SENSORS
INCORPORATED
507 Kelsey Street ● Delano, MN 55328
Phone 763-972-1040 Fax 763-972-1041
Toll Free 888-920-0939
Sensorsincorporated.com

ADVANCED ILLUMINATION

LED Lighting & Innovation Since 1993

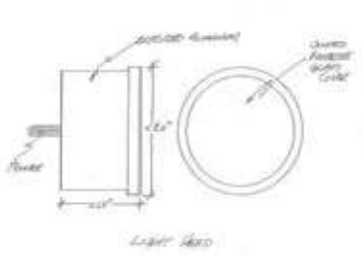
LED Lighting & Electronics

PRODUCT SOURCEBOOK

Image Experts
for the Factory Floor

At Advanced illumination (Ai), we understand just how difficult it can be to choose the correct light source in order to acquire the best image for your applications. We built our business by focusing on the factory floor. Our mission is to make your challenges our challenges by providing complete service and support of tested and proven light sources using dependable solid state technology. Our vision is to become *the* trusted lighting source for factory automation professionals by partnering with the world's leading integrators, distributors, and developers of machine vision technology.



Advanced Control

Each Ai light is built with an internal electronic signature. Upon connection to a microprocessor-based SignaTech controller, the light signature is read and the controller automatically configures itself to output the optimum current level for a given pulse width. The SignaTech control system also applies to steady state, DC operation for those applications that do not require strobing.

Advanced Lighting Technology

To help our customers implement a robust lighting solution, we developed the **Flexible Response Product System** utilizing **Evenlite** technology and our Expandable Lighting products. The best lighting solution will increase the accuracy of your inspection and allow the camera to process clear digital images with speed and dexterity.

Advanced Flexibility

Ai's Flexible Response Product System combines our best technological innovations: Flexibility begins with **Standard Variations** - standard product housings built with end-user choice of LED wavelength, power input, stand-off, working distance, and mounting options, *built within two weeks.* If a standard housing does not suit the application, our **Expandable Lighting System** offers standard lighting technology in sizes to match your needs. **Evenlite** technology allows structured lighting effects to be developed far more easily than in the past. And finally, **Signatech** and **Signatech II** control systems round out the Flexible Response Product System by maximizing interchangability between lighting and control components without compromising performance.



LED **Innovations** Since **1993**

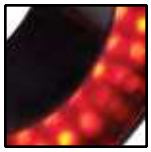
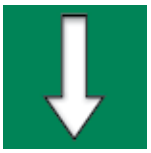


TABLE OF CONTENTS

Product Families

Additional Information


Direct


Back Light


Dark Field


Diffuse


Axial Diffuse


Electronics

About Ai

Since 1993 Advanced illumination has been a world leader in designing and manufacturing LED based lights for the machine vision industry. Featuring patented Evenlite LED aiming technology, Ai's extensive product line includes a number of exclusive designs, including RGB lightheads and Broad Area Linear Arrays.

Applications Lab: Our applications lab can help you determine the most appropriate lighting for your inspection - free of charge. Simply send a sample and a completed questionnaire (Send Us A Sample on our web site) to "Applications Lab" at the address listed below, and we will email you a solution report with bitmapped images to evaluate using your own vision tools.

Evaluation Lights: Our goal is to make sure your lighting provides optimal results. Once we've proven a solution in the lab, we offer lights for evaluation purposes - giving you two weeks to test the solution and decide if it meets your needs.

Contact Ai

Office Hours:
Monday - Friday
8:30 - 5:00 Eastern

24 Peavine Drive
Rochester VT 05767

p. 802.767.3830
f. 802.767.3831

Send information requests to:
sales@advill.com

ELECTRONICS TECHNOLOGY

Smart *Powerful* *Accurate*

Precise Lighting Control

Strobes, Intensity **Controllers** & Power Supplies

PULSAR 320

2 Outputs, 50A @ 100V

Pulsar 320 features

- Ethernet and USB Compatible
- DIN Rail Mount
- More Features than S6000-AS **at a Lower Cost**
- Compact Housing (5.1" x 3.37" x 3.9")

Used in Place of:
S4000
S6000, S6000-AS

iNLINE CURRENT SOURCE

iCS

iNLINE STROBE UNIT

iSU

- Improved Cable
- Power Indicator Light
- Turck Connector Option Available

Features

- Intensity Control
- Faster Delivery of Non-Stock Items
- Gate Control

Features

- Manual Potentiometer
- 30 - 300µSec output pulse-width
- Timing Bypass Option

PULSAR 710

- 100 Amps @ 100 Volts in pulsed mode
- 8 Amps @ 24 Volts in constant mode
- 4-channel outputs

CONTROLLERS

MS210, MS220, CS410 & CS420

- MS210 & MS220 controllers offer dual output control for color mixing
- CS410 & CS420 controllers provide dual independent intensity control (0-100%)
- MS220 & CS420 offer convenient touchpad control

SIGNATECH®

Ai's microprocessor based Signatech® electronics verify the electronic signature of a light head and automatically adjust the maximum current output accordingly. This feature optimizes light output and LED life. New Signatech II expands the original capabilities for large arrays and high current LEDs.

TURBO-CHARGING

Increasing light intensity and extending LED life, Turbo-Charging is the process of precisely synchronizing high bursts of current, at a safe duty-cycle, through our lights during camera integration time. Turbo-Charging maximizes the amount of information the camera receives in the shortest time possible.

Power Options

Depending on the product, **Standard Lights** are configured with a C2 or C5 connector, or with the IC power option. For lights with built with connectors, *CUTTING THE CABLE VOIDS THE WARRANTY* (see page 23).

Ai Connectors:

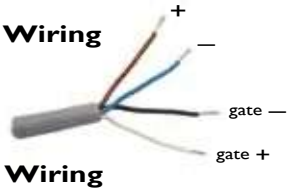
CS, MS & S Series
(C2)

Pulsar 320
(C5)

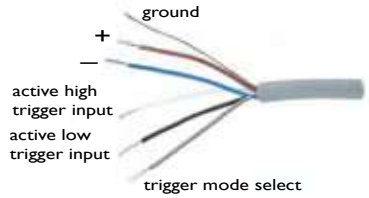
Pulsar 710
(C3)

iCS & iSU Lights are built for use with 24v DC regulated power source.

iCS Wiring



iSU Wiring



12 & 24 volt Lights are built with flying leads, for use with any regulated 12 or 24v DC power source. Load limiting resistors ensure safe operation and long LED life.

24v Wiring

Ask about our **Lighting Techniques** and **Product Training Seminars & Powerpoint** and **PDF Tutorial** Downloads

FREE **Application Lab Support**

Innovative *Bright* *Dependable*

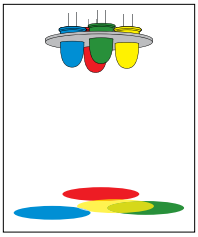
EXPANDABLE LIGHTING SYSTEM

EXPANDABLE

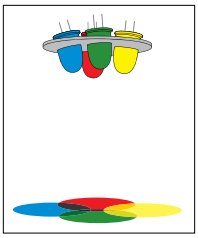
Look for this symbol, indicating Expandable Lighting Products!

The idea behind Ai's line of Expandable Lighting products is to build lights sized for your needs - *using proven technologies*. Surface mount LED back lights, Broad Area Linear Arrays, and Line Lights are among the lights available in customized sizes: Built specifically for your application - in TWO WEEKS!

- Evenlite® LED Aiming Technology for optimized light consistency and flexibility
- More than 100,000 unique configurations to meet your exact specifications
- Signatech® smart electronics provide unrivaled control
- Expandable Lights built to custom sizes in 2 weeks!
- All lights can be configured to work with user supplied 24v



Unaimed LEDs

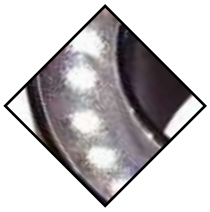


Evenlite

EVENLITE™

Patented LED Aiming Technology

- LEDs are sorted and binned based on electrical characteristics
- LEDs aimed based on optical axis
- Consistent light over an entire field-of-view
- Requires fewer LEDs
- Less heat is created



LEDs

High Brightness, Surface-Mount, & Standard (t1 3/4) LEDs

In 1993, when Ai developed some of the first LED lights for vision, we used the most commonly available LEDs of the time - T 1 ¾ red and amber LEDs. Though these early diodes were not particularly intense, we recognized the potential of LED lighting for machine vision. Since those days, LED technology has evolved significantly, allowing us to offer several LED types including High Brightness and surface mount varieties, most being available in wavelengths ranging from UV to IR. As they become available, Ai will apply these new technologies to create the bright, uniform, long-lived and reliable lighting solutions you have come to expect.

