DLi DIGITAL LIGHT® innovations

A TyRex Technology Family Company

CEL5500 DLP LIGHT ENGINES
PRODUCT GUIDE

World Leader in DLP® Light Exploration
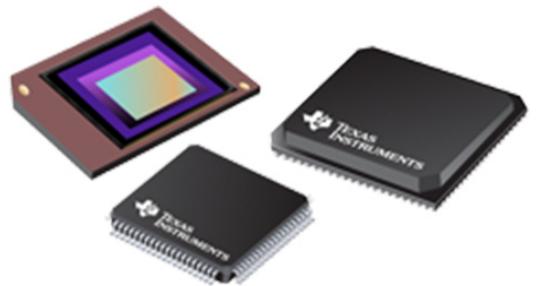
CEL5500 DLP Light Engines

The CEL5500 Compact Embeddable Light Engine is a modular, production-ready platform designed to provide users with a multi-functional, ready-to-use DLP solution for a variety of research, development and volume production needs. The flexible, scalable architecture of the CEL5500 allows for a wide variety of configurations and customizations to meet users' varying optics and illumination requirements. Users can choose between the following configurations: CEL5500-LED, CEL5500-Fiber, CEL5500-LED + fiber assembly, CELscope and user configurable options. These DLP light engines are designed for monochromatic structured light applications such as 3D printing, 3D machine vision, and microscopy. The CEL5500 is also optimized for video applications such as simulators, 3D display, head-up display, & digital signage.

The CEL5500 light engines utilize Texas Instruments' DLP5500 chipset which includes the DLP5500 DLP® 0.55" XGA Series 450 DMD, DLPC200 digital controller & DLPA200 DMD micromirror driver. The DLP5500 DMD features over 750,000 micromirrors that are organized in a two-dimensional array of 1024 micromirror columns by 768 micromirror rows. Each micromirror is approximately 10.8 microns in size. The DLP5500 DMD is used to modulate the amplitude and steer the direction of incoming light. The small, compact physical size of the DMD enables integration into portable equipment.

DLP5500 chipset

	Description	Function	Benefit
DLP5500	0.55" XGA DMD Digital Micromirror Device	MEMS component containing an array of aluminum micromirrors, with a reflectivity of 88%, that digitally switch up to 5000Hz binary patterns per second.	Fast, efficient and reliable spatial light modulator with a robust ceramic package enabling high lumen light processing applications.
DLPC200	DLP5500 Digital Controller	Conveniently interfaces user electronics to the DMD.	Provides developers the flexibility to time and control the micromirrors: up to 5000Hz binary and 500Hz 8-bit grayscale.
DLPA200	DMD Micromirror Driver	Conveniently and compactly integrates analog control required to clock the DMD micromirrors into a single chip.	Compatible with DLPC200 to enable reliable high-speed DMD performance.

The DLP5550 DMD is optimized for visible light between 420nm – 700nm but is transmissive in the 365nm – 405nm and 750nm – 1250nm wavelength ranges with reduced efficiency. The CEL5500 enables users to work with 1-bit binary pattern rates up to 5,000Hz, 8-bit grayscale pattern rates up to 500Hz, and 8-bit grayscale video rates up to 60Hz.

The CEL5500 is configured with 2x output syncs and 1x input trigger for connecting to external devices such as cameras or optical sensors. Users can daisy-chain additional devices if more than three devices are required. The host PC interfaces to the CEL5500 via USB and HDMI. The USB interface is used to control and transfer images to local memory to enable structured light mode speeds up to 5,000Hz binary and 500Hz 8-bit grayscale. The HDMI interface is used to stream 8-bit grayscale video up to 60Hz.

DLP® LightCommander™ API

The CEL5500 uses the DLP LightCommander™ API & Control Software. The use of this API makes it very convenient for LightCommander™ users to transition to the CEL5500 platform. The DLP5500 chipset is supported by the application programming interface (API) software. The API software provides a programming interface that allows users to control, in real-time, the configuration of the DLP5500 chipset. For example, the API has functions to set the LED drive current to configure sync and trigger signals and/or download patterns to flash memory. The API software is provided as a dynamically linked library (DLL) that can be accessed from user's custom application.

