Autonics

Cylindrical Photoelectric Sensors

BRQ Series (front sensing type)

PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.
The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

Features

- Excellent noise immunity and minimal influence from ambient light
- Reverse power protection circuit, reverse output protection circuit, output short overcurrent protection circuit
- Mutual interference prevention function (except through-beam type)
- Sensitivity adjuster
- Light ON/Dark ON mode selectable by control wire
- Various materials : Plastic, Metal (Ni-plated Brass), SUS316L
- Long sensing distance : 30 m (through-beam type)
- Body size
  - BRQT, BRQM : Standard
  - BRQP : Standard, Short body
- Protection rating
  - BRQT : IP67 (IEC standard), IP69K (DIN standard)
  - BRQM, BRQP : IP67 (IEC standard)

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

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

01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g., nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)
Failure to follow this instruction may result in personal injury, economic loss or fire.

02. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.
Failure to follow this instruction may result in explosion or fire.

03. Do not disassemble or modify the unit.
Failure to follow this instruction may result in fire.

04. Do not connect, repair, or inspect the unit while connected to a power source.
Failure to follow this instruction may result in fire.

05. Check 'Connections' before wiring.
Failure to follow this instruction may result in fire.

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

01. Use the unit within the rated specifications.
Failure to follow this instruction may result in fire or product damage.

02. Use a dry cloth to clean the unit, and do not use water or organic solvent.
Failure to follow this instruction may result in fire.

Cautions during Use

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- When connecting an inductive load such as DC relay or solenoid valve to the output, remove surge by using diodes or varistors.
- Use the product after 0.5 sec of the power input.
  When using a separate power supply for the sensor and load, supply power to the sensor first.
- The power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Wire as short as possible and keep it away from high voltage lines or power lines to prevent surge and inductive noise.
- When using switching mode power supply (SMPS), ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
- When using a sensor with a noise-generating equipment (e.g., switching regulator, inverter, and servo motor), ground F.G. terminal of the equipment.
- This unit may be used in the following environments.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude max. 2,000 m
  - Pollution degree 3
  - Installation category II

Product Components

Sensing type	Through-beam	Polarized retroreflective	Diffuse reflective
Product components	Product, instruction manual		
Reflector	-	MS-2A	-
Adjustment screwdriver	× 1	× 1	× 1
M18 fixing nut	× 4	× 2	× 2

Ordering Information

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

BRQ ❶ ❷ ❸ - ❹ ❺ ❻ ❼ ❽ - ❾ - ❿

❶ Material
T: SUS316L
M: Brass, Ni-plate
P: Plastic

❷ Sensing direction
No mark: Front

❸ Sensing distance
Number: Sensing distance (unit: mm)
Number+M: Sensing distance (unit: m)

❹ Sensing type
T: Through-beam
P: Polarized retroreflective
D: Diffuse reflective

❺ Power supply
D: 10 - 30 VDC

❻ Output
T: Solid state (transistor)

❼ Emitter/Receiver
No mark: Integrated type
1: Emitter
2: Receiver

❽ Appearance
A: Standard
B: Short body (plastic material model)

❾ Connection
No mark: Cable type
C: Connector type

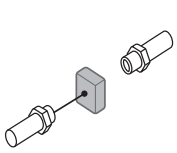
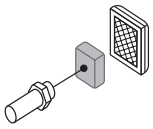
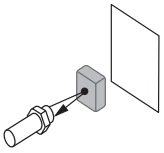
❿ Control output
No mark: NPN open collector output
P: PNP open collector output

Sold Separately

- Reflector: MS Series
- Retroreflective tape: MST Series
- Bracket: BK-BR-A
- M12 connector cable: C□D(H)4-□-□
- Fixing cap for plastic short body: BK-BR-B

