

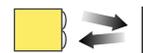
# R55 Color Mark Sensor

Color Registration Mark Sensor with Solid-State White Light Source



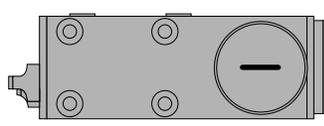
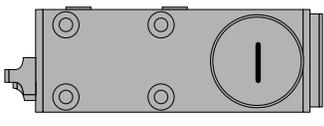
## R55 Features

- Outstanding color contrast sensitivity; detects 16 gray scale changes
- Reliably detects the toughest color mark contrasts, including 20% yellow against white
- Totally solid-state: no bulbs to replace and no need to switch between different colored light sources
- Rugged zinc alloy die-cast housing with high-quality acrylic lens suitable for food processing applications; rated IP67, NEMA 6
- Fixed-convergent sensing at 10 ±3 mm (0.39 ±0.12 inch); rectangular sensing image measures 1.2 mm x 3.8 mm (0.05" x 0.15") at 10 mm from the lens
- 50 microsecond sensing response (10,000 operations per second)
- 10 to 30V dc operation; all models offer both NPN and PNP digital outputs, plus 0 to 10 mA analog output
- Switch-selectable light or dark operate; selectable output timing functions: 50 ms off-delay; 50 ms non-retriggerable one-shot, and 100 ms retriggerable one-shot
- 15-turn sensitivity control permits accurate setup; 10-element light bar signal strength display makes setup easy and fast
- Choose models with either horizontal or vertical sensing image (see chart below)
- 2 meter (6.5') integral cable or 5-pin euro-style 300 mm (12") pigtail quick disconnect; 9 meter (30') integral cable is also available



Visible white, 450-650 nm

## R55 Convergent Mode

Models	Focus	Cable	Supply Voltage	Output Type	Sensing Image Orientation
R55CW1	10 mm (0.39")	2 m (6.5')*	10-30V dc	Bipolar NPN/PNP  Analog 0-10 mA	Parallel to sensor length 
R55CW1Q		Integral 5-pin Euro-Style QD**			
R55CW1QP		5-pin Euro-Style pigtail QD**			
R55CW2		2 m (6.5')*			Perpendicular to sensor length 
R55CW2Q		Integral 5-pin Euro-Style QD**			
R55CW2QP		5-pin Euro-Style pigtail QD**			

For R55 Sensors:

\* 9 m (30') cables are available by adding suffix "W/30" to the model number of any cabled sensor (e.g., **R55CW1 W/30**)

\*\* A model with a QD connector requires an accessory mating cable. See the Accessories section on page 8 for more information.

# R55 Color Mark Sensor – White LED

## Product Description

The R55 offers maintenance-free solid-state reliability, with the sensing performance until now offered only by short-lived incandescent color mark sensors. The R55 reliably detects all color contrasts found in common product registration color mark applications – even such extremely low contrasts as 20 percent yellow printed on white. In addition, a white LED light source and hybrid optics eliminate the need to switch between different color light sources for different color contrasts.

50 microsecond sensing response produces excellent registration repeatability, even in ultra-high-speed applications. This fast response, coupled with the small 0.05" x 0.15" sensing image, allows color marks to be made small and inconspicuous.

The R55 has built-in pulse-stretching output timing logic to permit reliable interfacing to slower inputs, such as those associated with some programmable logic controllers (PLCs). A 4-position DIP switch is accessed beneath the tethered switch cap (see figure 2). Switch #1 selects light operate (outputs energize when the lighter of the two colors is sensed) or dark operate (outputs energize when the darker of the two colors is sensed). Switch #2 selects a 50 millisecond non-retriggerable one-shot pulse. Switch #3 selects a 50 millisecond off delay. When switches #2 and #3 are both turned to OFF, the output is a 100 millisecond retriggerable one-shot.

