Adafruit PiTFT 3.5" Touch Screen for Raspberry Pi

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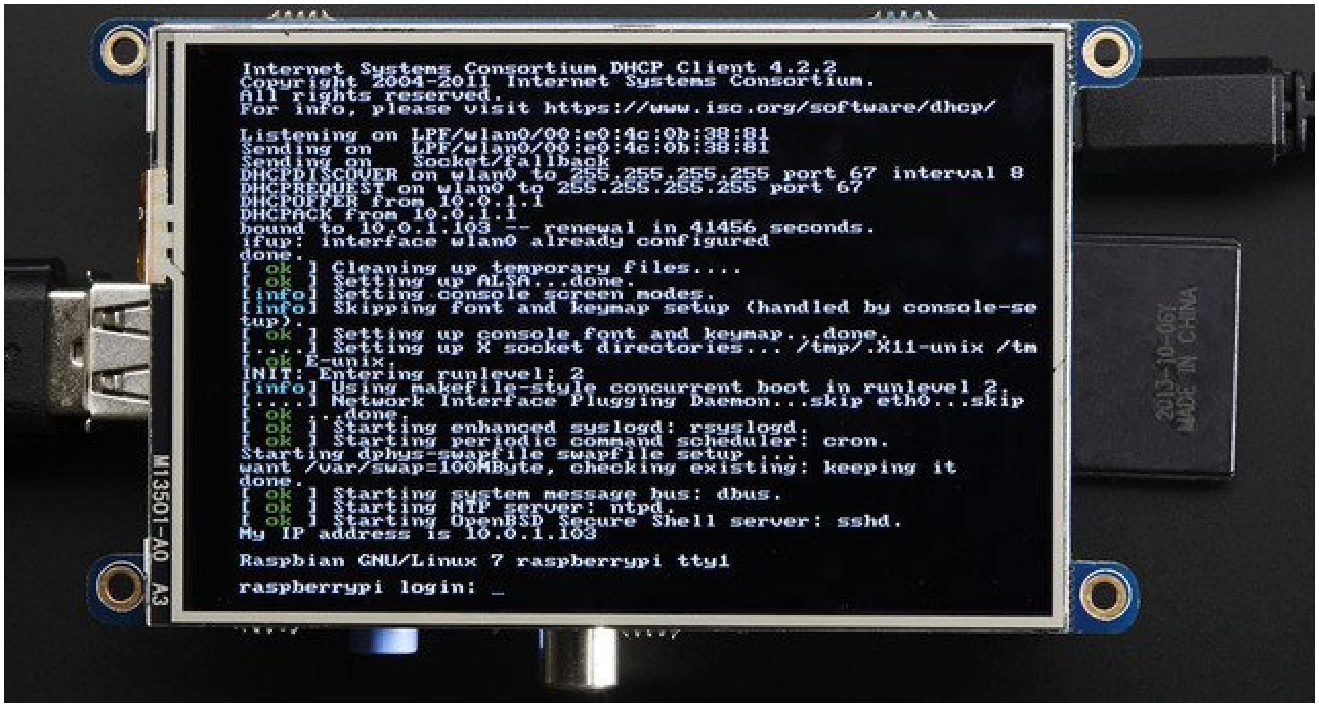
Guide Contents

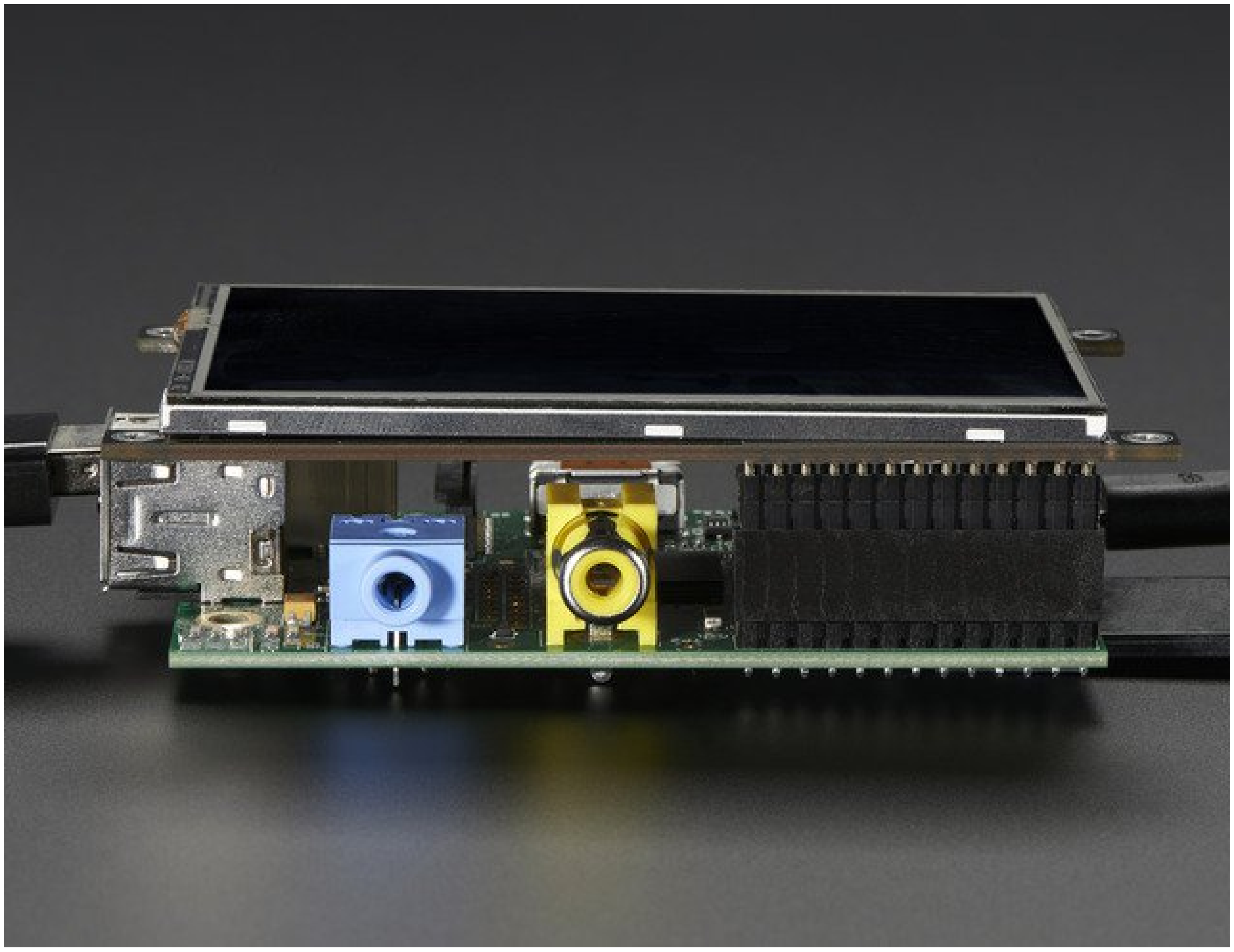
Overview

Is this not the cutest, little display for the Raspberry Pi? It features a **3.5" display with 480x320** 16-bit color pixels and a resistive touch overlay, but is only slightly larger than our popular original (http://adafru.it/dDE). The plate uses the high speed SPI interface on the Pi and can use the mini display as a console, X window port, displaying images or video etc. Best of all it plugs right in on top!

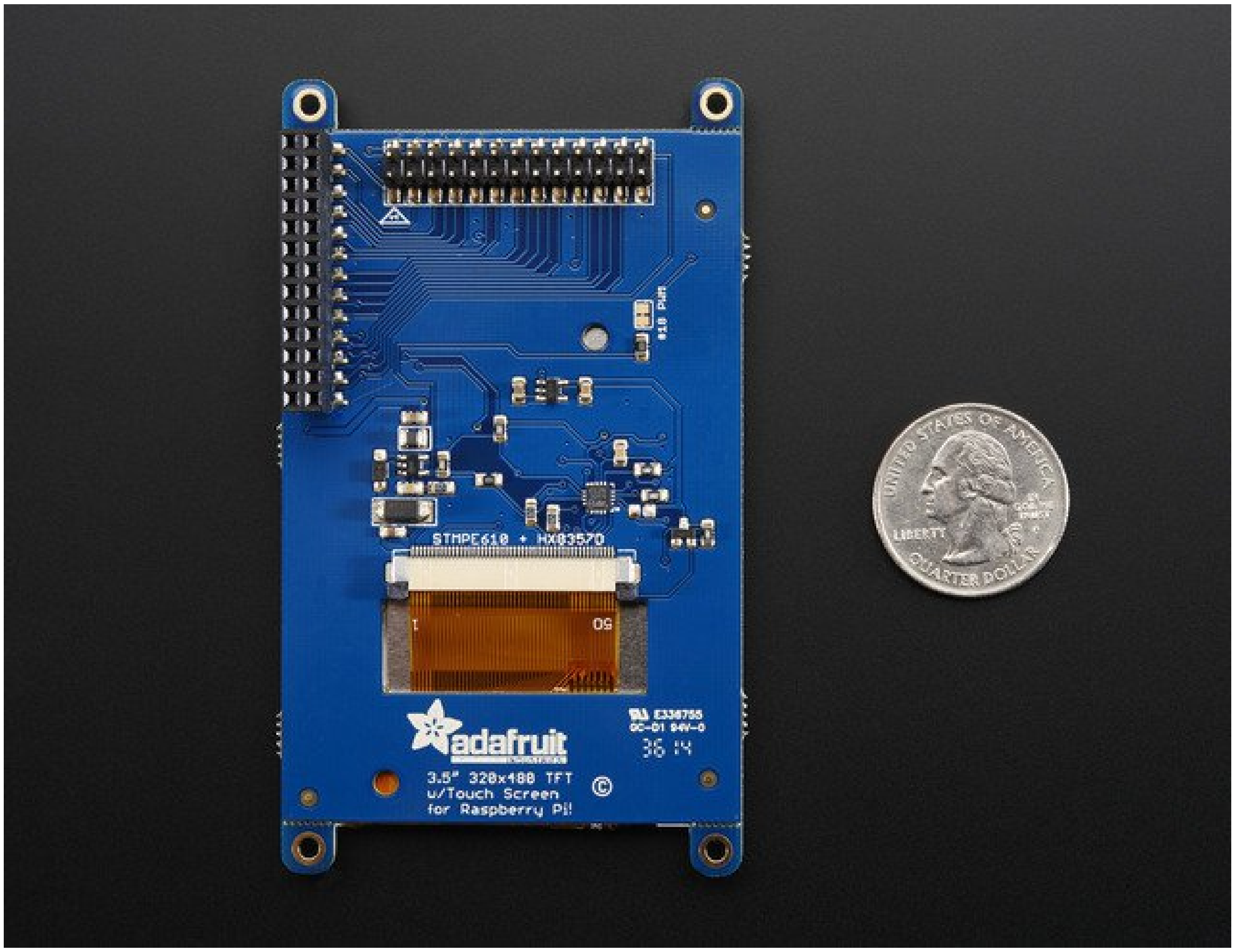


```
Internet Systems Consortium DHCP Client 4.2.2
Copyright 2004-2011 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

Listening on LPF/wlan0/00:e0:4c:0b:38:81
Sending on   LPF/wlan0/00:e0:4c:0b:38:81
Sending on   Socket/fallback
DHCPDISCOVER on wlan0 to 255.255.255.255 port 67 interval 8
DHCPREQUEST on wlan0 to 255.255.255.255 port 67
DHCPOFFER from 10.0.1.1
DHCPACK from 10.0.1.1
bound to 10.0.1.103 -- renewal in 41456 seconds.
ifup: interface wlan0 already configured
done.
[ ok ] Cleaning up temporary files....
[ ok ] Setting up ALSA...done.
[info] Setting console screen modes.
[info] Skipping font and keymap setup (handled by console-se
tup).
[ ok ] Setting up console font and keymap...done.
[....] Setting up X socket directories... /tmp/.X11-unix /tm
[ ok E-unix.
INIT: Entering runlevel: 2
[info] Using makefile-style concurrent boot in runlevel 2.
[....] Network Interface Plugging Daemon...skip eth0...skip
[ ok ...done.
[ ok ] Starting enhanced syslogd: rsyslogd.
[ ok ] Starting periodic command scheduler: cron.
Starting dphys-swapfile swapfile setup ...
want /var/swap=100MByte, checking existing: keeping it
done.
[ ok ] Starting system message bus: dbus.
[ ok ] Starting NTP server: ntpd.
[ ok ] Starting OpenBSD Secure Shell server: sshd.
My IP address is 10.0.1.103

Raspbian GNU/Linux 7 raspberrypi tty1

raspberrypi login: _
```

It's designed to fit nicely onto the Pi Model A or B but also works perfectly fine with the Model B+ as long as you don't mind the PCB overhangs the USB ports by 5mm.



Uses the hardware SPI pins (SCK, MOSI, MISO, CE0, CE1) as well as GPIO #25 and #24. GPIO #18 can be used to PWM dim the backlight if you like. All other GPIO are unused. There's a 2x13 header on the bottom, you can connect a standard Pi GPIO cable to it to use any of the other pins ask you like



Best of all, it comes **fully assembled** and ready to plug into your Pi! You can use this as a display for running the X interface, or pygame. You can also have an HDMI display seperately connected.

Easy Install

The PiTFT requires kernel support and a couple other things to make it a nice stand-alone display. We have a detailed step-by-step setup for hackers who want to tweak, customize or understand the PiTFT setup. If you just want to get going, check out the following for easy-install instructions!

Ready to go image

f you want to start with a fresh image, we have two for Raspbian. There's the larger 'classic Jessie' image that will boot into X by default, and requires a 8G image, it has a lot more software installed. There's also the smaller 'Jessie Lite' that will boot into the command line, and can be burned onto a 2G card! Click below to download and install into a new SD card. Unzip and follow the classic SD card burning tutorials (http://adafru.it/aMW)

This image is customized for the Resistive Touch 3.5" TFT, also known as PID #2097! Not for the 2.8" or 2.4" PiTFTs, PID #1601 or #1983
Download Jessie-based PiTFT 3.5" Resistive Image for Pi 1, Pi 2 and Pi 3 (March 25, 2016)
http://adafru.it/mAb
Download Jessie Lite-based PiTFT 3.5" Resistive Image for Pi 1, Pi 2 and Pi 3 (March 25, 2016)
http://adafru.it/mAG

Older Images:

- Raspbian Jessie 2015/09/24-based image (http://adafru.it/iDD)
- Raspbian Wheezy 2015/09/24-based image (http://adafru.it/idy)
- Raspbian 2014/09/09-based image (http://adafru.it/e10)
- Raspbian 2015/03/12 image (http://adafru.it/eUE)

The DIY Installer isn't working right now, please try the All-In-One image above - no ETA on why its not working, something to do with the latest Raspbian has changed. Thanks!

DIY Installer script

If you don't want to download an image, you can install our custom kernel and run our installation package helper from inside your existing Raspbian install. It will configure your

Pi for PiTFT joy

The helper is available for perusal here (http://adafru.it/eIn) if you are interested in how it works

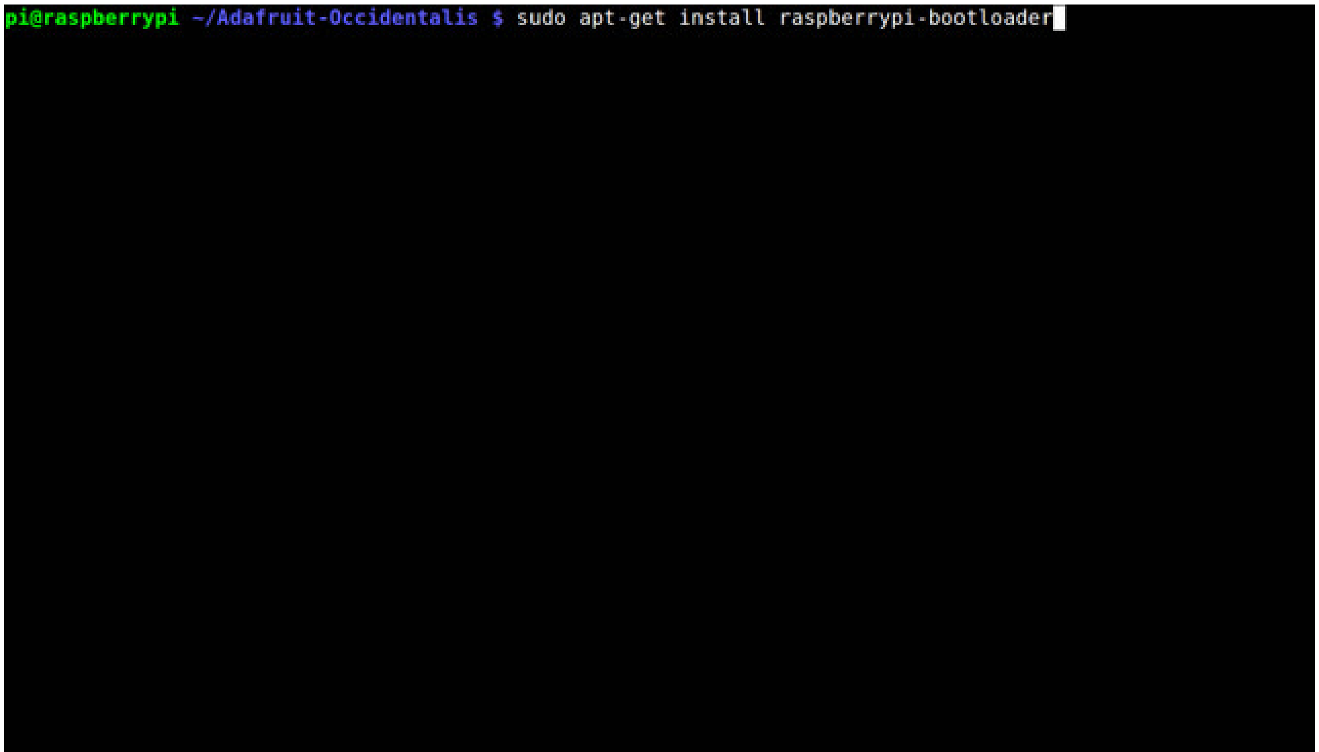
To download and run it, simply run the following commands:

```
curl -SLs https://apt.adafruit.com/add-pin | sudo bash
sudo apt-get install raspberrypi-bootloader
sudo apt-get install adafruit-pitft-helper
```

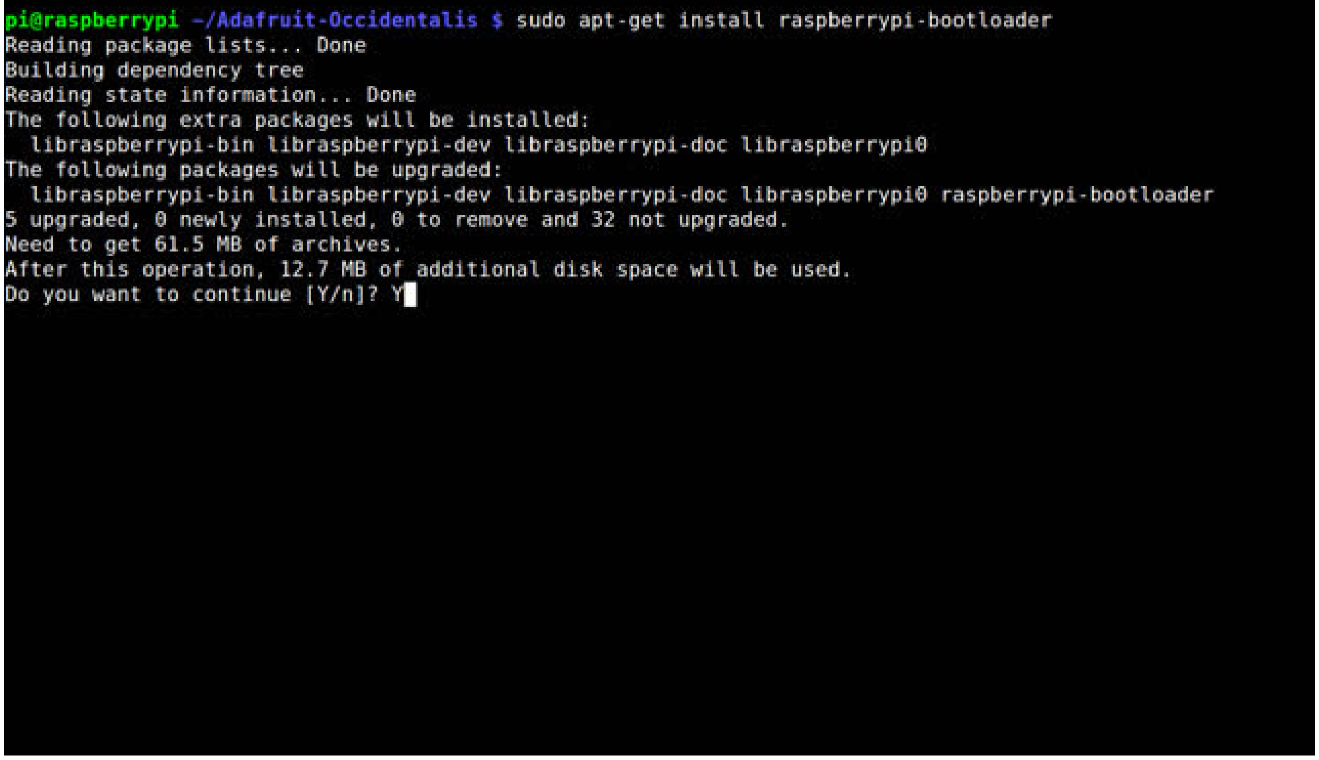
The first command adds **apt.adafruit.com** to your repository list, so you can grab code directly from adafruit's servers

```
pi@raspberrypi ~ $ curl -SLs https://apt.adafruit.com/add-pin | sudo bash
```

The next three do the actual download and installation, it'll take a while because there's a lot of software to replace for PiTFT support.

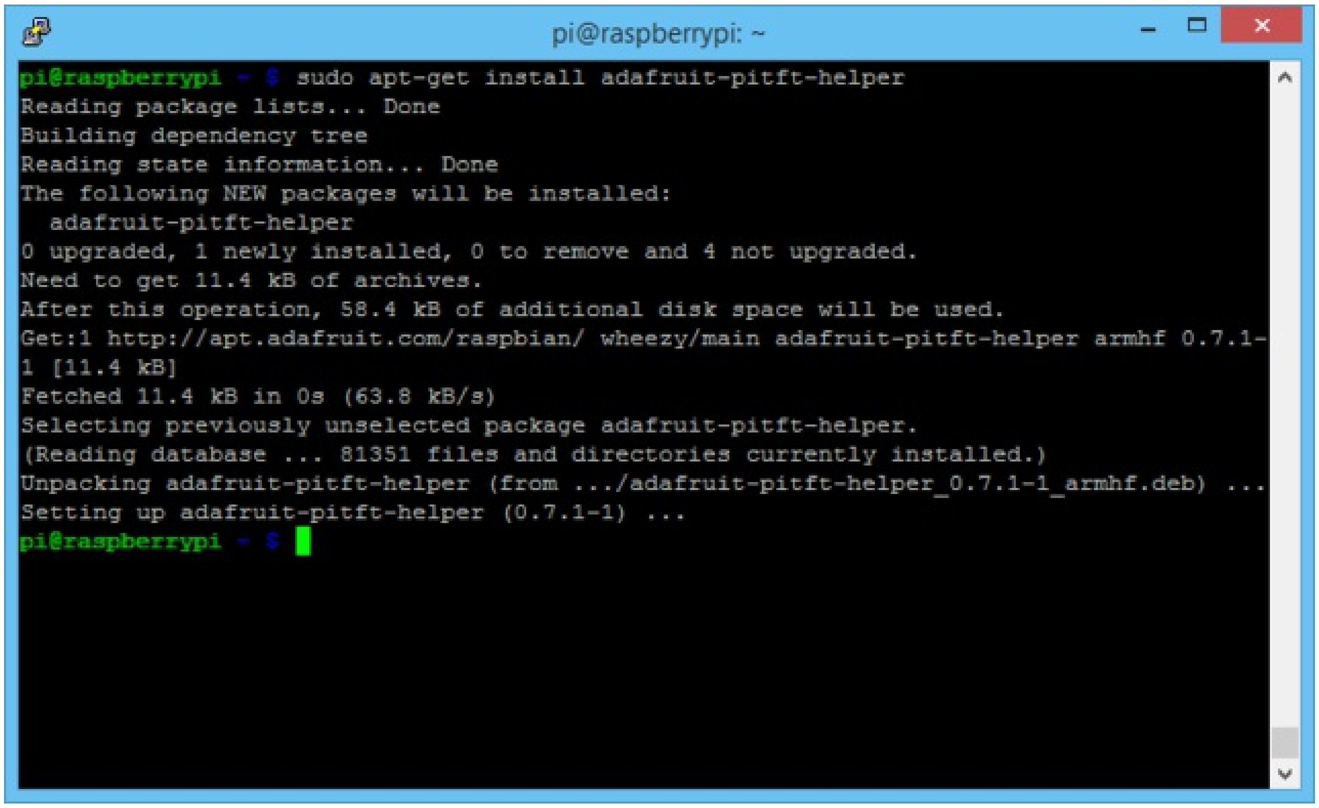


```
pi@raspberrypi ~/Adafruit-Occidentalis $ sudo apt-get install raspberrypi-bootloader
```



```
pi@raspberrypi ~/Adafruit-Occidentalis $ sudo apt-get install raspberrypi-bootloader
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  libraspberrypi-bin libraspberrypi-dev libraspberrypi-doc libraspberrypi0
The following packages will be upgraded:
  libraspberrypi-bin libraspberrypi-dev libraspberrypi-doc libraspberrypi0 raspberrypi-bootloader
5 upgraded, 0 newly installed, 0 to remove and 32 not upgraded.
Need to get 61.5 MB of archives.
After this operation, 12.7 MB of additional disk space will be used.
Do you want to continue [Y/n]? Y
```

It's normal for the Pi to pause at this step for up to 20 minutes, theres a lot of kernel software to replace



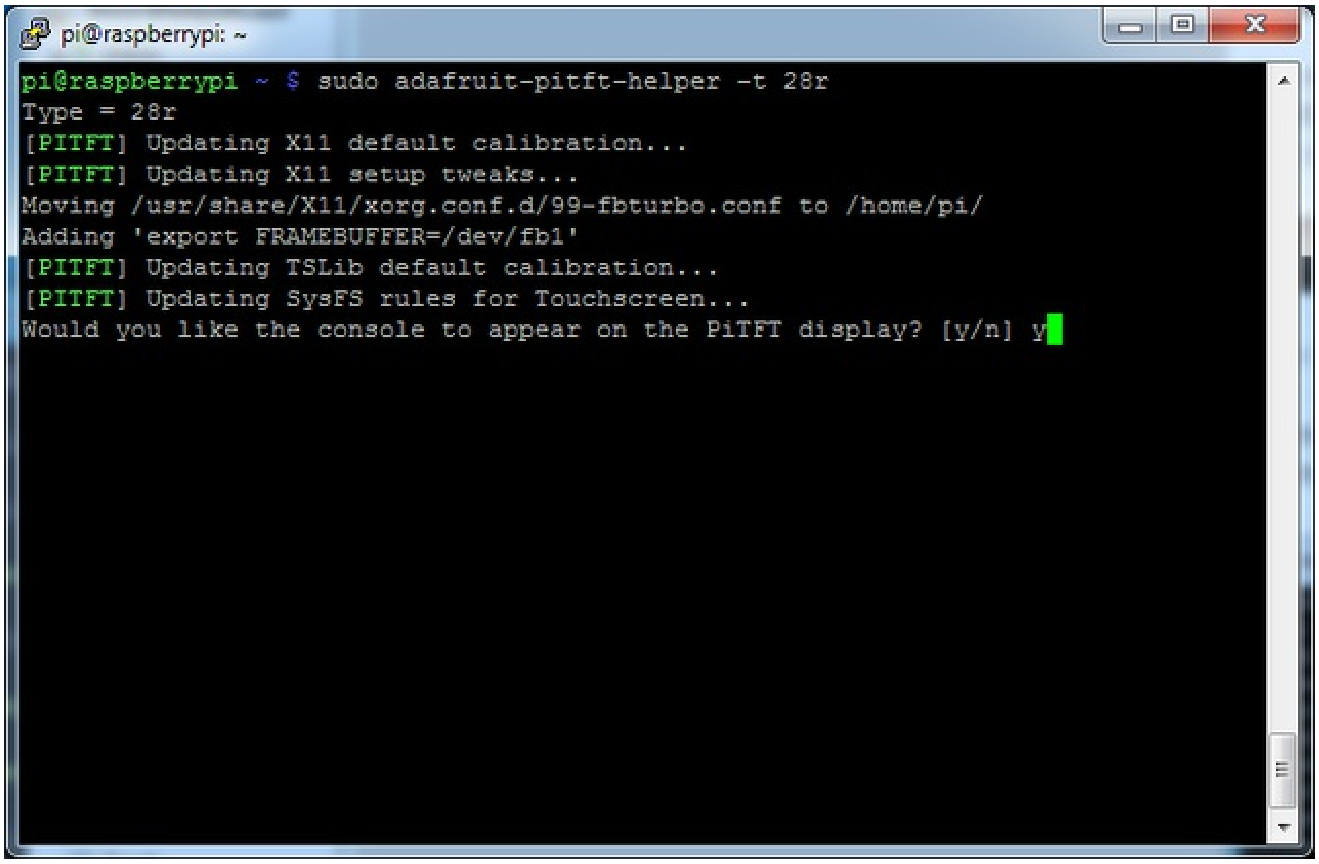
```
pi@raspberrypi ~ $ sudo apt-get install adafruit-pitft-helper
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  adafruit-pitft-helper
0 upgraded, 1 newly installed, 0 to remove and 4 not upgraded.
Need to get 11.4 kB of archives.
After this operation, 58.4 kB of additional disk space will be used.
Get:1 http://apt.adafruit.com/raspbian/ wheezy/main adafruit-pitft-helper armhf 0.7.1-
1 [11.4 kB]
Fetched 11.4 kB in 0s (63.8 kB/s)
Selecting previously unselected package adafruit-pitft-helper.
(Reading database ... 81351 files and directories currently installed.)
Unpacking adafruit-pitft-helper (from .../adafruit-pitft-helper_0.7.1-1_armhf.deb) ...
Setting up adafruit-pitft-helper (0.7.1-1) ...
pi@raspberrypi ~ $
```

OK now the kernel and helper are installed, all you have to do is run the helper which will configure the kernel device tree overlays and add the few configurations to make the console show up, etc.

```
sudo adafruit-pitft-helper -t 35r
```

This will install the "3.5 inch Resistive" type of PiTFT into the current install.

