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.

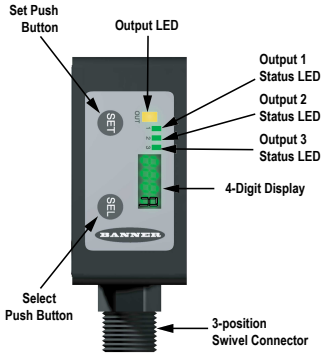
Models

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 µs	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 (SEt1) 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 SEt1 for channel 1, SEt2 for channel 2, or SEt3 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.

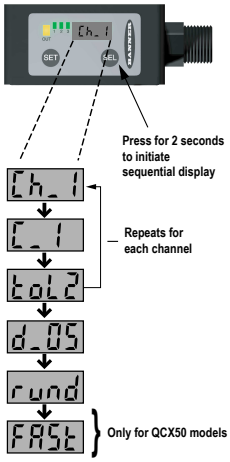
The output channel, sensing mode, and tolerance level will then be displayed sequentially, followed by the delay interval (applicable to all channels) and normal or fast mode (for QCX50 models). At the end of the sequence, the display indicates "run" or "rund" (depending on the delay setting).

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.

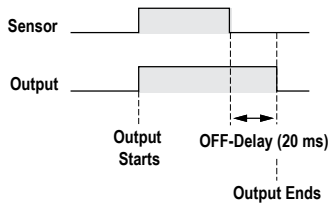
Run Mode— Normal sensor operation is called Run mode. The LED indicators and the 4-digit display indicate current operating status. For example, if the color sensor is detecting the color for which output 1 is programmed and no delay is selected, the indicators appear:

- 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 "FASt" 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 FASt).
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 FASt).

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.

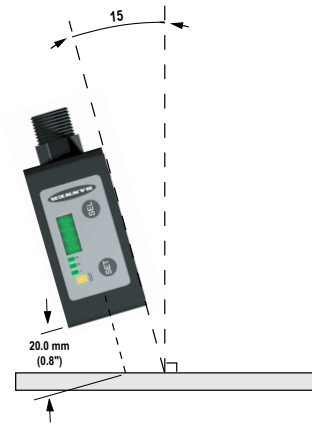
In the sensor's normal operating state (output enabled, red wire open or low), the sensor responds to all taught colors (the Output LED, Channel Status LEDs, and all outputs respond to target conditions). When the red wire is held high (output disabled, red wire at high supply potential), the sensor 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.

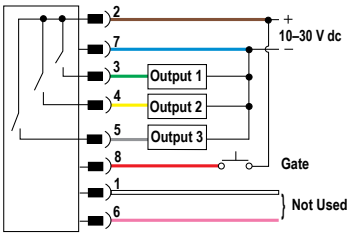
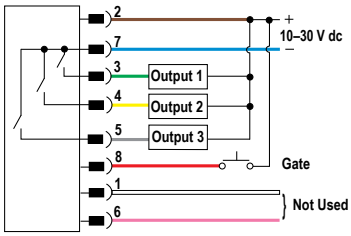
When the sensor is ON, the white emitter beam is ON and “run” or “rund” appears on the 4-digit status display.

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

PNP	NPN	Key
		1. White 2. Brown 3. Green 4. Yellow 5. Gray 6. Pink 7. Blue 8. Red

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 9 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 µs	700 µs
Gate OFF-Time	170 µs	400 µs

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

QC50 Models:

QCX50 Models:

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 M12/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)

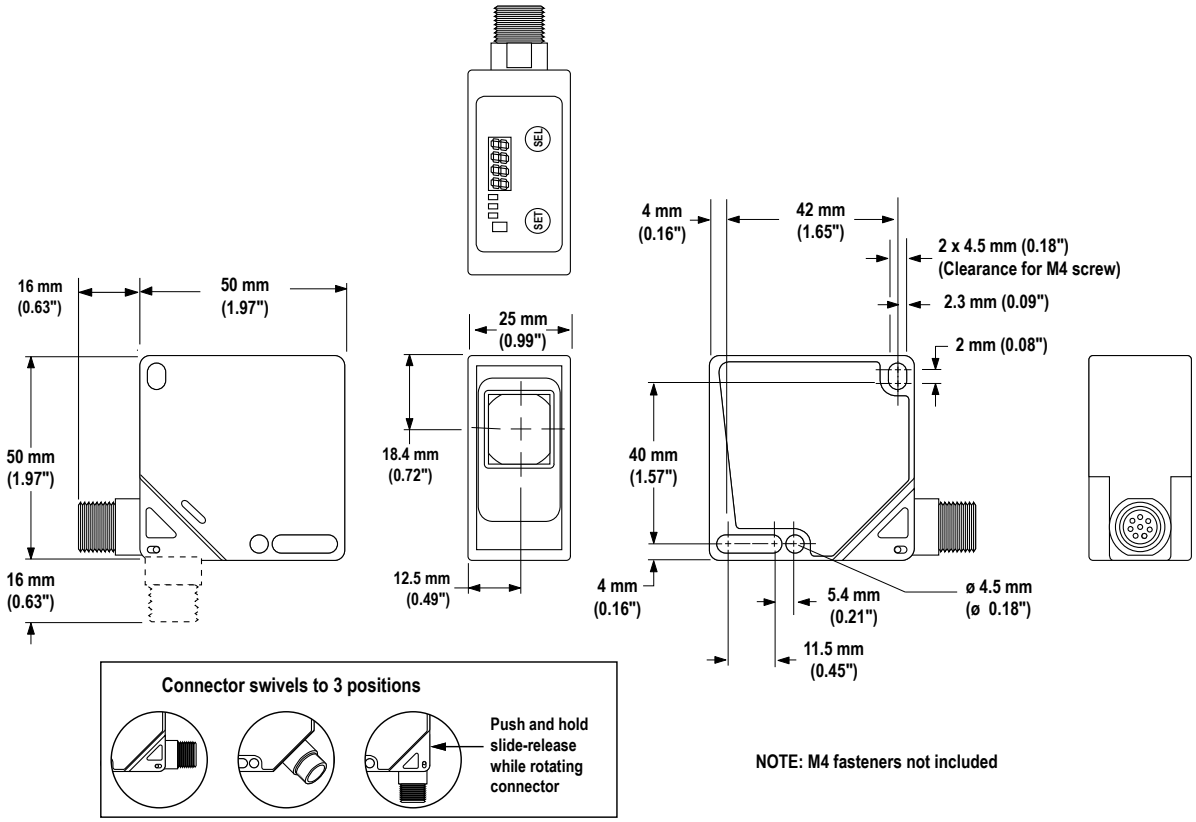
Required Overcurrent **Protection**

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*.

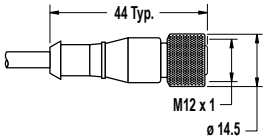
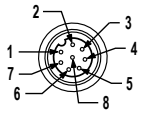
Supply Wiring (AWG)	Required Overcurrent **Protection** (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

Dimensions



Accessories

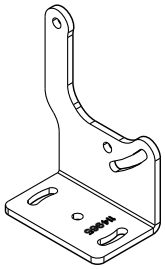
Cordsets

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

Brackets

SMBQC50

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



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