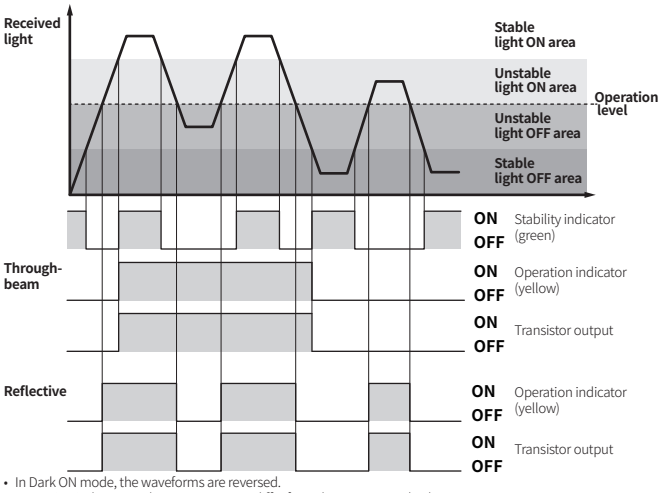
Cautions during Installation

- 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 curves
- When installing multiple sensors closely, it may result in malfunction due to mutual interference.
- For installation, tighten the screw with a torque of 14.7 N m (SUS316L, Brass, Ni-plate material model), 0.39 N m (plastic material model).
  Mount the brackets correctly to prevent the twisting of the sensor's optical axis.
- Do not impact with a hard object or bend the cable excessively. That could decrease the product's water resistance.
- Use this product after the test. Check whether the indicator works appropriately for the positions of the detectable object.

Through-beam	Retroreflective	Reflective
		
Emitter - Receiver: Install to face each other	Sensor - Reflector: At least 0.1 m apart, install to face each other (parallel with the sensing side of the unit)	Sensor - Sensing target: Install to face each other (parallel with the sensing side of the unit)

Operation Timing Chart and Indicators

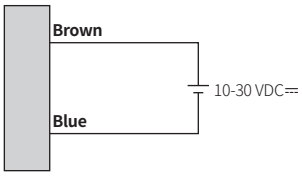
■ Light ON mode



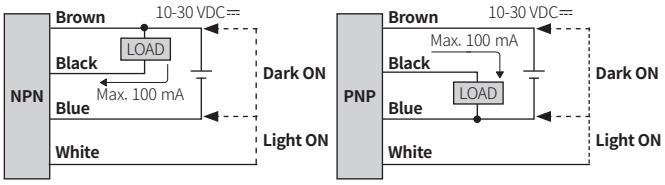
- In Dark ON mode, the waveforms are reversed.
- Operation indicator and transistor output differ from the sensing method.

Connections

■ Cable type: Emitter



■ Cable type: Receiver, Polarized retroreflective, Diffuse reflective type



■ Connector type

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

- Connector pin ②, ④ are N.C (not connected) terminal for the emitter.

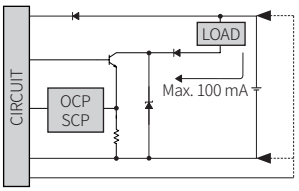
■ Operation mode selection

⚠ Be sure to connect the control wire when selecting the operation mode.
Failure to this instruction may result in product damage.

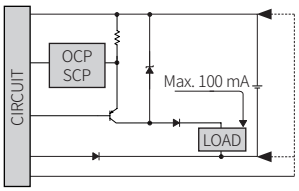
Operation mode	Wiring
Dark ON	Connect the control wire (white) to +V (brown)
Light ON	Connect the control wire (white) to 0 V (Blue)

Circuit

■ NPN open collector output



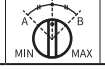
■ PNP open collector output



- 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.

Sensitivity Adjustment

- Set the adjuster for stable Light ON area, minimizing the effect of the installation environment.
- Use the offered adjustment screwdriver. Do NOT turn with excessive force to prevent product damage.
- The steps below are based on Light ON mode.

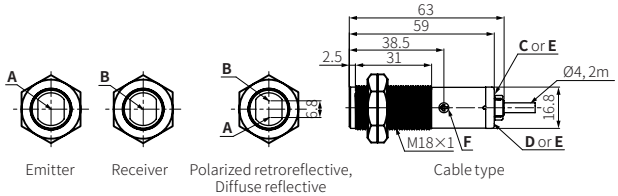
STEP	Status	Description	
01	Received		Turn the adjuster from MIN to MAX sensitivity and check the position (A) where the operation indicator activates under the light ON area.
02	Interrupted		Turn the adjuster from (A) to MAX and check the position (B) where the operation indicator activates under the light OFF area. If the operation indicator does NOT activate at the MAX (maximum sensitivity): MAX = (B).
03	-		Set the adjuster at the mid position between (A) and (B) for optimal sensitivity.

