Application Report
DLPA036B–July 2013–Revised February 2018

Using DLP® LightCrafter™ 4500 Triggers to Synchronize Cameras to Patterns

ABSTRACT

This document describes how to use the DLP® LightCrafter™ 4500 with the global trigger function of industrial USB 2, USB 3, FireWire, and GigE CCD cameras from Point Grey Research, The Imaging Source, and other manufacturers.

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1 Introduction

The DLP LightCrafter 4500 features two input and two output triggers for use in synchronizing cameras and other devices with the pattern sequence running on the board. This document focuses only on the output triggers, which are generally used to synchronize cameras with global shutters to allow the capture of each individual frame or pattern in a sequence of frames.

Most cameras with global shutters use opto-isolated trigger inputs in order to provide protection from potentially damaging voltages which may be applied inadvertently. The connector types, exact timing, and electrical requirements differ. Please see the manual for a particular camera, or check the manufacturer's website for application notes about using the trigger.

Figure 1 shows the location of the connectors for trigger in (J11) and trigger out (J14).

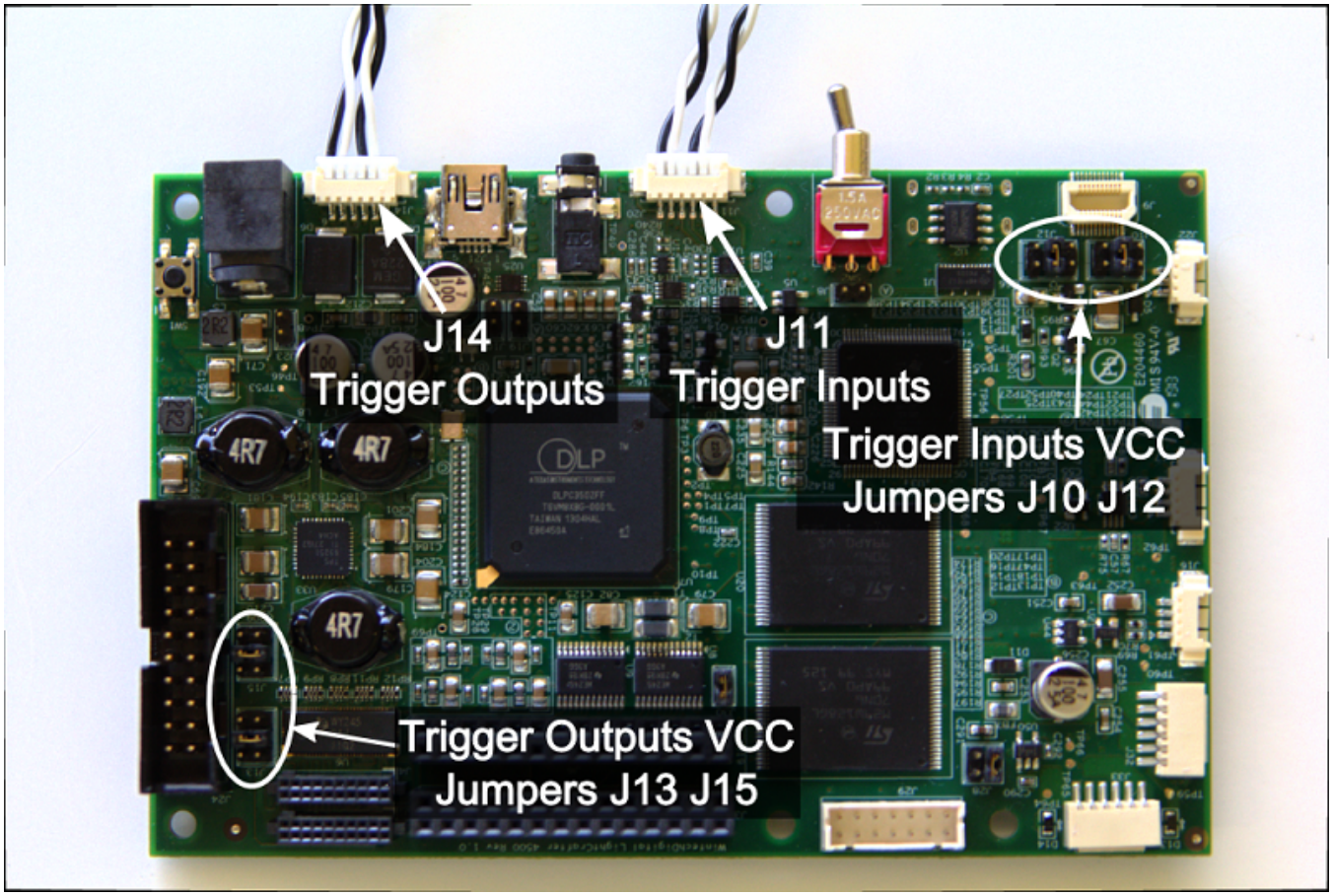


Figure 1. DLP LightCrafter 4500 Controller Board

2 Connections

2.1 Connector J14

Figure 2 shows the schematic of the trigger out connector J14.

