Application Report
DLPA036A–July 2013–Revised June 2014

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

ABSTRACT

This document describes how to use 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 others.

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1 Introduction

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).

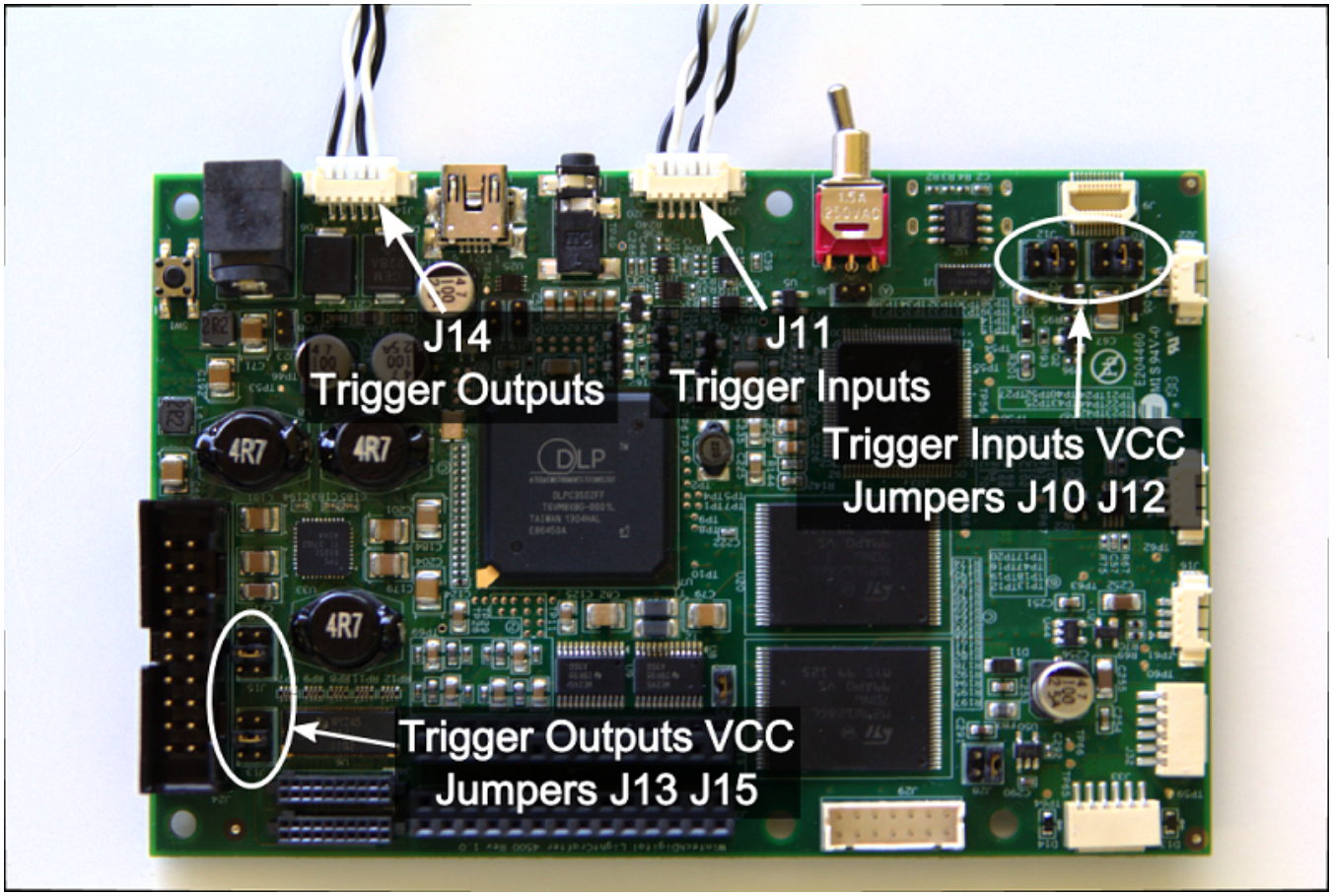


Figure 1. DLP LightCrafter 4500 Controller Board

2 Connections

2.1 J14

Figure 2 shows the schematic of the Trigger Out connector J14.

