Autonics



Color Mark Photoelectric Sensors

BC Series

PRODUCT MANUAL

Be sure to follow the instructions and precautions in the instruction manual, other manuals, and the Autonics website.
The specifications, dimensions, and other information in this document are subject to change without notice for product improvement.
Certain models may be discontinued without notice.

Safety Precautions

- 'Safety Precautions' are provided to ensure safe and proper use of the product and to prevent accidents or hazards. Please make sure to follow them carefully.
- ⚠ symbol indicates a caution, warning of potential hazards under certain conditions.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. **Fail-safe device must be installed when using the product in applications that may cause serious injuries or property loss. (E.g. nuclear control systems, medical equipment, ships, vehicles, railroads, aircraft, combustion devices, safety devices, security systems, disaster prevention devices, etc.)**
    Failure to do so may result in personal injury, property loss or fire.
02. **Do not use or store the product in environments containing flammable, explosive, or corrosive gases, or in places exposed to high humidity, direct sunlight, radiant heat, vibration, shock, or salt.**
    Failure to do so may result in explosion or fire.
03. **Do not disassemble, repair, or modify the product without authorization.**
    Failure to do so may result in fire.
04. **Do not connect, repair, or inspect the product while connected to a power source.**
    Failure to do so may result in fire.
05. **Check the connection diagram before wiring.**
    Failure to do so may result in fire.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. **Use the product within its rated specifications and performance limits.**
    Failure to do so may result in fire or product damage.
02. **Use a dry cloth to clean the product. Do not use water or organic solvents.**
    Failure to do so may result in fire.

Cautions During Use

- Make sure to follow the instructions in 'Cautions During Use'. Failure to do so may result in unexpected accidents.
- When connecting inductive loads such as DC relays or solenoid valves use a diode, varistor, or similar component to suppress surges.
- Wait at least 0.5 seconds after applying power before using the product. When using separate power supplies for sensor and load, apply power to the sensor first.
- Power input should be supplied from an isolated and limited voltage/current source, or from a Class 2 or SELV power supply.
- To prevent surges and inductive noise, separate the wiring from high-voltage and power lines, and keep wiring lengths as short as possible.
- When supplying power with an SMPS, ground the F.G. terminal and connect a noise suppression capacitor between the 0 V and F.G. terminals.
- When using the product with noise-generating devices (e.g. switching regulators, inverters, servo motors, etc.), make sure to ground the F.G. terminal of the unit.
- This product may be used in the following environmental conditions.
  - Indoors (environment condition rated in 'Specifications')
  - Altitude: up to 2,000 m
  - Pollution Degree 2
  - Installation Category II

Product Components

- Product
- Bracket
- M3 bolt × 2
- Instruction manual
- Adjustment screwdriver

CE UKCA EAC

Ordering Information

This is only for reference, the actual product does not support all combinations.
For selecting the specified model, follow the Autonics website.

BC ❶ - ❷ ❸ ❹ - ❺ - ❻

❶ Sensing distance
15: 15 mm

❷ Sensing type
L: Convergent reflective

❸ Power supply
D: 12 - 24 VDC

❹ Output
T: Solid state (transistor)

❺ Connection
C: Connector type

❻ Control output
No mark: NPN open collector output
P: PNP open collector output

Sold Separately

- M12 connector cable: C□D(H)4-□-□

Cautions during Installation

- Be sure to install this product by following the usage environment, location, and specified ratings. Consider the listed conditions below.
  - Installation environment and background (reflected light)
  - Sensing distance and sensing target
  - Direction of target's movement
  - Characteristic graphs
- When installing multiple sensors closely, it may result in malfunction due to mutual interference.
- If the sensing target has a glossy surface, high reflection or metal materials, tilt the sensor with an angle of from 10 to 20 degrees and install.
- For installation, tighten the screw with a torque of 0.8 N m. Mount the brackets correctly to prevent the twisting of the sensor's optical axis.
- Use this product after the test. Check whether the indicator works appropriately for color of the detectable object.

Setting Operation Mode

- Use the offered adjustment screwdriver.
  Do NOT turn with excessive force to prevent product damage.

