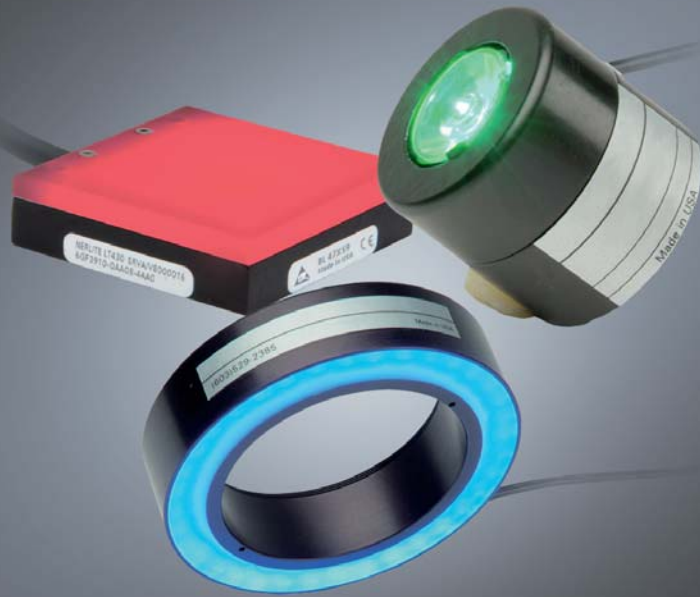


# Precision Lighting

## for Machine Vision



**MICROSCAN®**

Precision Data Acquisition  
and Control Solutions

# NERLITE

## Precision Lighting for Machine Vision

The better the lighting solution, the better your machine vision system will perform. Accurate, reliable and repeatable performance means greater productivity at a lower cost to you.

Innovative NERLITE® lighting products have enabled machine vision and auto ID systems to perform reliably in simple or challenging applications. Our NERLITE product line, the longest-established brand of machine vision lighting, has grown and been refined from our experience with hundreds of applications in dozens of industries. Ranging from cost effective solutions for common applications, to technically advanced implementations for challenges involving transparent, highly specular, round or irregularly shaped objects and surfaces, there is a NERLITE solution to your lighting problem.

### NERLITE Technology

Microscan Machine Vision Lighting products are manufactured under the brand name of NERLITE. NERLITE is widely recognized around the globe as the "standard" for machine vision illumination and machine vision imaging. The NERLITE brand encompasses a wide selection of products, including:

- Area Arrays, Spot Lights, Linear Arrays (Line Lights), Ringlights, or Dome Illuminators
- Backlight and Darkfield Illuminators
- DOAL® & COAL – Diffuse On-Axis Light® & Collimated On-Axis Coaxial Lights
- SCDI® – Square Continuous Diffuse Illuminator
- CDI® – Cloudy Day® Continuous Diffuse Illuminator
- MAXlite – Multi-Axis Light
- NERLITE also designs custom illuminators for OEMs

### Lighting Techniques

NERLITE machine vision lighting products are designed to control light delivery to the CCD array (camera). There are many lighting techniques to choose from. For a starting point in choosing the best lighting technique for your machine vision imaging application, see our light selection chart.

### Highlights

- **Cost-effective**  
Save research and design expense with complete packaged lighting solutions
- **Turnkey**  
Off-the-shelf solutions for hundreds upon hundreds of applications
- **Proven**  
Thousands of NERLITE lighting solutions in service worldwide since 1988
- **Modular and compact**  
Save integration effort and machine space
- **Reliable**  
Long-life, minimal service, LED-based designs with worldwide support
- **Large variety of lighting solutions**

Our team of lighting experts is ready to evaluate your application and configure a NERLITE solution: one that delivers the high-contrast images your vision system needs for feature or flaw detection, no matter how difficult the challenge.

Microscan's sales and support network, a combination of inhouse expertise and industry partners, spans the globe to provide fast access to NERLITE solutions and support for your business.

### Applications

- Fiducial Locations
- Blister Packs
- Semiconductor  
Wafers and Dies
- Ball Grid Arrays
- Dispensing
- Tinned PCBs
- Solder Packs
- Direct Part Marking  
Scanning
- Vial Scanning
- Robotic Guidance
- Print on Foil
- OCR and OCV
- Beverage  
Containers
- Label Inspection
- Component  
Presence

### Industries

- Automotive
- 2D Symbology/OCR
- Mail/Package  
Sorting
- Printing
- Electronics
- Pharmaceutical
- General  
Manufacturing
- Warehousing
- Semiconductor  
Packaging
- Food and  
Beverage
- CD/DVD  
Production

...and more!