Dimensions

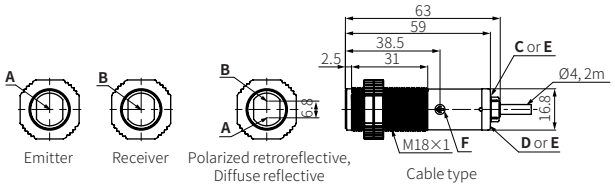
- Unit: mm, For the detailed drawings, follow the Autonics website.
- This dimensions shows the cable type.
  Refer to the 'Specifications' for the core, wiring, and connector.

A	Optical axis of emitter	D	Stability indicator (green)
B	Optical axis of receiver	E	Power indicator of emitter (red)
C	Operation indicator (yellow)	F	Sensitivity adjuster

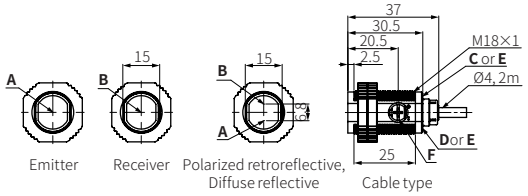
■ SUS316L, Ni-plate, Brass material model



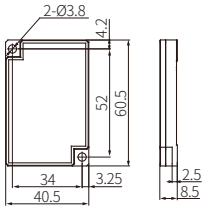
■ Plastic material model



■ Plastic material, short body model

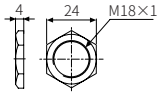


■ Reflector (MS-2A)

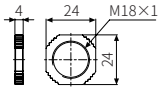


■ M18 fixing nut

- SUS316L, Ni-plate, Brass material model



- Plastic material model



Specifications

Model	BRQ□□-TDT□-□-□			BRQ□3M-PDT□-□-□	BRQ□□-DDT□-□-□		
Sensing type	Through-beam			Polarized retroreflective	Diffuse reflective		
Sensing distance	5 m	20 m	30 m	3 m [01]	100 mm [02]	400 mm [02]	1 m [03]
Sensing target	Opaque materials			Opaque materials	Opaque, translucent materials		
Min. sensing target	≥ Ø 7 mm			≥ Ø 75 mm	-		
Hysteresis	-			-	≤ 20 % of sensing distance		
Response time	≤ 1 ms						
Light source	Red			Red	Infrared	Red	Red
Peak emission wavelength	660 nm			660 nm	850 nm	660 nm	660 nm
Sensitivity adjustment	YES (Adjuster)			YES (Adjuster)	YES (Adjuster)		
Mutual interference prevention	-			YES	YES		
Operation mode	Light ON mode - Dark ON mode selectable (Control wire)						
Indicator	Operation indicator (yellow), stability indicator (green), power indicator (red) [04]						
Approval	CE UK CA cULus EAC			CE UK CA cULus EAC	CE UK CA cULus EAC		

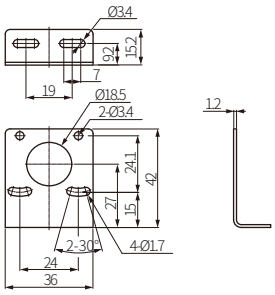
01) Reflector (MS-2A)
02) Non-glossy white paper 100 × 100 mm
03) Non-glossy white paper 300 × 300 mm
04) Only for the emitter

