Autonics

# Oil-resistant Photoelectric Sensors

## BJR Series

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

- Long sensing distance with lens of high performance
  : Through-beam type 15 m, diffuse reflective type 1 m, polarized retroreflective type 3 m (MS-2S)
- M.S.R. (Mirror Surface Rejection) function (Polarized retroreflective type)
- Compact size : W 11 × H 32 × L 20 mm
- Light ON/Dark ON operation mode switch
- Built-in sensitivity adjustment adjuster
- Reverse power protection circuit and output short overcurrent protection circuit
- Mutual interference prevention function (except through-beam type)
- Excellent noise immunity and minimal influence from ambient light
- Stronger in the environment with full of cutting fluid or lubricating oil (optimized for automobile and machine tool industry)
- IP67 protection rating (IEC standard), IP67G oil resistance protection rating (JEM 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-2S | - |
| Adjustment screwdriver | × 1 | × 1 | × 1 |
| Bracket A | × 2 | × 1 | × 1 |
| M3 bolt | × 4 | × 2 | × 2 |

CE UK CA 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.

BJR ❶ - ❷ ❸ ❹ - ❺ - ❻ - ❼

**❶ Sensing distance**
Number: Sensing distance (unit: mm)
Number+M: Sensing distance (unit: m)

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

**❸ Power supply**
D: 10 - 30 VDC⎓

**❹ Output**
T: Solid state (transistor)

**❺ Connection**
No mark: Cable type
W: Cable connector type

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

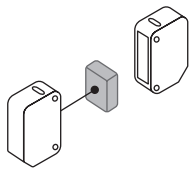
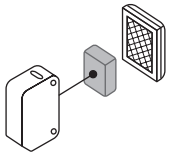
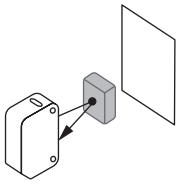
**❼ Oil resistant/Oil proof type**
No mark: Oil resistant type

## Sold Separately

- Reflector: MS Series
- Retroreflective tape: MST Series
- Bracket B (BJP SERIES BRACKET B)
- M12 connector cable: CID(H)3-□, CLD(H)3-□

## 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 0.5 N m. 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.
- Although some of the cable connector types can have color differences in the connector part due to the coating, it does not affect operation and performance.
- 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) |

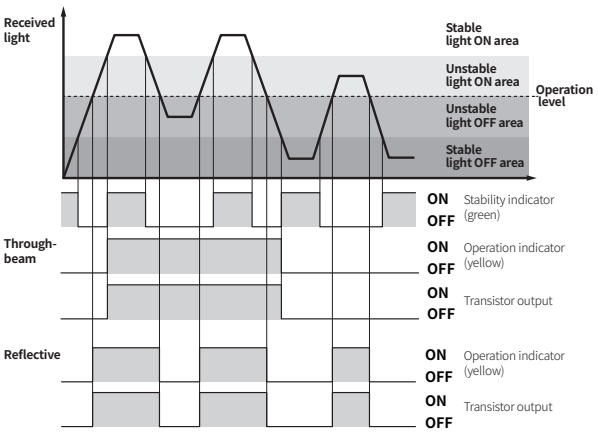
## Setting Operation Mode

- Be sure to set the mode before power-on.
- Use the offered adjustment screwdriver. Do NOT turn with excessive force to prevent product damage.

| L: Light ON mode | D: Dark ON mode |
|---|---|
|  |  |

## Operation Timing Chart and Indicators

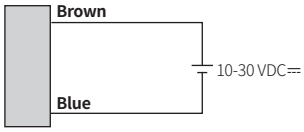
### ■ Light ON mode



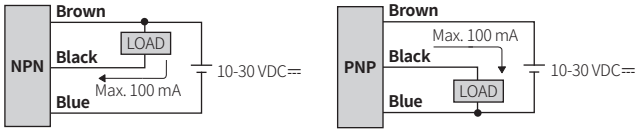

- In Dark ON mode, the waveforms are reversed.
- Operation indicator and transistor output differ from the sensing method.

## Connections

### ■ Cable type: Emitter




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



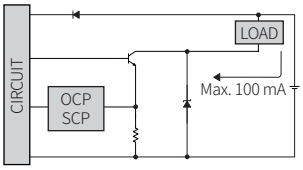

### ■ Cable connector type


| Pin | Color | Function |
|---|---|---|
| ① | Brown | +V |
| ② | - | - |
| ③ | Blue | 0 V |
| ④ | Black | OUT |

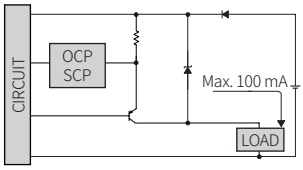
- Connector pin ④ is N.C (not connected) terminal for the emitter.

