

QCM50 Color Sensor

Instruction Manual

Original Instructions
209633 Rev. A
21 January 2020
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209633

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1 Product Description

High-performance color sensor with IO-Link



- Reliable color detection across the entire range of the sensor
- Up to 12 colors can be detected with one sensor, which saves inventory costs and enables faster changeover
- Available in a glare suppression model to reliably detect reflective targets
- Intuitive configuration with integrated digital display and on-board buttons
- IO-Link communication for remote configuration and monitoring



WARNING:

- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

1.1 Models

Models	Feature	Range (mm)	Spot Size (mm)	Outputs ¹	Stored Colors	Connection
QCM50-K3D25-Q8-5 ²	Glare suppression	18 to 32	6 × 6 at 25 mm	3 Discrete	7	Integral 5-pin M12/Euro-style quick disconnect
QCM50-K1D40-Q8-4	Small spot size	18 to 60	4 × 4 at 40 mm	1 Discrete	1	Integral 4-pin M12/Euro-style quick disconnect
QCM50-K3D40-Q8-5			4 × 4 at 40 mm	3 Discrete	7	Integral 5-pin M12/Euro-style quick disconnect
QCM50-K5D40-Q8-8			4 × 4 at 40 mm	5 Discrete	12	Integral 8-pin M12/Euro-style quick disconnect
QCM50-K1D60-Q8-4	Long range	20 to 150	8 × 8 at 60 mm	1 Discrete	1	Integral 4-pin M12/Euro-style quick disconnect
QCM50-K3D60-Q8-5			8 × 8 at 60 mm	3 Discrete	7	Integral 5-pin M12/Euro-style quick disconnect
QCM50-K5D60-Q8-8			8 × 8 at 60 mm	5 Discrete	12	Integral 8-pin M12/Euro-style quick disconnect

1.2 Overview

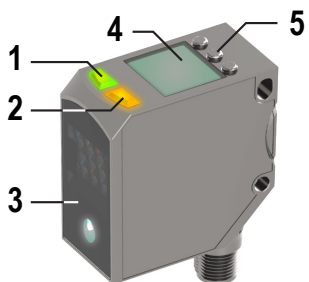


Figure 1. Sensor Features

1. Green LED: Power Indicator and IO-Link / Red: Status/Error Indicator
2. Amber LED: Output Indicator
3. Optical window
4. Display
5. Buttons

¹ PNP/NPN Auto-Detect based on output connection.

² Polarized optics (glare suppression). Not for use with black objects.

2 Installation Instructions

2.1 Sensor Installation

Install the sensor so the object to be detected moves horizontally to the sensor.

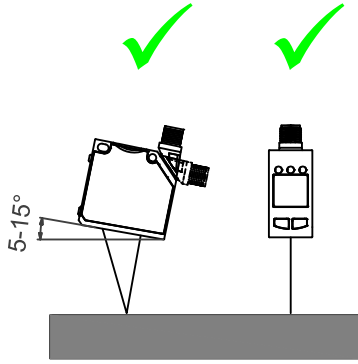


Figure 2. Installation for glare suppression models

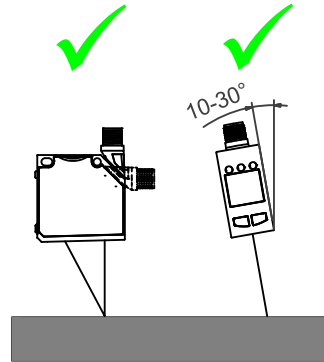


Figure 3. Installation for other models

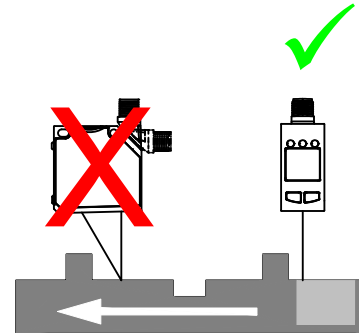
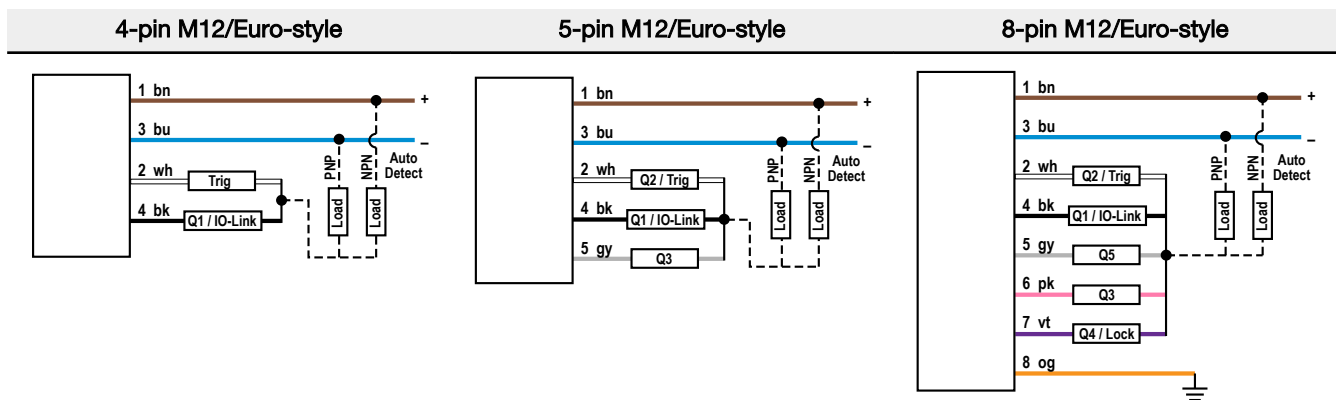


Figure 4. Installation for other models

2.2 Wiring Diagrams



The QCM50 Color Sensor requires a shielded cable. Refer to the Accessories list for a list of recommended cables.

