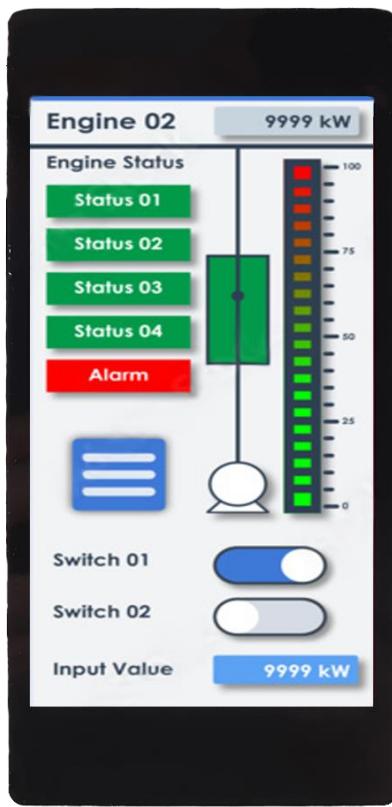


ELI50-CPW

User's Manual



Revision 1.0

FDI *Future Designs, Inc.*
Your Development Partner
996 A Cleaner Way, Huntsville, AL 35805

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1.0 Introduction

About ELI (the Easy LCD Interface)

ELI® is Future Designs, Inc.'s family of long-life, plug-and-play embedded displays. ELI products are true modular embedded display solutions that require no engineering or lead-time. All ELI products are compatible with a wide range of single board computers including Raspberry Pi, BeagleBone Black and Windows-based units. FDI designed ELI as an embedded display option that requires minimal development time to help customers reach production quickly. Once a product is in production, FDI's 10 to 15 year ELI product availability guarantee helps ensure production schedules without the risk of expensive or time consuming redesigns. Learn more about ELI at TeamFDI.com/ELI.

ELI Compatibility

ELI products are compatible with most Single Board Computers, PCs, and operating systems. See <https://www.teamfdi.com/product-details/eli50-cpw#compatibility> for the results of FDI's compatibility tests with popular operating systems and platforms. Our results, as indicated in the table, demonstrate ELI versatility but the table is not exhaustive. ELI products are designed to work with any single board computer that has an HDMI or DP output. To submit a question about ELI compatibility with a platform or operating system that is not included in the table, contact a member of the FDI support team at Support@teamfdi.com.

Your ELI Experience

Share your experience connecting ELI devices to various (single board) computers at: <http://www.teamfdi.com/edid/#edidform>.

2.0 Recommended Accessories (Purchased Separately)

- 7.5V to 17V DC (+/- 5%) Power Supply, with a center positive barrel connection.
- Power Input Cable (FDI P/N: ELI50-CPW-PIC) available from [DigiKey](#) or [Mouser](#).
- Or build your own Power Input Cable using these items.
 - 2.1mm I.D. x 5.5mm O.D. Jack to Screw Terminal, on [DigiKey PN: 1528-1386-ND](#)
 - 4-pin, 1.5mm Molex connector for power input, [Molex PN: 502578-0400](#)
 - 24AWG 225mm, male-male Molex cables for power input
 - [Red Molex PN: 2157102125](#)
 - [Black Molex PN: 2157101125](#)
- See [Figure 3. ELI50-CPW-PIC Power Input Cable](#) for a visual reference.

Note: All ELI units operate from +12V DC so this is the recommended power supply input voltage for the entire Family. See section 9.0, Power Details, for more information.



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- USB Type A to Mini Type B Cable (for touch)
- HDMI Cable (Type A Male)
- Lengths for the USB and HDMI cables will be determined by the ELI mounting location and position in each user application.

3.0 Touchscreen Precaution

When the ELI50-CPW is powering up and initializing, please refrain from touching the front of the display or laying it face down on a surface. This can interfere with proper touchscreen initialization and may cause temporary issues with the touch screen operation. If this condition occurs, please reset, or power up the unit correctly and normal touchscreen operation will resume.

4.0 ESD Warning



Figure 1. Electrostatic Sensitive Device

Our ELI units are shipped in a protective anti-static package. Do not subject the module to high electrostatic potential. Exposure to high electrostatic potential may cause damage to the boards that will not be covered under warranty. General practice for working with static sensitive devices should be followed when working with this device.

5.0 Determining the Revision of your ELI

All ELI devices have a label placed on the board to identify the part number and revision of the unit. This label will help you quickly and correctly identify your ELI unit's part number and revision number.

An example of an ELI label is shown below.



