BANNER®

more sensors, more solutions

Vision Lighting

FIRST EDITION

Advanced Vision Lighting Solutions from Banner.

Area Lights

Provides even illumination in a concentrated area **Page 10**

Linear Array Lights

Provides high-intensity illumination of large areas, at long distances **Page 12**

On-Axis Lights

Provides collimated illumination in same optical path as camera **Page 13**

Backlights

Installs behind the target, directly facing the sensor; has a highly diffused surface and uniform brightness, with a lower intensity than other lights **Page 14**

Ring Lights

Mounts directly to the sensor for easy setup and illuminates any object directly in front of the sensor **Page 16**

Low-Angle Ring Lights

Illuminates nearly perpendicular to the direction of an inspection, enhancing the contrast of surface features **Page 18**

Spot Lights

Provides even illumination in a small concentrated spot **Page 19**

Tubular Lights

Features flicker-free high-intensity illumination of large areas **Page 20**

Structured Lights

Uses Class 2 laser line with extra bright light for 3-dimensional sensing **Page 21**

For additional specialty lights **Page 21**

more sensors, more solutions

Banner is the name to trust for all your lighting needs.

There are many boutique lighting suppliers, but few can claim Banner's 40 plus years of LED design experience, rigorous quality control, excellent sales support and cost-effective solutions. Banner delivers a wide array of lighting choices built to exacting standards, and that means you can count on Banner to deliver high-quality illumination products.

Banner's lighting solutions provide self-regulation for consistent illumination, built-in universal strobe control and LEDs that last for 50,000+ hours of maintenance-free illumination. Plus, Banner offers the industry's broadest force of application engineers and more than 3,000 factory and field representatives worldwide to deliver sophisticated solutions for challenging applications.

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Linear array lights illuminate large objects. *Durable linear array lights provide high intensity lighting for challenging applications or for multiple areas of interest on large objects, such as the spot welds and cutouts on an automotive panel.*

Reliable vision performance requires advanced lighting solutions.

Banner knows light! We've been designing, building and perfecting LED-based industrial controls for 35 years and now, we've developed a comprehensive line of lighting solutions dedicated to your machine vision applications.

Our lights play well with your system.

Banner's lighting solutions provide the robust, world-class performance you expect, even when used with other manufacturer's vision systems. Our lights are built to the same high quality standard as our award-winning line of *Presence*PLUS® vision sensors and are designed to work on any vision platform. Add Banner's lighting solutions to improve the accuracy and reliability of ***any*** vision inspection, regardless of the hardware.

Banner Vision Lighting

EXAMPLE APPLICATIONS

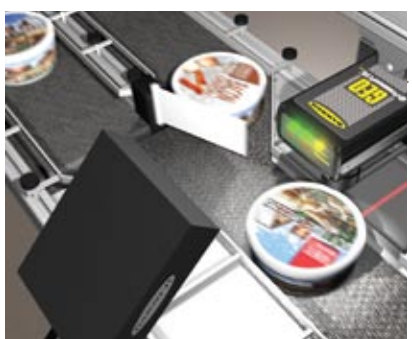
Solving the toughest applications. Yours.

With industry-leading design, manufacturing and application support, Banner's advanced lighting solutions offer the same advantages of all Banner products, including global availability from stock, localized application support, and the agility to provide customized lighting solutions quickly and affordably. Custom profiles, mounting and bracketing, or special material challenges, Banner has the expertise and engineering capabilities you need.

Optimize maximum contrast with backlighting
Because the large red backlight creates maximum contrast, its use can boost the reliability of a high-speed inspection of facial tissue boxes. The vision sensors signals the controller if the end-flaps aren't properly sealed.

Highlight surface defects with an on-axis light
An on-axis white light provides focused illumination in the same optical path as the vision sensor. The collimated light is used to highlight any raised defects on an otherwise flat surface. A defect will prevent proper sealing.

Provide even illumination with area light
When mounted at an angle, a white LED area light provides consistent and even illumination on each container lid. The angled light eliminates glare and prevents hotspots.



Area lights facilitate accurate color verification. *A white area light illuminates target highlighting color differences. A vision color sensor can easily inspect blister pack prior to final packaging.*

Lighting in the vision sensing strategy

Neglecting lighting considerations can cripple even the most sophisticated vision system. In fact, lighting is possibly the most critical factor in reliable and accurate vision sensor performance. A well-lit target will yield a high-contrast image that dramatically improves your vision sensor's repeatability, reliability and accuracy—making the difference between a successful integration, or the unfulfilled promise of high-speed visual inspection.

Within the integration process, lighting is arguably the most important step. Your choice of lighting source and fixturing can be used to accentuate or obscure features on your target. Appropriate lighting can even be used to mitigate visual noise or to accommodate other variables in the manufacturing environment.

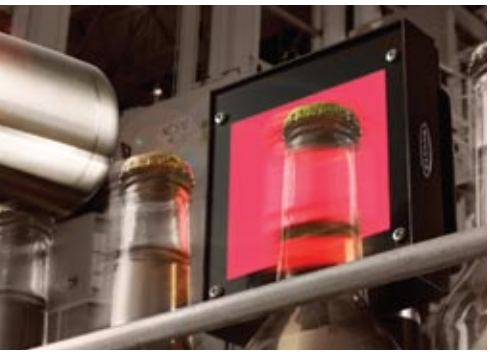
The best vision sensing strategy is driven by lighting considerations. The right lighting solution will often lower the demands on the vision system and the manufacturing infrastructure. Using proper lighting in the early stages of a system implementation reduces costs, labor and frustration.

Intelligent Design Delivers Superior Results

- **"Self-Regulation" is standard on all lighting models.** Our lights provide uniform illumination levels without the need of an external specialty power supply. Stable, consistent lighting is a requirement for the success of any inspection. With lighting from other suppliers, you'll spend on external drivers to produce stable illumination.
- **Standard "Universal Strobe" works with all vision systems.** Banner's built-in universal strobe control leads the vision lighting industry. This means our lights will easily strobe, synchronizing with any camera. Get superior performance at the price of a retrofit.
- **Banner "gets" LEDs.** With over 35 years of LED circuit design, packaging and manufacturing experience, we can confidently say we know what works in industrial sensing. And through our high volume buying, we source only the highest-quality, most-evolved components, such as LEDs that last for 50,000+ hours of maintenance-free illumination.

Global Product with Local Support

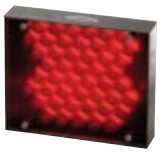
- **Wherever you are, we're there.** Banner has more than 3,000 factory and field representatives worldwide — and the largest force of application engineers in the industry — who solve thousands of the most challenging applications every year. We have the local support network to help you with questions, sales and application support.



Practical Vision Experience Means Better Lighting Solutions

- **We know lighting.** Few other lighting suppliers also engineer vision sensors. Banner understands the physics and geometry of light as well as application requirements because we've engineered vision sensors from the ground up and have solved thousands of vision applications in the process.
- **We know industry.** Banner builds solutions for the factory floor, so our lights are built to perform in punishing industrial applications. From our elegant, waterproof housings to our compact and ruggedized design, Banner components are engineered to the highest standards for performance and durability.
- **When we say "more solutions," we mean it.** Banner provides a wide variety of high quality lighting solutions for any application. You can choose from dozens of lighting configurations in five different colors with an array of filters, diffusers and mounting systems. Whatever application challenge you have, chances are we have the right solution.

