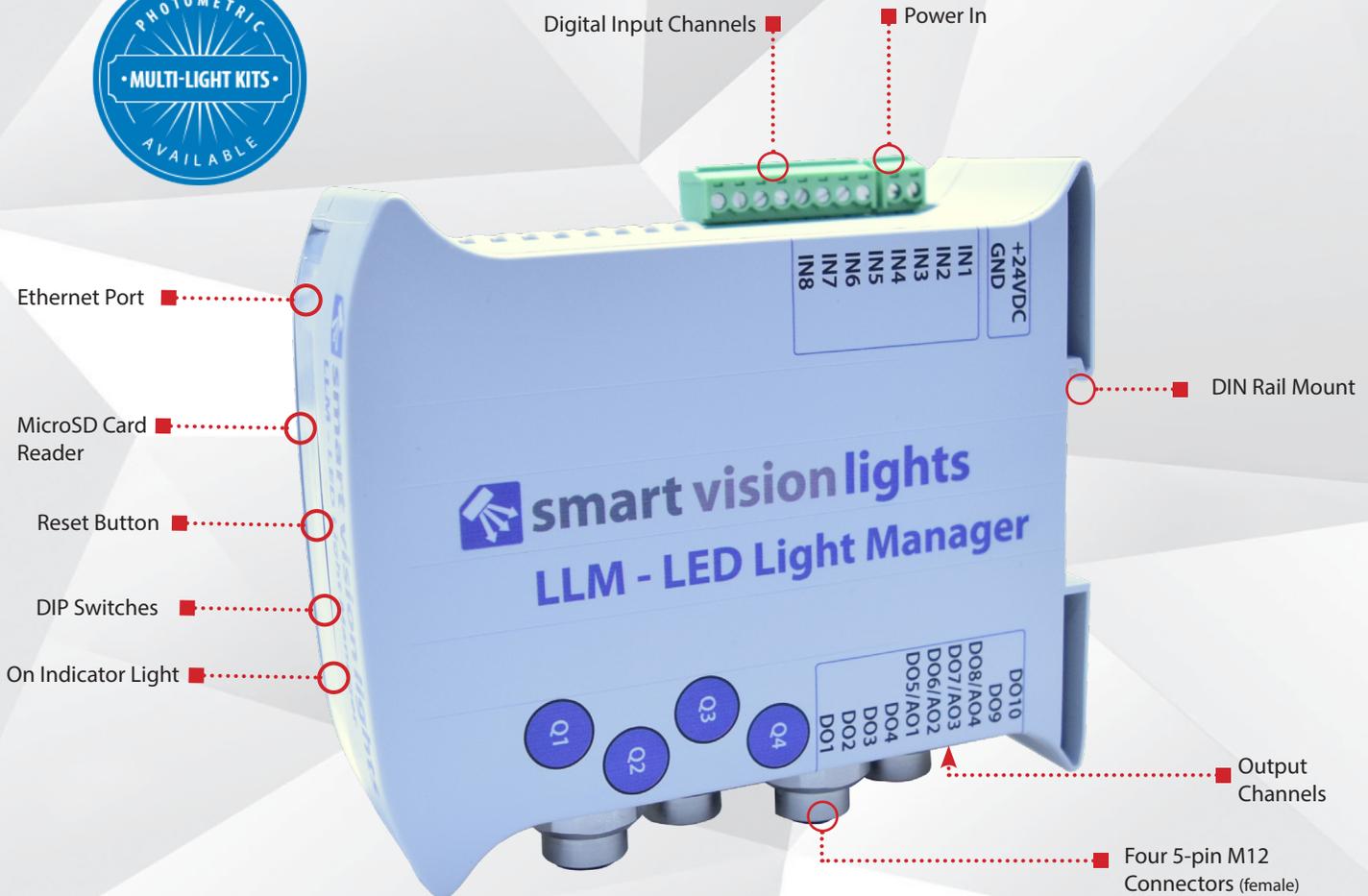


P R O D U C T D A T A S H E E T



<b>Warranty</b> <b>3</b> YEAR	<b>Mount</b> <b>DIN</b> RAIL	<b>Compliant</b> <b>CE</b> RoHS	<b>Zones</b> UPTO <b>4</b>	<b>Connector</b> <b>5-PIN</b> M12
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## PRODUCT HIGHLIGHTS

- ✓ Manage multiple lights operating in continuous, Multi-Drive™, or OverDrive™ modes
- ✓ Program operational mode, sequence, intensity, and more through an intuitive browser interface
- ✓ Connect up to four separate lights or 1 four-zone light
- ✓ Easily program the LLM using the web page interface
- ✓ PNP and NPN input and output channels



## PRODUCT DESCRIPTION

The programmable LED Light Manager (LLM) addresses the lighting control needs of multi-light machine vision solutions, including photometric 3D, multispectral and other multi-light systems.