CELconductor Control Software

CELconductor Control Software is also included with the CEL5500 light engines. This software gives users a graphical user interface (GUI) that provides full control over the DMD without the need for programming. It provides tools and resources for CEL5500 users to leverage when familiarizing themselves with the CEL5500. The CELconductor software is built on the LightCommander™ API and is a great illustration of the API's capability. It provides users a flowchart mode and table entry mode for configuring the CEL5500. The CELconductor GUI can download and sequence selected images as well as set the frame rate, exposure timing and LED brightness of the displayed images. Sync and trigger control parameters are found in the CELconductor Workflow tab that users can easily control via CELconductor. Users can also import and use custom code and projects built with the LightCommander software or DLPC200 API.

*All software is available for download on DLi's website under the product downloads section of the resource center.

CEL5500 OPTICS & ILLUMINATION

The modularity of the CEL5500 Light Engine gives users the capability to configure or customize the illumination source and projection lens to their specific needs. Its internal architecture is based on a telecentric illumination, TIR prism, and zero offset* design beneficial for monochromatic applications such as 3D printing, microscopy, and 3D machine vision.

The illumination system supports LED and fiber optics sources optimized for visible light and extends to 405nm. The standard projection lens is optimized for low lateral color distortion and correction for visible light between 420nm – 620nm with slightly degraded performance outside this range. Due to the CEL5500 zero offset design, users can apply a female to female lens adapter directly onto the 37mm threaded projection lens. This feature gives users the option to add off-the shelf lenses such as wide angle, telephoto, fisheye, and short throw macro.

*0% Offset = The image that's displayed in front of the projection lens will uniformly increase in size as the projection distance increases.

CEL5500 Optics & Illumination
SPECIFICATIONS & FEATURES

- Modular Optics Design
- 0% Offset, On-Axis
- Telecentric Illumination
- Near-Telecentric Projection
- Projection Width: 160mm - 500mm
- Working Distance: 300mm - 800mm
- Throw Ratio: 1.8
- Pixel Size at Image Plane: 156µm - 488µm
- Up to 250mW - 300mW (Red & Green)
- Up to 450mW (Blue)
- Up to 400mW (405nm)
- Uniformity: 70%
- Compatible with 37mm Lens Adapter
- CELscope Ready
- User Configurable Options

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CEL5500 DLP Light Engines
SPECIFICATIONS & FEATURES

Configurations	CEL5500-LED (R, G, B, or UV 405nm) CEL5500-Fiber CEL5500-LED + Fiber Assembly CELscope User Configurable Options
Controller Board	DLPC200
DMD	DLP5500
Support Chips	DLPC200 Digital Controller DLPA200 Micromirror Driver
Window Coating	VIS
Wavelength*	405nm – 700nm
Resolution	1024 x 768 (XGA)
Micromirror Pitch	10.8µm
Controller Software	CELconductor Control Software DLPC200 API
Controller Interface	USB 2.0 / HDMI
Pattern Rates	1-bit: 5,000Hz 8-bit: 500Hz 8-bit Grayscale Video: 60Hz
USB Transfer Rate**	1fps
On Board Memory	128MB Flash 256MB DDR2
Binary Pattern Storage	968
I / O Triggers	Master/Slave Delay, Pulse
Illumination	LED (R, G, B or 405nm UV) Fiber (5mm or 7mm ferrule diameter)
Design	Modular Optics Design On-Axis, 0% Offset Telecentric Illumination Near-Telecentric projection Compatible with 37mm lens adapter CELscope Ready User Configurable Options
Projection	Throw Ratio: 1.8:1 Working Distance: 300mm - 800mm Projection Width: 160mm - 500mm Pixel Size at Image Plane: 156µm - 488µm Up to 250mW - 300mW (Red & Green) Up to 450mW (Blue) Up to 400mW (405nm) Uniformity: 70%
Dimensions	7" x 3.8" x 3" / 0.5lb
Mounting Options	5x 1/4in- 20 tapped holes on baseplate (mount system to optical tables, small enclosures and tripod stands)

