Contents
1 Overview ........................................................................................................................................ 1
2 System Requirements .................................................................................................................. 1
3 Software Installation and Driver Installation ............................................................................ 1
4 User Interface Overview ............................................................................................................ 2

Trademarks
IntelliBright is a trademark of Texas Instruments.
DLP is a registered trademark of Texas Instruments.
Windows is a registered trademark of Microsoft Corporation.

1 Overview
The DLP® Display and Light Control evaluation module (EVM) includes a Windows®-based GUI tool used to control the EVM through SPI and I²C commands. This document provides instructions on how to use features provided by the GUI tool to communicate with the DLP Display and Light Control EVM.

2 System Requirements
The minimum recommended system requirements for the DLP Display and Light Control EVM GUI tool are:
• PC with 1.4-GHz Pentium IV CPU or higher
• Windows 7 or greater
• 4 GB of RAM
• 1920 × 1080
• 200 MB of free HD space
• USB port

3 Software Installation and Driver Installation
Download the installer for the DLP Display and Light Control EVM GUI tool. Execute the DLP Display and Light Control EVM GUI tool DLPPicoDisplayAndLightControl.x.x.x.x.Setup.exe and follow the instructions for software installation. The driver needed to communicate with the EVM is part of the installation, so no other installer is needed.

Table 1 lists all the tools that the file setup.exe installs.

Table 1. Table of Tool Variations

<table>
<thead>
<tr>
<th>EVM</th>
<th>Simple Mode</th>
<th>Product In Advanced Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLP2010EVM-LC</td>
<td>DLP Pico Display and Light Control x.x.x.x (DLP2010LC)</td>
<td>DLPC347x Pico Display and Light Controller (0.2 WVGA, 0.3 720p)</td>
</tr>
<tr>
<td>DLP3010EVM-LC</td>
<td>DLP Pico Display and Light Control x.x.x.x (DLP3010LC)</td>
<td>DLPC347x Pico Display and Light Controller (0.47 1080p)</td>
</tr>
<tr>
<td>DLP4710EVM-LC</td>
<td>DLP Pico Display and Light Control x.x.x.x (DLP3010LC)</td>
<td>DLPC347x Pico Display and Light Controller (0.47 1080p)</td>
</tr>
</tbody>
</table>
4 User Interface Overview

Figure 1. Information Page
Figure 1 shows the DLP Display and Light Control GUI tool. The GUI tool has 5 tabs on the left with 1 or more pages for each tab, which will communicate with the EVM by issuing SPI or I²C commands. To access a specific page, select the desired tab from the Main Navigation bar on the left (Figure 1) and then select the specific page from the Page Navigation bar on the top (Figure 2). Table 2 provides a brief description of the 13 pages.

**Table 2. Page Description**

<table>
<thead>
<tr>
<th>Tab</th>
<th>Page</th>
<th>Section</th>
<th>User Control Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>EVM Information</td>
<td>EVM Information</td>
<td>Get the status of the EVM</td>
</tr>
<tr>
<td>Display</td>
<td>Patterns and Images</td>
<td>Display Patterns</td>
<td>Set display patterns and checks which pattern is displayed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Display Images</td>
<td>Set display images to the device</td>
</tr>
<tr>
<td></td>
<td>Display Patterns</td>
<td>Video Information</td>
<td>Modify the type of video output given to the device</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Color Temperature</td>
<td>Choose from select color temperatures</td>
</tr>
<tr>
<td></td>
<td>Internal Patterns</td>
<td>Display Settings</td>
<td>Modify display and keystone settings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keystone Correction</td>
<td>Modify display and keystone settings</td>
</tr>
<tr>
<td></td>
<td>Splash Patterns</td>
<td>IntelligBight™</td>
<td>Modify IntelligBight settings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LED Current</td>
<td>Modify LED current settings</td>
</tr>
<tr>
<td>Light Control</td>
<td>External Patterns</td>
<td>Configure and display external patterns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal Patterns</td>
<td>Configure and display internal patterns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Splash Patterns</td>
<td>Configure and display splash patterns</td>
<td></td>
</tr>
<tr>
<td>Firmware</td>
<td>Backup Firmware</td>
<td>Backup the firmware on the device</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Update Firmware</td>
<td>Update the firmware on the device</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Update Flash Image</td>
<td>Create new firmware image for the device</td>
<td></td>
</tr>
</tbody>
</table>
In addition, there is a separate GUI tool installed for the advanced user/mode (Section 4.6). This advanced mode contains additional pages and commands that can be used with the EVM.