6.0 Technical Specifications

Table 1. Technical Specifications

Screen Size (diagonal inches):	5.0
Display Technology:	a-Si TFT LCD
Resolution:	720 x 1280 (WXGA Portrait)
Brightness (nits typical):	300
Contrast Ratio (typical):	1000:1
Aspect Ratio:	Tall 9:16
Interface Input Mode:	HDMI
Colors:	16.7M (24 bit)
Horizontal Viewing Angle:	85/85°
Vertical Viewing Angle:	85/85°
Surface:	1.1 mm anti-fingerprint treated glass
Touch Screen:	Projected Capacitive
Touch Screen Interface (mA typical/max):	USB Device
Touch Panel Hardness:	6H
Active Area (in mm, W x H):	62.10 x 110.40
Response Time (ms):	30
Backlight:	12 LEDs
Backlight Life (K hours typical):	30
Backlight Power Consumption (W Typical):	Up to 61% of total
Operating Temperature:	-20° to 70° C
Storage Temperature:	-30° to 80° C
Input Voltage:	7.5 to 17 VDC <u>+5%</u>
Power Consumption (mA, typ/max):	150/250 @ 12V
USB Power Consumption (mA, typ/max):	< 1mA (touch is powered from 12V)
RoHS Compliant:	Yes
Dimensions (in mm W x H x D)	71.61 x 145.36 x 6.26
Mounting:	3M 300LSE tape or other 3M tape
Weight (grams)	94



7.0 Mechanical Details

A 2D Mechanical Drawing of the unit is available on our website under the Documentation tab.
<https://www.teamfdi.com/product-details/eli50-cpw>

3D Mechanical Models (in both STEP and EASM format) are available from our website after completing a simple fillable NDA or Non-Disclosure Agreement.

<https://www.teamfdi.com/mechanicalmodelrequest>

8.0 Connectors

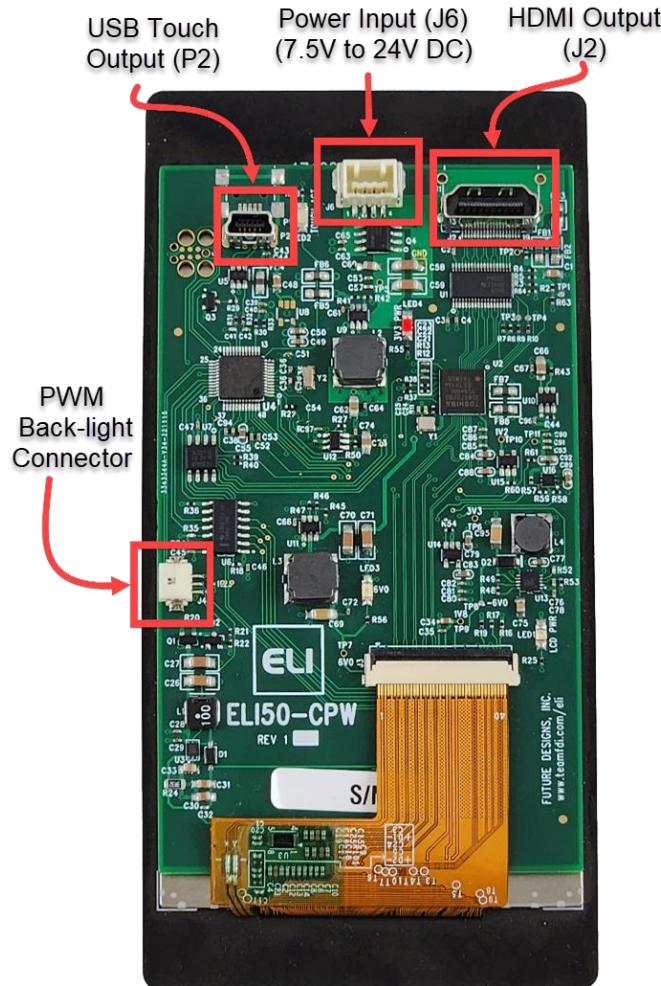
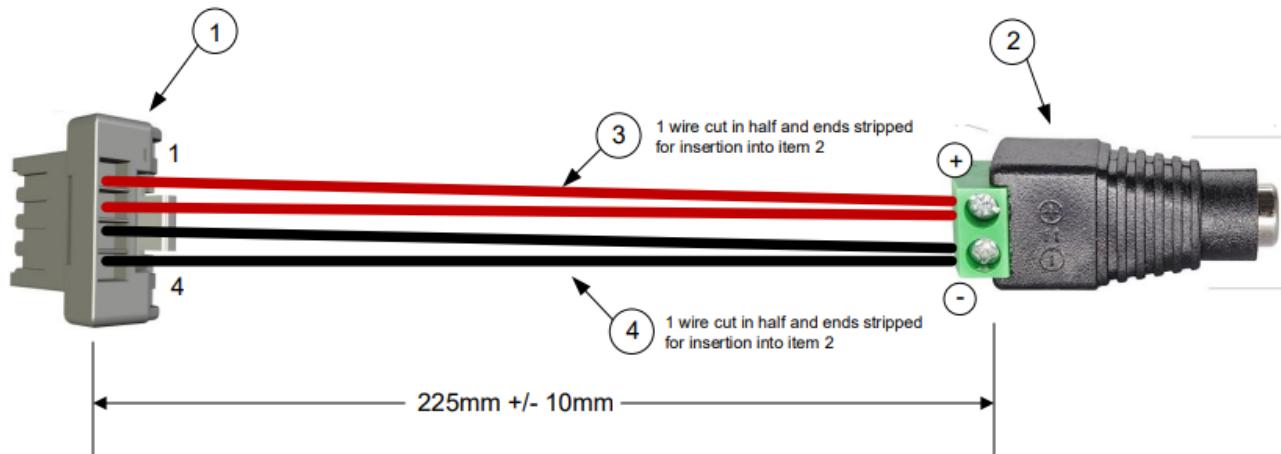