*Designed for use within and warranted for the specified wavelength range. See TI DMD data sheets for all recommended operating conditions
**Typical value, can vary depending upon data compression ratio and PC used

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CEL5500 CONFIGURATIONS

▸ **CEL5500-LED .55" XGA Light Engine**
▸ **CEL5500-Fiber .55" XGA Light Engine**
▸ **CEL5500-LED .55" XGA Light Engine + Fiber Block Assembly**
▸ **CELscope**
▸ **User Configurable Options**

*Detailed information on each illumination configuration is listed below.
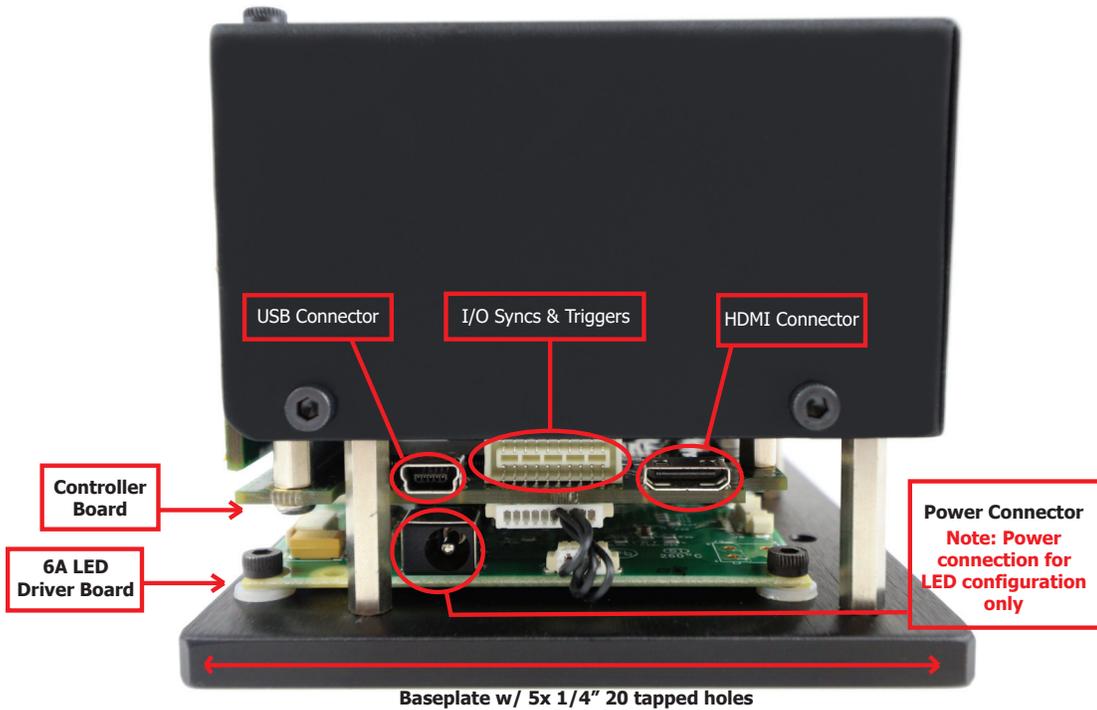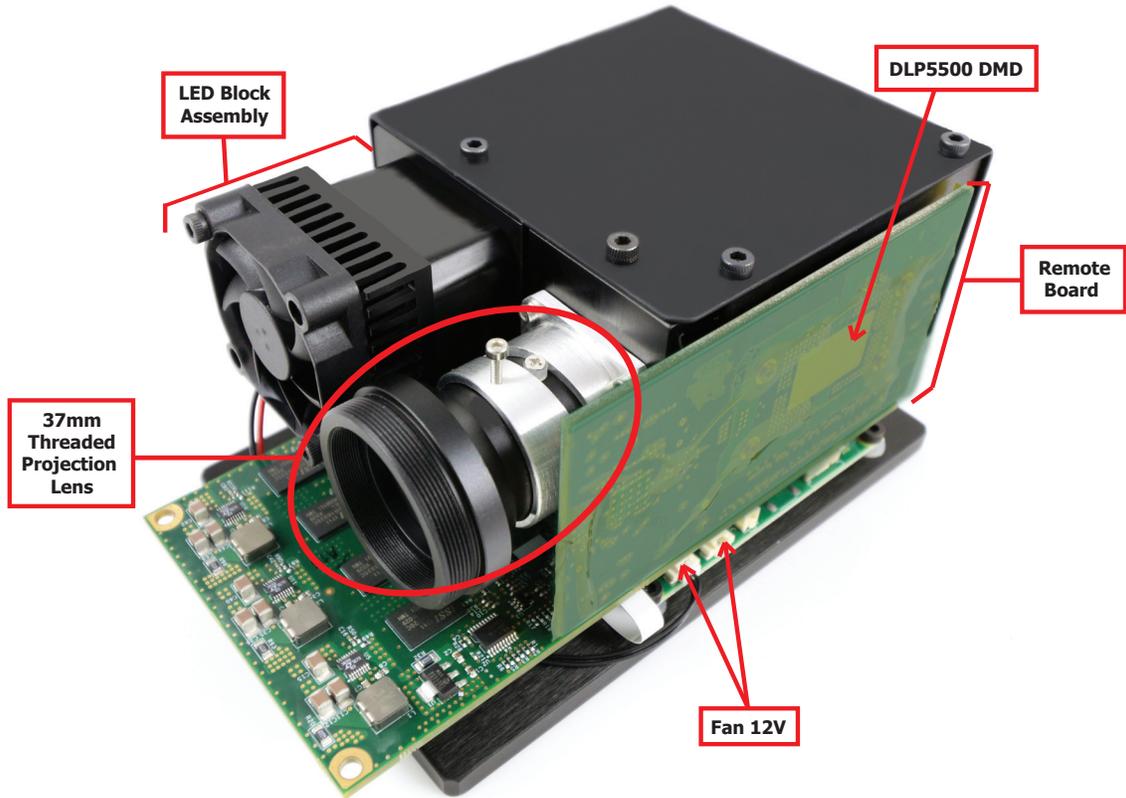
CEL5500-LED .55" XGA LIGHT ENGINE