At the end you will be prompted on whether you want the text console to appear on the PiTFT. Answer Y or N depending on your personal desires!



```
pi@raspberrypi ~ $ sudo adafruit-pitft-helper -t 28r
Type = 28r
[PITFT] Updating X11 default calibration...
[PITFT] Updating X11 setup tweaks...
Moving /usr/share/X11/xorg.conf.d/99-fbturbo.conf to /home/pi/
Adding 'export FRAMEBUFFER=/dev/fb1'
[PITFT] Updating TSLib default calibration...
[PITFT] Updating SysFS rules for Touchscreen...
Would you like the console to appear on the PiTFT display? [y/n] y
```

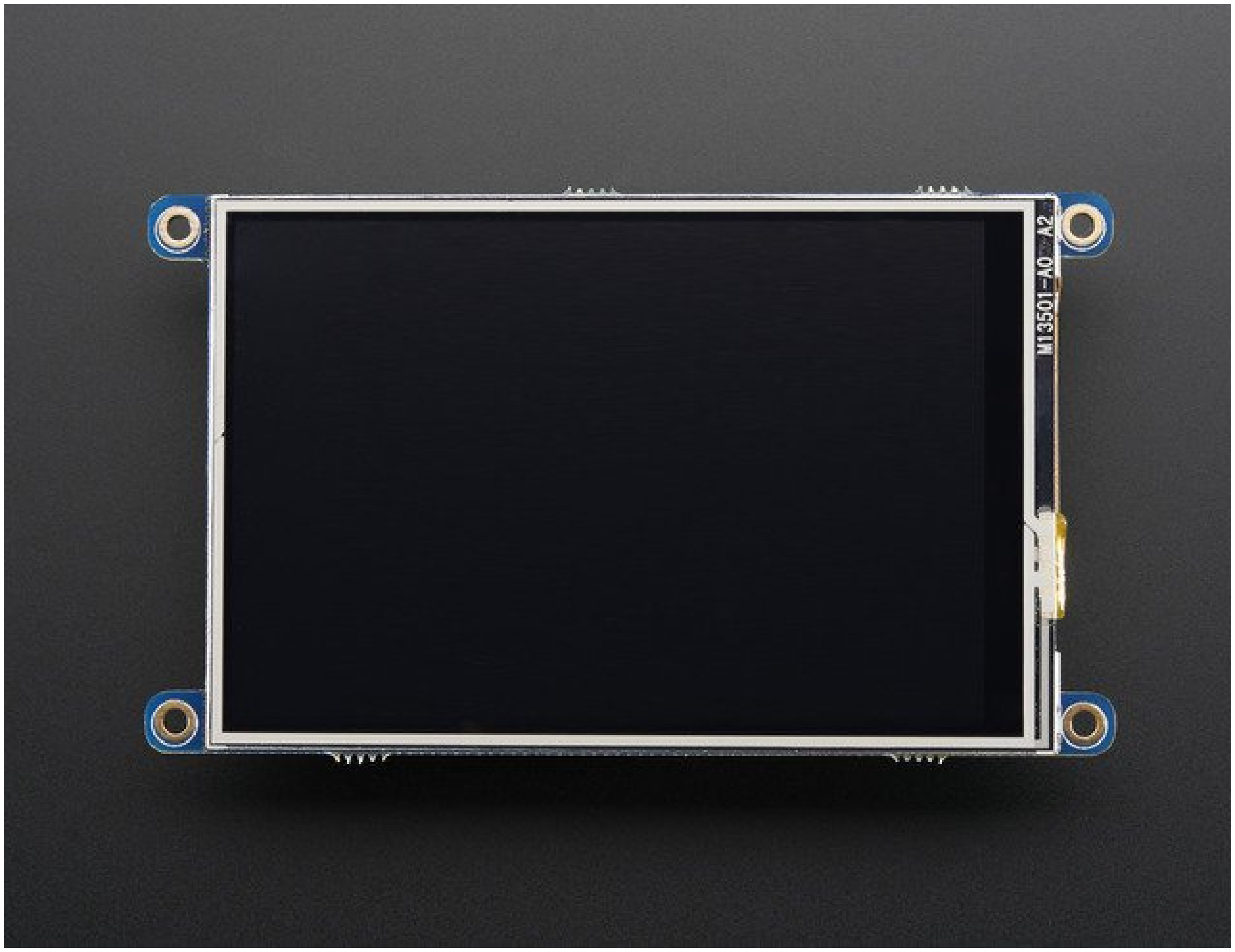
That's it!

Run **sudo reboot** to try out your fancy new PiTFT :)

Detailed Install

The DIY Installer isn't working right now, please try the All-In-One image above - no ETA on why its not working, something to do with the latest Raspbian has changed. Thanks!
If you've grabbed our Easy Install image, or use the script, this step is not required, it's already done! This is just for advanced users who are curious on how to configure and customize the kernel install

In the next few steps we'll cover the**detailed** installation procedure. Chances are, you should grab the Easy Install image or script. If you have some interest in the details of how we install the PiTFT setup, read on!



In order to add support for the 3.5" TFT and touchscreen, we'll need to install a new Linux Kernel. Lucky for you, we created a kernel package that you can simply install *over* your current Raspbian (or Raspbian-derived) install instead of needing a whole new image. This makes it easier to keep your install up-to-date.

To use our kernel .deb files you must be using Raspbian or derivative. This wont work with Arch or other Linux flavors. As Raspbian is the official OS for the Pi, that's the only Linux we will support! Others can recompile their own kernel using our github commits (http://adafru.it/aPa)but we have no tutorial or support or plans for such.

Before you start

You'll need a working install of Raspbian with network access.If you need help getting that far, check out our collection of Pi tutorials (http://adafru.it/aWq).

We'll be doing this from a console cable connection, but you can just as easily do it from the direct HDMI/TV console or by SSH'ing in. Whatever gets you to a shell will work!

Also, run **sudo apt-get update** !

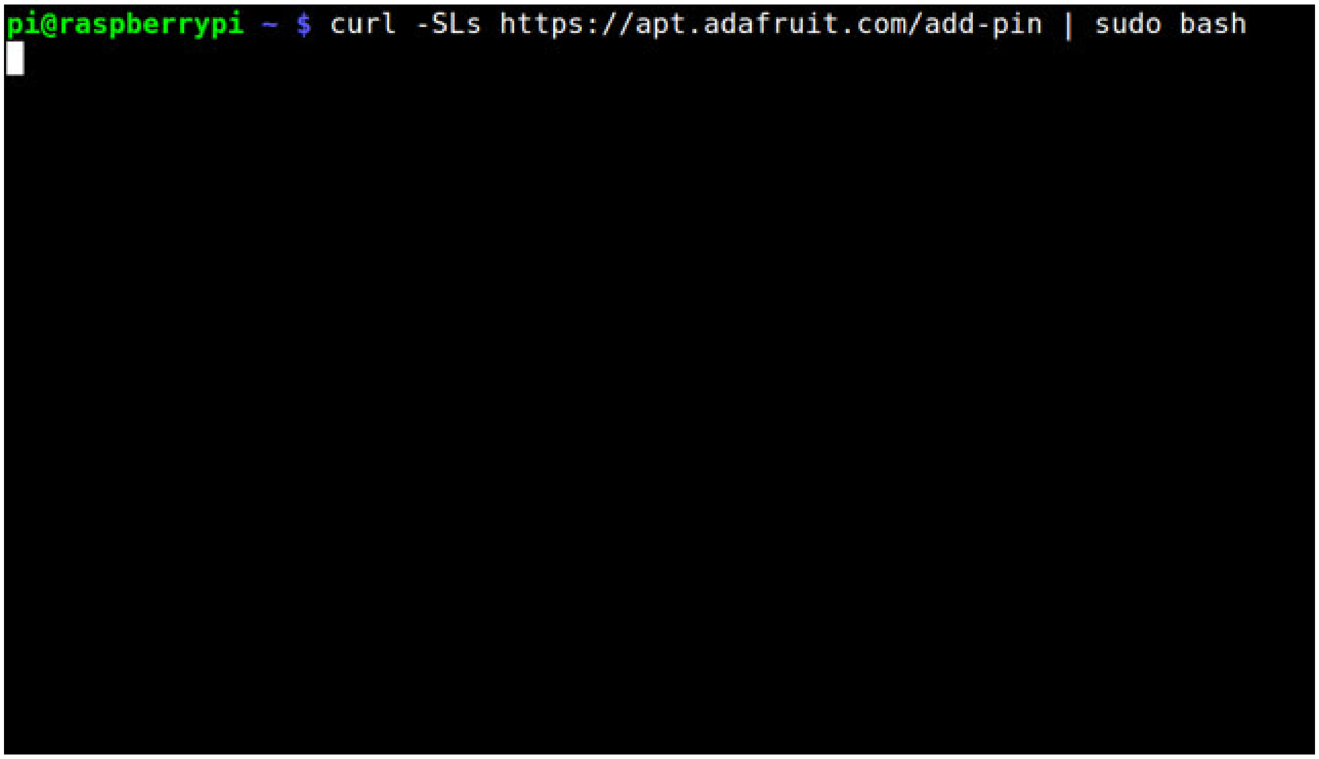
To run these all the setup and config commands you'll need to be logged into a proper Terminal - use ssh, a console cable, or the main text console (on a TV). The WebIDE console may not work.

Download & Install Kernel

The only way we're distributing the PiTFT kernel packages right now is thru apt.adafruit.com so you'll still need to run:

```
curl -SLs https://apt.adafruit.com/add-pin | sudo bash
```

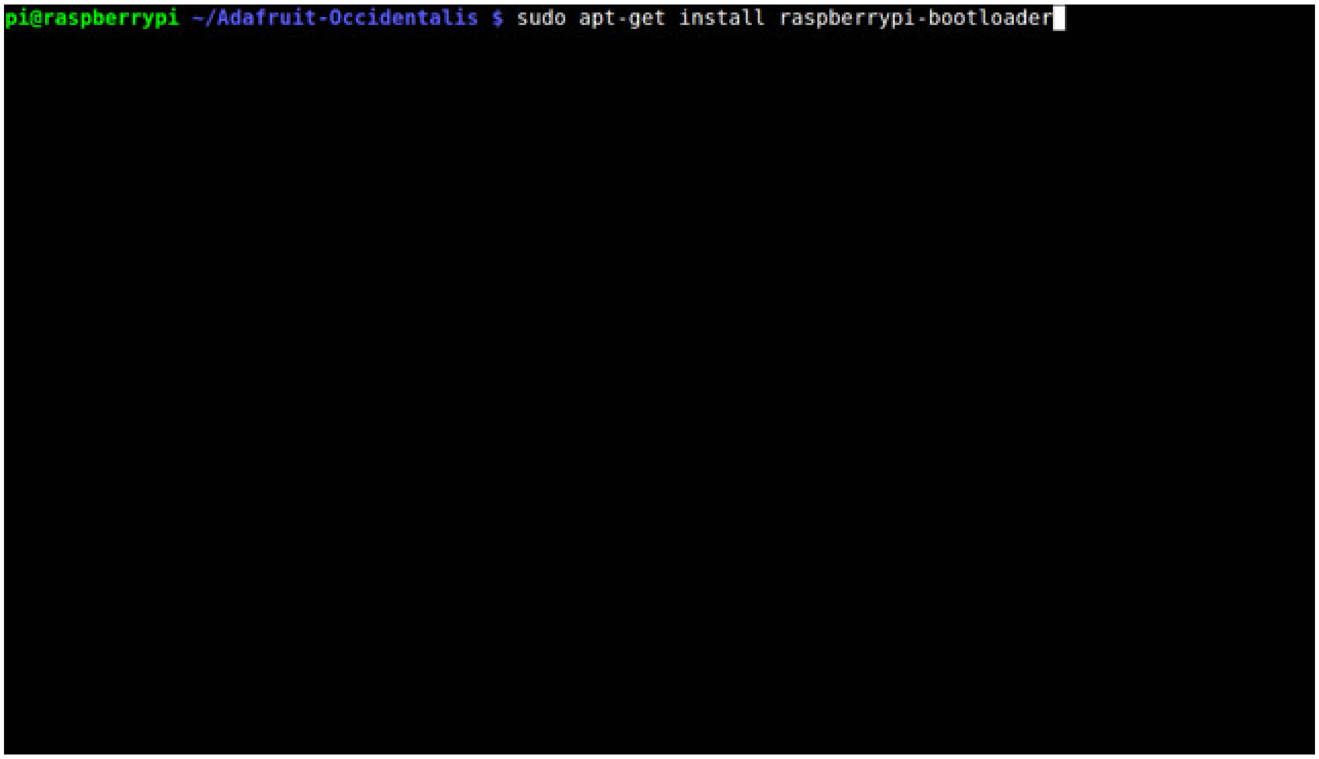
To add apt.adafruit.com to your list of software sources



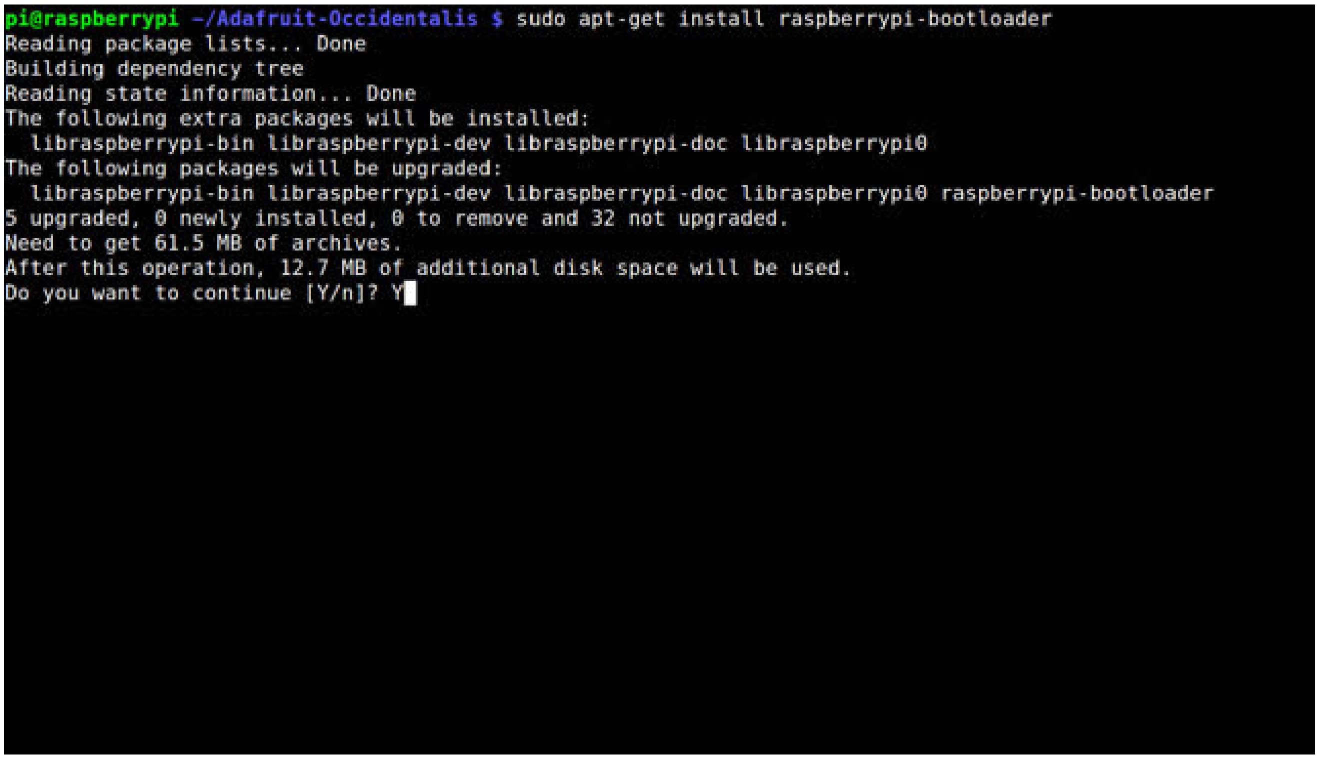
```
pi@raspberrypi ~ $ curl -SLs https://apt.adafruit.com/add-pin | sudo bash
```

Then install the kernel with

sudo apt-get install raspberrypi-bootloader



```
pi@raspberrypi ~/Adafruit-Occidentalis $ sudo apt-get install raspberrypi-bootloader
```



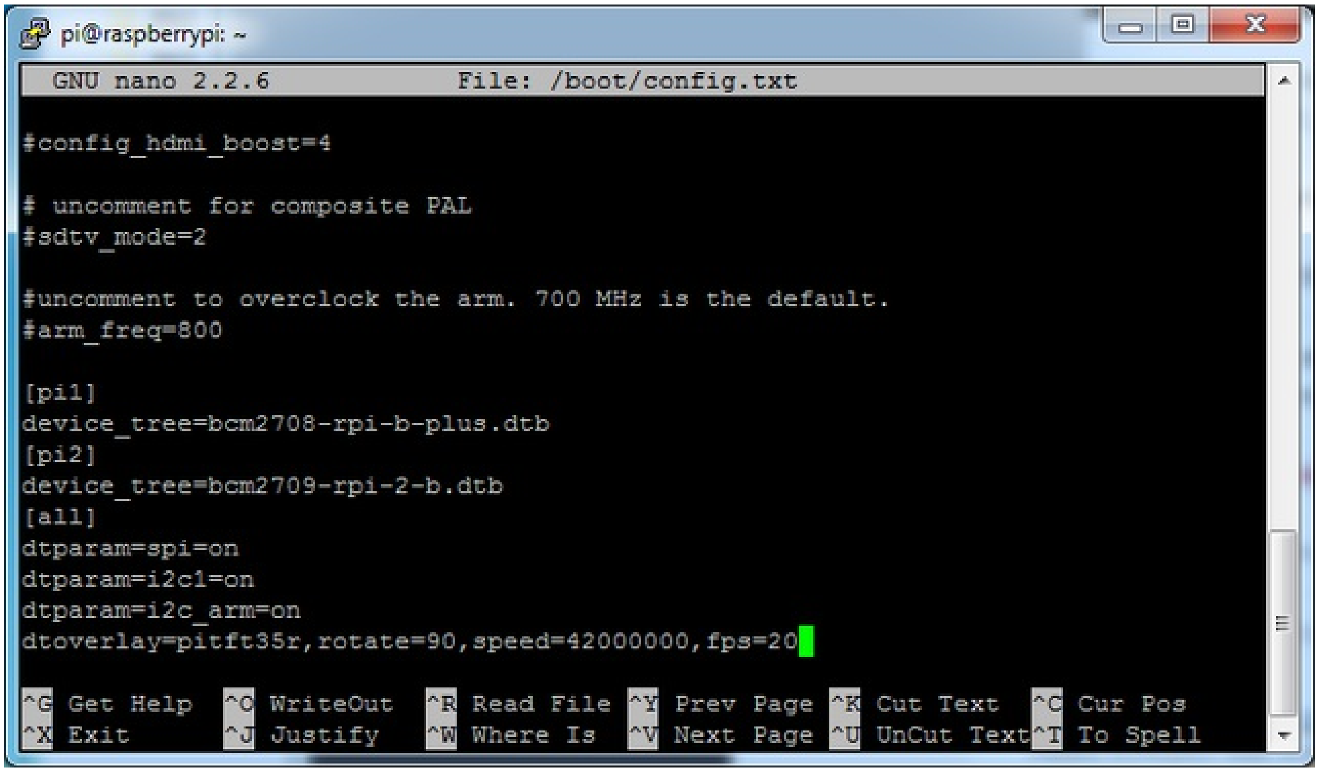
```
pi@raspberrypi ~/Adafruit-Occidentalis $ sudo apt-get install raspberrypi-bootloader
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  libraspberrypi-bin libraspberrypi-dev libraspberrypi-doc libraspberrypi0
The following packages will be upgraded:
  libraspberrypi-bin libraspberrypi-dev libraspberrypi-doc libraspberrypi0 raspberrypi-bootloader
5 upgraded, 0 newly installed, 0 to remove and 32 not upgraded.
Need to get 61.5 MB of archives.
After this operation, 12.7 MB of additional disk space will be used.
Do you want to continue [Y/n]? Y
```

OK since you're not going to run the helper, lets add the device tree overlay manually. Edit /boot/config.txt with

sudo nano /boot/config.txt

and add the following lines at the end:

```
[pi1]
device_tree=bcm2708-rpi-b-plus.dtb
[pi2]
device_tree=bcm2709-rpi-2-b.dtb
[all]
dtparam=spi=on
dtparam=i2c1=on
dtparam=i2c_arm=on
dtoverlay=pitft35r,rotate=90,speed=42000000,fps=20
```



```
  GNU nano 2.2.6            File: /boot/config.txt

#config_hdmi_boost=4

# uncomment for composite PAL
#sdtv_mode=2

#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800

[pi1]
device_tree=bcm2708-rpi-b-plus.dtb
[pi2]
device_tree=bcm2709-rpi-2-b.dtb
[all]
dtparam=spi=on
dtparam=i2c1=on
dtparam=i2c_arm=on
dtoverlay=pitft35r,rotate=90,speed=42000000,fps=20

^G Get Help  ^O WriteOut  ^R Read File ^Y Prev Page ^K Cut Text  ^C Cur Pos
^X Exit      ^J Justify   ^W Where Is  ^V Next Page ^U UnCut Text^T To Spell
```

The **rotate=** variable tells the driver to rotate the screen**0 90 180** or **270** degrees.
0 is portrait, with the bottom near theUSB jacks
90 is landscape, with the bottom of the screen near the headphone jack
180 is portrait, with the top near the USB jacks
270 is landscape, with the top of the screen near the headphone jack.
You can change this file with**nano** and reboot to make the change stick.

The **speed=** variable tells the driver how to fast to drive the display. 42MHz (**42000000**) is a good place to start but if your screen is acting funny, try taking it down to 16MHz (**16000000**) *especially* if you're doing something like using a GPIO extender to put the screen away from the Pi.

Save the file. Now we'll just reboot to let it all sink in.

> **sudo shutdown -h now** (if you don't have the TFT installed, shutdown, place the TFT on the Pi and re-power)

or

> **sudo reboot** (if you have the TFT plate installed already)

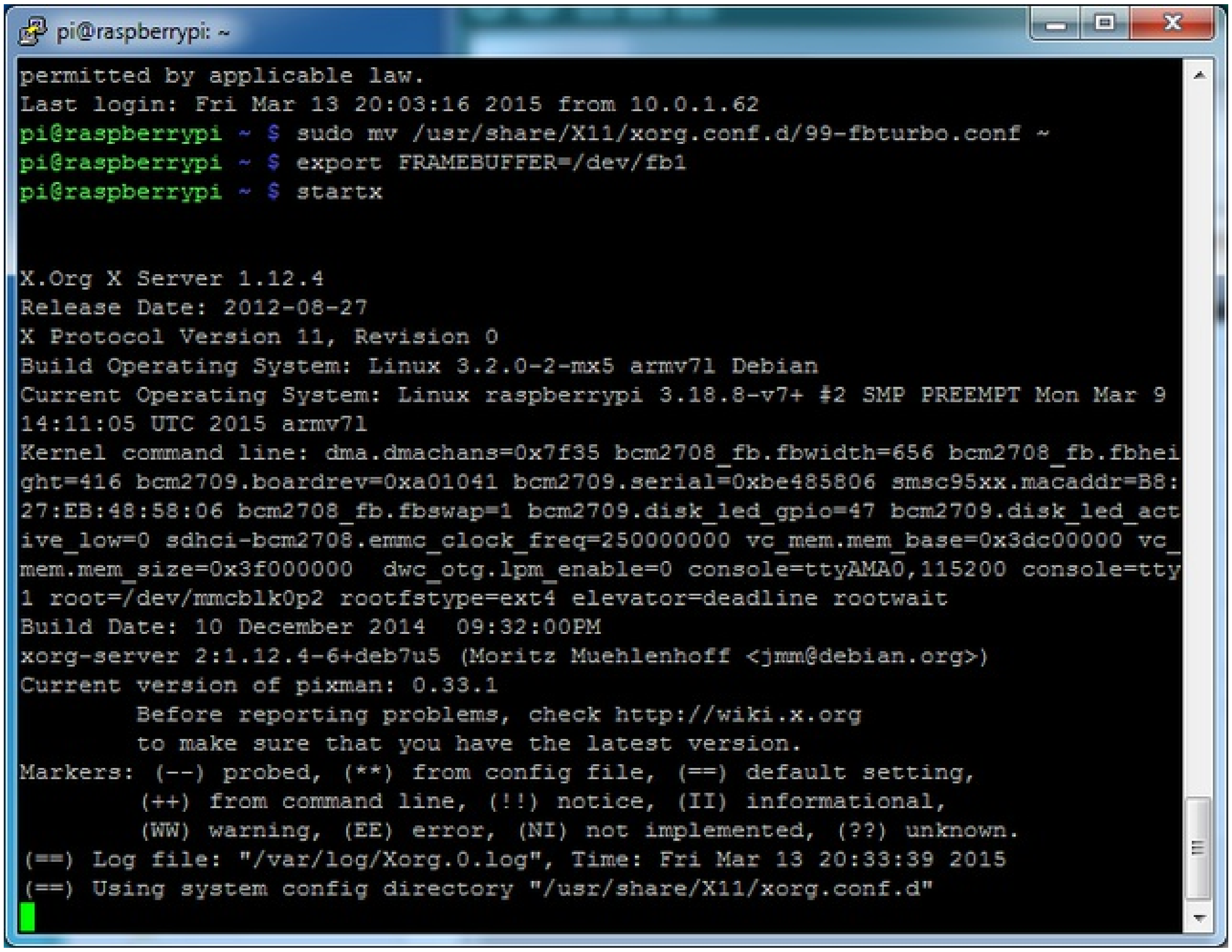
When the Pi restarts, the attached PiTFT should start out all white and then turn black. That means the kernel found the display and cleared the screen. If the screen did not turn black, that means that likely there's something up with your connection or kernel install.