Figure 2. ELI50-CPW Connectors

9.0 Power Details

A 12VDC +/- 5% power supply with a 2.0A output will power most any product from the ELI Family. This allows a common, off-the-shelf power supply such as the [1939-1462-ND](#) to be used for quick demos or prototyping across the entire ELI Family. In general, any 12VDC power supply with a 2.1mm center positive connection will be acceptable if it can provide enough current to power the particular ELI unit being used.

On the ELI50-CPW, a Power Input Cable is available to help easily power the unit for prototyping and testing. This cable is available from [DigiKey](#) or [Mouser](#) under P/N ELI50-CPW-PIC or you can build your own using the information given below and in Section 2.0, Recommended Accessories (Purchased Separately).



ITEM	QTY	FDI PN	DESCRIPTION	MFG	MFG PN
1	1	J000322	4PIN, HOUSING, 1.5MM	MOLEX	502578-0400
2	1	J000323	2PIN, SCR TERM TO 2.1MM FEM	DigiKey	1528-1386-ND
3	0.5	WR00030	RED WIRE, 24AWG, 450MM, M-M	MOLEX	2157102125
4	0.5	WR00031	BLACK WIRE, 24AWG, 450MM, M-M	MOLEX	2157101125

NOTE: WIRES ARE CUT IN HALF AND STRIPPED FOR CONNECTION TO ITEM 2

Figure 3. ELI50-CPW-PIC Power Input Cable

When ready, connect power via the cable into the power connector (J6).

Pin	Value
1	Positive Power Input
2	Positive Power Input
3	Ground
4	Ground

J6 Pinout

Mating Connector Details for J6:

- Manufacturer: Molex
- Part Number: 502578-0400
- Digi-Key [Housing Link](#)
- Pre-terminated wires:
 - Digikey [Red Link](#)
 - Digikey [Black Link](#)

LED4 is the “Power” LED indicator that is on if the ELI is connected to a DC input voltage.

LED1 is the “LCD Power” indicator and *LED3* is the “LCD 6V0 Power” Indicator. When DC input power is applied to the unit (via J6) and an HDMI input signal is present at J2, *LED1* and *LED3* will turn ON (*LED1* is Orange and *LED3* is Yellow). This LCD Power indicator only confirms that a DC input voltage and an HDMI signal are “present” at the ELI50-CPW inputs, but it does not mean that the input signals are necessarily valid or correct.