The CEL5500-LED Light Engine is designed for a variety of monochromatic structured light applications. It offers users a compact DLP solution that includes optics and illumination. The CEL5500-LED Light Engine utilizes a single-channel Red, Green, Blue or UV (405nm) LED. The LED block assembly houses the LED, collimator lenses, heatsink, fan and mounting hardware. The assembly screws directly onto the mounting block on the front of the chassis. Switching between LED block assemblies simply requires the removal of the CEL5500 top cover, unscrewing the LED block assembly and sliding it out of the chassis, giving users the option to easily drop-in-replace a different color LED block assembly. This design feature allows users to conveniently and cost effectively maximize the use of their DLP system.

The CEL5500 includes a DLi Driver 1000 6A LED driver board that powers the LED. To eliminate the need for two separate power supplies, the LED driver board was designed to take input from the power supply and distribute power to the LED and controller. To realize maximum supported pattern rates on the DLPC200, a driver capable of switching the LED current at high speed is required. The LED driver board is capable of switching between off-state and full-scale output in just a few microseconds, and is rated to drive the LED continuously in cases where strobe control is not required. The LED driver board operates from a 12V DC power supply. Auxiliary connectors for external fans and for LED current measurement are also provided.

The CEL5500-LED .55" XGA Light Engine configuration includes the following components: DLP5500 chipset, DLPC200 controller board, remote board, LED driver board, optics, LED block assembly (R, G, B, or UV 405nm), CELconductor control software, DLPC200 API, and power supply & cable, USB cable & HDMI cable. Additional LED block assemblies can be purchased upon request.