Operation mode		Description
N.O N.C	Color match mode (N.O.)	Target color matches reference color: Operation indicator (red) and transistor output ON
N.O N.C	Color mismatch mode (N.C.)	Target color does not match reference color: Operation indicator (red) and transistor output ON

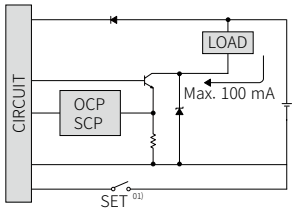
Connections



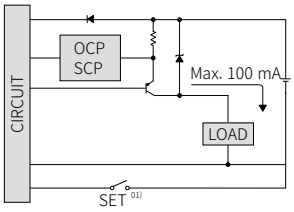
Pin	Color	Function
①	Brown	+V
②	White	SET
③	Blue	0 V
④	Black	OUT

Circuit

■ NPN open collector output



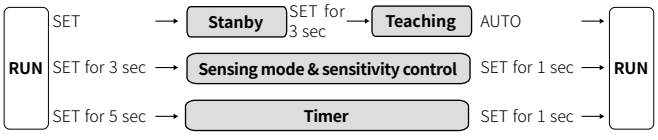
■ PNP open collector output



01) The external input wire(white, connect with the pin 2) is same with the SET key function.
- OCP (over current protection), SCP (short circuit protection)
- If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the protection circuit.

Setting Mode

- Use the SET key on the front of the sensor or external input wire (white, connect with the pin 2).
- Check the operations of indicator under the setting status.
- When resetting the sensor, it starts from the previous settings. (factory reset: not supported)



Teaching

Set the reference color with the teaching function. The operations of teaching indicator differ from the teaching status.

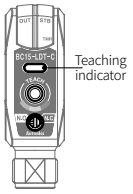
01. Place the sensor and color of target object facing the each other.
Installation distance: 15±2 mm
02. Press the SET key to enter the setting mode (teaching standby).
When there is no SET input for 10 seconds, the sensor will automatically return to RUN mode.
03. Hold the SET key for 3 seconds to proceed with the teaching.
04. When the teaching is complete, the teaching indicator displays the set reference color (teaching color), and the sensor automatically return to the RUN mode.

		Teaching indicator	Stability indicator (green)	Operation indicator (red)
Teaching standby		Flashing (orange)	OFF	OFF
Teaching complete		ON (teaching color)	ON	ON
Teaching error 01)	Excess light intensity	ON (green)	OFF	Flashing
	Insufficient light intensity	ON (red)		
	Fluctuating light intensity	ON (blue)		

01) Press the SET key to return the RUN mode.

■ Teaching indicator

- With the ability to check the set reference color, you do not need to re-set the teaching color every time.
- Displays a similar color after successfully "teaching" the color
- The teaching color and the color displayed on the teaching indicator may differ depending on environment conditions (ambient light, reflection angle, material, etc.)
- It may difficult to check the similar colors when installing multiple sensors. Teaching indicator color is available only for reference.



Sensing Mode and Sensing Sensitivity

Set the sensing mode and sensing sensitivity (fine-normal-rough).
The operations of indicator differ from each sensing mode.
- C mode (Color): distinguishes by color rate
- C + I mode (Color + Intensity): distinguishes by color rate and contrast

01. Hold the SET key for 3 seconds to enter the setting mode.
02. Press the SET key once to select the sensing mode and its sensitivity.
03. Hold the SET key over 1 seconds to return the RUN mode.

