

QC50 Series True Color Sensor



Datasheet

Compact, Self-Contained, Three-Output Color-Differentiating Sensor



- Two versions for application flexibility: QC50 models for most applications, and QCX50 models for more challenging applications
- Compact, self-contained design
- Analyzes and compares color to color, or varying intensities of one color
- QCX50 models excel in challenging applications, such as differentiating dark blue from black
- Easy-to-set programming options for 1, 2, or 3 colors
- Three programming parameters: channel, sensing mode, and tolerance level
- 10 tolerance levels to allow for product variation
- Output OFF-delay (6 options); selection applies to all three color channels
- Gate mode option (also called inhibiting, synchronization, or windowing)



WARNING: Not To Be Used for Personnel Protection

Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

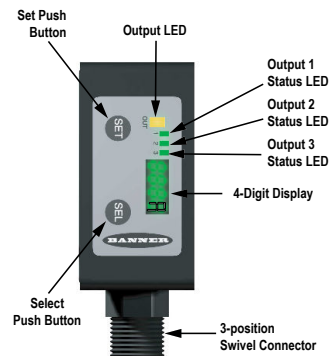
Models

Model	Sensing Range	Cable/ Connector ¹	Sensing Response Time	Output Type
QC50A3P6XDWQ	20 mm (0.8 inch) typical; varies according to sensor configuration	8-pin M12/Euro-style swivel QD connector	335 μ s	PNP, 3 channels
QC50A3N6XDWQ				NPN, 3 channels
QCX50A3P6XDWQ			Selectable 5 ms or 1 ms	PNP, 3 channels
QCX50A3N6XDWQ				NPN, 3 channels

Overview

The easy-to-use QC50 series true color sensor uses modulated white light with red, green, and blue (R, G, B) electronic filters to scan for the presence of one, two or three colors. Its compact size allows it to be mounted almost anywhere. Configuration options include Programming mode for color detection parameters and Setup mode for selecting an adjustable output OFF-delay or selecting between two response speeds (some models). Three solid-state outputs may be set individually for color differentiation or for color-plus-intensity differentiation (see [Program the Sensor](#) on page 2).

The sensor has two push buttons, Set and Select, plus a 4-digit LED display, an Output LED, and three Output Status LEDs (one for each sensing output), for easy programming and status monitoring during operation. The push buttons can be locked for security (see [Disable the Push Buttons](#) on page 4).



¹ Models with a quick disconnect require a mating cordset.



Configuration Instructions

Program the Sensor

Programming mode determines the colors the sensor will detect for each of the three outputs. Repeat the following steps for each output. The procedure is identical for all models.

The sensor has a 12-second time-out. If more than 12 seconds elapses between steps, sensor returns to Run mode without saving the settings.

The QC50 can be programmed to sense one, two, or three colors. Three outputs are available for this purpose. When a programmed color is sensed, the yellow Output ("OUT") indicator LED and the associated green Output Status LED turn ON, and the respective output conducts.

Sensing Modes—The Sensor functions in one of two sensing modes: Color only (expressed "C" on the 4-digit display) or Color-Plus-Intensity (expressed "C_I"). In Color sensing mode, only colors are sensed. This is most useful for sorting obvious color differences (for example, red or black or green). The Color-Plus-Intensity option refines the sensor's capabilities to include grayscale as well, broadening the spectrum of colors and shades which the sensor can be programmed to detect. This feature allows "batch" sorting or identifying within a color family (for example, light blue or medium blue or dark blue).

Tolerance Levels—The Sensor can be configured for one of 10 levels of tolerance (0 to 9). A higher number (for example 9, expressed "toL9" on the 4-digit display) permits the sensor to accept a wider range of target conditions, compared with lower tolerance levels. A tolerance level of 0 (expressed "toL0") causes much more precise discrimination and a narrower range of target conditions.