See the diagram on the following page for the components of the CEL5500-LED Light Engine:

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CEL5500-LED .55" XGA Light Engine

LED Block Assembly

DLP5500 DMD

Remote Board

37mm Threaded Projection Lens

Fan 12V

USB Connector

I/O Syncs & Triggers

HDMI Connector

Controller Board

6A LED Driver Board

Power Connector
Note: Power connection for LED configuration only

Baseplate w/ 5x 1/4" 20 tapped holes

CEL5500-FIBER .55" XGA LIGHT ENGINE

The CEL5500-Fiber Light Engine is designed for users looking to incorporate their own light source. Mounted to the front of the CEL5500-Fiber light engine is the fiber block assembly. The fiber block assembly houses the fiber optic collimator, fiber mounting block, & mounting hardware. The fiber block assembly screws directly onto the front of the chassis. The fiber optic collimator allows users to connect their light source via fiber optic liquid or glass light guide. The ferrule diameter of the standard fiber optic collimator assemblies offered are 5mmØ or 7mmØ. Note: this is the size of the cable termination, not the fiber core.

Fiber Optic Collimator Specifications:

Light Guide Ferrule OD[1]	Focal Length (mm)	Clear Aperture (mm)	F# / NA	Material Lens	Wavelength Range (nm)
5mm	19	22	0.86/0.5	B270	350~2000
7mm	19	22	0.86/0.5	B270	350~2000

1. Ferrule length must be at least 15mm

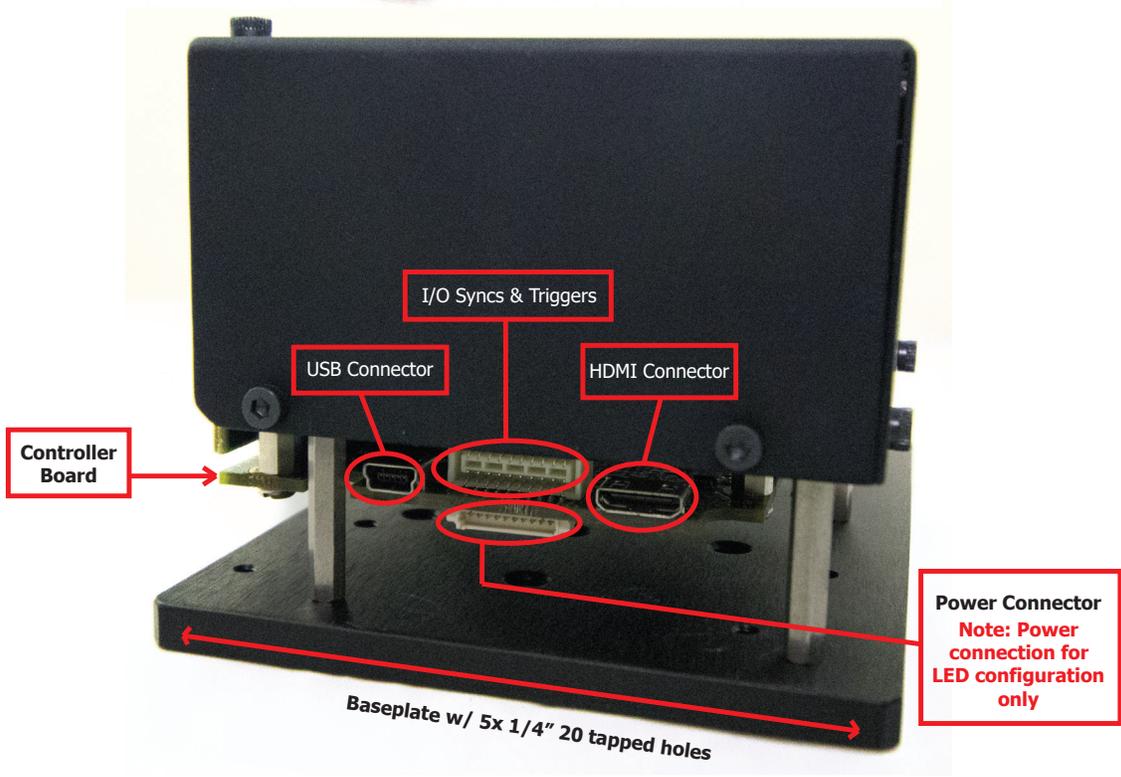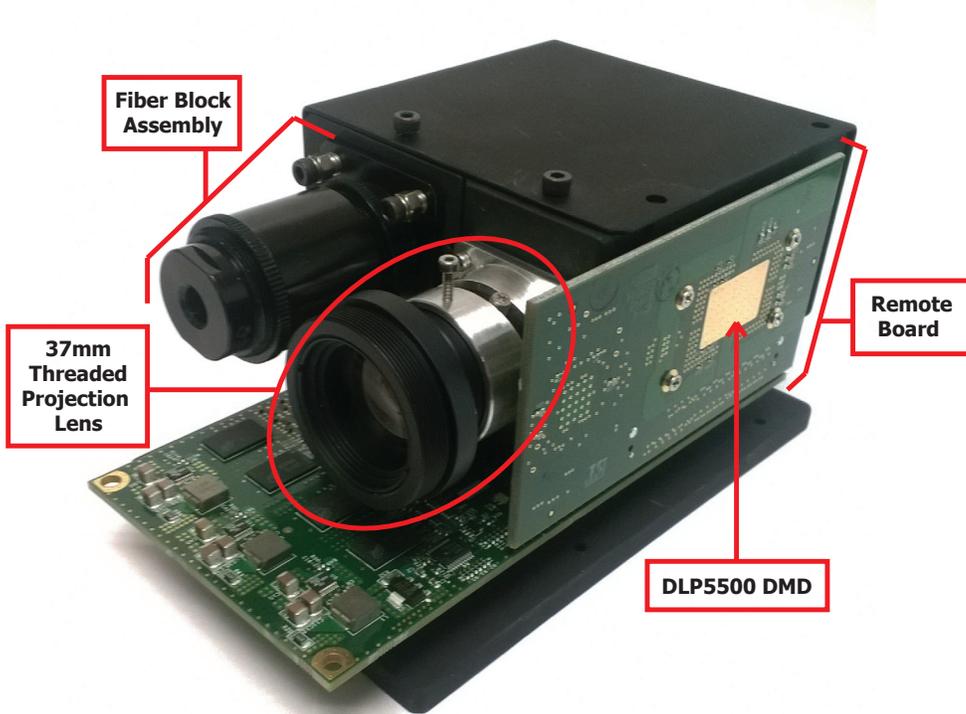Light Guide Ferrule Diameter