Sensing mode	Sensing sensitivity	Teaching indicator	Stability indicator (green)	Operation indicator (red)
C mode	Fine	Flashing (red)	OFF	Flashing
	Normal	Flashing (green)		
	Rough	Flashing (blue)		
C + I mode	Fine	Flashing (red)	Flashing	OFF
	Normal	Flashing (green)		
	Rough	Flashing (blue)		

Timer Setting

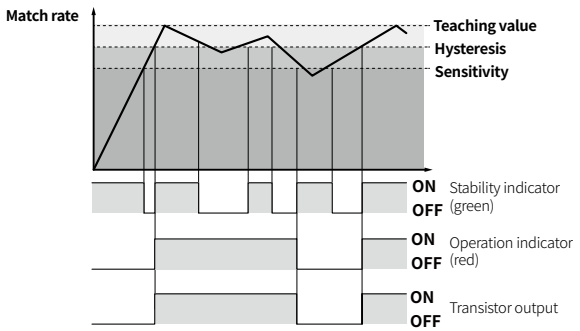
Timer (40ms OFF delay) function helps to prevent malfunction of output from target objects moving too rapidly. The operations of indicator differ from the setting mode.

01. Hold the SET key for 5 seconds to enter the setting mode.
02. Press the SET key once to ON or OFF the timer.
03. Hold the SET key over 1 seconds to return the RUN mode.

		Timer indicator (orange)	Stability indicator (green)	Operation indicator (red)
Setting mode	Timer ON	ON	Flashing	Flashing
	Timer OFF	OFF		

Operation Timing Chart and Indicators

■ Color match mode (N.O.)

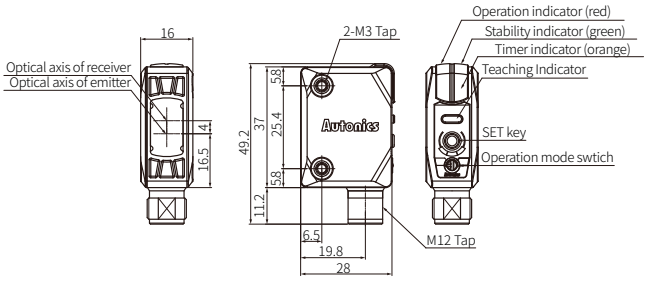


Status	Teaching indicator	Stability indicator (green)	Operation indicator (red)
Stable match	ON (teaching color)	ON	ON
Unstable match		OFF	ON
Unstable mismatch		OFF	OFF
Stable mismatch		ON	OFF

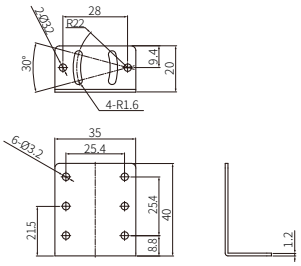
- In color mismatch mode (N.C.), the waveforms are reversed.

Dimensions

• Unit: mm, For the detailed drawings, follow the Autonics website.



■ Bracket



Specifications

Model	BC15-LDT-C-□
Sensing type	Convergent reflective
Sensing distance	15 mm ± 2 mm
Sensing target	Opaque materials, translucent materials
Hysteresis	≤ 20 % of sensing distance (may vary by sensing mode or sensitivity)
Response time	≤ 500 μs
Light source	Full Color (Red, Green, Blue)
Min. spot size	W 1.24 × L 6.7 mm
Sensing mode	C mode (color only) - C+I mode (color + intensity) selectable (SET key or SET cable)
Sensitivity adjustment	YES (SET key or SET cable)
Operation mode	Color match (Normally Open) - Color mismatch (Normally Closed) mode selectable (Adjuster)
Teaching	YES
Timer	OFF-delay mode: 40 ms
Indicator	Operation indicator (red), stability indicator (green), teaching indicator (full color), timer indicator (orange)
Certifications	CE KC EAC
Unit weight (packaged)	≈ 14 g (≈ 80 g)