Robust, proven light sources for a host of industrial

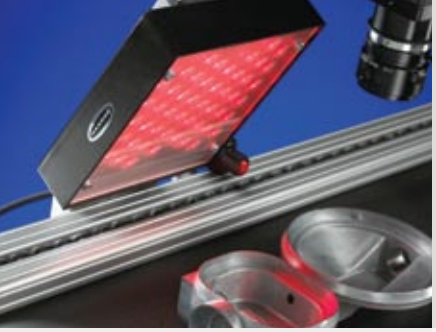
	High-Intensity **LED Area Lights** 70 mm	**LED Area Lights** 62 x 62 & 80 x 80 mm	High-Intensity **Linear Array Lights** 290 & 580 mm	**LED On-Axis Lights** 50 & 100 mm
Color (wavelength)	Page 10	Page 11	Page 12	Page 13
Red	625 nm	**62 x 62 mm:** 630 nm **80 x 80 mm:** 660 nm	625 nm	630 nm
White	5500 K	5500 K	5500 K	5500 K
Blue	470 nm	**62 x 62 mm:** 464-475 nm **80 x 80 mm:** 660 nm	470 nm	470 nm
Green	530 nm	**62 x 62 mm:** 520-540 nm **80 x 80 mm:** 525 nm	530 nm	530 nm
Infrared	850 nm	**62 x 62 mm:** 940 nm **80 x 80 mm:** 850 nm	850 nm	850 nm
Supply Voltage & Current				
Operating Voltage	24V dc ± 10%	24V dc ± 10%	24V dc ± 10%	24V dc ± 10%
Built-in; Strobe Control	5 - 24V dc (Active High or Low)	5V dc ± 10% @ 10 mA (Active Low)	5 - 24V dc (Active High or Low)	5V dc ± 10% @ 10 mA (Active Low)
Current Draw at Full Intensity — Infrared	350 mA max	**62 x 62 mm:** 24V dc @ 150 mA max **80 x 80 mm:** 24V dc @ 250 mA max	**290 mm:** 24V dc @ 800 mA max **580 mm:** 24V dc @ 1.6 A max	**50 mm:** 150 mA **100 mm:** 500 mA
Current Draw at Full Intensity — All Others		**62 x 62 mm:** 24V dc @ 200 mA max **80 x 80 mm:** 24V dc @ 250 mA max		
Construction				
Housing	Black anodized aluminum / Nickel-plated aluminum or 316 stainless steel	Steel with black zinc plating	Nickel-plated aluminum or 316 stainless steel	Black anodized aluminum
Window	Clear diffused acrylic / Clear acrylic, clear glass or clear diffused acrylic	Clear acrylic	Clear acrylic, clear glass or clear diffused acrylic	Optical glass with anti-reflective coating
Rating	IP50; NEMA 2 / IP68; NEMA 4X	IP40; NEMA 1	IP68; NEMA 4X	IP40; NEMA 1
Connection	** Suffix M, W, or Q added to model numbers denotes termination type.*			
M*	2 m 3-pin pigtail Pico QD / —	2 m 3-pin pigtail Pico QD	—	0.6 m 3-pin pigtail Pico QD
W or Q*	0.15 m 5-pin pigtail Euro QD / 5-pin integral Euro QD	2 m or 9 m 3-conductor attached cable with flying leads	5-pin integral Euro QD	—
Useful Life (LED ON time) Hours (strobing will increase life)	50,000	20,000	50,000	20,000
Operating Temperature	0˚ to +50˚ C	0˚ to +50˚ C	0˚ to +50˚ C	0˚ to +50˚ C
Effective Range — Minimum	6"	3"	24"	1"
Effective Range — Maximum	48"	**62 mm:** 12" **80 mm:** 20"	10' +	6"

vision applications.






LED Backlights 70 x 70 & 85 x 220 mm	**LED Ring Lights** 62 x 62 & 80 x 80 mm	High-Intensity **LED Ring Lights** 70 mm	**Low-Angle Ring Lights** 150 mm	High-Intensity **LED Spot Lights**	**Tubular Light** High-Frequency Fluorescent
Page 14	Page 16	Page 17	Page 18	Page 19	Page 20
660 nm	630 nm	625 nm	640 nm	625 nm	—
—	5500 K	5500 K	—	5500 K	4100 K
—	464-475 nm	470 nm	—	470 nm	—
—	520-540 nm	530 nm	—	530 nm	—
940 nm	850 nm	940 nm	880 nm	—	—
24V dc ± 10%	24V dc ± 10%	24V dc ± 10%	24V dc ± 10%	10-30V dc	24V dc, 110V ac, 220V ac or 120/277V ac
5V dc ± 10% @ 10 mA (Active Low)	5V dc ± 10% @ 10 mA (Active Low)	5 - 24V dc (Active High or Low)	5V dc ± 10% @ 10 mA (Active Low)	5V dc ± 10% @ 10 mA (Active Low)	—
70 x 70 mm: 24V dc @ 250 mA max **85 x 220 mm:** 24V dc @ 500 mA max	**62 x 62 mm:** 24V dc @ 100 mA max **80 x 80 mm:** 24V dc @ 180 mA max **62 x 62 mm:** 24V dc @ 130 mA max **80 x 80 mm:** 24V dc @ 250 mA max	350 mA max	350 mA max 500 mA max	10-30V dc @ 360 mA max	120V ac @ 0.15-0.26 A or 277V ac @ 0.07-0.11 A (Depending on bulb size/wattage)
Steel with black zinc plating	Steel with black zinc plating	Black anodized aluminum	Steel with black zinc plating	Black anodized aluminum	Acrylic
White acrylic	Clear acrylic	Clear diffused acrylic	—	Glass lens	Clear acrylic tube
IP40; NEMA 1	IP20; NEMA 1	IP50; NEMA 2	IP0; NEMA 0	IP68; NEMA 4X	IP68; NEMA 4X
0.3 m 3-pin pigtail Pico QD	0.3 m 3-pin pigtail Pico QD	0.3 m 3-pin pigtail Pico QD	2 m 3-pin pigtail Pico QD	2 m 3-pin pigtail Pico QD	—
2 m or 9 m 3-conductor attached cable with flying leads	2 m or 9 m 3-conductor attached cable with flying leads	5-pin 0.15 m pigtail Euro QD	2 m or 9 m 3-conductor attached cable with flying leads	2 m or 9 m 3-conductor attached cable with flying leads	2.5 m attached cable (unterminated or wall plug)
20,000	20,000	50,000	20,000	50,000	—
0° to +50° C	0° to +50° C	0° to +50° C	0° to +50° C	0° to +50° C	-18° to +40° C
—	3"	6"	0"	0"	4"
—	**62 mm:** 12" **80 mm:** 20"	48"	1"	18"	24"



Area Lights

Our Lights Adapt to Your Inspection

Banner area lights can be mounted within your existing inspection independent of the vision sensor's optical axis. You can change the direction or distance of the light for improved optical contrast without adding fixtures or realigning the inspected parts. Indirect lighting can improve image quality by eliminating glare and hotspots and creating shadows that highlight raised features. Our high-intensity lights deliver brighter illumination at longer ranges for the highest levels of contrast and image detail. Banner area lights are available in a variety of sizes, intensities and housings, offering a host of options to customize your solution, including IP68-rated lights.