The CEL5500-Fiber Light Engine configuration includes the following components: DLP5500 chipset, DLPC200 controller board, remote board, optics, fiber block assembly (5mmØ or 7mmØ), CELconductor control software, DLPC200 API, and power supply & cable, USB cable & HDMI cable. Note: Fiber light guides not included.

See diagrams on the following page for the CEL5500-Fiber Light Engine components and connections:

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CEL5500-Fiber .55" XGA Light Engine

Fiber Block Assembly

37mm Threaded Projection Lens

Remote Board

DLP5500 DMD

I/O Syncs & Triggers

USB Connector

HDMI Connector

Controller Board

Power Connector
Note: Power connection for LED configuration only

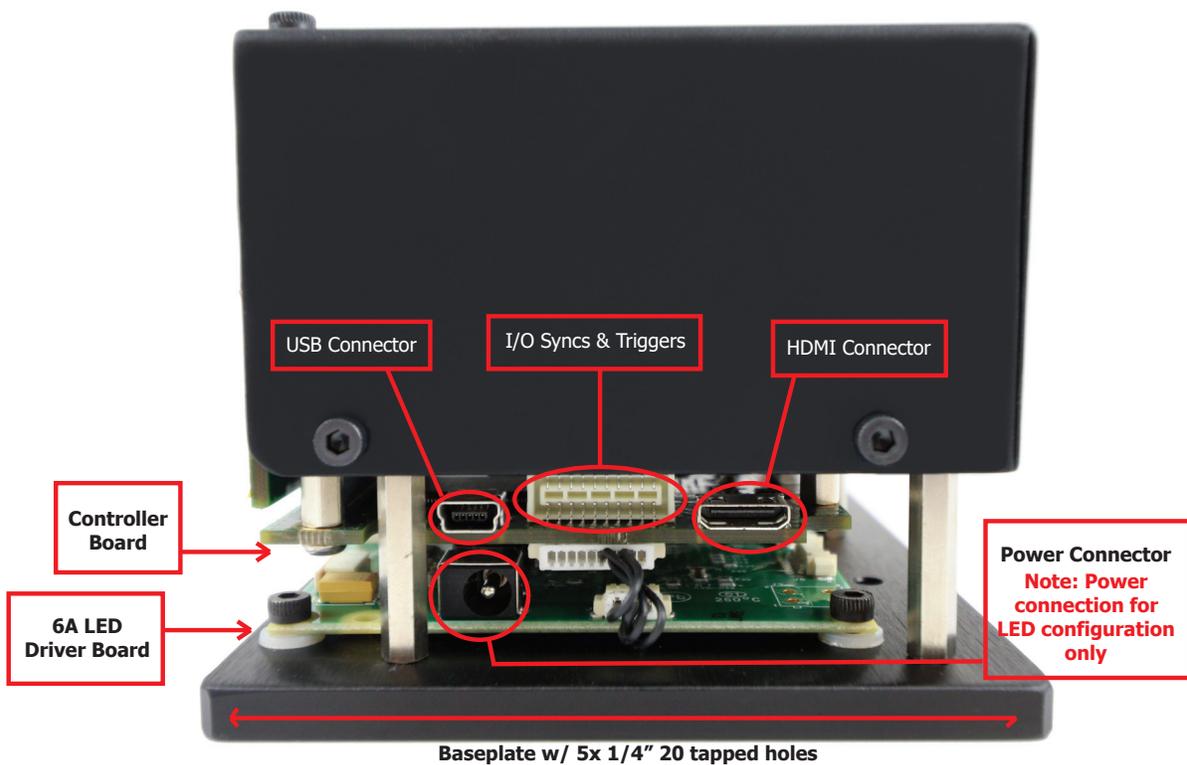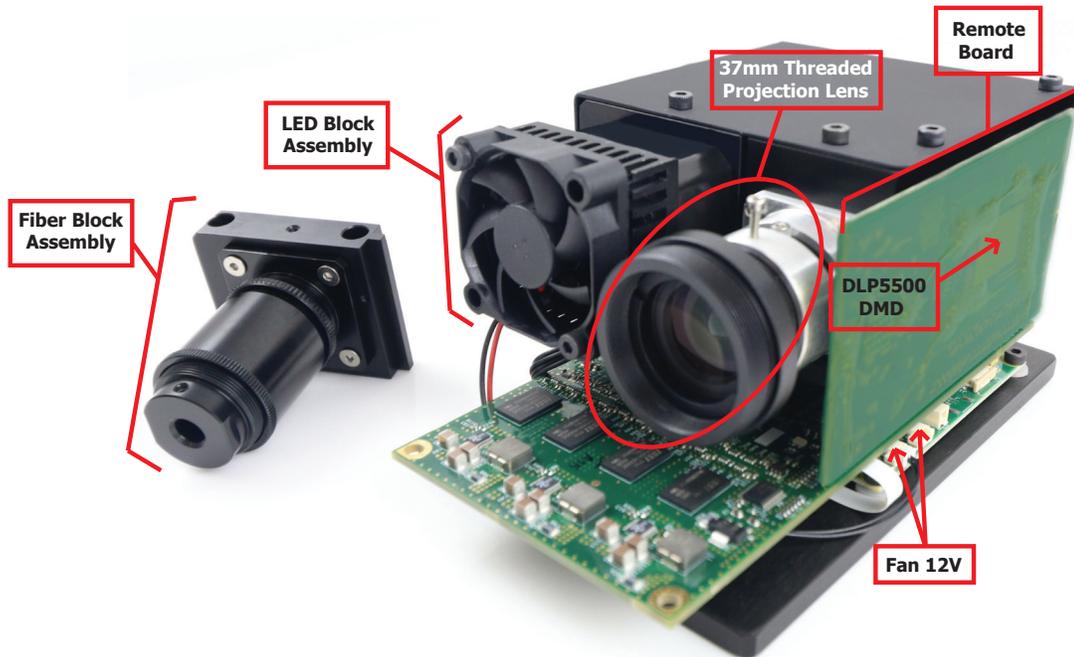Baseplate w/ 5x 1/4" 20 tapped holes