Solder anything that needs resoldering!

Now that you're rebooted, log back in on the console/TV/SSH. There's nothing displayed on the screen yet, we'll do a test to make sure everything is perfect first!

Run the following commands to startx on the/**dev/fb1** framebuffer, a.k.a PiTFT screen:

```
sudo mv /usr/share/X11/xorg.conf.d/99-fbturbo.conf ~
export FRAMEBUFFER=/dev/fb1
startx
```



```
permitted by applicable law.
Last login: Fri Mar 13 20:03:16 2015 from 10.0.1.62
pi@raspberrypi ~ $ sudo mv /usr/share/X11/xorg.conf.d/99-fbturbo.conf ~
pi@raspberrypi ~ $ export FRAMEBUFFER=/dev/fb1
pi@raspberrypi ~ $ startx


X.Org X Server 1.12.4
Release Date: 2012-08-27
X Protocol Version 11, Revision 0
Build Operating System: Linux 3.2.0-2-mx5 armv7l Debian
Current Operating System: Linux raspberrypi 3.18.8-v7+ #2 SMP PREEMPT Mon Mar 9
14:11:05 UTC 2015 armv7l
Kernel command line: dma.dmachans=0x7f35 bcm2708_fb.fbwidth=656 bcm2708_fb.fbhei
ght=416 bcm2709.boardrev=0xa01041 bcm2709.serial=0xbe485806 smsc95xx.macaddr=B8:
27:EB:48:58:06 bcm2708_fb.fbswap=1 bcm2709.disk_led_gpio=47 bcm2709.disk_led_act
ive_low=0 sdhci-bcm2708.emmc_clock_freq=250000000 vc_mem.mem_base=0x3dc00000 vc_
mem.mem_size=0x3f000000  dwc_otg.lpm_enable=0 console=ttyAMA0,115200 console=tty
1 root=/dev/mmcblk0p2 rootfstype=ext4 elevator=deadline rootwait
Build Date: 10 December 2014  09:32:00PM
xorg-server 2:1.12.4-6+deb7u5 (Moritz Muehlenhoff <jmm@debian.org>)
Current version of pixman: 0.33.1
        Before reporting problems, check http://wiki.x.org
        to make sure that you have the latest version.
Markers: (--) probed, (**) from config file, (==) default setting,
        (++) from command line, (!!) notice, (II) informational,
        (WW) warning, (EE) error, (NI) not implemented, (??) unknown.
(==) Log file: "/var/log/Xorg.0.log", Time: Fri Mar 13 20:33:39 2015
(==) Using system config directory "/usr/share/X11/xorg.conf.d"
```

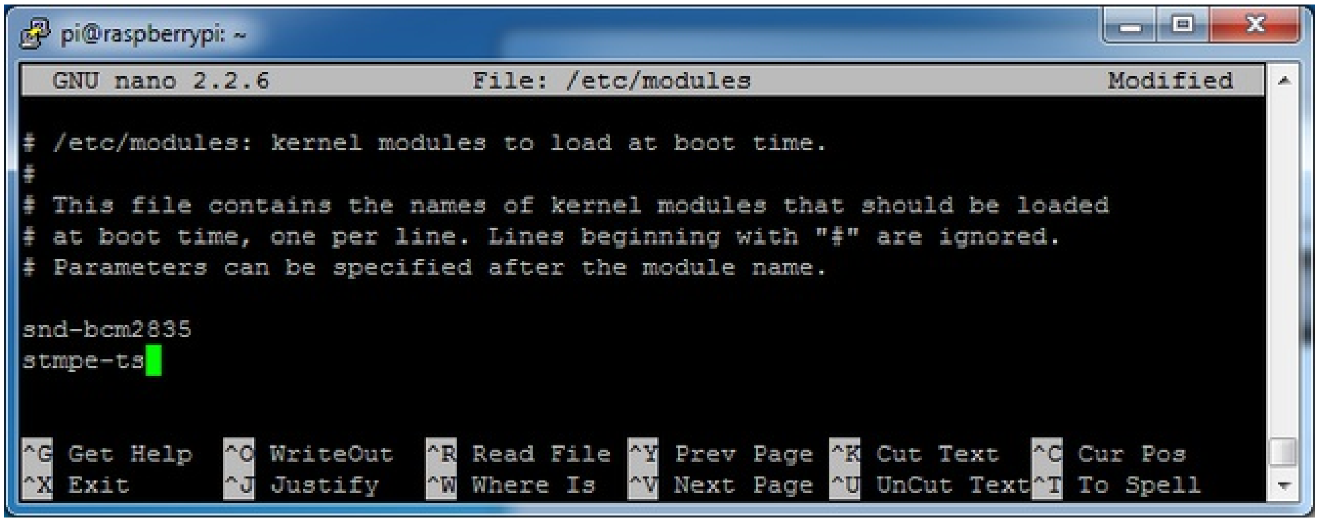
You should see the Pi desktop show up on the TFT! Congrats, you've completed the first test perfectly.

Hit Control-C in the console to quit the X server so we can continue configuration

Next up we'll add support for the touch screen automatically on boot. Edit the module list with

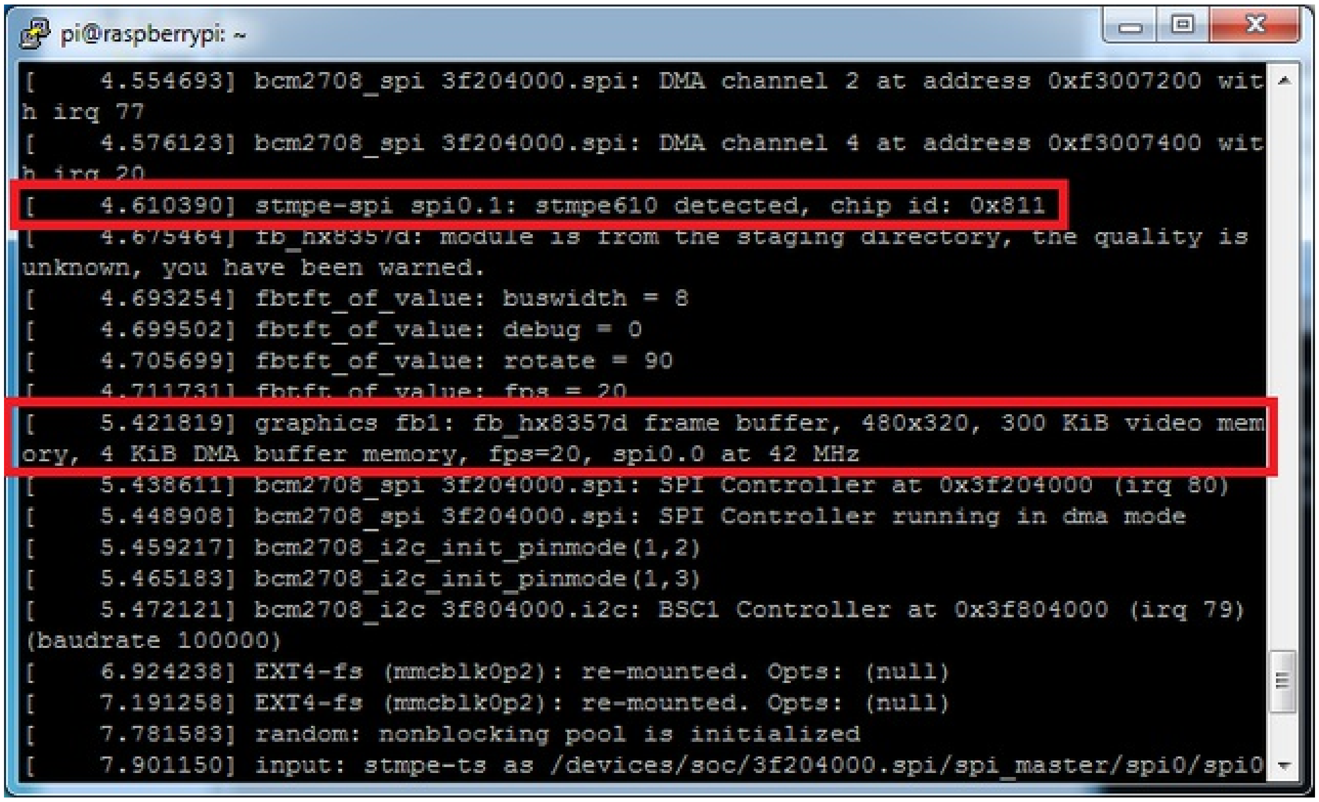
sudo nano /etc/modules

and add **stmpe-ts** on a line at the end



```
pi@raspberrypi: ~
  GNU nano 2.2.6              File: /etc/modules                       Modified

# /etc/modules: kernel modules to load at boot time.
#
# This file contains the names of kernel modules that should be loaded
# at boot time, one per line. Lines beginning with "#" are ignored.
# Parameters can be specified after the module name.

snd-bcm2835
stmpe-ts


^G Get Help   ^O WriteOut   ^R Read File  ^Y Prev Page  ^K Cut Text   ^C Cur Pos
^X Exit       ^J Justify    ^W Where Is   ^V Next Page  ^U UnCut Text^T To Spell
```

Save the file and reboot the Pi with**sudo reboot** and look at the console output (or run **dmesg** in the console window after logging in) you will see the modules install. Look in particular for the STMPE610 detection and the HX5387D screen frequency as highlighted here



```
pi@raspberrypi: ~
[    4.554693] bcm2708_spi 3f204000.spi: DMA channel 2 at address 0xf3007200 wit
h irq 77
[    4.576123] bcm2708_spi 3f204000.spi: DMA channel 4 at address 0xf3007400 wit
h irq 20
[    4.610390] stmpe-spi spi0.1: stmpe610 detected, chip id: 0x811
[    4.675464] fb_hx8357d: module is from the staging directory, the quality is
unknown, you have been warned.
[    4.693254] fbtft_of_value: buswidth = 8
[    4.699502] fbtft_of_value: debug = 0
[    4.705699] fbtft_of_value: rotate = 90
[    4.711731] fbtft_of_value: fps = 20
[    5.421819] graphics fb1: fb_hx8357d frame buffer, 480x320, 300 KiB video mem
ory, 4 KiB DMA buffer memory, fps=20, spi0.0 at 42 MHz
[    5.438611] bcm2708_spi 3f204000.spi: SPI Controller at 0x3f204000 (irq 80)
[    5.448908] bcm2708_spi 3f204000.spi: SPI Controller running in dma mode
[    5.459217] bcm2708_i2c_init_pinmode(1,2)
[    5.465183] bcm2708_i2c_init_pinmode(1,3)
[    5.472121] bcm2708_i2c 3f804000.i2c: BSC1 Controller at 0x3f804000 (irq 79)
(baudrate 100000)
[    6.924238] EXT4-fs (mmcblk0p2): re-mounted. Opts: (null)
[    7.191258] EXT4-fs (mmcblk0p2): re-mounted. Opts: (null)
[    7.781583] random: nonblocking pool is initialized
[    7.901150] input: stmpe-ts as /devices/soc/3f204000.spi/spi_master/spi0/spi0
```

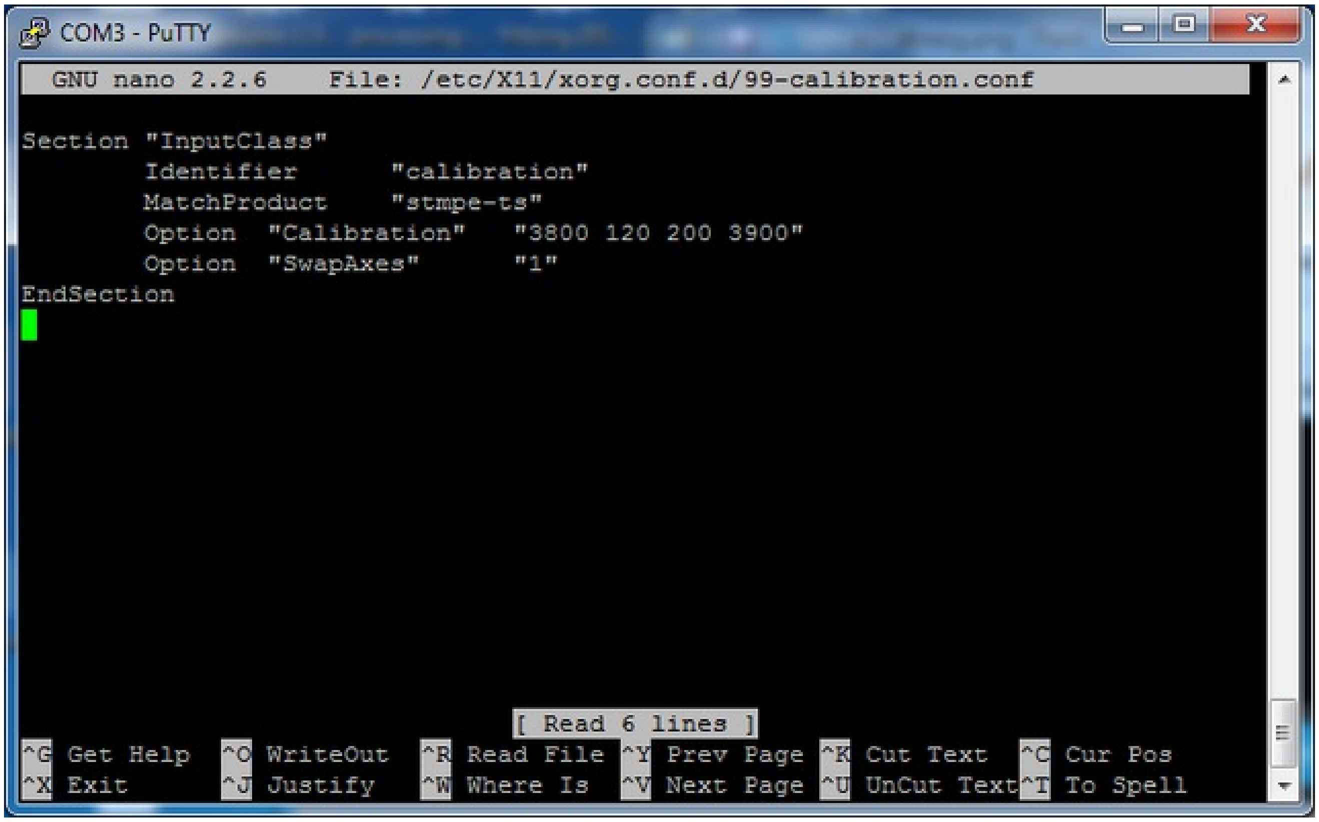
We can set up the touchscreen for**rotate=90** configuration by doing the following (for more

delicate calibration or for other rotate=XX values, see the next section)
Create the directory and new calibration configuration file:

```
sudo mkdir /etc/X11/xorg.conf.d
sudo nano /etc/X11/xorg.conf.d/99-calibration.conf
```

and enter in the following lines, then save.

```
Section "InputClass"
        Identifier      "calibration"
        MatchProduct    "stmpe-ts"
        Option  "Calibration"   "3800 120 200 3900"
        Option  "SwapAxes"      "1"
EndSection
```



```
  GNU nano 2.2.6    File: /etc/X11/xorg.conf.d/99-calibration.conf

Section "InputClass"
        Identifier      "calibration"
        MatchProduct    "stmpe-ts"
        Option  "Calibration"   "3800 120 200 3900"
        Option  "SwapAxes"      "1"
EndSection



                                [ Read 6 lines ]
^G Get Help   ^O WriteOut   ^R Read File  ^Y Prev Page  ^K Cut Text   ^C Cur Pos
^X Exit       ^J Justify    ^W Where Is   ^V Next Page  ^U UnCut Text^T To Spell
```

You can now try to run X again with

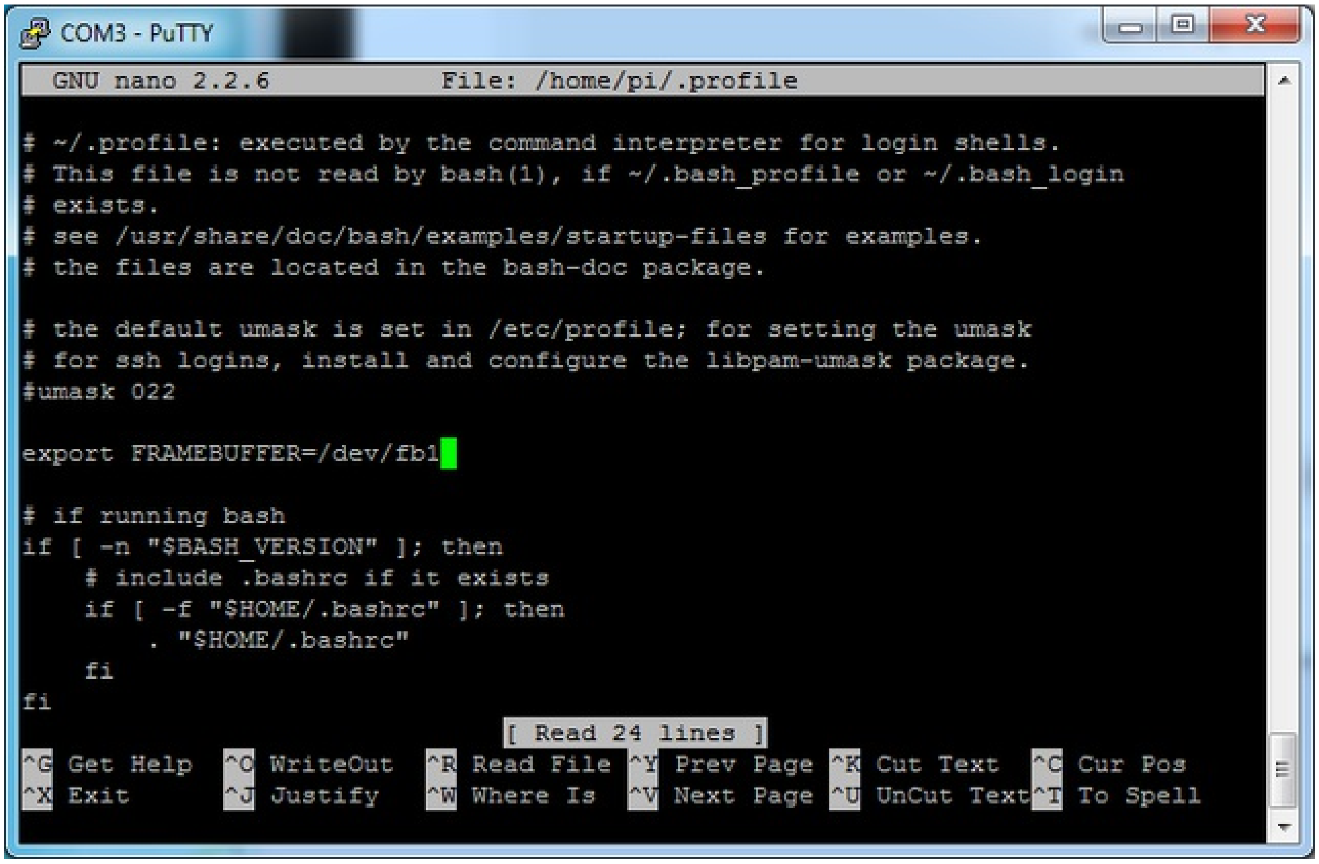
```
FRAMEBUFFER=/dev/fb1 startx
```

Type Control-C to quit **X**

If you don't ever want to have to type FRAMEBUFFER=/dev/fb1 before startx, you can make it a default state by editing your profile file: **sudo nano ~/.profile** and adding

```
export FRAMEBUFFER=/dev/fb1
```

near the top and saving the file. Then reboot to reload the profile file. It will now always assume you want to use /dev/fb1



```
  GNU nano 2.2.6            File: /home/pi/.profile

# ~/.profile: executed by the command interpreter for login shells.
# This file is not read by bash(1), if ~/.bash_profile or ~/.bash_login
# exists.
# see /usr/share/doc/bash/examples/startup-files for examples.
# the files are located in the bash-doc package.

# the default umask is set in /etc/profile; for setting the umask
# for ssh logins, install and configure the libpam-umask package.
#umask 022

export FRAMEBUFFER=/dev/fb1

# if running bash
if [ -n "$BASH_VERSION" ]; then
    # include .bashrc if it exists
    if [ -f "$HOME/.bashrc" ]; then
        . "$HOME/.bashrc"
    fi
fi
                               [ Read 24 lines ]
^G Get Help   ^O WriteOut   ^R Read File  ^Y Prev Page  ^K Cut Text   ^C Cur Pos
^X Exit       ^J Justify    ^W Where Is   ^V Next Page  ^U UnCut Text^T To Spell
```

Detailed Calibration

If you've grabbed our Easy Install image, or use the script, this step is not required, it's already done! This is just for advanced users who are curious on how to configure and customize the touchscreen

Setting up the Touchscreen

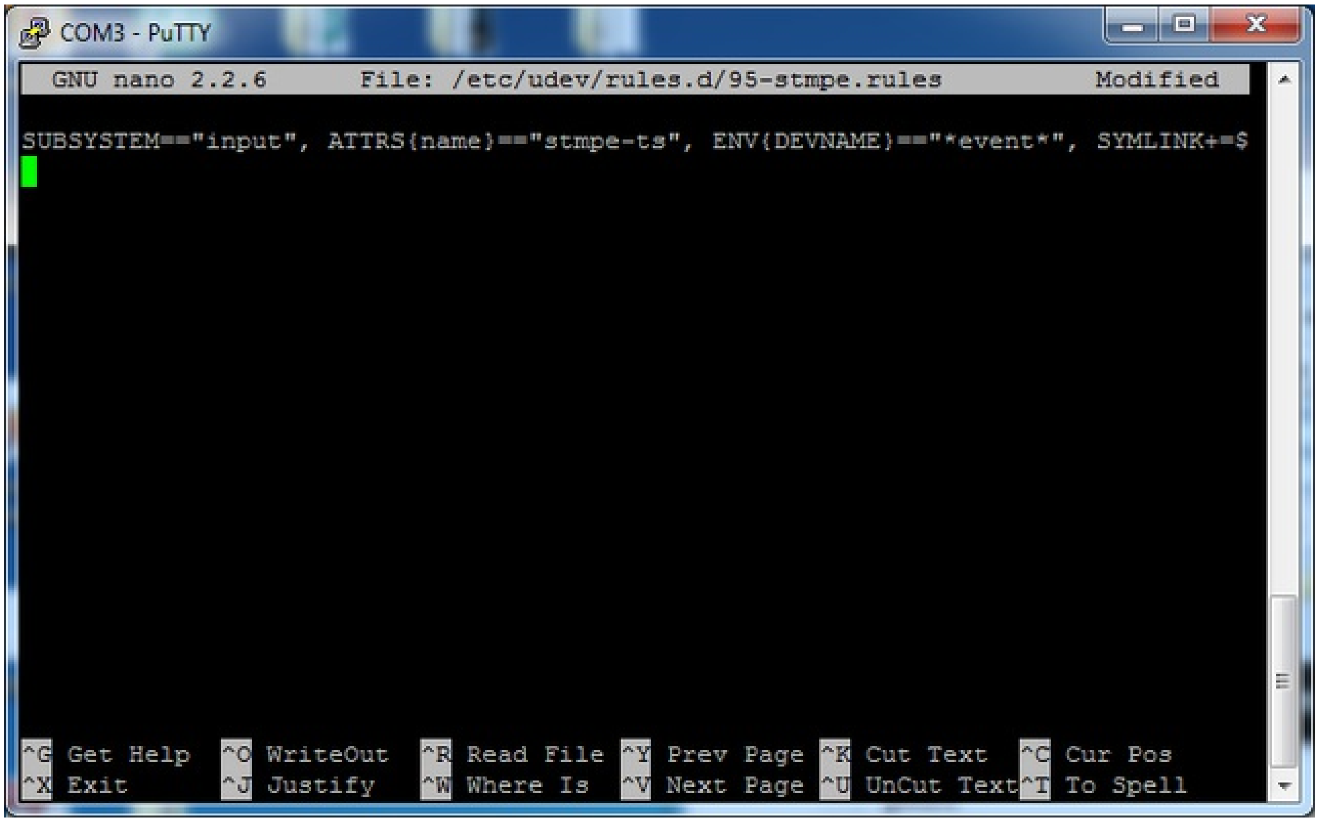
Now that the screen is working nicely, we'll take care of the touchscreen. There's just a bit of calibration to do, but it isn't hard at all.

Before we start, we'll make a **udev** rule for the touchscreen. That's because the **eventX** name of the device will change a lot and its annoying to figure out what its called depending on whether you have a keyboard or other mouse installed.