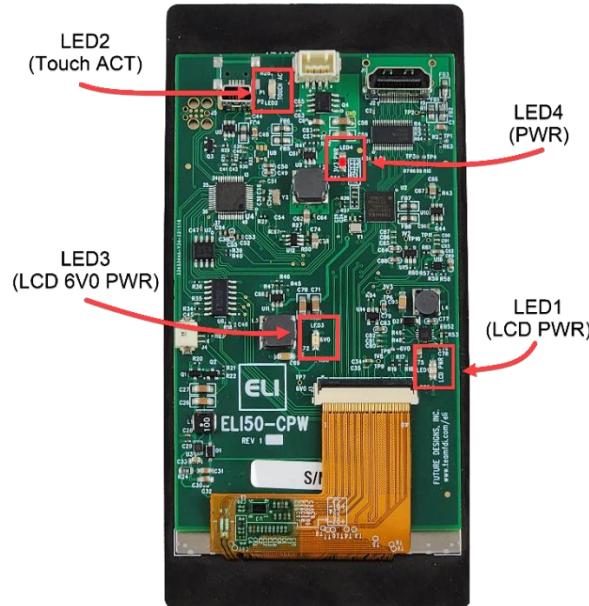


Figure 4. ELI50-CPW LEDs



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ELI50-CPW units can use power supplies ranging from +7.5 to +17.0 VDC \pm 5% (2.0A).

For volume production applications, the input power can be optimized for your ELI unit and lower capacity power supplies can be used.

To verify that the ELI50-CPW unit is correctly powered you may check the input voltage with a Fluke multi-meter or scope by probing test point TP5, shown below. Please verify that the input voltage is present, and within the \pm 5% tolerance and is free from excessive noise or AC ripple.

Note: If using an input that is within the 7.5V to 17.0V (\pm 5%) range of an ELI50-CPW, the voltage measured from TP5 will reflect the input voltage being utilized.

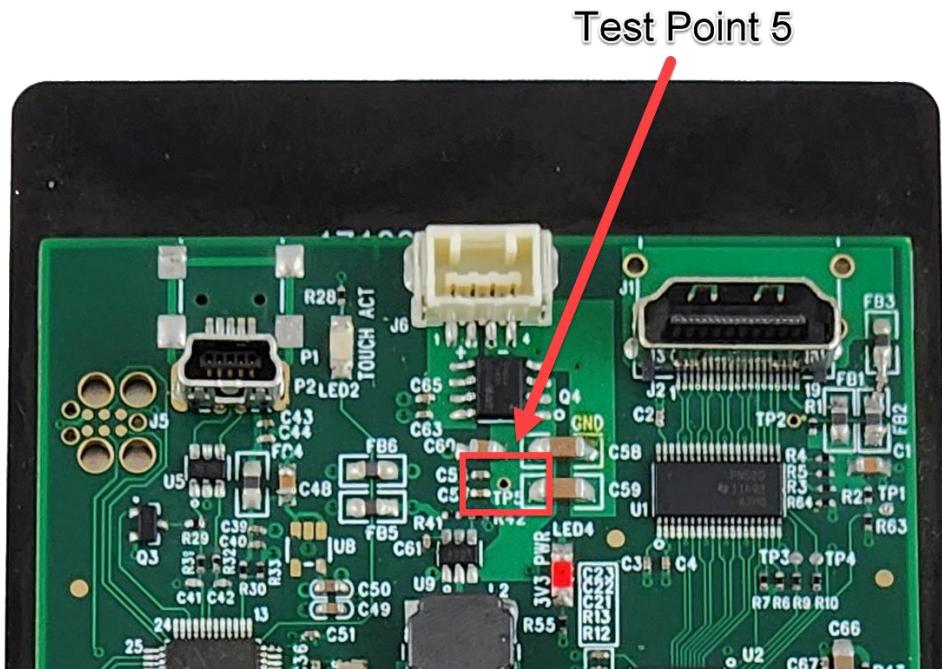


Figure 5. ELI50-CPW Test Point TP5. Probe to measure input voltage

Note on Proper Power Up Sequence:

The ELI50-CPW must be powered on before the SBC video source to ensure that the EDID information can be read properly to auto initialize the correct screen resolution and timing.

Some Single-Board Computers or other HDMI video sources might only read the EDID information when the video source is first powering up, so it is critical to make sure that the ELI50-CPW is powered up first to assure proper initialization of the video / screen resolution.

10.0 Touch Activity LED

ELI50-CPW has a Touchscreen Activity LED (*LED2*) located near the USB touch Interface (P2):

