TCD210045AB Autonics

Oil-proof Photoelectric Sensors



BJR-F 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)
- \bullet Compact size : W 11 \times H 32 \times L 20 mm
- Adjuster for Light ON/Dark ON mode
- Sensitivity adjustment Adjuster
- Built-in reverse polarity protection circuit and output short overcurrent protection circuit
- $\bullet \ \ \text{Mutual interference prevention function (except through-beam type)}\\$
- 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), IP67F oil proof 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.

05. Check 'Connections' before wiring.

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.

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. 2,000m
- 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 or B ⁰¹⁾	× 2	×1	×1		
M3 bolt	× 4	× 2	× 2		

01) Cable type and cable connector type: Bracket A, connector type: Bracket B

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 0 2 3 4 6 0 0

Sensing distance

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

Sensing type

T: Through-beam P: Polarized retroreflective D: Diffuse reflective

Power supply

D: 10 - 30 VDC=

Output

T: Solid state (transistor)

G Connection

No mark: Cable type C: Connector type W: Cable connector type

6 Control output

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

Oil resistant/Oil proof type

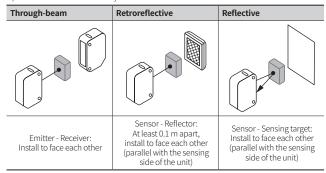
F: Oil proof type

Sold Separately

- · Reflector: MS Series
- M8 connector cable: CID(H)408-□, CLD(H)408-□
- Retroreflective tape: MST Series • 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.



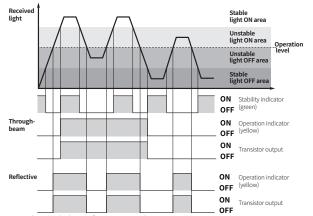
Setting Operation Mode

- 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
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Operation Timing Chart and Indicators

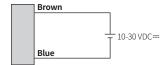
■ Light ON mode



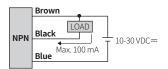
In Dark ON mode, the waveforms are reversed.
 Operation indicator and transistor output differ from the sensing method.

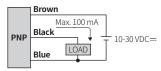
Connections

Cable type: Emitter



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





■ Connector type



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

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

Cable connector type

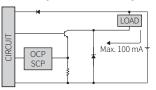


Pin	Color	Function
1	Brown	+V
2	-	-
3	Blue	0 V
4	Black	OUT

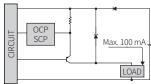
Connector pin ④ is N.C (not connected) terminal for the emitter.

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.

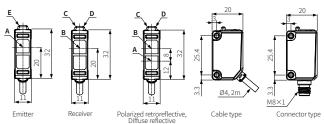
Sensitivity Adjustment

- 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	__\B_B	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	-	à B	Set the adjuster at the mid position between (A) and (B) for optimal sensitivity.

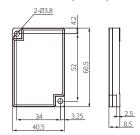
Dimensions

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



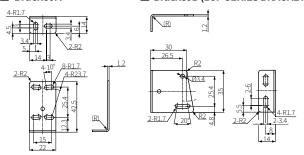
Α	Optical axis of emitter	D	Stability indicator (green)
В	Optical axis of receiver	E	Power indicator (red)
С	Operation indicator (yellow)		

■ Reflector (MS-2S)



■ Bracket A

■ Bracket B (BJP SERIES BRACKET B)



Specifications

Model	BJR□-TDT	-□-□-F	BJR3M-PDT-□-□-F	BJR□-DDT	-DDT-□-□-F	
Sensing type	Through-be	am	Polarized retroreflective	Diffuse refle	Diffuse reflective	
Sensing distance	10 m	15 m	3 m ⁰¹⁾	100 mm ⁰²⁾	1 m ⁰³⁾	
Sensing target	Opaque ma	iterials	Opaque materials	Opaque materials, translucent materials		
Min. sensing target	≥ Ø 12 mm		≥ Ø 75 mm	-	-	
Hysteresis	-		-	≤ 20 % of s distance	ensing	
Response time	≤1 ms					
Light source	Infrared	Red	Red	Red	Infrared	
Peak emission wavelength	850 nm 660 nm		660 nm	660 nm	850 nm	
Sensitivity adjustment	YES (Adjuste	er)	YES (Adjuster)	YES (Adjuster)		
Mutual interference prevention	-		YES	YES		
Operation mode	Light ON m	ode - Dark ON	mode selectable (Adjuster)		
Indicator	Operation is	ndicator (yello	w), stability indicator (gree	n), power indi	icator (red) 04)	
Approval	C€ ‱ EHI		C € K EHL	C€ 5½ EHI		

- 01) Reflector (MS-2S)
- 02) Non-glossy white paper 100 \times 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)		
Connector type	≈ 12 g (≈ 65 g)	≈ 6 g (≈ 75 g)	≈ 6 g (≈ 60 g)		
Cable connector type	\approx 55 g (\approx 105 g)	≈ 30 g (≈ 95 g)	≈ 30 g (≈ 80 g)		
Power supply	10-30 VDC== ±10 % (ripp	ole P-P: ≤ 10 %)			
Current consumption	It depends on the sensing	g type			
Through-beam	Emitter: ≤ 20 mA, receive	er: ≤ 20 mA			
Reflective	≤ 30 mA				
Control output	NPN open collector outp	ut / PNP open collector out	put 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 μ s) by the noise simulator				
Dielectric strength	Between the charging pa	rt 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, inc	andescent lamp: ≤ 3,000 lx	:		
Ambient temperature	-25 to 60 °C, storage: -40 t	o 70°C (no freezing or cond	ensation)		
Ambient humidity	35 to 85 %RH, storage: 35	to 85 %RH (no freezing or	condensation)		
Protection rating	IP67 (IEC standard), IP67F (JEM standard)				
Connection	Cable type / Connector ty	/pe / Cable connector type i	model		
Cable spec.	Ø 4 mm, 3-wire (Emitter: 2	2-wire), cable type: 2 m, cabl	le connector type: 300 mm		
Wire spec.	AWG26 (0.52 mm, 20-core), insulator outer diameter: Ø 1 mm				
Connector	Connector type: M8 4-pin	plug type, cable connector	type: M12 4-pin plug type		
Material	Case: ABS, CAP: PA12, ser	nsing part: PMMA			

