

DLP3030-Q1 Combiner HUD EVM DLP3030CHUDQ1EVM

User's Guide



Literature Number: DLPU065

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Introduction

1.1 EVM Overview

The DLP3030CHUDQ1EVM evaluation module (EVM) is a wide field of view (WFOV) combiner head-up display (C-HUD) table top demonstrator. This C-HUD demonstrator enables Tier 1 and OEM customers to demonstrate a state of the art, high-performance WFOV HUD powered by TI DLP® technology. The C-HUD is based on the DLP3030-Q1 chipset and DLP3030-Q1 PGU.

The EVM runs off of a nominal 12-V supply (not provided; see [Section 2.3](#) for details) and accepts an HDMI input video interface.

Additionally, TI provides a software tool that can communicate via a Microsoft® Windows® PC's USB port for brightness and display mode configuration.



1.2 Warnings

CAUTION



Caution Hot surface.
Contact may cause burns.
Do not touch.

1.3 Specifications

Table 1-1. Performance Specifications

Resolution	WVGA (864 × 480)	Dimming Range	>5,000:1 ⁽¹⁾
Field of View	12° × 3.6°	Contrast Ratio	>1,000:1 (FoFo)
Virtual Image Distance	2.5 m	Color Gamut	125% NTSC ⁽¹⁾
Virtual Image Size	487 mm × 155 mm	Overall Dimensions	Roughly 300 mm × 275 mm × 250 mm
Eyebox Size	130 mm × 60 mm	Power Input	6-18 VDC
Max Brightness (Eyebox)	>34,000 cd/m ² ⁽¹⁾	Video Input	HDMI
PGU Lumens	>70 Lumens ⁽¹⁾	Control Interface	SPI (via Cheetah USB to SPI adapter)

⁽¹⁾ System was calibrated at 25°C and Vbatt at 12 V.

Table 1-2. Power Specifications

PARAMETER	TEST CONDITIONS	MIN	NOM	MAX	UNIT
Vbatt Input Voltage		6	12	18	V
Power Consumption	Q8WP RGB LEDs operating at 70/30 DMD duty cycle	2 ⁽¹⁾	5.6 ⁽²⁾	13.9 ⁽³⁾	W

⁽¹⁾ This value defines minimum white-balanced brightness setting. With LEDs off, power consumption drops to 1.44 W.

⁽²⁾ Produces 15,000 cd/m² on DLP3030CHUDQ1EVM or 32 lumens on DLP3030PGUQ1EVM.

⁽³⁾ Produces 34,000 cd/m² on DLP3030CHUDQ1EVM or 70 lumens on DLP3030PGUQ1EVM.

Table 1-3. Temperature Specifications

PARAMETER	MIN	NOM	MAX	UNIT
Operational Ambient Temperature Range	−40		105	°C
Storage Ambient Temperature Range	−40		105	°C

1.4 Kit Contents

Table 1-4. DLP3030CHUDQ1EVM Kit Contents

ITEM NO.	ITEM
1	DMD Interface Board
2	Formatter Controller Board
3	Total Phase Cheetah USB to SPI Adapter
4	3-in DMD Ribbon Cable (2×)
5	Photodiode Cable
6	RGB LED Power and Thermistor Cable
7	Cheetah SPI Interface Cable
8	Power Input Cable
9	6-ft HDMI cable
10	WFOV HUD PGU
11	5-mm M3 Screws (4×)
12	1-ft HDMI cable extender
13	HDMI Panel Mount Connector
14	Combiner HUD Optics
15	12-mm M3 Screws (2×)
16	10-mm M4 Screws (4×)
17	Combiner Glass Mount
18	Combiner Glass

