



Application Note

AN_250

Configuring FT313H Driver for Embedded Linux

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This application note shows the user how to configure driver files for the FT313H USB High Speed Host Controller.

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1 Introduction

This document shows how to configure the driver files for the FT313H High Speed Host Controller for use in an embedded Linux single board computer (SBC). The driver files are simple text files and can be easily modified to allow the FT313H to communicate with a variety of embedded Linux SBCs.

1.1 Scope

This document is designed as an introduction to Platform drivers and USB Host drivers for the FT313H device with a simple embedded Linux system. It is assumed the user is familiar with basic Linux commands and Linux based Operating Systems such as Ubuntu. This document covers FT313H drivers only, and does not describe hardware implementation details of the FT313H .

1.2 Hardware Required

[DevKit 8600 Embedded Linux board](#)

[UMFT313EV Development Module](#)

Adapter board to bridge DevKit bus interface connector with UMFT313EV development module.

(note: adapter board is a custom part dependent upon the system processor) USB Hub

[FTDI USB to Serial DB9 cable.](#)

Linux PC with SD card reader

2 GB micro SD card with SD card adapter.

1.3 Linux Operating System and Development Tools

Angstrom Linux source files and development tools are provided with the DevKit 8600 installation CD (Tools/Drivers CD is provided with purchase of DevKit from Embest). It assumed the user is familiar with tools such as Menuconfig and other Linux utilities for building custom Linux kernels for embedded systems.

Source Files and Tools Required from DevKit CD:

- Linux 3.x sdk kernel directory

- U-boot bootstrap loader directory

- Cross compile tools directory

Note: Users of other embedded systems should consult the support websites of these systems.

1.3.1 Installation of tools and source files

In a Linux terminal window on the Linux PC, create the following home directory and extract the following tar files from the CD or install package:

```
mkdir $HOME/tools
cd /media/cd/linux/tools (depends on your source)
tar xvf arm-2009q1-203-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2 -C $HOME/tools
tar -xvf arm-eabi-4.4.0.tar.bz2 -C $HOME/tools
```

Copy the following compile utilities to the tools directory:

```
cp /media/cd/linux/tools/mkimage $HOME/tools
```

```
cp /media/cd/linux/tools/mkfs.ubifs $HOME/tools
```

```
cp /media/cd/linux/tools/ubinize $HOME/tools
cp /media/cd/linux/tools/ubinize.cfg $HOME/tools
```

Add environment variables to allow use of above tools:

```
export PATH=$HOME/tools/arm-2009q1/bin:$HOME/tools/arm-eabi
-4.4.0/bin:$HOME/tools:$PATH
```

The next step is to extract and install the kernel source directories from disc or other archive:

```
mkdir $HOME/work
cd $HOME/work
tar jxvf /media/cdrom/linux/source/u-boot-2011.09-psp04.06.00.03.tar.bz2
tar jxvf /media/cdrom/linux/source/linux-3.1.0-psp04.06.00.03.sdk.tar.bz2
```

1.3.2 Create Bootstrap program

To create the u-boot loader, run the following commands

```
cd u-boot-2011.09-psp04.06.00.03
make distclean
make devkit8600_config
make
```

When these steps are complete, the u-boot directory will contain the required MLO and u-boot.img files.

2 Introduction to Linux Drivers

2.1 Drivers used by the FT313H and the embedded system

Embedded Linux systems such as the DevKit8600 and Beaglebone do not use a standard interface bus like PCI-X for desktop PCs. Instead, external hardware is plugged directly into the system bus. There is a special driver file called the Platform driver that configures the ARM processor and its support chips to talk to external devices such as the FT313H. The Platform driver is analogous to the Board Support Package (BSP) used by embedded Windows CE systems.

In addition, there is a specialized Host Controller driver (HCD) for the FT313H to communicate with the USB stack on the embedded system.

Both the Platform driver and HCD driver are compiled when building the kernel image file for the embedded system.

Figure 2.1 shows the relationship between the FT313H, system bus and the embedded OS.

