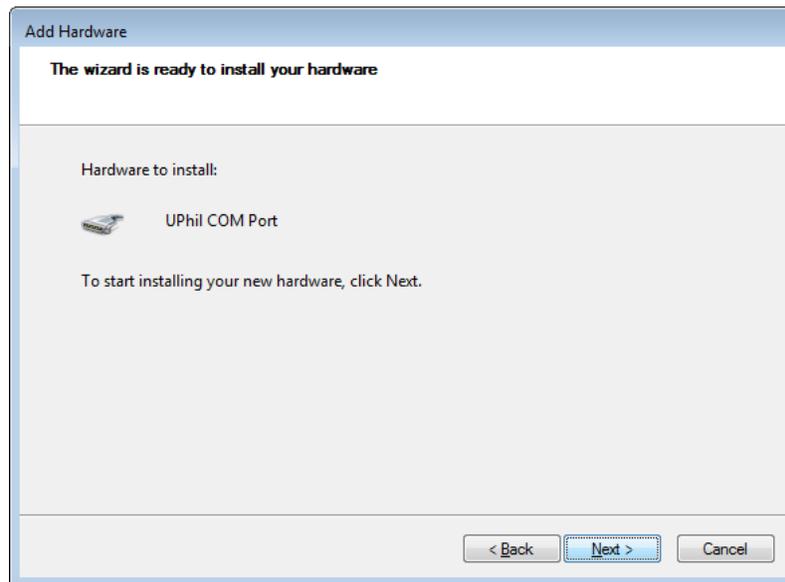
- i. Select the **UPhilUsbCOM.inf** file located in the Drivers directory, and then click **Open**



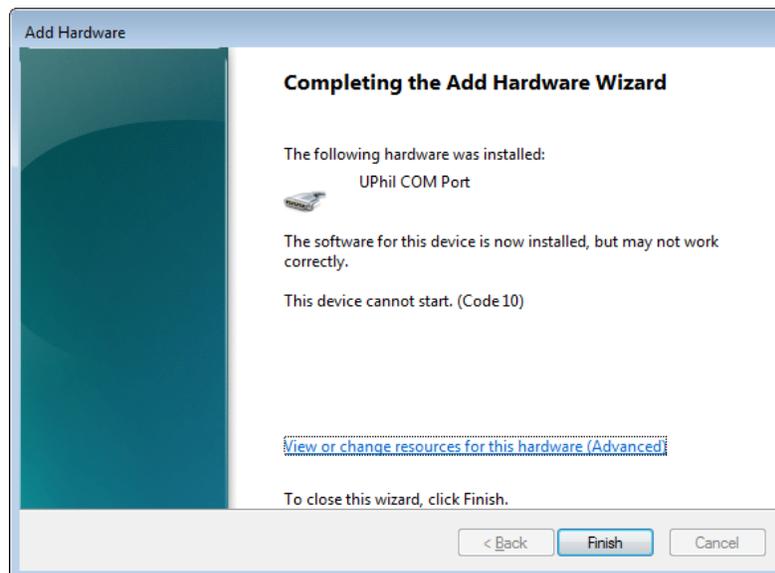
- j. Click **OK**.
- k. Select the **UPhil COM Port**, and then click **Next >**