# NERLITE

## The right lighting solution for every application

Use the “A T-E-S-T” method to identify the effects of different lighting techniques on part features. Select a relevant feature of your part, then compare the effects of the various lighting techniques on that feature.

The goal is to select a lighting technique that creates the highest possible contrast between the feature of interest and its surroundings.

	Part Feature <sup>1)</sup>	Backlight	DOAL	LALL Rings & Arrays	DOME, SCDI, CDI <sup>2)</sup>	Dark field	Examples
<b>A</b>	<b>Absorption</b> <sup>4)</sup> Look for change in light absorption, transmission or reflection	None	Uniformity of technique ensures absorption changes on flat surfaces are observable	Application dependent	Uniformity of technique ensures absorption, changes on bumpy surfaces are observable	Minimal effect	<ul style="list-style-type: none"> <li>■ Fuses in block</li> <li>■ Ink printed matter</li> <li>■ Plastic caps</li> <li>■ UV emission</li> <li>■ IR through plastic</li> </ul>
<b>T</b>	<b>Texture</b> <sup>3)</sup> Look for change in surface texture or finish	None	Textured surfaces darker than polished	Application dependent	Minimizes texture	Textured surfaces brighter than polished	<ul style="list-style-type: none"> <li>■ Polished surface</li> <li>■ Laser annealed</li> <li>■ Sandpaper grit</li> <li>■ Scratched surface</li> <li>■ Material change</li> </ul>
<b>E</b>	<b>Elevation</b> Look for change in height from surface to camera	None	Angled surfaces are darker	Application dependent	Minimizes shadows	Outer edges are bright	<ul style="list-style-type: none"> <li>■ Notched part</li> <li>■ Dot-peen mark</li> <li>■ Embossing</li> <li>■ Engraving</li> <li>■ Angled/beveled</li> <li>■ Foreign debris</li> </ul>
<b>S</b>	<b>Shape</b> Look for change in shape along the x/y axis (contour)	Shows outside contours	Changes evident if background is different	None	None	Contour highlighted, flat surfaces darker than raised	<ul style="list-style-type: none"> <li>■ Parts on conveyour</li> <li>■ Coins</li> <li>■ Edge dimensions</li> <li>■ Short shot</li> <li>■ Injection molding</li> </ul>
<b>T</b>	<b>Translucency</b> Look for change in density-related light transmission	Shows changes in translucency vs. opaqueness	Minimizes clear, flat overcoats (e.g. glass, varnishes) if background is different and shows changes in translucency vs. opaqueness if background is different	Application dependent	Minimizes clear, bumpy overcoats (e.g. plastic overwrap, curved glass) and shows changes in translucency vs. opaqueness if background is different	None	<ul style="list-style-type: none"> <li>■ Drilled hole</li> <li>■ Thin area in plastic</li> <li>■ Plastic lens ID number</li> <li>■ Multilayer material</li> <li>■ Debris in liquid</li> <li>■ LCD inspection</li> </ul>

1) Surface absorption is effected by the color (spectrum) of illumination. Surface texture, elevation, shape and translucency are effected by the direction of illumination.

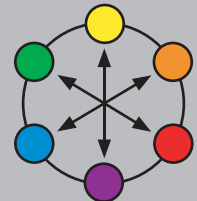
2) Uniformity of lighting increases in ascending order from Domes to SCDIs to CDIs.

3) Texture is both the presence of texture (matte, diffused, bumpy, rough) or its absence (shiny, specular, reflective, polished, smooth, glossy).

4) Using the opposite light spectrum will make a part feature appear darker. Using the same light spectrum will make a part feature appear lighter.

**Examples:**

- If the part feature you want to make darker is red, use a green light.
- Use a green light to make a green feature appear lighter.



### Effects of lighting techniques on a ball bearing



The ball bearing



Fiber optic ringlight



Fluorescent ringlight



Diffused dome light



NERLITE DOAL



NERLITE SCDI



NERLITE CDI

### Large Area LED Lights - LALLs



For illuminating small to very large areas, from close proximity or at a distance, or whenever very high intensity is required: NERLITE LALLs are the solution.