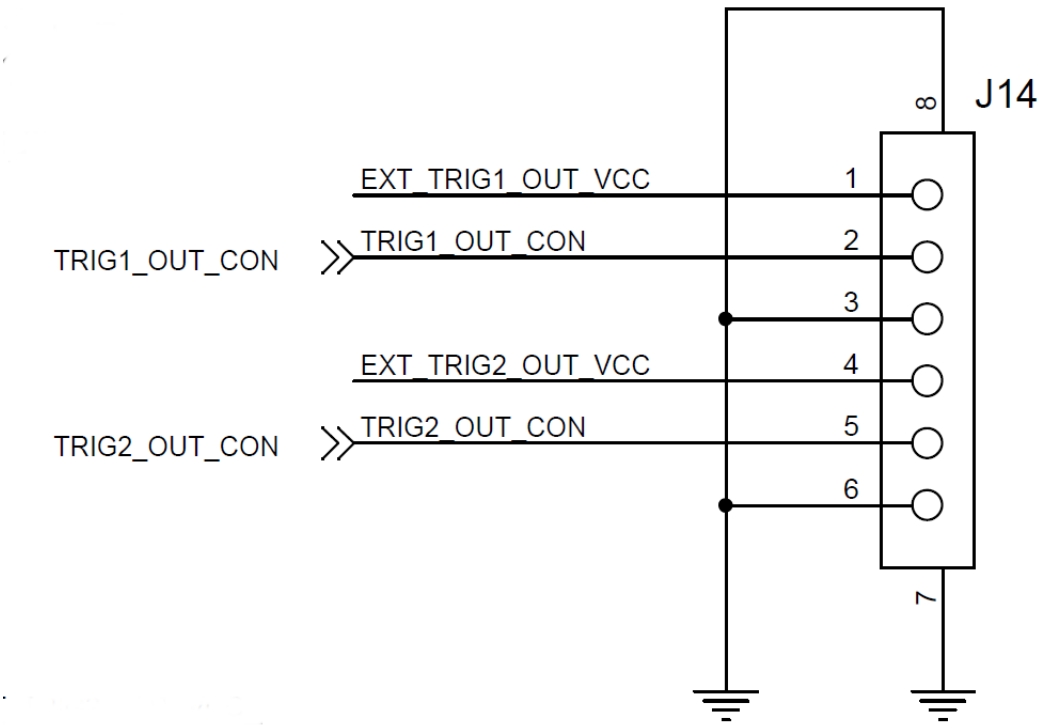


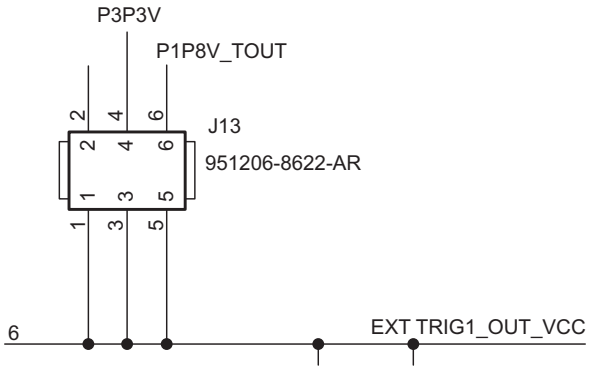
Figure 2. Schematic of J14 – Trigger Out 1 and 2

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 1 Out, the voltage level is set by putting a jumper onto the appropriate pins of header J13. Likewise, the voltage for Trigger 2 Out 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 J13 and J15