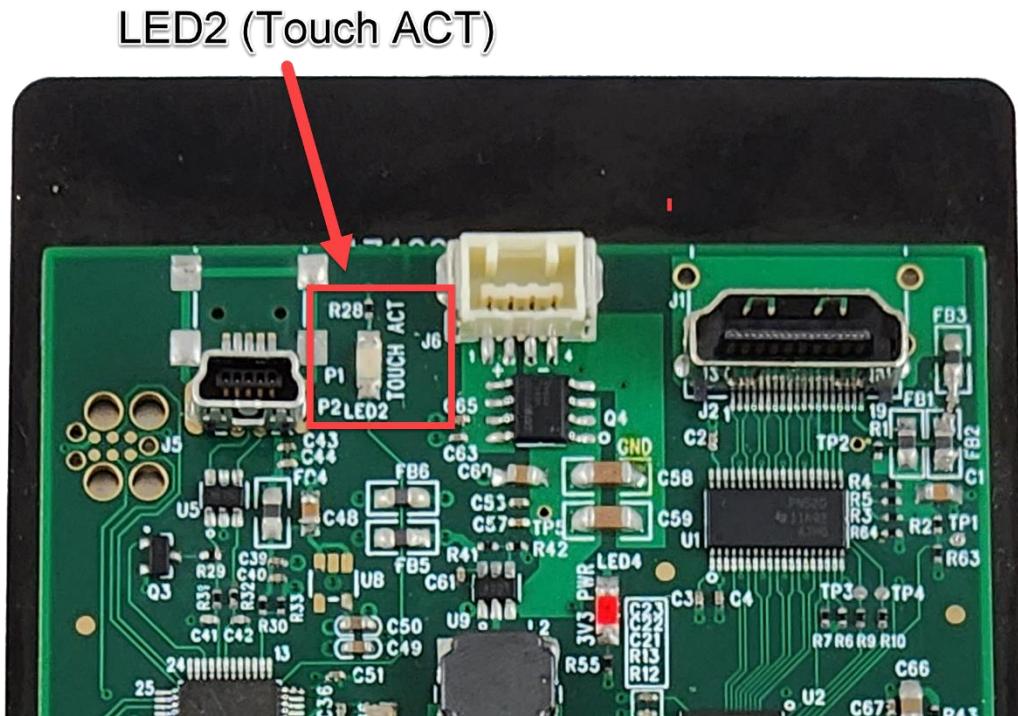


Figure 6. ELI50-CPW – Touch Activity LED

This Green *LED2* will stay on when the USB touch interface is connected and blink whenever any touchscreen input is detected, allowing for verification of the touch response.

Note that no touch response will be read if the HDMI is disconnected, or the ELI display is not detected by the video source.

11.0 Extended Display Information Data (EDID)

ELI uses Extended Display Identification Data (EDID) for automatic configuration with many operating systems. You can find out more on our website at <http://www.teamfdi.com/edid/>.

The ELI50-CPW must be powered on before the SBC video source to ensure that the EDID can be read properly.

Some Single-Board Computers or other HDMI video sources might only read the EDID information when the video source is first powering up, so it is critical to make sure that the ELI50-CPW is powered up first to assure proper initialization of the video / screen resolution.

12.0 PWM Control of Backlight

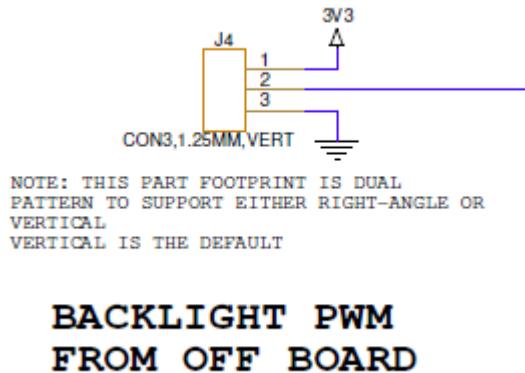


Figure 7. PWM Backlight Control

NOTE: For Rev 1.x units the PWM feature is not implemented but will be supported in future revisions.

J4 mating connector housing information:

- Manufacturer: Hirose
- Part Number: DF12-3S-1.25C
- Digi-Key Link: <https://www.digikey.com/products/en?keywords=H2180-ND>
- Pre-terminated wires <https://www.digikey.com/en/products/filter/jumper-wires-pre-crimped-leads/453?s=N4IgjCBcoLQCxVAYygMwIYBsDOBTANCAG4B2aWehA91ANogDsAHAGwgC6hADgC5QggAvsKA>

ELI provides an input, so an external processor or SBC can control the backlight to vary the display brightness or to reduce power consumption (the display backlight is typically one of the larger sources of power consumption in the unit). PWM dimming is an input with a 0 to 3.3 VDC range and the user should drive this with a push-pull type output or a suitable open collector output.