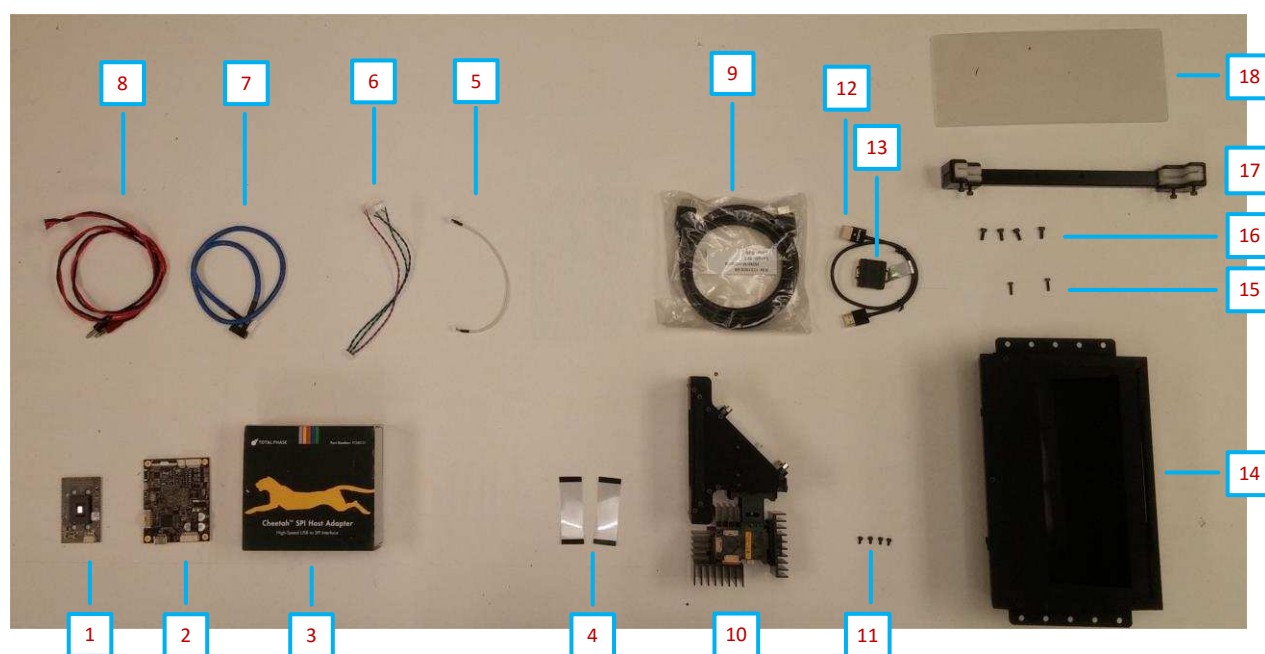
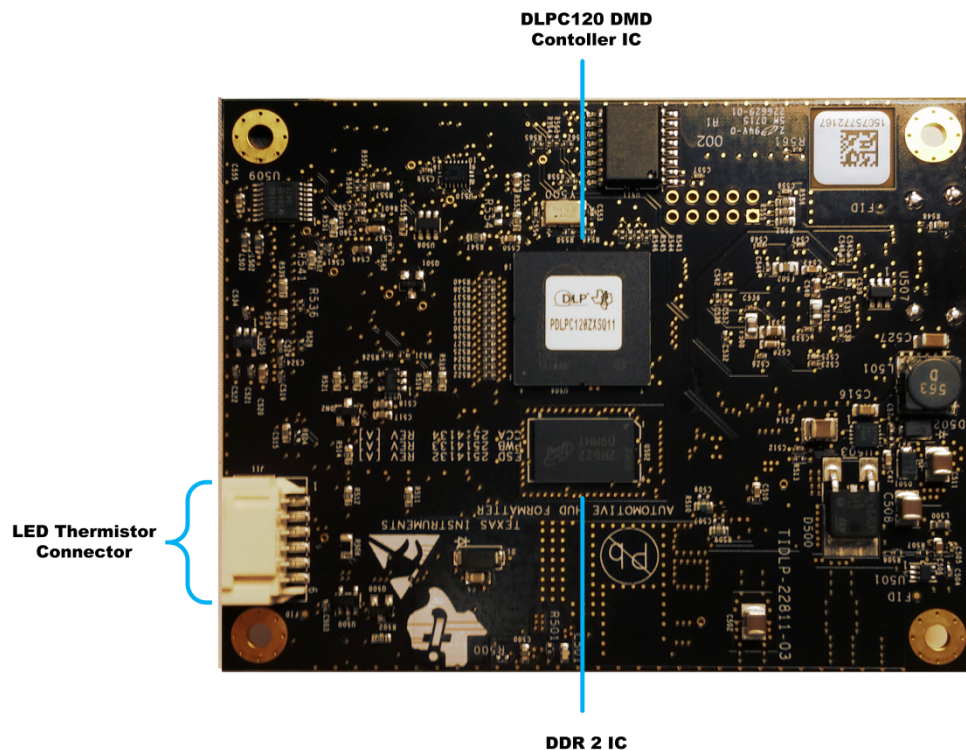
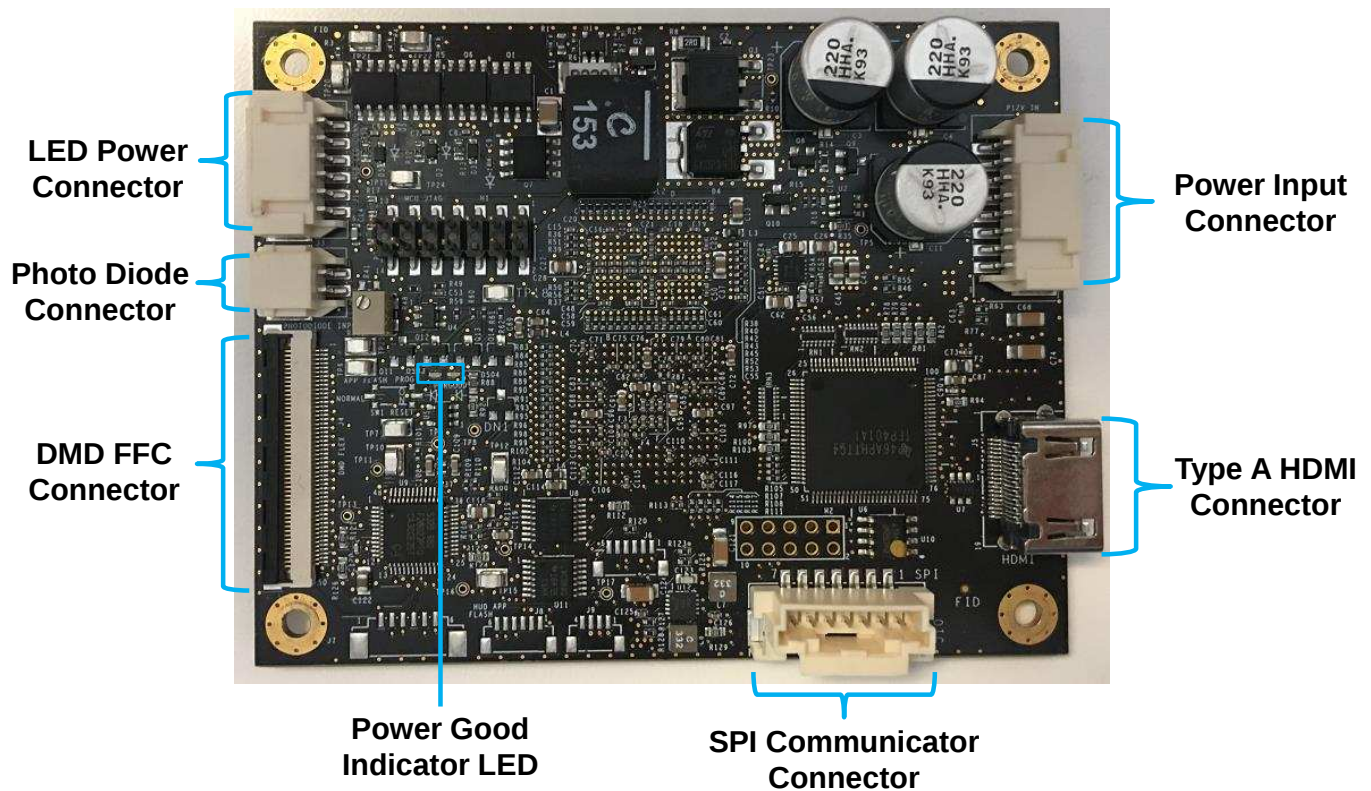