The R55 offers a 10-element moving LED light bar which displays signal strength, relative to the switch point setting. The display is invaluable during setup (see "Sensitivity Adjustment" on page 5). Switch #4 is used to disable the light bar display during normal operation, if desired.

The sensor has two bipolar outputs: one sinking (NPN) and one sourcing (PNP). Both switching outputs will switch loads up to 150 mA. A third dedicated 0 to 10 mA analog output may be used for applications such as measuring or monitoring surface brightness or texture. See Specifications and Hookup (pages 6-7) for more information.

The construction of the R55 is extremely robust with a die-cast metal housing, plastic optics, and IP67 and NEMA 6 leakproof design for harsh sensing environments.

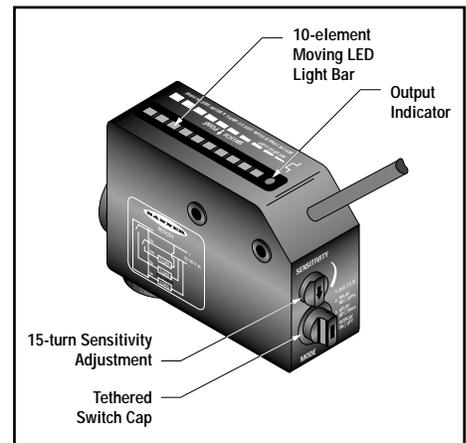
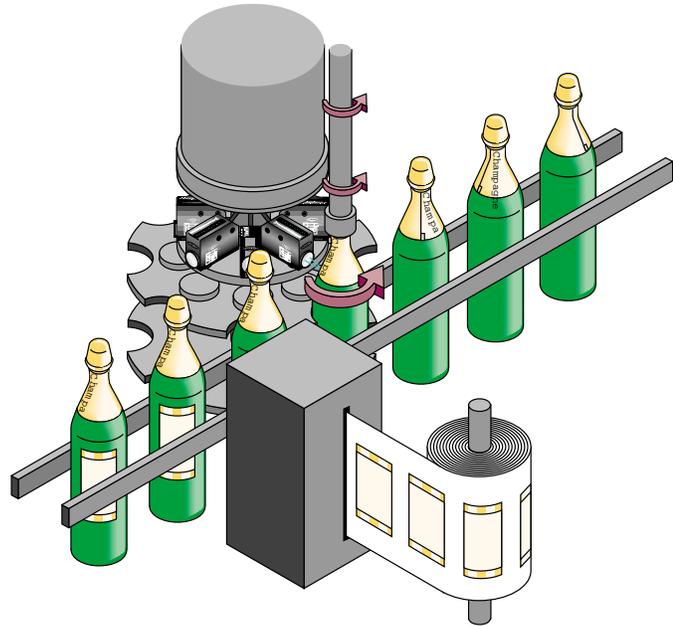
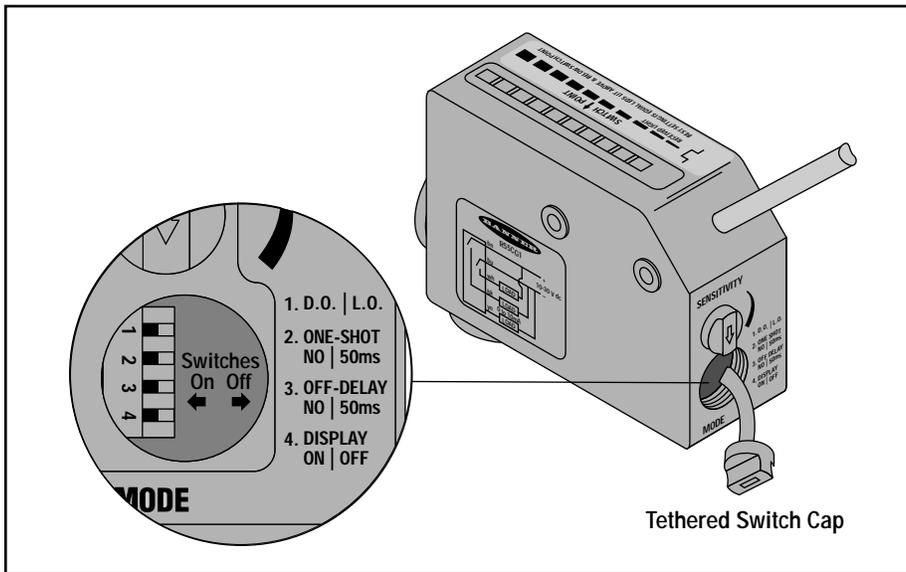


