Precision Lighting
for Machine Vision

MICROSCAN.

**Precision Data Acquisition
and Control Solutions**

NERLITE

Precision Lighting for Machine Vision

Lighting is critical in machine vision applications, as it allows vision cameras to "see" the part or mark. 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.

Microscan's innovative NERLITE® lighting products enable machine vision and auto ID systems to perform reliably in thousands of applications worldwide. NERLITE is the longest-established brand of machine vision lighting, and has grown and been refined from our experience with hundreds of applications in dozens of industries. Ranging from simple solutions for common applications, to technically advanced configurations for challenges involving transparent, highly specular, round or irregularly shaped objects and surfaces, there is a NERLITE solution for your lighting problem.

NERLITE TECHNOLOGY

NERLITE machine vision lighting is available in a wide range of shapes, wavelengths and designs:

- Area Arrays, Spot Lights, Bar Lights, Ring Lights, and Dome Illuminators
- High Intensity HI-BRITE Illuminators
- Backlight and Dark Field Illuminators
- DOAL® – Diffuse On-Axis Lights
- SCDI® – Square Continuous Diffuse Illuminators
- CDI® – Cloudy Day® Continuous Diffuse Illuminators
- NERLITE also designs custom lights for OEMs

INDUSTRIAL DESIGN

Microscan has optimized the NERLITE product line for factory automation applications by standardizing on 24-volt power, standardizing on industrial connections, allowing operation to 40° C, and using a single-point controller for any light. In addition, all NERLITE machine vision lights are backed by an industry leading 3 year warranty with standard lights in stock and ready for rapid delivery.

SIMPLIFIED

Our team of lighting experts has engineered the NERLITE products to allow you to focus on the critical lighting requirements of your machine vision application, such as the wavelength (color), field of view (size) and required geometry to optimize the signal-to-noise ratio of acquired image. This means our customers do not need to be concerned with choosing the right controller, determining the correct voltage, or picking the right connector for a successful installation.

HIGHLIGHTS

- **Wide range of products**
  Off-the-shelf solutions for hundreds and hundreds of applications

- **Cost-effective**
  Save research and design expense with complete packaged lighting solutions

- **Industrial designs**
  Optimized for factory automation applications

- **Reliable**
  Long lasting LED technology backed by 3 year warranty and worldwide support

- **Easily integrated**
  Standardized connectivity, power and controller provide flexible, simplified integration

- **Proven choice**
  Pioneered industrial lighting with thousands of NERLITE lighting solutions in service worldwide since 1988

APPLICATIONS

- Fiducial Locations
- Blister Packs
- Semiconductor Wafer and Dies
- Ball Grid Arrays
- Dispensing
- Tinned Printed Circuit Boards (PCBs)
- Solder Packs
- Direct Part Marks
- Vial Scanning
- Robotic Guidance
- Print on Foil
- OCR and OCV
- Beverage Containers
- Label Verification
- Component Presence
- Packaging Inspection
- Laser Etching
- Measure Translucency
- View or Locate Openings
- "Flash" Detection
- Crimp and Seal Inspection
- CD/DVD Artwork Verification
- Enhance Surface Features
- Detect Surface Flaws

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 [1]	Backlight	DOAL	HI-BRITE, Ring & Array	Dome, SCDI, CDI [2]	Dark Field	Examples
A	**Absorption** [4] 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	■ Fuses in block ■ Ink printed matter ■ Plastic caps ■ UV emission ■ IR through plastic
T	**Texture** [3] Look for change in surface texture or finish	None	Textured surfaces DARKER than polished	Application dependent	Minimizes texture	Textured surfaces BRIGHTER than polished	■ Polished surface ■ Laser annealed ■ Sandpaper grit ■ Scratched surface ■ Material change
E	**Elevation** Look for change in height from surface to camera	None	Angled surfaces are darker	Application dependent	Minimizes shadows	Outer edges are bright	■ Notched part ■ Dot peen mark ■ Embossing ■ Engraving ■ Angled/beveled ■ Foreign debris
S	**Shape** 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	■ Parts on conveyor ■ Coins ■ Edge dimensions ■ Short shot ■ Injection molding
T	**Translucency** 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	■ Drilled hole ■ Thin area in plastic ■ Plastic lens ID number ■ Multi-layer material ■ Debris in liquid ■ LCD inspection