MORE INFO ONLINE **Data Sheet:** 135621

LED High-Intensity IP68 Sealed Area Light Model Key

Voltage: **24V dc**

Light	Color	Type of Light	Size	Housing Construction	Window†	Relative Intensity		Intensity Adjustment	Connector Type
LED	R	A	70	A	D	4	—	X	Q

- **Color:** **B** = Blue; **G** = Green; **I** = Infrared; **R** = Red; **W** = White
- **Type of Light:** **A** = Area Light
- **Size:** **70** = 70 mm
- **Housing Construction:** **A** = Nickel-plated Aluminum; **SS** = 316 Stainless Steel
- **Window†:** **P** = Plastic clear; **G** = Glass clear; **D** = Diffused clear plastic
- **Intensity Adjustment:** **X** = Fixed; **P** = Potentiometer
- **Connector Type:** **Q** = 5-pin Euro* pigtail QD

* Models require a mating cordset (see page 22).
† For replacement windows and diffusers (see page 22).

Accentuate target position
A blue area light evenly illuminates and accentuates the position of toggle switches on a steering wheel component. The vision sensor can use the toggle switch positions to quickly verify the correct location and orientation of each component before it is added to a steering wheel assembly.

Detect UPC code reliably
Mobile device boxed units must be oriented correctly before they are packaged for shipping. A red area light provides the reliable detection of a UPC code which is used to ensure proper package orientation.

Create optimal contrast for character reading with a high-intensity light
A high-intensity area light creates optimal contrast for a vision sensor with OCR/OCV reading capabilities. The sensor can quickly read the 2D bar code and optical characters in order to accurately sort and route packages.

Banner Area Lights are available in sealed, IP68-rated models that withstand high-pressure washdown solutions and caustic detergents.

LED High-Intensity Area Light Model Key

Voltage: **24V dc**

Light	Color	Type of Light	Size	Housing Construction	Window††	Relative Intensity		Intensity Adjustment	Connector Type
LED	R	A	70	X	D	4	—	X	M

- **Color:** **B** = Blue, **G** = Green, **I** = Infrared, **R** = Red, **W** = White
- **Type of Light:** **A** = Area Light
- **Size:** **70** = 70 mm
- **Housing Construction:** **X** = Non-Sealed
- **Window:** **D** = Diffused clear plastic
- **Intensity Adjustment:** **X** = Fixed, **P** = Potentiometer
- **Connector Type:** **M** = 2 m 3-pin Pico pigtail QD*, **Q** = 0.15 m 5-pin Euro pigtail QD†

* Pico QD model required for *P4* sensors.
† Models require a mating cordset (see page 22).
†† For replacement windows and diffusers (see page 22).

MORE INFO ONLINE **Data Sheet:** 134756

LED Area Lights

Voltage: **24V dc**

Models†		Color	Connection*	Data Sheet 80 mm	Data Sheet 62 mm
80 x 80 mm	62 x 62 mm				
LEDRA80X80W	LEDRA62X62W	Red	2 m	115607	121779
LEDRA80X80M	LEDRA62X62M		2 m Threaded 3-pin Pico pigtail QD	116949	121780
LEDWA80X80W	LEDWA62X62W	White	2 m	115607	121779
LEDWA80X80M	LEDWA62X62M		2 m Threaded 3-pin Pico pigtail QD	116949	121780
LEDBA80X80W	LEDBA62X62W	Blue	2 m	115607	121779
LEDBA80X80M	LEDBA62X62M		2 m Threaded 3-pin Pico pigtail QD	116949	121780
LEDGA80X80W	LEDGA62X62W	Green	2 m	115607	121779
LEDGA80X80M	LEDGA62X62M		2 m Threaded 3-pin Pico pigtail QD	116949	121780
LEDIA80X80W	LEDIA62X62W	Infrared	2 m	115607	121779
LEDIA80X80M	LEDIA62X62M		2 m Threaded 3-pin Pico pigtail QD	116949	121780

MORE INFO ONLINE

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LEDRA80X80W W/30**). QD models can be connected directly to *P4* sensors; splitter cordsets available for powering two lights (see page 23).
† For replacement windows and diffusers (see page 22).

Specialty LED Area Lights

Voltage: **12V dc**

Size	Models*	Color	Connection	Data Sheet
100 x 100 mm	LEDRA100X100N	Red	1.8 m with 9-pin D-sub connector	67425
	LEDWA100X100N	White		
	LEDBA100X100N	Blue		
	LEDIA100X100N	Green		

MORE INFO ONLINE

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 23).

Linear Array Lights

Rugged, High-Intensity Lighting

If a demanding industrial environment or large inspection area is compromising your vision system performance, Banner's linear array light can help. With twice the lumens of our powerful area lights, high-intensity linear arrays effectively illuminate large areas, while cutting through dust, mist and grime. The stainless steel or nickel-plated aluminum IP68-rated housing stands up to the rigors of washdowns and corrosive cleaners.

Banner offers the linear array light in various sizes, and in four colors plus infrared, to meet any challenge. As with any of Banner's area light family, linear array lights can be easily mounted in an existing system, independent of the vision sensor. Linear arrays provide clean, bright and even illumination to create the optical contrast necessary for reliable, accurate inspections.

LED IP68 Sealed Linear Array Model Key

Voltage: **24V dc**

MORE INFO ONLINE **Data Sheet:** 127725

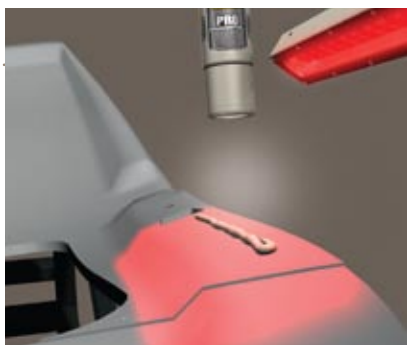
Light	Color	Type of Light	Size	Housing Construction	Window†	Relative Intensity		Intensity Adjustment	Connector Type
LED	R	LA	290	A	D	5	—	X	Q

- **Color:** **B** = Blue; **G** = Green; **I** = Infrared; **R** = Red; **W** = White
- **Type of Light:** **LA** = LInear Array
- **Size:** **290 mm**; **580 mm**
- **Housing Construction:** **A** = Nickel-plated Aluminum; **SS** = 316 Stainless Steel
- **Window†:** **P** = Plastic clear; **G** = Glass clear; **D** = Diffused clear plastic
- **Intensity Adjustment:** **X** = Fixed
- **Connector Type:** **Q** = 5-pin Euro* pigtail QD

* Models require a mating cordset (see page 22).
† For replacement windows and diffusers (see page 22).

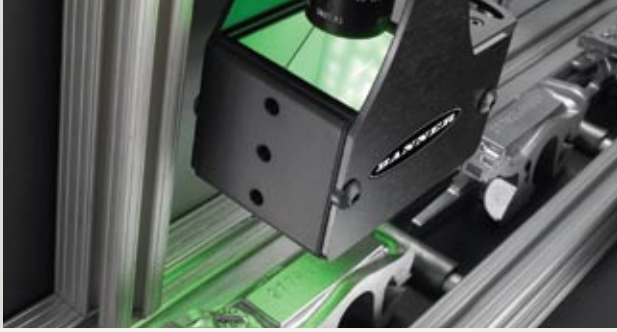
Create high-intensity illumination over a large part
A high-intensity red LED linear array light creates optimal contrast over a large automotive part so that a vision sensor can verify that the dispensed bead has been applied correctly.

Use high-intensity lighting for even illumination
Using high-intensity white linear array lights, a vision sensor recieves even and constant illumination to reliably verify the presence and quality of each rivet on an automobile steering wheel frame assembly.



More information online at **bannerengineering.com**

On-Axis Lights



A Creative Solution for Tricky Inspections

Conventional ring lights can't illuminate certain highly reflective surfaces without creating unwanted glare and hotspots. Banner's innovative on-axis light uses a beam splitter to focus light along the camera's optical axis, providing direct and diffuse light that render reflective surfaces bright, without glare. Rough surfaces or scratches appear dark.