Standard Variations: *Customized Lights in 2 Weeks!*

Our patented LED aiming process allows us to "soft customize" a light in two weeks or less. Customizable variables include working distance, field of view, wavelength, lensing, mounting, and powering options. Ai offers literally thousands of standard variations, built specifically to meet your needs.

RGB

Ai is the *only* LED machine vision lighting manufacturer building RGB lightheads. Combining red, green & blue LEDs makes a bright white that is color tunable for maximum image contrast.

NEW PRODUCTS

SL147

(page 8)

EL138

(page 11)

RL12006

(page 15)

BL128

(page 11)

RL152

(page 14)

inline Strobe Unit

(page 19)

EL128

(page 11)

RL12006
72 High Brightness LEDs
I.D.: **132mm (5.2")** O.D.: **160mm (6.3")**
F.O.V.: **50mm (2.0")**

SL147
4 High Brightness LEDs
Dim.: **62mm x 66.7mm (2.44" x 2.63")**
F.O.V.: **65mm (2.5")**

BL128
Low Profile Back Light
Dim.: **58.7mm x 58.7mm (2.31" x 2.31")**
F.O.V.: **50mm x 50mm (2.0" x 2.0")**

iSU - inline Strobe Unit
Built-in Strobe Control
30 to 300µSec output pulse-width
Timing Bypass Option

EL138
Expandable High Brightness Strip Back Light
Max. Illuminated Length: **2438.4mm (96")**
Increment: **152.4mm (6")**

RL152
Bottle Lid/Label Illuminator
I.D.: **31.8mm (1.25")** O.D.: **226.4mm (8.91")**
F.O.V.: **125mm x 125mm (5" x 5")**

EL128
Expandable, Low Profile Linear Back Light
50mm (2") x up to Max. **355.6mm (14")**
Increment: **25.4mm (1")**

LL137

(page12)

AL143

(page 13)

EXPANDABLE

EL137

(page 12)

CB0404

(page 11)

RL127

(page 14)

EXPANDABLE

CBXXYY

(page 11)

EXPANDABLE

EL115

(page 13)

LL137
12 High Brightness LEDs
Illuminated Length: **304.8mm (12")**
Housing Length: **311.2mm (12.25")**

EL137
Expandable High Brightness Line Light
Max. Illuminated Length: **2438.4mm (96")**
Increment: **152.4mm (6")**

CBXXYY
Expandable Collimated Back Light
Max. Illum. Size: **406.4mm x 406.4mm (16" x 16")** Increment: **25.4mm (1")**

AL143 HB
6 High Brightness LEDs
Dim.: **61.9mm x 92.1 (2.44 x 3.63")**
F.O.V.: **100mm (4")**

CB0404
324 Surface Mount LEDs
Dim.: **123.1mm x 123.1mm (4.84" x 4.84")**
F.O.V.: **100mm x 100mm (4.0" x 4.0")**

EL115 HB
Expandable Wash-Down Linear Array
Max. Illum. Length.: **2336.8mm (92")**
Increment.: **50mm (2.0")**

RL127 HB
12 High Current LEDs
O.D.: **116.9mm (4.6")** I.D.: **66.4mm (2.61")**
F.O.V.: **100mm (4")**

Coaxial Spot Light

SL112-WHI HB

SL073-470 HB

SL2507-660

SL2420-660

SL1236-660

NEW

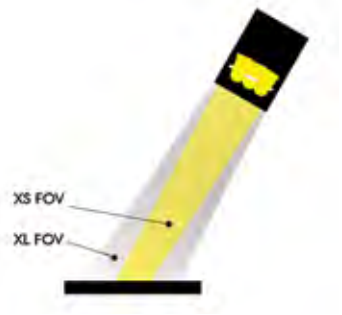
SL147-470 HB

SL4301-660

Spot Lights

Ai's Spot Lights provide significantly uniform illumination for creating high contrast. Standard configurations are shipped next day, or within two weeks when ordered as a Standard Variation - customer specified wavelength, working distance, field of view, and power option.

- Compact designs offer high intensity illumination for non-specular objects
- Can be ordered to light a given field of view from a specified distance
- SL112 coaxial spot light for use with microscopes and fiber optic bundles



Light Function Diagram

SL112 HB
1 High Brightness LED
O.D.: **25.4mm (1.0")**
Barrel O.D.: **8mm (.32")**
Cable: **1.5 meters (4.9')**
Standard Part: **SL112-WHIIC**

SL2507
7 LEDs
O.D.: **23mm (.90")**
F.O.V.: **30mm (1.2")**
Cable: **1.5 meters (4.9')**
Standard Part: **SL2507-66075L**

SL1236
36 LEDs
O.D.: **54mm (2.12")**
F.O.V.: **45mm (1.8")**
Cable: **1.5 meters (4.9')**
Standard Part: **SL1236-660100L**

SL4301
1 LED
Standard Version O.D.: **8mm (.31")**
"B" Version O.D.: **10mm (.39)**
Cable: **1.5 meters (4.9')**
Standard Part: **SL4301-660**

SL073 HB
1 High Brightness LED
Barrel O.D.: **23mm (.90")**
Mounting O.D.: **30mm (1.2")**
Cable: **1.5 meters (4.9')**
Standard Part: **SL073-WHI24**

SL2420
20 LEDs
O.D.: **38mm (1.5")**
F.O.V.: **45mm (1.8")**
Cable: **1.5 meters (4.9')**
Standard Part: **SL2420-660100L**

SL147 HB
4 High Brightness LEDs
Dim.: **62mm (2.44") x 66.7mm (2.76")**
F.O.V.: **65mm (2.5")**
Cable: **1.5 meters (4.9')**
Standard Part: **SL147-WHIIC**

Fiber Optic Couplers
CP112-DJ (Dolan-Jenner)
CP112-Fostec
CP112-Moritex
Focusing Lens:
LN112-30

HB High Brightness LEDs: 470 530 590 625 850 WHI

T 1¾ LEDs: 395 470 520 590 660 880 WHI

SL112 Accessories

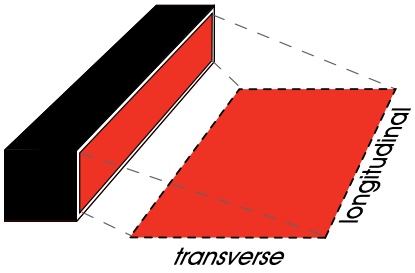
Fiber Optic Couplers provide a maximum active fiber optic diameter of 6.4mm (.25") for three common brands of fiber optic light guides

NEW

Focusing Lens
Fixed-focus condensing lens offers a focused pattern at working distances longer than typically used with the SL112

Broad Area Linear Arrays

Ai's unique Broad Area Linear Arrays (BALA) are designed to provide a long, wide field of illumination with controlled "fall off" in the transverse direction. Originally designed for inspecting circuit boards, these versatile lights can be applied in both dark field and bright field situations. The EL150 is available in lengths of up to 80".