1. To sample the color, position the new color to be sensed within scanning distance, typically 20 mm (0.8 in).
The sensor samples the color. The Output LED and all Output Status LEDs are off. The display shows run (no OFF-delay) or rund (OFF-delay selected).
2. Select the channel.
 - a) Press and hold **Set** for more than two seconds.
 - b) By default, channel 1 (SE1) is selected. Click **Select** until the desired channel is displayed.
 - c) Click **Set** to save your selection.

The Output LED and Output Status LEDs are OFF. The display shows SE1 for channel 1, SE2 for channel 2, or SE3 for channel 3.

3. Select the sensing mode.
 - a) Click **Select** to choose between Color (default) or Color + Intensity.
 - b) Click **Set** to save your selection.

The Output LED and Output Status LEDs are OFF. The display shows C for Color or C_I for Color + Intensity. After the sensor saves the color settings, the Output LED is ON and the selected channel Output Status LED is on. The display shows uPdt (flashing for two seconds).

4. Select the tolerance level.
 - a) Click **Select** until the desired tolerance level is displayed. There are 10 tolerance levels to choose from.
 - b) Click **Set** to save the tolerance setting.

The Output LED is on and the Output Status LED for the selected channel is on. The displays reads toL0 (most selective) through toL9 (least selective).

If the color being taught is out of the sensor's range, **FAIL** appears in the 4-digit display, followed by **Hi** or **Lo** (indicating too much or too little light, respectively).

Save the selected sensor settings by clicking the **Set** button at the end of Programming mode selection. The settings are saved in the sensor's EEPROM memory and the sensor remembers the current settings, even after being powered off.

Indicator Displays

To review the sensor's settings, press **Select** for 2 seconds or more.

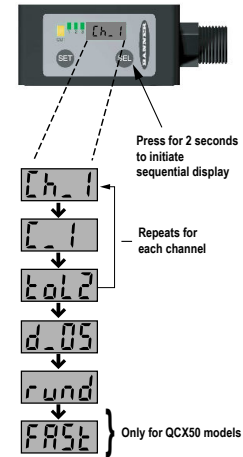
The output channel, sensing mode, and tolerance level will then be displayed sequentially, followed by the delay interval (applicable to all channels) and normal or fast mode (for QCX50 models). At the end of the sequence, the display indicates "run" or "rund" (depending on the delay setting).

Non-Initialization Display Messages—When using a sensor for the first time, the message "E2Pr" may be displayed. This indicates the memory has yet to be used. To correct this situation, set up a channel according to the procedure described earlier in *Programming Mode*. When any channel is set up successfully, a "run" or "rund" message is displayed.

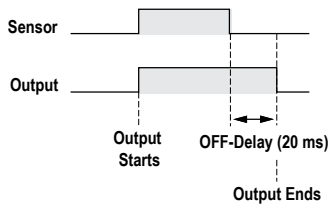
Run Mode—Normal sensor operation is called Run mode. The LED indicators and the 4-digit display indicate current operating status. For example, if the color sensor is detecting the color for which output 1 is programmed and no delay is selected, the indicators appear:

- Output (Out) LED: ON Yellow
- Output 1 Status LED: ON Green
- 4-digit display: run

Fast Mode—When a QCX50 model sensor is operating in Fast mode, the display will flash "FAS" for approximately 5 seconds of every 40 seconds.



Set the Output OFF-Delay



The output OFF-delay represents the time interval, following termination of sensing, during which the outputs remain active. The selected delay will apply to all three outputs.

An output OFF-delay value up to 40 milliseconds may be set. The figure shows a 20 ms OFF-delay (d_20). The output continues for an interval after sensing stops (applies to all outputs).

1. Press **Set** for more than six seconds.
2. Click **Select** until the desired delay setting is displayed. You may choose from the following delay settings:
 - d_00 (no delay)
 - d_05 (5 ms delay)
 - d_10 (10 ms delay)
 - d_20 (20 ms delay)
 - d_30 (30 ms delay)
 - d_40 (40 ms delay)

The Output LED is off (no target) and all Channel Status LEDs are off.

