

Configuring Linux PCs for use with ELI43-CP and ELI43-CR

Summary:

When plugging the ELI43-CP or ELI43-CR into a computer with an AMD or NVIDIA GPU (Graphics Processing Unit, or Video Card) running Linux, only a white or black screen is usually shown on the ELI unit. To fix this, the Linux PC needs to run some commands in the terminal using the xrandr tool. Then we will need to save the settings to a script file which runs on startup. This guide will explain how to configure Linux to work with ELI43-CP and ELI43-CR.

Required Hardware:

- Linux PC with an AMD or NVIDIA GPU w/ working display
- ELI43-CP or ELI43-CR
- Display already working with Linux PC

Required Software:

- Linux OS (Tested with Ubuntu 16.04 and 14.04)

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1. Determining Display Adapter Name

NOTE: “~” indicates that what follows is a command entered into the terminal.

NOTE: “#” indicates that what follows is a command entered into the terminal with root permissions.

1. Open up the terminal on the Linux PC
 - a. Clicking the Ubuntu logo in the top left corner.
 - b. Type in “terminal” in the search bar to search for the terminal application.
 - c. Click the icon labelled “Terminal” when it shows up in the search menu.

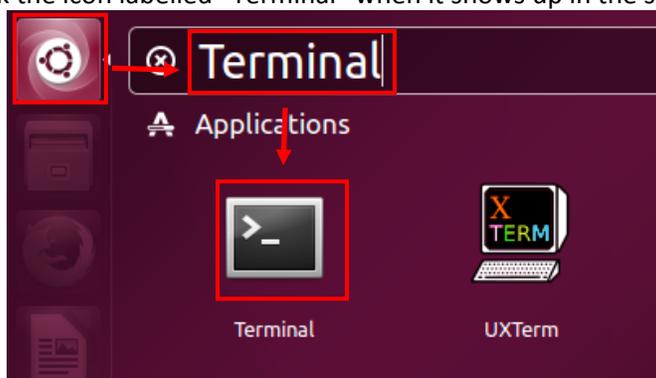


Figure 1 - Opening the Terminal

2. Run the following command with the ELI43 disconnected from the computer

```
~ xrandr -q
```

3. Look at all the connected displays and make note of all the devices it says are connected.

```
VGA1 disconnected (normal left inverted right x axis y axis)
VIRTUAL1 disconnected (normal left inverted right x axis y axis)
DP-1-1 disconnected
DP-1-2 disconnected
DP-1-3 connected primary 1920x1080+1920+0 509mm x 286mm
 1920x1080    60.00*+
 1280x1024    75.02    60.02
 1152x864     75.00
 1024x768     75.08    60.00
 800x600      75.00    60.32
 640x480      75.00    60.00
 720x400      70.08
```

Figure 2 - Connected Devices

4. Connect the ELI43 to the computer via HDMI (or equivalent adapters) to the computer.
5. Run the following command:

```
~ xrandr -q
```

6. Check which device is now connected that was previously disconnected.

```
VGA1 disconnected (normal left inverted right x axis y axis)
VIRTUAL1 disconnected (normal left inverted right x axis y axis)
DP-1-1 connected
DP-1-2 disconnected
DP-1-3 connected primary 1920x1080+1920+0 509mm x 286mm
 1920x1080    60.00*+
 1280x1024    75.02    60.02
 1152x864     75.00
 1024x768     75.08    60.00
 800x600      75.00    60.32
 640x480      75.00    60.00
 720x400      70.08
```

Figure 3 - Connected Devices after ELI43 is Connected

7. Here, DP-1-1 was not connected when we had the ELI43 disconnected, and now is showing as connected. This device is the device you should use in the "--addmode" and "--output" commands performed later in this guide.

