Precise Lighting for Machine Vision
Precise 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), Ring Lights, or Dome Illuminators
- Backlight and Dark-Field 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
- and also NERLITE designed 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!
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.

<table>
<thead>
<tr>
<th>Part Feature 1)</th>
<th>Backlight</th>
<th>DOAL</th>
<th>LALL Rings &amp; Arrays</th>
<th>DOME, SCDI, CDI 2)</th>
<th>Dark field</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorption 4)</td>
<td>None</td>
<td>Uniformity of technique ensures absorption changes on flat surfaces are observable</td>
<td>Application dependent</td>
<td>Uniformity of technique ensures absorption changes on bumpy surfaces are observable</td>
<td>Minimal effect</td>
<td></td>
</tr>
<tr>
<td>1) Surface absorption is effected by the color (spectrum) of illumination. Surface texture, elevation, shape and translucency are effected by the direction of illumination.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texture 3)</td>
<td>None</td>
<td>Textured surfaces darker than polished</td>
<td>Application dependent</td>
<td>Minimizes texture</td>
<td>Textured surfaces brighter than polished</td>
<td></td>
</tr>
<tr>
<td>2) Uniformity of lighting increases in ascending order from Domes to SCDIs to CDIs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevation</td>
<td>None</td>
<td>Angled surfaces are darker</td>
<td>Application dependent</td>
<td>Minimizes shadows</td>
<td>Outer edges are bright</td>
<td></td>
</tr>
<tr>
<td>3) Texture is both the presence of texture (matte, diffused, bumpy, rough) or its absence (shiny, specular, reflective, polished, smooth, glossy).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>Shows outside contours</td>
<td>Changes evident if background is different</td>
<td>None</td>
<td>None</td>
<td>Contour highlighted, flat surfaces darker than raised</td>
<td></td>
</tr>
<tr>
<td>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:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Translucency</td>
<td>Shows changes in translucency vs. paqueness</td>
<td>Minimizes clear, flat overcoats (e.g. glass, varnishes) if background is different and shows changes in translucency vs. opaqueness if background is different</td>
<td>Application dependent</td>
<td>Minimizes clear, bumpy overcoats (e.g. plastic overwrap, curved glass) and shows changes in translucency vs. opaqueness if background is different</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>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:</td>
<td></td>
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<td></td>
</tr>
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</table>

Effects of lighting techniques on a ball bearing

The ball bearing
Fiber Optic Ring Light
Fluorescent Ring Light
Diffused Dome light
NERLITE DOAL
NERLITE SCDI
NERLITE CDI

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.
## Large Area LED Lights - LALLs

**Functionality**

- Area Array
- Ringlights
- Backlights
- DOAL
- SCDI
- MAXlite
- Dome

**Use Cases**

- **Food processing and packaging**
  - Package sorting inspection
  - Robotic guidance/manipulation
  - Foodpackaging use

- **Inspection**
  - Label placement inspection
  - Label inspection
  - BGA ball placement
  - Reading laser-etched symbologies

- **Label inspection applications**
  - Measure thickness of materials
  - View openings (e.g., drilled holes)
  - Locate or measure outside dimension

### Illustrations

- Image captured with Area Array.
- Image 11 o'clock position.
- Object: Medical wafer in blister package.
- Data Matrix on gear shaft.
- Object: Printed Circuit Board Assembly.
- Object: Screw head.
- Object: Wrinkled foil pouch.
- Image 1 o'clock position.

### Summary

- The LALL’s high intensity, lower power consumption, compact size, and corrosion-resistant washdown, seal out non-hazardous dust, lint, and fibers, and are ideal for both new installation and as replacements.