Power supply	12-24 VDC⎓ ±10 % (ripple P-P: ≤ 10 %)
Current consumption	≤ 30 mA
Control output	NPN open collector output / PNP open collector output model
Load voltage	≤ 30 VDC⎓
Load current	≤100 mA
Residual voltage	NPN: ≤ 1 VDC⎓, PNP: ≤ 2.5 VDC⎓
Protection circuit	Reverse power protection circuit, output short overcurrent protection circuit
Insulation resistance	≥ 20 MΩ (500 VDC⎓ megger)
Noise immunity	±240 VDC⎓ the square wave noise (pulse width: 1 μs) by the noise simulator
Dielectric strength	Between the charging part and the case: 1,000 VAC~ 50/60 Hz for 1 min
Vibration	1.5 mm double amplitude at frequency of 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	500 m/s² (≈ 50 G) in each X, Y, Z direction for 3 times
Ambient illuminance (receiver)	Incandescent lamp: ≤ 3,000 lx
Ambient temperature	-10 to 55 °C, storage: -25 to 75 °C (no freezing or condensation)
Ambient humidity	35 to 85 %RH, storage: 35 to 85 %RH (no freezing or condensation)
Protection rating	IP67 (IEC standard)
Connection	Connector type
Connector	M12 4-pin plug type
Material	Case: PC, sensing part: Acrylic, bracket: SUS304, bolt: Carbon Steel

Troubleshooting

Problem	Cause	Troubleshooting
Does NOT operate	Power supply	Supply power within rated voltage.
	Open, connection error	Check the cable connections.
Does NOT operate occasionally	Excess light intensity alarm during teaching, output chattering	Install the sensor tilted with an angle of 10 to 20 degrees. (when sensing metal or glossy objects)
	Converter external light interference	Install a visor on the sensor or install the sensor away from the external light source.
	Contamination of sensor cover	Remove the substance using a soft brush or cloth and reset the sensitivity.
	Connector error	Check connector assembly.
Operation/Stability indicator flash alternately every 0.5 seconds.	Overcurrent input due to the input voltage and load	Supply power within rated voltage.

Sold Separately: M12 Connector Cable

• For detailed information, refer to the 'M8/M12 Connector Cable' manual.

Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
	DC	M12 (Socket-Female) 4-pin	4-wire	2 m	Oil resistant PVC	CIDH4-2
				3 m		CIDH4-3
				5 m		CIDH4-5
				7 m		CIDH4-7
				2 m	Oil resistant PVC c UL us	CIDH4-2-A
				3 m		CIDH4-3-A
				5 m		CIDH4-5-A
				7 m		CIDH4-7-A
	DC	M12 (Socket-Female) 4-pin, L type	4-wire	2 m	Oil resistant PVC	CLDH4-2
				3 m		CLDH4-3
				5 m		CLDH4-5
				7 m		CLDH4-7
				2 m	Oil resistant PVC c UL us	CLDH4-2-A
				3 m		CLDH4-3-A
				5 m		CLDH4-5-A
				7 m		CLDH4-7-A
	DC	M12 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin	1 m	Oil resistant PVC	C1DH4-1
				3 m		C1DH4-3
				5 m		C1DH4-5
				7 m		C1DH4-7
	DC	M12 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin, L type	1 m	Oil resistant PVC	C2DH4-1
				3 m		C2DH4-3
				5 m		C2DH4-5
				7 m		C2DH4-7
	DC	M12 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin, L type	1 m	Oil resistant PVC	C3DH4-1
				3 m		C3DH4-3
				5 m		C3DH4-5
				7 m		C3DH4-7
	DC	M12 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin	1 m	Oil resistant PVC	C4DH4-1
				3 m		C4DH4-3
				5 m		C4DH4-5
				7 m		C4DH4-7
	DC	M12 (Plug-Male) 4-pin	M12 (Plug-Male) 4-pin	2 m	PVC	C1D4-2P
				5 m		C1D4-5P

Product Characteristics

This data is based on internal testing and for reference only. Performance may vary by installation and usage environment. Product testing prior to use is recommended.

Characteristic Graphs: Uncoated (TYPICAL)

■ Standard sensing color

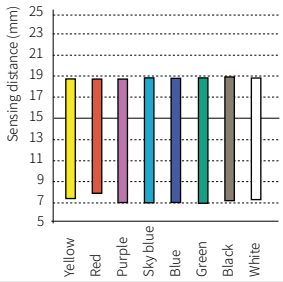
Reference color	PANTONE color code
Yellow	Yellow U
Red	Red032U
Purple	Purple U
sky blue	306U
Blue	Blue072U
Green	Green U
Black	405U
White	—