Unit weight (packaged)	Material	Through-beam	Polarized retroreflective, Diffuse reflective
Cable type	SUS316L	≈ 140 g (≈ 220 g)	≈ 70 g (≈ 150 g)
	Brass, Ni-plate	≈ 140 g (≈ 220 g)	≈ 70 g (≈ 150 g)
	Plastic	≈ 110 g (≈ 160 g)	≈ 60 g (≈ 120 g)
	Plastic (short)	≈ 100 g (≈ 150 g)	≈ 50 g (≈ 120 g)
Connector type	SUS316L	≈ 50 g (≈ 160 g)	≈ 30 g (≈ 140 g)
	Brass, Ni-plate	≈ 50 g (≈ 160 g)	≈ 30 g (≈ 140 g)
	Plastic	≈ 25 g (≈ 110 g)	≈ 15 g (≈ 110 g)
	Plastic (short)	≈ 20 g (≈ 100 g)	≈ 10 g (≈ 100 g)

Power supply	10-30 VDC⎓ ±10 % (ripple P-P: ≤ 10 %)
Current consumption	It depends on the sensing type
Through-beam	Emitter: ≤ 20 mA, receiver: ≤ 20 mA
Reflective	≤ 30 mA
Control output	NPN open collector output / PNP open collector output model
Load voltage	≤ 30 VDC⎓
Load current	≤ 100 mA
Residual voltage	NPN: ≤ 2 VDC⎓, PNP: ≤ 2 VDC⎓
Protection circuit	Reverse power/output 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)	Sunlight: ≤ 11,000 lx, incandescent lamp: ≤ 3,000 lx
Ambient temperature	-25 to 60 °C, storage: -30 to 70 °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) SUS316L material model: IP67 (IEC standard), IP69K (DIN standard)
Connection	Cable type / Connector type model
Cable spec.	Ø 4 mm, 4-wire, (Emitter: 2-wire), 2 m
Wire spec.	AWG26 (0.52 mm, 20-core), insulator outer diameter: Ø 1 mm
Connector	M12 4-pin plug type
Material	Case: It depends on the model. (refer to 'Ordering Information'), lens and lens cover: PMMA

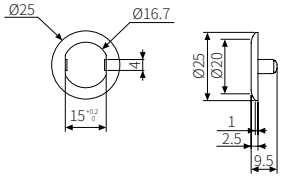
Sold Separately: Bracket (BK-BR-A)

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



Sold Separately: Fixing Cap (BK-BR-B)

- Unit: mm, For the detailed drawings, follow the Autonics website.
- Only for the plasic material short body model



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 cULus	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 cULus	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

Sold Separately: Reflector MS Series

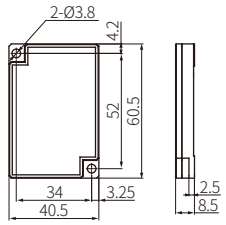
Appearance	Size (W × H)	Reflectance	Sensing type	Model
	40.5 × 60.5 mm	Typical reflectivity	Retroreflective	MS-2
		Typical reflectivity	Polarized retroreflective	MS-2A
		High reflectivity	Polarized retroreflective	MS-2S
	81.5 × 60.5 mm	Typical reflectivity	Retroreflective	MS-3
		High reflectivity	Polarized retroreflective	MS-3S
	29.3 × 38 mm	Typical reflectivity	Retroreflective	MS-4
	15.4 × 24 mm	Typical reflectivity	Retroreflective	MS-5
	13.7 × 23 mm	Typical reflectivity	Retroreflective	MS-6

- Material: PMMA / ABS (front part / rear part)
- Installation: Bolt mounting

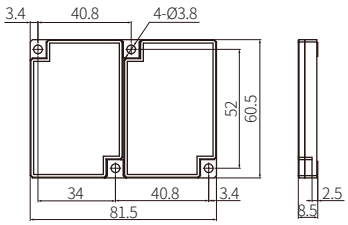
■ Dimensions

(Unit: mm)

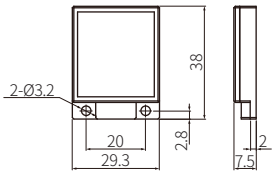
MS-2□



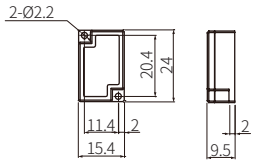
MS-3□



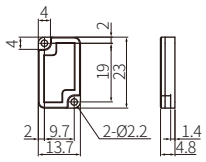
MS-4



MS-5



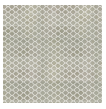
MS-6



■ Cautions during Installation

- Select a reflector size that is suitable for the installation space and operating environment of the sensors.
- In general, a bigger size of the reflector results in a longer sensing distance.
- Reflectors with high reflectivity increase the sensing distance compared to typical reflectors.
- The reflectance may vary depending on the operating environment for the sensors.