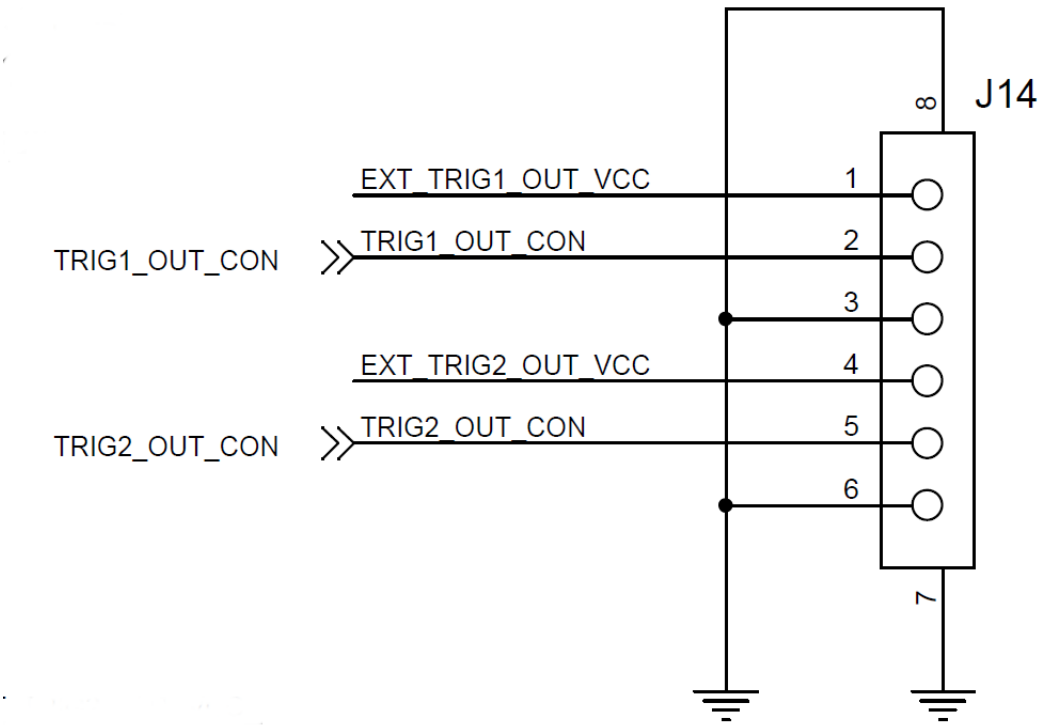


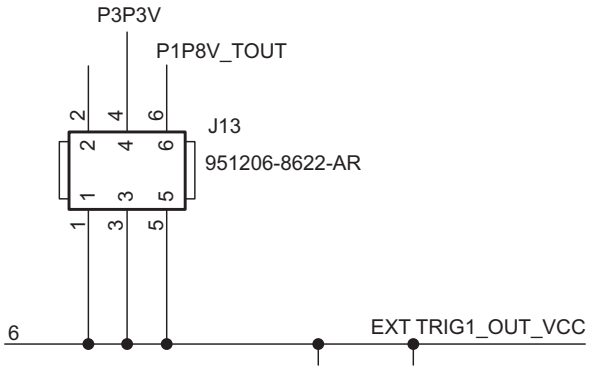
Figure 2. Schematic of J14 – Trigger Out 1 and 2

Opto-isolators require a small amount of current to operate. They are not digital circuits that respond to a voltage level relative to ground. Instead, they isolate two circuits by changing an electrical signal into a light signal, and then back to an electrical signal, all within the opto-isolator. This isolates one circuit from any noise, or ground level differences between the circuits on either side of the opto-isolator.

The trigger outputs of DLP LightCrafter 4500 can be set to the required logic voltage level (1.8 V or 3.3 V) by inserting a jumper across the appropriate pins of the corresponding jumpers. These jumpers are shown in the illustration of DLP LightCrafter 4500 controller board