2. Configuring the ELI43-CP/CR

1. Turn on the Linux PC with both the ELI43 and another display connected. This second display will be used to configure the PC.
2. When the computer is started up, the ELI43 will not display correctly:

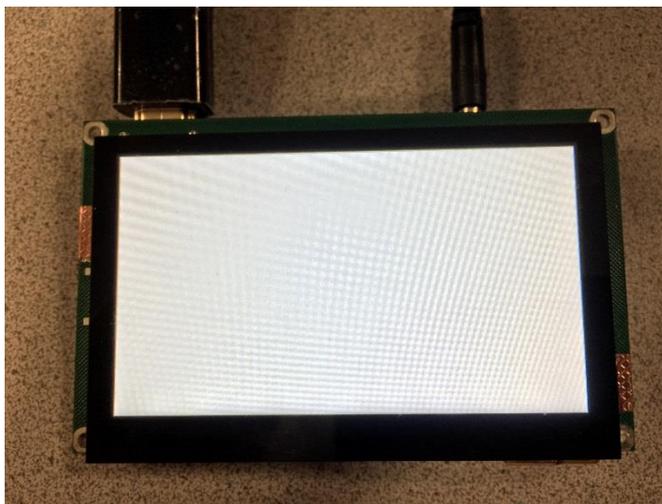


Figure 4- ELI43 upon initially being plugged in to Linux PC with AMD or NVIDIA GPU

3. Open up the terminal.
 - a. Clicking the Ubuntu logo in the top left corner.
 - b. Type in “terminal” in the search bar to search for the terminal application.
 - c. Click the icon labelled “Terminal” when it shows up in the search menu.

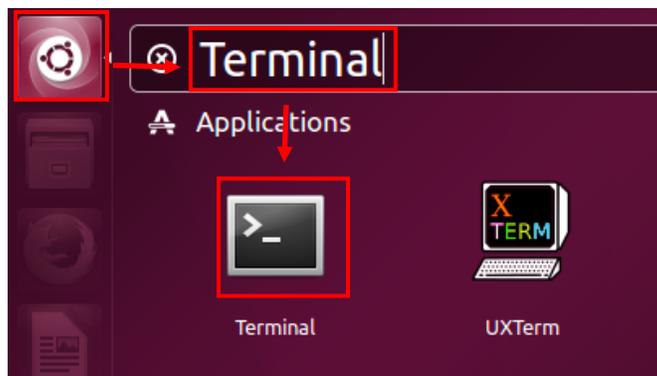


Figure 5 - Opening the Terminal

4. Log into the terminal as root.
 - a. Enter the following command into the terminal: `~ su`
 - b. After entering the command into the terminal, you will be prompted to enter the root password. Enter it now. If for some reason you are unable to log in as root, then enter all commands that require root permissions with “sudo” before the command.

i. Example: ~ sudo command

5. Enter the following commands into the terminal as root:

```
# xrandr --newmode "480x272_60.00" 9.00 480 496 536 592 272 275 285 288 -hsync -vsync
# xrandr --addmode HDMI1 "480x272_60.00"
# xrandr --output HDMI1 --mode "480x272_60.00"
```

NOTE: HDMI1 is the name of the display adapter the ELI unit is connected through, there is more information on finding the name of this device in Section **Error! Reference source not found. Error! Reference source not found.**

6. Upon entering the last command, the display should change to the proper resolution. If there were no display modes existing for the device, the display may start working after the "addmode" line. But the "output" line ensures the mode is set for the device.

3. Description of the "--newmode" Command

1. In general, the command to make a new mode is as follows:

```
# xrandr --newmode <name> <clock MHz> <hdisp> <hsync-start> <hsync-end> <htotal> <vdisp>  
<vsync-start> <vsync-end> <vtotal> [flags...]
```

2. The individual components are described below:
 - a. <name>: A name for the new timing mode in quotes. EX. "480x272_60.00"
 - b. <clock MHz>: The frequency of the pixel clock in Megahertz
 - c. <hdisp>: The horizontal resolution. EX. For 480x272, this value would be 480
 - d. <hsync-start>: This is the beginning of the Horizontal Sync Pulse. This goes at the end of the Horizontal Front Porch. EX. For this timing, the Horizontal Front Porch is 15, so $480+15=495$. The Horizontal Sync Pulse starts 1 after the end of the Horizontal Front Porch. So 496 is hsync-start.
 - e. <hsync-end>: This is hsync-start + Horizontal Sync Pulse Width. Ex. The pulse width in this example is 40. So, $496+40= 536$.
 - f. <htotal>: This is the hdisp + Horizontal Front Porch + Horizontal Back Porch
 - g. <vdisp>: The vertical resolution. EX. For 480x272, this value will be 272
 - h. <vsync-start>: This is the beginning of the Vertical Sync Pulse. This goes at the end of the Vertical Front Porch. EX. For this timing, the Vertical Front Porch is 15, so $480+15=495$. The Vertical Sync Pulse starts 1 after the end of the front porch. So 496 is vsync-start.
 - i. <vsync-end>: This is vsync-start + Vertical Sync Pulse Width. Ex. The pulse width in this example is 10. So, $496+10= 506$.
 - j. <vtotal>: This is the vdisp + Vertical Front Porch + Vertical Back Porch
 - k. [flags...]: Here we have -vsync and -hsync. This means vsync is negative polarity and hsync is negative polarity. +vsync and +hsync would be positive polarities.