To control the display, backlight the user should connect an externally generated Pulse Width Modulated (PWM) signal to J4 pin 2 along with a common ground to J4 pin 3. The frequency range for this signal is from 5KHz to 100KHz. Each ELI unit's display backlight properties will vary, so the user should test their version for an acceptable range of brightness control. For example, your 0 to 100% brightness range may be 40% to 90% of the PWM range. In certain installations, a series resistor on J4 pin 2 may be required to ensure a clean PWM signal is provided to the ELI. The suggested value for the resistor is 100ohms. See **Figure 9** below, for example of connectivity. Actual testing in your installation may require this resistor to be changed, or possibly not required at all.

On the ELI unit, the PWM dimming signal is pulled up to LCD_VDD providing 100% backlight power when no PWM signal is applied at pin 2 of J4. If nothing is connected to J5 the ELI will drive



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the display at 100% brightness (default).

The LCD_VDD output at pin 1 of J4 is a $3.3\text{VDC} \pm 5\%$. If the external system is capable of directly driving the PWM dimming signal at 3.3VDC , there is no need to connect pin 1 to the cable. ELI provides the 3.3 VDC signal, called LCD_VDD, for the external system in case this voltage is needed to generate the correct levels on the PWM dimming input.

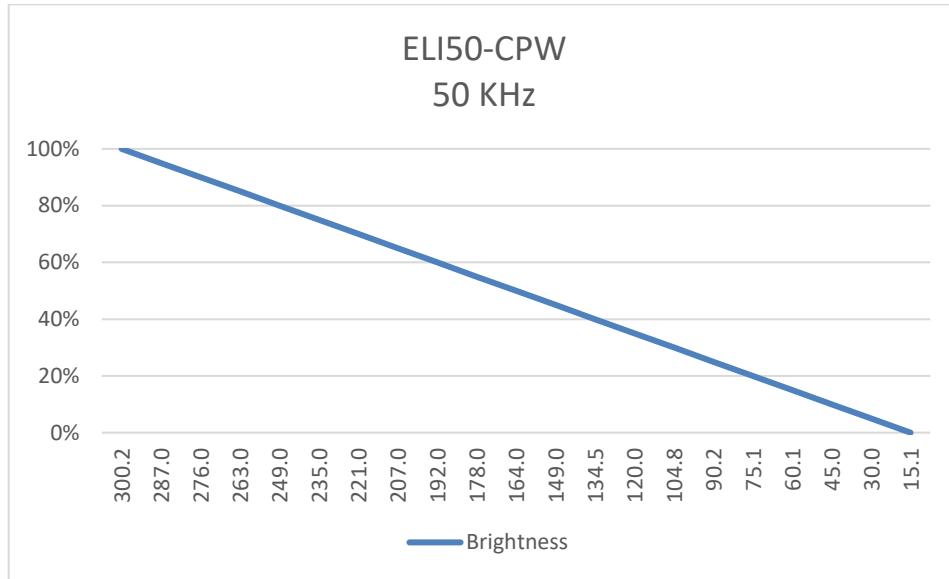


Figure 8. ELI50-CPW Backlight Curve in Nits

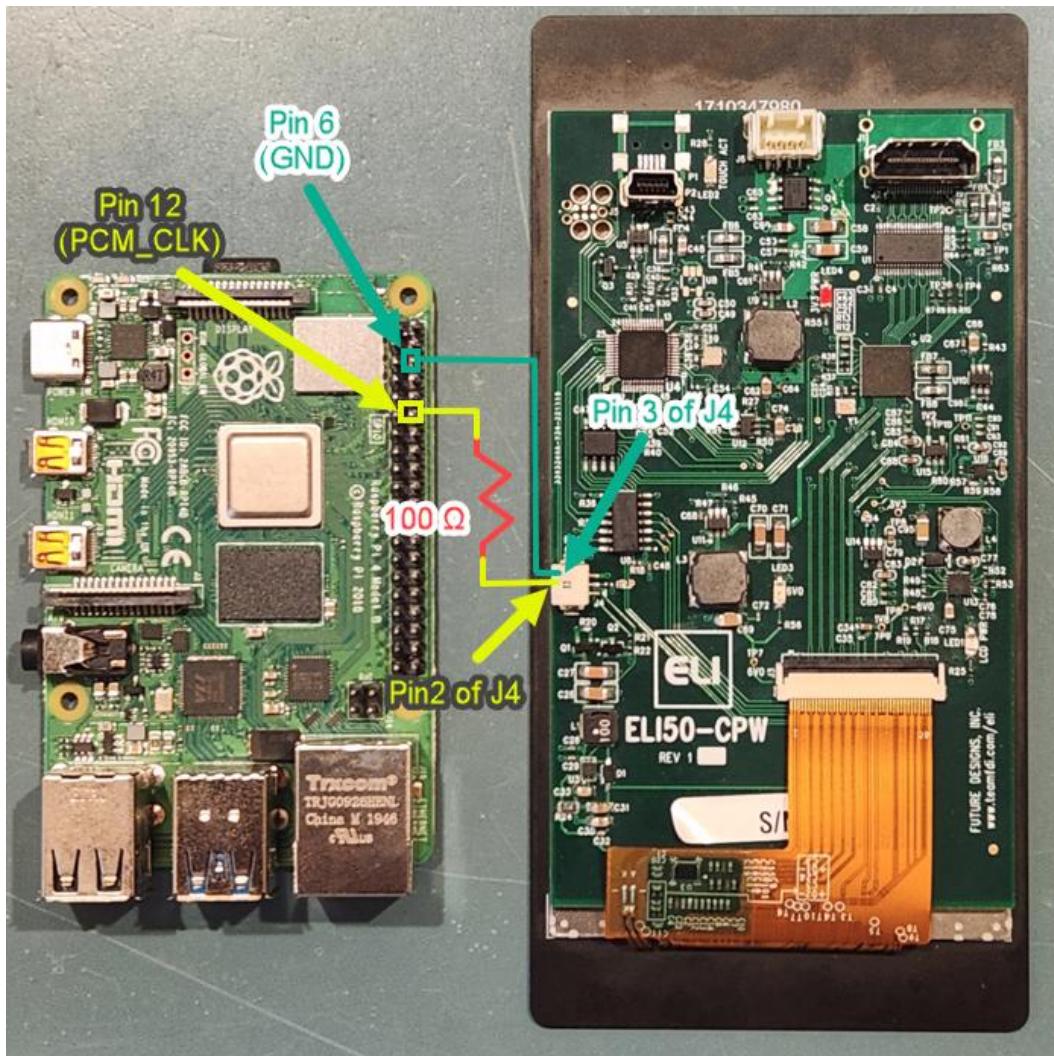


Figure 9. Raspberry Pi Signal and Ground

The ELI backlight can be easily controlled from a Raspberry Pi. See Figure 9 for a wiring diagram. Our software is available on the website at <https://www.teamfdi.com/product-details/eli50-cpw#software> or you may copy the code from here:

```

/*
Changes brightness of ELI backlight given a command line argument between 0 and the set