Use the questionmark icon (?) in the bottom-left corner of each section to provide access information on that section and display the commands.

4.1 Information Tab

4.1.1 Information Page

The information page shows status information the EVM after it is connected and powered on. Refer to the guide on the left portion of the Information page to see how to set up the EVM.

The status of the EVM is displayed on the bottom-left corner of the Information page. The EVM Status shows one of the following:

- Ready
- Connected, Incompatible EVM
- Connected, Powered off
- Not connected

Figure 3. Information Page

Table 2. Page Description (continued)

<table>
<thead>
<tr>
<th>Tab</th>
<th>Page</th>
<th>Section</th>
<th>User Control Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debug</td>
<td>Event Viewer</td>
<td></td>
<td>View the event occurred on the device</td>
</tr>
<tr>
<td></td>
<td>Command Log</td>
<td></td>
<td>View the command(s) issued to the device with the option to export to a batch file</td>
</tr>
</tbody>
</table>
In addition to the EVM connection status, the page shows the Input Source or Operating Mode. When connected, the Input shows one of the following:

- External video port
- Test pattern generator
- Splash screen
- External pattern streaming
- Internal pattern streaming
- Space coded pattern streaming

After the EVM is connected, if the tool used (DLPC2010LC or DLPC3010LC) does not match the EVM being accessed (DLP2010EVM-LC or DLP3010EVM-LC) the EVM Status displays "Incompatible".

After the EVM is connected, click **Get** on the bottom-right corner to get the information and status of the EVM. The Information page also lets user checks if any errors have occurred, checkmark(s) indicates specific errors.

The following commands are used to obtain information about the EVM:

- Read short status (0xD0)
- Read system status (0xD1)
- Read DMD device ID (0xD5)
- Read controller device ID (0xD4)
- Write PAD register address (0xEC)
- Read PAD register (0xED)
- Read system software version (0xD2)
- Read flash build version (0xD9)
- Read system temperature (0xD6)
4.2 Display Tab

4.2.1 Patterns and Images Page

The Patterns and Images page has two sections:
- Display Patterns
- Splash Image

To set a display pattern, select the desired pattern, foreground, and background colors, and then click **Set** in the Display Patterns section on the middle of the page. To confirm the display pattern, click **Get**.

To set a splash image, select the desired image, then click **Set** in the Splash Images section on the right.

Depending on what is stored in the flash memory, the actual image displayed may be different from what is shown on the section.

Use these commands to set the display pattern:
- Write image freeze (0x1A)
- Write operating mode select (0x05)
- Write input image size (0x2E)
- Write image crop (0x10)
- Write test pattern select (0x0B)
- Read Test Pattern Select (0x0C)

The following commands are used to set the display image:
- Write Image Freeze (0x1A)
- Read Splash Screen Header (0x0F)
• Write Input Image Size (0x2E)
• Write Image Crop (0x10)
• Write Display Size (0x12)
• Write Splash Screen Select (0x0D)
• Write Operating Mode Select (0x05)
• Write Splash Screen Execute (0x35)

4.2.2 Video and Color Page

The Video and Color page has two sections:
• Video information
• Color temperature

When the EVM is displaying video, click Get on the Video Information section lets user sees the input size, cropping size, display size, and frame rate. Click Switch to External Video to toggle (return) the EVM to video mode (HDMI).

To set the desired look, select cool, medium, warm, or user defined, and then click Set. Click Get to see the current color temperature setting. To modify the user defined look, refer to Section 4.2.4 to set the LED Current settings.

The following commands are used in the Video Information section:
• Write input image size (0x2E)
• Write display size (0x12)
• Write image crop (0x10)
• Write operating mode select (0x05)
• Read operating mode select (0x06)
• Read input image size (0x2F)
• Read display size (0x13)
• Read image crop (0x11)
• Read look select (0x23)

The following commands are used in the Color Temperature section:
• Read RGB LED current (0x55)
• Write RGB LED current (0x54)
• Write flash data type select (0xDE)
• Write flash data length (0xDF)
• Read flash start (0xE3)
• Write look select (0x22)
• Read operating mode select (0x06)
• Write splash screen execute (0x35)
• Read look select (0x23)

4.2.3 Display Settings Page

The Display Settings page has two sections; the Display Settings section and the Keystone Correction section.