## 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.

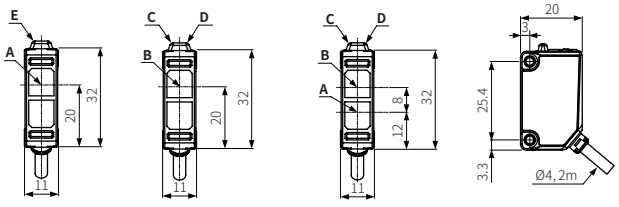
## Sensitivity Adjustment

- 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. |

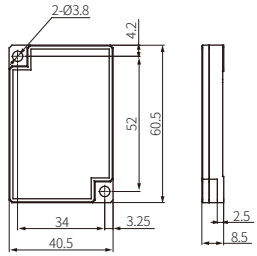
## Dimensions

- 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 spec.

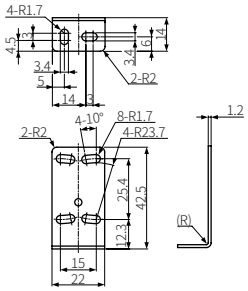



| | | | |
|---|---|---|---|
| A | Optical axis of emitter | D | Stability indicator (green) |
| B | Optical axis of receiver | E | Power indicator (red) |
| C | Operation indicator (yellow) | | |

■ **Reflector (MS-2S)**




■ **Bracket A**




## Specifications

| Model | BJR15M-TDT-□-□ | BJR3M-PDT-□-□ | BJR□-DDT-□-□ | |
|---|---|---|---|---|
| Sensing type | Through-beam | Polarized retroreflective | Diffuse reflective | |
| Sensing distance | 15 m | 3 m [01] | 100 mm [02] | 1 m [03] |
| Sensing target | Opaque materials | Opaque materials | Opaque materials, translucent materials | |
| Min. sensing target | ≥ Ø 12 mm | ≥ Ø 75 mm | - | - |
| Hysteresis | - | - | ≤ 20 % of sensing distance | |
| Response time | ≤ 1 ms | | | |
| Light source | Infrared | Red | Infrared | Red |
| Peak emission wavelength | 850 nm | 660 nm | 850 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 (Adjuster) | | | |
| Indicator | Operation indicator (yellow), stability indicator (green), power indicator (red) [04] | | | |
| Approval | CE UK EAC | CE UK EAC | CE UK EAC | |

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

| Unit weight (packaged) | Through-beam | Polarized retroreflective | Diffuse reflective |
|---|---|---|---|
| Cable type | ≈ 95 g (≈ 145 g) | ≈ 50 g (≈ 115 g) | ≈ 50 g (≈ 100 g) |
| Cable connector type | ≈ 55 g (≈ 105 g) | ≈ 30 g (≈ 95 g) | ≈ 30 g (≈ 80 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: ≤ 1 VDC⎓, PNP: ≤ 2 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)** | Sunlight: ≤ 11,000 lx, incandescent lamp: ≤ 3,000 lx |
| **Ambient temperature** | -25 to 60 °C, storage: -40 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), IP67G (JEM standard) |
| **Connection** | Cable type / Cable connector type model |
| **Cable spec.** | Ø 4 mm, 3-wire (emitter: 2-wire), cable type: 2 m, cable connector type: 300 mm |
| **Wire spec.** | AWG26 (0.52 mm, 20-core), insulator outer diameter: Ø 1 mm |
| **Connector** | M12 4-pin plug type |
| **Material** | Case: ABS, CAP: PA12, sensing part: PMMA |

## IP67G (JEM standard)

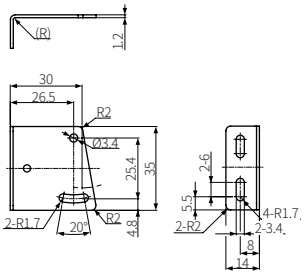
■ **Used oil (for reference only)**

| Oil type | JIS standard | Oil name | Kinetic viscosity (mm²/s, 40°C) | PH |
|---|---|---|---|---|
| Lubricating oil | — | Velocite Oil No.3 | 2 | — |
| Water-insoluble cutting fluid | 2-5 | Tectyl Cut 527 | 27 | — |
| Water-soluble cutting fluid | — | Tectyl Cool 263C | — | 9.5 (10% Solution) |

- Special coating prevents penetration of oil (drops and powder) into the product. It obtains the protection rating of enhanced oil resistance. (Pass the dropping test for 240 hours with the above oil)

## Sold Separately: Bracket B (BJP SERIES BRACKET B)

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




## 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 | 3-wire | 2 m | PVC | CID3-2 |
| | | | | 5 m | | CID3-5 |
|  | DC | M12 (Socket-Female) 4-pin | 3-wire | 2 m | Oil resistant PVC | CIDH3-2 |
| | | | | 5 m | | CIDH3-5 |
|  | DC | M12 (Socket-Female) 4-pin, L type | 3-wire | 2 m | PVC | CLD3-2 |
| | | | | 5 m | | CLD3-5 |
|  | DC | M12 (Socket-Female) 4-pin, L type | 3-wire | 2 m | Oil resistant PVC | CLDH3-2 |
| | | | | 5 m | | CLDH3-5 |