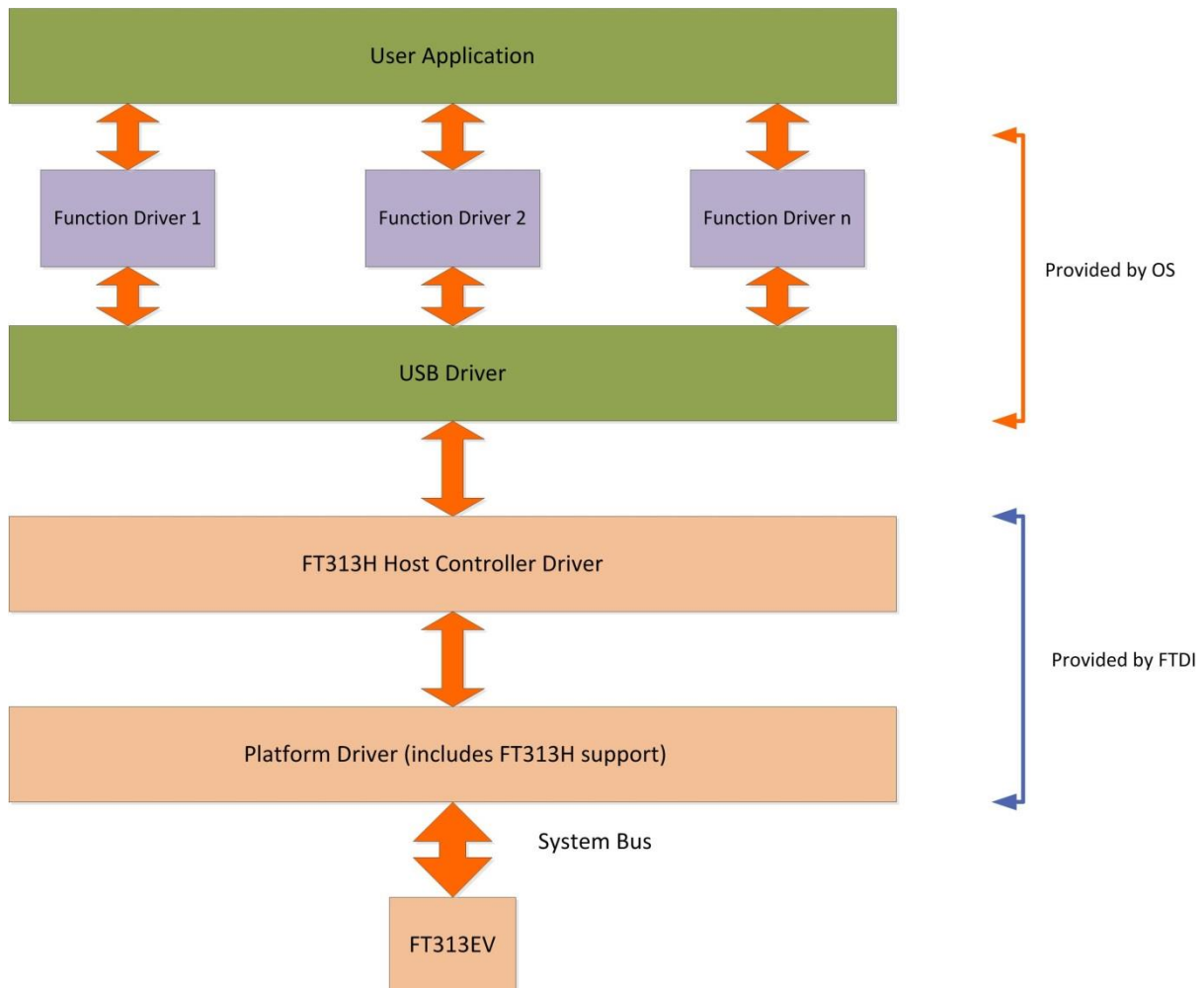


Figure 2.1 USB Driver Flow

2.2 FTDI Driver Files for FT313H

Download the driver files from the FT313 [drivers link](#) on the FTDI website.

The Platform driver file is **board-am335xevm.c**. This file is used to configure the GPMC (general purpose memory controller) module of the ARM processor. The structure of this file depends on the ARM processor and support hardware used in the embedded Linux system. The included file is optimized for the DevKit 8600. This file is contained in the **FT313H_Platform.tar** archive.

The Host Controller driver is the next higher level driver for the FT313H. This driver consists of several separate files that need to be compiled. The FT313H HCD driver files are contained in the **FT313H_hcd_demo.zip** archive.

These files need to be copied into the ARM driver source directories before building the new kernel image files:

Copy board-am335xevm.c to **/linux-3.1.0-psp04.06.00.03.sdk/arch/arm/mach-omap2**

Copy the ft313h_hcd_demo files to **/linux-3.1.0-psp04.06.00.03.sdk/drivers/usb/host**

There are also two sets of Makefiles and Kconfig files that are used for compiling the ft313H_HCD driver files. The Makefile is a script that creates the required kernel components. The Kconfig files guide the operation of the menuconfig utility. These files are contained in the **Make_Kconfig.tar** archive.