Light Function Diagram

- Low angle incidence illumination over a long, wide area
- Extremely even illumination over the full lighted length, with controlled "fall off" in the transverse direction
- For wider coverage, two BALAs can be aligned opposite to and facing each other

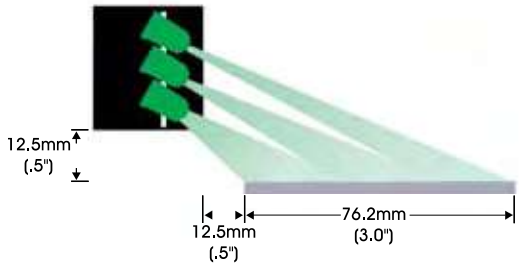
AL4424
4" Length / 24 LEDs
Housing Length: **119mm (4.72")**
Illuminated Length: **117mm (4.6")**
Cable: **1.5 meters (4.9')**
Standard Part: **AL4424-660**

AL4554
9" Length / 54 LEDs
Housing Length: **249mm (9.82")**
Illuminated Length: **246mm (9.70")**
Cable: **1.5 meters (4.9')**
Standard Part: **AL4554-660**

AL46120
20" Length / 120 LEDs
Housing Length: **534mm (21.04")**
Illuminated Length: **508mm (20")**
Cable: **1.5 meters (4.9')**
Standard Part: **AL46120-660**

EL150 EXPANDABLE
Expandable BALA
Housing Width: **33mm (1.33")**
Length Increments: **25mm (1.0")**
Max Length: **2032mm (80")**
Cable: **1.5 meters (4.9')**

T 1¾ LEDs: 395 470 520 590 660 880 WHI



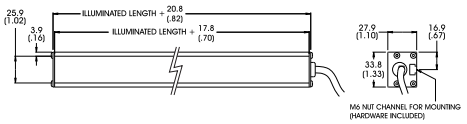
Recommended BALA Set Up

AL4424-660

AL4554-660

AL46120-660

EXPANDABLE



EL150

Back Lights

Surface Mount LEDs

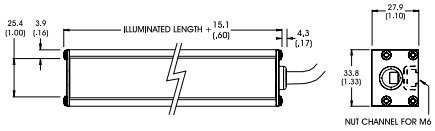
Surface Mount LED Back Lights provide significant uniformity over the entire active area of illumination and can be ordered in 25mm (1") increments up to 589mm x 864mm (22" x 34"). The EL193 is available in 25mm (1") increments up to 2032mm (80") in length.

BL0202-660

BL0404-660

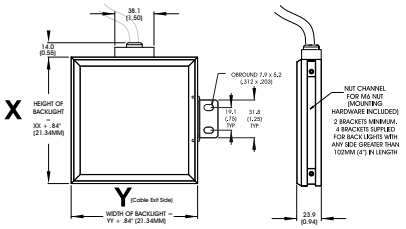
BL0808-660

EXPANDABLE



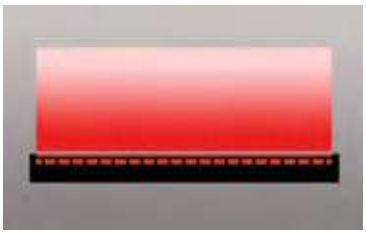
EL193

EXPANDABLE



BLXXYY

- Consistent intensity over entire active area of illumination
- Expandable versions up to 589mm x 864mm (22" x 34")
- Mounting options include integral M6 nut channel, or included brackets



Light Function Diagram

BL0202
48 LEDs
Dim.: **72mm x 72mm (2.84" x 2.84")**
F.O.V.: **50mm x 50mm (2" x 2")**
Cable: **1.5 meters (4.9')**
Standard Part: **BL0202-660**

BL0404
192 LEDs
Dim: **123mm x 123mm (4.84" x 4.84")**
F.O.V: **100mm x 100mm (4" x 4")**
Cable: **1.5 meters (4.9')**
Standard Part: **BL0404-660**

BL0808
768 LEDs
Dim: **225mm x 225mm (8.84" x 8.84")**
F.O.V: **200mm x 200mm (8" x 8")**
Cable: **1.5 meters (4.9')**
Standard Part: **BL0808-66024**

EL193 EXPANDABLE
Back Light Strip
Lighted Width: **25mm (1")**
Housing Width: **33mm (1.33")**
Max Length: **2032mm (80")**
Cable: **1.5 meters (4.9')**

BLXXYY* EXPANDABLE
Expandable Surface Mount LED Back Light
Increment: **25mm (1")**
Max Illum. Size: **589mm x 864mm (22" x 34")**
Cable: **1.5 meters (4.9')**

Surface Mount LEDs: 470 530 660 880 WHI

* Cable Exits "Y" Side of BLXXYY

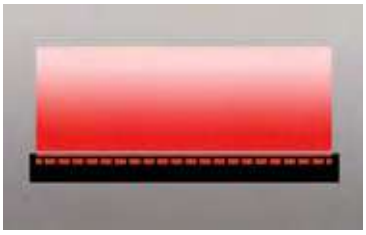
Surface Mount LED Power Requirements:

24v = 20mA per 25mm x 25mm (1" x 1")
12v = 60mA per 25mm x 25mm (1" x 1")

Lights with a surface area greater than 16 square inches require the use of a 24v power source or the Pulsar 710 controller. The Pulsar 320 can be used for strobed applications.

Back Lights
Specialty

Because not all back lighting needs are the same, Ai offers a variety of back lights - including expandable collimated, high brightness, and low profile surface mount models. Built to meet the size and lighting requirements of your application, in most cases these lights ship within two weeks.



Light Function Diagram

- Space saving BL128 and EL128 offer low profile, consistent illumination
- Collimated back lights - 4" x 4" standard, or expandable up to in sizes up to 16" x 16".
- High Intensity EL138 Line Scan Back Light in 6" increments up to 96"

CB0404
192 LEDs
Dim: **123mm x 123mm (4.84" x 4.84")**
F.O.V: **100mm x 100mm (4" x 4")**
Cable: **1.5 meters (4.9')**
Standard Part: **CB0404-WHIIC**

EL138 EXPANDABLE
Expandable High Intensity Strip Back Light
Lighted Width.: **25mm (1")**
Housing Width.: **50.2mm (1.98")**
Max. Length: **2438mm (96')**
Increment: **152.4mm (6")**

CBXXYY* EXPANDABLE
Expandable Collimated Back Light
Increment: **25mm (1")**
Max Illum. Size: **407mm x 407mm (16" x 16")**
Cable: **1.5 meters (4.9')**

BL128
100 LEDs
Dim.: **58.7mm x 58.7mm (2.31" x 2.31")**
F.O.V.: **50mm x 50mm (2 x 2")**
Cable: **1.5 meters (4.9')**
Standard Part: **BL128-WHIIC**

EL128 EXPANDABLE
Expandable Low-Profile Back Light
Lighted Width: **50mm (2")**
Max. Lighted Length: **355.6mm (14")**
Increment: **25.4mm (1")**
Cable: **1.5 meters (4.9')**

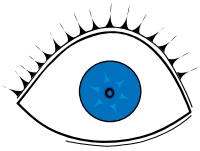
BL5420
20 LEDs
O.D.: **38mm (1.5")**
F.O.V.: **4mm or 30mm (.18" or .79")**
Cable: **1.5 meters (4.9')**
Standard Part: **BL5420-660**

High Brightness LEDs: 470 530 590 625 850 WHI
T 1¾ LEDs: 395 470 520 590 660 880 WHI
Surface Mount LEDs: 470 530 660 880 WHI

* Cable Exits "Y" Side of CBXXYY

Lighting Tip:

The human eye sees differently than a vision system. When testing a lighting solution, judge the lights based on what the camera sees.



CB0404

NEW

BL128

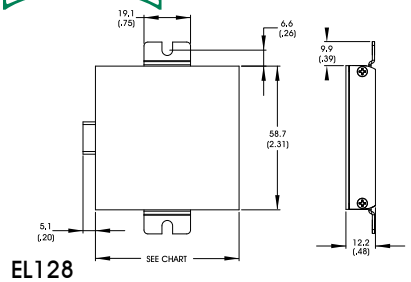
NEW

EXPANDABLE

EL138

NEW

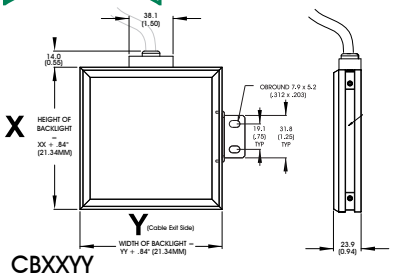
EXPANDABLE



EL128

NEW

EXPANDABLE



CBXXYY

NEW

BL5420-660

Line Lights

Ai's Line Lights provide a narrow band of intense illumination for use in web inspections or in non-specular applications requiring a long, thin field of view. Two different designs are available in four standard sizes, or custom lengths up to 96" for the EL137 or 80" for the EL163.