■ Sensing distance by sensing color

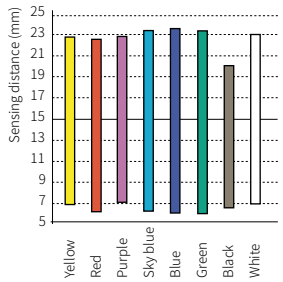
• BC15-LDT-C

C mode

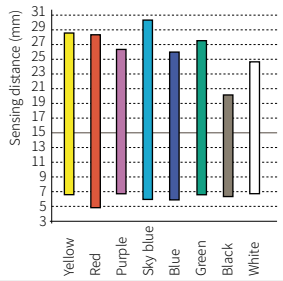
• Fine



• Normal

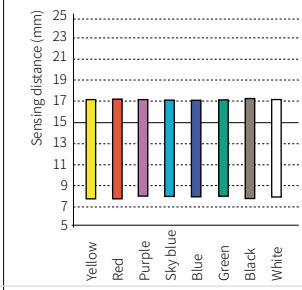


• Rough

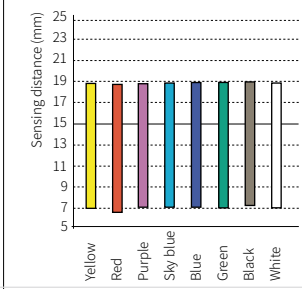


C + l mode

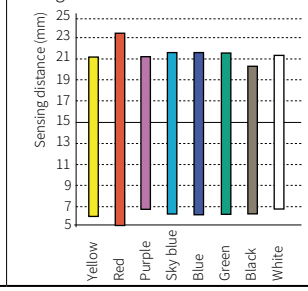
• Fine



• Normal



• Rough



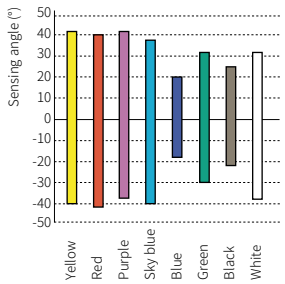
Characteristic Graphs: Uncoated (TYPICAL)