Designed to comply with NEMA 4X and IP-64. LALLs are suitable for indoor or outdoor use,

provide protection against falling and splashing liquids (e.g., washdown), seal out non-hazardous dust, lint and fibers, and are corrosion resistant.

The LALL's high intensity, lower power consumption, compact and easily integrated design, strobe capability and long-life make them ideal for both new installation and as replacements for less robust light sources (e.g., fluorescents).

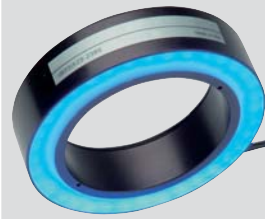
### Area Array



An Area Array's general purpose, unidirectional design (adjustable via mounting position) may be used for darkfield (creating shadows and specular reflection) or for brightfield lighting for diffused surfaces.

As with other incident (aka "front") lighting choices, subtle adjustments to working distance and angle of light delivery can deliver good image contrast for minimal investment.

### Ringlights



Ringlights can be an economical, easily integrated (direct attachment to lens) choice for illuminating diffused surfaces.

As with other incident (aka "front") lighting choices, subtle adjustments to working distance and angle of light delivery can deliver good image contrast for minimal investment.

### Backlights



Backlights provide diffused illumination from behind the subject. They are used to outline a part's overall shape, minimize visibility of clear housings, and to view openings such as drilled holes.

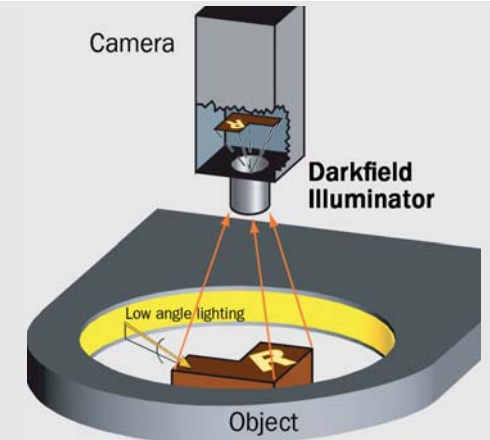
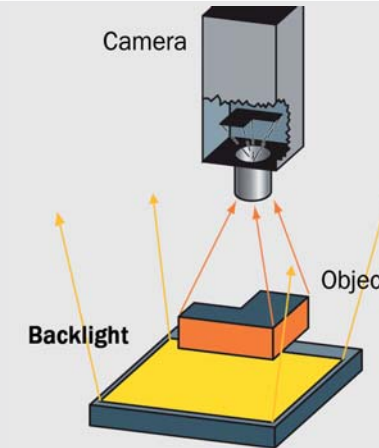
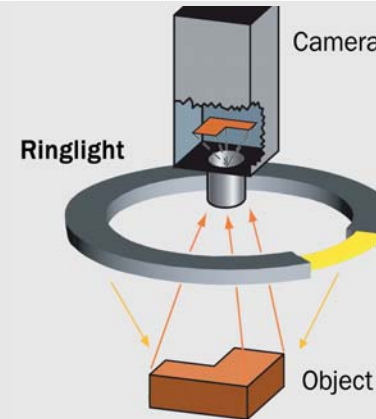
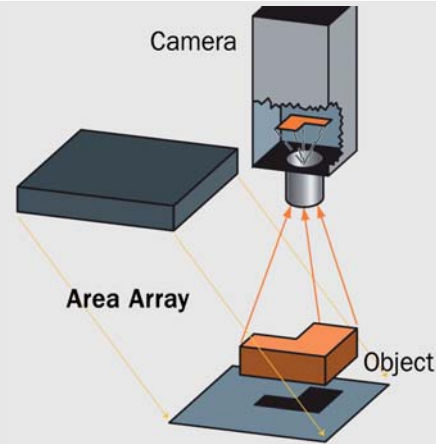
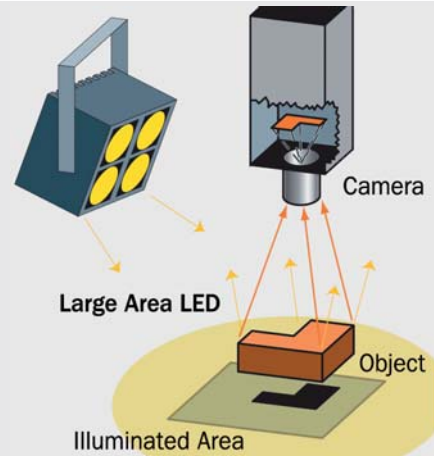
### Darkfield



Darkfield Illuminators provide effective low-angle lighting to targeted regions.