Banner offers a number of models and options to deliver the performance you need. Choose from four visible LED colors or infrared models, and the size you need to light your field of view. An optional glass dust cover provides additional protection and makes cleaning easier in dirty industrial environments.

LED On-Axis Lights

Voltage: **24V dc**

Models†		Color	Connection*	Data Sheet
100 x 100 mm	50 x 50 mm			
LEDRO100M	**LEDRO50M**	Red	0.6 m Threaded 3-pin Pico pigtail QD	126059
LEDWO100M	**LEDWO50M**	White		
LEDBO100M	**LEDBO50M**	Blue		
LEDGO100M	**LEDGO50M**	Green		
LEDIO100M	**LEDIO50M**	Infrared		

* QD cordset with flying leads are available for connecting to models other than *P4* (see page 23).
† For models with dust cover, add suffix **-D** (example, **LEDRO100M-D**).

Specialty LED On-Axis Lights

Voltage: **12V dc**

Size	Models*	Description	Connection	Data Sheet
25 mm dia.	**LEDRO25N**	Red	0.5 m with 9-pin D-sub connector	67437
	LEDWO25N	White		
	LEDBO25N	Blue		
75 mm dia.	**LEDRO75N**	Red	0.5 m with 9-pin D-sub connector	67439
	LEDRO75N-H	Red, high output		
	LEDWO75N	White		
	LEDBO75N	Blue		

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 23).

Detect surface irregularities without unwanted glare
A white on-axis light provides even, diffused illumination useful in highlighting any surface irregularities and color differences. A vision color sensor can easily verify that each container has the correct lid.

Backlights

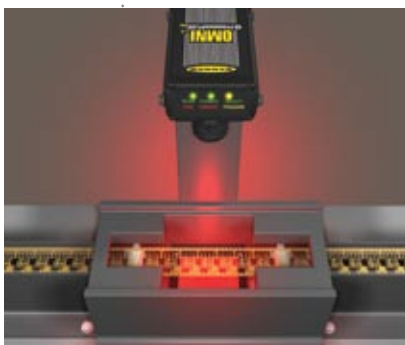
Measure and Gauge, Quickly and Accurately

No matter how small your target or how fast your line, backlights always provide more optical contrast than any other lighting solution. More contrast means the most accurate results. When placed behind the target and aimed directly towards the vision sensor, a backlight creates an image that shows a dark shadow of the part (a silhouette).

Banner backlights are available in two sizes, in either red or infrared LEDs. The high contrast images created using a backlight are ideal for high accuracy applications such as precision measurement and gauging of small parts.

Create high contrast images of target

By creating high contrast silhouettes of connector pins on a stamped metal subassembly, a red backlight improves the high-speed reliability of a counting application, which also detects bent or missing pins.



More information online at **bannerengineering.com**

LED Backlights

Voltage: **24V dc**

Models†		Color	Connection*	Data Sheet
70 x 70 mm	85 x 220 mm			
LEDRB70X70W	**LEDRB85X220W**	Red	2 m	115349
LEDRB70X70M	**LEDRB85X220M**		2 m Threaded 3-pin Pico pigtail QD	116947
LEDIB70X70W	**LEDIB85X220W**	Infrared	2 m	115349
LEDIB70X70M	**LEDIB85X220M**		2 m Threaded 3-pin Pico pigtail QD	116947

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LEDRB70X70W W/30**).
QD models can be connected directly to *P4* sensors; splitter cordsets available for powering two lights (see page 23).
† For replacement windows and diffusers (see page 22).

Specialty LED Backlights

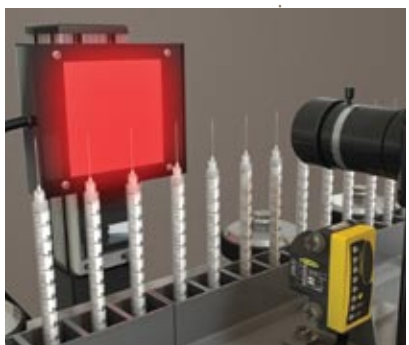
Voltage: **12V dc**

Illumination Area	Models*	Color	Connection	Data Sheet
50 x 50 mm	**LEDRB50X50N**	Red	1.8 m with 9-pin D-sub connector	67426
	LEDWB50X50N	White		
	LEDBB50X50N	Blue		
	LEDIB50X50N	Infrared		
75 x 75 mm	**LEDRB75X75N**	Red		67427
	LEDWB75X75N	White		
	LEDBB75X75N	Blue		
	LEDIB75X75N	Infrared		
100 x 100 mm	**LEDRB100X100N**	Red		67428
	LEDWB100X100N	White		
	LEDBB100X100N	Blue		
	LEDIB100X100N	Infrared		
100 x 200 mm	**LEDRB100X200N**	Red		67431
	LEDIB100X200N	Infrared		

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 22).

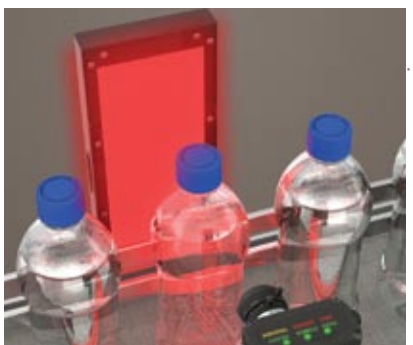
Illuminate thin and low-profile objects

A high-speed vision sensor checks syringes for missing, bent or damaged cannulae. A red backlight provides the right illumination for high contrast images, even when lighting targets as thin and low-profile as needles.



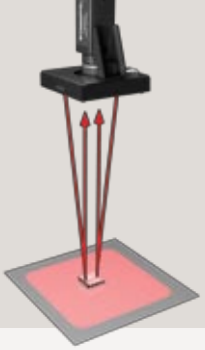
Create optimum contrast for simultaneous inspections

The general-purpose vision sensor conducts two inspections: it confirms that the cap is properly applied and it checks the bottle's fill level. A red backlight placed directly behind the bottle creates optimum contrast for these different inspections.



More information online at **bannerengineering.com**

Ring Lights



Reliable Lighting for Most Applications

The ring light is the tried-and-true standard, used most often in general vision inspections. It brightly illuminates the area directly in front of the camera, and is especially useful for small parts and in high-speed inspections. With Banner ring lights, installation and setup is easier because they mount directly on Banner *Presence*PLUS® vision sensors or to other industrial cameras.

Banner offers a large selection of ring lights with a choice of sizes and intensities, in four visible colors plus infrared.

LED *Pro* Ring Lights

Voltage: **24V dc**

Models		Color	Connection*	Data Sheet
80 x 80 mm	62 x 62 mm			
LEDRR80X80W	**LEDRR62X62W**	Red	2 m	108626
LEDWR80X80W	**LEDWR62X62W**	White		
LEDBR80X80W	**LEDBR62X62W**	Blue		
LEDGR80X80W	**LEDGR62X62W**	Green		
LEDIR80X80W	**LEDIR62X62W**	Infrared		

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LEDRR80X80W W/30**).
† For replacement windows and diffusers (see page 22).