3. Click **Set** to save the settings.
The Output LED is off (no target) and all Channel Status LEDs are off. The display shows run (no delay selected) or rund (delay selected).

Set the Sensing Response Speed

The QCX50 models feature two selectable sensing response speeds: Normal and Fast. At either speed, sensing resolution is improved over that of the QC50 models.

The faster the speed, the lower the resolution. Normal speed is the recommended mode for most applications and provides the best resolution. Normal speed enables such high-resolution sensing as differentiating between similar shades of beige.

1. To access the selection mode, press and hold **Set** and **Select** together for more than two seconds.
The current selection is displayed (norm or FAS).
2. Click **Select** to toggle between fast and normal speeds.
3. Press **Set** for more than two seconds or wait 20 seconds for the sensor to time out and return to Run mode with new settings.
The new selection is displayed (norm or FAS).

Using the Gating Function

The output function of the sensor's color detection can be gated using the sensor's red wire (see [Wiring Diagrams](#) on page 5). Using this function controls the sensor's output and permits output to occur only when signaled by the use of the red wire. This output control feature is most useful when multiple repeats of a color could occur, such as with registration marks in a margin, yet only one point on the work is needed for an accurate determination. Gating is also known as triggering, windowing, inhibiting, or synchronization.

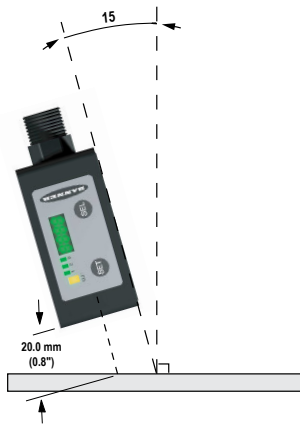
In the sensor's normal operating state (output enabled, red wire open or low), the sensor responds to all taught colors (the Output LED, Channel Status LEDs, and all outputs respond to target conditions). When the red wire is held high (output disabled, red wire at high supply potential), the sensor does not respond to the taught colors (LEDs do not light and outputs do not conduct; i.e., inhibit).

Disable the Push Buttons

Lock out the push buttons to prevent accidental or unauthorized adjustments on the production floor.

1. Connect a switch between the Gate input and +10 to 30 V dc.
The sensor is ready for the keypad to be enabled or disabled.
2. To disable the buttons: close the Gate switch and power up the sensor.
The sensor push buttons are disabled.
3. To enable the buttons: open the Gate switch and power up the sensor.
The sensor push buttons are enabled.

Installing the Color Sensor

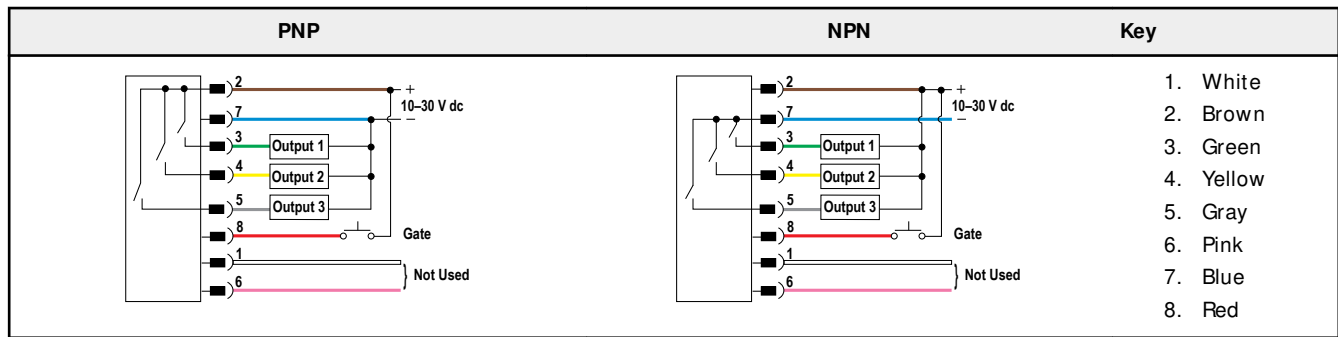


When sensing glossy surfaces, install the sensor at approximately a 15° angle with respect to the target.