Figure 1-1. DLP3030CHUDQ1EVM Kit Contents

1.5 Electronic Boards Overview



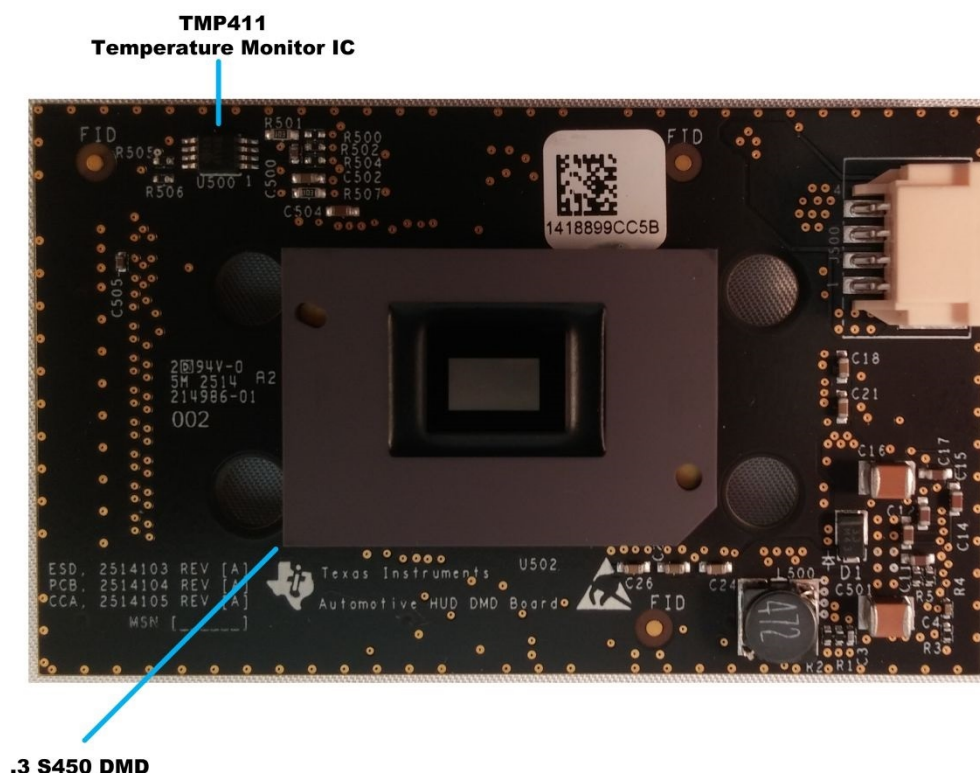


Figure 1-4. DMD Interface Board Front

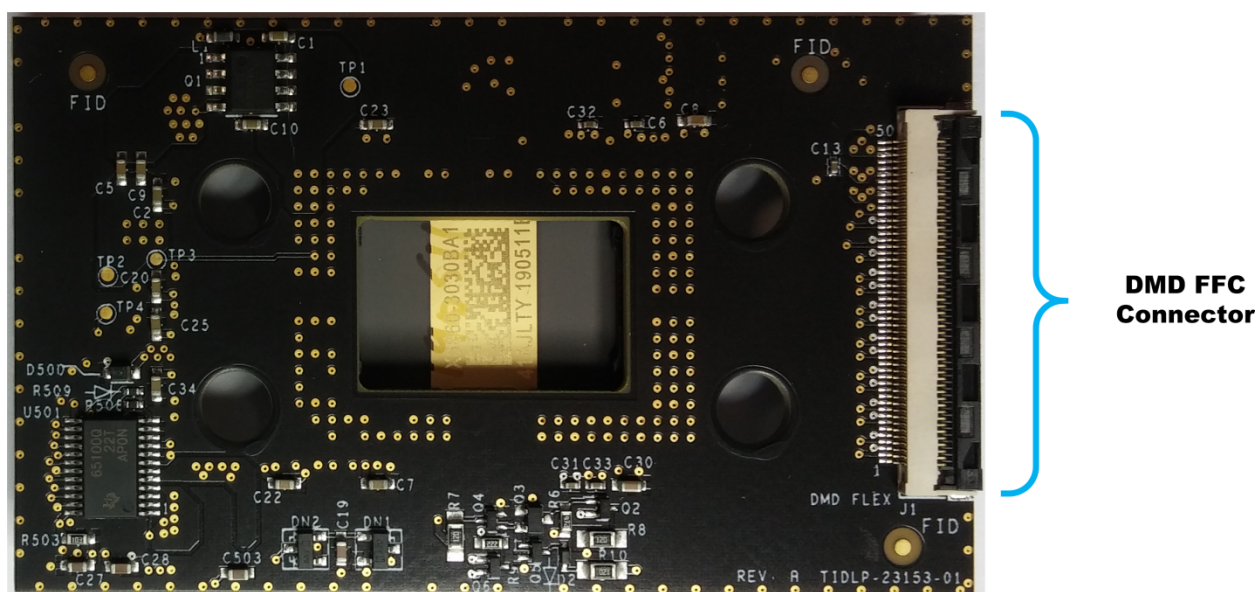


Figure 1-5. DMD Interface Board Back

Getting Started

2.1 Section Overview

This section will provide step-by-step instructions to display an image using the EVM. [Section 2.2](#) contains EVM physical assembly instructions, [Section 2.3](#) contains electrical power-up instructions, [Section 2.4](#) contains EVM GUI installation and use, and [Section 2.5](#) contains connector pinout tables.

2.2 Kit Assembly

Table 2-1. Required Tools and Items

ITEM NO.	ITEM
1	M3 Allen Wrench
2	M4 Allen Wrench
3	Phillips Screw Driver
4	12 V @ 3-A Power Supply

2.2.1 Instructions to Assemble EVM

- Install the DMD Ribbon Cable between the DMD Board and the Formatter Board, ensuring that it is inserted evenly across the entire connector, as shown on the right in [Figure 2-1](#).