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.
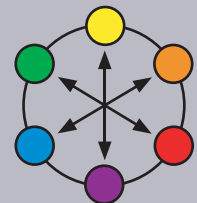
Effects of lighting techniques on a ball bearing

| The ball bearing | Fiber optic ring light | Fluorescent ring light | Diffused dome light | NERLITE DOAL | NERLITE SCDI | NERLITE CDI |

HI–BRITE

HI-BRITE illuminators provide a high intensity output over a large area. Featuring IP67 industrial sealing and the brightest LEDs in their class, they include a built-in controller for a complete and easily integrated solution for rugged automation environments.

Versatile 10° spot and 50° flood lens options allow them to be used at both near and far distances to accommodate a variety of applications.

Area Array

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

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

Bar Lights

Bar lights use LED arrays in compact, linear units to provide economical illumination for a variety of applications.

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

Ring Lights

Ring lights are a cost-effective, easily integrated solution for illuminating surfaces. Packaging and mounting advancements emphasize durability and versatility for any diffused surface lighting application.

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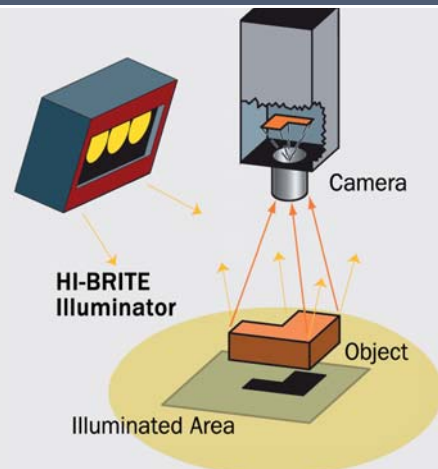
Backlights

Backlights provide sharp contrast to outline a part's shape, minimize visibility of clear housings, and to view openings such as drilled holes. High intensity and uniformity are packed into a low-profile industrial package for optimal thermal management.

Edge To Edge models can be easily combined to create larger illuminated areas.

Functionality
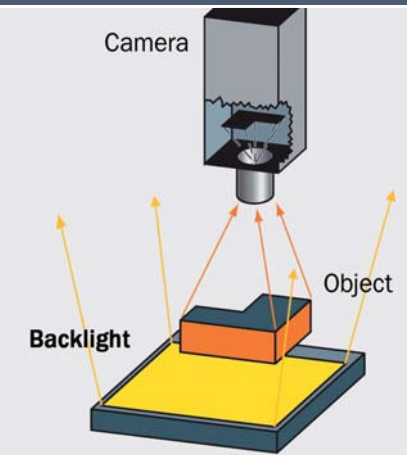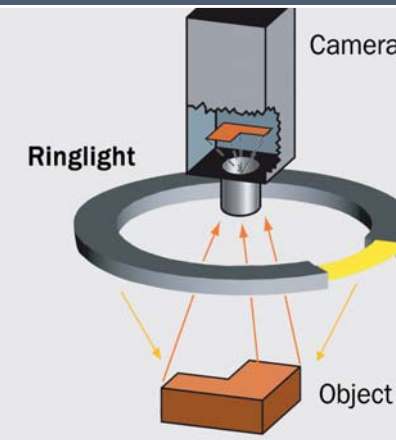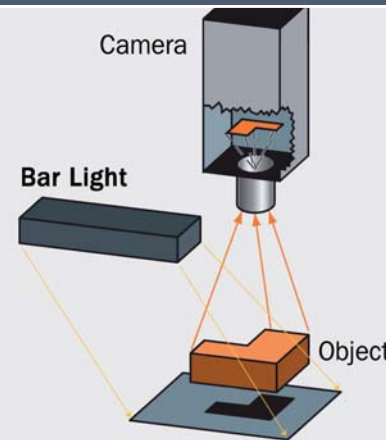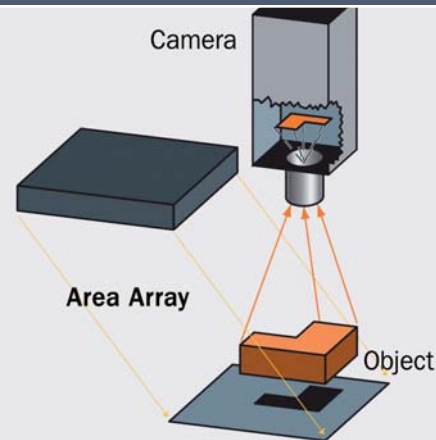
Typical Applications