range. Uses bcm2835 header file provided by Broadcom at http://www.airspayce.com/mikem/bcm2835/bcm2835-1.52.tar.gz This source code must be compiled using "g++ brightness.cpp -o brightness -l
bcm2835" in order to properly link the header file. Must be run using sudo, accessing GPIO
pins requires root permissions. After compiling, you may add executable to "/usr/bin" which
allows you to type "sudo brightness <value>" to change brightness anywhere in terminal ("sudo
brightness 20" is full brightness). The "/boot/config.txt" file must also be changed by
adding a "#" before the line "dtparam=audio=on". This disables audio output from the
Raspberry Pi. If this is not disabled then anytime sound is output the screen will return to
100% brightness.
*/
#include<iostream>
#include<bcm2835.h>
#include<string>

using namespace std;

#define LED RPI_GPIO_P1_12 // PWM pin number for backlight control
#define RANGE 20 // Range for PWM steps
#define CLOCK 192 // Clock rate

int main(int argc, char *argv[]){
    int data = 0; // Brightness level

    if(argc != 2){ // Give user correct usage if ran incorrectly
        cout << "Error: correct usage, brightness <value>" << endl;
        return 1;
    }

    data = stoi(argv[1]);

    if(data > RANGE || data < 0){
        cout << "Error: brightness value must be between 0 and " << RANGE << endl;
        return 1;
    }

    if(!bcm2835_init())
        return 1;

    bcm2835_gpio_set_pad(BCM2835_PAD_GROUP_GPIO_0_27, BCM2835_PAD_DRIVE_2mA); // Sets the
    drive current to 2mA
    bcm2835_gpio_fsel(LED, BCM2835_GPIO_FSEL_ALT5); // Sets up pin 18 for alt5 pwm mode

    bcm2835_pwm_set_clock(CLOCK); // Sets pwm clock to 19.2 MHz / CLOCK
    bcm2835_pwm_set_mode(0,1,1); // Sets mode to markspace
    bcm2835_pwm_set_range(0,RANGE); // Sets range
    bcm2835_pwm_set_data(0,data); // Sets data rate to argument value

    bcm2835_close();
    return 0;
}