Note: This connector has a latch that must be lifted when installing the cable and then clamped down to secure its position.

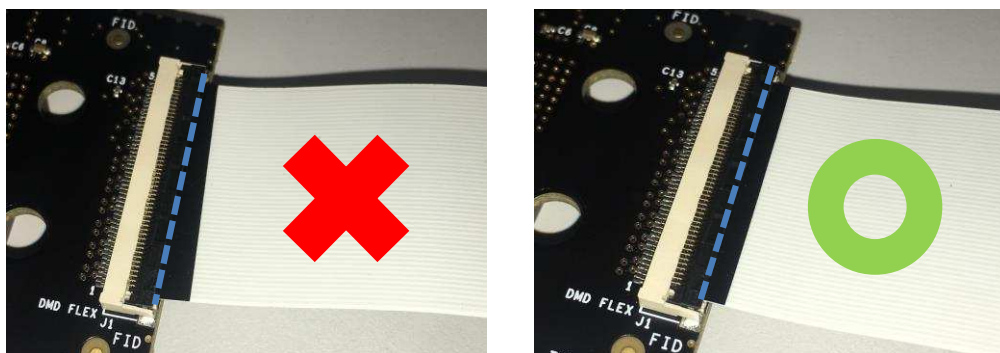


Figure 2-1. DMD Flex Cable Installation Alignment

- Install the LED Power Cable into the Formatter Board using the cable connector with the red, green and blue wires.
- Install the LED Thermistor Cable, part of the LED Power Cable, into the Formatter Board using the cable connector with the three brown wires.
- Install the Photodiode Cable to the Formatter Board.

CAUTION

Please ensure that the LED Power and LED Thermistor cables are installed into the proper connector, as shown in [Figure 2-2](#). Improper installation may cause damage to the LEDs.

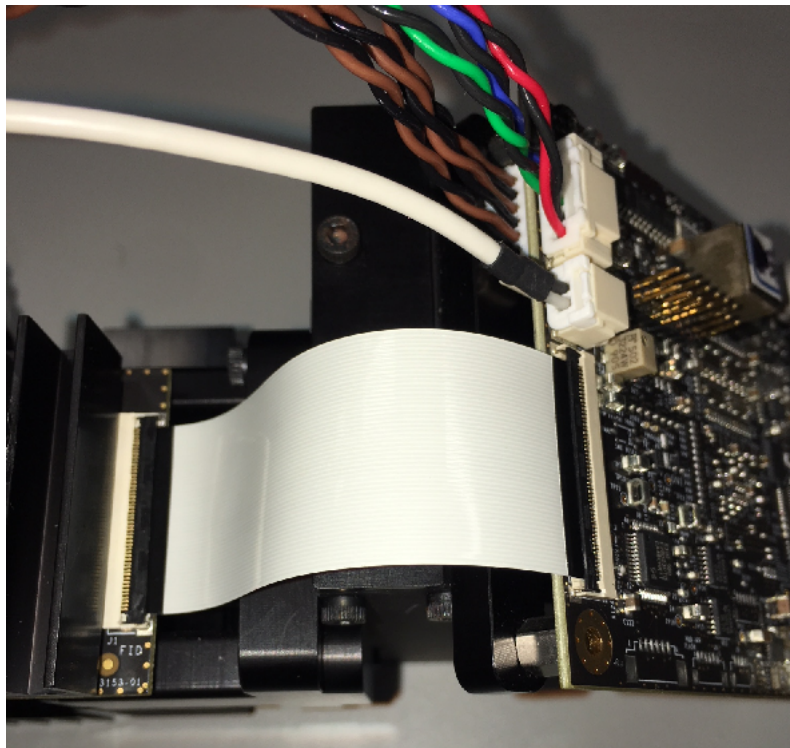


Figure 2-2. Installation of PGU Cables into Formatter Board

- Install the other three connectors to the matching LED color, red cable for red LED, etc. The letter representing each wire color is marked on each LED board connector.
- Install the Photodiode Cable onto the PGU near the Red LED.