IP67F (JEM standard)

■ Used oil (for reference only)

Oil type	JIS standard Oil name		Kinetic viscosity (mm²/s, 40°C)	РН
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)

Even if oil (drops and powder) penetrates into the product, it operates normally.

It obtains the protection rating of enhanced oil proof. (Pass the dropping test for 240 hours with the above oil)

Sold Separately: M8 Connector Cable

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

Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
		M8 (Socket-		2 m	PVC	CID408-2
	DC	Female) 4-pin	4-wire	5 m	PVC	CID408-5
	DC	M8 (Socket-		2 m	Oil resistant	CIDH408-2
	DC Female) 4-wire 4-pin	4-wire	5 m	PVC	CIDH408-5	
w	DC	M8 (Socket-	4-wire	2 m	- PVC	CLD408-2
	DC	Female) 4-pin, L type		5 m		CLD408-5
	M8 (Socket-		4-wire	2 m	Oil resistant	CLDH408-2
	DC Female) 4-pin, L type		4-WIIC	5 m	PVC	CLDH408-5

Sold Separately: M12 Connector Cable

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

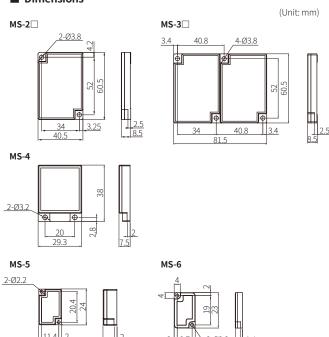
Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
		M12 (Socket-		2 m	PVC	CID3-2
	DC	Female) 4-pin	3-wire	5 m	PVC	CID3-5
	DC	M12 (Socket- Female)	3-wire	2 m	Oil resistant	CIDH3-2
DC	БС	4-pin		5 m	PVC	CIDH3-5
	DC	M12 (Socket- Female)	3-wire	2 m	PVC	CLD3-2
	БС	4-pin, L type	3-wile	5 m	FVC	CLD3-5
		M12 (Socket-	3-wire	2 m	Oil resistant	CLDH3-2
	DC Female) 4-pin, L type		J-WIIC	5 m	PVC	CLDH3-5

Sold Separately: Reflector MS Series

Appearance	Size (W × H)	Reflectance	Sensing type	Model
3800		Typical reflectivity	Retroreflective	MS-2
	40.5 × 60.5 mm	Typical reflectivity	Polarized retroreflective	MS-2A
		High reflectivity	Polarized retroreflective	MS-2S
	81.5 × 60.5 mm	Typical reflectivity	Retroreflective	MS-3
	81.5 × 60.5 mm	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



■ 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
- 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	ЕЯС	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

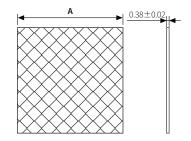
- Material: PMMA / PC / Acrylic (surface film / prism layer / adhesive layer) Ambient temperature: -35 to 65 °C (temperature for adhesion: 10 to 30 °C) Installation: Tape cutting (installation distance: \geq 20 mm)

Reflectance of MST Series

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

Dimensions

(Unit: mm)



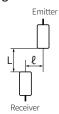
Model	Α
MST-50-10	□ 50
MST-100-5	□ 100
MST-200-2	□ 200

■ Cautions during Installation

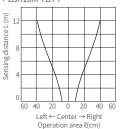
- Select a retroreflective tape that is suitable for the installation space and operating environment of the sensors.
- In general, a bigger size of retroreflective tape results in a longer sensing distance.
- \bullet Be sure to check the reflectance of the MST series for proper use.
- The reflectance 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
- Do not press or damage the surface of the retroreflective tape.
- \bullet Regularly clean the tape to maintain optimal performance, using only neutral detergents. Do not use chemical solvents.

Characteristic Curves: Through-beam Type

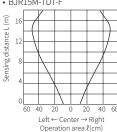
■ Sensing area



• BJR10M-TDT-F



• BJR15M-TDT-F

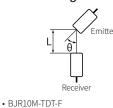


■ Emitter angle

Sensing distance L (m)

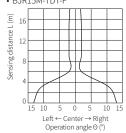
15 10

Left ← Center → Right Operation angle Θ (°)



10 15

• BJR15M-TDT-F



■ Sensing area



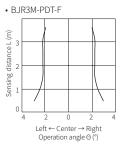
Characteristic Curves: Polarized Retroreflective Type

• BJR3M-PDT-F

Left ← Center → Right Operation area $\ell(cm)$

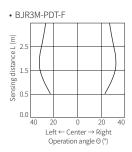
■ Sensor angle





■ Reflector angle



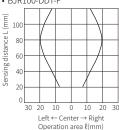


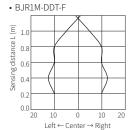
Characteristic Curves: Diffuse Reflective Type

Sensing area









Operation area $\ell(mm)$