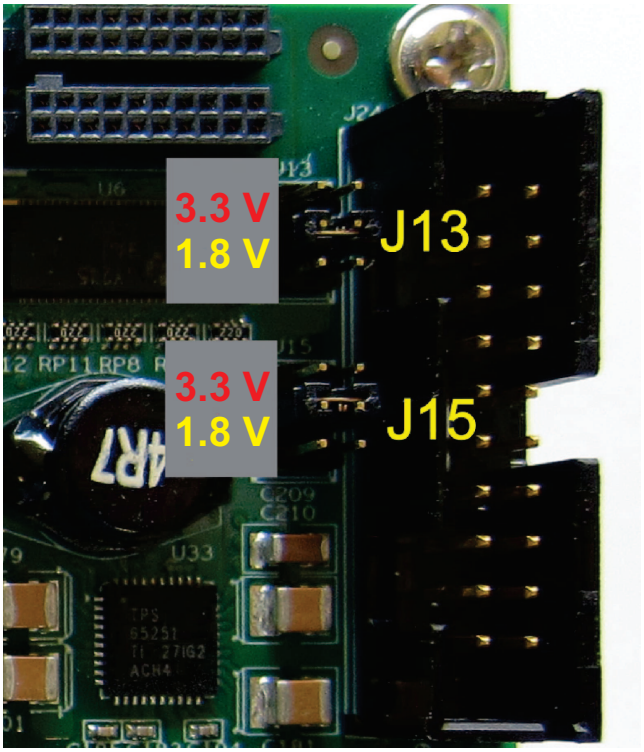
Figure 3 shows the Trigger Out 1 voltage level select header J13. This is the same for Trigger Out 2 header J15.



A J13: The desired voltage level for Trigger 1 Out is selected by 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 1 Out) and J15 (Trigger 2 Out). This board has the jumpers inserted to select 3.3 V.

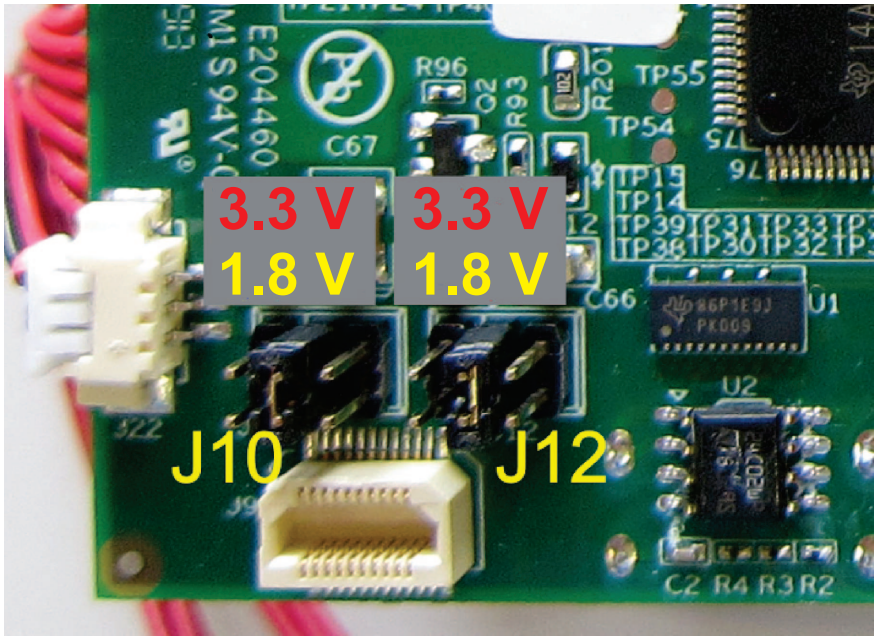


A In this case, the jumpers are installed for 3.3 V.

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

2.3 J10 and J12

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



A In this case, the jumpers are installed for 3.3 V.

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

3 DLP LightCrafter 4500 and The Imaging Source Firewire Camera

Figure 6 shows an example hook-up of DLP LightCrafter 4500 and The Imaging Source Firewire camera. The camera is connected to Trigger 1 Out. Trigger 2 Out is not used. There is no cable connected for Trigger In. In addition to the Trigger Out cable, Power supply, USB, and Firewire cables are shown in Figure 6.