3 Configuration Instructions

3.1 Menu System for the 4-pin Models

The following functions are available using the sensor's menu system. Q represents the transistor output.

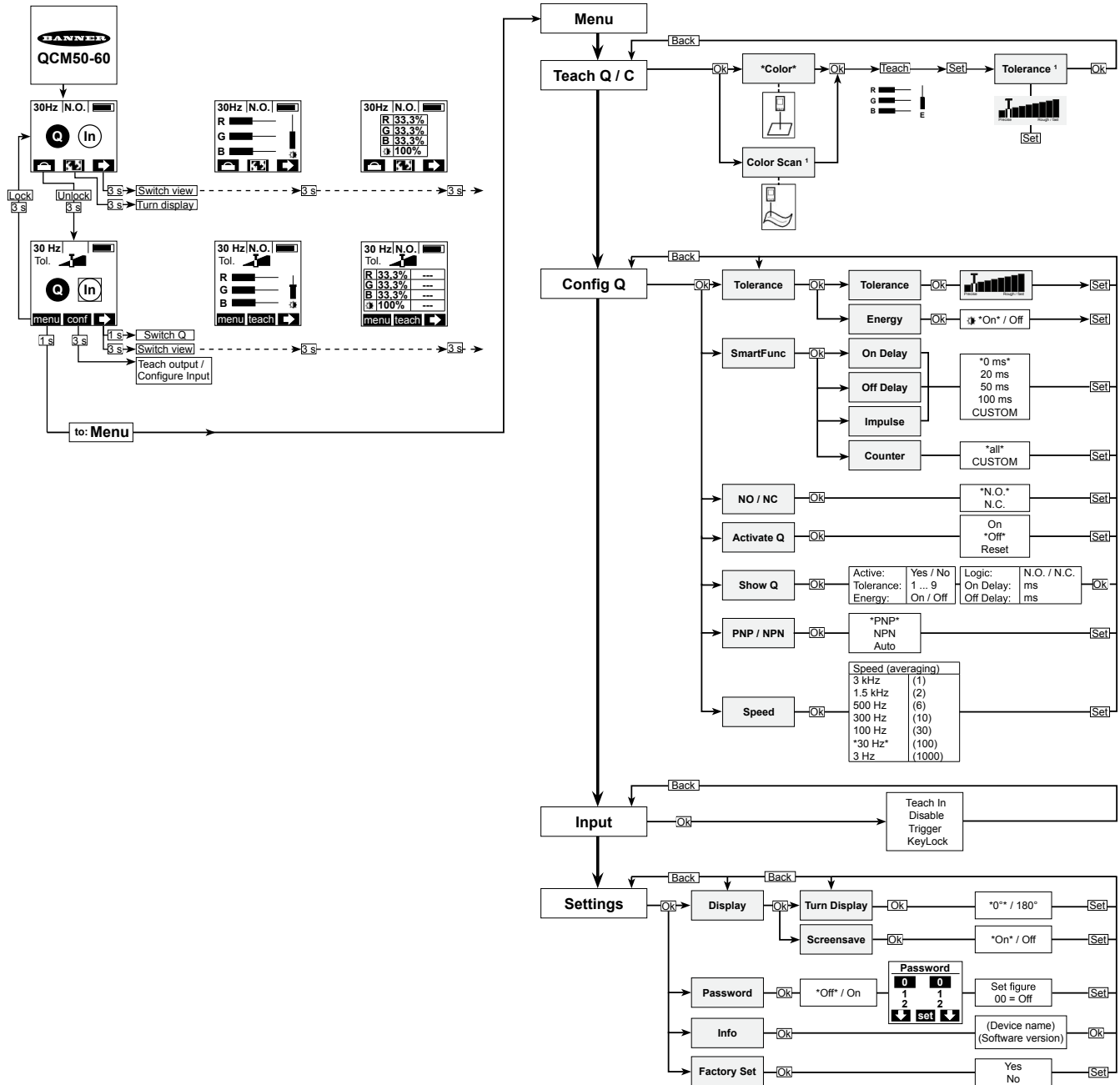


Figure 5. Menu Map for the 4-pin Models

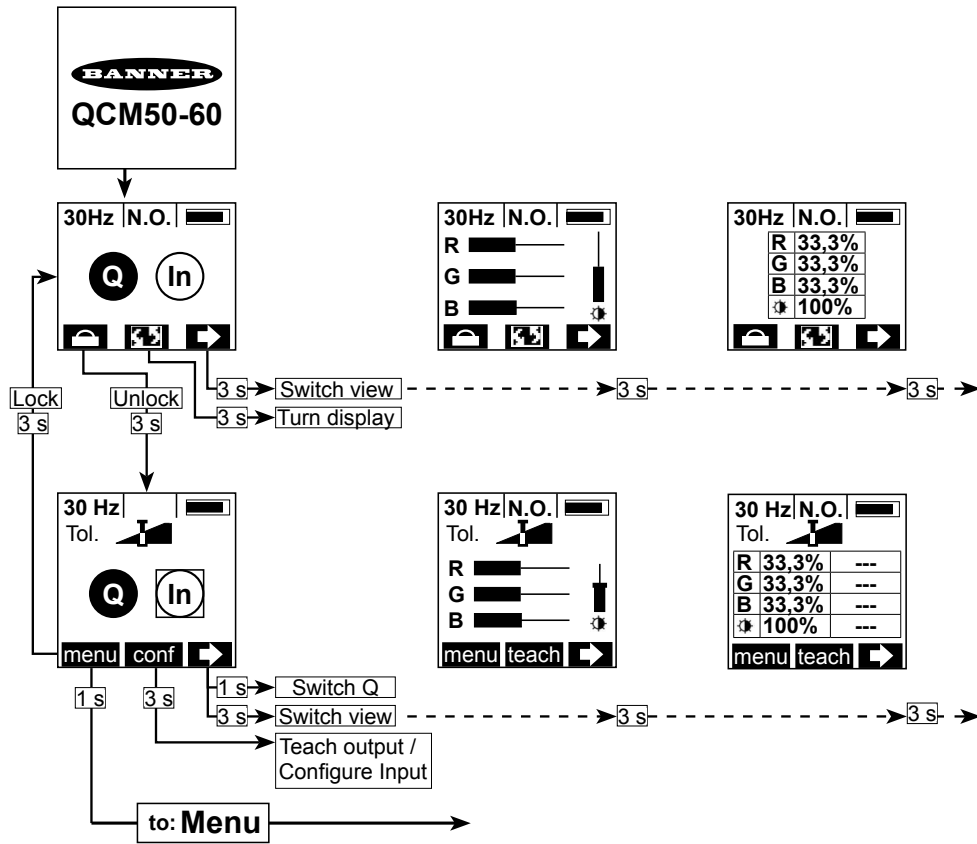


Figure 6. Top Level Menu

Views	Key
	<p>CM —Color Mode</p> <p>N.O. —Normally open</p> <p>Q4— Switching out; white (off) or black (on)</p> <p>RGB— Red/Green/Blue</p>
	<p>Tol. —Tolerance (1 to 9)</p> <p> —Energy / brightness (normalized values)</p> <p>○ Off</p> <p>● On</p> <p>◻ Selected</p> <p>⊗ Deactivated</p>
<p>← taught-in color values</p> <p>← Live color values</p>	

Fast Teach-In	