Run

sudo nano /etc/udev/rules.d/95-stmpe.rules

to create a new **udev** file and copy & paste the following line in:
SUBSYSTEM=="input", ATTRS{name}=="stmpe-ts", ENV{DEVNAME}=="*event*", SYMLINK+="input/touchscreen"



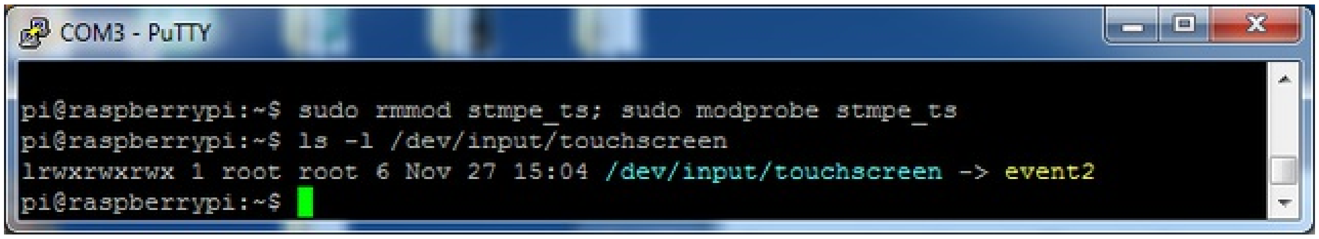
```
  GNU nano 2.2.6       File: /etc/udev/rules.d/95-stmpe.rules         Modified

SUBSYSTEM=="input", ATTRS{name}=="stmpe-ts", ENV{DEVNAME}=="*event*", SYMLINK+=$
```

COM3 - PuTTY
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell

Remove and re-install the touchscreen with

sudo rmmod stmpe_ts; sudo modprobe stmpe_ts

Then type **ls -l /dev/input/touchscreen**
It should point to **eventX** where X is some number, that number will be different on different setups since other keyboards/mice/USB devices will take up an event slot

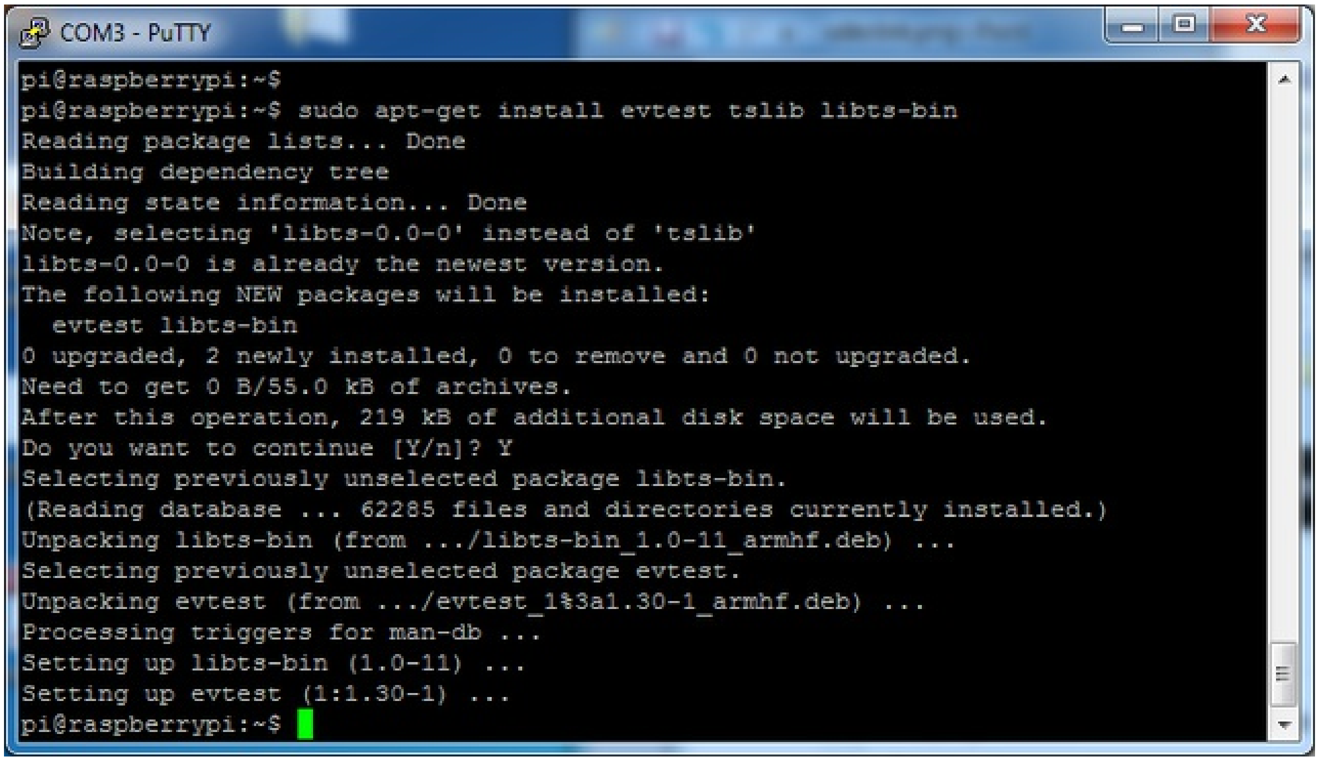


```
pi@raspberrypi:~$ sudo rmmod stmpe_ts; sudo modprobe stmpe_ts
pi@raspberrypi:~$ ls -l /dev/input/touchscreen
lrwxrwxrwx 1 root root 6 Nov 27 15:04 /dev/input/touchscreen -> event2
pi@raspberrypi:~$
```

There are some tools we can use to calibrate & debug the touchscreen. Install the "event

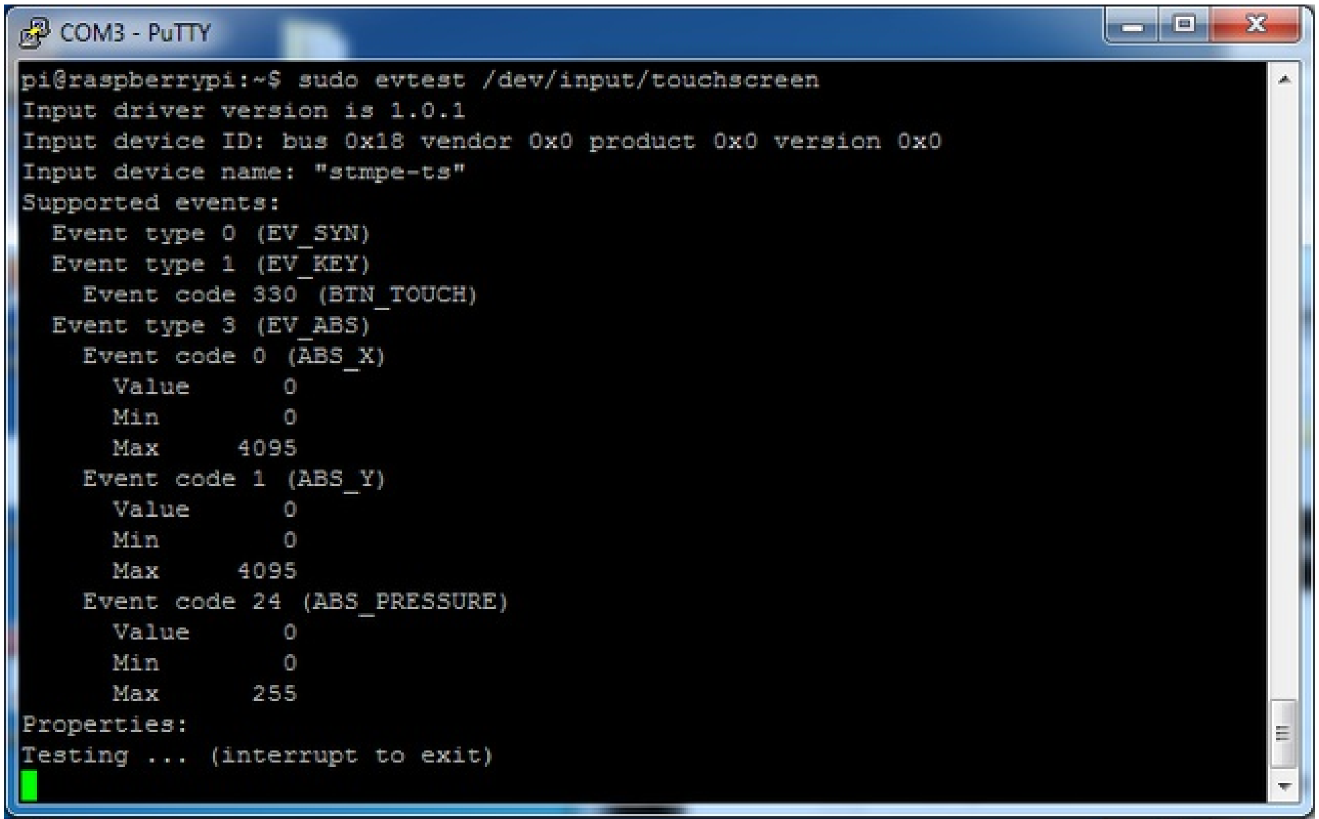
There are some tools we can use to calibrate & debug the touchscreen. Install the "event test" and "touchscreen library" packages with

sudo apt-get install evtest tslib libts-bin

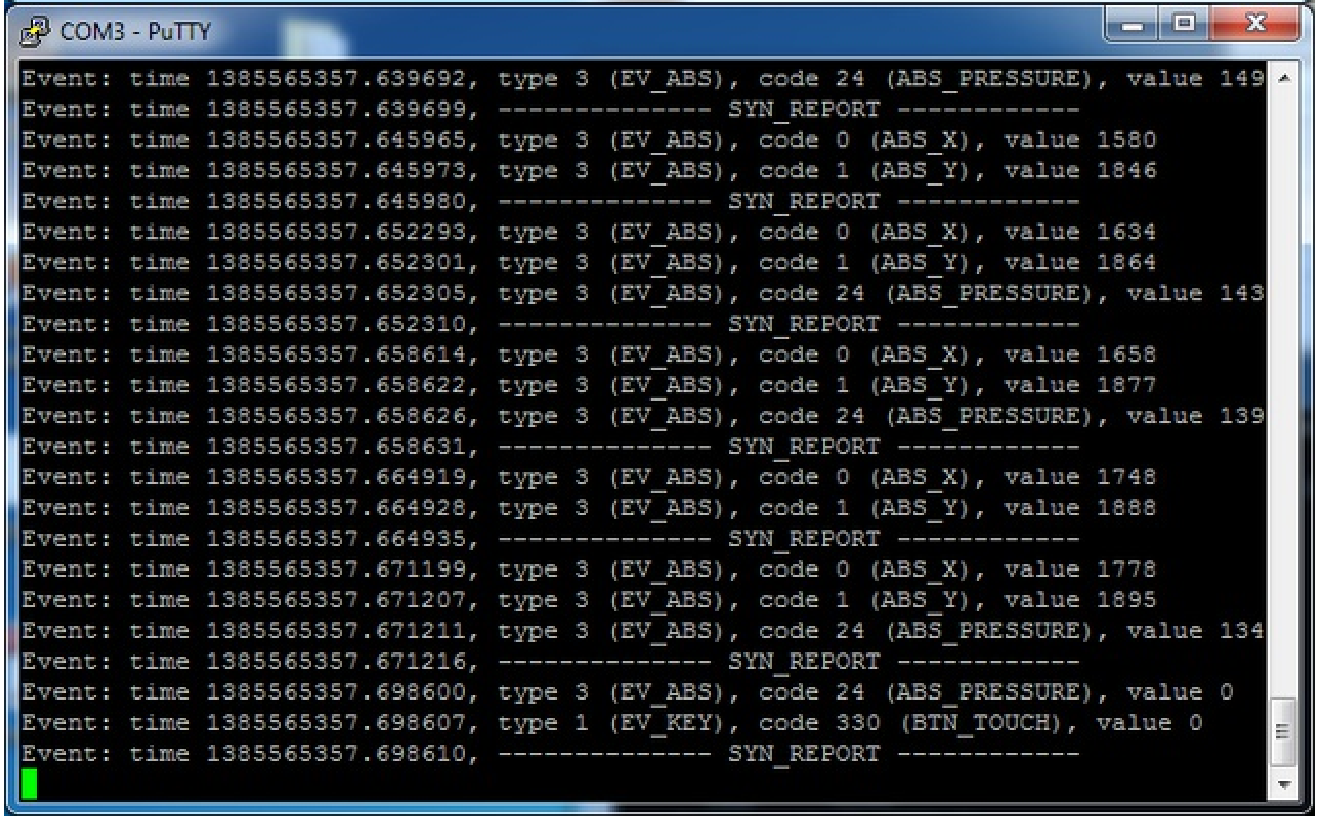


```
pi@raspberrypi:~$
pi@raspberrypi:~$ sudo apt-get install evtest tslib libts-bin
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'libts-0.0-0' instead of 'tslib'
libts-0.0-0 is already the newest version.
The following NEW packages will be installed:
  evtest libts-bin
0 upgraded, 2 newly installed, 0 to remove and 0 not upgraded.
Need to get 0 B/55.0 kB of archives.
After this operation, 219 kB of additional disk space will be used.
Do you want to continue [Y/n]? Y
Selecting previously unselected package libts-bin.
(Reading database ... 62285 files and directories currently installed.)
Unpacking libts-bin (from .../libts-bin_1.0-11_armhf.deb) ...
Selecting previously unselected package evtest.
Unpacking evtest (from .../evtest_1%3a1.30-1_armhf.deb) ...
Processing triggers for man-db ...
Setting up libts-bin (1.0-11) ...
Setting up evtest (1:1.30-1) ...
pi@raspberrypi:~$
```

Now you can use some tools such as **sudo evtest /dev/input/touchscreen** which will let you see touchscreen events in real time, press on the touchscreen to see the reports.



```
pi@raspberrypi:~$ sudo evtest /dev/input/touchscreen
Input driver version is 1.0.1
Input device ID: bus 0x18 vendor 0x0 product 0x0 version 0x0
Input device name: "stmpe-ts"
Supported events:
  Event type 0 (EV_SYN)
  Event type 1 (EV_KEY)
    Event code 330 (BTN_TOUCH)
  Event type 3 (EV_ABS)
    Event code 0 (ABS_X)
      Value      0
      Min        0
      Max     4095
    Event code 1 (ABS_Y)
      Value      0
      Min        0
      Max     4095
    Event code 24 (ABS_PRESSURE)
      Value      0
      Min        0
      Max      255
Properties:
Testing ... (interrupt to exit)
```



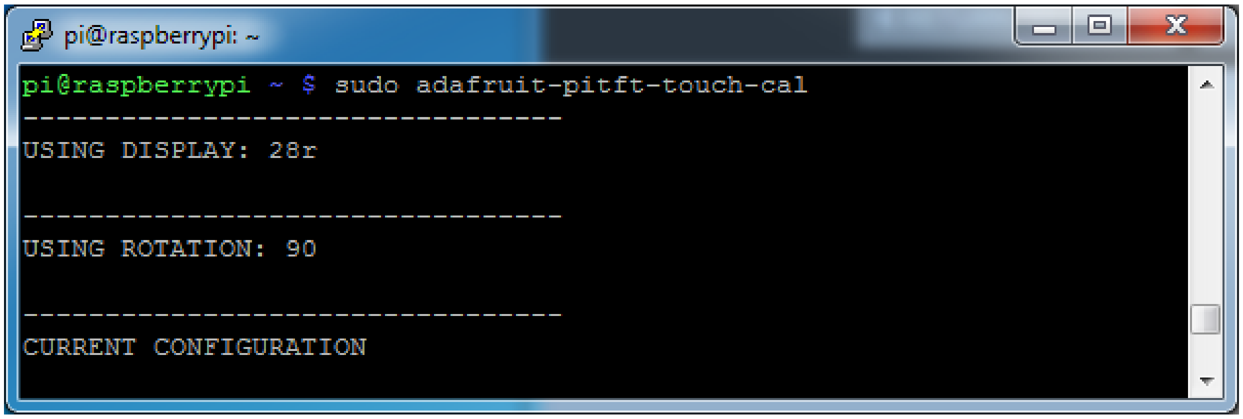
```
Event: time 1385565357.639692, type 3 (EV_ABS), code 24 (ABS_PRESSURE), value 149
Event: time 1385565357.639699, -------------- SYN_REPORT ------------
Event: time 1385565357.645965, type 3 (EV_ABS), code 0 (ABS_X), value 1580
Event: time 1385565357.645973, type 3 (EV_ABS), code 1 (ABS_Y), value 1846
Event: time 1385565357.645980, -------------- SYN_REPORT ------------
Event: time 1385565357.652293, type 3 (EV_ABS), code 0 (ABS_X), value 1634
Event: time 1385565357.652301, type 3 (EV_ABS), code 1 (ABS_Y), value 1864
Event: time 1385565357.652305, type 3 (EV_ABS), code 24 (ABS_PRESSURE), value 143
Event: time 1385565357.652310, -------------- SYN_REPORT ------------
Event: time 1385565357.658614, type 3 (EV_ABS), code 0 (ABS_X), value 1658
Event: time 1385565357.658622, type 3 (EV_ABS), code 1 (ABS_Y), value 1877
Event: time 1385565357.658626, type 3 (EV_ABS), code 24 (ABS_PRESSURE), value 139
Event: time 1385565357.658631, -------------- SYN_REPORT ------------
Event: time 1385565357.664919, type 3 (EV_ABS), code 0 (ABS_X), value 1748
Event: time 1385565357.664928, type 3 (EV_ABS), code 1 (ABS_Y), value 1888
Event: time 1385565357.664935, -------------- SYN_REPORT ------------
Event: time 1385565357.671199, type 3 (EV_ABS), code 0 (ABS_X), value 1778
Event: time 1385565357.671207, type 3 (EV_ABS), code 1 (ABS_Y), value 1895
Event: time 1385565357.671211, type 3 (EV_ABS), code 24 (ABS_PRESSURE), value 134
Event: time 1385565357.671216, -------------- SYN_REPORT ------------
Event: time 1385565357.698600, type 3 (EV_ABS), code 24 (ABS_PRESSURE), value 0
Event: time 1385565357.698607, type 1 (EV_KEY), code 330 (BTN_TOUCH), value 0
Event: time 1385565357.698610, -------------- SYN_REPORT ------------
```

AutoMagic Calibration Script

If you rotate the display you need to recalibrate the touchscreen to work with the new screen orientation. You can manually run the calibration processes in the next section, or you can run a small Python script which will automatically set a default touchscreen calibration based on the screen orientation.

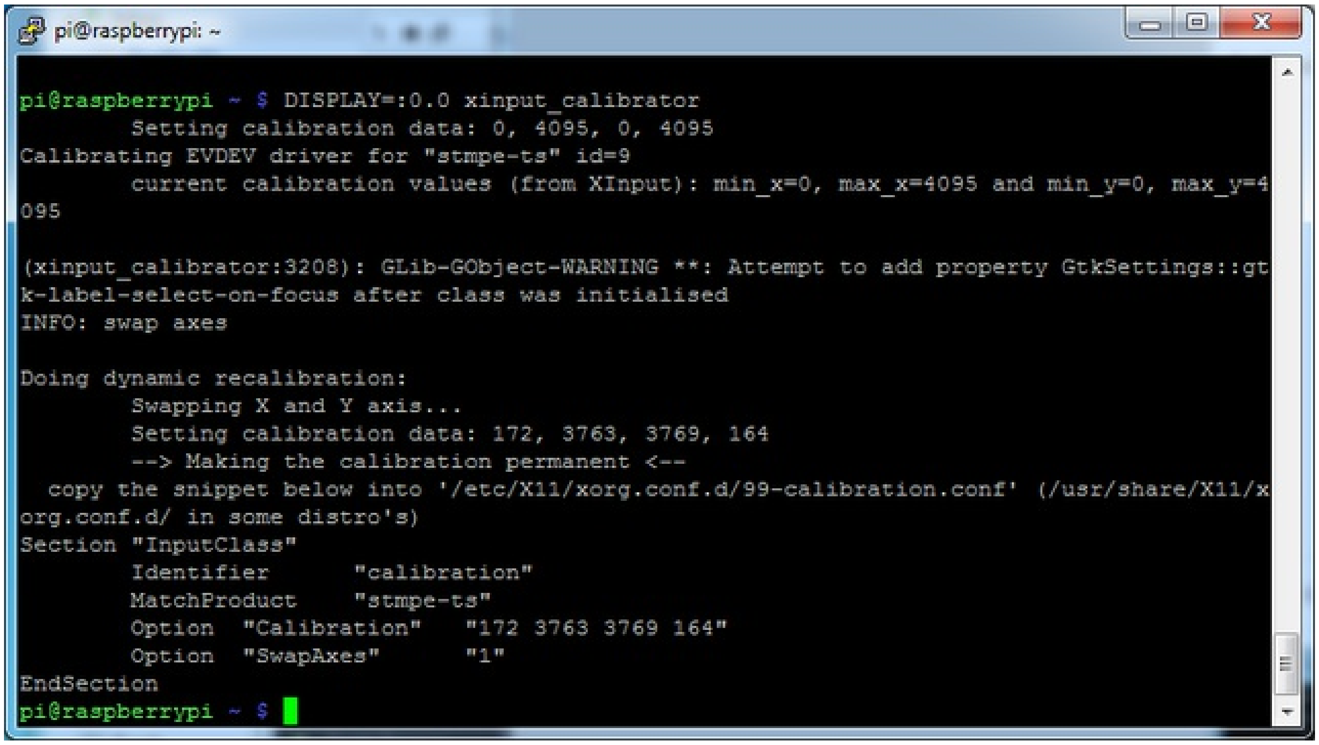
This helper is automatically installed for you but if you'd like you can check it out here on github (http://adafru.it/elu)

Run it at the command line with**sudo adafruit-pitft-touch-cal**
it will try to figure out what display you have installed and the rotation it's set up for



```
pi@raspberrypi ~ $ sudo adafruit-pitft-touch-cal
---------------------------------
USING DISPLAY: 28r

---------------------------------
USING ROTATION: 90

---------------------------------
CURRENT CONFIGURATION
```

By default the script will attempt to read the screen orientation by examining the PiTFT module configuration with modprobe. If the script can read the orientation it will print out the current orientation, the current touchscreen calibration values, and the new touchscreen calibration values baesd on the current orientation. Before updating the calibration the script will ask you to confirm that you'd like to make the change. Press **y** and enter to confirm.



```
pi@raspberrypi ~ $ DISPLAY=:0.0 xinput_calibrator
        Setting calibration data: 0, 4095, 0, 4095
Calibrating EVDEV driver for "stmpe-ts" id=9
        current calibration values (from XInput): min_x=0, max_x=4095 and min_y=0, max_y=4
095

(xinput_calibrator:3208): GLib-GObject-WARNING **: Attempt to add property GtkSettings::gt
k-label-select-on-focus after class was initialised
INFO: swap axes

Doing dynamic recalibration:
        Swapping X and Y axis...
        Setting calibration data: 172, 3763, 3769, 164
        --> Making the calibration permanent <--
  copy the snippet below into '/etc/X11/xorg.conf.d/99-calibration.conf' (/usr/share/X11/x
org.conf.d/ in some distro's)
Section "InputClass"
        Identifier      "calibration"
        MatchProduct    "stmpe-ts"
        Option  "Calibration"   "172 3763 3769 164"
        Option  "SwapAxes"      "1"
EndSection
pi@raspberrypi ~ $ 
```

Try using this default calibration script to easily calibrate your touchscreen display. Note that the calibration values might not be exactly right for your display, but they should be close enough for most needs. If you need the most accurate touchscreen calibration, follow the steps in the next section to manually calibrate the touchscreen.

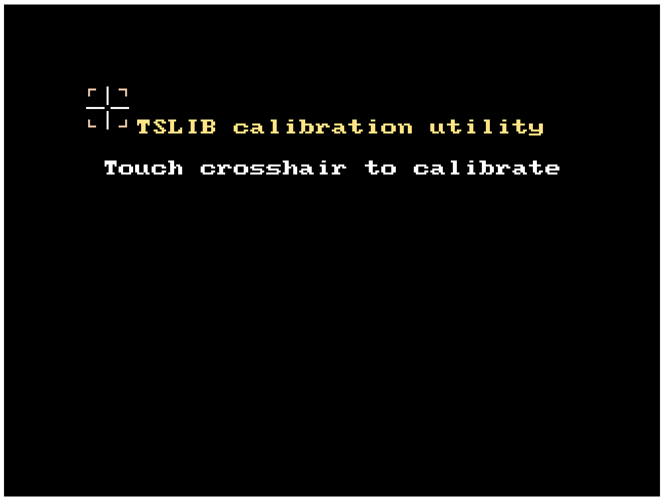
Manual Calibration

If you rotate the display you have some other setup where you need to carefully calibrate you can do it 'manually'

You will want to calibrate the screen once but shouldn't have to do it more than that. We'll begin by calibrating on the command line by running

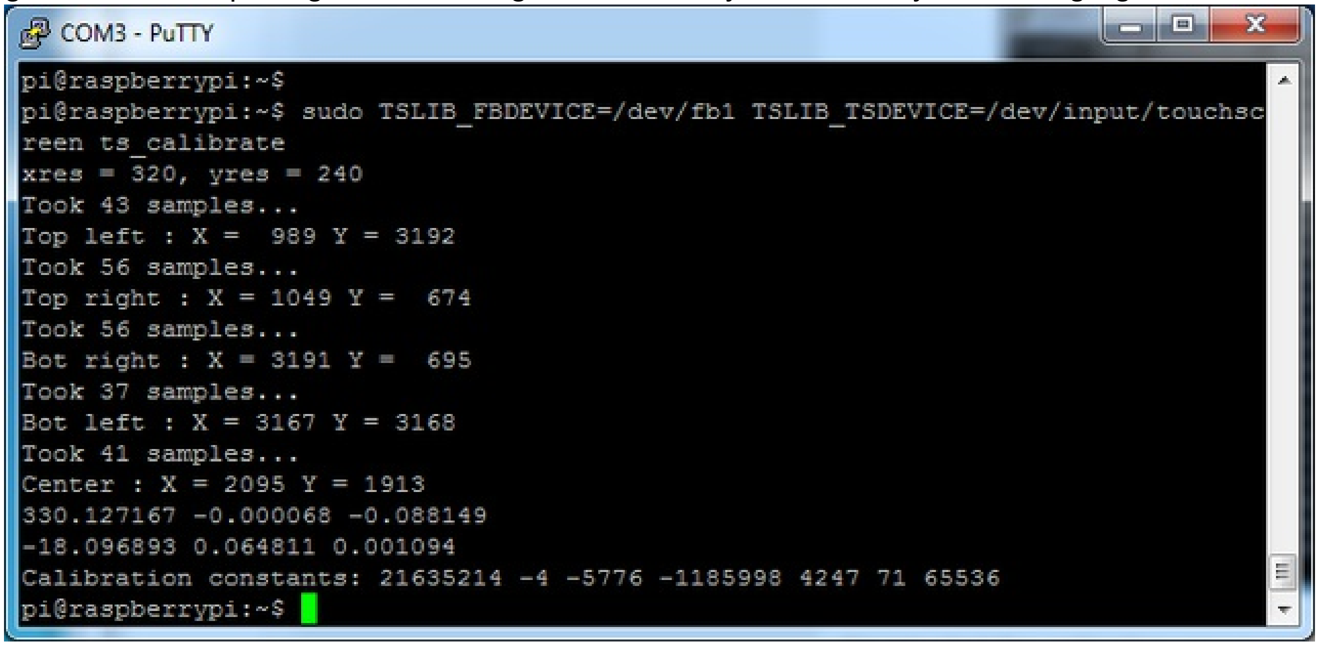
sudo TSLIB_FBDEVICE=/dev/fb1 TSLIB_TSDEVICE=/dev/input/touchscreen ts_calibrate

follow the directions on the screen, touching each point. Using a stylus is suggested so you get a precise touch. Don't use something metal, plastic only!



