Precision Lighting
for Machine Vision

MICROSCAN
Precision Data Acquisition and Control Solutions
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 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
- NERLITE also designs custom illuminators for OEMs

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.

Highlights

- Cost-effective
  Save research and design expense with complete packaged lighting solutions
- Turnkey
  Off-the-shelf solutions for hundreds and 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

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.

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
- 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.

## Part Feature

<table>
<thead>
<tr>
<th>Feature</th>
<th>Backlight</th>
<th>DOAL</th>
<th>LALL, Rings &amp; Arrays</th>
<th>DOME, SCDI, CDI</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>Fuses in block, Ink printed matter, Plastic caps, UV emission, IR through plastic</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>Polished surface, Laser annealed, Sandpaper grit, Scratched surface, Material change</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>Notched part, Dot peen mark, Embossing, Engraving, Angled/beveled, Foreign debris</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>Parts on conveyor, Coins, Edge dimensions, Short shot, Injection molding</td>
</tr>
<tr>
<td>Translucency</td>
<td>Shows changes in translucency vs. opacity</td>
<td>Minimizes clear, flat overcoats (e.g. glass, varnishes) if background is different and shows changes in translucency vs. opacity 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. opacity if background is different</td>
<td>None</td>
<td>Drilled hole, Thin area in plastic, Plastic lens ID number, Multi-layer material, Debris in liquid, LCD inspection</td>
</tr>
</tbody>
</table>

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.

## Effects of lighting techniques on a ball bearing

![The ball bearing](image1)
![Fiber optic ringlight](image2)
![Fluorescent ringlight](image3)
![Diffused dome light](image4)
![NERLITE DOAL](image5)
![NERLITE SCDI](image6)
![NERLITE CDI](image7)
### Application Examples

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

#### Medical wafer in blister package.
- Packaged product inspection (blister-packed pharmaceuticals, tubed computer chips)
- Inspecting for surface flaws.
- Reduce shadows
- Diminish clear overcoats or coverings

#### Circuit board with Data Matrix.
- Fiducial location
- Electronic component inspection
- Diminish visibility of clear overcoats or coverings
- Create contrast between specular, diffuse and/or absorptive surfaces
- Enhance scribed, indented, or embossed features

#### Screw head.
- Differentiate specular, diffuse, or absorptive features on bumpy/curved surfaces
- Reduce shadows
- Diminish clear overcoats or coverings

#### CDI
- Economical solution for shiny curved surfaces
- Illuminate diffused or specular, flat or curved surfaces

#### DOAL
- The DOAL’s coaxial (on-axis) illumination is used for applications not requiring an on-axis lighting approach. It is designed for critical applications involving highly specular and faceted surfaces where any light reflection is undesirable.
- Through this coaxial lighting approach, a dome illuminator is placed in close proximity to an object.
- The DOAL integrates cutting-edge technology to yield a self-contained diffuse lighting environment.
- It is designed for critical applications involving highly specular and highly curved surfaces. With the DOAL, light rays reflect off the dome, the lower chamber, increasing the solid angle of illumination.

#### SCDI
- 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 areas, from close proximity or at a distance, or are ideal for illuminating small to very large areas, from close proximity or at a distance, or illuminate diffused surfaces.
- They enhance the contrast of surface features which can be very important in high contrast imaging applications.

#### Backlights
- Backlights provide diffuse illumination, without direct attachment to the lens. They are used to outline a part’s overall shape, minimize visibility of clear housings, and provide protection against falling and splashing liquids (e.g., washdown), seal out non-hazardous dust, lint and fibers, and are corrosion resistant.
- Arrays are suitable for indoor or outdoor use, whenever very high intensity is required. They can be used to light any surface at any angle.
- Backlights are ideal for illuminating small to very large areas, from close proximity or at a distance, or illuminate diffused surfaces.

#### Dome Illuminators
- Dome illuminators are an economical source of light, providing uniform illumination over a wide solid angle.
- They are a cost-effective alternative to the CDI and are used in a variety of applications.
- They can be used to illuminate flat, diffused surfaces or to provide uniform illumination over a wide solid angle.
**Spot and Area Arrays**

- **Functionality**
  - Lighting can be an essential need for a variety of applications.

- **Application Examples**
  - **Object**: Housing assembly.
    - Large surface inspection (roadways, railways, runways).
  - **Object**: Object: O-ring gaskets.
    - Inspecting for surface flaws.
  - **Object**: Gear shaft.
    - Reducing shadows.
  - **Object**: Screw head.
    - CD/DVD label inspection.
  - **Object**: Wrinkled foil pouch.
    - Differentiate specular, diffuse, or absorptive features on bumpy/curved surfaces.

**Ringlights**

- **Functionality**
  - Ringlights provide continuous diffuse lighting environment.

- **Application Examples**
  - **Object**: Medical wafer in blister package.
    - Inspecting surfaces with geometric contours.
  - **Object**: Circuit board with Data Matrix.
    - Emphasize elevation changes.

**Backlights**

- **Functionality**
  - Backlights provide diffused illumination.

- **Application Examples**
  - **Object**: Screw head.
    - CD/DVD label inspection.
  - **Object**: Wrinkled foil pouch.
    - Reduce shadows.

**Dark-field**

- **Functionality**
  - Dark-field Illuminators provide effective low-light imaging.

- **Application Examples**
  - **Object**: Medical wafer in blister package.
    - Enhance scribed, indented, or embossed features.
  - **Object**: Gear shaft.
    - Enhance scribed, indented, or embossed features.

**DOAL**

- **Functionality**
  - DOALs are designed for applications involving highly specular and faceted surfaces.

- **Application Examples**
  - **Object**: Medical wafer in blister package.
    - Enhance scribed, indented, or embossed features.
  - **Object**: Gear shaft.
    - Enhance scribed, indented, or embossed features.

**SCDI**

- **Functionality**
  - The SCDI is designed for critical applications involving highly specular and faceted surfaces.

- **Application Examples**
  - **Object**: Medical wafer in blister package.
    - Enhance scribed, indented, or embossed features.
  - **Object**: Gear shaft.
    - Enhance scribed, indented, or embossed features.
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.

- **LED Lighting Driver:**
  Stable constant current output for driving LED lighting.

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

- **Filter Thread Mount:**
  Lens Adapter for "V2" ring lights.