The Display Settings section lets user crops, scales, and rotates the input image. After all the desired values are selected, clicking Set to send the new information to the EVM. Click Get lets user sees the current display settings on the EVM.
The Keystone Correction section lets user enables keystone on the EVM. Keystone is used when the EVM is not located on a flat surface and has a vertical tilt of ±40 degrees. Keystone correction ensures that the image displayed is rectangular.

Please note, not all functions shown on this page are supported on all EVMs.

The following commands are used in the Display Settings section:
- Write image crop (0x10)
- Write display size (0x12)
- Write display image orientation (0x14)
- Read operating mode select (0x06)
- Read splash screen select (0x0E, if display splash image)
- Read splash screen header (0x0F, if display splash Image)
- Write input image size (0x2E, if Display Splash Image)
- Write splash screen select (0x0D, if display splash image)
- Write operating mode (0x05; if display splash image)
- Write splash screen execute (0x35; if display splash image)
- Read display size (0x13)
- Read image crop (0x11)
- Read display image orientation (0x15)

The following commands are used in the Keystone Correction section:
- Write image freeze/unfreeze (0x1A)
- Write Keystone correction control (0x88)
- Write Keystone projection pitch angle (0xBB)
- Read operating mode select (0x06)
- Read splash screen select (0x0E; if display splash image)
- Read splash screen header (0x0F; if display splash image)
- Write operating mode (0x05; if display splash image)
- Write splash screen execute (0x35; if display splash image)
- Read Keystone correction control (0x89)
- Read Keystone projection pitch angle (0xBC)
4.2.4 IntelliBright™ Page

The IntelliBright™ page has two sections:

- IntelliBright™
- LED Current

IntelliBright™ is the name given to two image-processing algorithms designed to dynamically optimize the brightness or power consumption on per frame basis. The IntelliBright™ section lets user changes settings specific to each algorithm and check which settings are currently running on the EVM.

The EVM has three LEDs whose currents can be changed to reduce power consumption and change the perceived color temperature of the displayed image. The LED Current section lets user modifies the current values and see what the EVM is using at any moment.

The following commands are used in the IntelliBright™ section:

- Write local area brightness boost control (0x80)
- Write CAIC image processing control (0x84)
- Write LED output control method (0x50)
- Read CAIC maximum available power (0x57)
- Read CAIC RGB LED current (0x5F)
- Read operating mode select (0x06)
- Read splash screen select (0x0E; if display splash image)
- Read splash screen header (0x0F; if display splash image)
- Write operating mode (0x05; if display splash image)
- Write splash screen execute (0x35; if display splash image)
- Read local area brightness boost control (0x81)
• Read CAIC image processing control (0x85)
• Read LED output control method (0x51)

The following commands are used in the LED Current section:
• Write RGB LED enable (0x52)
• Write RGB LED current (0x54)
• Read RGB LED enable (0x53)
• Read RGB LED current (0x55)

### 4.3 Light Control Tab

#### 4.3.1 External Patterns Page

External pattern streaming mode involves the projection of patterns input via the projector's video parallel port through the DLP controller board onto the DMD.

On the External Patterns page, users define and check these pattern configurations:
• illumination selection
• bit depth
• patterns per frame
• exposure time
• pre-exposure dark time
• post-exposure dark time

On the External Patterns page, users define and confirm these trigger-out settings:

![Figure 8. External Patterns Page](image)
4.3.1.1 Set Up External Pattern Mode

Follow these steps to set up External Pattern mode:

1. Enter illumination type, bit depth and number of patterns per frame.
2. Enter required exposure time and dark time.
3. Establish trigger outputs if required.
4. Ensure that the EVM is connected and click Set. If an invalid timings error message displays, adjust the patterns timings in step 2 to ensure that the timings are within the supported range and click Set again.
5. To verify that the image projected by the EVM has been updated accordingly, click Get.
6. The frame rate field updates. The frame rate field is not editable. The frame rate mentioned in this field is calculated as follows:

\[
\text{Frame Rate (Hz)} = \frac{1000}{(\text{Exposure Time (µs)} + \text{Pre-exposure Dark Time (µs)} + \text{Post-exposure Dark Time (µs)}) \times \text{Patterns per Frame}}
\]  

Consult the Help section for more information and the list of commands used in this page. Access the Help section from the bottom left of the page.