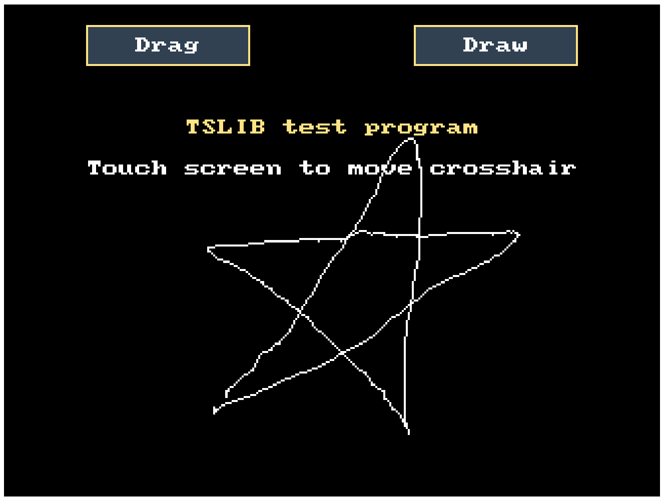
```
TSLIB calibration utility
Touch crosshair to calibrate
```

You should see five crosshair targets. If you see less than that, the touchscreen probably generated multiple signals for a single touch, and you should try calibrating again.



```
pi@raspberrypi:~$
pi@raspberrypi:~$ sudo TSLIB_FBDEVICE=/dev/fb1 TSLIB_TSDEVICE=/dev/input/touchsc
reen ts_calibrate
xres = 320, yres = 240
Took 43 samples...
Top left : X =  989 Y = 3192
Took 56 samples...
Top right : X = 1049 Y =  674
Took 56 samples...
Bot right : X = 3191 Y =  695
Took 37 samples...
Bot left : X = 3167 Y = 3168
Took 41 samples...
Center : X = 2095 Y = 1913
330.127167 -0.000068 -0.088149
-18.096893 0.064811 0.001094
Calibration constants: 21635214 -4 -5776 -1185998 4247 71 65536
pi@raspberrypi:~$
```

Next you can run **sudo TSLIB_FBDEVICE=/dev/fb1 TSLIB_TSDEVICE=/dev/input/touchscreen ts_test** which will let you draw-test the touch screen. Go back and re-calibrate if you feel the screen isn't precise enough!



X Calibration

You can also calibrate the X input system but you have to use a different program called **xinput_calibrator**

You can do this if the calibration on the screen isnt to your liking or any time you change the **rotate=XX** module settings for the screen. Since the screen and touch driver are completely separated, the touchscreen doesn't auto-rotate

Normally you'd have to compile it but we have a ready to go package for you so run:

```
wget http://adafruit-download.s3.amazonaws.com/xinput-calibrator_0.7.5-1_armhf.deb
sudo dpkg -i -B xinput-calibrator_0.7.5-1_armhf.deb
```

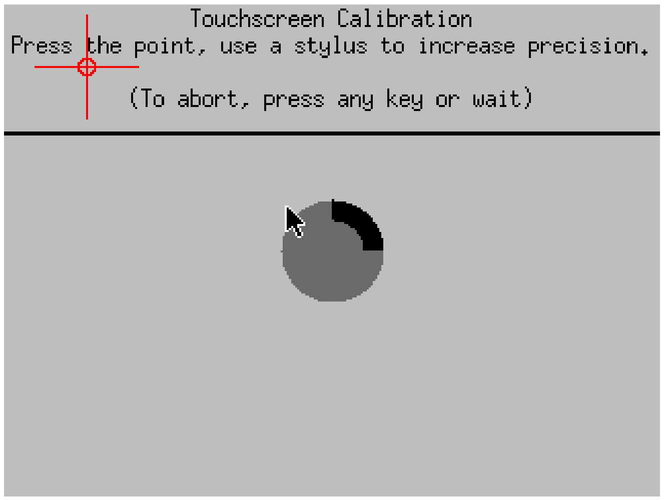
Before you start the xinput_calibrator you will need to delete the old calibration data so run

```
sudo rm /etc/X11/xorg.conf.d/99-calibration.conf
```

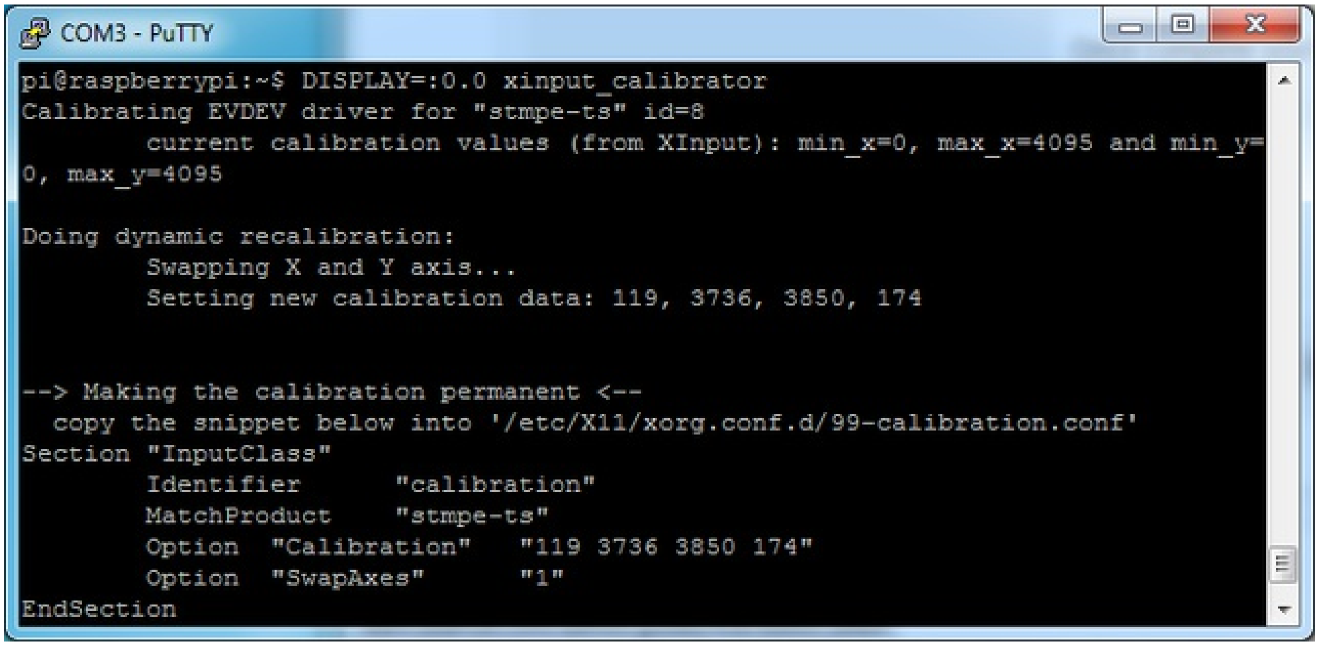
Before running **startx** and the calibrator - otherwise it gets really confused!
Now you'll have to run the xcalibrator while also running X. You can do this by **startx** and then opening up the terminal program and running the **xinput_calibrator** command (which is challenging to do on such a small screen) OR you can do what we do which is run startx in a SSH/Terminal shell and then run the xinput_calibrator from the same shell, which requires the following command order:

```
FRAMEBUFFER=/dev/fb1 startx &
DISPLAY=:0.0 xinput_calibrator
```

Follow the directions on screen


Touchscreen Calibration
Press the point, use a stylus to increase precision.
(To abort, press any key or wait)

Once complete you'll get something like:



```
pi@raspberrypi:~$ DISPLAY=:0.0 xinput_calibrator
Calibrating EVDEV driver for "stmpe-ts" id=8
        current calibration values (from XInput): min_x=0, max_x=4095 and min_y=
0, max_y=4095

Doing dynamic recalibration:
        Swapping X and Y axis...
        Setting new calibration data: 119, 3736, 3850, 174


--> Making the calibration permanent <--
  copy the snippet below into '/etc/X11/xorg.conf.d/99-calibration.conf'
Section "InputClass"
        Identifier      "calibration"
        MatchProduct    "stmpe-ts"
        Option  "Calibration"   "119 3736 3850 174"
        Option  "SwapAxes"      "1"
EndSection
```

Run **sudo nano /etc/X11/xorg.conf.d/99-calibration.conf** and copy the

```
Section "InputClass"
    Identifier      "calibration"
    MatchProduct    "stmpe-ts"
    Option  "Calibration"   "119 3736 3850 174"
#       Option  "SwapAxes"      "1"
EndSection
```

or whatever you got, into there. You can quit X if you want by typing**fg** to bring that command into the foreground, and then Control-C to quit.

Depending on the 'rotation' of the screen, when you do this calibration, you may need to comment out the SwapAxes part with a # and/or **swap the numbers around so**

looks like:

- Option "Calibration" "119 3736 3850 174"

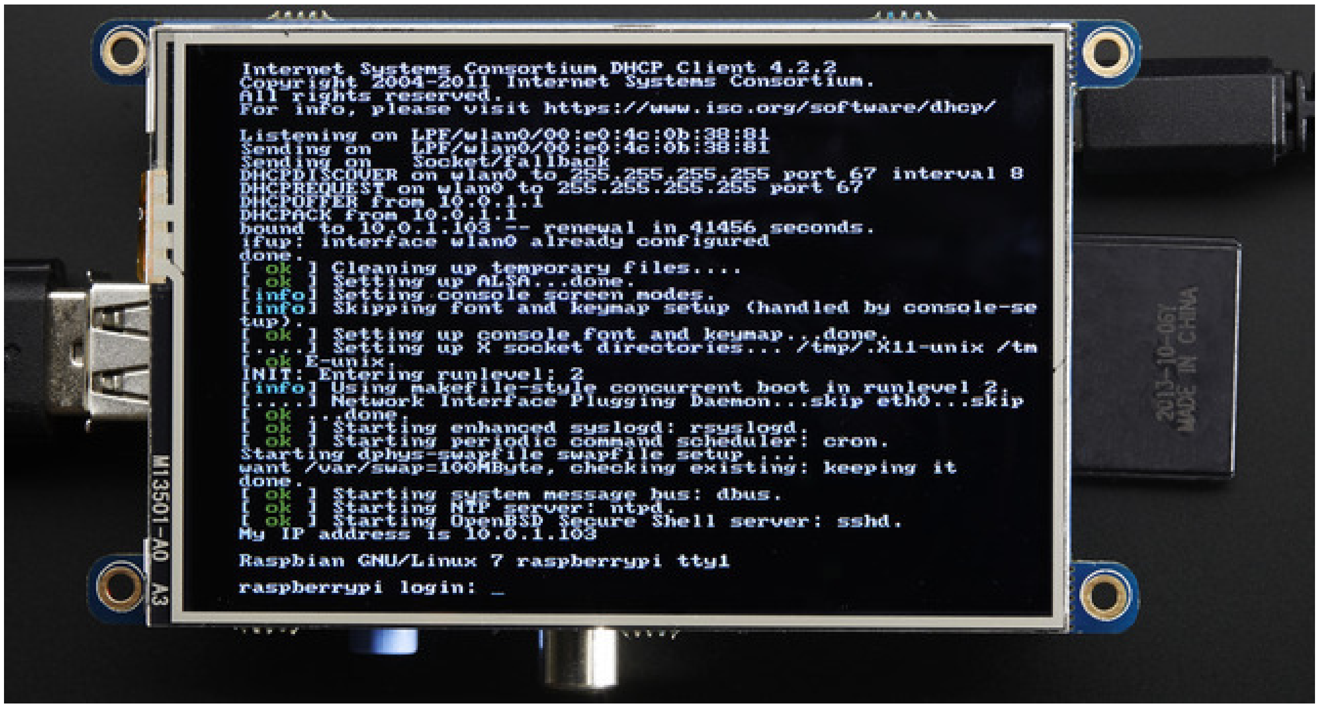
to

- Option "Calibration" "3736 119 174 3850"

Your touchscreen is now super calibrated, hurrah!

Detailed Console Use

If you've grabbed our Easy Install image, or use the script, this step is not required, it's already done! This is just for advanced users who are curious on how to configure and customize the console



```
Internet Systems Consortium DHCP Client 4.2.2
Copyright 2004-2011 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

Listening on LPF/wlan0/00:e0:4c:0b:38:81
Sending on   LPF/wlan0/00:e0:4c:0b:38:81
Sending on   Socket/fallback
DHCPDISCOVER on wlan0 to 255.255.255.255 port 67 interval 8
DHCPREQUEST on wlan0 to 255.255.255.255 port 67
DHCPOFFER from 10.0.1.1
DHCPACK from 10.0.1.1
bound to 10.0.1.103 -- renewal in 41456 seconds.
ifup: interface wlan0 already configured
done.
[ ok ] Cleaning up temporary files....
[ ok ] Setting up ALSA...done.
[info] Setting console screen modes.
[info] Skipping font and keymap setup (handled by console-se
tup).
[ ok ] Setting up console font and keymap...done.
[....] Setting up X socket directories... /tmp/.X11-unix /tm
[ ok E-unix.
INIT: Entering runlevel: 2
[info] Using makefile-style concurrent boot in runlevel 2.
[....] Network Interface Plugging Daemon...skip eth0...skip
[ ok ...done.
[ ok ] Starting enhanced syslogd: rsyslogd.
[ ok ] Starting periodic command scheduler: cron.
Starting dphys-swapfile swapfile setup ...
want /var/swap=100MByte, checking existing: keeping it
done.
[ ok ] Starting system message bus: dbus.
[ ok ] Starting NTP server: ntpd.
[ ok ] Starting OpenBSD Secure Shell server: sshd.
My IP address is 10.0.1.103

Raspbian GNU/Linux 7 raspberrypi tty1

raspberrypi login: _
```

One fun thing you can do with the display is have it as your main console instead of the HDMI/TV output. Even though it is small, with a good font you can get 40 x 60 of text. For more details, check out https://github.com/notro/fbtft/wiki/Boot-console (http://adafru.it/cXQ)

First up, we'll update the boot configuration file to use the TFT framebuffer**/dev/fb1** instead of the HDMI/TV framebuffer /**dev/fb0**

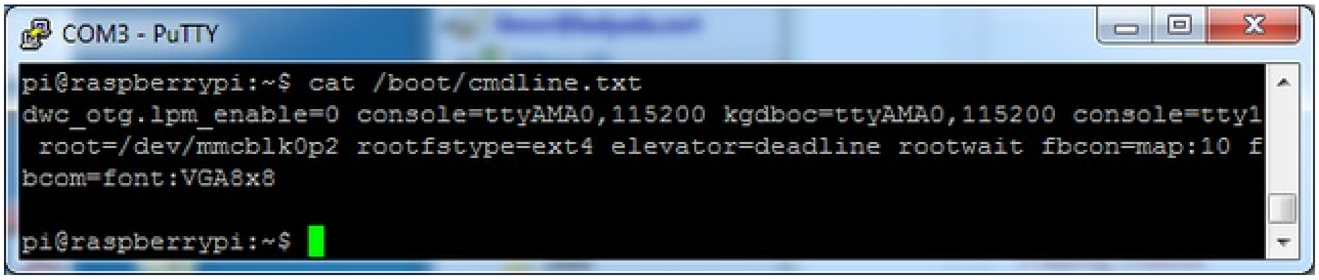
```
sudo nano /boot/cmdline.txt
```

you can also edit it by putting the SD card into a computer and opening the same file.

At the end of the line, find the text that says**rootwait** and right after that, enter in: **fbcon=map:10 fbcon=font:VGA8x8** then save the file.

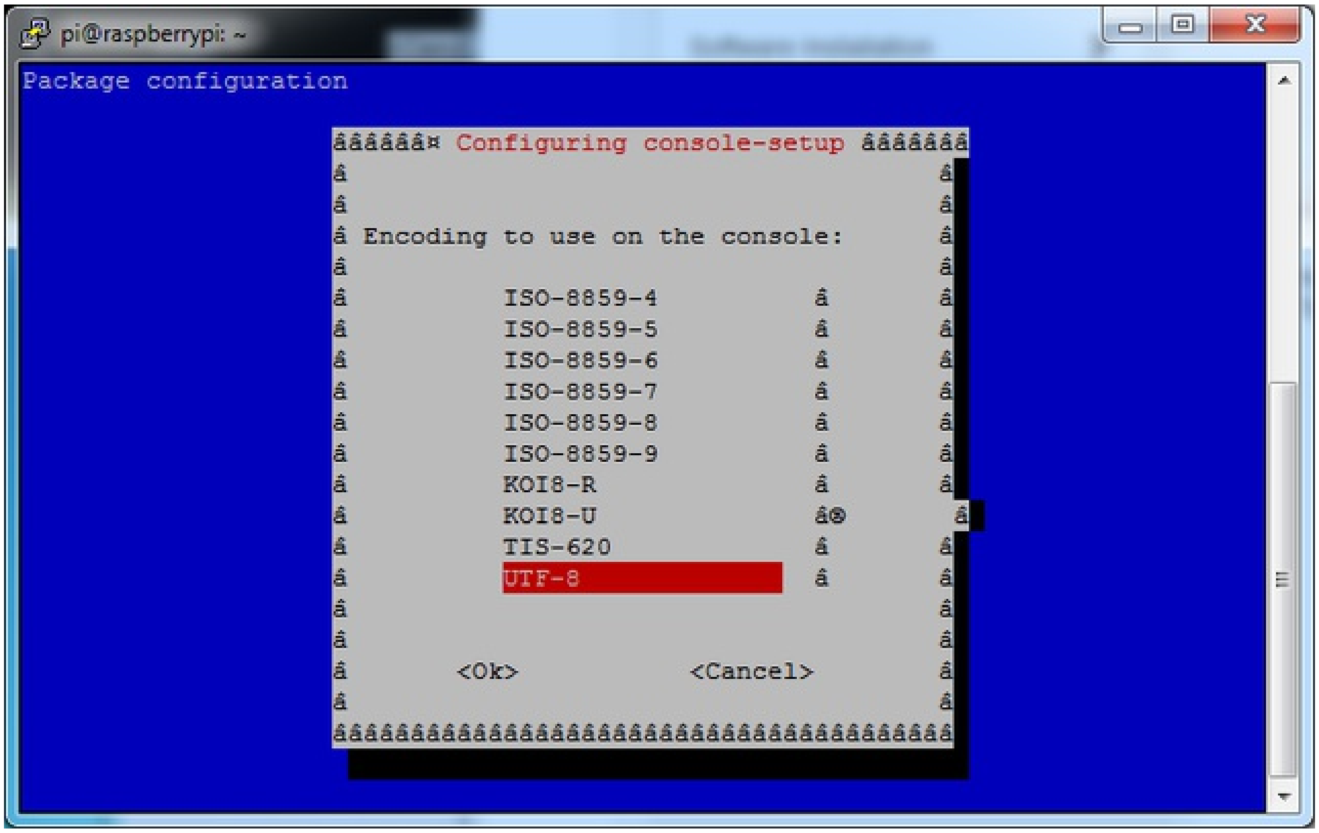
On the next boot, it will bring up the console.

Note that the kernel has to load up the display driver module before it can display anything on it so you won't get the rainbow screen, a NooBs prompt, or a big chunk of the kernel details since the module is loaded fairly late in the boot process.

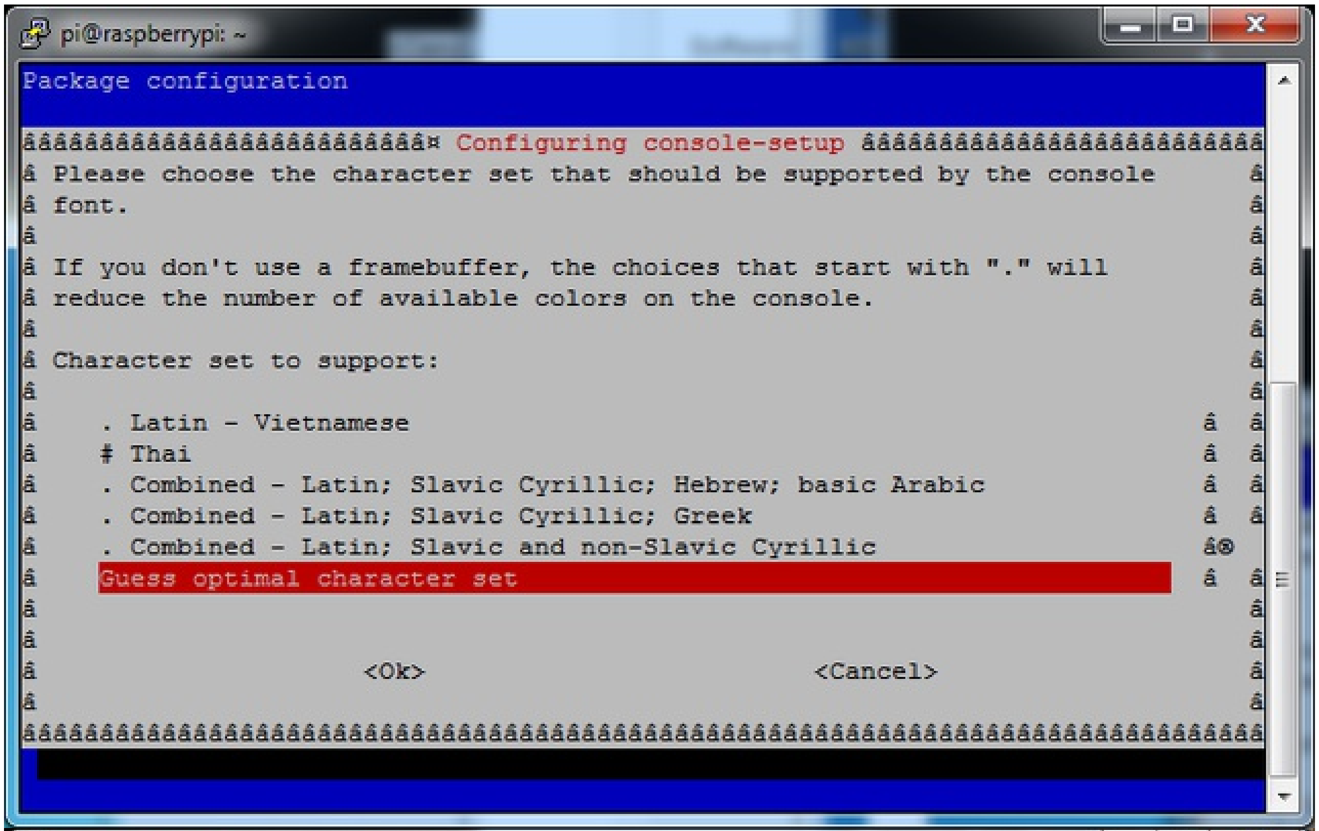


```
pi@raspberrypi:~$ cat /boot/cmdline.txt
dwc_otg.lpm_enable=0 console=ttyAMA0,115200 kgdboc=ttyAMA0,115200 console=tty1
 root=/dev/mmcblk0p2 rootfstype=ext4 elevator=deadline rootwait fbcon=map:10 f
bcom=font:VGA8x8

pi@raspberrypi:~$
```

I think the VGA8x8 font is a bit chunky, you probably want 12x6 which is what is shown in the photo above. To change the font, run **sudo dpkg-reconfigure console-setup** and go thru to select Terminus 6x12

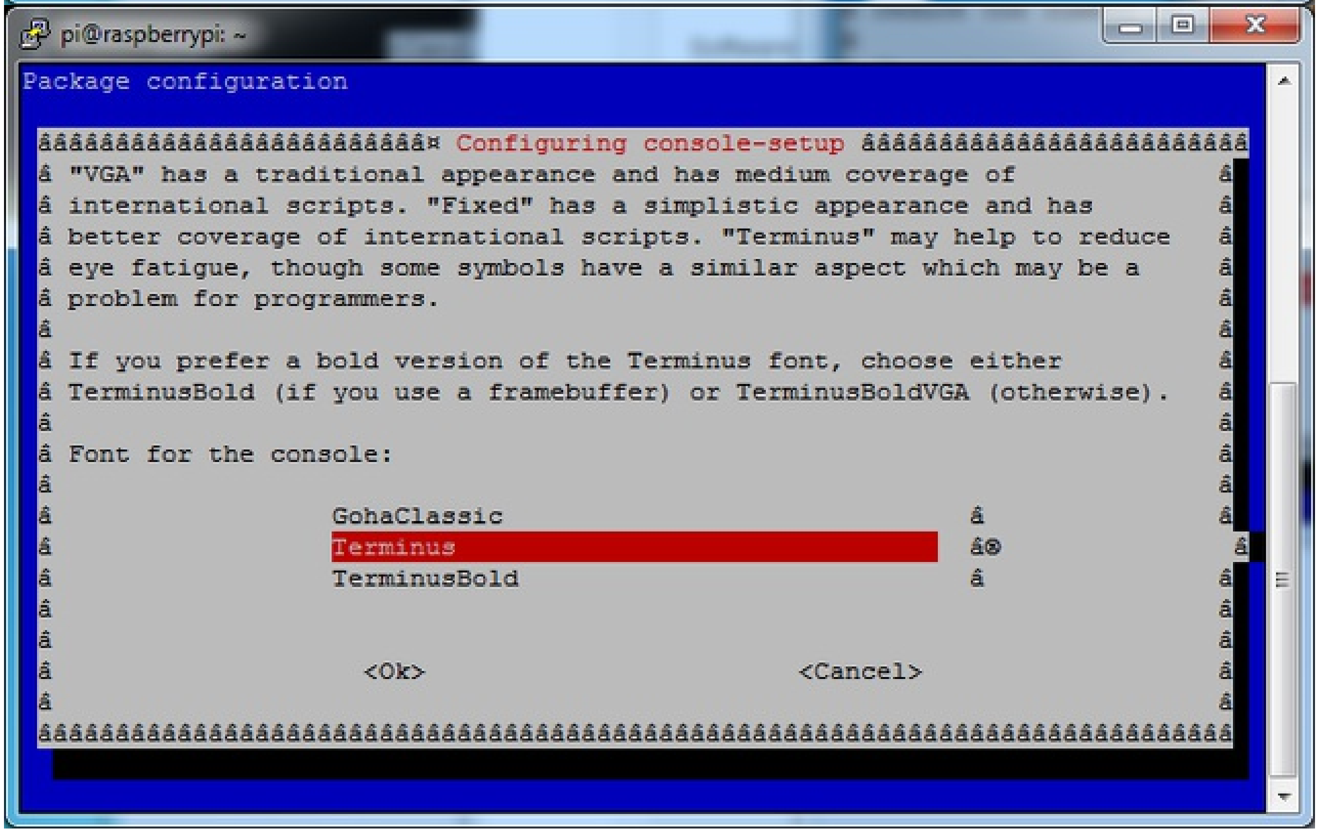


```
Package configuration

âââââââ¤ Configuring console-setup âââââââ
â                                        â
â                                        â
â Encoding to use on the console:        â
â                                        â
â          ISO-8859-4          â         â
â          ISO-8859-5          â         â
â          ISO-8859-6          â         â
â          ISO-8859-7          â         â
â          ISO-8859-8          â         â
â          ISO-8859-9          â         â
â          KOI8-R              â         â
â          KOI8-U              â®         â
â          TIS-620             â         â
â          UTF-8               â         â
â                                        â
â                                        â
â       <Ok>           <Cancel>          â
â                                        â
ââââââââââââââââââââââââââââââââââââââââ
```