```

Figure 10. Backlight Control for Raspberry Pi



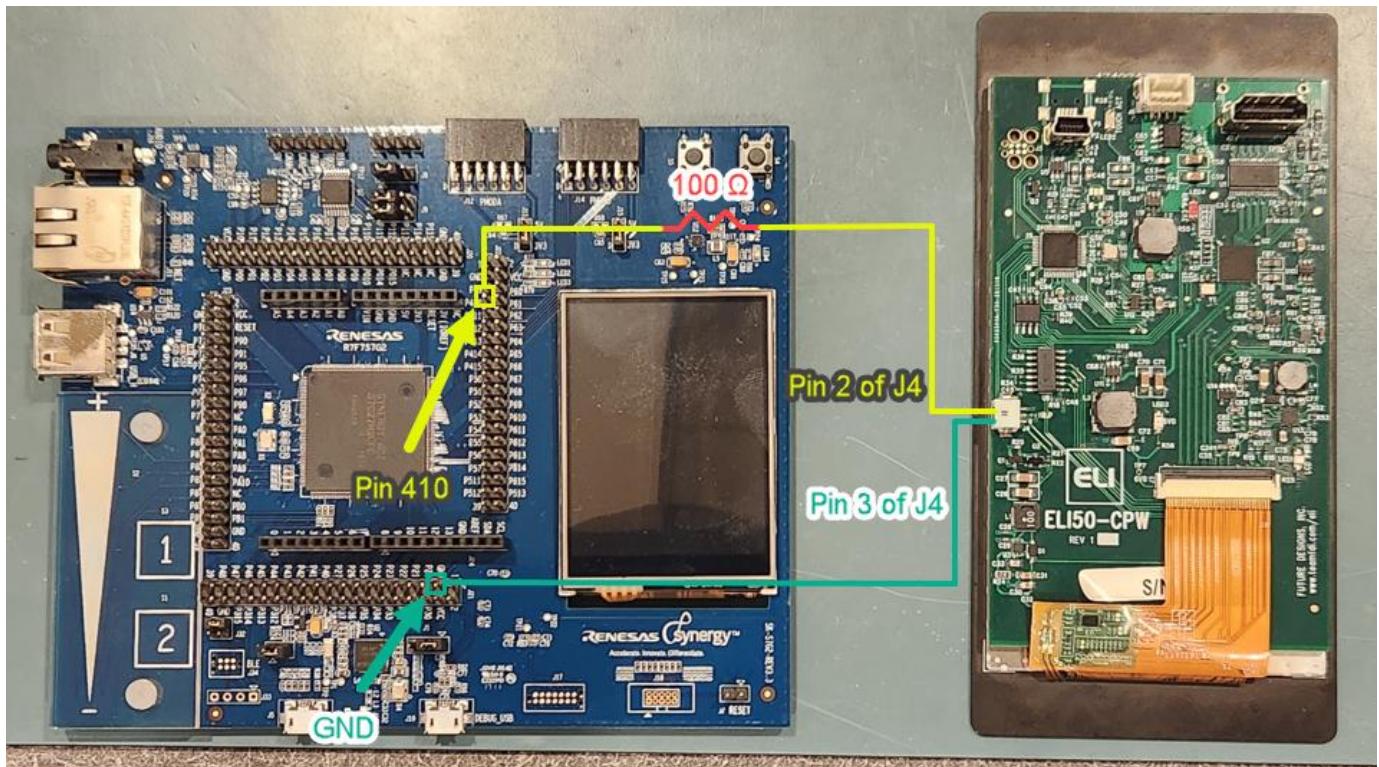


Figure 11. Renesas Synergy S7G2 Signal and Ground

As an example, the ELI backlight can also be controlled from a Renesas Synergy S7G2 wired as shown in Figure 11. The software for Synergy can be found on our website at <https://www.teamfdi.com/product-details/eli50-cpw#software>.

13.0 Support

13.1 Where to Get Help

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

13.2 Useful Links

- Future Designs, Inc. Forums: <https://www.teamfdi.com/forums/>
- ELI50-CPW Product Page: <http://www.teamfdi.com/product-details/eli50-cpw>
- ELI Software User's Manual: <http://www.teamfdi.com/wp-content/uploads/ELI-Software-Users-Manual.pdf>
- Tell us about your ELI experience: <http://www.teamfdi.com/edid/#edidform>
- EDID Information Page: <http://www.teamfdi.com/edid/>