4.3.2 Internal Patterns Pages

Internal Patterns streaming mode involves projection of patterns created internally by the functional block of the controller. Select a group of one row or one column patterns to be replicated through the array by the Controller. The order of display of groups of patterns is configurable.
4.3.2.1 Internal Patterns Pattern Sets Page

On the Pattern Sets page, user can add or delete pattern sets and add or delete patterns to and from each pattern set. A preview window on the right shows the pattern selected. Click Next on the bottom-right or any of the tab (Pattern Order or Pattern Control) on the left to continue.
4.3.2.2 Internal Patterns Pattern Order Page

Figure 10. Internal Patterns, Pattern Order Page

On the Pattern Order page, users can configure the default order for pattern sets to display. It also allows users to configure these pattern sets:

- number of patterns
- illumination selection
- exposure time
- pre-exposure dark time
- post-exposure dark time

After setting the pattern order table and the pattern orientation, the user can either load the pattern data directly flash to run the patterns or save the pattern data on the computer to update the firmware later. Review the timing diagram to ensure that the patterns and trigger signals are output as desired.

**NOTE:** Trigger controls available on this page are used to draw the timing diagram only, they do not affect the functionality of the EVM.

Click **Next** on the bottom-right or any of the tab (Pattern Sets or Pattern Control) on the left to continue.
4.3.2.3 Internal Patterns Pattern Control Page

On the Pattern Control page, users can configure the trigger out, trigger in and pattern ready signals and to control the display of patterns in internal pattern mode. This page requires the EVM to be connected to the GUI in order to work.

Configure the triggers and pattern ready signal as required and click Set. To view the current configuration of these signals, click Get. After all the configurations are set, the user can select and control how to run these patterns:

- run once
- run continuously
- pause
- step
- stop
- reset

The following commands are used on this page:

- Write trigger out configuration (0x92)
- Write trigger in configuration (0x90)
- Write pattern ready configuration (0x94)
- Write pattern order table entry (0x98)
- Write operating mode select (0x05)
- Write internal pattern control (0x9E)
- Read trigger out configuration (0x93)
- Read pattern configuration (0x97)

Figure 11. Internal Patterns, Pattern Control Page
4.3.3 Splash Patterns Page

Splash Patterns display images stored in flash memory. On the Space-Coded Patterns page, users define these pattern configurations:

- splash image index
- illumination selection
- bit depth
- patterns per frame
- exposure time
- pre-exposure dark time
- post-exposure dark time

On the Space-Coded Patterns page, users define these trigger out settings:

- enable
- invert
- delay for both triggers

The following commands are used on this page:

- Write trigger out configuration (0x92)
- Write pattern configuration (0x96)
- Write operating mode select (0x05)
- Write splash screen select (0x0D)
• Read splash screen header (0x0E)
• Write display size (0x12)
• Write image crop (0x10)
• Write input image size (0x2E)
• Write splash screen execute (0x35)
• Read trigger out configuration (0x93)
• Read pattern configuration (0x97)

4.4 Firmware Tab

4.4.1 Backup Firmware Page

Figure 13. Backup Firmware Page

On the Backup Firmware page, users can backup the EVM firmware. Click the browser button to select the folder and image filename for the backup.
4.4.2 Update Firmware Page

The Update Firmware page allows the user to update the EVM firmware. Click the browser icon to select folder and image filename for the update.