Figure 1. For trigger out 1, the voltage level is set by putting a jumper onto the appropriate pins of header J13. Likewise, the voltage for trigger out 2 is set by header J15. The same voltage selection scheme works for trigger 1 in (J10) and trigger 2 in (J12). See the schematic of one of the headers, J13, in Figure 3.

2.2 Connectors J13 and J15

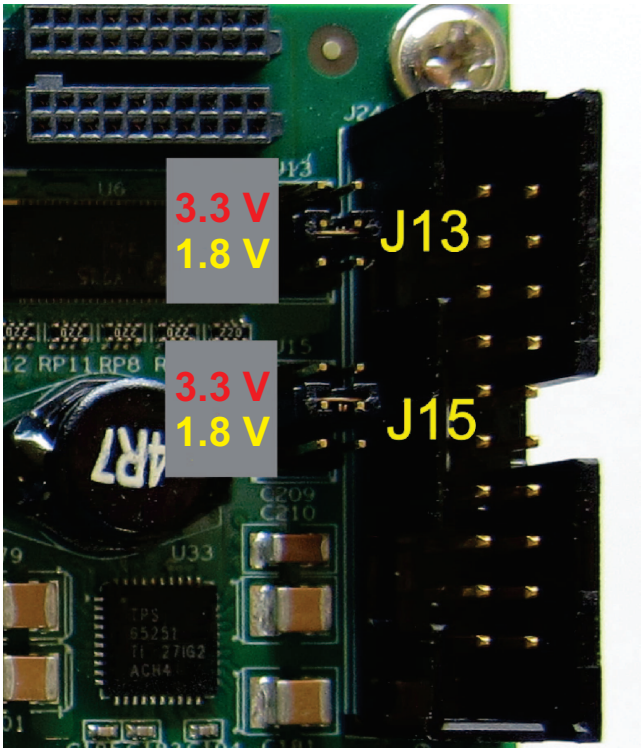
Figure 3 shows the trigger out 1 voltage level select header J13. This is the same for trigger out 2 header J15.



J13: The desired voltage level for trigger out 1 is selected by the insertion of a jumper between the appropriate pair of pins.

Figure 3. Schematic of J13

Figure 4 shows how the jumpers are placed to select the voltage levels on J13 (trigger out 1) and J15 (trigger out 2). This board has the jumpers inserted to select 3.3 V.