Figure 1. R55 Features

## R55 Mode Settings



The four switches located behind the tethered cap labeled "MODE" are used to select the functions shown in the table below.

Figure 2. R55 Mode Settings

## R55 DIP Switch Setting Configurations

Switch	Function	Description
1	ON = Dark Operate (D.O.) OFF = Light Operate (L.O.)	Switching outputs energize at transition from light to dark Switching outputs energize at transition from dark to light
2	ON = no one-shot timer OFF = 50 millisecond non-retriggerable one-shot	
3	ON = no OFF delay timer OFF = 50 millisecond OFF delay timer	
2 & 3	ON = no output timer OFF = 100 millisecond retriggerable one-shot	
4	ON = 10-element light bar display is enabled OFF = 10-element light bar display is disabled	

NOTE: Factory setting is all switches in ON position.

# R55 Color Mark Sensor – White LED

## Lens Location

The lens of the R55 may be installed at either of two lens ports (see Figure 3). The lens and the lens port cap are both threaded and may be exchanged by hand; no tools are required. The lens and cap both include an o-ring seal.

## Mounting

The R55 includes a total of eight size M5 threaded holes used for mounting (see dimension drawing on page 8). These threaded holes are positioned to match the mounting hole patterns found on competitive color mark sensors. The R55 includes four M5 x 0.8 x 6 mm stainless steel cap screws and a hex key wrench.

The R55 focus is located at 10 mm (0.39") ahead of the lens surface. The R55 must be mounted within 3 mm (0.12") of this distance from the surface of the material for reliable sensing (Figure 3).

### Consider the following when mounting the R55:

- 1) When sensing a color mark on a reflective (shiny) material, mount the R55 at an angle which places the lens centerline at approximately 15° off perpendicular to the material's surface (see Figure 4b). This "skew angle" will minimize strong direct reflections (which tend to overwhelm the sensor), and allow the sensor to discern the relatively small optical contrast offered by difference in colors.
- 2) Clear materials are poor reflectors of light. When sensing a mark printed on a clear material (e.g., a clear poly web), position a reflective surface directly behind the clear material which will return light to the R55. The printed mark, regardless of its color, then becomes the dark condition, as it blocks the light from reaching the reflective surface. Most clear materials are also shiny; it is important also to include a 15° skew angle when sensing clear materials (Figure 4b).
- 3) Whenever possible, it is a good idea to sense a web material at a location where it passes over a tension bar or roller, to minimize the adverse affects of web "flutter" or sag (Figure 4a).