Extract Make_KCon_drivers_usb to **/linux-3.1.0-psp04.06.00.03.sdk/drivers/usb**

Extract Make_KCon_drivers_usb_host to **/linux-3.1.0-psp04.06.00.03.sdk/drivers/usb/host**

Now that the FT313H platform and host controller drivers have been copied to the correct locations, the next task is to build the kernel. This process will differ depending on the embedded Linux system in use.

2.3 Building the Kernel

In a terminal window, go to the \$HOME/work/linux-3.1.0-psp04.06.00.03.sdk directory.

```
make distclean
make devkit8600_defconfig
make menuconfig
```

Menconfig will start with following menu, scroll down to reach device drivers. Hit enter to select.

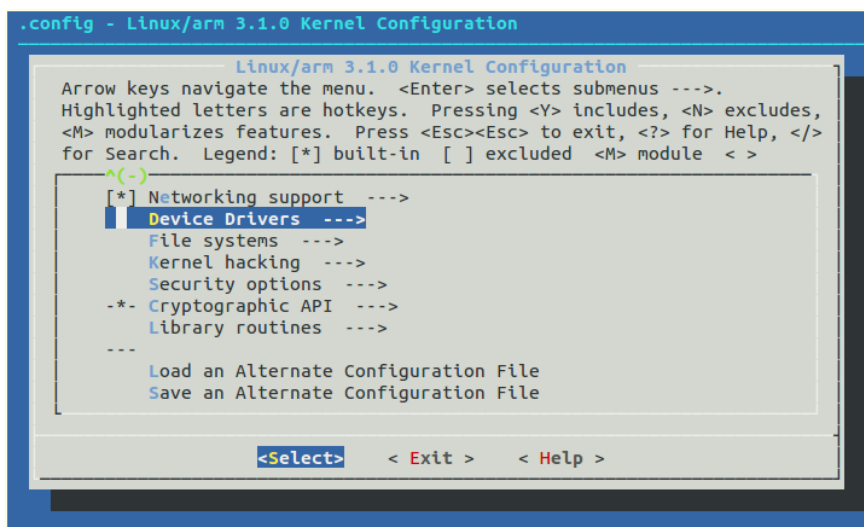


Figure 2.2 Menuconfig Device Drivers

If menuconfig reports an error, make sure you have installed the ncurses library:

```
sudo apt-get install ncurses-dev
```

Next, scroll down in the device drivers menu to USB Support and select:

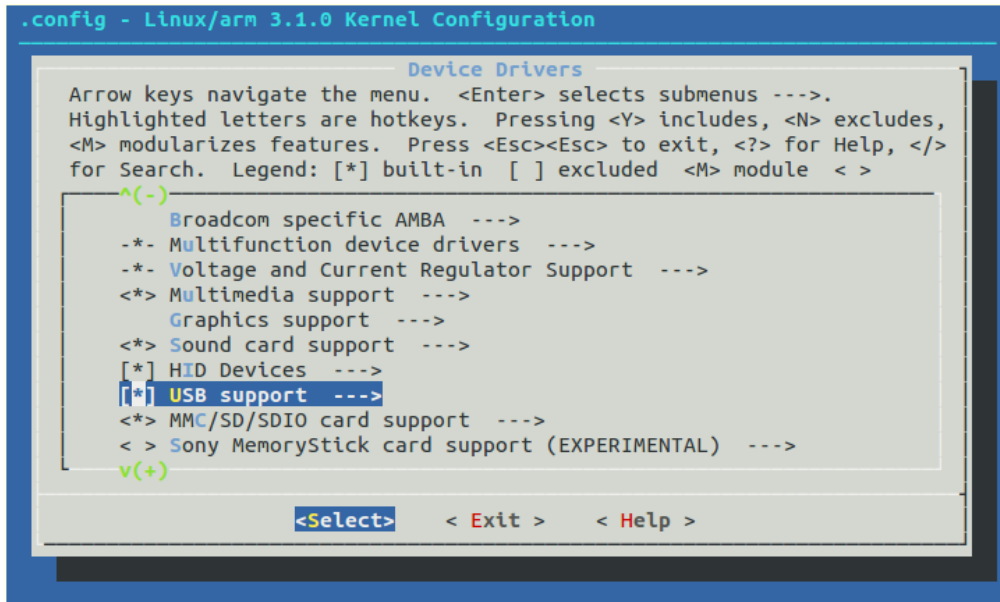


Figure 2.3 Menuconfig USB Support

Under USB Support, you should be able to find the FT313H entry. Enter Y to select FT313H support:

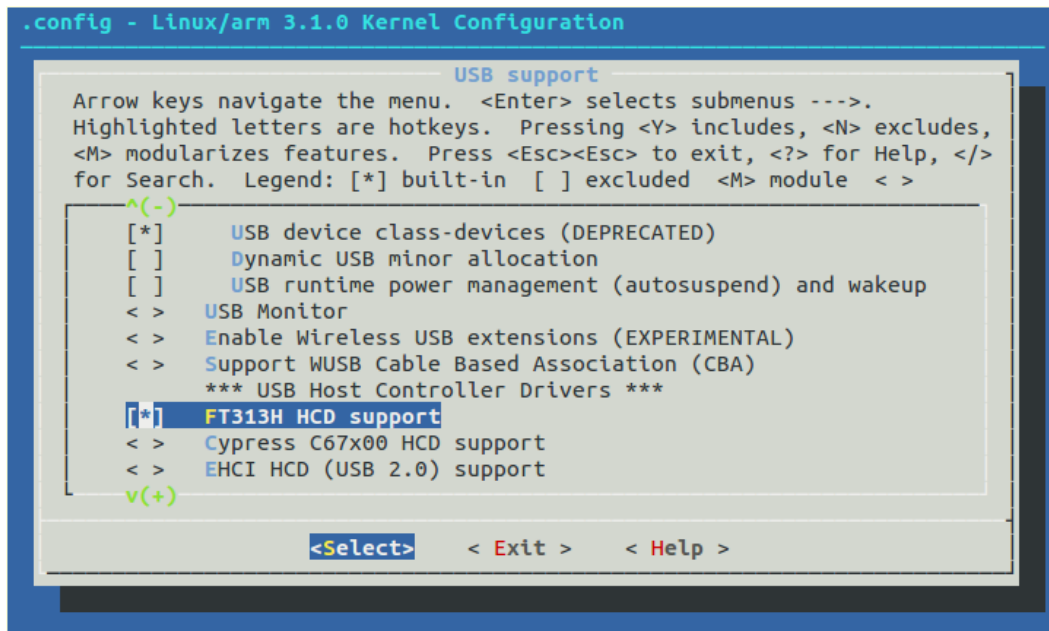


Figure 2.4 Menuconfig FT313H Support

Back up to the first page in menuconfig by entering <ESC> <ESC> until you reach the following page. Select Yes to save and exit:

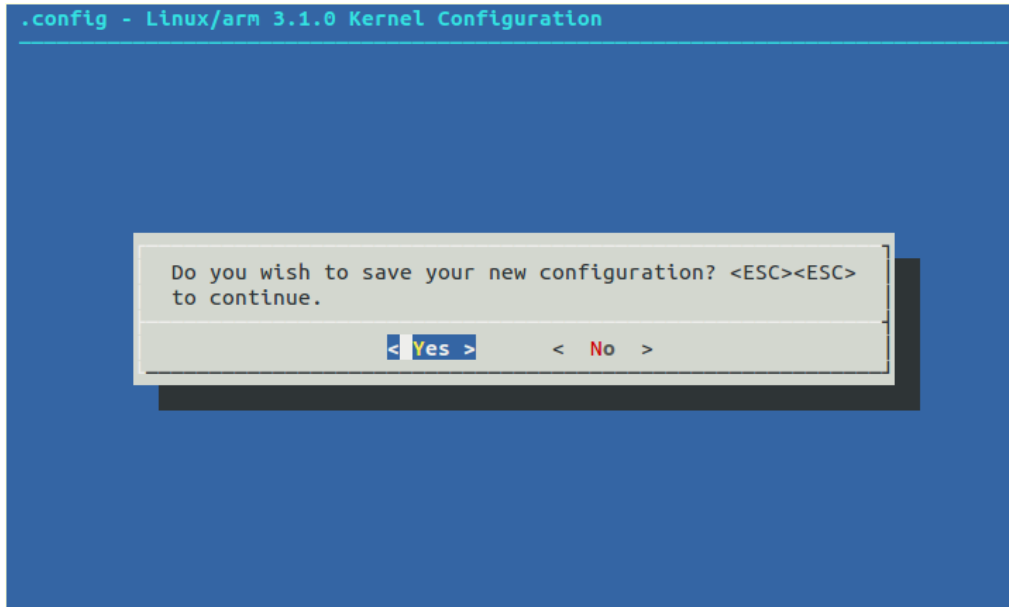


Figure 2.5 Save Changes to Menuconfig

In a terminal window, enter

```
make uImage
```

This will build the new kernel image, and will take approx. 30 minutes. The new kernel image will be created in subdirectory **/arch/arm/boot**.