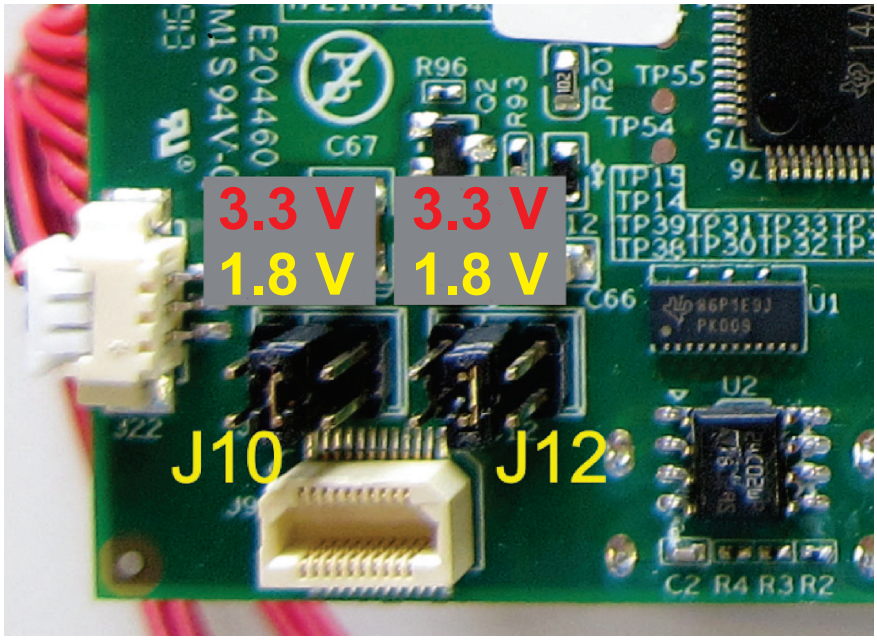


In this example, the jumpers are installed for 3.3 V.

Figure 4. Jumper Locations for Setting Voltage Levels on J13 (Trigger Out 1) and J15 (Trigger Out 2)

2.3 Connectors J10 and J12

Figure 5 shows how the jumpers are placed to select the voltage levels on J10 (trigger in 1) and J12 (trigger in 2). This board has the jumpers inserted to select 3.3 V.



Example, the jumpers are installed for 3.3 V.

Figure 5. Jumper Locations for Setting Voltage Levels on J10 (Trigger In 1) and J12 (Trigger In 2)

3 DLP LightCrafter 4500 and The Imaging Source Firewire Camera

Figure 6 shows an example setup of the DLP LightCrafter 4500 connected to the imaging source firewire camera. The camera is connected to trigger out 1. trigger out 2 is not used. There is no cable connected for trigger in. In addition to the trigger out cable, the power supply, USB, and firewire cables are shown in Figure 6.