<table>
<thead>
<tr>
<th>LALL Type</th>
<th>Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Array</td>
<td>Food processing and packaging</td>
</tr>
<tr>
<td>Ringlights</td>
<td>Inspection</td>
</tr>
<tr>
<td>Backlights</td>
<td>Package sorting inspection</td>
</tr>
<tr>
<td>DOAL</td>
<td>Robotic guidance/manipulation</td>
</tr>
<tr>
<td>SCDI</td>
<td>Foodpackaging use</td>
</tr>
<tr>
<td>MAXlite</td>
<td>Label placement inspection</td>
</tr>
<tr>
<td>Dome</td>
<td>Label inspection</td>
</tr>
</tbody>
</table>

**Advantages**

- Suitable for indoor or outdoor use, 4X and IP-64.
- Suitable for applications requiring: NERLITE LALLs are robust, reliable, and offer exceptional performance in high-intensity environments.

**Illumination**

- For illuminating small to very large areas, from close proximity or at a distance, or large areas, from close proximity or at a distance.

**Applications**

- Whenever very high intensity is required: NERLITE LALLs are designed to deliver robust illumination in demanding environments.

**Benefits**

- Inspect for label presence or absence, correct label, and control costs.
- Illuminate flat, diffused surfaces.
- Measure translucency, measure thickness of materials, view openings (e.g., drilled holes), locate or measure outside dimension.

**Features**

- The SCDI is designed to be an economical, versatile, and reliable illumination source for a wide range of applications.

- The MAXlite is ideal for applications requiring high-intensity, diffuse illumination, with adjustable on-axis and dark field lighting.

- The CDI combines patented technology with precision integrating optics to deliver a uniform, high-contrast image of wafer beneath clear blister package cover.

**Examples**

- Object: DVD label inspection.
- Inspect for label presence or absence, correct label, and control costs.
- Illuminate diffused or specular, flat or curved surfaces.
- Reduce shadows, diminish clear overcoats or coverings, and reduce the contrast of surface features such as laser embossed text.

**Conclusion**

- The LALL’s versatility and reliability make them an ideal choice for a wide range of inspection and illumination applications.
### Large Area LED Lights - LALLs

- **Large Area LED Lights**
- **Large Area Lights**
- **Ringlights**
- **Backlights**
- **DOAL**
- **SCDI**
- **MAXlite**
- **Dome Softfields**
- **Dome**

#### Application Examples

- **Large surface inspection** (roadways, railways, runways)
- **Automotive/Aerospace assembly**
- **Food processing and packaging**
- **Robotic guidance/manipulation**

**Functionality**

- Large Area LED Lights - LALLs
  - Area Array Ringslights Backlights DOAL SCDI MAXlite Dome Softfields Dome
  - LALLs (Large Area Light) are designed for large areas, from close to far distances.
  - They are suitable for indoor or outdoor use.
  - Designed to comply with NEMA standards.
  - Suitable for long-life washdown, seal out non-hazardous dust, lint and fibers.

**Object:** Housing assembly.

- Object: Labeled bottle.
- **Label inspection**
  - Inspecting label presence or absence, correct label and label inspection.

**Object:** O-ring gaskets.

- **Label inspection**
  - Inspection of circular objects (gaskets, washers).

**Object:** Circuit board with Data Matrix.

- **Label inspection**
  - Reading laser-etched symbologies.

**Object:** Printed Circuit Board Assembly.

- **Label inspection**
  - Inspecting surfaces with geometric contours.
  - Reading laser-etched symbologies.

**Object:** Miniature lamp.

- **Label inspection**
  - Measuring translucency.
  - View openings (e.g., drilled holes).

**Object:** Screw head.

- **Label inspection**
  - Inspection of surfaces for contaminants (particles, residues).

**Object:** Wrinkled foil pouch.

- **Label inspection**
  - View openings like drilled holes.

**Object:** Circuit board with Data Matrix.

- **Label inspection**
  - High contrast elements for minimal investment.

**Object:** Circuit board with Data Matrix.

- **Label inspection**
  - BGA ball placement.

**Object:** Circuit board with Data Matrix.

- **Label inspection**
  - Fiducial location.

**Object:** Circuit board with Data Matrix.

- **Label inspection**
  - Control costs by integrating one lighting unit that addresses a variety of applications.

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**Object:** Circuit board with Data Matrix.
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.

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