The LLM can drive up to four separate lights of virtually any type or up to four individual zones or channels within an integrated photometric or multispectral ring light solution. Each program can contain up to six sequences with up to four lights set to continuous on, off, or any intensity level in between, and even OverDrive™ strobe mode.

Additional information about the LED Light Manager (LLM) can be found at: [smartvisionlights.com/products/llm](http://smartvisionlights.com/products/llm).



## PRODUCT SPECIFICATIONS

Electrical Input	24VDC +/- 5%
Electrical Input Connector	2 position screw terminal block – 14 AWG max wire size
Operating Current (No Load)	70 mA
Number of Input Channels	8 (including 1 input channel with interrupt capability)
Input Connector	8 position screw terminal block – 14 AWG max wire size
Max Input Channel Voltage	Not to exceed electrical input voltage
On / Off Trigger Input	PNP mode: +4VDC or greater to activate (max 26VDC) NPN mode: GND (<1VDC) to activate
Input Channel Current	PNP line: 4 mA @ 4VDC   10 mA @ 12VDC   20 mA @ 24VDC NPN line: 15 mA @ Ground (0VDC)
Output Channels	4 channels for lights plus 2 additional outputs, such as a camera trigger
Output Connectors	4 5-pin M12 connectors 10 position screw terminal block – 14 AWG max wire size (configurable for NPN or PNP)
Total Output Current (M12 Connectors)	<b>Total Average Output Current: 8 A</b> - sum of all 4 channels (polyfuse protected) Maximum average output current per any 1 channel 2.8 A
Trigger Output Current (Per Channel)	PNP (sourcing): 65 mA NPN (sinking): 65 mA
Analog Output (Per Channel)	Voltage: 1–10VDC, continuous mode intensity control Current: 0.5 mA max (with fault protection)
Slave Mode	Selectable and configurable with DIP switches
Indicator Lights	Power on = green light Ethernet = 2 indicator lights
Protection Circuitry	Polyfuse protection
Programming Connector	Ethernet port
SD Card	microSD card
Reset Button	Hold down for 3 seconds
Mounting	DIN rail
Dimensions	H = 120 mm (4.7"), L = 107 mm (4.2"), W = 45 mm (1.8")
Ambient Temperature	-18°–40° C (0°–104° F)
Ambient Humidity	0–95% non-condensing
Weight	~233g
Compliances	CE, RoHS
Warning	The user must ensure that the potential difference between any combination of applied signals does not exceed the supply voltage. The LED Light Manager (LLM) must not be used in an application where its failure could cause a danger to personal health or damage to other equipment.
Terminal Blocks (Included with LLM)	2 position terminal block plug 8 position terminal block plug 10 position terminal block plug



## RESOURCE CORNER

Additional resources are available on our website, including CAD files, videos, and application examples.



## MODE OPTIONS

### Master Mode (Default Mode)

Master mode allows you to use the full function of the LLM. This mode allows you to control up to six sequences and zones using the built-in web browser based interface. **DIP switch 1 needs to be set to master mode.**

### Slave Mode

Slave mode allows you to bypass the controls set using the web page interface. When the LLM is set to slave mode, the output signal follows the input signal and allows for the output signal to be set to the same or opposite polarity as the input signal.

**DIP switch 1 needs to be set to slave mode.**



## INPUT TRIGGERING

The LLM uses the following convention for setting up the input triggering.

**NPN triggering:** The triggering device provides a sinking signal that is at ground potential (typically less than 1VDC)

**PNP triggering:** The triggering device provides a sourcing signal that is between 4VDC and 24VDC



## WIRING CONFIGURATION

### Master Mode

When connecting a camera to the LLM:

Action	Pin
Sequence Start	Input 6
Exposure Complete	Input 7
Camera Trigger	Data Output 9

### Slave Mode

Data outputs 1–8 are slaves to the data input. They can be set to be the same or opposite polarity as the input signal.



### NOTE:

The four 5-pin M12 connectors on the LLM will not function if DIP switch 1 is set to slave mode.

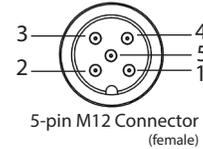


## OUTPUT CONFIGURATION EXAMPLES

### Using 5-pin M12 Connector

Lights can be connected using a standard 5-pin M12 connector. Up to four lights can be connected to a single LLM.