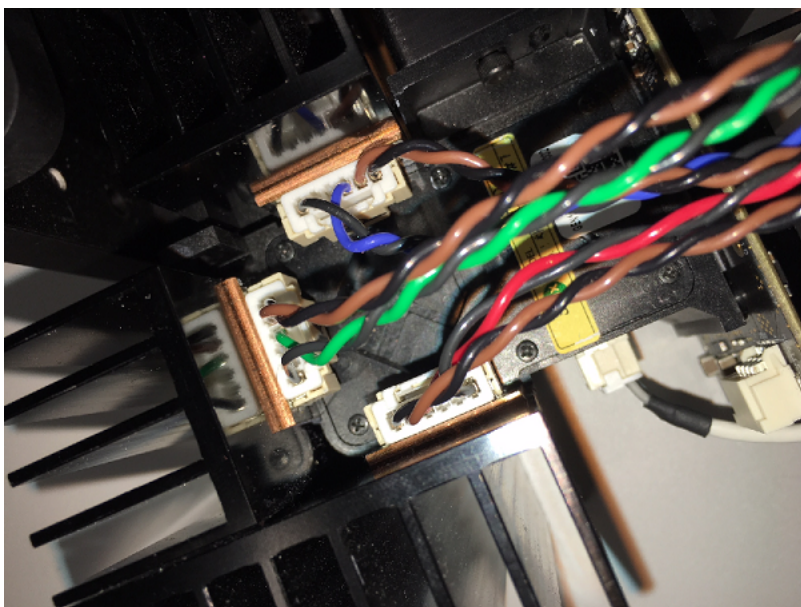


Figure 2-3. Installation of LED and Photodiode Cables into PGU

- Install the HDMI cable into the HDMI connector on the Formatter Board.



Figure 2-4. HDMI Cable Install

- Install the Power Input Cable into the Formatter Board.

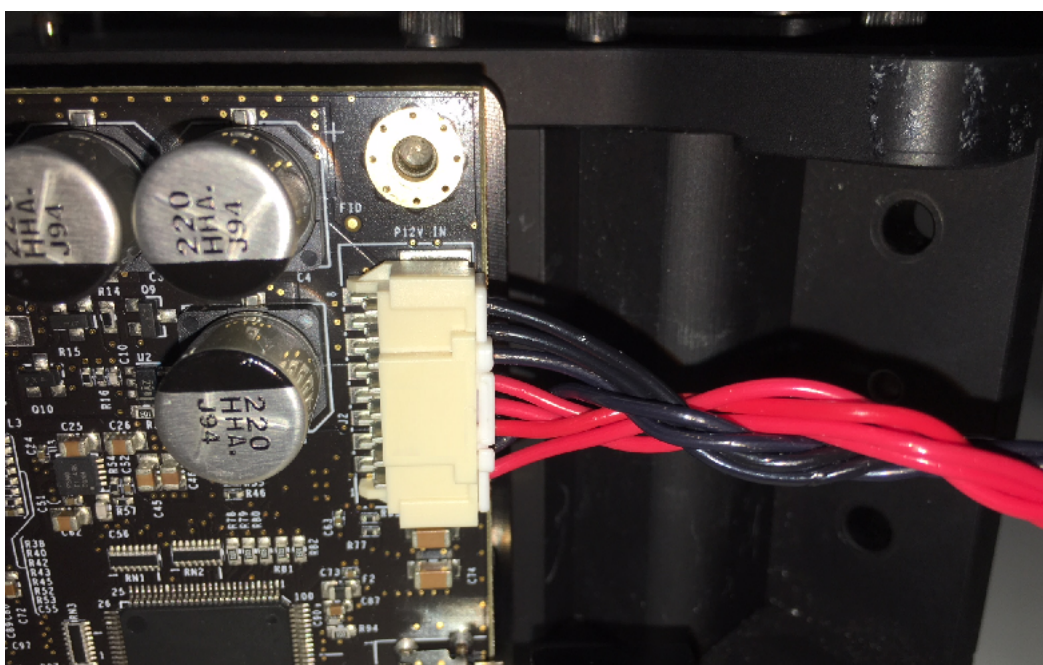


Figure 2-5. Power Cable Install

- Install the Combiner Glass into the Combiner Glass mount.

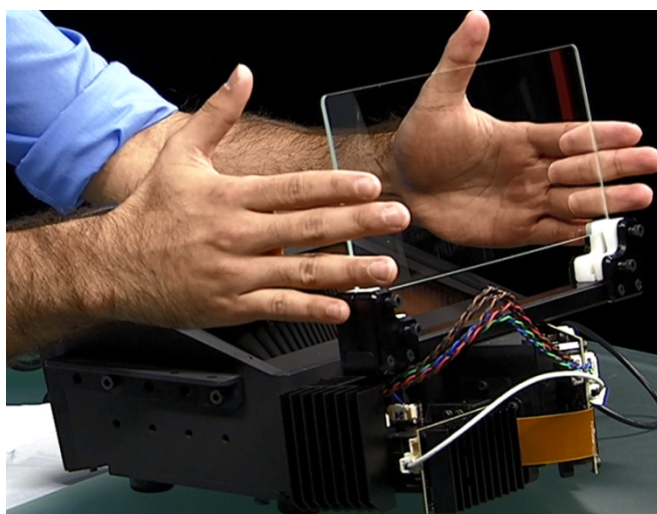


Figure 2-6. Combiner Glass Install

- Gently use the set screws on the Combiner Glass mount to ensure that the Combiner Glass is secure.