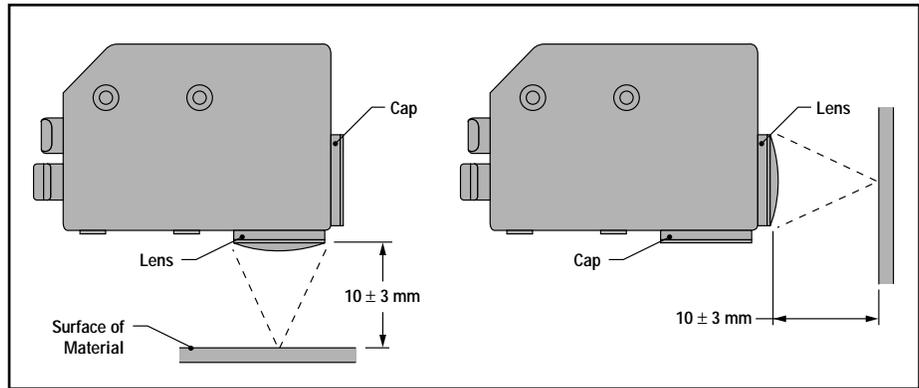


Figure 3. R55 Lens Positions

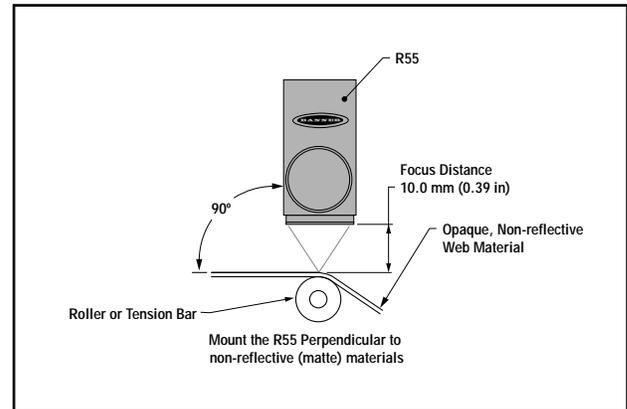


Figure 4a. Mounting for sensing opaque non-reflective materials

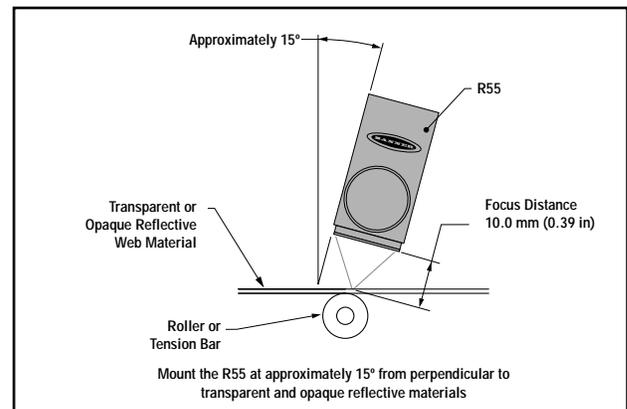


Figure 4b. Mounting for sensing opaque reflective and transparent materials

## Sensitivity Adjustment

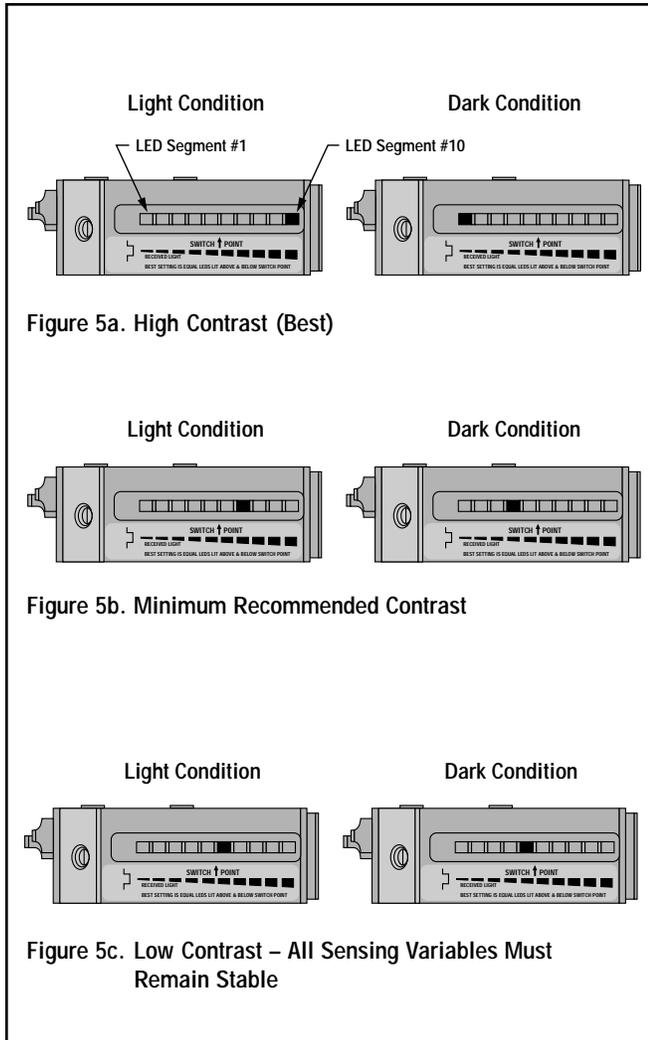


Figure 5. Sensitivity Adjustment; Light and Dark Condition Settings Should be Equally Spaced from the Switch Point

The 10-element moving LED light bar displays received light signal strength, relative to the switch point setting. This display makes sensitivity adjustment extremely easy and accurate.

Every color registration mark application involves sensing the difference between two colors, which relates, optically, to differentiating between two gray scale levels (one color returns more reflected light to the sensor than the other). The condition which returns the greater amount of light is referred to as the “light condition.” The light condition is usually obvious to the eye. However, the light bar displays exactly how the sensor “sees” the difference between the color mark and its background.

The “Switch Point” is electronically maintained between segments 5 and 6 of the 10-element moving LED light bar display (Figure 5a). The digital outputs switch whenever there is a transition across the “Switch Point” (in either direction).

After mounting the R55 (see page 4), apply power to the sensor. Hookup information is shown on a side label of the R55, and on page 7. Alternately present the light and the dark conditions to the R55, and adjust its Sensitivity so that the “Switch Point” is centered between the light bar readings for the two sensing conditions (Figure 5).

NOTE: The Sensitivity adjustment is a 15-turn potentiometer which is clutched at both ends to prevent damage. It “free-wheels” at both the top and the bottom end of its adjustment range. (Clockwise rotation increases sensitivity.)

## Sensing Contrast

In any photoelectric application, the difference in received light level between the light and dark conditions is called the optical *contrast*. In general, the greater the contrast, the more reliable the sensing application will be and the more forgiving the sensor will be to sensing variables such as vibration of the material being sensed.

Contrast is indicated on the light bar by the distance between the light condition and the dark condition; they should be equally spaced on either side of the Switch Point. The best possible contrast is displayed when the light condition displays at segment 10 (far right) and the dark condition displays at segment 1 (far left). The minimum recommended sensing contrast for most applications will display two segments above and below the Switch Point. Sensing for a contrast which registers at segments 5 and 6 should be reserved for applications which are perfectly stable (where no sensing variables such as vibration, color variations, surface variations, etc. are allowed). See Figure 5.