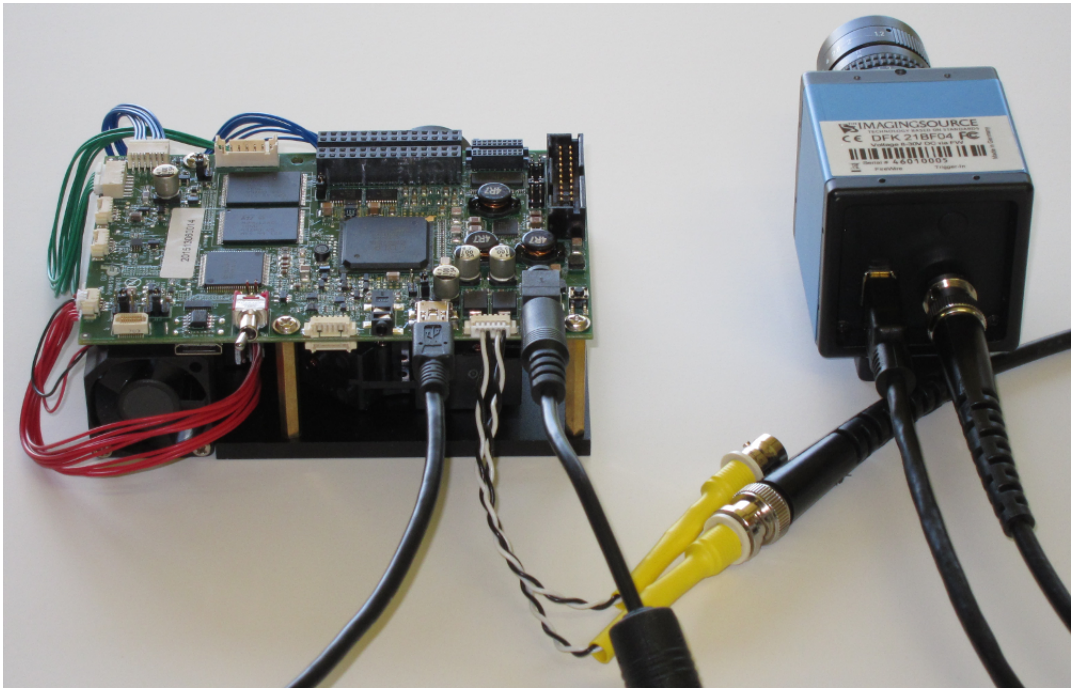


Figure 6. Example Hook-Up of DLP LightCrafter 4500 and Firewire Camera from The Imaging Source