When the sensor is ON, the white emitter beam is ON and “run” or “rund” appears on the 4-digit status display.

1. Determine the best position for the swivel connector (back, side, or bottom of the sensor).
2. Measure the appropriate operating distance from the front surface of the sensor optics to the point where the sensor is to be fastened.
Typically, the ideal distance is 20 mm (0.8 in).
3. Fasten the sensor to its intended location using two screws (M4 × 35 or longer).
Any two of three holes in the housing may be used for this purpose.
4. Attach the power cable to the sensor's connector. Refer to [Wiring Diagrams](#) on page 5 for more information.

Wiring Diagrams



Specifications

Supply Voltage

10 V dc to 30 V dc, 2 V pp maximum ripple
 40 mA maximum at 24 V dc (excluding output current)

Supply Protection Circuitry

Protected against reverse polarity, over-voltage, and transient voltage

Output Configuration

3 PNP or 3 NPN outputs, depending on model
 30 V dc maximum
 Saturation Voltage: < 2 V

Output Rating

100 mA maximum load per output channel

Output Protection

Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power up

Output Response Time

QC50 models: 335 microseconds
 QCX50 models: Selectable 5 ms (normal) or 1 ms
 500 ms delay at power-up; outputs do not conduct during this time

	QC50 Models	QCX50 Models
Gate ON-Time	335 μ s	700 μ s
Gate OFF-Time	170 μ s	400 μ s

Data Retention

EEPROM nonvolatile memory

Environmental Rating

IEC IP67

Ambient Light Rejection

According to EN 609475-2

Operating Conditions

-10 °C to +55 °C (+14 °F to +131 °F)
 90% at +50 °C maximum relative humidity (non-condensing)

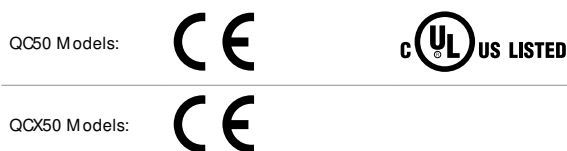
Shock Resistance

Approx. 30 G; 3 shocks per axis; 11 ms duration

Vibration

0.5 mm (0.2 inch) amplitude; 10 Hz to 60 Hz frequency; 30 minutes for each X, Y, Z axis

Certifications



Sensing Beam

Pulsed white LED (400 nm to 700 nm)

Sensing Receiver

Solid-state photodiode device with R, G, B filters

Sensing Range

20 mm (0.8 inches) typical; varies depending on sensor configuration

Adjustments

2 push buttons (Set and Select)
 Color scanning, color mode, delay and tolerance
 Manual adjustment of color channels, sensing mode and tolerance level

Indicators

4-digit LCD display: indicates sensing mode, display information, tolerance level, channel status
 Yellow output LED: ON when any output is conducting
 Three Green channel output status LEDs: ON when its corresponding channel output is conducting

Connections

8-pin M 12/ Euro-style swivel quick disconnect; 2 m (6.5 ft), 5 m (15 ft), or 9 m (30 ft) cable available separately

Construction

ABS shock-resistant housing; glass window and lens

Minimum Spot Diameter

4 mm (0.2 inches)

Required Overcurrent Protection



WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.