![DLi Digital Light Innovations logo]

CEL5500-LED .55" XGA LIGHT ENGINE + FIBER BLOCK ASSEMBLY

The CEL5500-LED Light Engine + Fiber Block Assembly gives users the best of both worlds. With the addition of the Fiber Block Assembly, users have the option to easily switch between LED and Fiber configurations without the need to purchase multiple DLP light engines. The CEL5500-LED configured light engine can be quickly transformed to the fiber configuration by disconnecting the LED and fan cable from the LED Driver Board, removing the CEL5500 top cover, unscrewing the LED Block Assembly & sliding it out of the chassis, and inserting the Fiber Block Assembly in its place.

The CEL5500-LED Light Engine + Fiber Block Assembly configuration includes the following components: DLP5500 chipset, DLPC200 controller board, remote board, LED driver board, optics, LED block assembly, (R, G, B, or UV 405nm), fiber block assembly (5mmØ or 7mmØ), CELconductor control software, DLPC200 API, and power supply & cable, USB cable & HDMI cable. Additional LED block assemblies can be purchased upon request.

See the diagram on the following page for the components of the CEL5500-LED Light Engine + Fiber Block Assembly.

CEL5500-LED .55" XGA Light Engine + Fiber Block Assembly

Fiber Block Assembly

LED Block Assembly

37mm Threaded Projection Lens

Remote Board

DLP5500 DMD

Fan 12V

Controller Board

6A LED Driver Board

USB Connector

I/O Syncs & Triggers

HDMI Connector

Power Connector
Note: Power connection for LED configuration only

Baseplate w/ 5x 1/4" 20 tapped holes

![DLi DIGITAL LIGHT innovations]

CELscope

The CELscope integrates the CEL5500 Light Engine with a microscope objective to create a full DLP microscopy application setup. The CELscope can be tailored with a select choice of microscope objective magnifications. A linear translation stage and eye piece are included. The CELscope can be upgraded with a camera port. The CELscope is available as an LED, Fiber, or LED + fiber block assembly configuration. The CELscope is ideal for a range of research applications such as confocal microscopy, fluorescence microscopy, 3D holographic microscopy, optogenetics, nanolithography and medical imaging.

CELscope
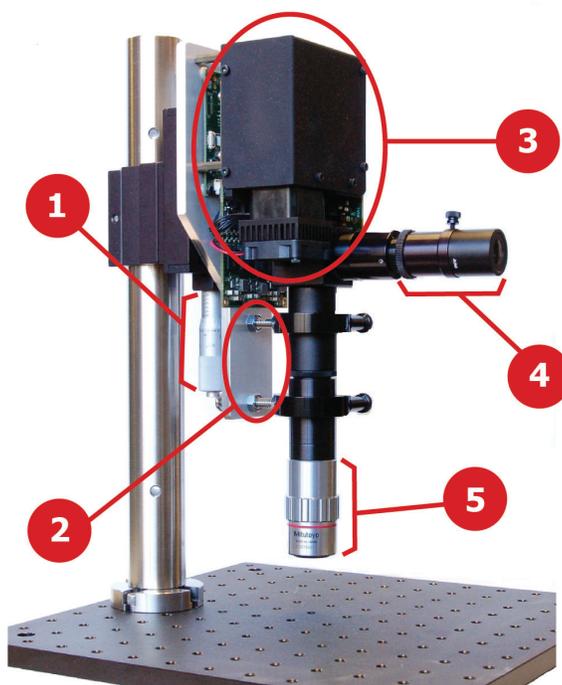
1. **Linear Translation Stage**
2. **Mounting Plate**
3. **CEL5500 Light Engine**
4. **Eyepiece**
5. **Microscope Objective**

CEL5500 LIGHT ENGINE USER CONFIGURABLE OPTIONS

For users who want to design or use their own illumination or projection optics, the CEL5500 is available with a C-mount or SM1 interface on either or both the illumination and projection side. For additional information, users can contact us at 512-617-4700 or sales@dlinnovations.com.