Teach-in and Tolerance	<p>Press Teach or Tol for 1 second to toggle between the two settings.</p> <p>Press Teach for 3 seconds to teach the selected channel.</p>

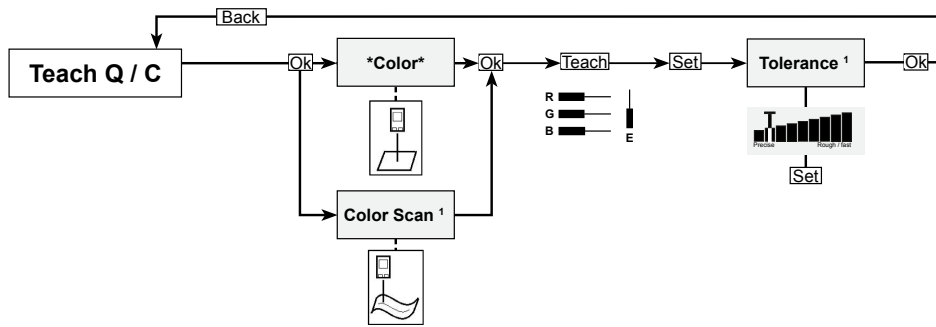


Figure 7. Teach Menu

Teach Menu	
Color	Teaches the single color the sensor sees at this moment.
Color Scan	Teaches all colors the sensor sees during the scan. The scanning can be paused.
Tolerance	Sets the tolerance to one of 9 levels.

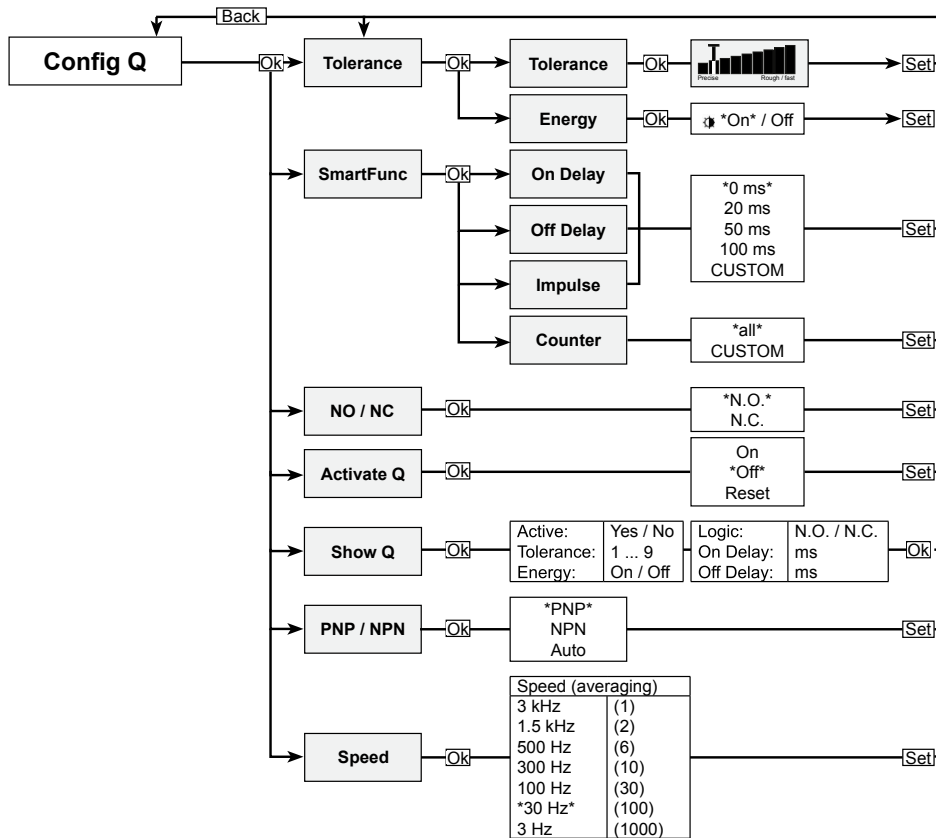


Figure 8. Config Q Menu

Config Q	
Tolerance	Tolerance adjustable in 9 levels.
Energy	Energy evaluation can be turned off. This may be helpful in applications with object distances larger 65 mm. Past 65 mm, the energy decreases with increasing object distance. The color values remain the same.