- l. Click **Next**> to install the driver



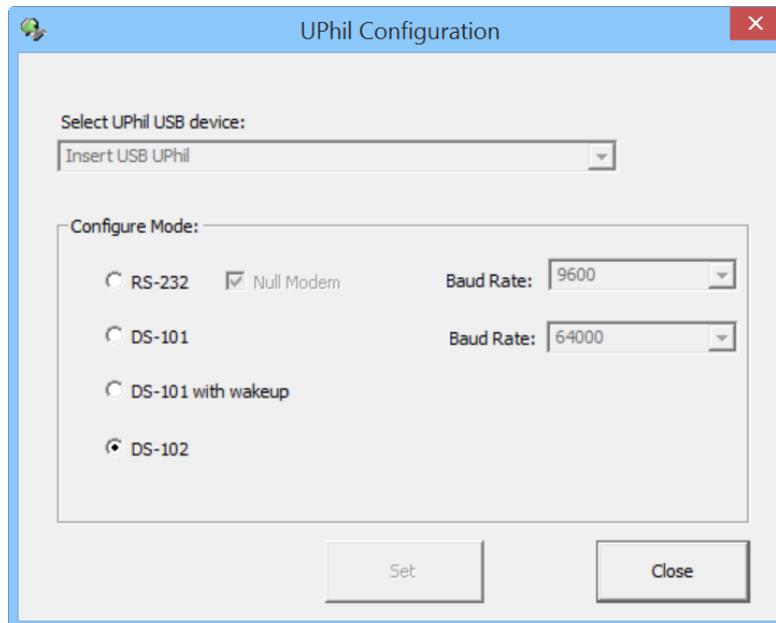
- m. Click **Finish**



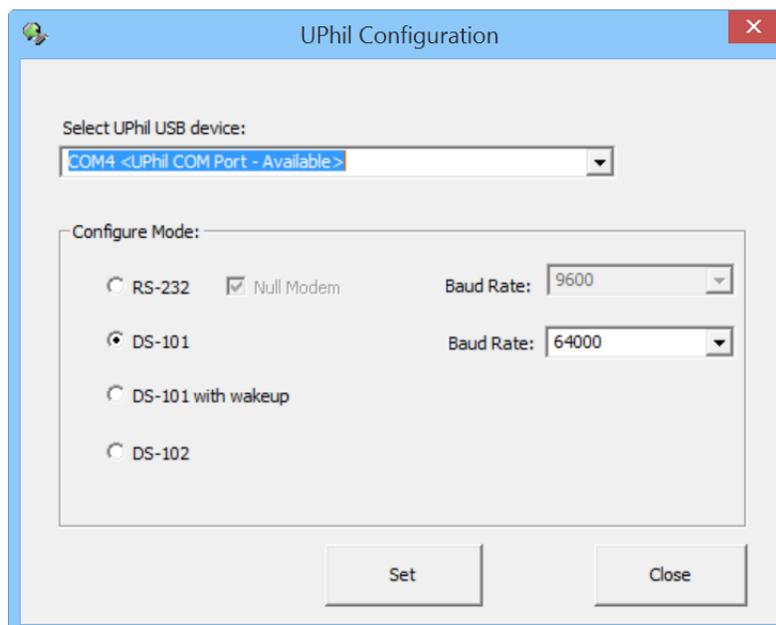
## 4.2 Starting the UPhil Configuration Application

After the drivers have been installed, the user will need to run the Configuration application. Follow the steps below to start the UPhil Configuration application

1. Run the program **UPhilConfig.exe** from the installation directory. The executable that runs on the 64 bit version of Windows is in the UPhil\_x64 folder; the executable that runs on the 32 bit version of Windows is in the UPhil\_x86 folder.



2. Plug in UPhil to the PC using the USB cable.
3. Under **Select UPhil USB device:**, click the drop down arrow for **COM4 <UPhil COM Port - Available>** – **Available>**.



Note – There should only be a single port in the pull down; if more than the single Available UPhil port shows up, you may need to go back to Device Manager and delete those other ports.

4. To verify that UPhil is operational, select a mode and click **Set**. The LED will be illuminated. The selected configuration mode corresponds to the following colors:
  - RS-232 is red
  - DS-101 is green
  - DS-101 with wakeup is light blue (cyan)
  - DS-102 is blue

### 4.3 Using UPhil as a Protocol Converter with Existing Programs

The UPhil Configuration Application can be used with existing Windows applications, including DMD-PS, iApp, ACES, and the SKL Update Wizard to convert the DS-101 protocol over RS-232 electrical to full-fledged DS-101, as defined in EKMS 308. This provides a 6x gain in transfer speed. The UPhil configuration application will provide a COM port available for use by the existing applications.

With UPhil attached to both the PC and to an end unit (e.g., SKL, TKL), use the UPhil Configuration screen to select the COM port and set the mode to the desired protocol and speed. Note that DS-102 is not normally utilized in existing applications. From the existing Windows application (DMD-PS, iApp, ACES, etc.), select the UPhil COM port. Transfer can then be performed as usual.

## 5 UPhil Installation for Linux

It is recommended that users installing UPhil on Linux have experience using Linux. The following libraries must be installed prior to compiling the UPhil source code:

```
libusb-1.0.0-dev
libudev-dev
```

If using Ubuntu 14.04, open the Software Package Manager and search for libusb-1.0.0-dev and libudev-dev. Click Install to begin the installation.



If using an earlier Ubuntu version or another variant of Linux, the libusb-1.0.0-dev package must be downloaded, compiled, and installed.

After the libraries have been installed, copy the UPhil Linux directory from the CD-ROM to a local directory. This directory will be referred to as <uphil\_root>.

Change to the directory <uphil\_root>/src/uphil. The Makefile may need to be modified depending on if libusb-1.0.0-dev was downloaded using the source or from a package manager. Open the include file with your favorite editor and change the following lines to point to the include path for libusb-1.0.0-dev:

```
CPPFLAGS+=-I/usr/include/libusb-1.0
```

To compile the source code, type make at the command prompt. The output of the Makefile should look similar to the following sample output:

```
websec@ubuntu:~/uphil_linux/src/uphil$ make
mkdir -p gen
xxd -i data/r2336/bsfuqf.ufa gen/bsfuqf.h
xxd -i data/r2316/fpgabootloader.bin gen/fpgabootloader.h
xxd -i data/r2300/usbzsla.bix gen/usbzsla.h
xxd -i data/r2329/VirtualCom.bix gen/VirtualCom.h
gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
uphil.o uphil.c
gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
ezusb.o ezusb.c
ezusb.c: In function 'logerror':
ezusb.c:47:9: warning: implicit declaration of function 'vsyslog'
[-Wimplicit-function-declaration]
```

```
vsyslog(LOG_ERR, format, ap);
^

ar rcs libuphil.a uphil.o ezusb.o

gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
chat.o chat.c

gcc -Wall -g -std=c99 -o chat chat.o -L/usr/local/lib -lusb-1.0 -
lpthread -lrt -ludev

gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
load.o load.c

gcc -Wall -g -std=c99 -o load load.o libuphil.a -L/usr/local/lib
-lusb-1.0 -lpthread -lrt -ludev

gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
receive.o receive.c

gcc -Wall -g -std=c99 -o receive receive.o -L/usr/local/lib -
lusb-1.0 -lpthread -lrt -ludev

gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
rs232.o rs232.c

gcc -Wall -g -std=c99 -o rs232 rs232.o -L/usr/local/lib -lusb-1.0
-lpthread -lrt -ludev

gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
send.o send.c

gcc -Wall -g -std=c99 -o send send.o -L/usr/local/lib -lusb-1.0 -
lpthread -lrt -ludev
```