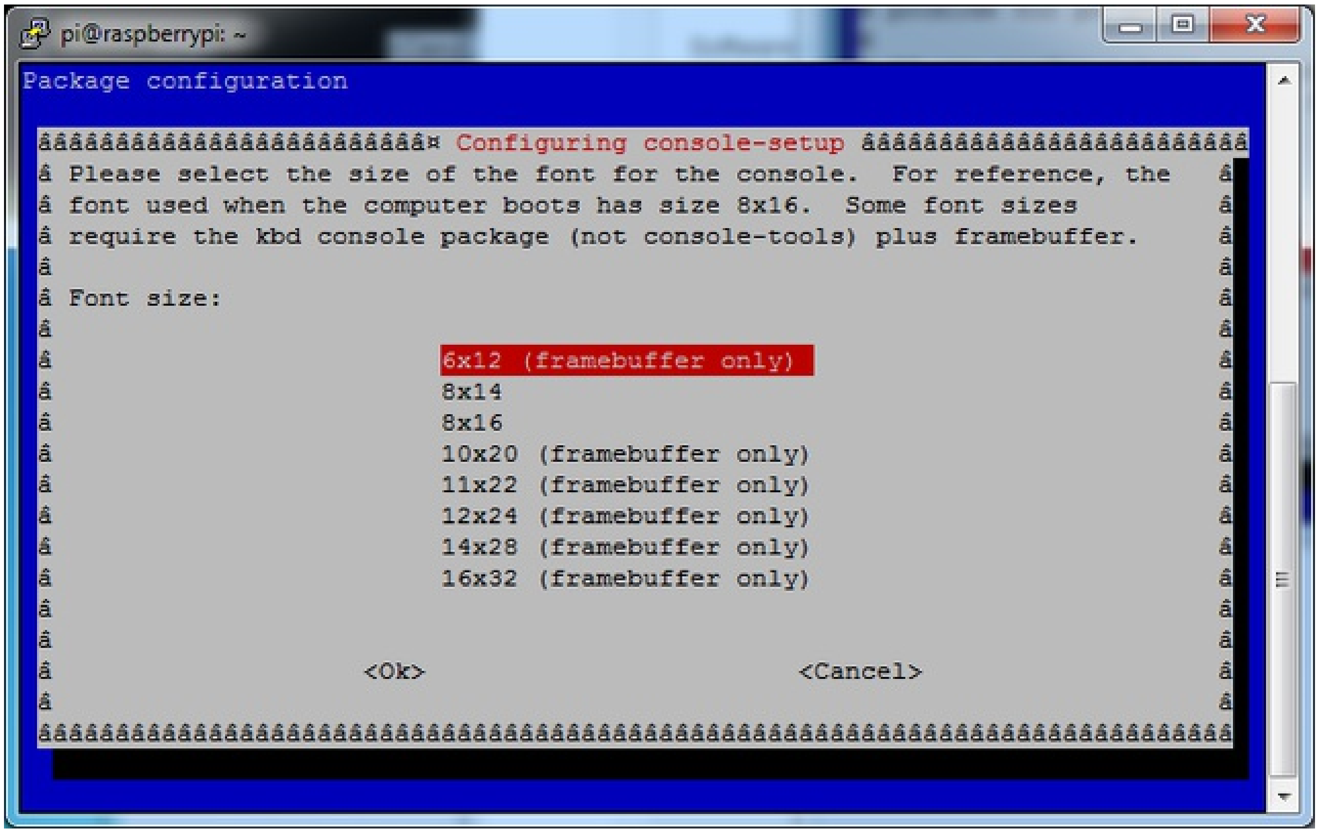
pi@raspberrypi: ~

```
Package configuration

 Configuring console-setup
 Please choose the character set that should be supported by the console
 font.

 If you don't use a framebuffer, the choices that start with "." will
 reduce the number of available colors on the console.

 Character set to support:

     . Latin - Vietnamese
     # Thai
     . Combined - Latin; Slavic Cyrillic; Hebrew; basic Arabic
     . Combined - Latin; Slavic Cyrillic; Greek
     . Combined - Latin; Slavic and non-Slavic Cyrillic
     Guess optimal character set


                  <Ok>                            <Cancel>
```



pi@raspberrypi: ~

```
Package configuration

 Configuring console-setup
 "VGA" has a traditional appearance and has medium coverage of
 international scripts. "Fixed" has a simplistic appearance and has
 better coverage of international scripts. "Terminus" may help to reduce
 eye fatigue, though some symbols have a similar aspect which may be a
 problem for programmers.

 If you prefer a bold version of the Terminus font, choose either
 TerminusBold (if you use a framebuffer) or TerminusBoldVGA (otherwise).

 Font for the console:

                  GohaClassic
                  Terminus
                  TerminusBold


                <Ok>                            <Cancel>
```



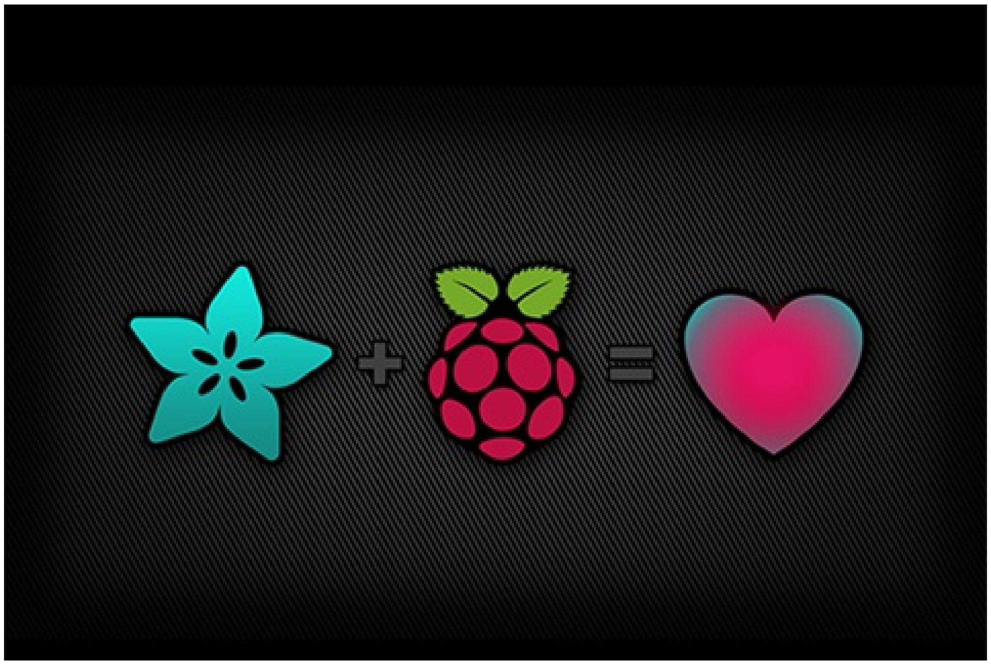
```
Package configuration

ââââââââââââââââââââââââââââ¤ Configuring console-setup ââââââââââââââââââââââââââ
â Please select the size of the font for the console.  For reference, the   â
â font used when the computer boots has size 8x16.  Some font sizes         â
â require the kbd console package (not console-tools) plus framebuffer.     â
â                                                                            â
â Font size:                                                                 â
â                                                                            â
â                          6x12  (framebuffer only)                          â
â                          8x14                                              â
â                          8x16                                              â
â                          10x20  (framebuffer only)                         â
â                          11x22  (framebuffer only)                         â
â                          12x24  (framebuffer only)                         â
â                          14x28  (framebuffer only)                         â
â                          16x32  (framebuffer only)                         â
â                                                                            â
â                                                                            â
â                     <Ok>                        <Cancel>                   â
â                                                                            â
ââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââââ
```

Turn off Console Blanking

You may notice the console goes black after 30 minutes, this is a sort of 'power saving' or 'screensaver' feature. You can disable this by editing **/etc/kbd/config**and setting the blank time to 0 (which turns it off)

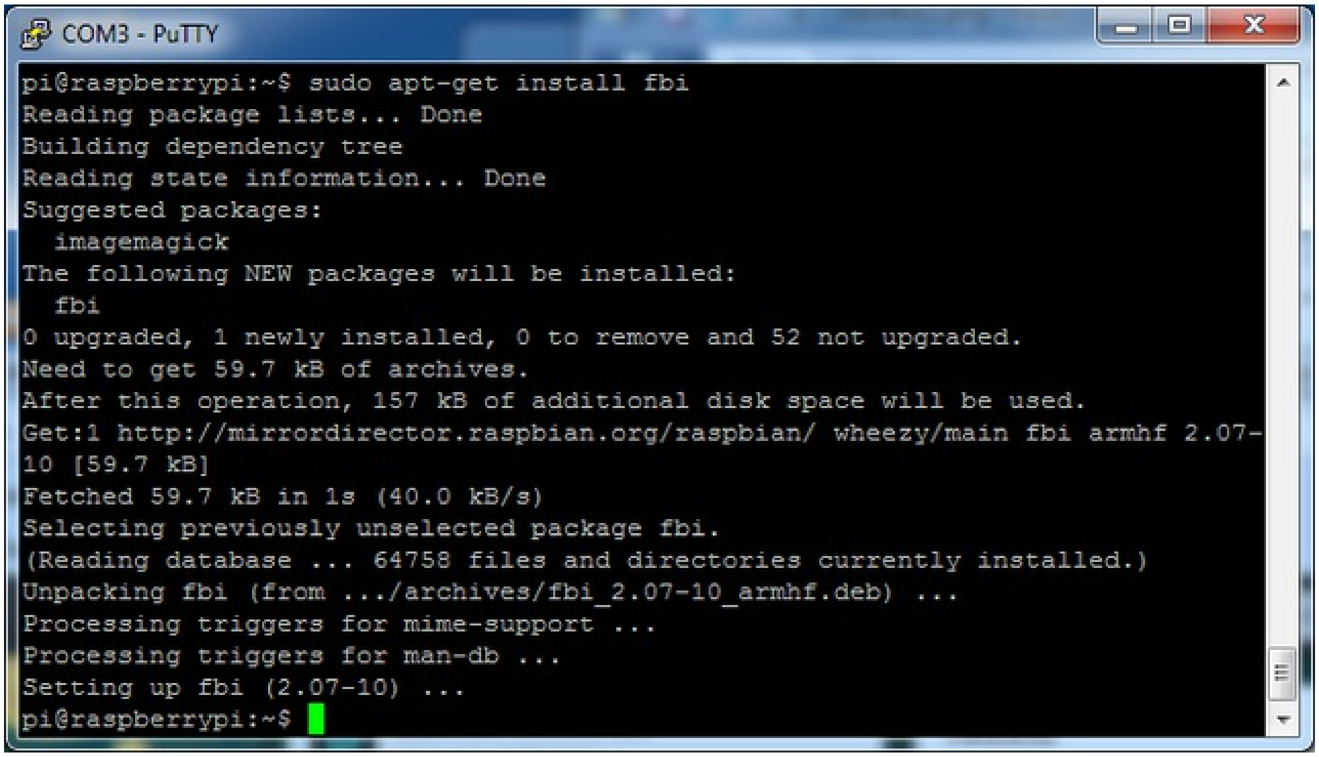
```
BLANK_TIME=30
```

Displaying Images



You can display every day images such as GIFs, JPGs, BMPs, etc on the screen. To do this we'll install **fbi** which is the **frame buffer image** viewer (not to be confused with the FBI agency!)

sudo apt-get install fbi will install it



```
pi@raspberrypi:~$ sudo apt-get install fbi
Reading package lists... Done
Building dependency tree
Reading state information... Done
Suggested packages:
  imagemagick
The following NEW packages will be installed:
  fbi
0 upgraded, 1 newly installed, 0 to remove and 52 not upgraded.
Need to get 59.7 kB of archives.
After this operation, 157 kB of additional disk space will be used.
Get:1 http://mirrordirector.raspbian.org/raspbian/ wheezy/main fbi armhf 2.07-
10 [59.7 kB]
Fetched 59.7 kB in 1s (40.0 kB/s)
Selecting previously unselected package fbi.
(Reading database ... 64758 files and directories currently installed.)
Unpacking fbi (from .../archives/fbi_2.07-10_armhf.deb) ...
Processing triggers for mime-support ...
Processing triggers for man-db ...
Setting up fbi (2.07-10) ...
pi@raspberrypi:~$
```

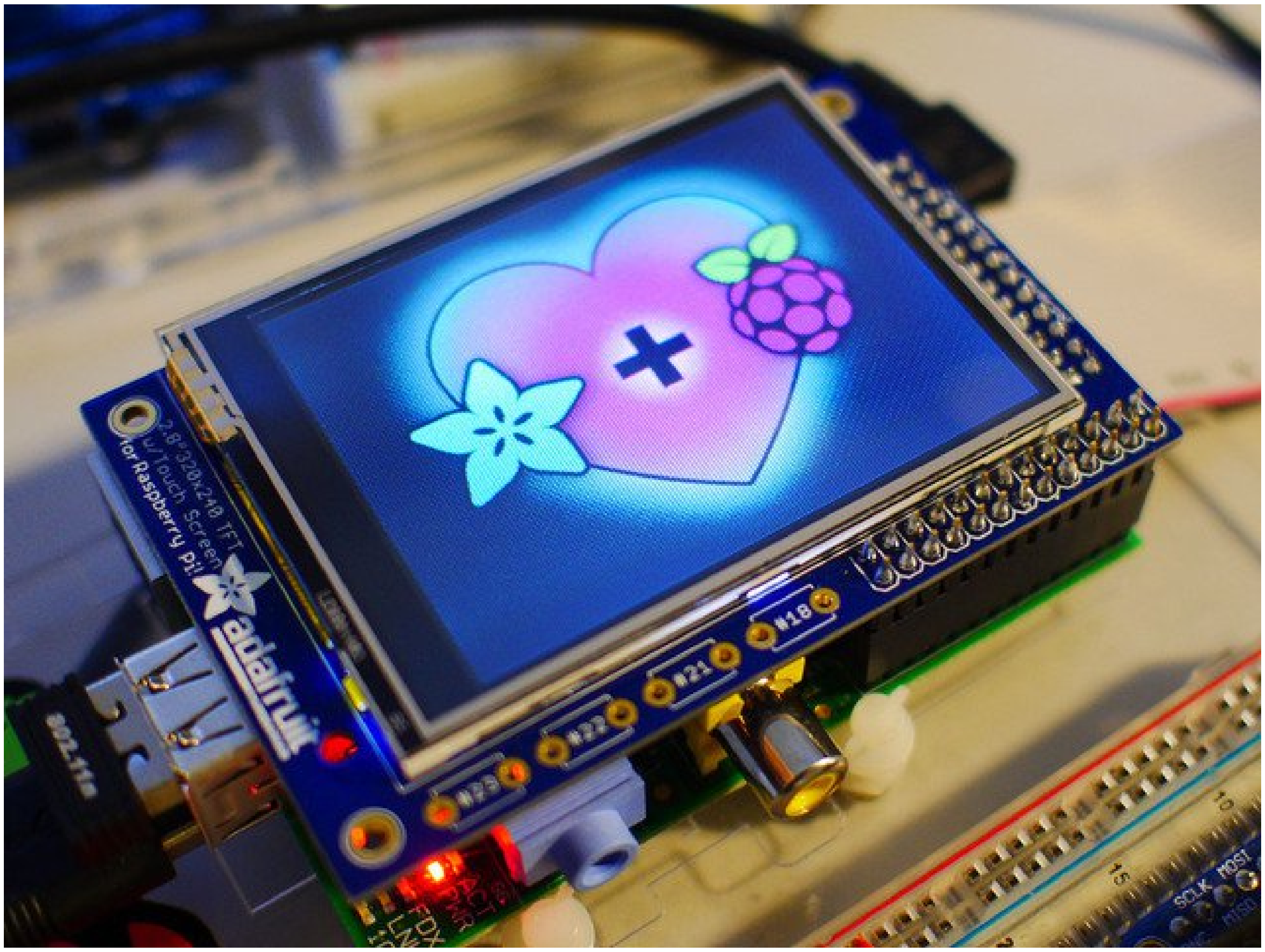
Grab our lovely wallpaper with

> **wget http://adafruit-download.s3.amazonaws.com/adapiluv480x320.png** (http://adafru.it/cXU)

and view it with

> **sudo fbi -T 2 -d /dev/fb1 -noverbose -a adapiluv480x320.png**

That's it!


2.8" 320x240 TFT
w/Touch Screen
for Raspberry Pi!
adafruit
#23
#22
#21
#18

Using FBCP

The Ideal: Adafruit's PiTFT displays are razor sharp. Whereas small composite screens on the Raspberry Pi usually require some video scaling (resulting in blurriness), PiTFT uses the GPIO header, digitally controlled pixel-by-pixel for a rock steady image. Though not a *lot* of pixels, it works great for retro gaming (and the display neatly stacks above the board, no side protuberances for video cables).

The Downside: this GPIO link entirely bypasses the Pi's video hardware, including the graphics accelerator. Many games and emulators *depend* on the GPU for performance gains. So the PiTFT has traditionally been limited to just a subset of specially-compiled emulators that can work and run well enough without the GPU.

The Solution: our latest PiTFT drivers, along with a tool called *fbcp* (framebuffer copy), careful system configuration, and (optionally) the more potent Raspberry Pi 2 board open the doors to many more gaming options. Existing emulator packages (such as RetroPie, with *dozens* of high-performance emulators and ports) — previously off-limits to the PiTFT — can run quite effectively now!

Click here to go to our FBCP tutorial!
http://adafru.it/fbe

Backlight

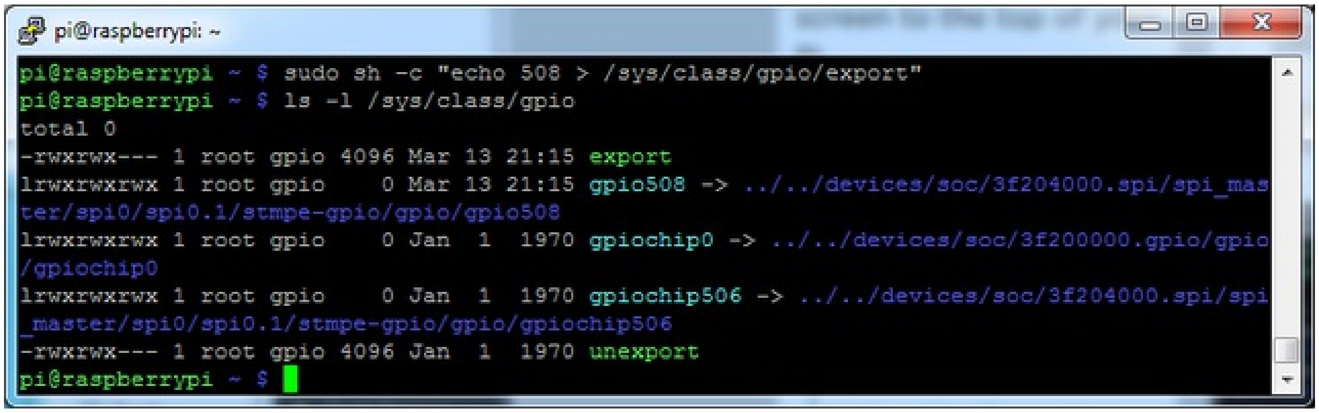
The backlight of the 3.5" display has 6 LEDs in a row, and we use a boost converter to get the 5V from the Pi up to the ~20V needed to light up all the LEDs. By default, the backlight's on...but you can control it in two ways.

On / Off Using STMPE GPIO

First option is to just turn it on and off using the extra GPIO created by the touchscreen driver

Start by getting access to the GPIO by making a device link

```
sudo sh -c "echo 508 > /sys/class/gpio/export"
ls -l /sys/class/gpio
```



```
pi@raspberrypi ~ $ sudo sh -c "echo 508 > /sys/class/gpio/export"
pi@raspberrypi ~ $ ls -l /sys/class/gpio
total 0
-rwxrwx--- 1 root gpio 4096 Mar 13 21:15 export
lrwxrwxrwx 1 root gpio    0 Mar 13 21:15 gpio508 -> ../../devices/soc/3f204000.spi/spi_mas
ter/spi0/spi0.1/stmpe-gpio/gpio/gpio508
lrwxrwxrwx 1 root gpio    0 Jan  1  1970 gpiochip0 -> ../../devices/soc/3f200000.gpio/gpio
/gpiochip0
lrwxrwxrwx 1 root gpio    0 Jan  1  1970 gpiochip506 -> ../../devices/soc/3f204000.spi/spi
_master/spi0/spi0.1/stmpe-gpio/gpio/gpiochip506
-rwxrwx--- 1 root gpio 4096 Jan  1  1970 unexport
pi@raspberrypi ~ $
```

Once you verify that you see GPIO #508, then you can set it to an output, this will turn off the display since it will output 0 by default

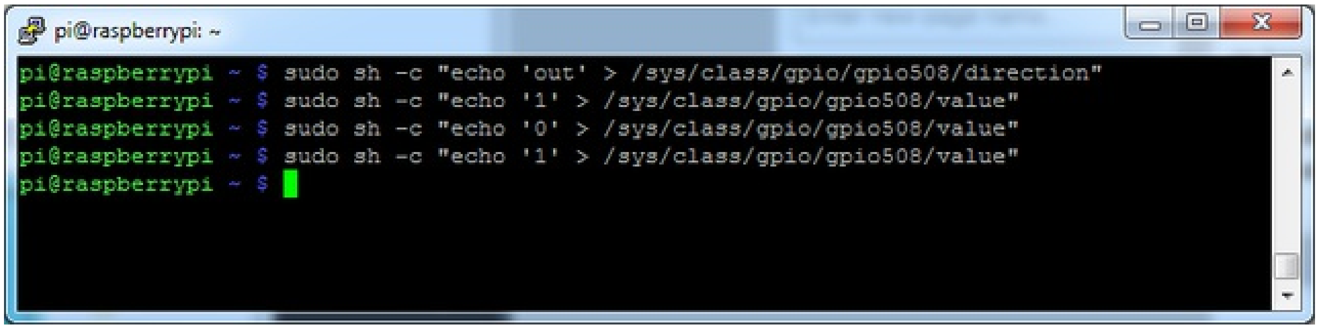
```
sudo sh -c "echo 'out' > /sys/class/gpio/gpio508/direction"
```

Then turn the display back on with

```
sudo sh -c "echo '1' > /sys/class/gpio/gpio508/value"
```

or back off

```
sudo sh -c "echo '0' > /sys/class/gpio/gpio508/value"
```



```
pi@raspberrypi ~ $ sudo sh -c "echo 'out' > /sys/class/gpio/gpio508/direction"
pi@raspberrypi ~ $ sudo sh -c "echo '1' > /sys/class/gpio/gpio508/value"
pi@raspberrypi ~ $ sudo sh -c "echo '0' > /sys/class/gpio/gpio508/value"
pi@raspberrypi ~ $ sudo sh -c "echo '1' > /sys/class/gpio/gpio508/value"
pi@raspberrypi ~ $
```

PWM Backlight Control with GPIO 18

If you want more precise control, you can use the PWM output on GPIO 18. There's python code for controlling the PWM but you can also just use the kernel module and shell commands.

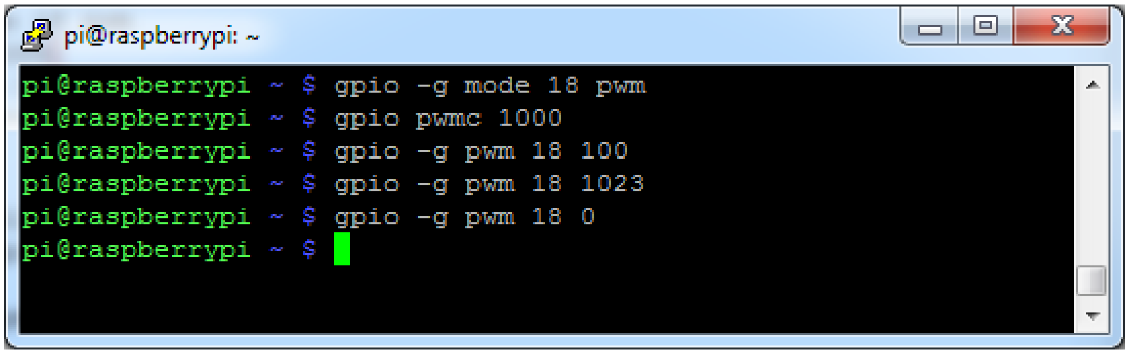
If you did the above commands, you'll need to turn off the STMPE GPIO which overrides the PWM output. You only have to run this if you set GPIO508 to an output in the previous option

sudo sh -c "echo 'in' > /sys/class/gpio/gpio508/direction"

OK now you can set the GPIO #18 pin to PWM mode using WiringPi's**gpio** command

With these basic shell commands, you can set the GPIO #18 pin to PWM mode with 1000 Hz frequency, set the output to 100 (out of 1023, so dim!), set the output to 1023 (out of 1023, nearly all the way on) and 0 (off)

```
gpio -g mode 18 pwm
gpio pwmc 1000
gpio -g pwm 18 100
gpio -g pwm 18 1023
gpio -g pwm 18 0
```



```
pi@raspberrypi ~ $ gpio -g mode 18 pwm
pi@raspberrypi ~ $ gpio pwmc 1000
pi@raspberrypi ~ $ gpio -g pwm 18 100
pi@raspberrypi ~ $ gpio -g pwm 18 1023
pi@raspberrypi ~ $ gpio -g pwm 18 0
pi@raspberrypi ~ $
```

Try other numbers, from 0 (off) to 1023 (all the way on)!

PiTFT Pygame Tips

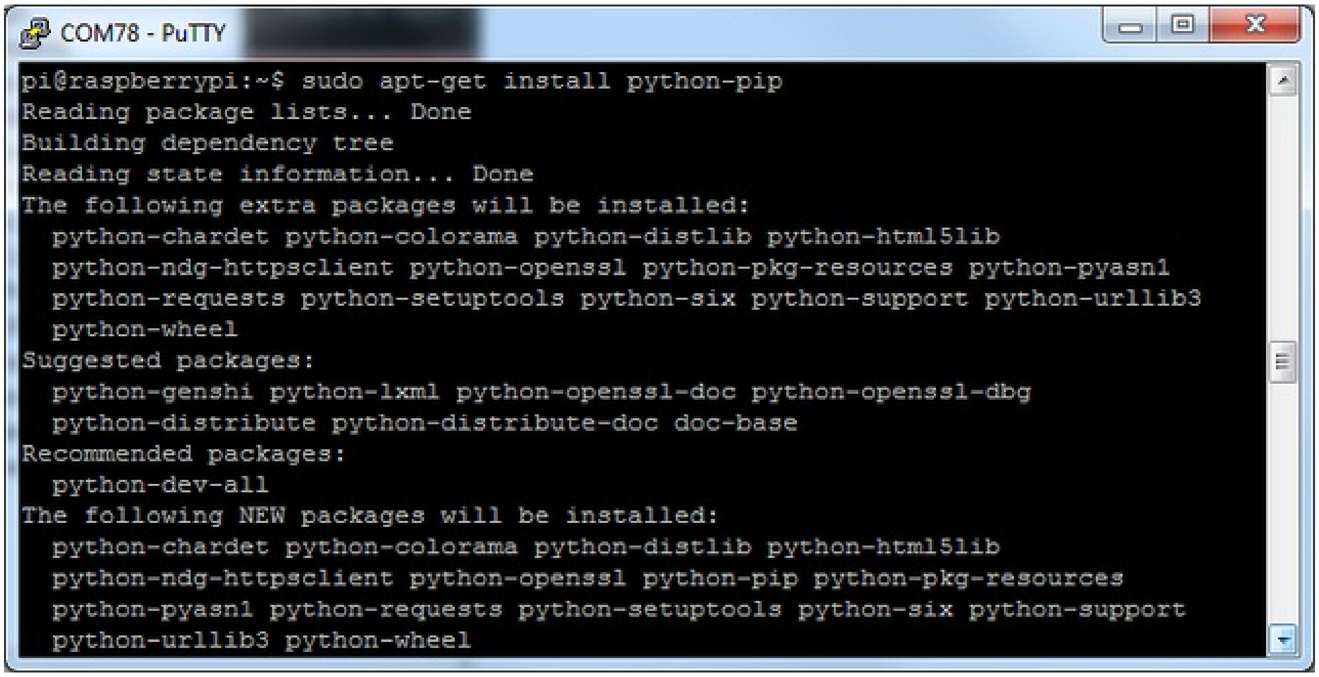
Since the PiTFT screen is fairly small, you may need to write custom UI programs. Pygame is the easiest way by far to do this.