LED *P4* Ring Lights

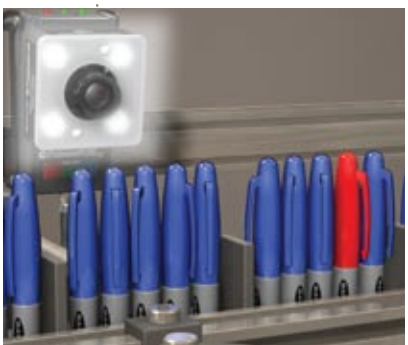
Voltage: **24V dc**

Models		Color	Connection*	Data Sheet
80 x 80 mm	62 x 62 mm			
LEDRR80X80M	**LEDRR62X62M**	Red	0.3 m Threaded 3-pin Pico pigtail QD	116941
LEDWR80X80M	**LEDWR62X62M**	White		
LEDBR80X80M	**LEDBR62X62M**	Blue		
LEDGR80X80M	**LEDGR62X62M**	Green		
LEDIR80X80M	**LEDIR62X62M**	Infrared		

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LEDRR80X80M W/30**).
† For replacement windows and diffusers (see page 22).

Illuminate bar code for high-speed scanning
A red LED ring light on a vision bar code reader facilitates accurate, high-speed scanning of a pharmaceutical product ID that meets stringent and evolving FDA requirements for traceability.

Highlight color differences with a white high-intensity light
A white high-intensity ring light illuminates target highlighting color differences. A vision color sensor can easily reject incorrect color of marker prior to packaging.



More information online at **bannerengineering.com**

LED High-Intensity Ring Lights Model Key

Voltage: **24V dc**

Light	Color	Type of Light	Size	Housing Construction	Window††	Relative Intensity		Intensity Adjustment	Connector Type
LED	**R**	**R**	**70**	**X**	**D**	**4**	—	**X**	**M**

- **Color:** **B** = Blue; **G** = Green; **I** = Infrared; **R** = Red; **W** = White
- **Type of Light:** **R** = Ring Light
- **Size:** **70** = 70 mm
- **Housing Construction:** **X** = Not sealed
- **Window††:** **D** = Diffused clear plastic
- **Intensity Adjustment:** **X** = Fixed; **P** = Potentiometer
- **Connector Type:** **Q** = 0.15 m 5-pin Euro pigtail QD*; **M** = 0.3 m 3-pin Pico pigtail QD†

* Models require a mating cordset (see page 22).
Optional bracket SMBPPRHI required for use with *Pro* sensors.
† Pico QD model required for *P4* sensors. Pico QD models include a built-in mounting bracket for use with *P4* sensors.
†† For replacement windows and diffusers (see page 22).

MORE INFO ONLINE **Data Sheet:** 134757

LED IP68 Sealed *Pro* Ring Lights

Voltage: **24V dc**

Size	Models†		Color	Housing	Connection*	Data Sheet
	Glass Window	Plastic Window				
90 mm dia.	LEDRR90S-G	LEDRR90S-P	Red	Nickel-plated Aluminum	3-pin Pico QD	128842
	LEDRR90SS-G	LEDRR90SS-P		Stainless Steel		
	LEDWR90S-G	LEDWR90S-P	White	Nickel-plated Aluminum		
	LEDWR90SS-G	LEDWR90SS-P		Stainless Steel		
	LEDBR90S-G	LEDBR90S-P	Blue	Nickel-plated Aluminum		
	LEDBR90SS-G	LEDBR90SS-P		Stainless Steel		
	LEDGR90S-G	LEDGR90S-P	Green	Nickel-plated Aluminum		
	LEDGR90SS-G	LEDGR90SS-P		Stainless Steel		
	LEDIR90S-G	LEDIR90S-P	Infrared	Nickel-plated Aluminum		
	LEDIR90SS-G	LEDIR90SS-P		Stainless Steel		

* Models require a mating cordset (see page 23).
† Lights mount to camera with M44X.8 threads. Windows are factory replaceable, contact factory at 1-888-373-6767.

MORE INFO ONLINE

Specialty Ring Lights

Voltage: **24V dc**

Size	Models	Description	Data Sheet
100 mm dia.	**HFFW5100**	100V ac Fluorescent	115969
	HFFW5100A220	220V ac Fluorescent	115970
	HFFBB	100V ac UV Fluorescent	115968

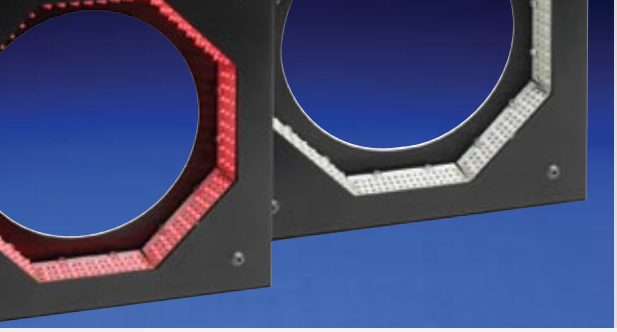
MORE INFO ONLINE

RFLBB UV fluorescent ring lamp replacement bulb, **RFLW5100** fluorescent ring lamp replacement bulb.
NOTE: Specialty lights are not stocked and are non-returnable.

Provide high-intensity illumination for optimal contrast

A blue high-intensity LED ring light provides optimal contrast between the adhesive bead and the metal background on a small automotive part. The vision sensor accurately verifies that the adhesive bead has been properly dispensed.

More information online at **bannerengineering.com**



Low-Angle Ring Lights

Reveal Surface Features or Flaws

Banner low-angle ring lights enhance the contrast of the most minute surface features, making them ideal for a number of quality, identifcation and verification applications. Low-angle ring lights are aimed nearly perpendicular to the imaged surface of the target object, casting shadows that emphasize changes in elevation, including surface irregularities or identifying characteristics such as stamped bar codes.

LED Low-Angle Ring Lights

Voltage: **24V dc**

Size	Models	Color	Connection*	Data Sheet
150 mm dia.	**LEDRI150-3W**	Red	2 m	127582
	LEDRI150-3M		2 m Threaded 3-pin Pico pigtail QD	
	LEDII150-3W	Infrared	2 m	
	LEDII150-3M		2 m Threaded 3-pin Pico pigtail QD	

* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LEDRI150-3W W/30**).
QD models can be connected directly to *P4* sensors.

Specialty LED Low-Angle Ring Lights

Voltage: **12V dc**

Size	Models*	Color	Connection	Data Sheet
100 mm dia.	**LEDRI100N**	Red	1.8 m with 9-pin D-sub connector	67432

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 23).

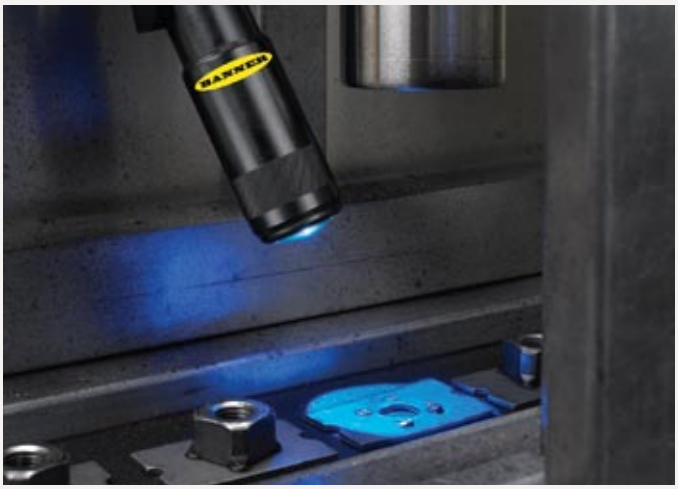
Detect and verify bar codes on metal parts

A vision bar code reader detects and verifies 2D bar codes stamped into metal parts. A red low-angle ring light with its ability to highlight height changes facilitates detection of dot-peened bar code symbols.