Using daisy-chainable and direct connect lights is possible as long as you do not exceed the 5-pin M12 connector max value (see Product Specifications for value).



5-pin M12 Connectors (Female) Pin Layout

Pin	Function	Signal
1	Power Out	+24VDC
2	NPN	Sinking Signal
3	GND	Ground
4	PNP	Sourcing Signal
5	Varies by Light*	Varies by Light*

\*See Note

**NOTE:**

Smart Vision Lights recommends referencing the data sheet for each individual light for wiring configuration to determine exact wiring option and pin 5 function/signal.

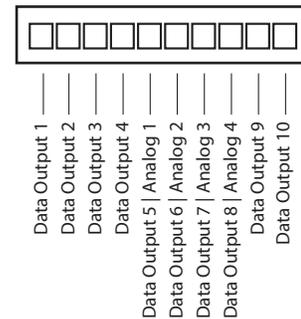
### Using Output Terminal Blocks

#### Master Mode

If using a light with an external driver or non-Smart Vision Lights' light with an internal driver, use data output (1–4) to trigger PNP input.

Analog output is used when managing intensity control.

Data output (9) can be used for controlling additional output devices, such as a camera trigger.



#### Slave Mode

Data outputs 1–8 are slaves to the data input and are configured using the DIP switches. The output signal follows the input signal and allows for the output signal to be set to the same or opposite polarity as the input signal. *Slave mode can only use terminal block (input/output).*

**NOTE:**

If lights are using a separate power source, number of lights per channel are limited only by data output (1–4) or analog output (1–4). See Output Current per channel for data output values or Analog Output per channel for analog output values in Product Specifications.



## RECOMMEND LIGHTS

Smart Vision Lights recommends the following lighting kits for best results when using the LLM for multi-zone lighting. Kits includes the LLM, lights, cables, and mounting equipment. See our LLM Photometric Multi-Light Kits guide for more information.

- LM45 Kit
- LM75 Kit
- LXE300 Kit
- S75 Kit
- DFL12 Kit
- DFL24 Kit
- DFL460 Kit



Light(s)

+



Mount(s) /  
Adapter(s)

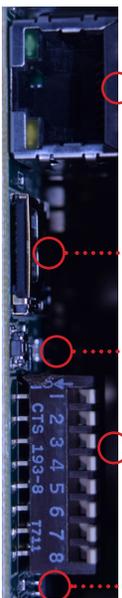
+



Cable(s)



## LLM FRONT PANEL



-  Ethernet Port
-  MicroSD Card Reader
-  Reset Button
-  DIP Switches
-  On Indicator Light

Allows you to connect an Ethernet cable to the LLM.

MicroSD Card used to store the program file. Required when using web page interface as well as when running LLM in master mode.

Smart Vision Lights recommends holding the reset button down for three seconds.

DIP switches allow you to set the configuration of the LLM. See DIP switches section for more information.

Indicator light to show that the LLM has power.



## DIP SWITCHES

← ON

1	Slave		Master
2	Input NPN		Input PNP
3	Output NPN		Output PNP
4	Not Used		Not Used
5	Not Used		Not Used
6	Trigger Delay On		Trigger Delay Off
7	Restart Sequence On		Restart Sequence Off
8	Test Mode On		Test Mode Off

*Example:* Toggling DIP switch 1 in the opposite direction of the number (1) will set the LLM into Master mode.

**NOTE:**

In order to use the setting you program using the web page interface, you need to have **DIP switch 1 set to master.**

The DIP switches located on the front of the LLM are used to configure the LLM for master or slave mode as follows:

**Master Mode (DIP switch 1)**

DIP switch 1 set the LLM to master mode. Master mode uses the settings configured during your last programming session.

**Set Trigger Delay (DIP switch 6 - Active in Master mode)**

Set camera trigger delay to 50  $\mu$ s.

**Restart Sequence Event (DIP switch 7 - active in Master mode)**

Restart sequence event with each sequence start signal. (See *Restart Sequence Event for more information*)

**Test Mode (DIP switch 8 - active in Master mode)**

Allows you to select if you want to run the LLM in test mode. Available on version 1.7 or greater. (See *Test Mode for more information*)

**Slave Mode (DIP switch 1)**

When DIP switch 1 is set to slave mode, DIP switches 2 and 3 become active. Setting DIP switch 1 to slave mode bypasses the program created when accessing the web page interface. The output signal follows the input signal and allows the output signal to be set to the same or opposite polarity as the input signal. *Slave mode can only use terminal block (input/output).*

**Input Signal PNP/NPN (DIP switch 2 - active in Slave mode)**

Allows you to select your input signal as either PNP (sourcing) or NPN (sinking).