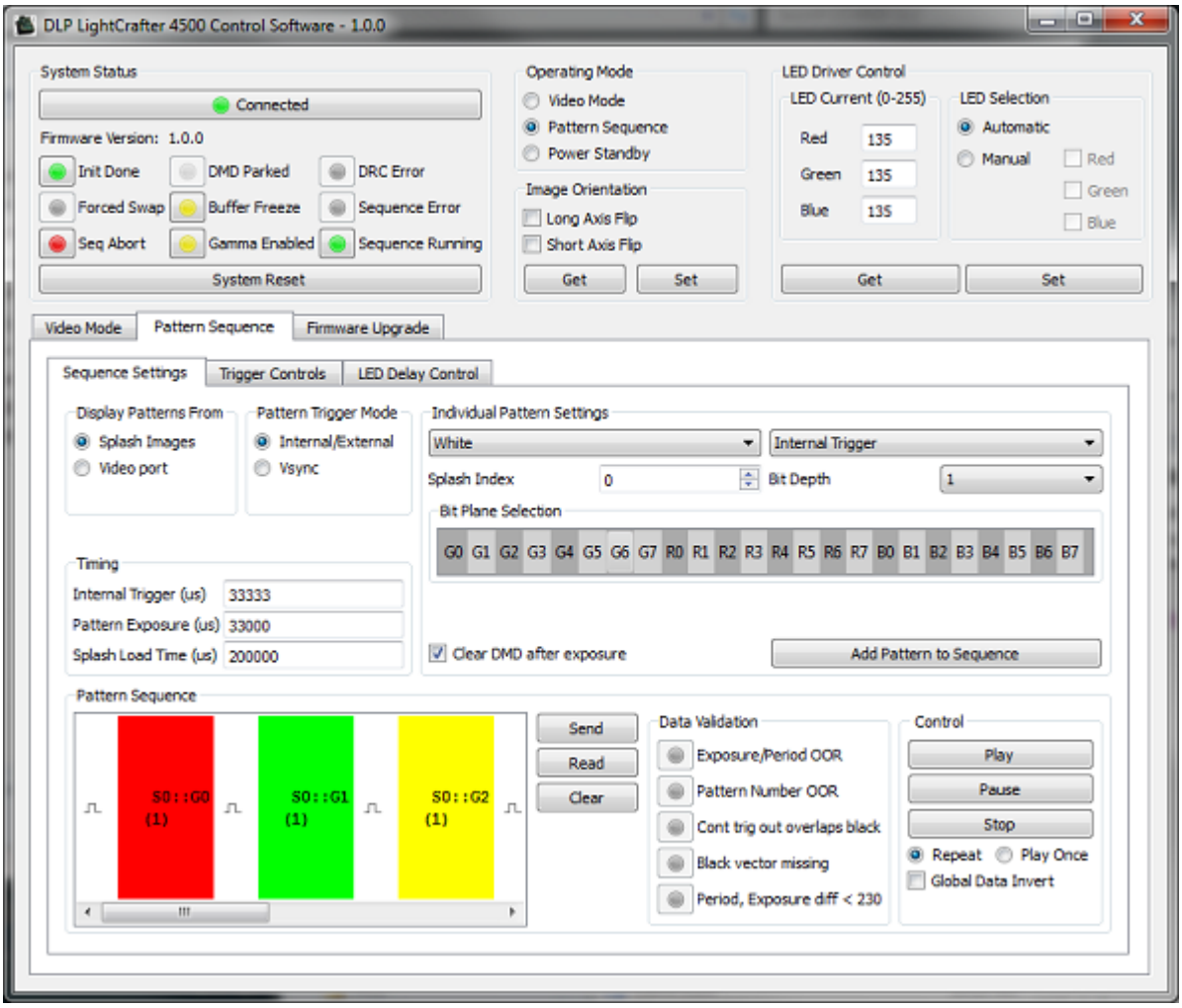


Figure 7. DLP LightCrafter 4500 Control Software – Pattern Sequence/Sequence Settings Tab

An example of setting DLP LightCrafter 4500 to trigger a camera on a Pattern Sequence is shown in Figure 7. Note that under **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 **Individual Pattern Settings** the trigger has been set to **Internal Trigger**. The **Internal Trigger (µs)** has been set to 33333 µs, which sets the period between successive patterns. This period results in a pattern rate of 30 frames per second.

Important Note: The **Pattern Exposure(µs)** must be set shorter than the **Internal Trigger (µs)** by *more than* 230 µs. If this requirement is not met, the pattern will not run. The control software will indicate an error by lighting the annunciator next to the **Period Exposure diff < 230** in the **Data Validation** area.