4. Saving Configuration Changes

1. With the computer turned on, click the Ubuntu icon.
2. Type "Startup" and click "Startup Applications" once it appears under "Applications"



Figure 6 - Opening Startup Applications

3. Once Startup Applications is open, click <Add> on the right of the window.

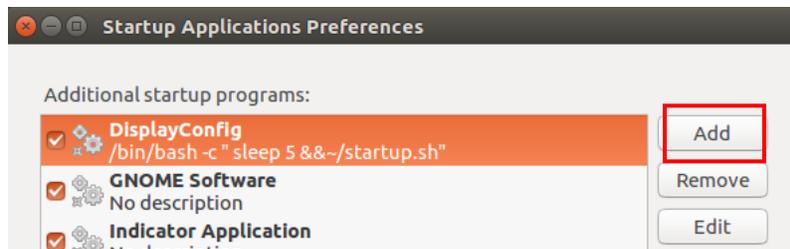


Figure 7 - Startup Applications Preferences Window

4. Enter a name for this startup application. We used "DisplayConfig"
5. Enter the following in the "Command" field:

```
/bin/bash -c "sleep 5&&~/startup.sh"
```

NOTE: This executed the Linux shell commands in quotes. Commands are separated by "&&". First, we sleep for 5 seconds, to give the system some time to startup. Then we run a shell script we will create soon.

6. Enter any description in the "Comment" field. We just put the command there as a baseline reference in case we needed to change it.

- Our settings are as shown in the picture below:

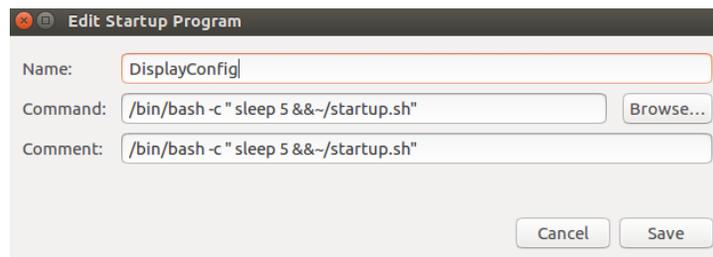


Figure 8 - Startup Program Settings

- Click <Save> to save these settings.
- Now we need to create the “startup.sh” script.
- Open up the terminal by clicking on the Ubuntu logo and typing “Terminal” in the search area.

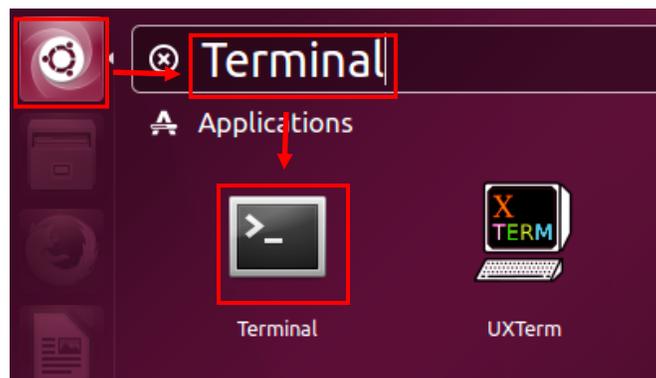


Figure 9 - Opening the Terminal

- Once the terminal is open, type:

```
~ nano startup.sh
```

- The terminal should be replaced with a blank text editor. (You may use any other text editor you are familiar with to create this file).
- Enter the following (using the correct display adapter we found in Section **Error! Reference source not found.:** **Error! Reference source not found.:**):

```
xrandr --newmode "480x272_60.00" 9.00 480 496 536 592 272 275 285 288 -hsync -vsync  
xrandr --addmode HDMI1 "480x272_60.00"  
xrandr --output HDMI1 --mode "480x272_60.00"
```

```
GNU nano 2.5.3 File: startup.sh Modified  
! /bin/bash  
xrandr --newmode "480x272_60.00" 10.00 480 496 536 592 272 275 285 288 -hsync -vsync  
xrandr --addmode DP-1-1 "480x272_60.00"  
xrandr --output DP-1-1 --mode "480x272_60.00"
```