They enhance the contrast of surface features such as laser embossed or engraved marks or surface defects.

### Functionality



### Typical Applications

- Robotic guidance/manipulation
- Package sorting inspection
- Traffic monitoring
- Food processing and packaging
- Automotive/aerospace assembly
- Large surface inspection (roadways, railways, runways)

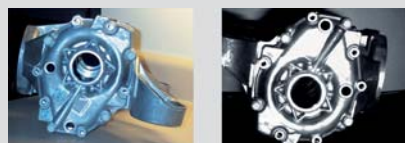
- Illuminate flat, diffused surfaces
- Control costs
- Non-diffuse incident (front) lighting
- Darkfield or brightfield lighting
- Label placement inspection

- Illuminate flat, diffused surfaces
- Control costs
- Inspection of circular objects (gaskets, washers)
- When direct attachment to lens is required
- Lab use where interchangeable optics such as diffusers or fresnel (focusing) lenses are desired
- Label inspection

- Locate or measure outside dimension
- View openings (e.g., drilled holes)
- Diminish clear glass or plastic housings
- Measure thickness of materials
- Locate mounting holes
- Measure translucency
- Diffuse incident (front) lighting

- BGA ball placement
- Reading laser-etched symbologies
- Inspecting surfaces with geometric contours
- Label inspection applications
- Make textured surfaces appear bright
- Emphasize elevation changes

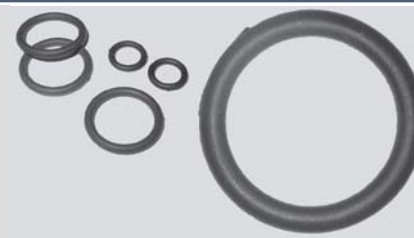
### Application Examples



**Object: Housing assembly.** Detect presence/absence of fasteners.



**Object: Labeled bottle.** Image captured with Area Array. Inspect for label presence or absence, correct label and proper orientation.



**Object: O-ring gaskets.** Excess material ("flash") detected at 11 o'clock position.



**Object: Miniature lamp.** Image captured with Backlight. Inspecting integrity of lamp filament.



**Object: Circuit board with Data Matrix.** Image showing high contrast Data Matrix.


**DOAL**

**SCDI**

**MAXlite**

**Dome**

**CDI**




With the DOAL's coaxial (on-axis) illumination, light rays reflect off a beam splitter directly on to an object at nearly 90°.

Through this coaxial lighting approach, specular surfaces perpendicular to the camera appear illuminated, while surfaces at an angle to the camera appear dark. Non-specular surfaces absorb light and appear dark.




The SCDI is designed for applications involving highly specular and moderately curved surfaces.

The SCDI works on the same principles as the DOAL, but with added uniformity for non-planar surfaces. With the SCDI, light rays reflect off the beamsplitter and the lower chamber, increasing the solid angle of illumination.



The MAXlite (Multi-Axis Illuminator) is designed for applications requiring a combination of lighting geometries.

The MAXlite provides independently adjustable on-axis and darkfield light in one package.