## Sold Separately: Reflector MS Series

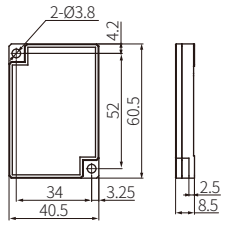
| Appearance | Size (W × H) | Reflectance | Sensing type | Model |
|---|---|---|---|---|
|  | 40.5 × 60.5 mm | Typical reflectivity | Retroreflective | MS-2 |
| | | Typical reflectivity | Polarized retroreflective | MS-2A |
| | | High reflectivity | Polarized retroreflective | MS-2S |
|  | 81.5 × 60.5 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

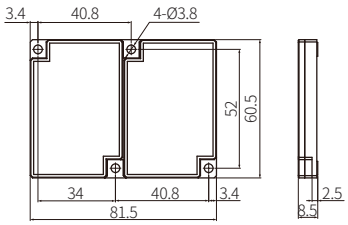
### ■ Dimensions

(Unit: mm)

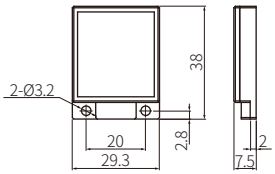
**MS-2□**



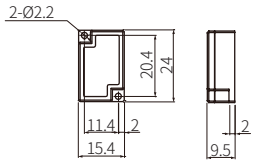

**MS-3□**



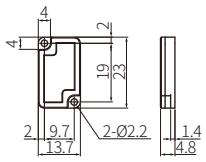

**MS-4**




**MS-5**



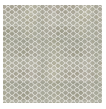

**MS-6**




### ■ 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<br>• Polarized retroreflective | MST-50-10 |
|  | 100 × 100 mm | EAC | 5 | • Retroreflective<br>• Polarized retroreflective | MST-100-5 |
|  | 200 × 200 mm | EAC | 2 | • Retroreflective<br>• Polarized retroreflective | MST-200-2 |

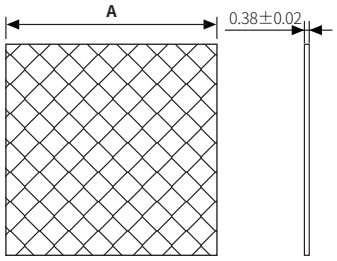
- Material: PMMA / PC / Acrylic (surface film / prism layer / adhesive layer)
- Ambient temperature: -35 to 65 °C (temperature for adhesion: 10 to 30 °C)
- Installation: Tape cutting (installation distance: ≥ 20 mm )

### ■ 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)



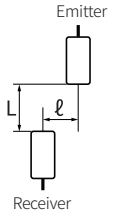

| Model | A |
|---|---|
| **MST-50-10** | □ 50 |
| **MST-100-5** | □ 100 |
| **MST-200-2** | □ 200 |

### ■ Cautions during Installation

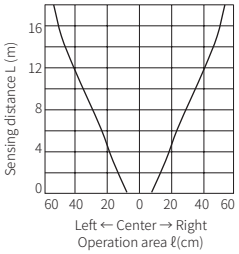
- Select a retroreflective tape that is suitable for the installation space and operating environment of the sensors.
- In general, a bigger size of retroreflective tape results in a longer sensing distance.
- Be sure to check the reflectance of the MST series for proper use.
- The reflectance may vary 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

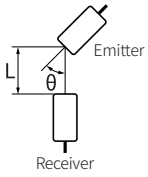
### ■ Sensing area



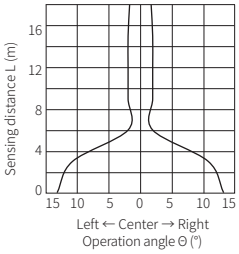

• BJR15M-TDT




### ■ Emitter angle

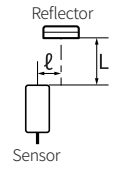



• BJR15M-TDT

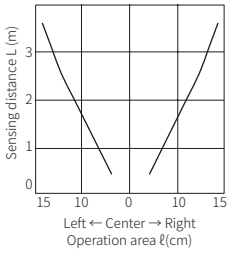



## Characteristic Curves : Polarized Retroreflective Type

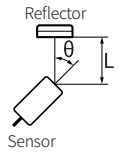
### ■ Sensing area



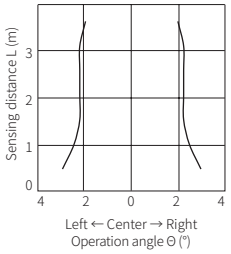

• BJR3M-PDT



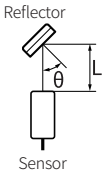

### ■ Sensor angle



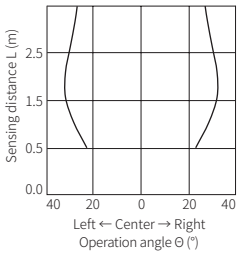

• BJR3M-PDT




### ■ Reflector angle

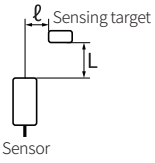



• BJR3M-PDT

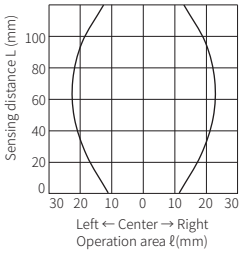



## Characteristic Curves: Diffuse Reflective Type

### ■ Sensing area




• BJR100-DDT




• BJR1M-DDT