Config Q	
Smart Function	<p>On Delay</p> <p>Input H L Output H L</p> <p>Delay</p> <p>adjustable in 1 ms steps</p>
	<p>Off Delay</p> <p>Input H L Output H L</p> <p>adjustable in 1 ms steps</p>
	<p>Impulse</p> <p>Input H L Output H L</p> <p>adjustable in 1 ms steps</p>
	<p>Counter</p> <p>Input H L Output H L</p>
Activate Q	<p>Activate / Deactivate—The stored colors C remain in the sensor.</p> <p>Reset— Resets the switching output to factory settings. Stored colors on this Q will be deleted.</p>
PNP/NPN	Automatically detects the PNP/ NPN setting.
Speed	Speed (Averaging)—Less speed results in more precise color recognition. Additional averaging also helps if ambient light disturbs the measurement.

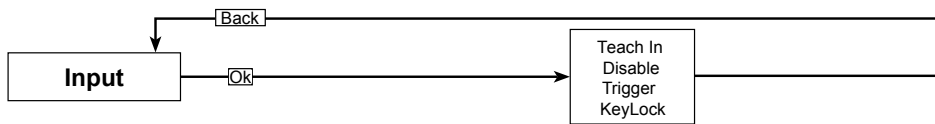


Figure 9. Input Menu

Input	
Input	<p>Different input function can be set.</p> <ul style="list-style-type: none"> • Trigger = Trigger (24 V: sensor does measure, 0 V: sensor does not measure). • KeyLock = Keylock (24 V keys are locked, 0 V keys are unlocked). • Teach = After having the teach pin on 24 V for 3 s, the sensor is taught the color that it sees at this moment. Any further high signal will be ignored, until a falling edge occurs.

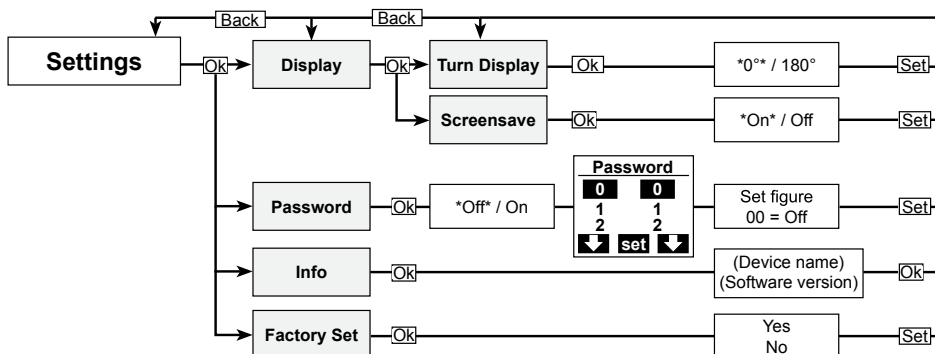


Figure 10. Settings Menu

Settings	
Display	Turn Display—Display is turned 180°. Screensave ON—Display turns off after 3 minutes. Screensave OFF—Display stays on.
Password	Definition of unlock password. This has to be entered each time when unlocking the sensors. If password is forgotten, a master password can be obtained from the factory.
Factory Set	Deletes all modifications that are done since set up of the sensor, all settings are reset to original factory settings.

3.2 Menu System for the 5-pin and 8-pin Models

The following functions are available using the sensor's menu system. Q represents the transistor output.