## 5.1 Using UPhil on Linux

To begin working with UPhil, firmware needs to be loaded. Use the USB cable to connect UPhil to the PC, if not already connected. Type in the following command to upload the firmware to all connected UPhil devices. Note that UPhil firmware needs to be loaded every time UPhil is disconnected and reconnected.

```
> ./load all
```

UPhil can be tested to see if it is working by typing the following command. This command will enable the RS-232 interface and turn the LED to red.

```
> ./rs232
```

### 5.1.1 Using UPhil configuration script

For more UPhil configuration options, the UPhil script can be used. Change to the directory <uphil\_top>/bin. Make the script file executable.

```
> chmod +x uphil
```

To get the parameters and help documentation for the UPhil script, type the following command:

```
> sudo ./uphil
```

To set UPhil into DS-101 mode, type the following command:

```
> sudo ./uphil ds101
```

## 5.1.2 Linux Installation Troubleshooting

The following installation issues may arise during UPhil installation on Linux.

### 5.1.2.1 Compile issue - *libusb.h:No such file or directory*

```
websec@ubuntu:~/uphil_linux/src/uphil$ make
mkdir -p gen
xxd -i data/r2336/bsfuqf.ufa gen/bsfuqf.h
xxd -i data/r2316/fpgabootloader.bin gen/fpgabootloader.h
xxd -i data/r2300/usbzsla.bix gen/usbzsla.h
xxd -i data/r2329/VirtualCom.bix gen/VirtualCom.h
gcc -Wall -g -std=c99 -I/usr/local/include/libusb-1.0 -c -o
uphil.o uphil.c
uphil.c:2:20: fatal error: libusb.h: No such file or directory
#include <libusb.h>
                ^
compilation terminated.
make: *** [uphil.o] Error 1
```

To fix this issue, modify the libusb-1.0.0-dev include path in the Makefile.

### 5.1.2.2 Unable to find *libusb-1.0.0-dev*

```
websec@ubuntu:~/uphil_linux/src/uphil$ sudo apt-get install
libudev-dev
[sudo] password for websec:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
```

```
libudev-dev
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 25.4 kB of archives.
After this operation, 343 kB of additional disk space will be
used.
Err http://us.archive.ubuntu.com/ubuntu/ trusty-updates/main
libudev-dev amd64 204-5ubuntu20.13
404 Not Found [IP: 91.189.91.24 80]
E: Failed to fetch
http://us.archive.ubuntu.com/ubuntu/pool/main/s/systemd/libudev-
dev_204-5ubuntu20.13_amd64.deb 404 Not Found [IP: 91.189.91.24
80]

E: Unable to fetch some archives, maybe run apt-get update or try
with --fix-missing?
```

To fix this issue, type in `sudo apt-get update` and try again. The source for `libusb-1.0.0-dev` can also be downloaded using an older version of Linux.

## 6 Additional Information

### 6.1 FAQs

#### **What is the maximum Baud Rate?**

We have shown the default signal rates for the EKMS protocols. The UPhil board can go at a higher baud rate. At higher baud rates, some signal roll off may occur. In the lab, we have sent RS-232 working 4Mb/per second. For DS101, we think can go to 500K bits/sec without an issue. The higher rates have not been field tested as of yet.

#### **What is the current?**

UPhil draws 165mA of current over the USB port. It can be used on handheld, mobile phones or PCs. Future firmware updates are planned and will lower the current draw by ½ or more.

#### **What is the USB speed?**

UPhil runs at USB full speed.

### 6.2 Support

WebSec can support the integration and development associated with the EKMS protocols and UPhil. We have a mature set of libraries, application and test equipment to support EKMS development for almost any project.

### 6.3 Data Collection Device (DCD)

The DCD is an EKMS oscilloscope, logic analyzer, and packet analyzer built into one device. It is invaluable for developing new EKMS devices and troubleshooting existing communication issues.

### 6.4 EKMS Software Libraries

WebSec has over two decades of development working with EKMS software. We have built software libraries that work on Windows, Linux, Android, and the Harris's Sierra II (ARM926-EJS).

For assistance or questions regarding UPhil, please contact David Webster at 858.229.9875 or at [websterdav@webseccorp.com](mailto:websterdav@webseccorp.com).