LL2912A-WHI

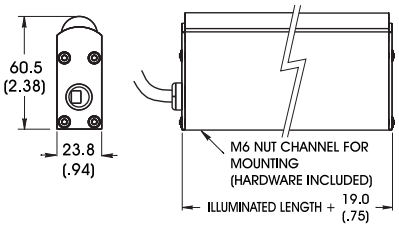
LL3024A-WHI

LL3148A-WHI

Replaces the LL068

LL137-WHI HB

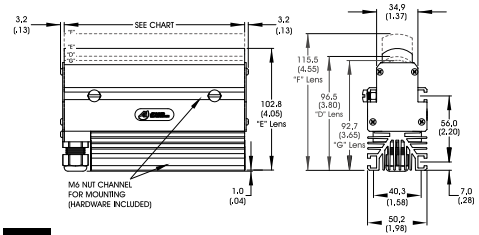
EXPANDABLE



EL163

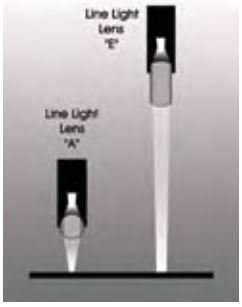
EXPANDABLE

Replaces the LL068



EL137 HB

- Ideally suited for use with line-scan applications
- Standard lengths, or build your own with the EL163 and LL068
- EL163 lengths up to 80"; EL137 lengths to 96"



Light Function Diagram

LL2912
76mm (3") Length / 12 LEDs
Illuminated Length: **76mm (.92")**
Housing Length: **100.8mm (3.97")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL2912A-WHI**

LL3024
152mm (6") Length / 24 LEDs
Illuminated Length: **152mm (6")**
Housing Length: **179.8mm (7.08")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL3024A-WHI**

LL3148
305mm (12") Length / 60 LEDs
Illuminated Length: **305mm (12")**
Housing Length: **337.6mm (13.29")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL3148A-WHI**

LL137 HB
12 High Brightness LEDs
Illuminated Length: **305mm (12")**
Housing Length: **311.2mm (12.25")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL137E12-WHI24**

EL163 EXPANDABLE
Expandable Standard LED Line Light
Housing Width: **24mm (.94")**
Length Increments: **38mm (1.5")**
Max Length: **2032mm (80")**
Cable: **1.5 meters (4.9')**

EL137 HB EXPANDABLE
Expandable High Brightness LED Line Light
Housing Width: **50.2mm (1.98")**
Length Increments: **152mm (6")**
Max Length: **2438mm (96")**
Cable: **1.5 meters (4.9')**

HB High Brightness LEDs: 470 530 590 625 850 WHI

T 1¾ LEDs: 395 470 520 590 660 880 WHI

Lighting Tip:

Sometimes light color is the key to creating greater contrast. Changing the wavelength of the light can be an easy and inexpensive way to improve your inspection results. *(See page 21.)*

Linear Array Lights
High Brightness LEDs

Ai's High Current LED Line Lights provide significant illumination for web applications, and can be used for larger area inspections such as robotic work cells. Our Linear Arrays come in a range of sizes, from the compact AL116 and AL126 to our expandable EL174, available in lengths up to 84".

Light Function Diagram

- High intensity illumination from a long distance
- Useful for large area lighting
- Easy mounting via M6 or M4 nut channel
- Line Lights can be ordered with optional heat sink

AL116 HB
24 High Brightness LEDs
Illuminated Length: **100mm (4")**
Housing Length: **118mm (4.63")**
Cable: **1.5 meters (4.9')**
Standard Part: **AL116-WHIIC**

AL126 HB
12 High Brightness LEDs
Illuminated Length: **100mm (4")**
Housing Length: **118mm (4.63")**
Cable: **1.5 meters (4.9')**
Standard Part: **AL126-WHIIC**

LL5806 HB
6 High Brightness LEDs
Illuminated. Length: **152mm (6")**
Housing Length: **174mm (6.84")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL5806-WHI24**

LL6212 HB
12 High Brightness LEDs
Illuminated Length: **304mm (12")**
Housing Length: **322mm (12.7")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL6212-WHI24**

LL6324 HB
24 High Brightness LEDs
Illuminated Length: **609mm (24")**
Housing Length: **627mm (24.7")**
Cable: **1.5 meters (4.9')**
Standard Part: **LL6324-WHI24**

AL143 HB
6 High Brightness LEDs
Dim.: **92.1mm x 61.9mm (3.63" x 2.44")**
F.O.V.: **100mm (4")**
Cable: **1.5 meters (4.9')**
Standard Part: **AL143-WHIIC**

EL174 HB EXPANDABLE
High Brightness LEDs
Housing Width: **33mm (1.33")**
Length increments: **152mm (6")**
Maximum Length: **1829mm (72")**
Cable: **1.5 meters (4.9')**

EL116 HB EXPANDABLE
Housing Width: **32.2mm (1.27")**
Maximum Length: **521.2mm (20.52")**
EL126
Housing Width: **20.1mm (.79')**
Maximum Length: **1029.2mm (40.62")**

HB High Brightness LEDs: 470 530 590 625 850 WHI
T 1¾ LEDs: 395 470 520 590 660 880 WHI

EXPANDABLE

EL115-WHI HB

EL115
Expandable Wash-Down Linear Array *(strobe only)*
Maximum Length: **2509.3mm (96")**
Length Increments: **50mm (2")**
Cable: **1.5 meters (4.9')**
NEMA 4X Grade, Field Replaceable Enclosure

NEW

Now available in RED and BLUE!

AL116-WHIIC HB
EL116

Now available in RED and BLUE!

AL126-WHIIC HB
EL126

LL5806-WHI HB

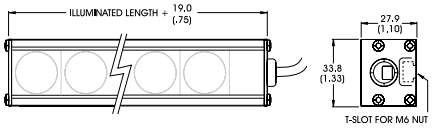
LL6212-WHI HB

LL6324-WHI HB

NEW

AL143-WHI HB

EXPANDABLE



EL174 HB

Ring Lights
Bright Field

Ai's Ring Lights feature Evenlite LED aiming technology, and can be ordered in both off-the-shelf, standard configuration for next day shipping, or as a Standard Variation - your specified working distance and field-of-view, wavelength and power configuration - within two weeks.

- Co-axial light source designed for use in non-specular inspections
- Convenient around the lens mounting - most lights accommodate lenses up to 55mm in diameter
- Mounting options include barrel, C, and brackets

Light Function Diagram

Now available in RED and BLUE!

RL121-WHI HB

RL2316-660

RL1424-470

RL4260-660

RL36120-660

RL113-WHI HB

Now available in RED and BLUE!

RL127-WHI

RL121 HB
12 High Brightness LEDs
I.D.: **35mm (1.38")** O.D.: **75mm (2.95")**
F.O.V.: **44mm (1.75")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL121-WHIIC**

RL1424
24 LEDs
I.D.: **55mm (2.19")** O.D.: **84mm (3.33")**
F.O.V.: **45mm (1.7")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL1424-660100L**

RL36120
120 LEDs
I.D.: **55mm (2.18")** O.D.:**126mm (4.98")**
F.O.V.: **135mm (5.3")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL36120-660200XL**

RL127 HB
24 High Brightness LEDs
I.D.: **66.4mm (2.61")** O.D.: **116.9mm (4.6")**
F.O.V.: **50mm (2.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL127-WHIIC**
RL127-WHIC5

RL2316
16 LEDs
I.D.: **23mm (.91")** O.D.: **54mm (2.15")**
F.O.V.: **45mm (1.7")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL2316-660100L**

RL4260
60 LEDs
I.D.: **55mm (2.18")** O.D.: **100mm (4.0")**
F.O.V.: **45mm (1.7")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL4260-660100L**

RL113 HB
12 High Current LEDs
I.D.: **66mm (2.60")** O.D.: **152mm (6")**
F.O.V.: **175mm (7")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL113-WHIIC**

RL152
96 High Current LEDs
I.D.: **31.8mm (1.25")** O.D.: **226.4mm (8.91")**
F.O.V.: **125mm (5")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL152-WHIC5**

HB High Brightness LEDs: 470 530 590 625 850 WHI

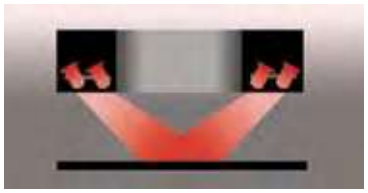
T 1¾ LEDs: 395 470 520 590 660 880 WHI

NEW

RL152-WHI

Ring Lights
Dark Field

Ai's Dark Field Ring Lights include both standard (45°) and low angle dark field options. These lights are ideal for the inspection of etched code or detection of surface flaws on highly reflective materials.