# R55 Color Mark Sensor – White LED

## R55 Color Mark Sensor (White LED) Specifications

<b>Supply Voltage and Current</b>	10 to 30V dc (including 10% maximum ripple) at less than 70 mA (exclusive of load)
<b>Supply Protection Circuitry</b>	Protected against reverse polarity and transient voltages
<b>Output Configuration</b>	Digital outputs are bipolar: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor  Analog output is a current source which is proportional to the received light level
<b>Output Rating</b>	Digital outputs are 150 mA maximum (each) <b>Off-state leakage current</b> <10 microamps at 30V dc <b>Saturation voltage</b> (NPN output) <2.0V at 150 mA dc <b>Saturation voltage</b> (PNP output) <1.5V at 150 mA dc  Analog output: 0 to 10 mA Maximum load voltage drop is $V_{\text{supply}}$ minus 7 volts (3V at $V_{\text{supply}} = 10\text{V}$ ; 23V at $V_{\text{supply}} = 30\text{V}$ )
<b>Output Protection Circuitry</b>	All outputs are protected against false pulse on power-up and continuous overload or short circuit of outputs
<b>Output Response Time</b>	<50 microseconds ON and OFF with no output delay timing selected (NOTE: 100 millisecond delay on power-up; NPN & PNP outputs are non-conducting at this time)
<b>Sensing Image</b>	Rectangular: 1.2 mm x 3.8 mm (0.05" x 0.15") at 10 mm (0.39") from face of lens; image oriented either parallel or perpendicular to sensor length, depending on model (see page 1)
<b>Adjustments</b>	15-turn Sensitivity control with external knob Four DIP switches select the following functions: Switch #1: Light or dark operate Switch #2: 50 millisecond non-retriggerable one-shot Switch #3: 50 millisecond off delay Switches #2 and #3: 100 millisecond retriggerable one-shot Switch #4: Enable/disable for 10-element light bar
<b>Indicators</b>	10-element green moving LED light bar displays signal strength, relative to the switch point setting Green LED output indicator
<b>Construction</b>	Zinc alloy die-cast housing with steel cover, both with black acrylic polyurethane finish Lens, lens port cap, Sensitivity control, and Mode switch cap are o-ring sealed Lens and light bar display window are acrylic Lens port cap and lens holder are ABS Mode switch cap is Delrin® Sensitivity control knob is Nylon
<b>Environmental Rating</b>	NEMA 6, IP67
<b>Connections</b>	PVC-jacketed 5-conductor 2 m (6.5') or 9 m (30') attached cable, or 5-pin Euro-style quick disconnect on 300 mm (12") cable pigtail. Mating QD cables are purchased separately. See Accessories section, page 7.
<b>Operating Temperature</b>	<b>Temperature:</b> -10° to +55°C (+14° to 131°F) <b>Maximum relative humidity:</b> 90% at 50°C (non-condensing)
<b>Vibration and Mechanical Shock</b>	All models meet IEC 68-2-6 and IEC 68-2-27 testing criteria.
<b>Application Notes</b>	Mount sensor at approximately a 15° angle when sensing color marks on shiny, reflective materials (do not mount sensor exactly perpendicular to shiny material surfaces).  Minimize web or product "flutter" whenever possible for greatest sensing reliability.
<b>Certifications</b>	

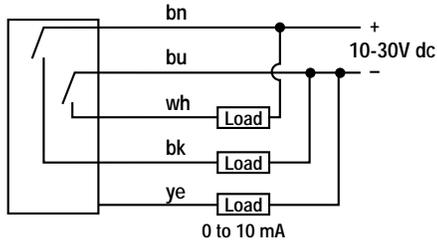
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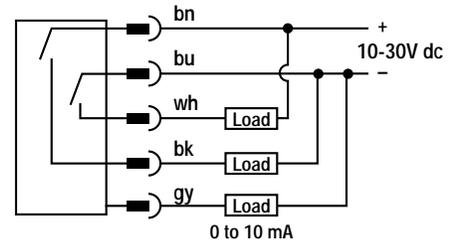
# R55 Color Mark Sensor – White LED