■ Sensing angle by sensing color

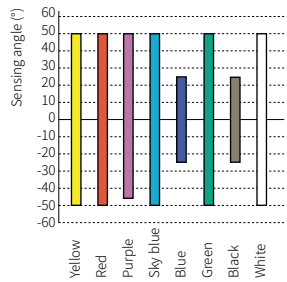
• BC15-LDT-C

C mode

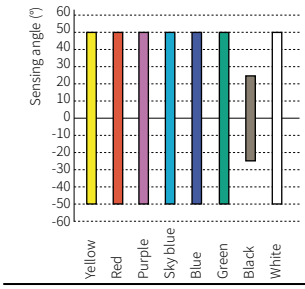
• Fine



• Normal

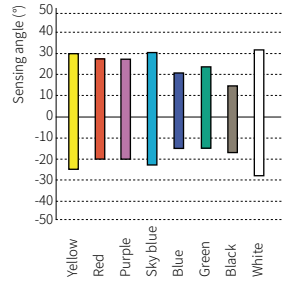


• Rough

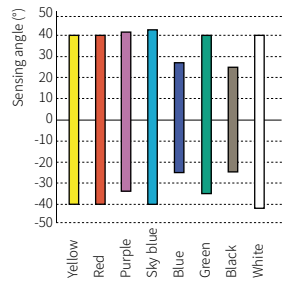


C + l mode

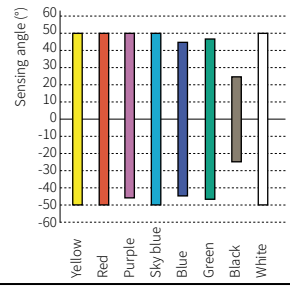
• Fine



• Normal



• Rough



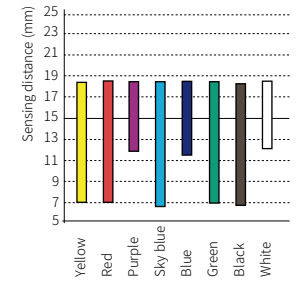
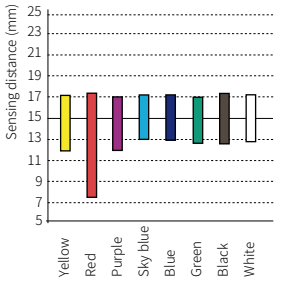
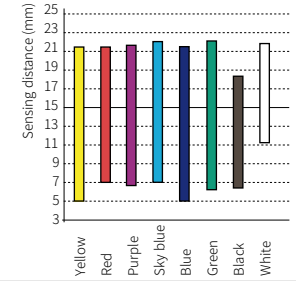
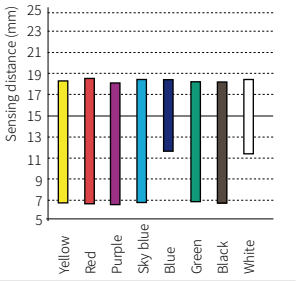
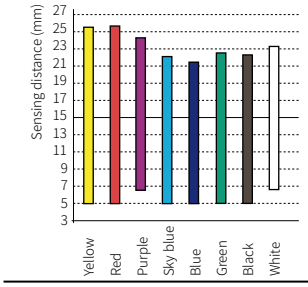
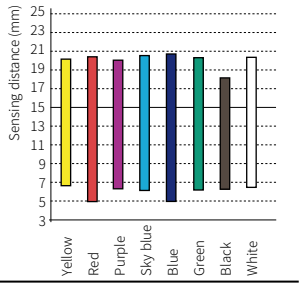
Characteristic Graphs: Coated (TYPICAL)

■ Standard sensing color

Reference color	PANTONE color code
Yellow	Yellow C
Red	Red032C
Purple	Purple C
Sky blue	306C
Blue	Blue072C
Green	Green C
Black	405C
White	—

■ Sensing distance by sensing color

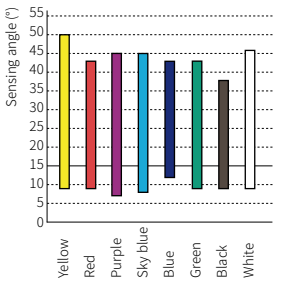
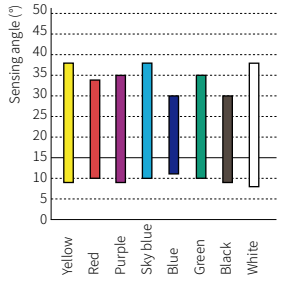
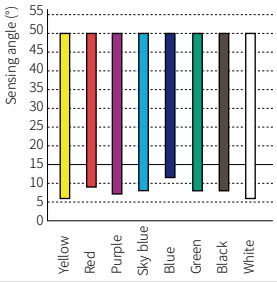
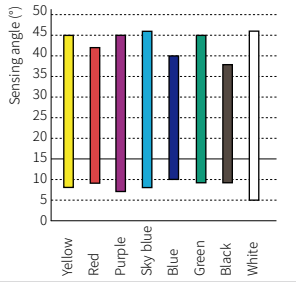
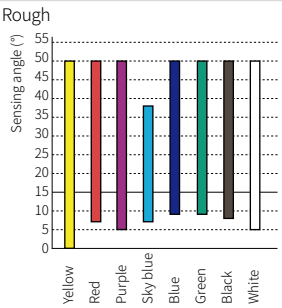
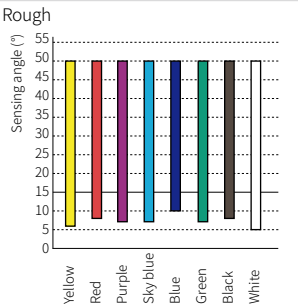
• BC15-LDT-C

C mode	C + I mode
• Fine 	• Fine 
• Normal 	• Normal 
• Rough 	• Rough 

Characteristic Graphs: Coated (TYPICAL)

■ Sensing angle by sensing color

• BC15-LDT-C

C mode	C + I mode
• Fine 	• Fine 
• Normal 	• Normal 
• Rough 	• Rough 

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