Jeremy Blythe has an excellent tutorial here on getting started.(http://adafru.it/kD2)

However, *before* you follow that link you'll want to set up pygame for the best compatibility:

Install pip & pygame

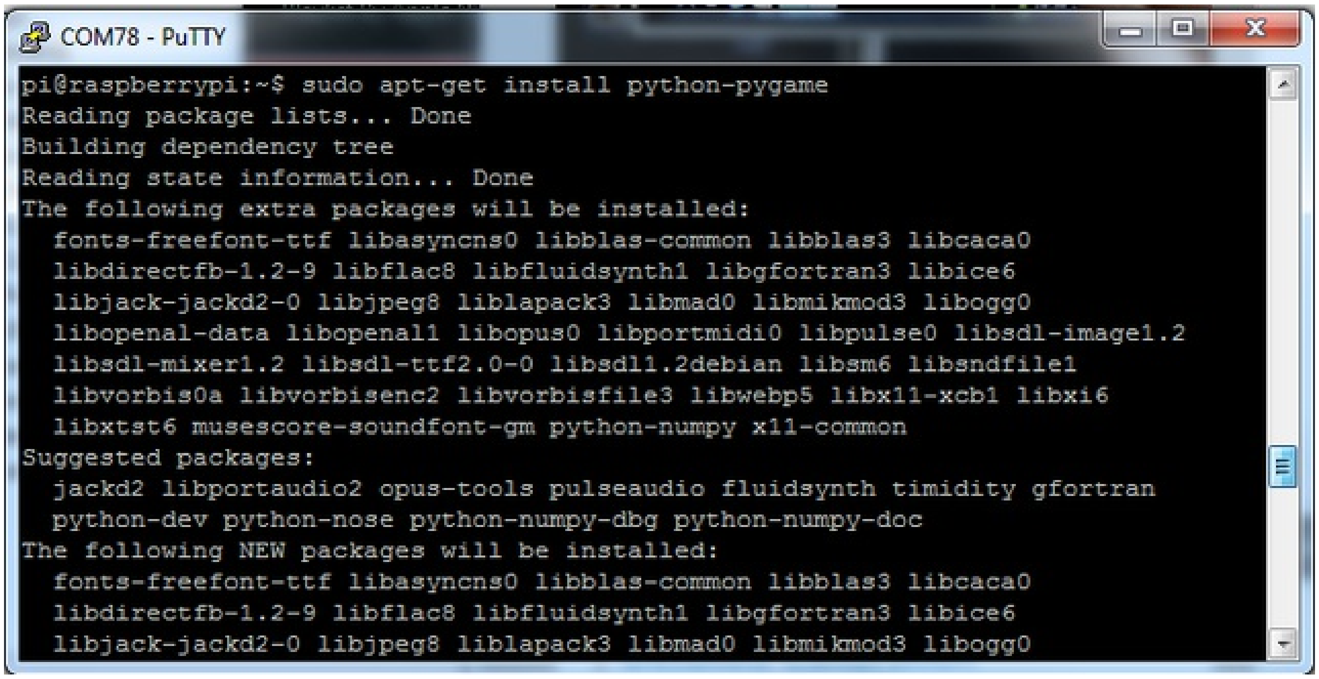
Install Pip: **sudo apt-get install python-pip**



```
pi@raspberrypi:~$ sudo apt-get install python-pip
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  python-chardet python-colorama python-distlib python-html5lib
  python-ndg-httpsclient python-openssl python-pkg-resources python-pyasn1
  python-requests python-setuptools python-six python-support python-urllib3
  python-wheel
Suggested packages:
  python-genshi python-lxml python-openssl-doc python-openssl-dbg
  python-distribute python-distribute-doc doc-base
Recommended packages:
  python-dev-all
The following NEW packages will be installed:
  python-chardet python-colorama python-distlib python-html5lib
  python-ndg-httpsclient python-openssl python-pip python-pkg-resources
  python-pyasn1 python-requests python-setuptools python-six python-support
  python-urllib3 python-wheel
```

Install Pygame: **sudo apt-get install python-pygame**

(this will take a while)



```
pi@raspberrypi:~$ sudo apt-get install python-pygame
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  fonts-freefont-ttf libasyncns0 libblas-common libblas3 libcaca0
  libdirectfb-1.2-9 libflac8 libfluidsynth1 libgfortran3 libice6
  libjack-jackd2-0 libjpeg8 liblapack3 libmad0 libmikmod3 libogg0
  libopenal-data libopenal1 libopus0 libportmidi0 libpulse0 libsdl-image1.2
  libsdl-mixer1.2 libsdl-ttf2.0-0 libsdl1.2debian libsm6 libsndfile1
  libvorbis0a libvorbisenc2 libvorbisfile3 libwebp5 libx11-xcb1 libxi6
  libxtst6 musescore-soundfont-gm python-numpy x11-common
Suggested packages:
  jackd2 libportaudio2 opus-tools pulseaudio fluidsynth timidity gfortran
  python-dev python-nose python-numpy-dbg python-numpy-doc
The following NEW packages will be installed:
  fonts-freefont-ttf libasyncns0 libblas-common libblas3 libcaca0
  libdirectfb-1.2-9 libflac8 libfluidsynth1 libgfortran3 libice6
  libjack-jackd2-0 libjpeg8 liblapack3 libmad0 libmikmod3 libogg0
```

Ensure you are running SDL 1.2

SDL 2.x and SDL 1.2.15-10 have some serious incompatibilities with touchscreen. You can force SDL 1.2 by running a script. ([Thanks to heine in the forums!](http://adafru.it/fH3)(http://adafru.it/fH3))

Edit a new file with **sudo nano installsdl.sh**
and paste in the following text:

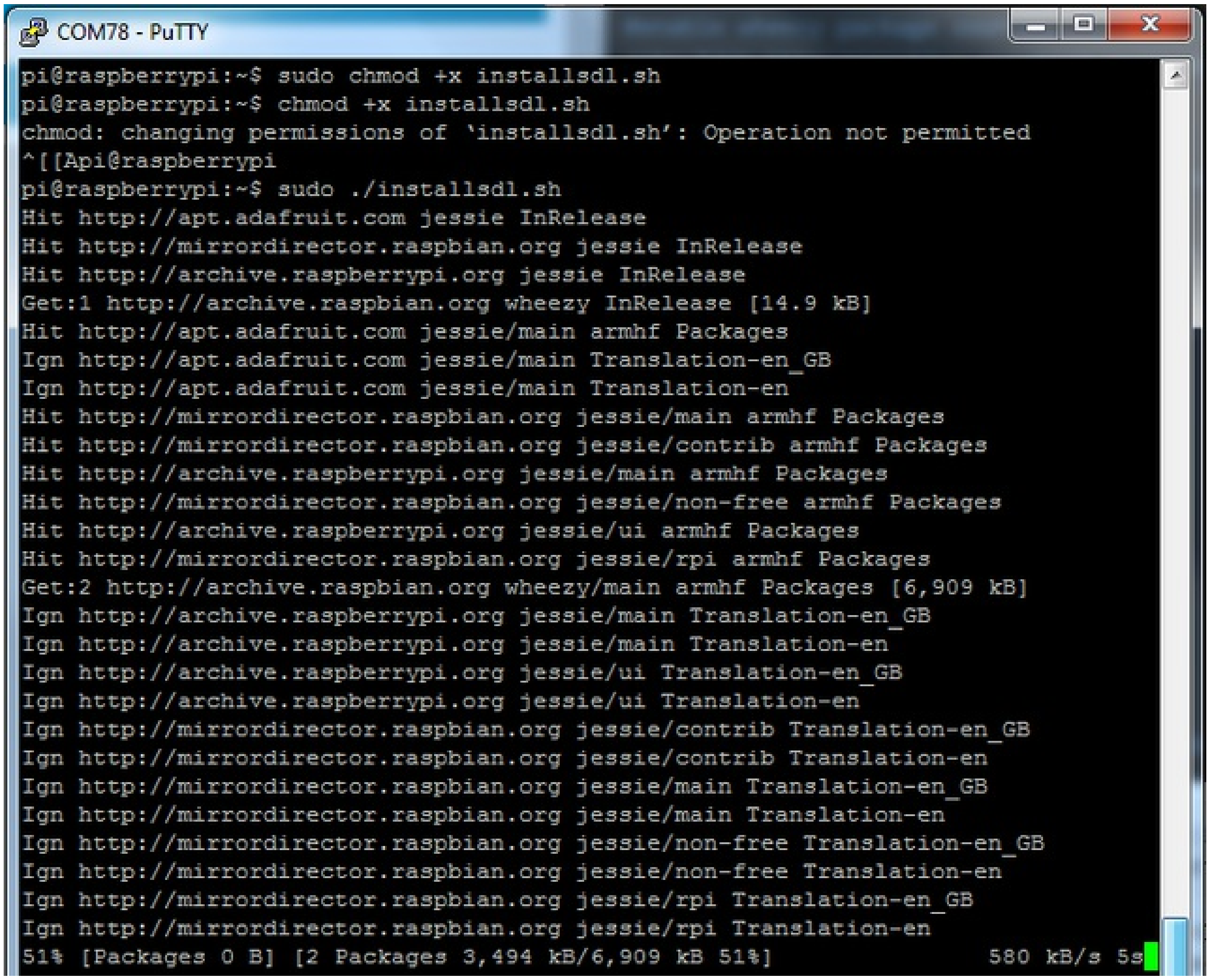
```
#!/bin/bash

#enable wheezy package sources
echo "deb http://archive.raspbian.org/raspbian wheezy main
" > /etc/apt/sources.list.d/wheezy.list

#set stable as default package source (currently jessie)
echo "APT::Default-release \"stable\";
" > /etc/apt/apt.conf.d/10defaultRelease

#set the priority for libsdl from wheezy higher then the jessie package
echo "Package: libsdl1.2debian
Pin: release n=jessie
Pin-Priority: -10
Package: libsdl1.2debian
Pin: release n=wheezy
Pin-Priority: 900
" > /etc/apt/preferences.d/libsdl

#install
```

apt-get update
apt-get -y --force-yes install libsdl1.2debian/wheezy

run

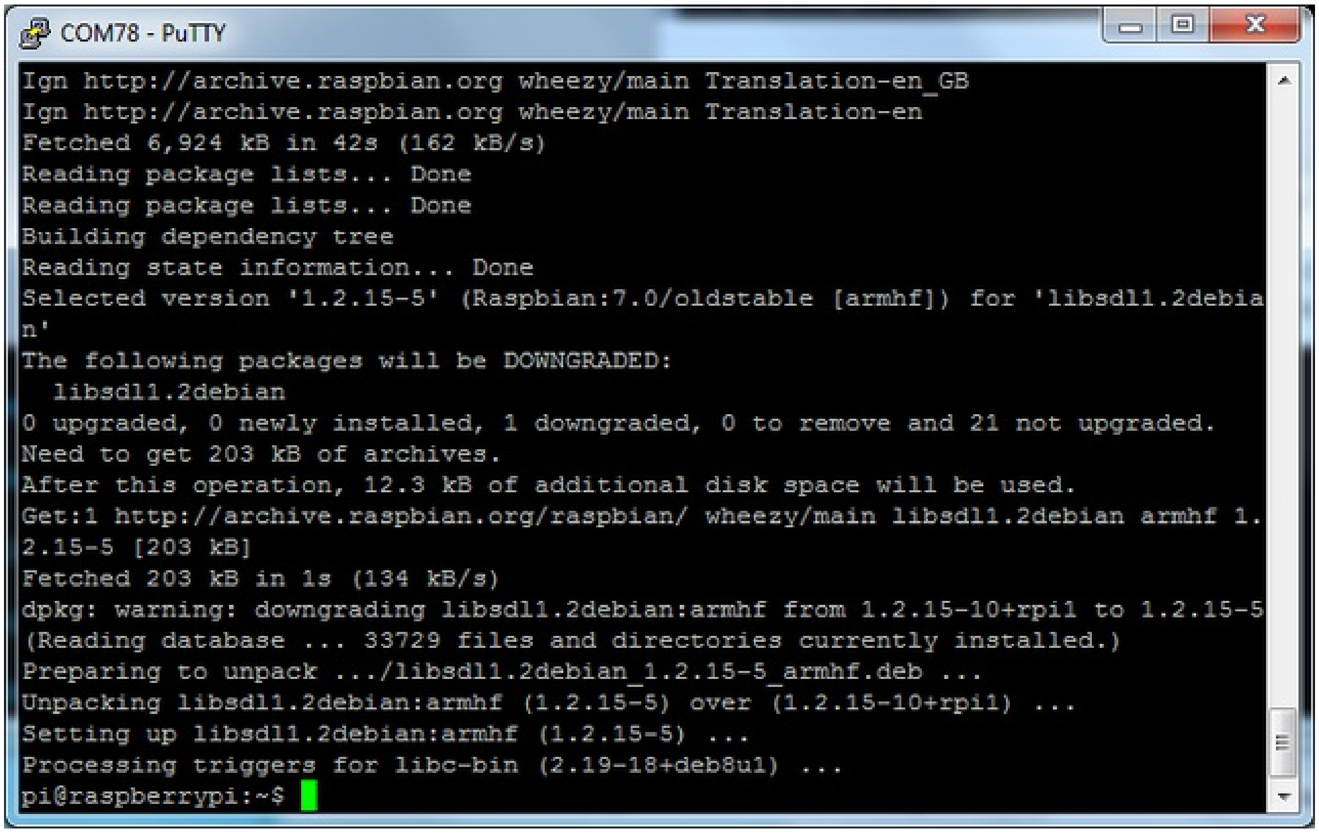
sudo chmod +x installsdl.sh

sudo ./installsdl.sh



```
pi@raspberrypi:~$ sudo chmod +x installsdl.sh
pi@raspberrypi:~$ chmod +x installsdl.sh
chmod: changing permissions of ‘installsdl.sh’: Operation not permitted
^[[Api@raspberrypi
pi@raspberrypi:~$ sudo ./installsdl.sh
Hit http://apt.adafruit.com jessie InRelease
Hit http://mirrordirector.raspbian.org jessie InRelease
Hit http://archive.raspberrypi.org jessie InRelease
Get:1 http://archive.raspbian.org wheezy InRelease [14.9 kB]
Hit http://apt.adafruit.com jessie/main armhf Packages
Ign http://apt.adafruit.com jessie/main Translation-en_GB
Ign http://apt.adafruit.com jessie/main Translation-en
Hit http://mirrordirector.raspbian.org jessie/main armhf Packages
Hit http://mirrordirector.raspbian.org jessie/contrib armhf Packages
Hit http://archive.raspberrypi.org jessie/main armhf Packages
Hit http://mirrordirector.raspbian.org jessie/non-free armhf Packages
Hit http://archive.raspberrypi.org jessie/ui armhf Packages
Hit http://mirrordirector.raspbian.org jessie/rpi armhf Packages
Get:2 http://archive.raspbian.org wheezy/main armhf Packages [6,909 kB]
Ign http://archive.raspberrypi.org jessie/main Translation-en_GB
Ign http://archive.raspberrypi.org jessie/main Translation-en
Ign http://archive.raspberrypi.org jessie/ui Translation-en_GB
Ign http://archive.raspberrypi.org jessie/ui Translation-en
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-en_GB
Ign http://mirrordirector.raspbian.org jessie/contrib Translation-en
Ign http://mirrordirector.raspbian.org jessie/main Translation-en_GB
Ign http://mirrordirector.raspbian.org jessie/main Translation-en
Ign http://mirrordirector.raspbian.org jessie/non-free Translation-en_GB
Ign http://mirrordirector.raspbian.org jessie/non-free Translation-en
Ign http://mirrordirector.raspbian.org jessie/rpi Translation-en_GB
Ign http://mirrordirector.raspbian.org jessie/rpi Translation-en
51% [Packages 0 B] [2 Packages 3,494 kB/6,909 kB 51%]          580 kB/s 5s
```

it will force install SDL 1.2



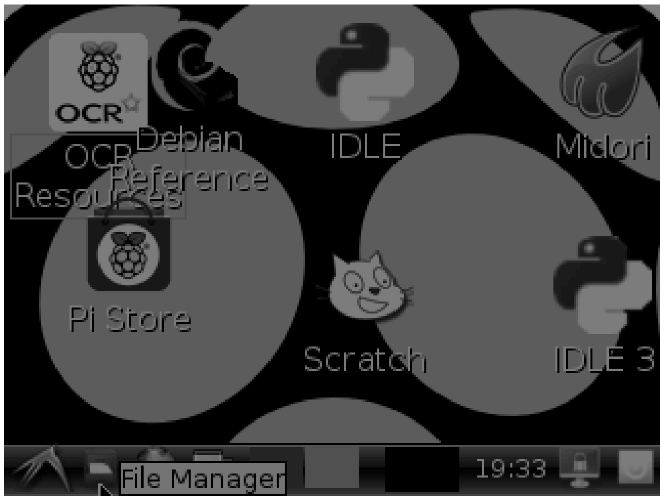
```
Ign http://archive.raspbian.org wheezy/main Translation-en_GB
Ign http://archive.raspbian.org wheezy/main Translation-en
Fetched 6,924 kB in 42s (162 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree
Reading state information... Done
Selected version '1.2.15-5' (Raspbian:7.0/oldstable [armhf]) for 'libsdl1.2debia
n'
The following packages will be DOWNGRADED:
  libsdl1.2debian
0 upgraded, 0 newly installed, 1 downgraded, 0 to remove and 21 not upgraded.
Need to get 203 kB of archives.
After this operation, 12.3 kB of additional disk space will be used.
Get:1 http://archive.raspbian.org/raspbian/ wheezy/main libsdl1.2debian armhf 1.
2.15-5 [203 kB]
Fetched 203 kB in 1s (134 kB/s)
dpkg: warning: downgrading libsdl1.2debian:armhf from 1.2.15-10+rpi1 to 1.2.15-5
(Reading database ... 33729 files and directories currently installed.)
Preparing to unpack .../libsdl1.2debian_1.2.15-5_armhf.deb ...
Unpacking libsdl1.2debian:armhf (1.2.15-5) over (1.2.15-10+rpi1) ...
Setting up libsdl1.2debian:armhf (1.2.15-5) ...
Processing triggers for libc-bin (2.19-18+deb8u1) ...
pi@raspberrypi:~$
```

OK **now** you can continue with pygame

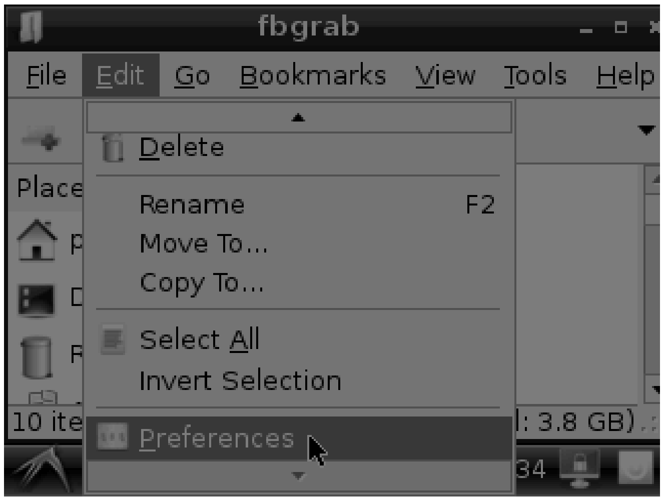
More Tips

Making it easier to click icons in X

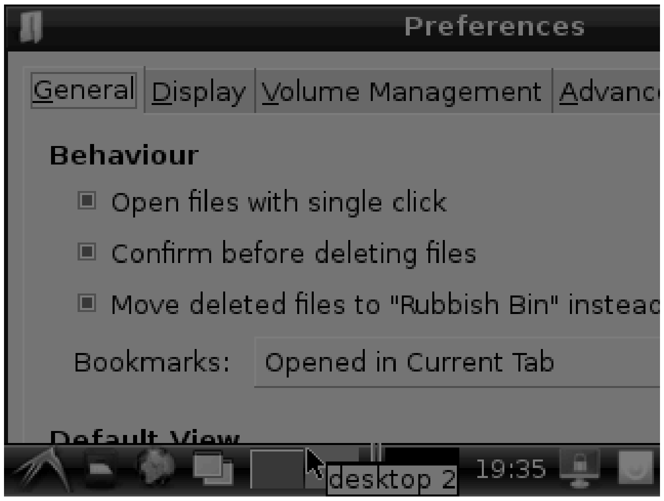
If you want to double-click on icons to launch something in X you may find it annoying to get it to work right. In LXDE you can simply set it up so that you only need to single click instead of double.
From LXDE launch the file manager (sorry these pix are grayscale and from the 2.8" TFT, still figuring out how to screenshot the framebuffer!)



Then under the **Edit** menu, select **Preferences**



Then select **Open files with single click** and close the window (you'll need to drag it over to get to the X button


Preferences

General | Display | Volume Management | Advanc

Behaviour

- Open files with single click
- Confirm before deleting files
- Move deleted files to "Rubbish Bin" instead

Bookmarks: Opened in Current Tab

Default View

Right-click on a touchscreen

Obviously if you have a touchscreen, it cannot tell what finger you are pressing with. This means that all 'clicks' are left clicks. But if you want a right-click, you *can* do it.

Just add the following lines into your InputClass of**/etc/X11/xorg.conf.d/99-calibration.conf** after the calibration section

```
Option "EmulateThirdButton" "1"
Option "EmulateThirdButtonTimeout" "750"
Option "EmulateThirdButtonMoveThreshold" "30"
```

So for example your file will look like:

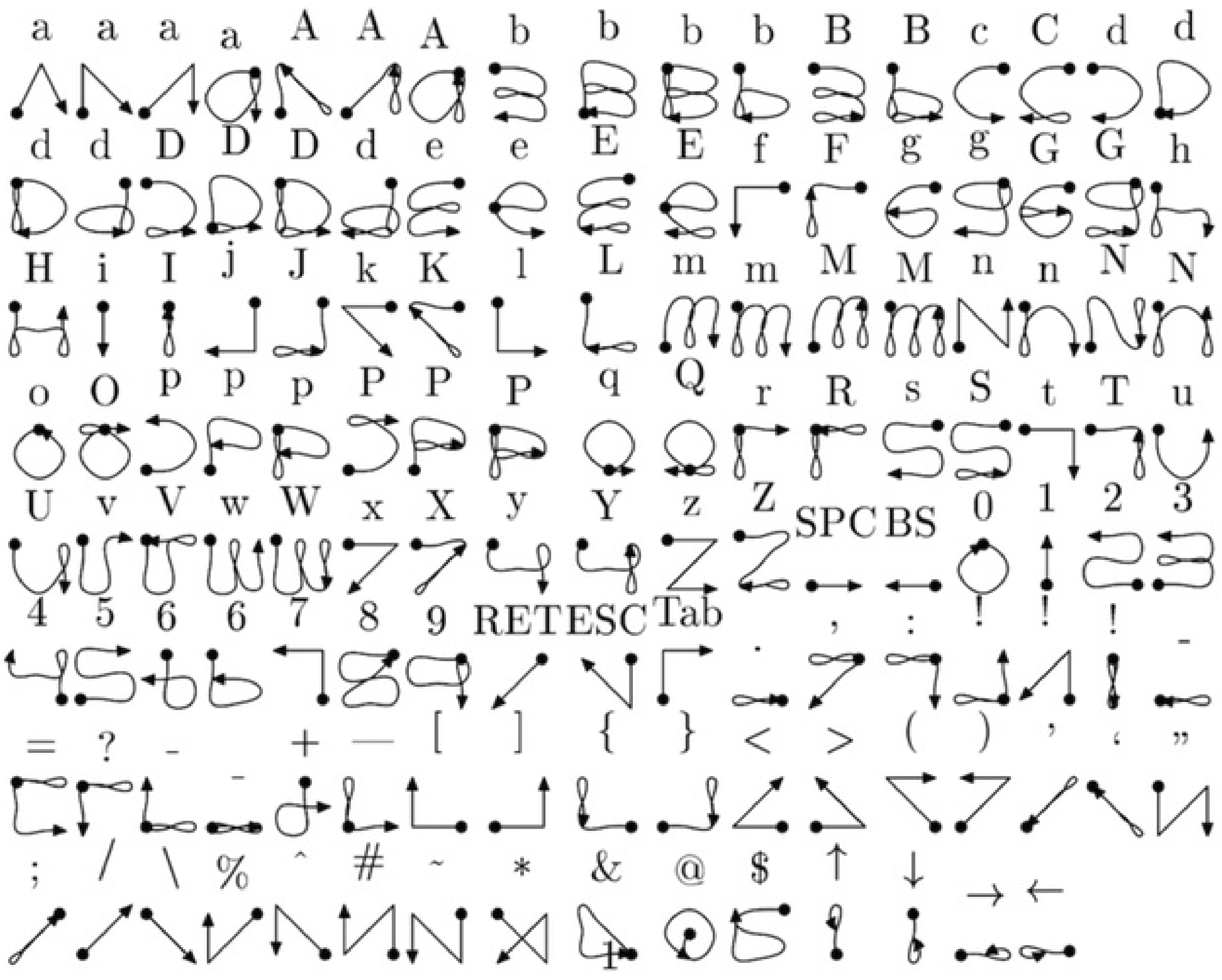
```
Section "InputClass"
  Identifier      "calibration"
  MatchProduct    "stmpe-ts"
  Option  "Calibration"   "3800 120 200 3900"
  Option  "SwapAxes"      "1"
  Option "EmulateThirdButton" "1"
  Option "EmulateThirdButtonTimeout" "750"
  Option "EmulateThirdButtonMoveThreshold" "30"
EndSection
```

This makes a right mouse click emulated when holding down the stylus for 750 ms.

(Thx adamaddin! (http://adafru.it/fH3))

Gesture Input

[You can use the same tutorial we have for the 2.8" TFT if you'd like to use gesture input!](http://adafru.it/dJ1) (http://adafru.it/dJ1)


a a a a A A A b b b b B B c C d d
d d D D D d e e E E f F g g G G h
H i I j J k K l L m m M M n n N N
o O p p p P P P q Q r R s S t T u
U v V w W x X y Y z Z SPC BS 0 1 2 3
4 5 6 6 7 8 9 RET ESC Tab . , : ! ! ! -
= ? - - + — [ ] { } < > ( ) ' ' "
; / \ % ^ # ~ * & @ $ ↑ ↓ → ←

FAQ

I have a question that isn't answered here

Check out the 2.8" resistive PiTFT FAQ (http://adafru.it/dJ2) for an answer to many common questions.

How can I bring up X on the HDMI/TV monitor?