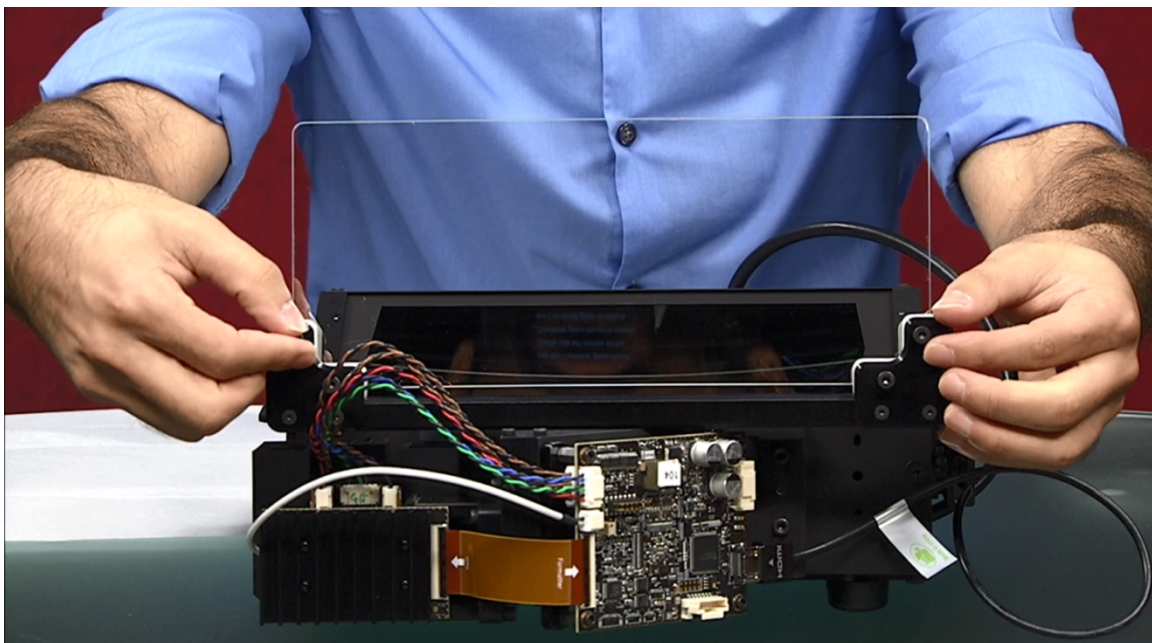


Figure 2-7. Securing Combiner

- Install one end of the HDMI cable into the HDMI connector on the side of the housing.
- Plug the other side of the HDMI cable into a compatible computer.
- Continue to [Section 2.3](#) for instructions on how to power up the system.

2.3 First Power Up

Instructions to Power on HUD Package

- Procure a 12-V (3-A) supply.
- Power off the supply.
- Install the banana connectors on the Power Input Cable into the power supply. The red cable goes to the V+ terminal, and the black cable goes to the V– terminal.
- Power on the supply.
- Once the system is powered up, a green indicator light on the Formatter Board will illuminate, and the computer will detect an additional display called DLP_WVGA. See [Figure 1-2](#) to locate the indicator LED.
- If the PC is trying to duplicate the image on the EVM and the monitor, then the PC resolution can be changed. To fix this, change the PC's external monitor setting to "Extend."
 - Press "Windows + P" key combination, then select "Extend" as shown in [Figure 2-8](#).

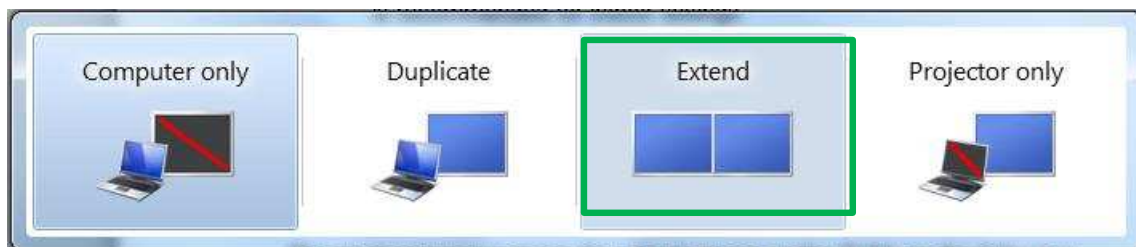


Figure 2-8. PC Video Output Mode Configuration

- The EVM will now be displaying the video content.



Figure 2-9. Example of C-HUD Displaying Video Content

- For control options, like dimming the display or changing the input source settings, please reference [Section 2.4](#) to install the Cheetah USB to SPI Adapter and Automotive Control Program (ACP) Lite on your computer.

2.4 EVM Software Tool Configuration

TI provides a software graphical user interface (GUI) tool, called the Automotive Control Program (ACP) Lite, which can be used to configure behavior of the EVM. The following functions are supported with ACP Lite, among others:

- Brightness / Dimming Control
- Image Orientation Flip
- Display Mode Configuration
 - Internal Splash Images
 - Internal Test Patterns
 - External Video Resolutions via HDMI (refer to [Table 2-2](#) for list of supported resolutions)

Table 2-2. External Input Resolutions

RESOLUTION		
960 × 480	960 × 250	960 × 240
960 × 160	864 × 480 ⁽¹⁾	854 × 480
854 × 240	853 × 480	852 × 480
800 × 480	640 × 480	640 × 240
640 × 160	500 × 250	480 × 240
400 × 240	320 × 240	320 × 160
320 × 120	—	—

⁽¹⁾ 864 × 480 is the default input video resolution on system power-up.