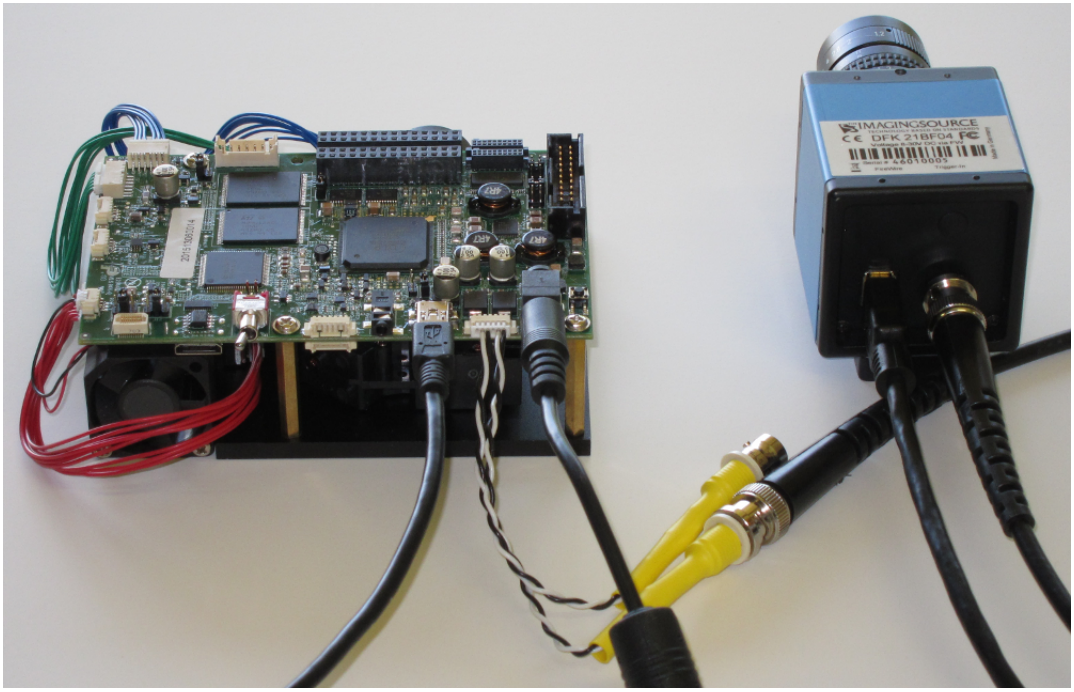


Figure 6. Example Setup of DLP LightCrafter 4500 and Firewire Camera from The Imaging Source