**Output Signal PNP/NPN (DIP switch 3 - active in Slave mode)**

Allows you to select your output signal as either PNP (sourcing) or NPN (sinking).



## PROGRAMMING

### Smart Vision Lights LED Light Manager

MODE:  RUN  PROGRAM

INPUT:  PNP  NPN

	Q1	Q2	Q3	Q4
Sequence 1	100% ▼	100% ▼	Off ▼	100% ▼
Sequence 2	100% ▼	Off ▼	Off ▼	Off ▼
Sequence 3	Off ▼	100% ▼	Off ▼	Off ▼
Sequence 4	Off ▼	Off ▼	100% ▼	Off ▼
Sequence 5	Off ▼	Off ▼	Off ▼	100% ▼
Sequence 6	100% ▼	100% ▼	100% ▼	100% ▼

Ver. 1.7

#### Programming the LLM

- Open web browser and enter IP address **192.168.0.200**
- The most recent event program will be displayed
- Select PROGRAM from MODE
- Click on SAVE to enter program mode
- Web page will refresh
- Select either PNP or NPN for INPUT
- Select the values for your sequences / zones
- Set MODE to RUN
- Review your sequences / zones
- Click on SAVE to save your program

#### NOTE:

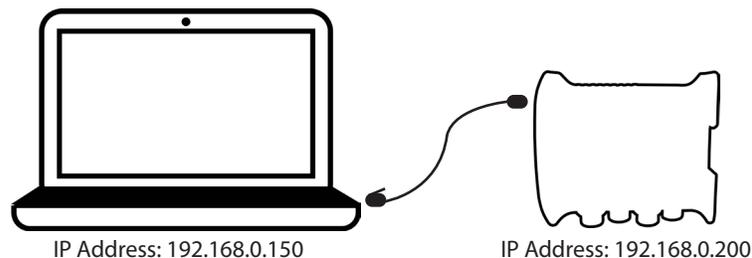
Review **Input Triggering** section for using PNP or NPN.

#### NOTE:

The LLM is set to use IP address: **192.168.0.200**

If your network is not set up to use 192.168.0.xxx, you will need to connect a computer to the LLM using a standard Ethernet cable (such as a Cat5e cable). Set your computer's IP address manually to 192.168.0.150. Set the subnet to 255.255.255.0. You will now be able to communicate with the LLM via your web browser.

**Note:** Make sure you set your computer back to the network settings prior to making the above changes to ensure your computer works properly on your network.



#### Managing Multiple LLMs on the Same Network

Smart Vision Lights recommends not programming multiple LLMs on the same network at the same time. When needing to program multiple LLMs, it is best to connect each LLM separately to a computer, program it, and move to the next one to do the same.



## MANAGING SEQUENCES

A sequence event consists of the total number of sequences selected. You can select from one to six sequences. For example, if you only need five sequences, you can leave all the zones off in the sixth sequence.

### Once the event is activated (“Sequence Start” signal on input 6), two things happen:

1. The first sequence (sequence 1) of lights (zones) is triggered.
2. The camera is triggered via data output 9.

(This is repeated for all the sequences selected, as described below.)

The LLM waits for the camera exposure to be completed before triggering the next sequence (such as sequence 2). The “Exposure Complete” signal is monitored on input 7. If the “Exposure Complete” signal is not detected within two seconds, the system times out, triggers the next sequence, and waits again for the “Exposure Complete” signal. This occurs for all the sequences chosen for the sequence event.

Once the sequences are complete, the LLM waits for the next “Sequence Start” signal (event start).

### To drive the exposure complete input:

- If the PNP is selected for the input, connect a pulse signal of 4VDC or greater (max 26VDC).
- If the NPN is selected for the input, connect a pulse signal less than 1VDC (above ground).



## RESTART SEQUENCE EVENT

Sometimes there is a need to interrupt the sequence event and start the event from the beginning. (A sequence event consists of the total number of sequences selected.)

Setting DIP switch 7 to the ON position while in Master mode, the sequence event will restart each time the sequence is triggered. When DIP switch 7 is in the ON position, applying a signal to the sequence start input (IN 6) will result in a restart of the sequence event.

For example, if the LLM is currently in second sequence of a four-sequence event and the LLM receives a sequence start trigger (on IN 6), the LLM will skip the last two sequences in the sequence event and restart from the first sequence.

**Note:** The current sequence will be completed before the sequence event is restarted.

*This feature is available on version 1.7 or above.*



## TEST MODE

The LLM can be put in a test mode, which will allow the LLM to operate without any control lines connected.