2.4.1 Automotive Control Program (ACP) Lite and Total Phase Cheetah Software Installation

The ACP Lite and Total Phase Cheetah software are necessary to control the EVM. Follow the procedure below to download and install the ACP Lite and Total Phase Cheetah drivers.

Note: The Total Phase Cheetah drivers and cheetah.dll are not distributed by Texas Instruments. Login credentials must be created for www.totalphase.com/ in order to download the required software.

1. Install Automotive Control Program (ACP) Lite
 - Login to www.ti.com/tool/DLP3030CHUDQ1EVM
 - Navigate to the software downloads section.
 - Download Automotive Control Program (ACP) Lite installer package.
 - Extract the ZIP file.
 - Run setup.exe.
 - Follow default installation instructions to completion.
2. Install Cheetah drivers
 - Download and install USB drivers for the Cheetah from www.totalphase.com/products/usb-drivers-windows

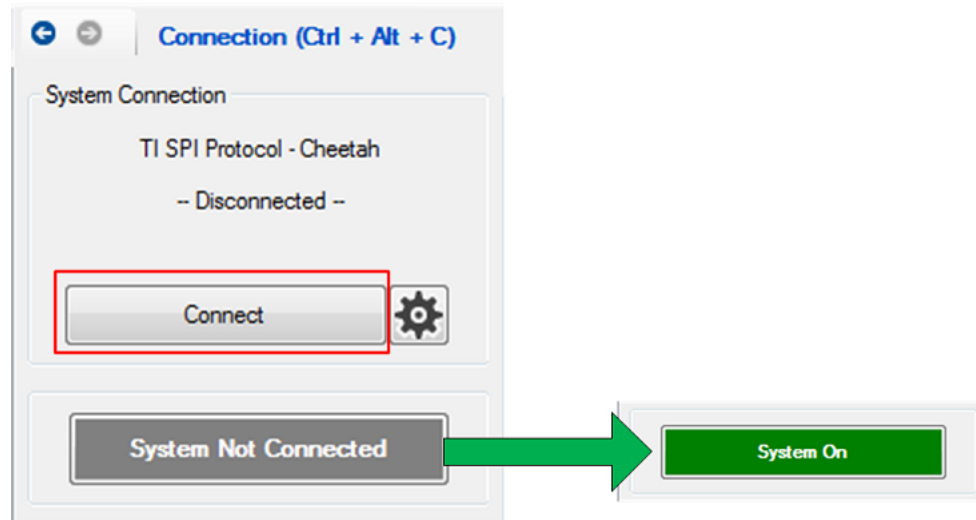
Note: The installation program should be “Run as administrator” by right-clicking.
3. Download and Move cheetah.dll file
 - Download Flash Center software from www.totalphase.com/products/flash-center/
 - From the downloaded folder, copy cheetah.dll
 - Paste cheetah.dll file into ACP installation directory, found at the following location if the default install options were followed:
 - C:\Program Files (x86)\Texas Instruments\Automotive Control Program Lite [version number]\
 - Close and re-open the ACP Lite tool

2.4.2 How to Connect and Use the ACP Lite Tool

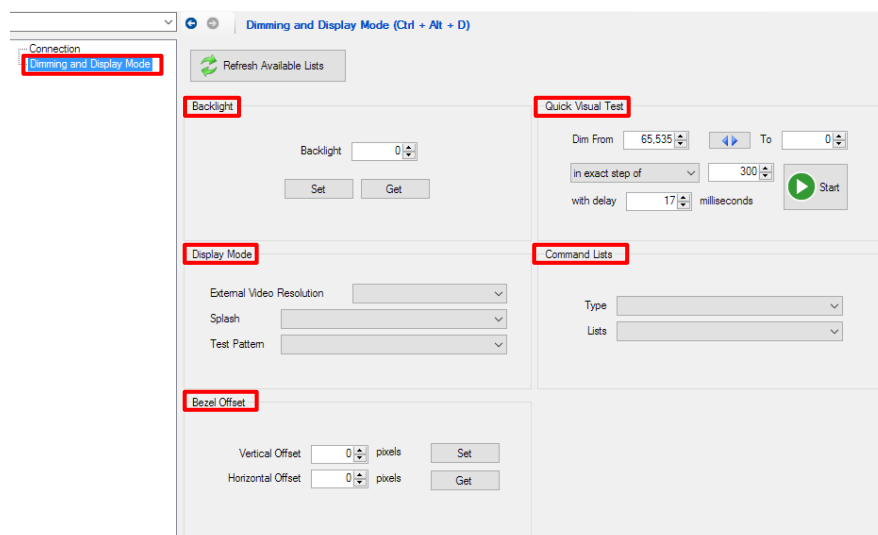
This section explains how to connect to a PC to the EVM and display images or videos.