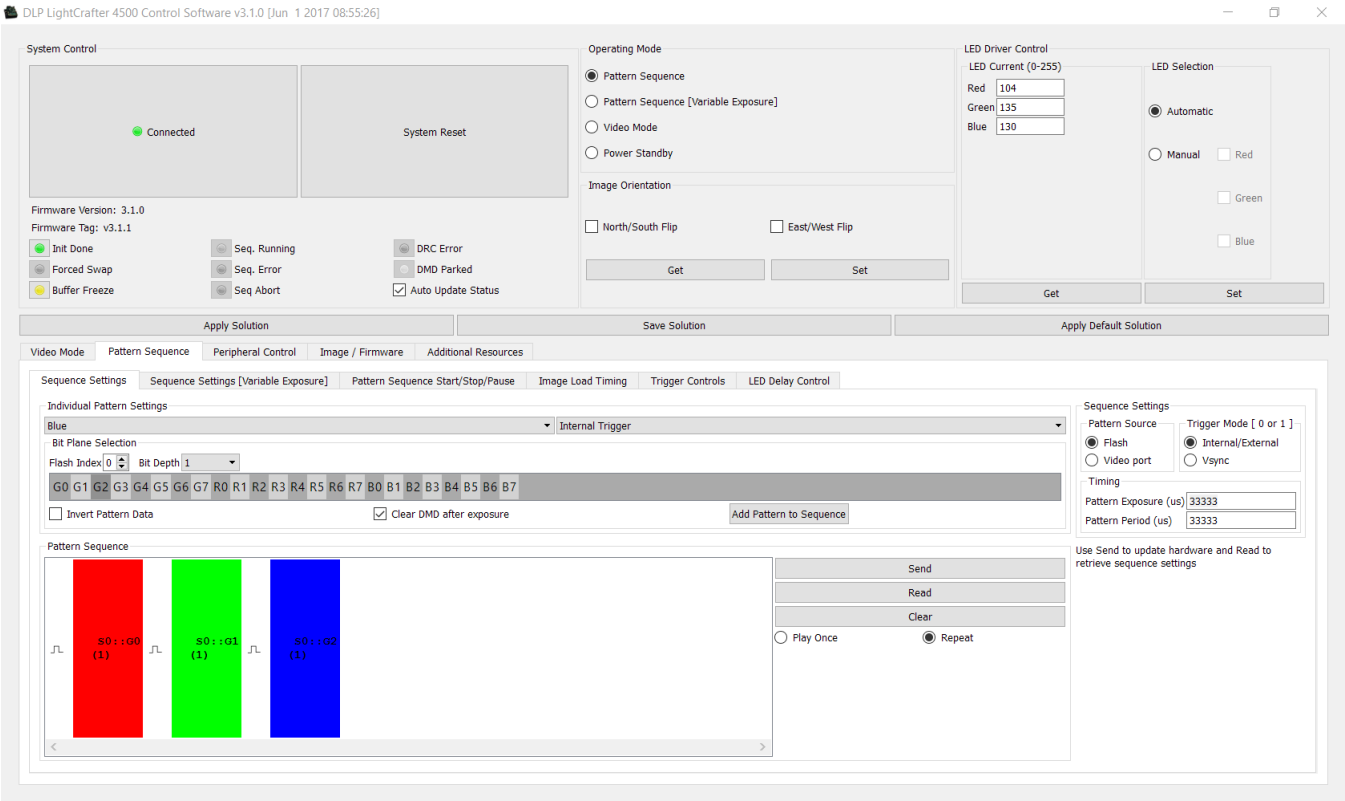


Figure 7. DLP LightCrafter 4500 Control Software – Pattern Sequence/Sequence Settings Tab

An example of setting the DLP LightCrafter 4500 to trigger a camera on a pattern sequence is shown in Figure 7. Note that under the **operating mode** the **pattern sequence** button has been selected. This automatically opens the **pattern sequence/sequence settings** tab. For this illustration, a pattern sequence has been created and sent to DLP LightCrafter 4500.

Under **sequence settings** the **pattern source** is set to **flash** and the **trigger mode** has been set to **internal/external**. The **pattern exposure (µs)** has been set to 33333 µs, which sets the period between successive patterns. This period results in a pattern rate of about 30 frames per second.

Important Note: If the **pattern exposure (µs)** is desired to be less than the **pattern period (µs)** and **clear DMD after exposure** is not checked, **pattern exposure (µs)** must be set shorter than the **pattern period (µs)** by *more than* 230 µs. If this requirement is not met, the pattern will not run. The control software indicates an error by lighting the annunciator next to the **period, exposure diff < 230** in the **pattern sequence start/stop/pause** tab.

The trigger out 1 signal high time corresponds to the **pattern exposure (µs)**. That is, the trigger out signal will be active for the length of the exposure within the trigger period.