Accentuate surface irregularities

A red low-angle ring light illuminates the etched bar code on an IC chip. The light creates enough contrast between the different surface textures for the camera to accurately read the bar code.

Spot Lights



Get into a Tight Spot

At a mere 30 mm, Banner's compact spot lights squeeze into restricted spaces, or can be used to provide closely-focused illumination on small parts. For more concentrated light, you can also fine-tune the spot size using the built-in focus adjustment.

A well-placed spot light can effectively create shadows or highlights to boost optical contrast. Available in a range of colors, this fully submersible, IP68-rated light was designed to withstand harsh washdown and other challenging industrial environments.

LED Sealed Spot Lights

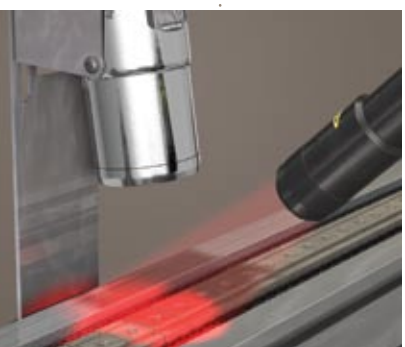
Voltage: **10 to 30V dc**

Size	Models	Color	Connection*	Data Sheet
30 mm dia.	**LEDRSW**	Red	2 m	122987
	LEDRSM		2 m Threaded 3-pin Pico pigtail QD	122986
	LEDWSW	White	2 m	122987
	LEDWSM		2 m Threaded 3-pin Pico pigtail QD	122986
	LEDBSW	Blue	2 m	122987
	LEDBSM		2 m Threaded 3-pin Pico pigtail QD	122986
	LEDGSW	Green	2 m	122987
	LEDGSM		2 m Threaded 3-pin Pico pigtail QD	122986

* For 9 m cable, add suffix **W/30** to the model number (example **LEDRSW W/30**). QD models can be connected directly to the *P4* sensors; splitter cordsets available for powering two lights (see page 23).

Highlight small parts in a small area

A compact spot light provides angled illumination in a small area. The extremely bright and even illumination highlights the absence of threads on a very small metal part.

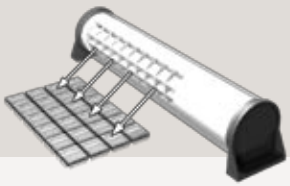


Use a single LED for extremely bright illumination

A spot light uses a single green LED to provide even, targeted illumination. A vision sensor can easily detect the presence or absence of surface features or defects.

More information online at **bannerengineering.com**

Tubular Lights



Economical Large Area Illumination

Looking for an economical solution to effectively light a large inspection area? Banner's high-frequency fluorescent tubular light provides simple, cost-effective and flicker-free illumination in a rugged, sealed housing. These lights generate diffuse and even illumination to solve a myriad of applications.

Available in both ultraviolet (UV) and white light models in both ac and dc operating voltage, fluorescent tubular lights feature integrated mounting brackets and are available with a built-in ballast or more compact models with external ballasts. Housings are waterproof and rated IP67; NEMA 4X for use in washdown environments.

Sealed Fluorescent Tubular Lights

Voltage: **Varies**

Length	Models		Voltage	Ballast	Data Sheet
	White	Black UV			
8"	**HFFW8DC**	**HFFB8DC**	24V dc	Integral	115387
8"	**HFFW8AC110**	**HFFB8AC110**	110V ac		
8"	**HFFW8AC230**	**HFFB8AC230**	230V ac		
12"	**HFFW12DC**	**HFFB12DC**	24V dc		
12"	**HFFW12AC**	**HFFB12AC**	120 to 277V ac		
14"	**HFFW14DC**	—	24V dc		
15"	**HFFW15AC110**	—	110V ac		
15"	**HFFW15AC230**	—	230V ac		
24"	**HFFW24AC**	—	120 to 277V ac		
36"	**HFFW36AC**	—	120 to 277V ac		
48"	**HFFW48AC**	—	120 to 277V ac		
8"	**HFFW8ACR**	**HFFB8ACR**	120 to 277V ac	Remote	115387
12"	**HFFW12ACR**	**HFFB12ACR**	120 to 277V ac		
15"	**HFFW15ACR**	—	120 to 277V ac		
24"	**HFFW24ACR**	—	120 to 277V ac		
36"	**HFFW36ACR**	—	120 to 277V ac		
48"	**HFFW48ACR**	—	120 to 277V ac		

Note: Replacement bulbs available, contact factory for information. All models have louvers and integral mounting flange; optional brackets are available for heavy-duty mounting (two brackets required for each light, see page 25).

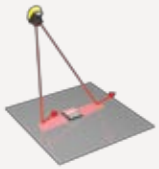
Effectively illuminate large areas

With a fluorescent tubular light illuminating the area of an entire pallet, a vision sensor can confirm if a layer of boxes is complete. The sensor will then signal the palletizer to add another layer of boxes.

Provide contrast over a large area with a fluorescent light

A fluorescent tubular light effectively illuminates a package of pastries, prior to final cartoning. The light provides enough contrast even over the large area for vision sensor to detect a package of frosting within the sensor's field of view.

Laser Emitters for Stuctured Illumination



- Provides high-contrast illumination
- Senses surface height differences
- Provides 3D inspection with a 2D camera

Laser Emitters

Voltage: **10 to 30V dc**

Model	Description	Connection*	Data Sheet
QS186LE212	Extra Bright Horizontal Line (Class 2)	2 m	109415

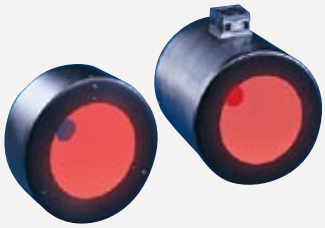
* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QS186LE212 W/30**).

Specialty LED Highly Diffused Lights

- Minimizes glare and shadows
- Illuminates curved surfaces softly and evenly
- Minimizes texture

Highly Diffused Lights

Voltage: **12V dc**



Size	Model*	Description	Connection	Data Sheet
150 mm dia.	**LEDRD150N**	**Red**, dome	1.8 m with 9-pin D-sub connector	66955
25 x 25 mm light aperture	**LEDRS25N**	**Red**, on-axis	0.5 m with 9-pin D-sub connector	67441
59 x 75 mm light aperture	**LEDRS75N**	**Red**, on-axis		67442
	LEDGS75N	**Green**, on-axis		

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 23).

Specialty LED Multi-Lights

- Provides multiple angles and highly diffused lighting

Multi-Lights

Voltage: **12V dc**

Size	Model*	Description	Connection	Data Sheet
50 mm dia.	**LEDRM50N**	**Red**, low-angle & on-axis	1.8 m with 9-pin D-sub connector	67435
	LEDRM50N-H	**Red**, low-angle & on-axis, high output		67436
75 mm dia.	**LEDRM75N**	**Red**, low-angle & on-axis		67443
150 mm dia.	**LEDRC150N**	**Red**, low-angle & on-axis multi-light		67444
200 mm dia.	**LEDRC200N**	**Red**, low-angle & on-axis multi-light		

NOTE: Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 23).