HI–BRITE
- Large surface inspection
- Package sorting inspection
- Traffic monitoring
- Food processing and packaging
- Automotive/aerospace assembly

Area Array
- Locate or measure outside dimensions
- Illuminate flat, diffused surfaces
- Product defect inspection
- Label inspection and placement verification
- Non-diffuse incident (front) lighting
- Dark field or bright field lighting

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

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

Application Examples
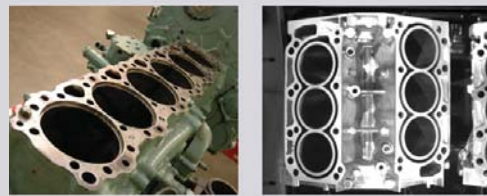
Object: Large engine block. Provides good contrast over large areas to perform product inspection.

Object: Labeled bottle. Inspect for label presence or absence, correct label and proper orientation.

Object: Circuit board. Image captured shows high contrast Data Matrix symbols.

Object: Plastic bottle. Defect on top of a plastic bottle is clearly identified.

Object: Light bulb. Resulting image clearly shows silhouette of filament inside the bulb.

Dome	Dark Field	DOAL®	SCDI®	CDI®

Dome

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

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

Dark Field

Dark field Illuminators provide effective low-angle lighting to targeted regions, and enhance the contrast of surface features such as laser embossed or engraved marks or surface defects.

Dark field illuminators are particularly well suited for applications such as reading laser-etched symbologies, and inspecting surfaces with geometric contours.

DOAL®

DOAL illuminators provide the best contrast for images of features marked or embossed on a flat specular surface with diffuse and uniform on-axis illumination.

With the coaxial lighting approach, specular surfaces perpendicular to the camera appear bright, while surfaces which are marked or embossed absorb light and appear dark.

SCDI®

SCDI illuminators provide enhanced diffuse lighting performance. The patented design makes it ideal for inspecting moderately faceted and undulating reflective surfaces.

SCDI illumination allows products to be inspected in the package and prevents non-uniform light reflections from causing a vision system to see defects where none exist.