4.4.3 Update Flash Image Pages

The user has the option to modify settings in the flash image through the Update Flash Image wizard. The DLP Display and Light Control EVM GUI Tool gives users the ability to customize the default flash image provided on ti.com. The customizable components of the flash image are:

- Splash images
- Start-up image orientation
- Start-up splash image
- Start-up LED current
- Auto-initialization routine
4.4.3.1 Update Flash Image Start Page

The start page for Update Flash Image outlines the options that can be modified in the flash. Click Start on the bottom-right corner or Step 1 - Flash Image on the left to continue. The user can also select any of the options (Step 1, 2, 3, or 4) on the left to move to the other pages.
4.4.3.2 Update Flash Image Flash Image Page

The flash image page for Update Flash Image allows the user select these options:

- EVM Type
- input flash image file
- output flash image file

Click **Next** on the bottom-right corner or **Step 2 - White Point** on the left to continue. Click the **Back** button at the bottom-left of the section to go back to the start page or any of the options (Step 1, 2, 3, or 4) on the left to move to other pages.
4.4.3.3  Update Flash Image White Point Page

On the white point page, the user can overwrite the Red, Green, or Blue Duty Cycle values. The user can also opt to not change the values. Click Next on the bottom-right corner or Step 3 - Splash Image on the left to continue. The user can also click the Back button at bottom-left of the section to go back to the Step 1 - Flash Image page or any of the options (Step 1, 2, 3, or 4) on the left to move to other pages.
4.4.3.4 Update Flash Image Splash Image Page

On the splash image page for Update Flash Image, the user can overwrite and select image files to store in flash memory. The user has the option to skip the splash image update screen. Click Next on the bottom-right corner or Step 4 - Startup Option on the left to continue. Click the Back button at the bottom-left of the section to go back to the Step 2 - White Point page or any of the options (Step - 1, 2, 3, or 4) on the left to move to other pages.
4.4.3.5 Update Flash Image Startup Option Page

Figure 19. Update Flash Image - Startup Option Page

on the option page for Update Flash Image, users can overwrite these startup options:

- long or short-axis flip
- startup image file
- startup Red, Green, or Blue LED current

Click Finish on the bottom-right corner to build the flash image. The user can also click the Back button at the bottom-left of the section to go back to the Step 3 - Splash Image page or any of the options (Step 1, 2, 3, or 4) on the left to move to other pages.
4.4.3.6 Update Flash Image Finish Page

The Finish Page page is not selectable. When the flash image build is completed, the finish page for Update Flash Image display the information. To run the backup, click Yes on the bottom-left to go to the Backup Firmware page. Click No on the bottom-right to go to the Update Firmware page to update the EVM with the newly created flash image.
4.5  **Debug Tab**

4.5.1  **Event Viewer Page**

![Event Viewer Page](Figure 21. Event Viewer Page)

The Event Viewer Page lists the timestamp and description of the events occurred on the EVM system.
4.5.2 Command Log Page

The Command Log Page lists the commands sent to the EVM System with the option to clear all entries or export the allowable write commands to a batch file.

4.6 Advanced Tool

Advanced GUI Tool allows more experienced users more control of the EVM system with utilities such as:

- connection settings
- scripting
- direct command communication with the EVM

The tool also offers an Event Viewer and Command Log as does the simple tool, but also includes:

- console
- watch variables
- variable list when working with the scripting tool
4.6.1 Connection Page

While the EVM is disconnected, the Connection page allows users to select these settings:

- I²C or SPI
- EVM type
- additional interface settings

It then connects or disconnects from the system. Always ensure that the EVM status set to Connected before attempting to send any I²C commands in Advanced mode.
4.6.2 Scripting Page

On the Scripting page, users can write command scripts to execute on the EVM system. The user can monitor the execution of the script through the console, watch variables, and variable pages listed on the bottom of the page. Click Scripting Reference from the Help menu to see the list of commands available and the syntax for each command.
4.6.3 Command Pages

Figure 25. Command Pages

On the Command Pages, users can issue the command Set or Get from the GUI. Click on the command group (for example Display, Source or Test Pattern) on the left to display the list of commands available for that group. Users can set the parameters of the individual commands or get the parameters for the command. Click Get All or Set All at the top-right corner to send all the commands for the group selected.
Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (August 2018) to A Revision

<table>
<thead>
<tr>
<th>Change Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed free HD space from &quot;60 MB&quot; to &quot;200 MB&quot;</td>
<td>1</td>
</tr>
<tr>
<td>Updated Table 1</td>
<td>1</td>
</tr>
<tr>
<td>Updated Table 2</td>
<td>3</td>
</tr>
<tr>
<td>Updated instructions in Section 4.3.1.1</td>
<td>12</td>
</tr>
</tbody>
</table>
IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2019, Texas Instruments Incorporated