## R55 Hookup Diagrams

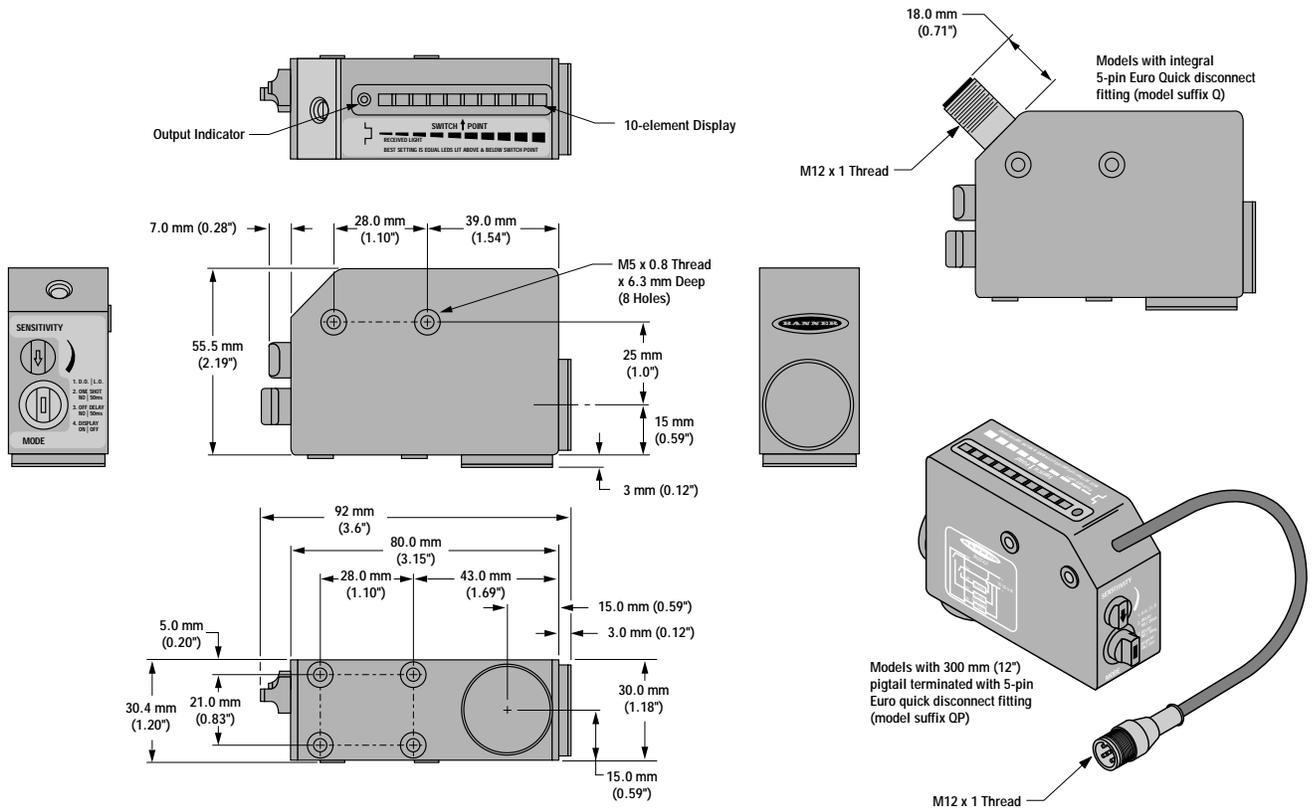
R55 Sensor  
with Attached Cable



R55 Sensor  
with Quick Disconnect



## R55 Color Mark Sensor Dimensions



## Quick-Disconnect (QD) Cables

Style	Model	Length	Connector	
5-Pin Euro	MQDC1-506	2 m (6.5')	Straight	
	MQDC1-515	5 m (15')	Straight	
	MQDC1-530	9 m (30')	Straight	
	MQDC1-506RA	2 m (6.5')	Right-angle	
	MQDC1-515RA	5 m (15')	Right-angle	
	MQDC1-530RA	9 m (30')	Right-angle	

# R55 Color Mark Sensor – White LED

<b>SMB55F</b>	<ul style="list-style-type: none"> <li>• 12-ga. 300 series stainless steel</li> <li>• Flat-mount bracket</li> </ul>	<b>SMB55A</b>	<ul style="list-style-type: none"> <li>• 12-ga. 300 series stainless steel</li> <li>• 15° offset bracket</li> </ul>
<b>SMB55RA</b>	<ul style="list-style-type: none"> <li>• 12-ga. 300 series stainless steel</li> <li>• Right-angle bracket</li> </ul>	<b>SMB55S</b>	<ul style="list-style-type: none"> <li>• 12-ga. 300 series stainless steel</li> <li>• 15° offset bracket</li> </ul>

**WARRANTY:** Banner Engineering Corp. warrants its products to be free from defects for one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.



## WARNING . . . Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products catalog for safety products which meet OSHA, ANSI and IEC standards for personnel protection.