Sold Separately: Retroreflective Tape MST Series

Appearance	Size (W × H)	Approval	Packaged unit	Sensing type	Model
	50 × 50 mm	EAC	10	• Retroreflective • Polarized retroreflective	MST-50-10
	100 × 100 mm	EAC	5	• Retroreflective • Polarized retroreflective	MST-100-5
	200 × 200 mm	EAC	2	• Retroreflective • Polarized retroreflective	MST-200-2

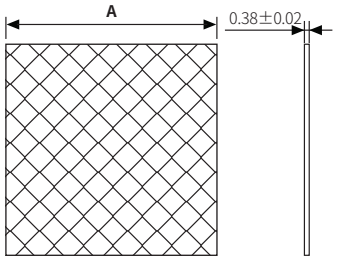
- Material: PMMA / PC / Acrylic (surface film / prism layer / adhesive layer)
- Ambient temperature: -35 to 65 °C (temperature for adhesion: 10 to 30 °C)
- Installation: Tape cutting (installation distance: ≥ 20 mm)

■ Reflectance of MST Series

Series	Sensing type	MST-50-10	MST-100-5	MST-200-2
BTS	Retroreflective	95%	100%	100%
BM		70%	110%	170%
BMS		90%	120%	190%
BEN		90%	130%	140%
BX		90%	100%	110%
BJ	Polarized retroreflective	40%	60%	100%
BJR		35%	45%	55%
BJX		35%	45%	55%
BH		60%	80%	140%
BEN		70%	90%	120%
BX		30%	40%	60%
BRQ		40%	50%	80%
BRQP (plastic material type)		40%	80%	85%
BRQPS (side sensing type)		25%	30%	35%

■ Dimensions

(Unit: mm)



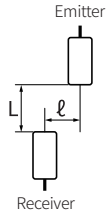
Model	A
MST-50-10	□ 50
MST-100-5	□ 100
MST-200-2	□ 200

■ Cautions during Installation

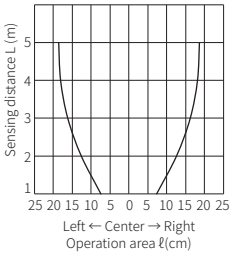
- Select a retroreflective tape that is suitable for the installation space and operating environment of the sensors.
- In general, a bigger size of retroreflective tape results in a longer sensing distance.
- Be sure to check the reflectance of the MST series for proper use.
- The reflectance may vary depending on the operating environment for the sensors.
- Before applying the tape, clean the adhesive side of the reflective tape with a dry cloth.
- Do not press or damage the surface of the retroreflective tape.
- Regularly clean the tape to maintain optimal performance, using only neutral detergents. Do not use chemical solvents.

Characteristic Curves: Through-beam Type

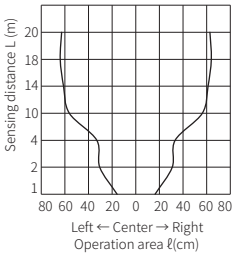
■ Sensing area



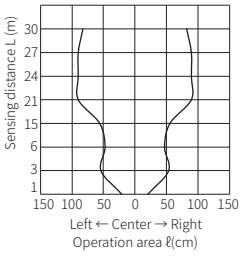
• BRQT[M]5M-TDTA



• BRQT[M]20M-TDTA-C



• BRQT[M]30M-TDTA-P



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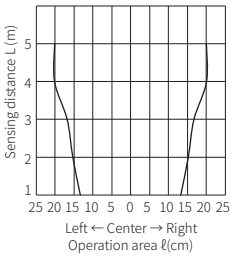

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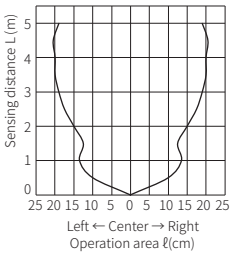