CDI®

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

The advanced design provides extraordinary diffuse lighting performance for critical applications. They are ideal lights for inspecting highly faceted and undulating reflective surfaces, such as inspection of blister-packaged products.
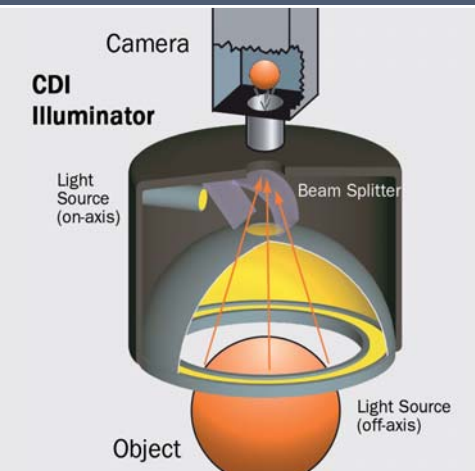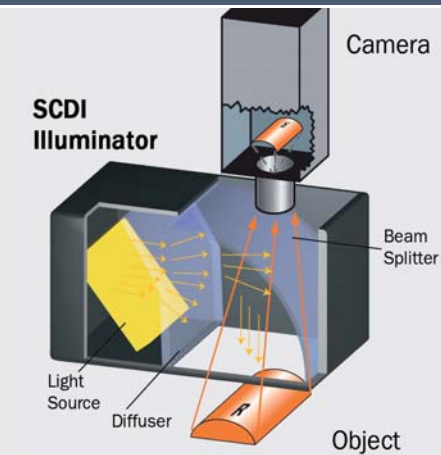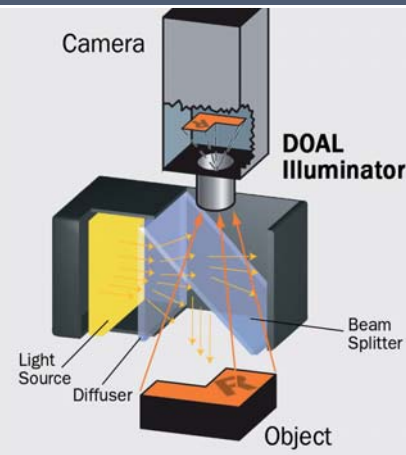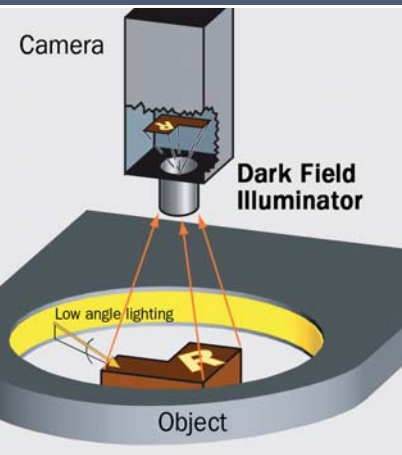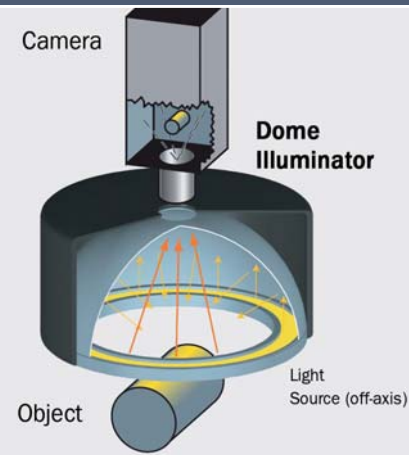
- Illuminate diffused or specular, flat or curved surfaces
- CD/DVD label inspection
- Inspection of surfaces for contaminants such as particles or residues

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

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

- Differentiate specular, diffuse, or absorptive features on moderately curved surfaces
- Reduce shadows
- Diminish clear overcoats or coverings
- Packaged product inspection (such as pharmaceuticals, computer chips)
- Inspector of solder patterns on circuit boards

- Differentiate specular, diffuse, or absorptive features on bumpy/wrinkled surfaces
- Reduce shadows
- Diminish clear overcoats or coverings
- CD/DVD artwork verification
- Packaged product inspection (pharmaceuticals, computer chips)

Object: Bottom of aerosol can. Uniform illumination of concave surface results in contrast against printed characters.
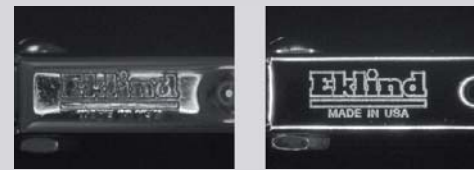
Object: Embossed logo on a metal surface. Low angle illumination provides a high contrast image.

Object: Stamped characters on a metal plate. High contrast image allows inspection or reading.

Object: Data Matrix on a gear shaft. Diffuse illumination allows clear image capture of marked symbol.

Object: Wrinkled foil pouch. Image captured clearly shows date and lot code.

NERLITE Accessories

NERLITE accessories provide the customer with a complete lighting solution. Our wide range of communication and connectivity accessories feature high quality components and user-friendly design to supplement the NERLITE product line, and provide the ability to adjust many lighting parameters to tackle the most challenging machine vision applications.

NL-200 LIGHTING CONTROLLER

- The NL-200 series controls any standard NERLITE lighting product in continuous, strobe or switched mode. Provides simplified connectivity and includes the power regulation, intensity control, timing and triggering functions needed for successful machine vision applications.

  With optional Ethernet connectivity and resident web server, the NL-200 Series is a powerful accessory to complement any NERLITE light.

OTHER ACCESSORIES

- Power Supply:
  DIN rail mount power supplies compatible with the complete NERLITE product line

- Cables and Cordsets (with regional compatibility)

- Ring Light Accessories:
  Diffuser (included)
  Fresnel focusing lenses
  Camera lens attachment adapters

NL-220, NL-220F image processing software on web server

NL-200 Series Controller

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