Follow these steps to display an image:

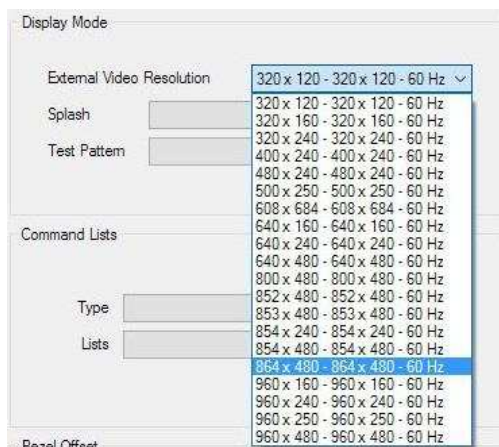
1. Install the Automotive Control Program and Cheetah Drivers as described in [Section 2.4.1](#) above.
2. Ensure the HDMI cable is connected from the PC to the Type A HDMI Connector on the LED Driver Board. See [Figure 1-2](#) to locate the HDMI connector.
3. Connect the USB cable from the PC to the Cheetah board, and connect the SPI cable from the Cheetah board to the LED Driver Board. See [Figure 1-2](#) to locate the SPI connector.
4. Open the Automotive Control Program (ACP) Lite tool.



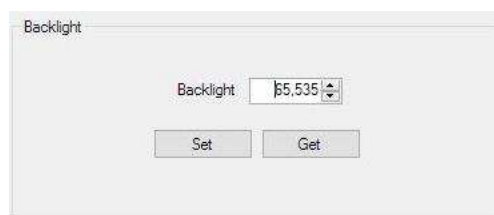
5. Click Connect as shown in the image above. The “System Not Connected” box will turn to “System On.”
6. Navigate to Dimming and Display Mode page.



7. In the Display Mode section, select an external video resolution, splash image, or test pattern to display. The EVM is configured to operate with an external video resolution of 864 × 480 on initial power-up.



8. To adjust brightness, change Backlight parameter. Backlight value range is 0 to 65535. Backlight 700 to 1000 is recommended for indoor settings.



2.5 Connector Pinouts

This section describes the pinout signals for each of the connectors of the electronics boards. Refer to [Figure 1-2](#) and [Figure 1-3](#) for the location of each connector.

Table 2-3. Power Input Connector

REFERENCE DESIGNATOR		CONNECTOR	
J2		MOLEX 5023520800	
PIN #	SIGNAL NAME	TYPE	NOTES
1	Vbatt	Power Input for Digital Circuits	6-V to 18-V Input (0.3-A max @ 12 V)
2	Ground	Ground for Digital Circuits	Ground 0.3-A max @ 12 V
3	Vbatt LED	Power Input for LED Driver Circuit	6-V to 18-V Input (2-A max @ 12 V)
4			
5			
6	Power Ground	Ground for LED Driver Circuit	Ground (2-A max @ 12 V)
7			
8			

Table 2-4. SPI Communication Connector

REFERENCE DESIGNATOR		CONNECTOR	
J10		MOLEX 5600200700 ⁽¹⁾	
PIN #	SIGNAL NAME	TYPE	NOTES
1	SPI CLK	SPI Clock	100-Ω Impedance Matched to Pin 4, Ground
2	3.3V	Power	
3	SPI SOMI	SPI Master In Slave Out	100-Ω Impedance Matched to Pin 3, 3.3
4	Ground	Ground	
5	SPI SIMO	SPI Master Out Slave In	100-Ω Impedance Matched to Pin 6, Ground
6	Ground	Ground	
7	SPI CSZ	SPI Chip Select	

⁽¹⁾ This connector is used for general system controls, such as dimming and video mode configuration.

Table 2-5. Photodiode Connector

REFERENCE DESIGNATOR		CONNECTOR	
J3		MOLEX 5023520200	
PIN #	SIGNAL NAME	TYPE	NOTES
1	PD Cathode	Cathode	The cathode is connected to the cable shield
2	PD Anode	Anode	The anode is noise sensitive and connected to the cable center conductor

Table 2-6. LED Power Connector

REFERENCE DESIGNATOR		CONNECTOR	
J1		MOLEX 5023520600	
PIN #	SIGNAL NAME	TYPE	NOTES
1	Blue LED Cathode	Cathode	
2	Blue LED Anode	Anode	Common Anode
3	Green LED Cathode	Cathode	
4	Green LED Anode	Anode	Common Anode
5	Red LED Cathode	Cathode	
6	Red LED Anode	Anode	Common Anode

Table 2-7. MCU JTAG Connector

REFERENCE DESIGNATOR		CONNECTOR	
H1		FCI 95278-101A14LF ⁽¹⁾	
PIN #	SIGNAL NAME	TYPE	NOTES
1	TMS	Piccolo JTAG Mode Select	
2	TRSTn	Piccolo JTAG Reset	Active Low
3	TDI	Piccolo JTAG Data Input	
4	Ground	Ground	
5	3.3V	Power	
6	No Connect	No Connect	This pin is cut off to key the connector
7	TDO	Piccolo JTAG Data Out	
8	Ground	Ground	
9	TCK	Piccolo JTAG Clock	
10	Ground	Ground	
11	TCK	Piccolo JTAG Clock	
12	Ground	Ground	
13	EMU0	Piccolo Programmer Output	Not used, pulled high to 3.3 V
14	EMU1	Piccolo Programmer Output	Not used, pulled high to 3.3 V

⁽¹⁾ This connector was designed to be compatible with the XDS100 and XDS510 programmers from Spectrum Digital.

Table 2-8. LED Thermistor Connector

REFERENCE DESIGNATOR		CONNECTOR	
J11		MOLEX 5023520600	
PIN #	SIGNAL NAME	TYPE	NOTES
1	Ground	Ground	
2	Blue Thermistor	Anode	
3	Ground	Ground	
4	Green Thermistor	Anode	
5	Ground	Ground	
6	Red Thermistor	Anode	

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