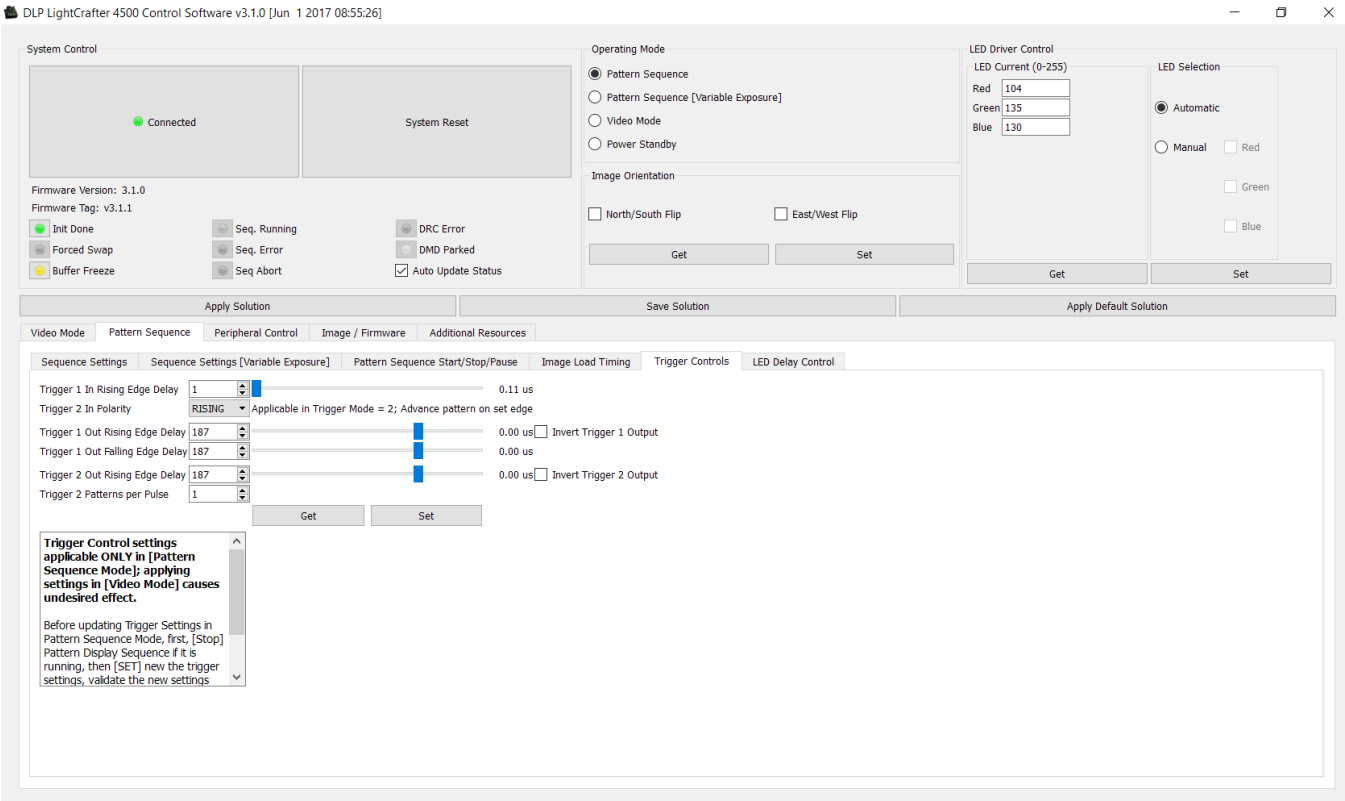


Figure 8. DLP LightCrafter 4500 Control Software – Pattern Sequence/Trigger Controls Tab

Figure 8 shows the **pattern sequence/trigger controls** tab of DLP LightCrafter 4500 control software. This screen allows for setting the **trigger out 1 rising edge delay** and **trigger out 1 falling edge delay**, and the **trigger out 2 rising edge delay**. On this tab it is also possible to set the **trigger 2 patterns per pulse** so that trigger out 2 sends a pulse every ***n*** patterns. This allows for synchronization of a whole pattern sequence consisting of ***n*** patterns. The trigger 2 pulse width is nominally 20 µs, but this can be varied somewhat by setting the **trigger out 2 rising edge delay**. Note the click box **invert trigger output 1** which does what it indicates along with the **trigger 2 in polarity** drop-down menu.

Verify that the trigger pulse width is compatible with the requirements of the specific camera which is being used. See the camera data sheet.

4 Conclusion

The trigger features of the DLP LightCrafter 4500 offer flexible means of synchronizing cameras or other devices to the pattern sequences projected by the module. Many different voltage level, polarity, and timing requirements can be accommodated by appropriate configuration of the DLP LightCrafter 4500 through its control software. Other resources are available for understanding and utilizing these and other features of the DLP LightCrafter 4500. Visit www.ti.com/dlp to download data sheets and other supporting documents.

5 Resources

The following is a list of suggested hardware:

- Trigger connector housing (connects to J11, J14)
  - Molex part number: 51021-0600
  - Digi-Key part number: WM1724-ND
- Crimp pins (6 each required for the trigger housing)
  - Molex part number: 50079-8100
  - Digi-Key part number: WM2023-ND

Revision History

Changes from A Revision (June 2014) to B Revision **Page**

- Updated GUI screenshot in Figure 7 and corresponding description 7
- Changed information related to pattern exposure, pattern period difference requirements, and trigger out 1 in Section 3. 7
- Updated GUI screenshot in Figure 8 and corresponding description 8

Changes from Original (July 2013) to A Revision **Page**

- Added section titles and updated image titles 2
- Removed 5.0-V trigger option 3

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