- In the test mode, the LLM will continuously run through the sequences. Each sequence will be displayed for two seconds.
- To enter into the test mode, set DIP switch 8 to the ON position and then press the reset button (the DIP switches are read at power up or after the Reset button is pressed).
- The sequences can be changed while in the test mode. The changes are updated automatically in the LLM once the changes are saved on the web page.
- While in the “Program” mode, the lights will turn off. After the changes are saved, there is a six-second delay. Following the delay, the lights will display the new changes.
- To exit the test mode, set DIP switch 8 to the OFF position and press the Reset button.

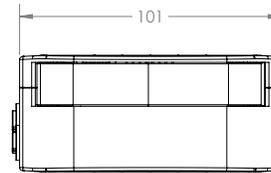
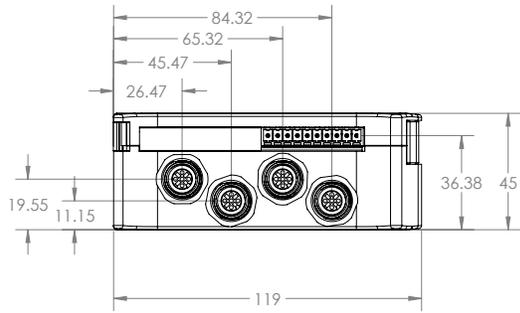
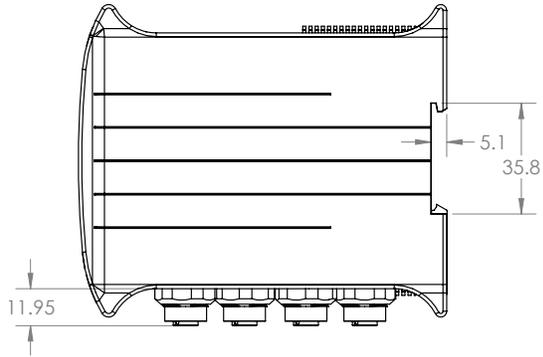
One application for the test mode is for setup. The lights in a particular sequence can appear to be on continuously by setting all sequences identically. This way, the lights in the repeating sequences will appear to be always on (there will be a very brief off period between sequences).

*This feature is available on version 1.7 or above.*



# PRODUCT DRAWING

Dimensions are in mm.





## ACCESSORIES

### Power Cables



Lengths	Part Number
5 m	5PM12-5
10 m	5PM12-10
15 m	5PM12-15

### Jumper Cables



Lengths	Part Number
300 mm	5PM12-J300
1000 mm	5PM12-J1000
2000 mm	5PM12-J2000

### Jumper Cables



Lengths	Part Number
2000 mm	5PM12-J2000-BLK



## GLOSSARY

This glossary covers all Smart Vision Lights product families; some content in this section may not apply to this specific product.

### TERMINOLOGY

**OverDrive™** Lights include an integrated high-pulse driver for complete LED light control.

**Continuous Operation** Lights stay on continuously.

**Multi-Drive™** Combines continuous operation and OverDrive™ strobe (high-pulse operation) mode into one easy-to-use light.

**Built-in Driver** The built-in driver allows full function without the need of an external controller.

**Camera to Light** Connecting the light directly to the camera, without the need for additional controllers or equipment.

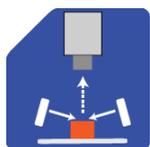
**Polarizers** Filters that reduce reflections on specular surfaces.

**Diffuser** Used to widen the angle of light emission, reduce reflections, and increase uniformity.

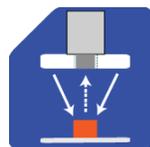
### TYPES OF ILLUMINATION



Projector



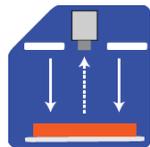
Dark Field



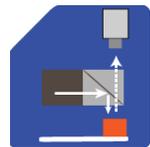
Radial



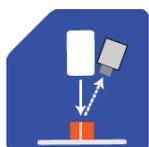
Bright Field



Direct



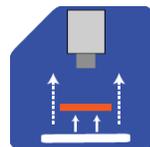
Axial



Line



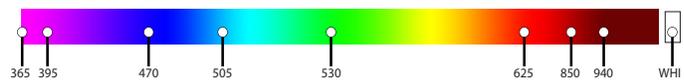
Diffuse Panel



Backlight

### COMMON COLOR/WAVELENGTHS LEGEND

Wavelengths options range from 365 nm to 1550 nm. Additional wavelengths available for many light families.



Shortwave Infrared LEDs are available in 1050 nm, 1200 nm, 1300 nm, 1450 nm, and 1550 nm.