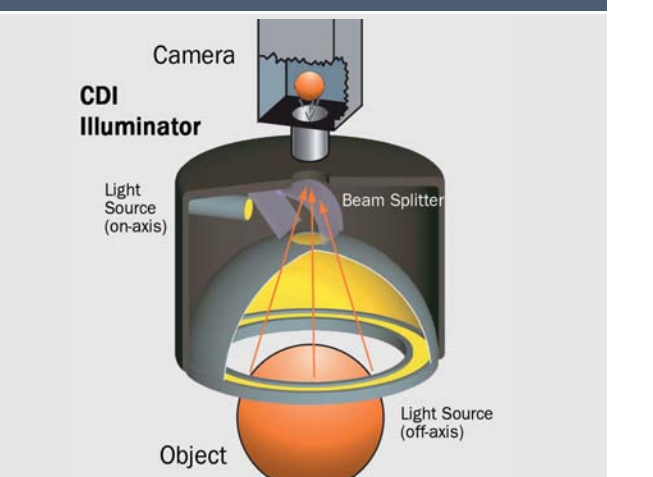
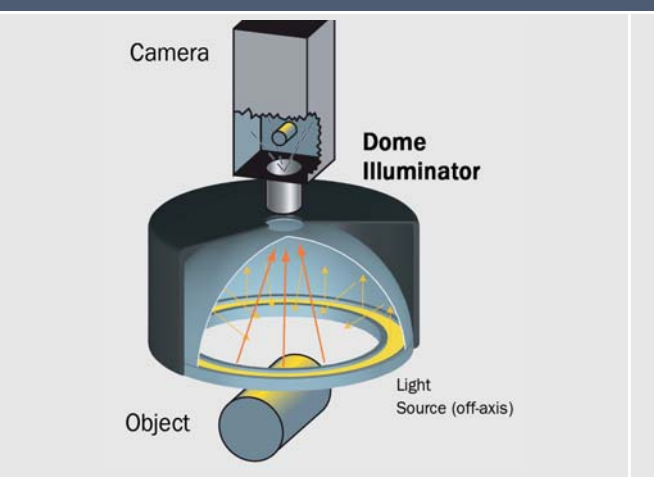
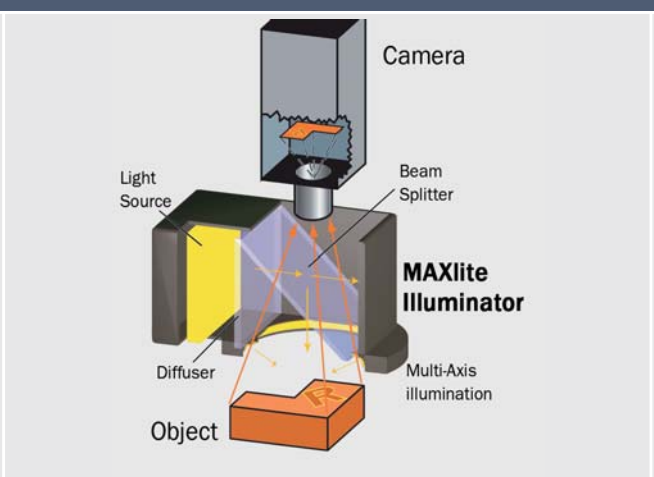
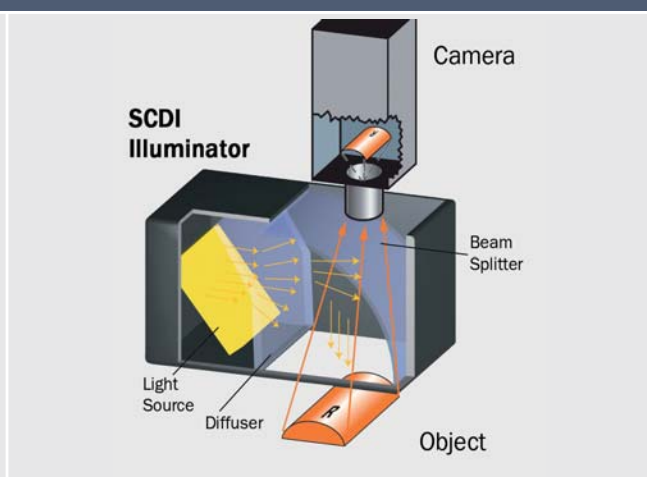
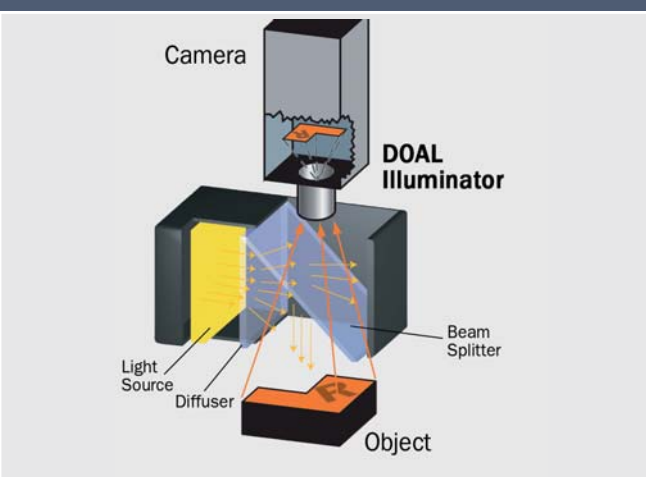
Dome Illuminators are an economical source of diffused, uniform light. Their large, solid angle of illumination supports imaging of curved surfaces.