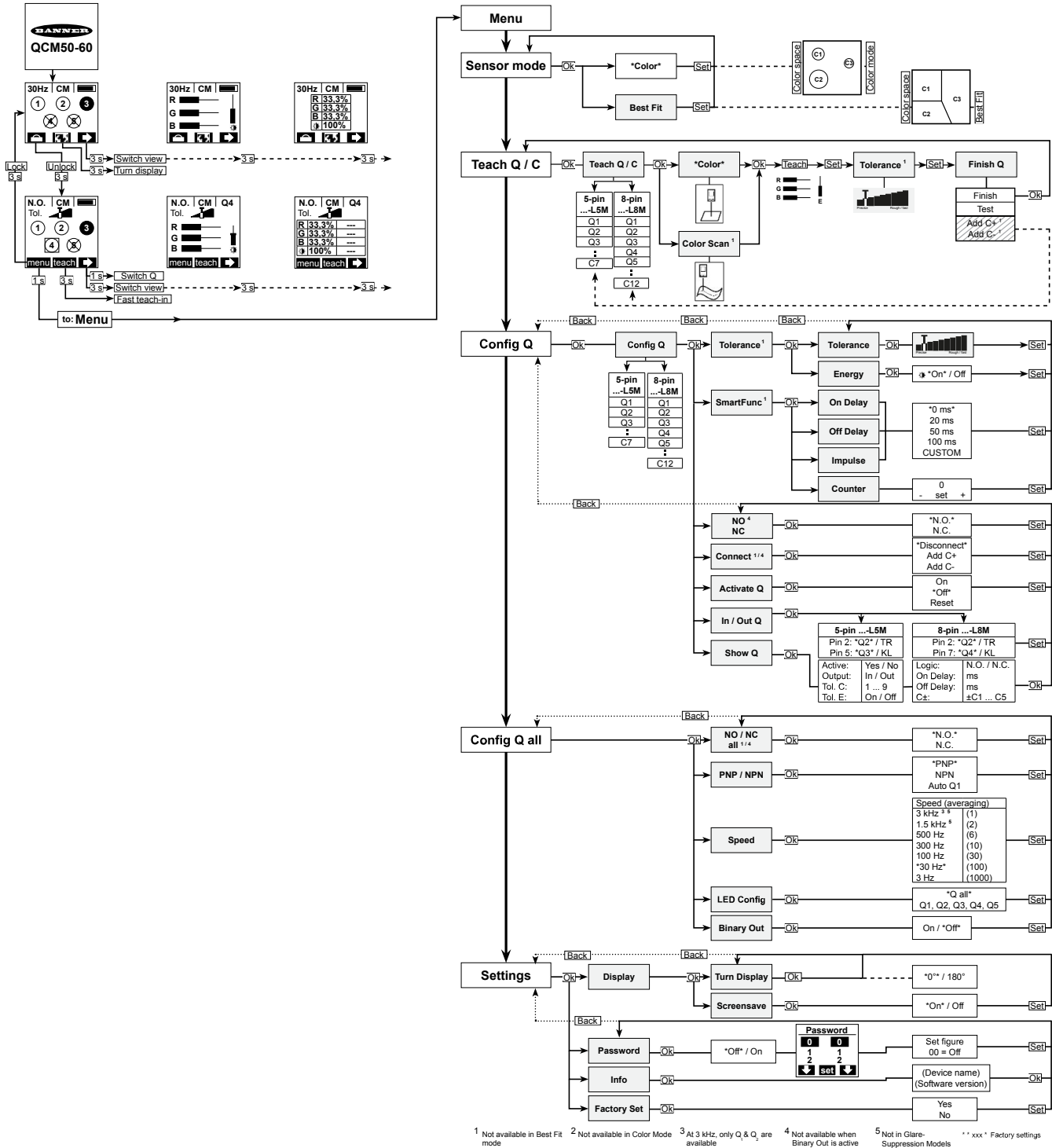


Figure 11. Menu Map for the 5-pin and 8-pin Models

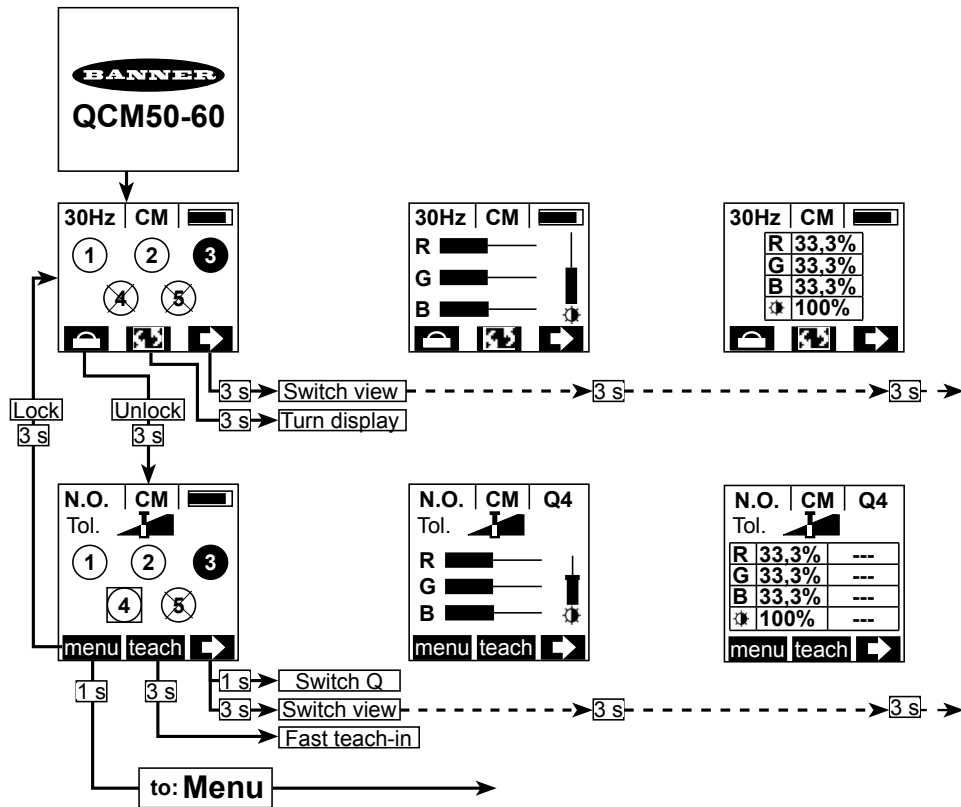


Figure 12. Top Level Menu

Views	Key
	CM – Color Mode BF – Best Fit Mode N.O. – Normally open Q1 through Q5 – Switching output; white (off) or black (on) RGB = red / green / blue Tol. – Tolerance (1 to 9) – Energy / brightness (normalized values)
	○ Off ● On ◻ Selected ⊗ Deactivated – Signal quality (flashing = too weak; flashing filled = signal overload)
<p>← taught-in color values</p> <p>← Live color values</p>	

Fast Teach-In	
Teach-in and Tolerance	Press Teach or Tol for 1 second to toggle between the two settings. Press Teach for 3 seconds to teach the selected channel.

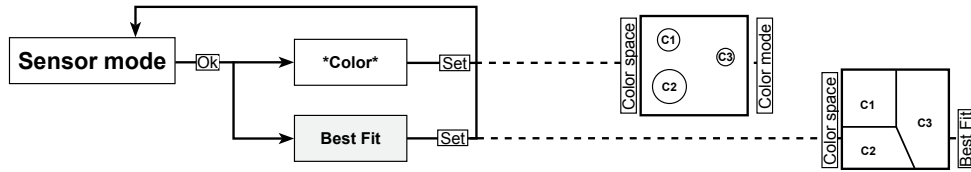


Figure 13. Sensor Mode Menu

Sensor Mode	
Color	Validates the taught color. Required colors ≥ 1 . Application = color detection / color evaluation. (Use when the false colors are not known.)
Best Fit	Switches the closest taught color. Required colors ≥ 2 . <ul style="list-style-type: none"> • One channel of the sensor always switches. • To prevent unwanted switching, teaching of the background is recommended. Application = Sorting of known objects. (Use when it should be distinguished between known colors.) <ul style="list-style-type: none"> • C+ and C- is not possible in BF mode. • N.O. / N.C. settings & Smart functions are deactivated in BF mode. When returning to color mode they are restored. • *N.O.* / N.C. settings can in BF mode only be adjusted for all Q at once via Config Q all.