Figure 10 - startup.sh Script Contents

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14. Use the keyboard shortcut CTRL+O to save the script.
15. Use the keyboard shortcut CTRL+X to exit and return to the terminal window.
16. Enter the following command in the terminal to make the script executable:

```
~ chmod 755 startup.sh
```

17. The ELI43 will now have the mode created and applied each time you log in.

****NOTE: If you want to have additional displays connected, Proceed to steps 17-21****

18. To get other displays to work with the ELI43, first find out the Display Adapter names for the other displays. You can do this by following the steps in Section 3 and disconnecting/connecting the other displays instead of the ELI43.
19. Now that you have the adapter names, we need to add a few lines to startup.sh
20. Open startup.sh by entering the following command (now that you have set permissions, you will need to run the following command as root):

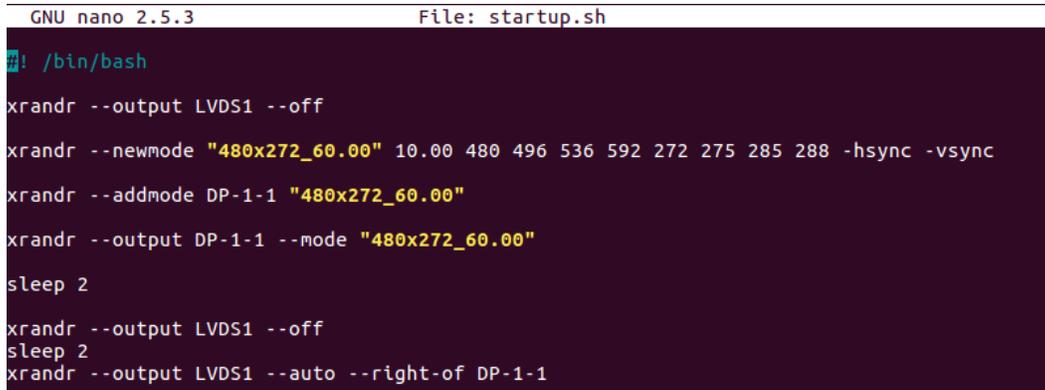
```
~ nano startup.sh
```

21. Enter the following line to the top of the script for each display (replacing LVDS1 with the name of your display adapter):

```
xrandr --output LVDS1 --off
```

22. Now, at the end of the script, enter the following (repeating the xrandr lines for each display. For the additional display after the first, replace "--right-of HDMI1" with the name of the last display you added):

```
sleep 2
xrandr --output LVDS1 --off
xrandr --output LVDS1 --auto --right-of HDMI1
```



```
GNU nano 2.5.3 File: startup.sh
! /bin/bash
xrandr --output LVDS1 --off
xrandr --newmode "480x272_60.00" 10.00 480 496 536 592 272 275 285 288 -hsync -vsync
xrandr --addmode DP-1-1 "480x272_60.00"
xrandr --output DP-1-1 --mode "480x272_60.00"
sleep 2
xrandr --output LVDS1 --off
sleep 2
xrandr --output LVDS1 --auto --right-of DP-1-1
```

Figure 11 - Setting up a Second Monitor

23. Use the keyboard shortcut CTRL+O to save the script.
24. Use the keyboard shortcut CTRL+X to exit and return to the terminal window.

25. These steps turn off all other displays and allows the ELI43 to start up by itself. We found that sometimes the displays would overlap if we didn't include this step. Then at the end, we wait 2 seconds to give the system some time to configure the ELI43, then we make sure LVDS1 (our example additional display) is turned off (we found that sometimes, setting the setting for the ELI43 turned on the other displays). Then we turn on the display using its "auto" mode.

5. Support

I. Where to Get Help

- Online technical support is available at <http://www.teamfdi.com/support/>.

II. Useful Links

- Future Designs, Inc. Forums: http://www.teamfdi.com/?post_type=forum
- ELI43-CP Product Page: <http://www.teamfdi.com/product-details/eli43-cp/>
- ELI43-CR Product Page: <http://www.teamfdi.com/product-details/eli43-cr/>