Use the **fb0** framebuffer when you want to display stuff on the HDMI/TV display, for example:
FRAMEBUFFER=/dev/fb0 startx
will use the HDMI/TV framebuffer for X windows instead of the PiTFT

That doesn't work! I can't get X on HDMI!

If both
FRAMEBUFFER=/dev/fb0 startx &
and
FRAMEBUFFER=/dev/fb1 startx &
wind up showing the GUI on your PiTFT, enter the following instruction from the command line:

```
sudo mv /usr/share/X11/xorg.conf.d/99-fbturbo.conf ~
```

I'm tring to run startx and I get FATAL: Module g2d_23 not found.

don't forget you have to remove the turbo file!
sudo mv /usr/share/X11/xorg.conf.d/99-fbturbo.conf ~

I want better performance and faster updates!

You can change the SPI frequency (overclock the display) by editing **/boot/config.txt** and changing the **dtoverlay** options line to:

dtoverlay=pitft28r,rotate=90,speed=62000000,fps=25

Or whatever you like for speed, rotation, and frames-per-second. BUT, here's the thing, the Pi only supports a *fixed number* of SPI frequencies. So tweaking the number a little won't do anything. The kernel will round the number to the closest value. You will always get frequencies that are 250MHz divided by an even number. Here's the only SPI frequencies this kernel supports

- 15,625,000 (a.k.a 16000000 = 16 MHz)
- 17,857,142 (a.k.a. 18000000 = 18 MHz)
- 20,833,333 (a.k.a 21000000 = 21 MHz)
- 25,000,000 (= 25 MHz)
- 31,250,000 (a.k.a 32000000 = 32MHz)
- 41,666,666 (a.k.a 42000000 = 42MHz)
- 62,500,000 (a.k.a 62000000 = 62MHz)

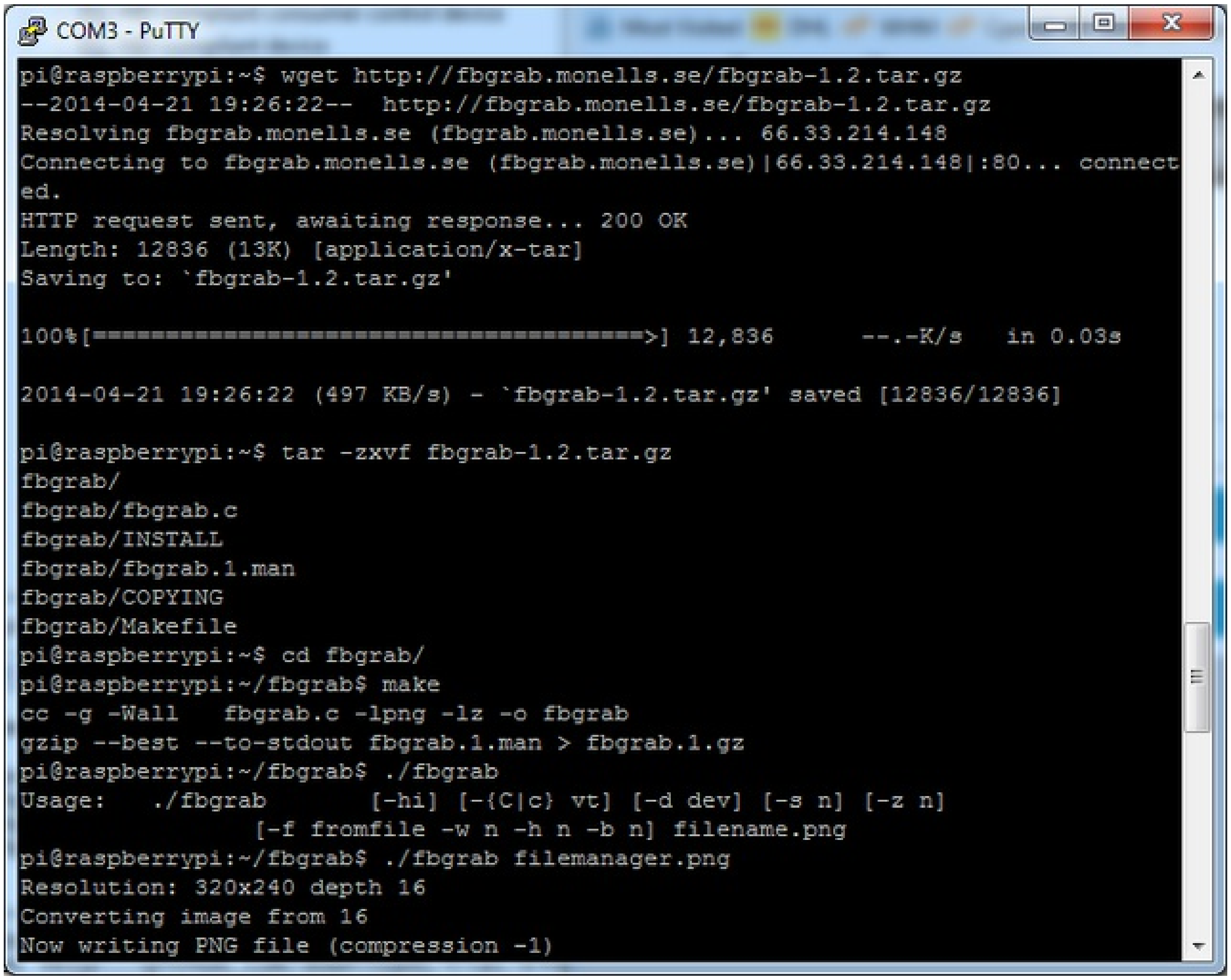
So if you put in 48000000 for the speed, you won't actually get 48MHz, you'll actually only get about 42MHz because it gets rounded down. We tested this display nicely with 32MHz and we suggest that. But you can put in 42MHz or even try 62MHz and it will update faster

You can tweak fps (frames per second) from 20 to 60 and frequency up to 62MHz for tradeoffs in performance and speed. Reboot after each edit to make sure the settings are loaded properly. There's a trade off that if you ask for higher FPS you're going to load the kernel more because it's trying to keep the display updated.

How can I take screenshots of the display?

We took the screenshots for this tutorial with (http://adafru.it/diV)**fbgra (http://adafru.it/diV)b (http://adafru.it/diV)**

```
wget http://fbgrab.monells.se/fbgrab-1.2.tar.gz (http://adafru.it/diW)
tar -zxvf fbgrab*gz
cd fbgrab/
make
./fbgrab screenshot.png
```

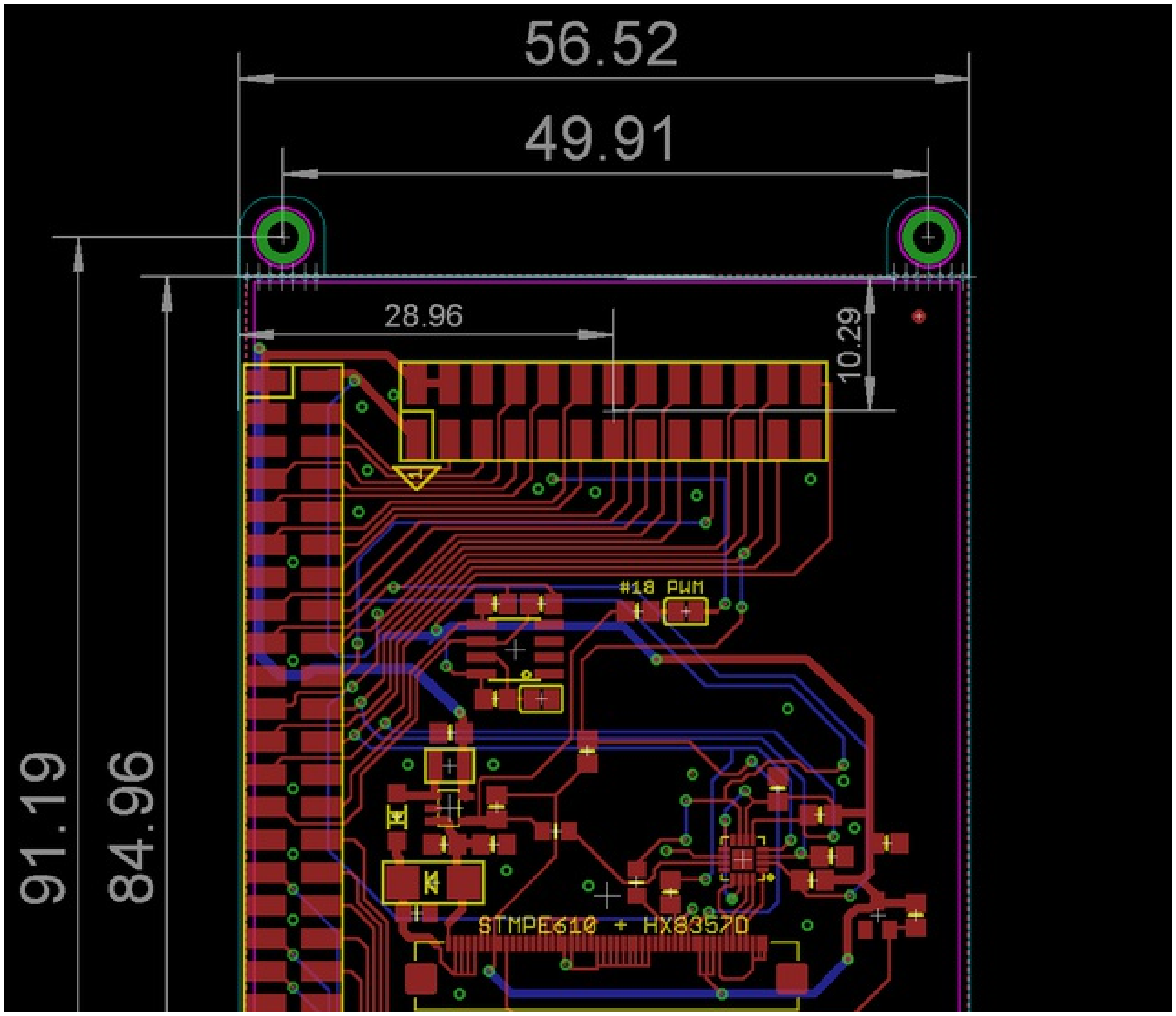

COM3 - PuTTY
```
pi@raspberrypi:~$ wget http://fbgrab.monells.se/fbgrab-1.2.tar.gz
--2014-04-21 19:26:22--  http://fbgrab.monells.se/fbgrab-1.2.tar.gz
Resolving fbgrab.monells.se (fbgrab.monells.se)... 66.33.214.148
Connecting to fbgrab.monells.se (fbgrab.monells.se)|66.33.214.148|:80... connect
ed.
HTTP request sent, awaiting response... 200 OK
Length: 12836 (13K) [application/x-tar]
Saving to: `fbgrab-1.2.tar.gz'

100%[======================================>] 12,836      --.-K/s   in 0.03s

2014-04-21 19:26:22 (497 KB/s) - `fbgrab-1.2.tar.gz' saved [12836/12836]

pi@raspberrypi:~$ tar -zxvf fbgrab-1.2.tar.gz
fbgrab/
fbgrab/fbgrab.c
fbgrab/INSTALL
fbgrab/fbgrab.1.man
fbgrab/COPYING
fbgrab/Makefile
pi@raspberrypi:~$ cd fbgrab/
pi@raspberrypi:~/fbgrab$ make
cc -g -Wall   fbgrab.c -lpng -lz -o fbgrab
gzip --best --to-stdout fbgrab.1.man > fbgrab.1.gz
pi@raspberrypi:~/fbgrab$ ./fbgrab
Usage:   ./fbgrab       [-hi] [-{C|c} vt] [-d dev] [-s n] [-z n]
                [-f fromfile -w n -h n -b n] filename.png
pi@raspberrypi:~/fbgrab$ ./fbgrab filemanager.png
Resolution: 320x240 depth 16
Converting image from 16
Now writing PNG file (compression -1)
```

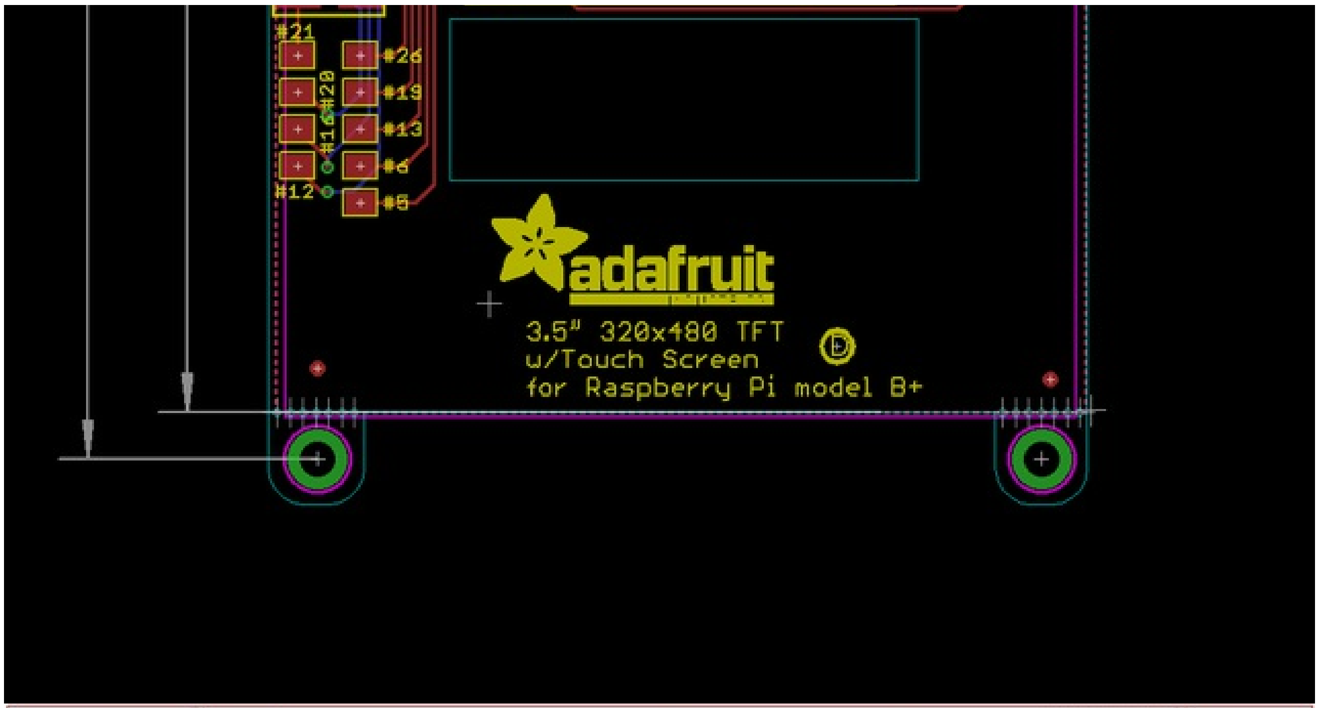
Downloads

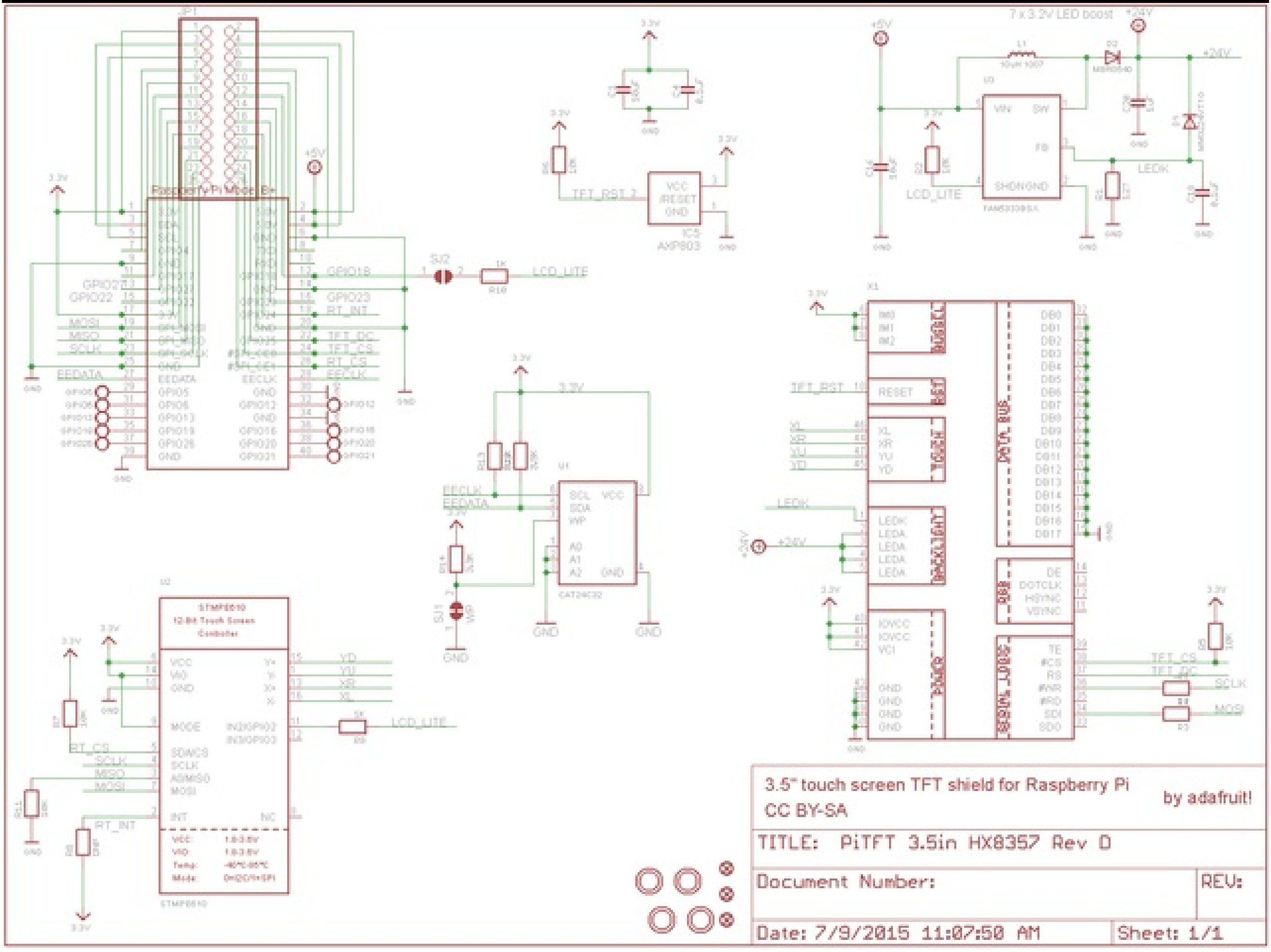
- The latest kernel fork that adds all the TFT, touchscreen, and other addons is here on github (http://adafru.it/aPa)
- Datasheet for the controller chip (http://adafru.it/dQQ)
- Datasheet for the 'raw' 3.5" TFT display (http://adafru.it/dR4)
- PCB files on GitHub (http://adafru.it/rEC)

Layout and Schematic for PiTFT Plus 3.5"

This is the newer PID 2441






3.5" touch screen TFT shield for Raspberry Pi
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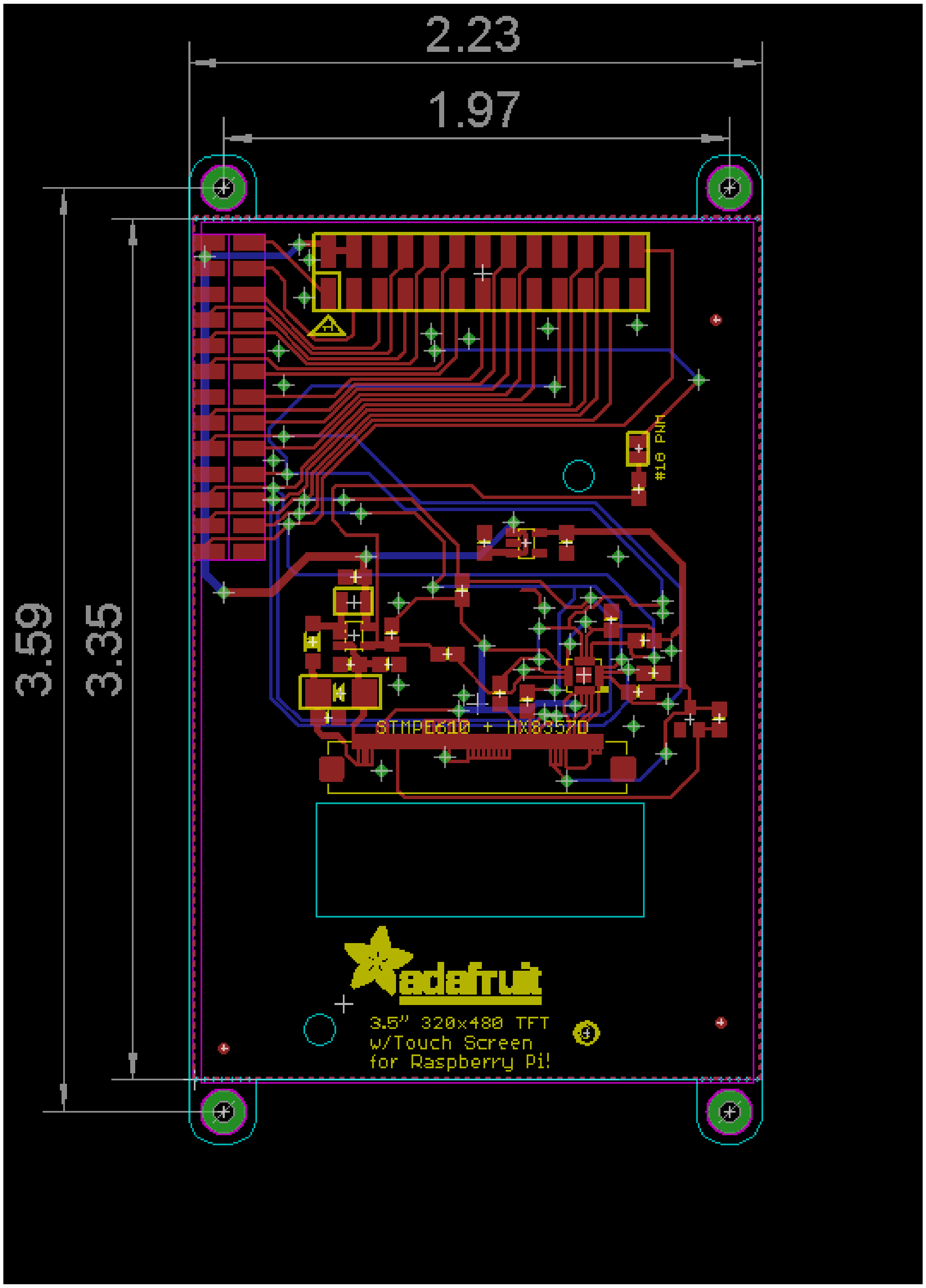
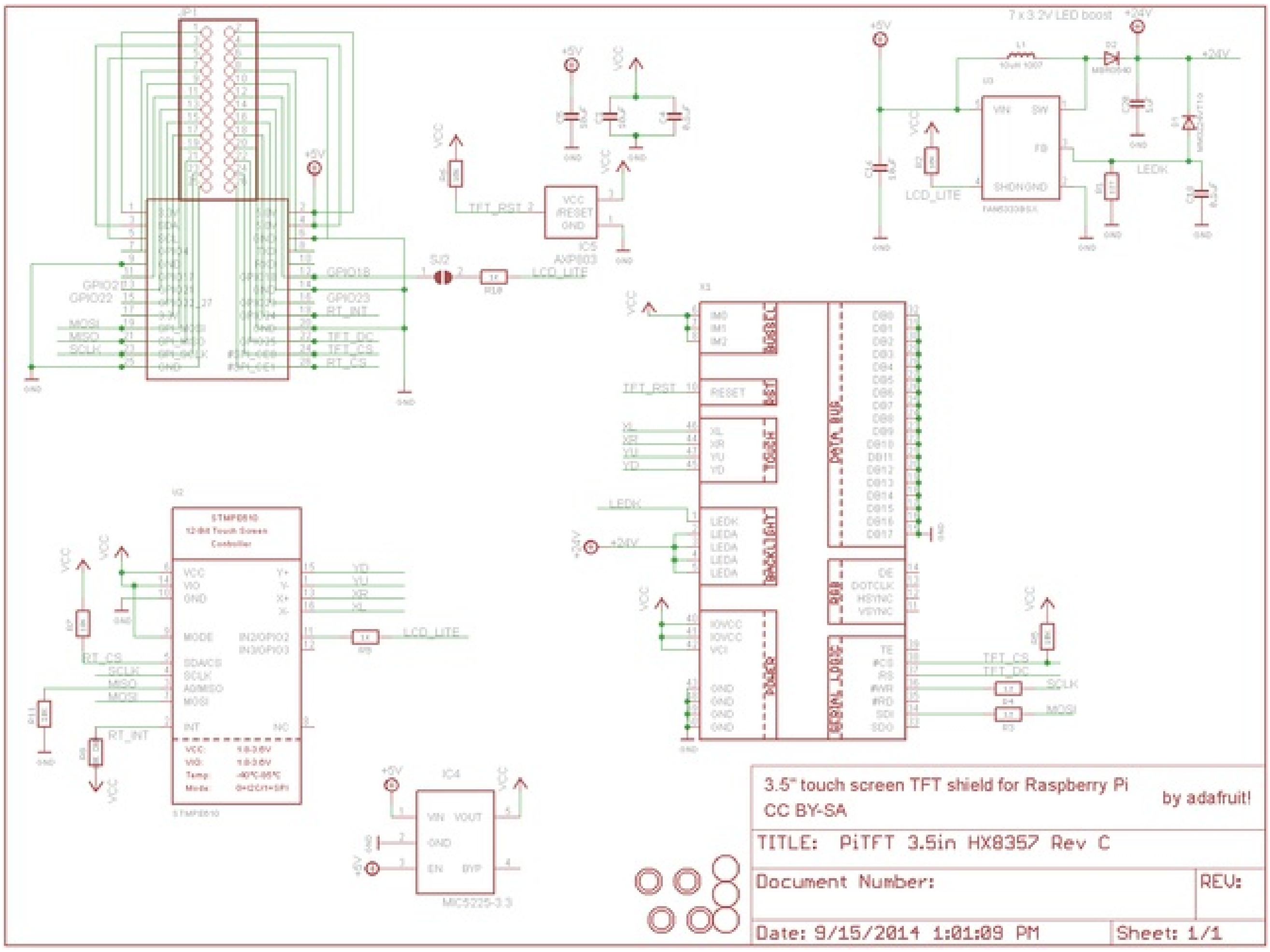
STMPE610
12-Bit Touch Screen Controller
CAT24C32
AXP803
FAN5333BSX
7 x 3.2V LED boost
Raspberry Pi Model B+

Layout and Schematic for original PiTFT

3.5"

This is the original PID #2097 version

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JP1
STMPE610
12-Bit Touch Screen Controller
IC4
MIC5225-3.3
IC5
AXP803
7 x 3.2V LED boost
FAN5333BSX
LCD_LITE
LEDK
TFT_RST
TFT_CS
TFT_DC
RT_CS
RT_INT
MOSI
MISO
SCLK
GPIO18
GPIO23
GPIO22
DATA BUS
BACKLIGHT
SERIAL LOGIC