2.4 Build UBI files

Go to the top level work directory:

```
cd $HOME/work
```

```
sudo $HOME/tools/mkfs.ubifs -r rootfs -m 2048 -e 126976 -c 812 -o ubifs.img
```

```
sudo $HOME/tools/ubinize -o ubi.img -2048 -p 128 KiB -s 512 -O 2048\  
$HOME/tools/ubinize.cfg
```

The required ubi.img file will be created in the work directory.

3 Loading new driver onto DevKit

The DevKit 8600 uses NAND flash and does not require a multiple partition SD card as with Android.

Copy the following files (MLO, u-boot.img, uImage and ubi.img) on to a micro SD card formatted for FAT32.

Plug in a FTDI USB to Serial cable to the DB9 monitor port on the side of the DevKit and plug the USB side into the Linux PC. Set up a TTY application on your Linux PC (such as GtKTerm) for a baud rate of 115.2 Kbaud, no flow control. Port name will be /dev/ttyUSB0.

Insert the micro SD card into the micro SD socket of the DevKit 8600. Press the reset button.

In the TTY window , you will see a startup prompt and a rapid countdown. Hit any key to stop auto- boot. You are now in u-boot mode.

In the TTY window, you should see the Dev Kit prompt. Enter "run updatesys" after the prompt.

```
DevKit8600# run updatesys
```

You will see messages similar to the following in the TTY:

```
NAND erase.chip device 0 whole chip
OK
Reading MLO

44371 bytes read
HW ECC BCH8 Selected

NAND write: device 0 offset 0x0, size 0x9705
37192 bytes written OK
Reading u-boot.img

232456 bytes read
HW UHCC BCH8 selected
NAND Write
Reading uImage

NAND write device 0 offset 0x280000, size 0x2d8970
2984304 bytes written OK
Reading ubi.img

NAND wite device 0 offset 0x780000, size 0x138000
204447232 bytes written OK
```

If the LEDS adjacent to the micro SD socket are flashing, the update is finished. Eject the micro SD card and reboot the DevKit 8600. This will boot the new kernel.

4 Demonstrating device support for FT313H

With the DevKit connected to an LCD monitor and a USB keyboard connected to the UMFT313EV board via a hub, you will see the Angstrom Linux boot screen and login prompt. The keyboard should be able to talk to the the DevKit via the FT313H. This confirms a successful inclusion of the FT313H driver into the linux kernel.

Enter "root" as the password. You can use Linux commands to observe OS files and run a simple graphics demo.

To show USB slave devices, just enter

```
dmesg | grep USB.
```

You can easily rebuild the kernel to include FTDI USB to Serial support (available in Menuconfig). You will also need to install a command line based TTY such as MiniTerm, Kermit or cu.

5 Summary

This is a simple introduction to installing and configuring the FT313H platform and Host driver on the Embest DevKit 8600.

With small changes, this procedure can be adapted to run on other embedded Linux platforms such as the BeagleBone Black and Raspberry Pi.

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Appendix A – References

Document & Website References

[TN_146 Creating Android Images for App Development](#)

[Building Embedded Linux Systems, Karim Yaghmour and Jon Masters, O'Reilly Media](#)

[Getting Started with the BeagleBone and BeagleBone Black](#)

[Gentoo Linux on the BeagleBone](#)

Acronyms and Abbreviations

Terms	Description
KConfig	File that configures options for Menuconfig.
Makefile	Script that builds executable programs and libraries from source code
Menuconfig	Linux utility for building a customized kernel image.
MLO	Stage 1 boot loader for embedded Linux systems. MLO loads the Stage 2 boot loader, U-Boot.
SBC	Single Board Computer
U-Boot	Stage 2 boot loader for embedded Linux. U-Boot loads the kernel image into memory.
UBI	Support file for building Linux image.
uImage	Kernel image file generated by make menuconfig.

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Appendix C – Revision History

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