Polarizing Filter Kits, Window Replacements and Lighting Diffusers

	Models	Description	Data Sheet
Filters	LEDRRPFK	Polarizing filter kit for 80 x 80 Ring Lights	108945
	LEDRRPFKS	Polarizing filter kit for 62 x 62 Ring Lights	108945
	LEDAPFK	Polarizing filter kit for 80 x 80 Area Lights and 70 x 70 Backlights	113657
	LEDAPFKS	Polarizing filter kit for 62 x 62 Area Lights	113657
	LEDRPFK90	Polarizing filter kit for Sealed Ring Lights	129871
	LEDFLTK	Kit with a variety of filters, diffusers and window replacements	—
	LEDLAPFK290S	Polarizing filter kit for 290 mm Linear Array Lights	137942
	LEDLAPFK580S	Polarizing filter kit for 580 mm Linear Array Lights	137942
	LEDAPFK70	Polarizing filter kit for 70 mm High-Intensity Area Lights	137941
	LEDRPFK70	Polarizing filter kit for 70 mm High-Intensity Ring Lights	137940
	LEDAPFK70S	Polarizing filter kit for 70 mm IP68 High-Intensity Area Lights	137939

	Models	Use With
Clear Plastic	LEDRCW	80 x 80 mm Ring Lights
	LEDRCWS	62 x 62 mm Ring Lights
	LEDAW	80 x 80 mm Area Lights
	LEDAWS	62 x 62 mm Area Lights
	LEDA70SW-P	70 mm Sealed High-Intensity Area Lights
	LEDLA290SW-P	290 mm Sealed Linear Array Lights
	LEDLA580SW-P	580 mm Sealed Linear Array Lights
Clear Plastic Diffuse	LEDRCDW	80 x 80 mm Ring Lights
	LEDRCDWS	62 x 62 mm Right Lights
	LEDR70CDW	70 mm High-Intensity Ring Lights
	LEDA70CDW	70 mm High-Intensity Area Lights
	LEDA70SCDW-P	70 mm Sealed High-Intensity Area Lights
	LEDLA290SCDW-P	290 mm Sealed Linear Array Lights
	LEDLA580SCDW-P	580 mm Sealed Linear Array Lights
Clear Glass	LEDLA290SW-G	290 mm Sealed Linear Array Lights
	LEDLA580SW-G	580 mm Sealed Linear Array Lights
	LEDA70SW-G	70 mm Sealed High-Intensity Area Lights
White Plastic	LEDBW	70 x 70 mm Red Backlights
	LEDBIW	70 x 70 mm Infrared Backlights
	LEDBWL	85 x 220 mm Red Backlights
	LEDBIWL	85 x 220 mm Infrared Backlights
White Plastic Diffuse	LEDRDW	80 x 80 mm Ring Lights
	LEDRDWS	62 x 62 mm Ring Lights
	LEDADW	80 x 80 mm Area Lights
	LEDADWS	62 x 62 mm Area Lights
	LEDA70SWDW-P	70 mm Sealed High-Intensity Area Lights
	LEDLA290SWDW-P	290 mm Sealed Linear Array Lights
	LEDLA580SWDW-P	580 mm Sealed Linear Array Lights

5-Pin Euro QD Cordsets

Straight, Female

End View	Model	Length	Dimensions	Used With
1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray	MQDC20-506	2 m	ø 15 mm M12 x 1 44 mm max.	• High Intensity Area Lights • High Intensity Ring Lights • Sealed Linear Array Lights NOTE: Except Stainless steel models
	MQDC20-515	5 m		
	MQDC20-530	9 m		

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut

End View	Model	Length	Dimensions	Used With
1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray	MQDC20SS-506	2 m	ø 15 mm M12 x 1 44 mm max.	• Sealed High Intensity Area Lights • Sealed Linear Array Lights NOTE: Stainless steel models
	MQDC20SS-515	5 m		
	MQDC20SS-530	9 m		

Cable: PVC jacket, PUR (polyurethane) connector body, 316 stainless steel coupling nut

3-Pin Pico QD Cordsets

Straight, Female

End View	Model	Length	Dimensions	Used With
1 = Brown 3 = Blue 4 = Black	**PKG3M-2**	2 m	34.7 mm, M8 x 1, ø 9.6 mm	• IP68 Sealed Ring Lights (Nickel-plated) • On-axis Lights
	PKG3M-4	4 m		
	PKG3M-7	7 m		
	PKG3M-10	10 m		

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut

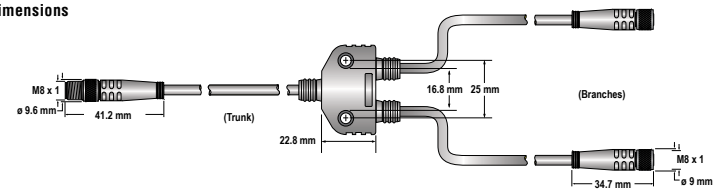
End View	Model	Length	Dimensions	Used With
1 = Brown 3 = Blue 4 = Black	**PKGV3M-4**	4 m	34.7 mm, M8 x 1, ø 9.6 mm	• IP68 Sealed Ring Lights (Stainless Steel)
	PKGV3M-7	7 m		
	PKGV3M-10	10 m		

Cable: PVC jacket, PUR (polyurethane) connector body, 316 stainless steel coupling nut

3-Pin Pico Splitter Cordset

End View	Model	Branches	Trunks	Used With
Female Male 1 = Brown 3 = Blue 4 = Black	**CSB-M831M831**	3-Pin Pico QD 2 x 0.2 m Female	0.2 m Male	Ring Lights, Area Lights, Spot Lights and Backlights

Dimensions



Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut.

Light Interface Module

Voltage: **24V dc**

Model	Strobe Output	Description	Used With	Data Sheet
PPLIM	5V @ 10 mA max.	Allows strobe operation of Banner vision lighting with any vision sensor or system	Vision Lights	128190

Continuous Power Supplies*

Model	Input	Input Cord	Outputs	Output Cable	Used With	Data Sheet
PSA-12	100-250V ac 50/60 Hz	North America (NEMA 5-15)	12V dc ±5% with voltage regulation of ±1% 3.5 A max.	1.8 m Terminated with 9-pin D-sub connector (female pins)	Continuous LED Lights	67445
PSA-12E		Cont. Europe (Schuko CEE 7)				
PSA-24	100-250V ac 50/60 Hz	North America (NEMA 5-15)	24V dc ±5% with voltage regulation of ±1% 2.2 A max.	1.8 m Terminated with 9-pin D-sub connector (female pins)	Continuous LED Lights	67447
PSA-24E		Cont. Europe (Schuko CEE 7)				
PSDINA-24 (DIN-rail mountable)	115-230V ac (Auto Select)	—	24V dc @ 2.5 A max.	—	*P4, Pro* & Lights	—

PSA..

PSDINA-24

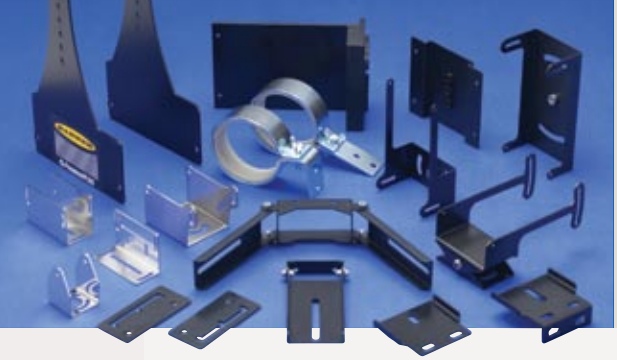
Lighting Variable Power Supplies*

Model	Input	Input Cord	Outputs	Output Cable	Used With	Data Sheet
PS2V-12	100-140V ac 60 Hz	North America (NEMA 5-15)	2-channels 6-12V dc	1.8 m Terminated with 9-pin D-sub connector (female pins)	Continuous LED Lights	67449
PS2V-12E	200-250V ac 50 Hz	Cont. Europe (Schuko CEE 7)	2 A max. per channel			

Lighting Power Supply Extension Cables*

Model	Length	Input Cord	Used With
DB906	1.8 m	Cable powers one continuous light (one end male pins and one end female; both ends terminated with 9-pin D-sub connector)	Continuous LED Lights
DB910	3.0 m		
DB9Y	1.8 m	Cable powers two continuous lights with one supply (9 m trunk with male connector and 9 m branches with female connector; ends terminated with 9-pin D-sub connector)	Continuous LED Lights
DB906S	1.8 m	Cable powers one strobed light (one end male pins and one end female; both ends terminated with 9-pin D-sub connector)	Strobed LED Lights
DB910S	3.0 m		
DB9YS	1.8 m	Cable powers one strobed light (9 m trunk with male connector and 9 m branches with female connector; ends terminated with 9-pin D-sub connector)	Strobed LED Lights

* These products are not stocked and are non-returnable.