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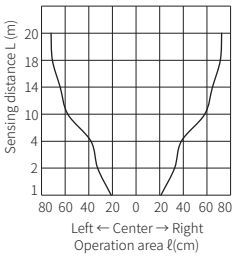

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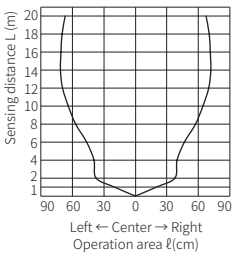

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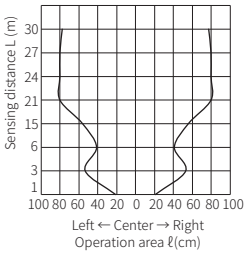

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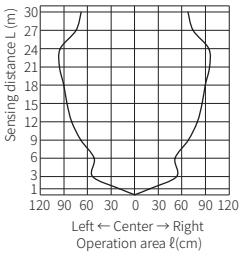
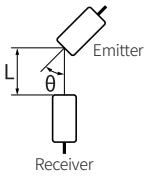


■ Emitter angle



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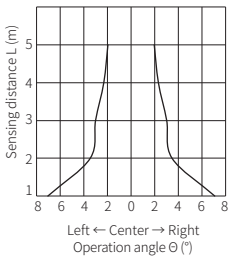

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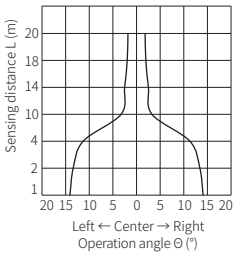

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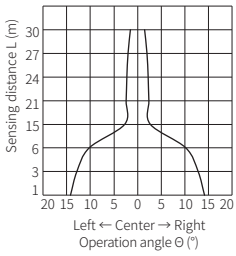

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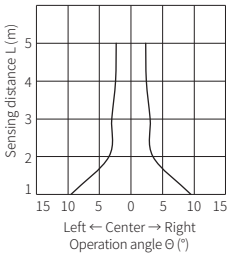

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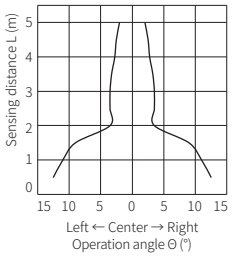

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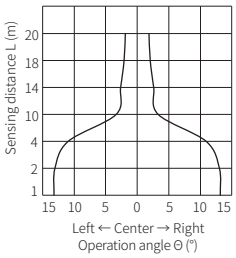

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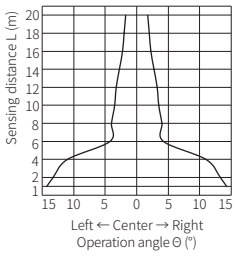

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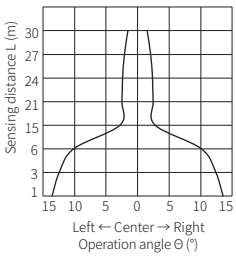

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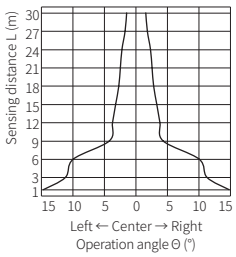
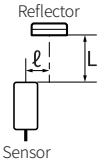
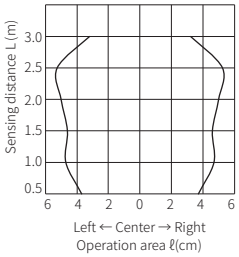


Characteristic Curves: Polarized Retroreflective Type

■ Sensing area



• BRQT[M]3M-PDTA-C-P



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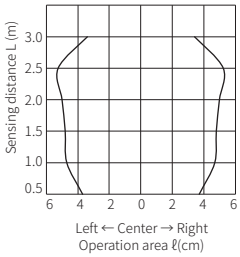

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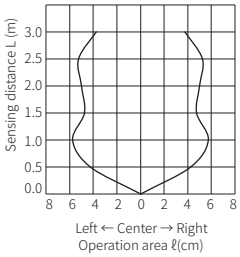
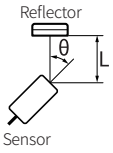