Changing mode deactivates all Q. The stored colors C remain however.

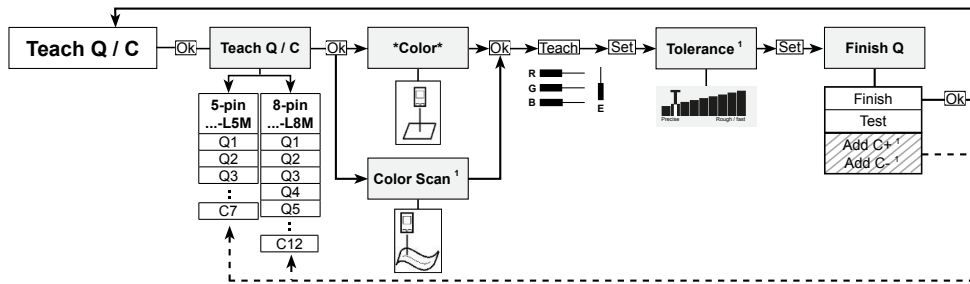


Figure 14. Teach Q/C Menu

Teach Q/C Menu	
Teach Q/C	Teaches a color (C) on a switching output (Q).
Color	Teaches a color point.
Color Scan	Teaches a color space (teaches colors until the stop button is pressed). Scanning can be paused.
Tolerance	Sets the tolerance to one of 9 levels.
Finish Q	Finish: Save and close. Test: Checks whether a detection will be reliable: <ul style="list-style-type: none"> • 3x green LED = OK, 3x red LED = not OK • C+: add an additional color (C) to the switching output (Q) that will be detected as well. • C-: add an additional color (C) to the switching output (Q) that must not be detected.

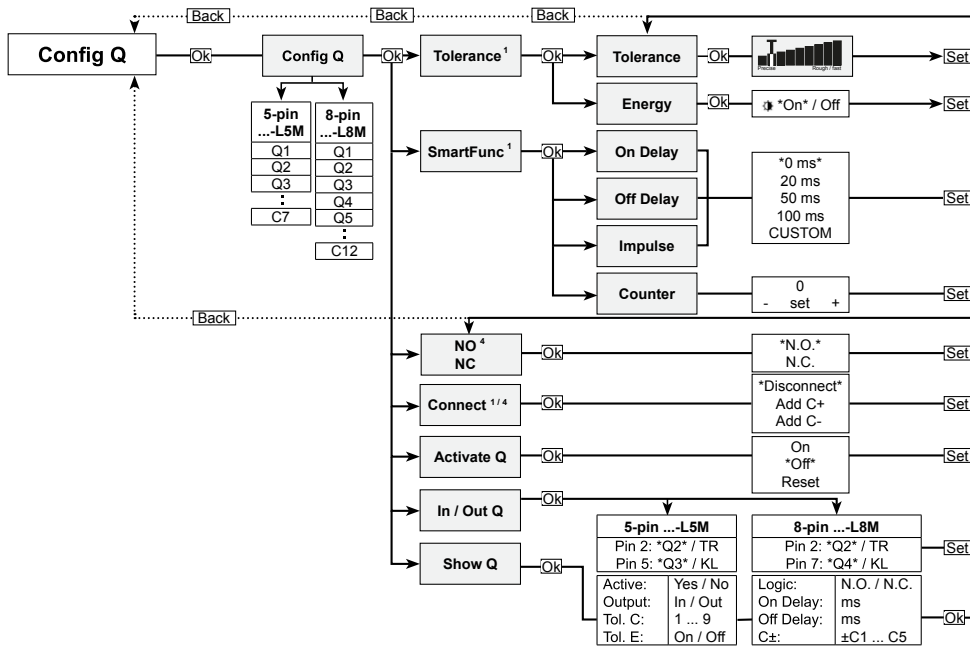


Figure 15. Config Q Menu

Config Q	
Tolerance	Tolerance adjustable in 9 levels.
Energy	Energy evaluation can be turned off. This may be helpful in applications with object distances larger 65 mm. Past 65 mm, the energy decreases with increasing object distance. The color values remain the same.
Smart Function	<p>On Delay</p> <p>adjustable in 1 ms steps</p>
	<p>Off Delay</p> <p>adjustable in 1 ms steps</p>
	<p>Impulse</p> <p>adjustable in 1 ms steps</p>
	<p>Counter</p>
Connect C+/C-	<p>The sensor can store more colors than it has outputs. Thus colors C and switching outputs Q are distinguished. It is preset which colors can be connected.</p>
Activate Q	<p>Activate / Deactivate—The stored colors C remain in the sensor.</p> <p>Reset— Resets the switching output to factory settings. Stored colors on this Q will be deleted.</p>

Config Q	
In/Out Q	<p>Some switching outputs can be set as input or output.</p> <ul style="list-style-type: none"> • TR = Trigger (high = lamp on, low = lamp off) • KL = Keylock (high = keys are locked, low = keys are unlocked) • Low signal $\leq 0.8 V$, high signal $\geq 3 V$