Light Function Diagram

- Excellent for detecting edges in a 360° inspection on any surface
- Apposelites are well suited to circuit board and BGA inspections
- Surface flaw detection on highly specular surfaces

RL2115
15 LEDs
I.D.: **19mm (.75")** O.D.: **55mm (2.15")**
F.O.V.: **12mm (.5")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL2115-660**

RL3940
40 LEDs
I.D.: **55mm (2.18")** O.D.: **100mm (3.93")**
F.O.V.: **35mm (1.4")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL3940-660**

RL3536
36 LEDs
I.D.: **55mm (2.18")** O.D.: **126mm (4.98")**
F.O.V.: **35mm (1.4")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL3536-660**

RL1360
60 LEDs
I.D.: **100mm (3.93")** O.D.: **140mm (5.52")**
F.O.V.: **25mm (1.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL1360-660**

RL1660
60 LEDs
I.D.: **101mm (4.0")** O.D.: **178mm (7.02")**
F.O.V.: **35mm (1.4")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL1660-660**

RL12006 HB
72 High Brightness LEDs
I.D.: **132.7mm (5.2")** O.D.: **160mm (6.3")**
F.O.V.: **50mm (2.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL12006-WHIIC**

RL5064 ***Dark Field/Bright Field***
64 LEDs
I.D.: **55mm (2.18")** O.D.: **100mm (3.93")**
F.O.V.: **44mm (1.75")**
Cable: **1.5 meters (4.9')**
Standard Part: **RL5064-660**

T 1¾ LEDs — 395 470 520 590 660 880 WHI

Need a Product Drawing?

Drawings and 3D Models of our products are available on-line. PDF and DXF files, as well as SolidWorks and STEP files, can be downloaded at:
advancedillumination.com/drawandmodels.html

RL2115-660

RL3940-660

RL3536-660

RL1360-660

RL1660-660

NEW

RL12006-WHI HB (available in white only)

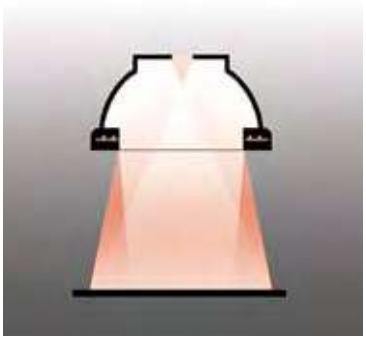
Dark Field/Bright Field

RL5064-660

Diffuse Lights
Domes & Flat Panel

Ai's Diffuse Lights offer both traditional and flat panel diffuse illumination - including two new expandable options - in a variety of sizes, including the expandable EL151 for cylindrical inspections and the DL071 for large objects.

- Evenly diffuse illumination over the full field-of-view
- Fields-of-view from 49mm (1.95") to 450mm (17.72")
- Well suited for inspecting shiny, curved surfaces



Light Function Diagram

DL2230-470

DL106-625 HB
DL7248-660

NEW HOUSING
DL097-WHI HB

NEW

EXPANDABLE

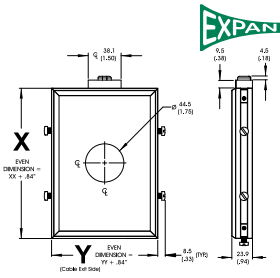
EL151-WHI

DL071-625 HB

PART NUMBER CHANGE
FD0808-660

NEW

EXPANDABLE



FDXXYY
FCXXYY

DL2230
30 LEDs
O.D.: **71mm (2.83")** F.O.V.: **49mm (1.9")**
Aperture: **19mm (.75")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL2230-660**

DL7248 (*RGB ONLY*)
48 LEDs
O.D.: **133mm (5.25")** F.O.V.: **85mm (3.3")**
Aperture: **19mm (.75")**
Cable: **1.5 meters (4.9')**
Built to Order

EL151 EXPANDABLE
Expandable Linear Diffuse Illuminator
Housing Width: **77.9mm (3.07")**
Expandable Increment: **50mm (2")**
Max. Length: **1778mm (70")**
Cable: **1.5 meters (4.9')**

FD0808 *(formerly DL083)*
720 Surface Mount LEDs
Dim.: **224.5mm x 224.5mm (8.84" x 8.84")**
F.O.V.: **127mm (5")** Aperture: **44.5mm (1.75")**
Cable: **1.5 meters (4.9')**
Standard Part: **FD0808-66024**

DL106 HB
12 High Brightness LEDs
O.D.: **133mm (5.25")** F.O.V.: **85mm (3.3")**
Aperture: **19mm (.75")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL106-660IC**

DL097 HB
12 High Brightness LEDs
O.D.: **214mm (8.44")** F.O.V.: **161mm (6.3")**
Aperture: **25mm (1.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL097-WHI24**

DL071 HB
24 High Brightness LEDs
O.D.: **531mm x 531mm (20.9" x 20.9")**
F.O.V.: **450mm x 450mm (17.7" x 17.7")**
Aperture: **50mm (2.0")** Cable: **1.5 M (4.9')**
Standard Part: **DL071-WHI24**

FDXXYY / FCXXYY* EXPANDABLE
Expandable Flat Diffuse / Flat Collimated Diffuse Light
Increment: **25mm (1")** Min: **75mm x 75mm (3" x3")**
Max. Size: **406mm x 406mm (16" x 16")**
Aperture: **22.2mm (.88") or 44.5mm (1.75")**
Cable: **1.5 meters (4.9')**
* Cable exits the "Y" side on the FDXXYY and FCXXYY

HB High Brightness LEDs: 470 530 590 625 850 WHI
T 1¾ LEDs: 395 470 520 590 660 880 WHI

LED Care and Cleaning

Periodic cleaning of lights will ensure long and stable operation. The following cleaning techniques will help to avoid damage to the optical surfaces.

Acrylic & Mylar: *Low-pressure air is the preferred choice for minor cleaning and dust removal. A fine-bristled nylon brush will aid in this process. When more aggressive cleaning is required, use clean, warm water and a clean, non-contaminating and non-abrasive cloth. If necessary, a mild non-abrasive detergent - such as dish soap - may be used.*

Axial Diffuse Illuminators

Axial Diffuse Illuminators provide extremely uniform illumination for the inspection of reflective objects. Ai offers six sizes that can be shipped next day when ordered in standard configurations, or can be ordered as a Standard Variation - customer specified wavelength and power options, in two weeks.

Light Function Diagram

- Evenly diffuse illumination over the full field-of-view
- High efficiency, coated "easy clean" dust cover protects beam splitter glass
- Well suited for use in inspecting uneven, angled or textured flat surfaces

DL072 HB
1 High Brightness LED
Dim.: **94mm x 33.4mm (3.71" x 1.32")**
F.O.V.: **25mm x 25mm (1.0" x 1.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL072-WHI24**

DL104 HB
4 High Brightness LEDs
Dim.: **121mm x 59mm (4.78" x 2.31")**
F.O.V.: **50mm x 50mm (2.0" x 2.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL104-625IC**
DL104-WHIIC

DL37100
100 LEDs
Dim: **155mm x 90mm (6.11" x 3.55")**
F.O.V.: **75mm x 75mm (3.0" x 3.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL37100-660**

DL085
384 LEDs
Dim.: **243.8mm x 162.6mm (9.6" x 6.4")**
F.O.V.: **150mm x 150mm (6" x 6")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL085-66024**

DL3316
16 LEDs
Dim.: **94mm x 33mm (3.71" x 1.32")**
F.O.V.: **25mm x 25mm (1.0" x 1.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL3316-660**

DL2449
48 LEDs
Dim.: **117mm x 58mm (4.6" x 2.28")**
F.O.V.: **50mm x 50mm (2.0" x 2.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL2449-660**

DL38144
144 LEDs
Dim.: **177mm x 110mm (6.99" x 4.33")**
F.O.V.: **100mm x 100mm (4.0" x 4.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL38144-660**

DL110 HB
12 High Brightness LEDs
Dim.: **312mm x 62mm (12.25" x 2.42")**
F.O.V.: **25mm x 300mm (1.0" x 12.0")**
Cable: **1.5 meters (4.9')**
Standard Part: **DL110-WHIIC**

HB High Brightness LEDs: 470 530 590 625 850 WHI

T 1¾ LEDs: 395 470 520 590 660 880 WHI

LED Care and Cleaning (continued)

Glass: Low-pressure air. Some aerosol air sprays contain ESD agents and should not be used, as they may leave residue on the surface. Use of standard household glass cleaners is not recommended

DO NOT USE on Acrylic or Mylar: halogens, esters, keytones, aromatics, alcohol, window cleaning sprays or solvents (acetone, benzene, gasoline, carbon tretrachloride, etc.). Do not use ammonia based cleaning solutions.