Mounting Systems and Lighting Brackets

Adjustable Mounting Systems

SMBPPLK SMBPPK6 SMBPPK3 SMBPPF1 & SMBPPFB

Model	Description	Used With
SMBPPK3	3" Column, Base, and Knuckle Kit	Vision Lights
SMBPPK6	6" Column, Base, and Knuckle Kit	
SMBPPK	Mounting Bracket Knuckle	
SMBPPKE3	3" Column	
SMBPPKE6	6" Column	
SMBPPKB	Mounting Bracket Base	
SMBPPLK	2" Mounting Knuckle Assembly	
SMBPPF1	Bogen Arm with Single Knob	
SMBPPFB	Bogen Arm Clamp	

Brackets

Area Lights

80 x 80 mm

SMBABM
Surface-mount bracket for mounting light from front

SMBACM*
Column-mount bracket with locking pivot

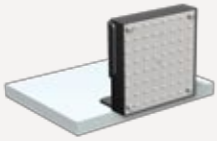
SMBP4ASM**
For mounting one area light to the *P4* housing

SMBP42ASM**
For mounting two area lights to *P4* housing

70 x 70 mm

SMBASCM*
Column-mount bracket with locking pivot

62 x 62 mm



SMBVLA62X62RA
For mounting an area light at a right angle

SMBVLA62X62S
Surface-mount bracket for mounting light from front

SMBP4ASM
For mounting one area light to the *P4* housing

SMBP42ASM
For mounting two area lights to *P4* housing

** Shown with optional SMBPPK6 mounting kit.*
*** Requires one SMBACM bracket with each light.*

Backlights

70 x 70 mm

SMBABM
Surface-mount bracket for mounting light from front

SMBACM*
Column-mount bracket with locking pivot

Sealed Linear Array

SMBLASRA
Right-angle metal bracket

Tubular Fluorescent Lights

SMBWFTLS
In-line bracket

SMBWFTLR
Right-angle bracket

Ring Light

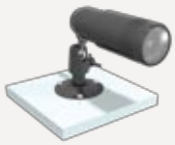
70 x 70 mm

SMBPPRHI
For mounting light to *Pro* camera

Spot Lights

SMBP4ASM
For mounting spot light to *P4* housing

SMBP42ASM
For mounting two spot lights to *P4* housing



SMBPPLK
2" pivoting knuckle assembly for spot light

On-Axis Lights

100 mm

SMBP4OAL100
For mounting on-axis light to *P4* housing

50 mm

SMBP4OAL50
For mounting on-axis light to *P4* housing

100 mm

SMBPPOAL100
For mounting on-axis light to *Pro* housing

50 mm

SMBPP4OAL50
For mounting on-axis light to *Pro* housing

** Shown with optional SMBPPK6 mounting kit (see page 24).*

Vision Lighting

MORE INFO ONLINE *Choosing Lighting*

A vision sensor captures an image and then electronically analyzes it for information. The reliable operation of a vision sensor depends on the image's optical contrast. Dedicated illumination can guarantee constant, consistent contrast. The following factors will help you more effectively choose the right light for your inspection:

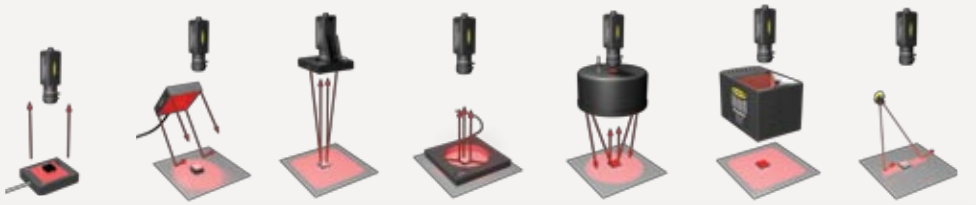
1) Optical properties of the part and its background
2) Lighting geometry
3) Lighting techniques

Optical Properties of a Target

Optical properties of a part must be used in conjunction with lighting to highlight features.

MORE INFO ONLINE *Lighting Techniques*

The main goal of lighting in a vision application is to create contrast between the feature(s) of interest and the background.



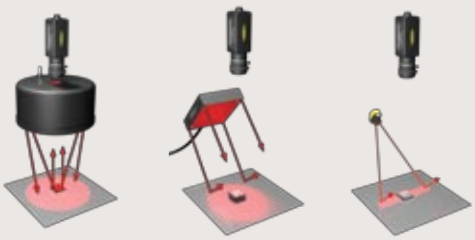
Optical Properties	Example Parts	Backlight	Directional	Ring	Low-Angle	Diffused	On-Axis	Structured
Shape	Notches Stampings Embossing	Highlights outlines and profiles	Casts shadows to highlight height changes	—	Height changes are bright. Flat surfaces are dark	Lowers contrast between shapes	Flat surfaces are bright. Height changes are dark	Highlights changes in height on part
Surface Texture	Polished metal Sandpaper	—	Textured surfaces are bright. Smooth surfaces are dark	—	Diffuse surfaces are brighter than reflective	Lowers contrast between reflective and textured surfaces	Reflective surfaces are brighter than diffuse	—
Color	Wires Printing Plastic UV Coatings	—	Based on target color	Based on target color	—	Based on target color	Based on target color	—
Translucency	Drilled hole Plastics	Solid parts block light, clear parts transmit light	—	—	—	—	—	—

Lighting Geometry

MORE INFO ONLINE *Lighting Geometry*

The geometry of propagation refers to how light energy leaves the source. Light can come from a point, diffuse or collimated source. When you understand how to manipulate lighting geometry, you can:

- Maximize features of interest
- Eliminate glare
- Eliminate hotspots
- Minimize unimportant features



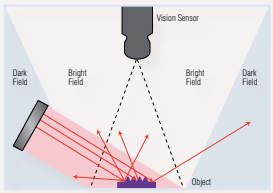
Diffuse Source | Collimated Source | Structured Source

Lighting Techniques

Lighting techniques refer to how the light source is mounted in relation to the target object and the sensor.

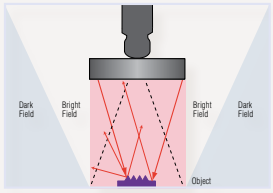
Dark-Field: Illuminate objects with indirect light.

- Casts shadows
- Highlights height changes
- Textured surfaces are bright



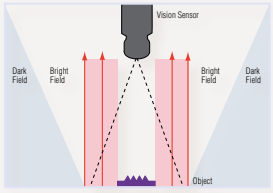
Bright-Field: Illuminate objects with direct light.

- Detect color change
- Smooth surfaces are bright



Backlight: Transmit light from behind the object.

- Highlights outlines and profiles
- Highest contrast



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