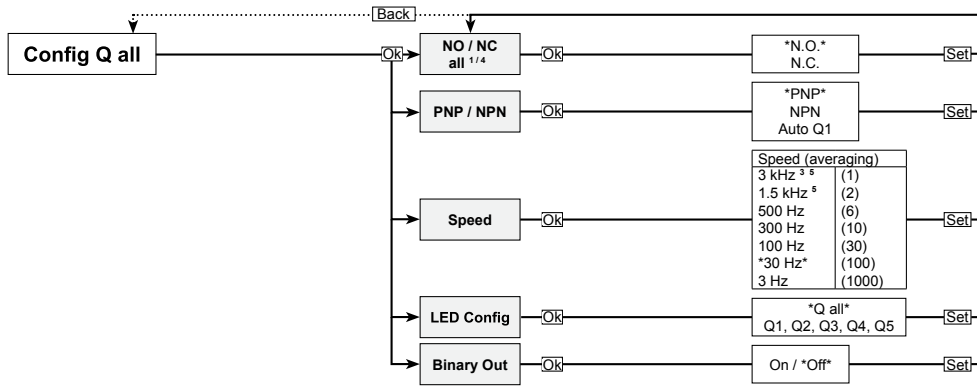


Figure 16. Config Q All Menu

Config Q All																																																																																																																	
PNP/NPN	Setting for all Q. Autodetect (Auto Q1) is set based on switching output Q1.																																																																																																																
Speed	Speed (Averaging). Less speed results with more precise color recognition. Additional averaging also helps if ambient light disturbs the measurement.																																																																																																																
Binary Out	<p>Logically combines the switching outputs in order to be able to detect up to 7 (5-pin models) / 12 (8-pin models) colors. The combination is shown in the figures below. Thereby:</p> <ul style="list-style-type: none"> • Connected colors will be disconnected. • Always only one color switches. The priority is C1 > C2 > C3... • Smart functions are not available in this mode. • All switching outputs will be set to N.O. <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <table border="1" style="margin-right: 20px;"> <tr><td>Q off</td><td>Q on</td></tr> </table> <table border="1" style="margin-right: 20px;"> <caption>5-pin...-L5M</caption> <thead><tr><th></th><th>C1</th><th>C2</th><th>C3</th><th>C4</th><th>C5</th><th>C6</th><th>C7</th></tr></thead> <tbody> <tr><td>Q1</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> <tr><td>Q2</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> <tr><td>Q3</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> </tbody> </table> <table border="1" style="margin-right: 20px;"> <caption>8-pin...-L8M</caption> <thead><tr><th></th><th>C1</th><th>C2</th><th>C3</th><th>C4</th><th>C5</th><th>C6</th><th>C7</th><th>C8</th><th>C9</th><th>C10</th><th>C11</th><th>C12</th></tr></thead> <tbody> <tr><td>Q1</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> <tr><td>Q2</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> <tr><td>Q3</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> <tr><td>Q4</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> <tr><td>Q5</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td><td>■</td></tr> </tbody> </table> <p style="margin-right: 20px;">No functionality in Binary Out</p> </div>	Q off	Q on		C1	C2	C3	C4	C5	C6	C7	Q1	■	■	■	■	■	■	■	Q2	■	■	■	■	■	■	■	Q3	■	■	■	■	■	■	■		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	Q1	■	■	■	■	■	■	■	■	■	■	■	■	Q2	■	■	■	■	■	■	■	■	■	■	■	■	Q3	■	■	■	■	■	■	■	■	■	■	■	■	Q4	■	■	■	■	■	■	■	■	■	■	■	■	Q5	■	■	■	■	■	■	■	■	■	■	■	■
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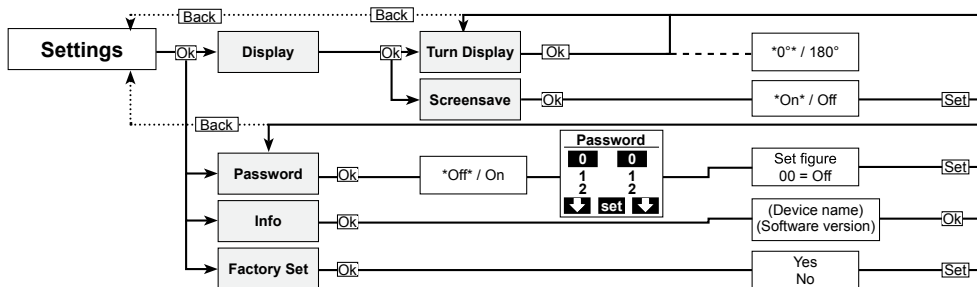


Figure 17. Settings Menu

Settings	
Display	Turn Display—Display is turned 180°. Screensave ON—Display turns off after 3 minutes. Screensave OFF—Display stays on.
Password	Definition of unlock password. This has to be entered each time when unlocking the sensors. If password is forgotten, a master password can be obtained from the factory.
Factory Set	Deletes all modifications that are done since set up of the sensor, all settings are reset to original factory settings.

3.3 Program the Sensor

Sensors have a large depth of field, so mount the sensor within its specified range (varies by model). For reflective targets, the sensor can be rotated up to 15 degrees from perpendicular to reduce specular reflections.

The sensor buttons correspond to the menu options listed at the top of the LCD screen. These options change with each screen.

1. Press and hold **Unlock** for 3 seconds to access the Menu.
2. Press **Menu**.
3. Select **Sensor Mode** and press **OK**.
A warning message stating that changing the mode deactivates all outputs displays. Press **OK** to clear the message.
4. Use the arrow button to select **Color** or **Best Fit** mode and press **Set**.
 - Color Mode—Validates the taught color; requires one or more color.
 - Best Fit Mode—Switches to the closest taught color; requires two or more colors.
5. Use the **Down** arrow to highlight **Teach Q/C** (Q are transistor outputs; C are additional colors not associated with a wired output) and press **OK**.
6. Select the Q or C you would like to teach and press **OK**.
7. Select **Color** for a target that is not moving and press **OK**.
In **Color Mode** you also can select **Color Scan** if the target is moving or If you have a range of colors that you want associated with a single output.
8. Present the target under the sensor LED and press **Teach**.
In **Color Mode** there will be a bar graph on the screen showing the red/blue/green values of the target.
9. Press **Set**.
10. In **Color Mode**, adjust the tolerance using the **Down** arrow. Press **Set**.
11. Select **Finish** to return to the Run mode configuration menu, then press **OK**.
In **Best Fit** mode, at least two colors need to be configured. Repeat the previous steps with an additional Q or C being configured.
12. Press **Back** to return the sensor to Run mode.
13. Verify the output turns on and off when you present and remove the target color.