DL072-WHI HB
DL3316-WHI

DL104-625 HB
DL2449-660

DL37100-660

DL38144-660

DL085-660

DL110-WHI HB

Electronics
Current Regulation & Intensity Controllers

Ai's inline Current Source (iCS) provides built-in current regulation and manual intensity control for most stock lights. Digital intensity control is available through dual output, single and four-channel controllers - some with built-in control panels - offering a wide choice of options for light management, including color manipulation of RGB lights.

Inline Current Source (iCS)*

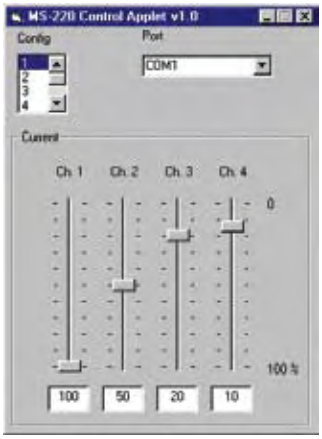
CS410

CS420

MS210

MS220

CS100 & CS300

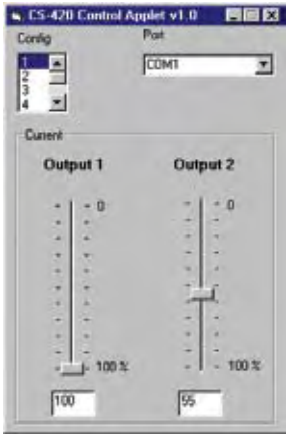


Graphical user interfaces provide simple to use control of our intensity controllers. All software and cables are provided with Ai electronic products.

Intensity is expressed as a percentage of 0-100%

Signatech Signature Recognition Technology for optimal safe light performance and long LED life.

Enclosures feature optimal thermal managementt



CS410
Intensity Controller
Dual Independent Outputs

CS420
Intensity Controller
Dual Independent Outputs
Touchpad Manual Controls

MS210
4-Channel Intensity Controller
Dual Slaved Outputs

MS220
4-Channel Intensity Controller
Dual Slaved Outputs
Touchpad Manual Controls

CS100 / CS100-IC
Single Output Current Regulator
IC version provides intensity control

CS300 / CS300-IC
Dual Output Current Regulator
IC version provides intensity control

Inline Current Source* (iCS)
Manual Intensity Control
Gate Control

Spectral wavelength

Optional power compatibility

PART# - XXX XX

(blue) 470
(green) 530
(red) 625
(white) WHI

IC
IS
C2
24

select "IC" or "IS" under Optional Power Compatability

iCS* & iSU* Ordering and Wiring Information

ICS PINOUT

BROWN	VIN +
BLUE	VIN -
WHITE	GHI (Gate HIGH)
BLACK	GHL (Gate LOW)

iCS and iSU Lights are built for use with a 24v DC regulated power source.

ISU PINOUT

BROWN	VIN +
BLUE	VIN -
WHITE	Active high trigger input
BLACK	Active low trigger input
GRAY	Trigger Mode Select: Connect to 0V to enable timing bypass. Leave floating for fixed trigger mode

** The iCS and iSU are built into the light cable and are ordered by adding 'IC' or "IS" to the part number. THESE ITEMS ARE NOT AVAILABLE AS STAND-ALONE PRODUCTS.*

Strobe Controllers

Ai's inline Strobe Unit (iSU) provides built-in, manually adjustable pulse widths of 30 to 300µSec. The Pulsar 320 and Pulsar 710 are designed for applications using the newest generation of high current LED light heads and arrays, including our large surface-mount back lights. The S4000, S6000, and S6000-AS units provide dependable, flexible strobing and DC continuous control for Ai's standard LED illuminators.

Pulsar 320

- Ethernet and USB Compatible
- DIN Rail Mount
- Compact Housing (5.1" x 3.37" x 3.9")
- Strobe Only

Pulsar 710

- 100A @ 100V in strobe mode
- 8A @ 24V in constant mode

Strobing Benefits

- Safely over-drive LEDs for greater intensity
- Stop action in high speed inspections
- Extend LED life

Pulsar 320
(Strobe Only)
2 outputs, 50A per output
High Current Strobe Controller

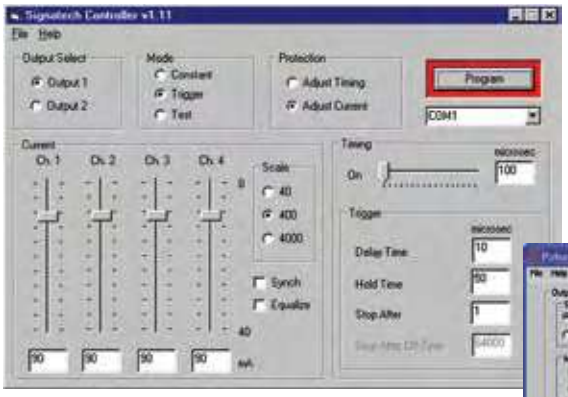
Pulsar 710
(Strobe & Constant)
4 channel output, 25A per output
High Current Strobe Controller

S4000
(Strobe & Constant)
Single Output, 16A per output
Single Trigger Input

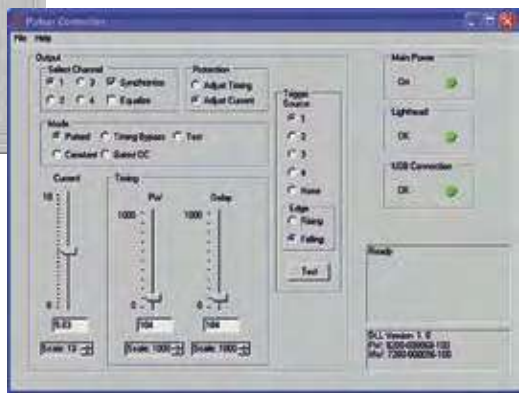
S6000
(Strobe & Constant)
Dual Output, 16A per output
Single Trigger Input

S6000-AS
(Strobe & Constant)
Dual Output, 16A per output
Dual Asynchronous Trigger Input

Inline Strobe Unit (iSU)
Features a Manual Potentiometer,
30 - 300µSec output pulse-width, and
Timing Bypass option



Signatech software enables the user to program all strobe controller current and timing parameters. Currents are programmable for each of four channels, and expressed in amps from 0-25.



Timing parameters include pulse width and post event delay time. All timing parameters are programmed in steps of 1 microsecond, up to a maximum of 1000.

NEW

Inline Strobe Unit (ISU)*

Pulsar 320

Pulsar 710

S4000

S6000 / S6000-AS

**The iSU is built into the light cable and is ordered by adding 'IS' to the part number. This item IS NOT available as a separate product.*

VISION LIGHTING BASICS

TO LEARN MORE...

Ai firmly believes an educated partner/customer is not only important, but a necessity. We offer lighting techniques and product educational resources on our web site, located in the **Technical Support** menu. Additionally, we conduct light application training classes held in conjunction with our Vision Company Partners, and at the request of our distributors, their SIs, and end-users. General PowerPoint and PDF training sessions are available under Technical Support for download. Please call your regional Ai Sales Rep or distributor for details.

The first step in designing and implementing a successful automated inspection process is selecting the proper illumination.

Lighting is the most cost effective and versatile element to consider when attempting to solve an application. More importantly, good lighting is required because a vision system, unable to differentiate subtle differences in appearance, needs consistent contrast levels to provide reliable results. (A general rule of thumb is that the vision system requires a minimum 20% contrast in order to perform effectively.) Even the best software depends on high quality data in order to perform efficiently; results are less dependable when the software is required to compensate for missing or potentially inaccurate information.