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

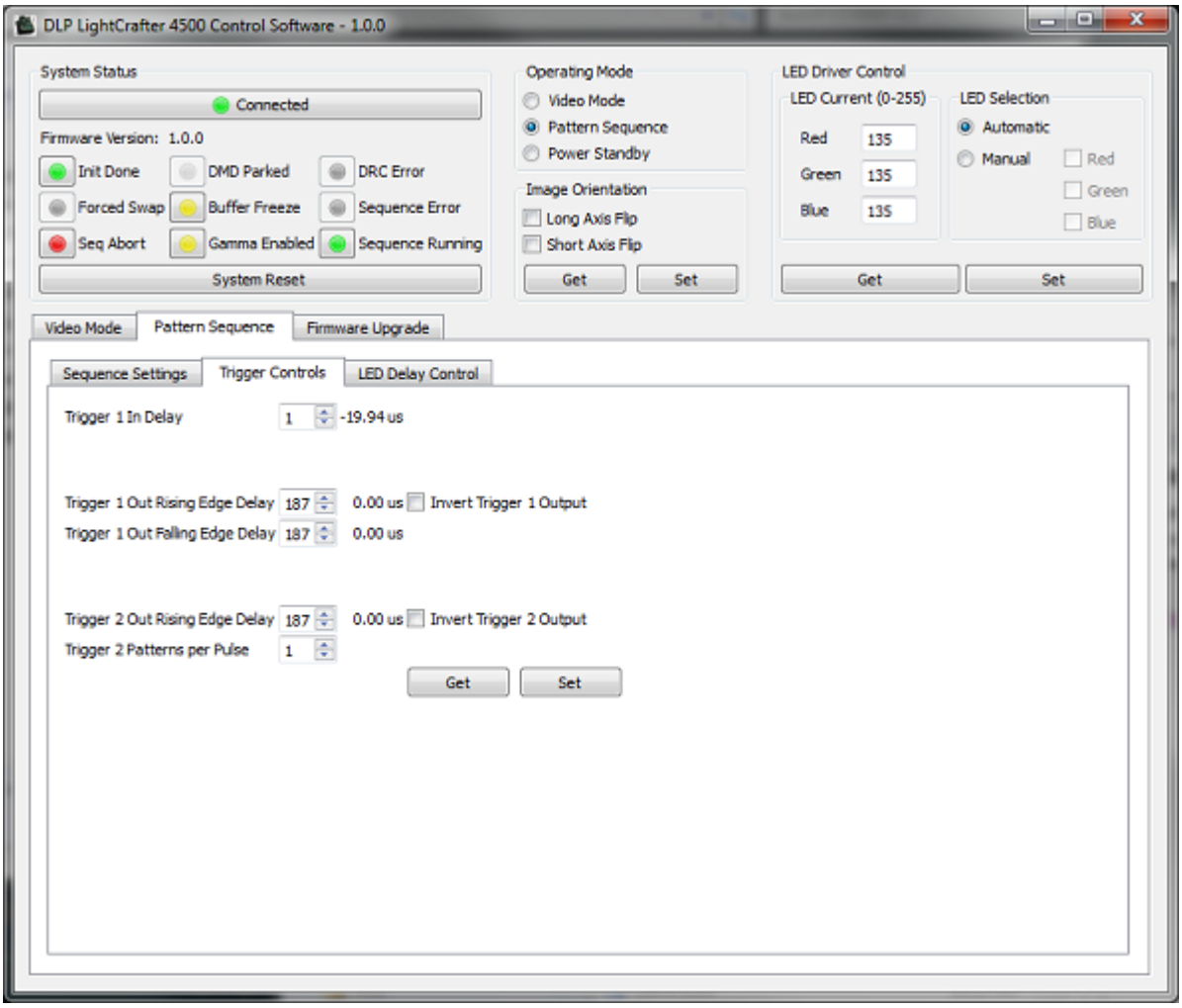


Figure 8. DLP LightCrafter 4500 Control Software – Pattern Sequence/Trigger Config Tab

Figure 8 shows the **Pattern Sequence/Trigger Controls** tab of DLP LightCrafter 4500 control software. This screen allows for setting the **Trigger 1 Out Rising Edge Delay** and **Trigger 1 Out Falling Edge Delay**, and the **Trigger 2 Out Rising Edge Delay**. On this tab it is also possible to set the **Trigger 2 Patterns per Pulse** so that Trigger 2 Out 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 2 Out Rising Edge Delay**. Note the click box **Invert Trigger 1 Output** which does what it indicates.

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 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 DLP LightCrafter 4500 through its control software. Other resources are available for understanding and utilizing these and other features of DLP LightCrafter 4500. Visit www.ti.com/dlp to download data sheets and other supporting documents.

5 Resources

The following hardware is helpful:

- 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 A History

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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