4 Specifications

Supply Voltage and Current

18 to 30 V dc
Less than 60 mA, exclusive of load

Supply Protective Circuitry

Protected against reverse polarity and transient voltages

Output Configuration

Solid-state auto-detect PNP/NPN output with IO-Link on pin 4
Output current < 100 mA
Outputs protected against short circuit

Certifications



Light Used

LED, white

Response Time

Glare suppression models: ≤ 540 μs (at 500 Hz)
Other models: ≤ 180 μs (at ≥ 1500 Hz)

LED class

LED risk group 2
(EN 62471:2008)

Maximum Capacitive Load

< 100 nF

Control Input

Trigger; keylock

Construction

Materials: Zinc die-cast, matte chrome housing; PMMA front screen and display

Warm-up Time

5 minutes

Power On Delay

< 150 ms

IO-Link

Communication mode: COM 2
Minimum cycle time: 4 ms
SIO mode: Compatible
Length of process data: 2 bytes / 6 bytes
Specification: 1.1

Environmental Conditions

Operating: -20 °C to +55 °C (-4 °F to +131°F)
Storage: -20 °C to +80 °C (-4 °F to +176 °F)

Environmental Rating³

IEC IP67, IEC IP69

Vibration and Mechanical Shock

EN 60947-5-2

Required Overcurrent Protection



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

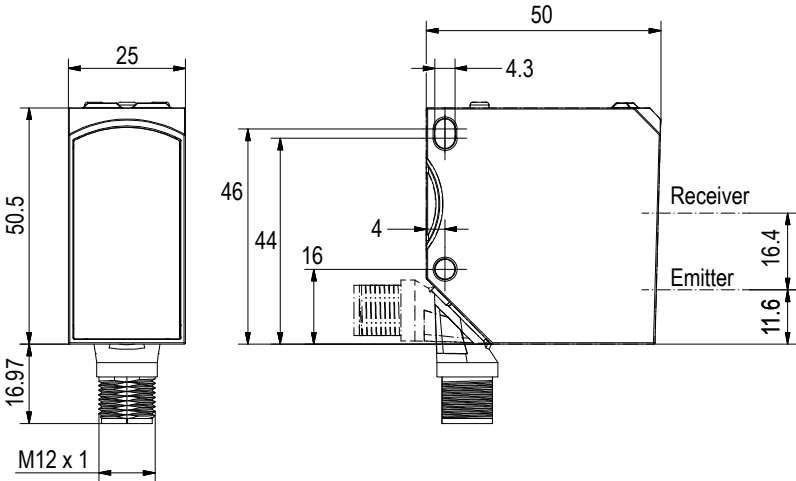
Overcurrent protection is required to be provided by end product application per the supplied table. Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply. Supply wiring leads < 24 AWG shall not be spliced. For additional product support, go to www.bannerengineering.com.

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

³ When connected with a IP67/IP69 cordset

4.1 Dimensions

All measurements are listed in millimeters, unless noted otherwise.



5 Accessories

5.1 Cordsets

4-Pin Threaded M12/Euro-Style Cordsets with Shield—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-406	1.83 m (6 ft)	Straight		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
MQDEC2-415	4.57 m (15 ft)			
MQDEC2-430	9.14 m (30 ft)			
MQDEC2-406RA	1.83 m (6 ft)	Right-Angle		
MQDEC2-415RA	4.57 m (15 ft)			
MQDEC2-430RA	9.14 m (30 ft)			

5-Pin Threaded M12/Euro-Style Cordsets with Shield—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQDEC2-506	1.83 m (6 ft)	Straight		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
MQDEC2-515	4.57 m (15 ft)			
MQDEC2-530	9.14 m (30 ft)			
MQDEC2-506RA	1.83 m (6 ft)	Right-Angle		
MQDEC2-515RA	4.57 m (15 ft)			
MQDEC2-530RA	9.14 m (30 ft)			
MQDEC2-550RA	15.2 m (50 ft)			

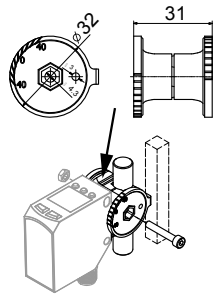
8-Pin Threaded M12/Euro-Style Cordsets with Shield—Single Ended				
Model	Length	Style	Dimensions	Pinout (Female)
MQ-QCM50-806	6 ft	Straight	Coming soon	<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray 6 = Pink 7 = Violet 8 = Orange</p>
MQ-QCM50-815	15 ft			

5.2 Brackets

All measurements are listed in millimeters, unless noted otherwise.

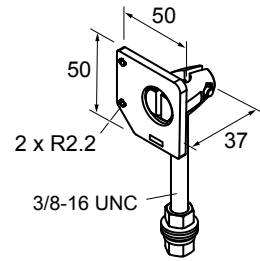
SMBQCM50DT

- Dovetail clamp bracket
- Allows sensor to mount to a 12 mm round bar or a 10 mm × 10 mm square bar
- Adjustable ± 40 degrees
- Material: Zinc die cast



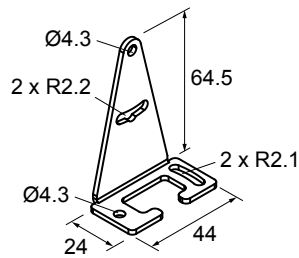
SMBQCM50FA

- Swivel bracket with tilt and pan movement for precision adjustment
- Easy sensor mounting to extruded rail t-slots
- Side mounting of the QCM50 with included hardware packet
- Includes 3/8-16 × 2 in socket head cap screw
- 304 stainless steel



SMBQCM50L

- Right-angle mounting bracket with a curved slot for versatile orientation
- ± 12 degree tilt adjustment
- Side mounting of the QCM50 with included hardware packet
- 14 gauge stainless steel



6 Banner Engineering Corp. Limited Warranty

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