The goal of selecting illumination is to create a consistent, robust environment in which to perform inspections.

Color



Modifying Light

After selecting the light type, a number of options are available to optimize inspection results:

The best light color for an inspection depends on two elements: the color of the object being inspected, and the sensitivity of the CCD.

Color CCDs generally - though not always - require a white illumination source, while a black and white inspection can be enhanced by experimenting with various colors to increase contrast.

Create contrast by using opposing colors on the color wheel; diminish contrast by using similar colors.

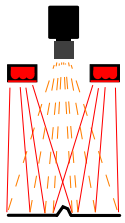
Like colors lighten, opposing colors darken.

Like colors lighten, opposing colors darken.

Like colors lighten, opposing colors darken.

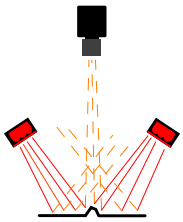
Like colors lighten, opposing colors darken.

Common Lighting Techniques



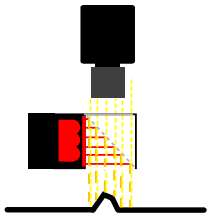
Direct Light

Direct Light: Light is aimed directly at an object, often creating distinct shadows. This type of lighting is effective when used on objects requiring high contrast, but creates specular reflections when used with shiny or reflective materials.



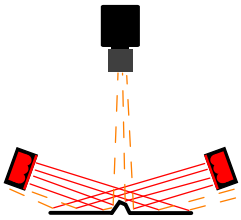
Dark Field

Dark Field: Light is projected at an angle to the surface, causing any variations to deflect light up into the camera, creating bright spots on a dark background or field. Nothing is seen by the vision system if there are no aberrations on the surface.



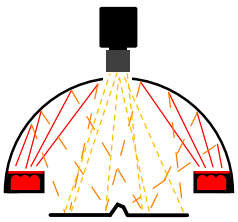
Co-Axial Illumination

Co-Axial Illumination: A variation of diffuse light in which a perpendicular wall of light is aimed at an angled beam splitter that reflects the light down. The object is viewed from above through the beam splitter. This light type is particularly helpful on highly reflective objects or in situations where the area of inspection is obscured by shadows from it's surroundings.



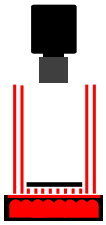
Low AngleDark Field

Low Angle Dark Field: Similar to standard 45° dark field, but typically oriented at 10° to 30° from the sample surface. Low angle dark field lighting is most sensitive to the smallest variations in surface detail or edge effects.



Diffuse Light

Diffuse Light: Reflected light, providing a non-directional, soft light free of harsh shadows that is well suited for highly specular objects. This illumination effect has been likened to the type of flat, non-directional light found on an overcast day.



Back Lighting

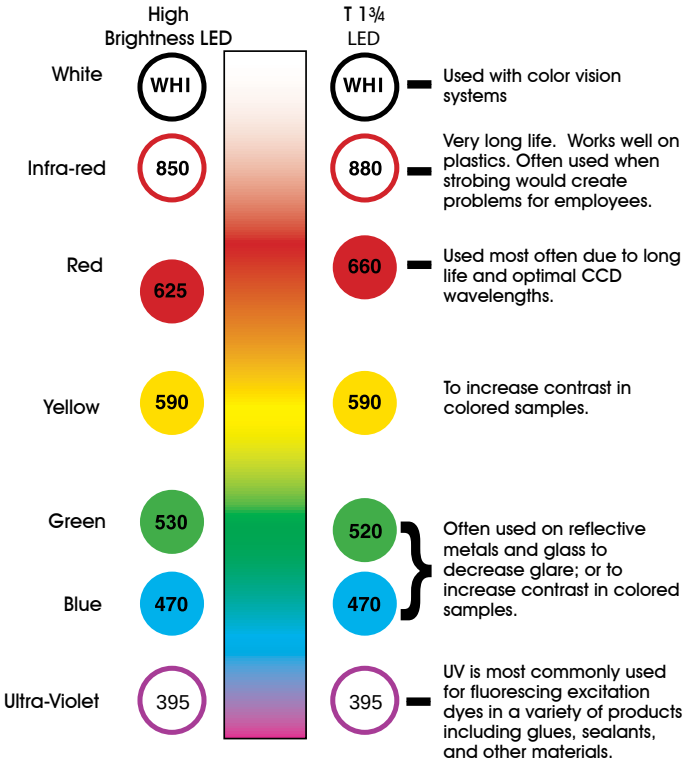
Backlighting: An even field of illumination is projected from behind an object. The object is seen as a silhouette by the camera. Backlighting is most commonly used for taking measurements or determining orientation of parts.

Flexibility

Each lighting technique has a specific purpose, but is also adaptable for a range of applications not immediately related to its function. (For example, a spotlight, which provides direct light, can be placed at an angle to create a dark field effect.) For some applications, the best results are achieved by combining multiple light types.

Applying Color

The following chart provides starting points for pairing many common products or inspection set-ups with the most effective light color.



A red data matrix code is used to illustrate how different colors react in a black and white inspection. Changing the light color can greatly enhance or diminish the contrast.


under blue light


under green light

under red light


under white light

Color Mixing

Using an "all color" RGB - red, green, blue light - offers several advantages over a standard monochrome or white spectrum light. When coupled with our MS210/220 multi-channel controller, an RGB light head can produce the entire visible spectrum of colors by independently adjusting the R, G, or B intensity values. This feature allows the operator to modify contrast based on relative color absorption versus reflection. Additionally, when all three channels are set to equal intensities, the light head produces a white light that is approximately 2x the intensity of current T1¾ white LED offerings.

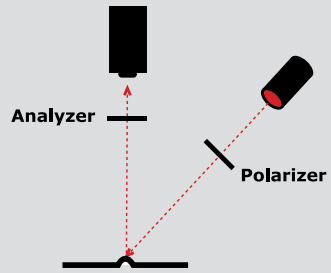


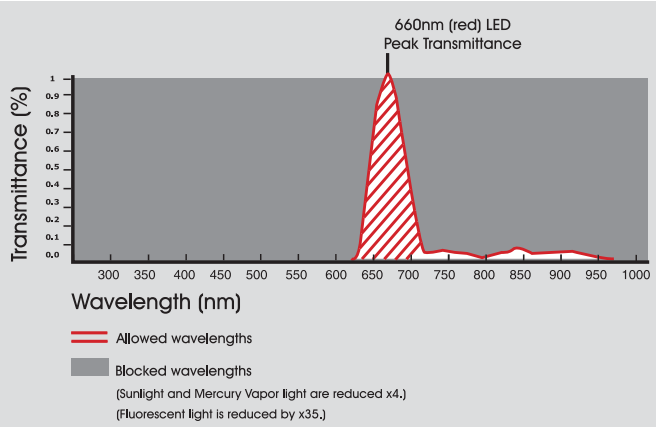

Using Filters

The ability to control what the vision system sees determines the efficiency of an inspection. Eliminating unnecessary data or noise increases the speed at which information can be processed, and limits the potential for false readings. One simple technique for restricting the light that reaches the CCD is the use of filters. There are several common, available filters including **polarizing**, **band pass**, and **cut off**.

Polarized Lighting: Polarizing filters provide an adjustable option for decreasing glare in an inspection. A two part process, the light is projected through a polarizing filter and then seen by the camera through an "analyzer". Adjusting the orientation of the analyzer allows the viewer to modify the orientation of the light collected by the camera.

Band Pass Filters allow only a narrow range of wavelengths through to the camera. In settings where ambient light creates a variable in the inspection environment, the band pass filter removes all but a specific range of light, eliminating the need for a shroud around an inspection area.