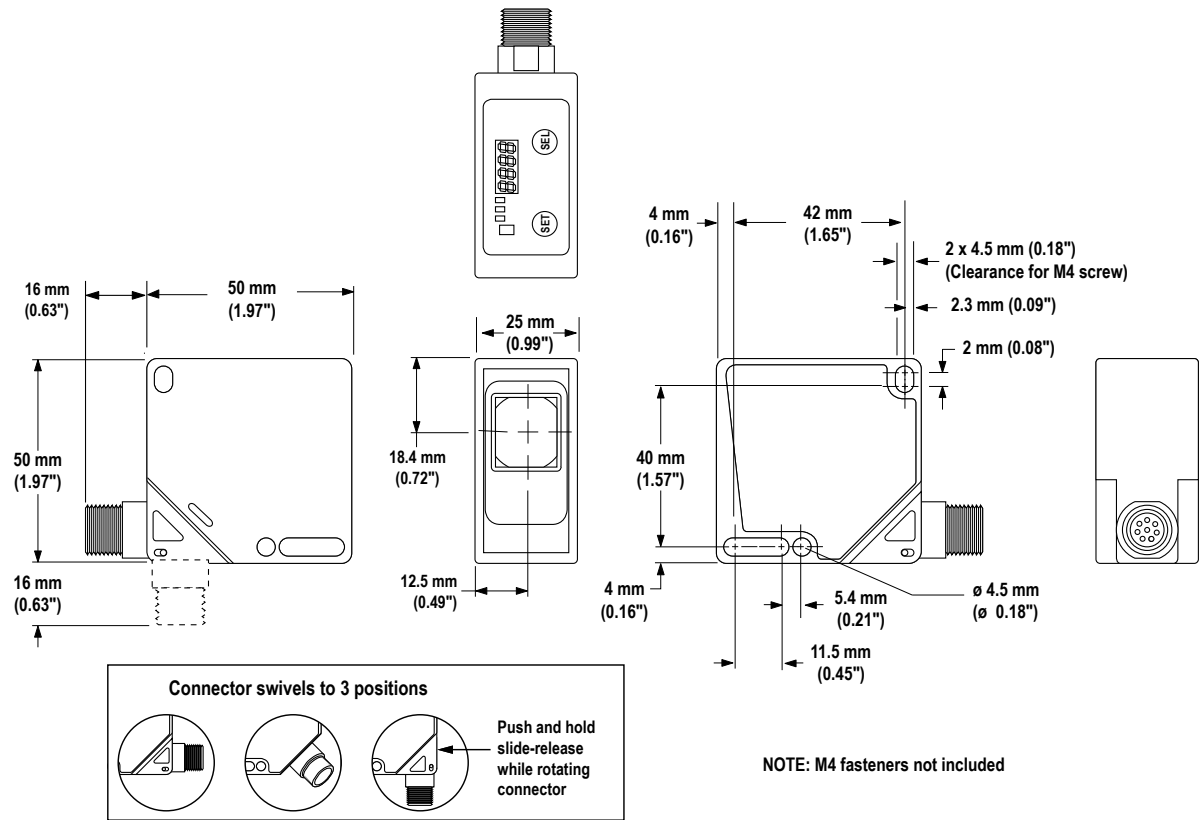
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Dimensions



Accessories

Cordsets

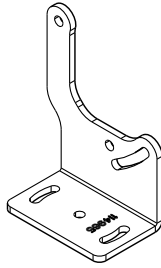
8-Pin Threaded M12/ Euro-Style Cordsets with Open-Shield				
Model	Length	Style	Dimensions	Pinout (Female)
MQDC2S-806	1.83 m (6 ft)	Straight		
MQDC2S-815	4.57 m (15 ft)			
MQDC2S-830	9.14 m (30 ft)			
MQDC2S-850	15.2 m (50 ft)			

1 = White 5 = Gray
 2 = Brown 6 = Pink
 3 = Green 7 = Blue
 4 = Yellow 8 = Red

Brackets

SM BQC50

- Multi-directional stainless steel L-bracket
- Provides a variety of mounting options
- Includes M4 SS hardware (2 screws, 2 flat washers, 2 lock washers, and 2 nuts)



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