They are a cost-effective alternative to the CDI for applications not requiring an on-axis lighting component.



The CDI combines patented optics with precision integrating sphere technology to yield a self-contained continuous diffuse lighting environment.

It is designed for critical applications involving highly specular and faceted surfaces where any reflections of camera aperture or "seams" in the lighting envelope will cause a vision system to see defects where none exist.



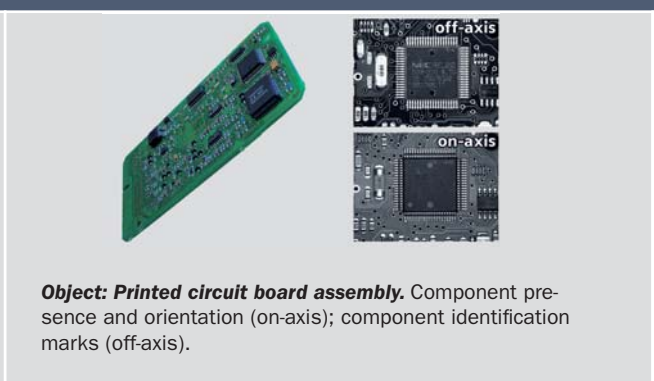
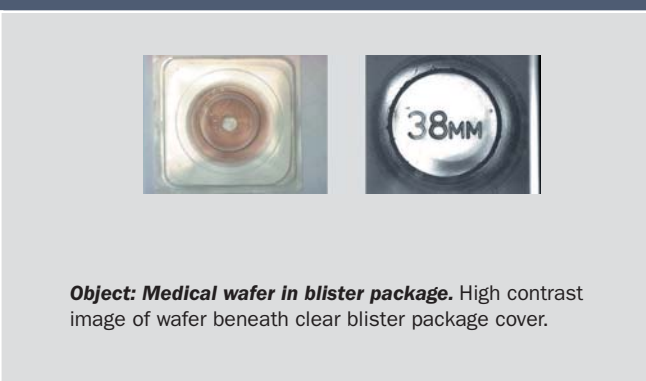
- Evenly illuminate flat, shiny surfaces
- Enhance scribed, indented, or embossed features
- Create contrast between specular, diffuse and/or absorptive surfaces
- Diminish visibility of clear overcoats or coverings
- Electronic component inspection
- Fiducial location

- CD/DVD artwork verification
- Inspector of solder patterns on circuit boards
- Packaged product inspection (blister-packed pharmaceuticals, tubed computer chips)
- Diminish clear overcoats or coverings
- Reduce shadows
- Differentiate specular, diffuse, or absorptive features on moderately curved surfaces

- Evenly illuminate flat, shiny surfaces
- Enhance scribed, indented, or embossed features
- Inspection of solder patterns on circuit boards
- Differentiate specular, diffuse, or absorptive features on moderately curved surfaces
- Control costs by integrating one lighting unit that addresses a variety of applications

- Illuminate diffused or specular, flat or curved surfaces
- Economical solution for shiny curved surfaces
- CD/DVD label inspection
- Inspection of surfaces for contaminants (particles, residues)

- CD/DVD artwork verification
- Inspect solder patterns on circuit boards
- Packaged product inspection (blister-packed pharmaceuticals, tubed computer chips)
- Diminish clear overcoats or coverings
- Reduce shadows
- Differentiate specular, diffuse, or absorptive features on bumpy/wrinkled surfaces



# NERLITE Accessories

NERLITE accessories provide the customer with a complete lighting solution. The accessory list includes the necessary power supplies and drivers to provide the customer with various operation modes ranging from continuous to strobe.

They also provide the ability to adjust many lighting parameters to tackle the most challenging lighting and vision applications.

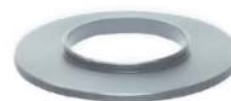
Examples:

- LED Lighting Controller: includes the power regulation, intensity control, timing and triggering functions required for machine vision systems

**Note:** Controllers do not supply power; a separate power source is required.



- Filter Thread Mount: Lens Adapter for "V2" Ring lights



- LED Lighting Driver: stable constant current output for driving LED lighting

**Note:** Drivers do not supply power; a separate power source is required.



## MICROSCAN®

Precision Data Acquisition  
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