■ Sensor angle



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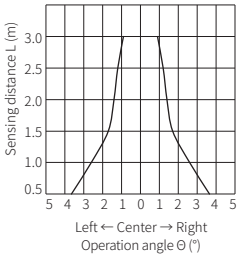

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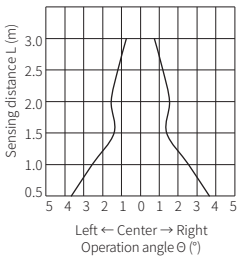

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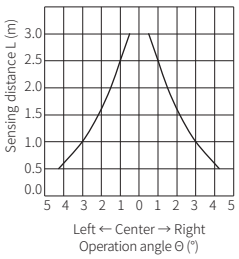
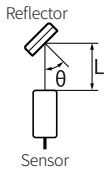


■ Reflector angle



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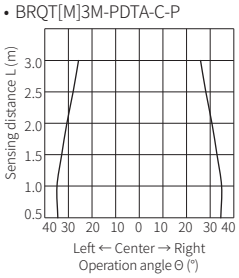

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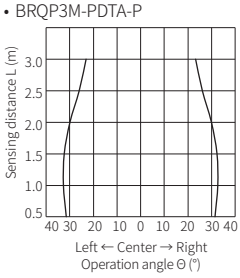

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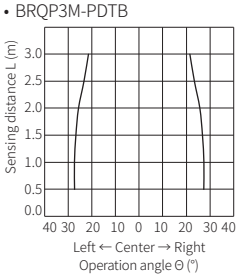
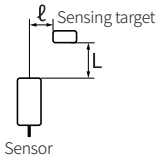
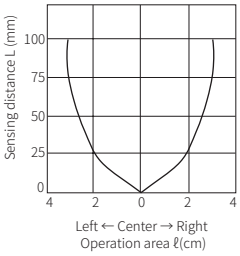


Characteristic Curves: Diffuse Reflective Type

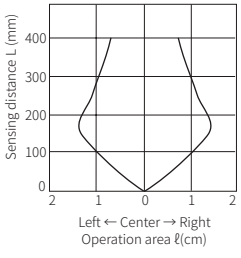
■ Sensing area



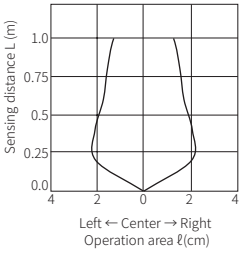
• BRQT[M]100-DDTA



• BRQT[M]400-DDTA-C



• BRQT[M]1M-DDTA-P



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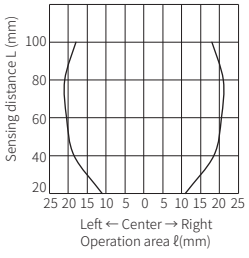

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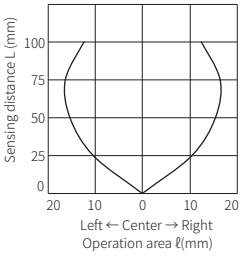

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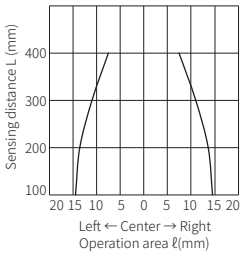

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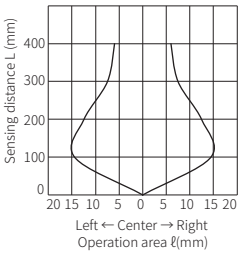

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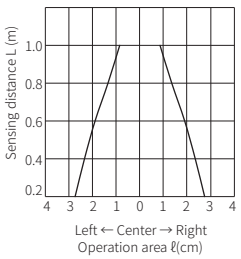

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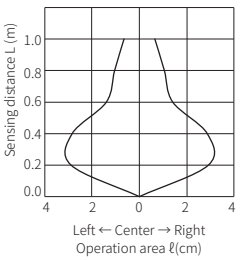

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