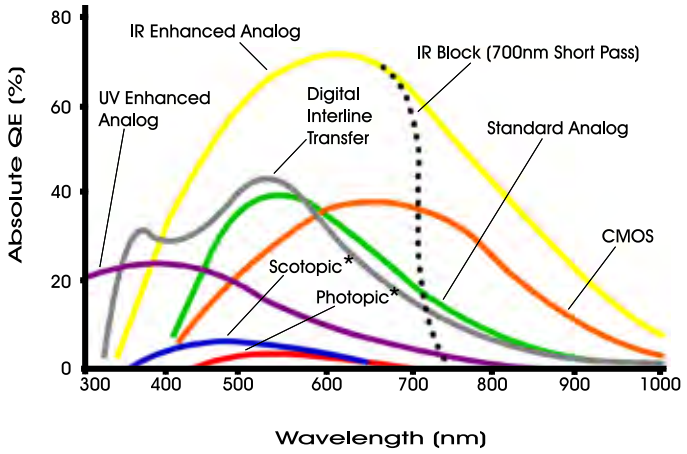


Cut Off Filters: Also known as Short Pass or Long Pass filters, a Cut Off Filter prevents light above or below a specific wavelength from being visible to the camera.

Collimation: In machine vision, collimation is used to "direct" stray rays from diffuse sources - often back lights - more parallel with respect to the optic axis. It is most useful for high-precision edge detection, necessary for accurate parts gauging, and works best with a monochrome source like red or blue light, because narrow wavelength ranges exhibit less chromatic aberration. Lens-based optical collimation produces the best results, but is also prohibitively expensive. Ai uses a relatively inexpensive film-based collimation product that actually increases the on-axis intensity as measured by a vision sensor.

Light Wavelength & CCD Sensitivity

Light efficiency is partly determined by the sensitivity of the CCD to specific wavelengths. A CCD with peak reception between 620nm - 700nm will register more output from a 660nm (red) light than from a 470nm (blue) light source.

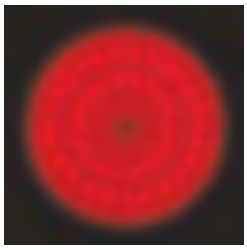


*Photopic: Human Daylight Vision
*Scotopic: Human Night Time Vision

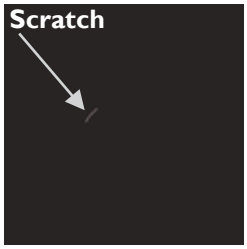
Infra-red (IR) is often overlooked as an illumination option. Invisible to the human eye, IR is useful for inspections in settings where a bright or flashing light might be distracting to workers. IR can be used to neutralize color differences, and has greater penetrating power, which is especially useful in plastics inspections.



Bright Field & Dark Field Illumination



Bright Field Projected on Mirrored Surface



Dark Field Projected on Mirrored Surface

The idea of creating a dark field using light causes a certain amount of confusion, but once understood is a simple and effective method for inspecting flat, reflective surfaces. Light projected at an angle to the surface of a reflective object reflects away at the same angle (the angle of incidence), unless something alters the light's path. A flaw or surface feature directs light up to the camera, whereas a smooth surface appears to be a dark field.

Tips for Finding a Solid Solution

- Know the inspection environment well, in order to avoid problems with ambient lighting or robotic or human interaction with the inspection line.
- Test as many variations of a product under the light as possible, in order to eliminate surprises.
- If a single light type does not create the necessary results, a combination of lights might do the trick.

Notes on Strobing

In machine vision, strobing is defined as flashing a light, typically coordinated with camera exposure. The timing, frequency, and duration of the strobe flash is determined by either the internal light strobe controller, or externally by a trigger event generated by a camera or part-in-place/proximity signal. LEDs lend themselves well for this activity as they are solid-state devices, rather than thermionic sources, and thus have little ramp up and down latency, and depending on duty-cycle, generate little or no heat.

Strobing is most often used to freeze motion in situations where continuous inspection is not necessary, typically singulated or indexed objects on a conveyor line, an approach limited primarily by the speed of the object. The inverse relationship between object speed and camera exposure time means that light intensity, during the camera exposure period, must increase proportionally for faster moving objects, or the vision system will not have adequate illumination and contrast levels to perform the inspection.

One solution is to overdrive the LED light - in other words, push extra current through the LEDs during this shortened exposure period to boost the intensity recorded by the camera. Hence, turbo-charging LEDs, or generating more light over a shorter period of time, may be advantageous.

Strobing also extends the real-time life of an LED light. For example, a red or IR LED light operated at a 10% duty cycle (as defined by time on / total time x 100%) will have a life of 10 x 100,000 hr, or 1,000,000 hours real-time. Because of the short on-time, little or no heat is generated, further lengthening the life of the light.

Finally, overdriving strobe lights has the effect of overwhelming ambient light contribution, and the short exposure times may also assist in creating sharper edges, particularly if a monochrome LED light is used.

LIMITED TWO YEAR WARRANTY

Every Advanced illumination, Inc. (Ai) product is thoroughly inspected and tested before leaving the factory. Products are warranted to be free of defects in workmanship and materials for a period of **TWO YEARS** from the original date of purchase. Should a defect develop during this period, return the complete product, freight prepaid, to one of Ai's distributors or to the Ai factory. Ai will inspect the unit, and if a defect is found will, at our option, repair or replace the product without charge. Ai disclaims liability for any implied warranties, including implied warranties or "merchantability" and "fitness for a specific purpose."

Ai cannot be held responsible for the unauthorized or inappropriate use of our products.

NO LIABILITY FOR CONSEQUENTIAL DAMAGES.

In no event shall Advanced illumination, Inc. be liable for consequential, special, incidental or indirect damages of any kind arising from the sale or use of products.

RETURN POLICY

Standard Products may be returned within 30 days of receipt of the order. Products must be in resalable condition, in function and appearance, with shipping charges prepaid. A restocking fee of 15% will be applied to all items accepted for return to stock. If you need to make a return, please call our Customer Service Department at 802.767.3830 x237 for a Return Merchandise Authorization (RMA) number. Clearly mark the outside of the package with the RMA number.

NO RETURNS CAN BE ACCEPTED FOR STANDARD VARIATION, CUSTOM VARIATION AND CUSTOM PRODUCTS.

There are currently over 100,000 unique configurations of the Ai product line. Therefore, we cannot restock a light built to your specifications. We would be glad to help you order your light if you are unsure of the correct part number or your exact requirements.

PRODUCT CLASSIFICATIONS

Our lighting products are classified into the following groups:

Standard: standard product with an "off the shelf" configuration. Compatible with Ai's Signatech power sources and electronics.

The following categories are built to a customer's unique specifications and CANNOT be accepted for return. See RETURN POLICY.

Standard Variation: standard product with a custom configuration, built to order along standardized guidelines. Customization options can include standoff, field of view, spectral characteristics, and compatibility with user supplied power. Standard variations may be configured for use with Ai Signatech power sources.

Custom Variation: standard product with a custom configurartion that falls outside of the published Standard Variation guidelines. Customization options can include standoff, field of view, spectral characteristics, compatibility with user supplied power, or have customized parts. Custom Variations may be configured for use with Ai Signatech power sources, dependent upon specifications.

Custom: fully custom designed and built products; or standard products with modified mechanical and/or optical and/or electrical components.

ORDERING AND SHIPPING

Unless specified otherwise, all products are shipped as follows:

Domestic: UPS Ground; **International:** UPS Worldwide Express

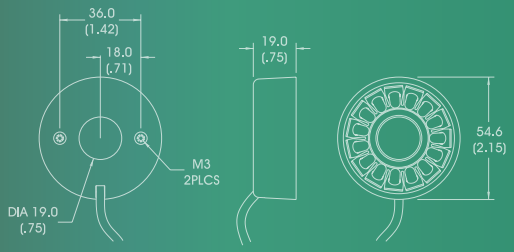
All shipments are FOB Rochester, Vermont. Federal Express or corporate account shipping can be arranged by contacting our Customer Service Department at 802.767.3830 x237.

PURCHASE ORDERS MUST ARRIVE AT THE FACTORY BY 12:00 NOON (EST) TO BE PROCESSED SAME DAY. Orders must be signed, detail the product ordered, and include customer's Purchase Order Number. Incomplete orders, or orders received after noon may not be processed until the next business day.

Standard Product, when in stock, can be shipped within 24 hours after receipt of the PO. When not immediately available, standard product will be shipped within three business days after receipt of order.

Standard Variations will be made available for delivery 2 weeks after receipt of PO.

Expedited Orders for Standard Variations require an additional charge per item ordered. Contact Customer Service for availability and pricing.



24 Peavine Drive
Rochester VT 05767
+1.802.767.3830