Autonics



L 3.7 mm Flat Photoelectric Sensors

BTF 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 0.3 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 (UL Type 1 Enclosure)
  - Altitude: up to 2,000 m
  - Pollution Degree 3
  - Installation Category II

Product Components

- Product, instruction manual
- [Through-beam] Brackets × 2, M2 bolt × 4
- [Diffuse / BGS reflective] Bracket, M2 bolt × 2

Ordering Information

For reference only. The actual product does not support all combinations.
To check all supported models, please refer to the Autonics website.

BTF ❶ - ❷ ❸ ❹ ❺ ❻ - ❼ - ❽ - ❾

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

❷ Sensing type
T: Through-beam
D: Diffuse reflective
G: BGS reflective

❸ Power supply
D: 10 - 30 VDC

❹ Output
T: Solid-state (transistor)

❺ Operation mode
L: Light ON
D: Dark ON

❻ Through-beam Emitter / Receiver [01]
No mark: Reflective type
1: Emitter
2: Receiver

❼ Connection type
No mark: Cable type
W: Cable connector type

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

❾ Cable specification
No mark: General type
F: Flexible type

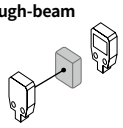
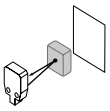
01) This model name is for through-beam photoelectric sensor management only and is not required when placing an order.

Sold Separately

- Bracket: BK-BTF-□
- Connector cable: C□D(H)408-□, C□D(H)4-□EB
- Slit for through-beam type:
  (round-shaped) ST-BTF-R0.5/1
  (rectangular-shaped) ST-BTF-S0.5

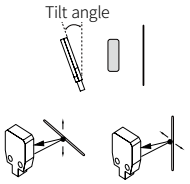
Cautions During Installation

- Be sure to install the product according to the operating environment, location, and specified ratings. Consider the following conditions.
  - Installation environment and background (reflected light)
  - Sensing distance and sensing target
  - Movement direction of sensing target
  - Sensor characteristic curves
- Check the mutual interference prevention values in the 'Specifications.' Installing multiple photoelectric sensors in close proximity may cause malfunctions due to mutual interference.
- Impact from hard objects, or excessive or repeated bending of the cable, may compromise the product's water-resistance.
- Test the sensor before use. Verify that the indicator operates correctly according to the presence or absence of the sensing target.

Through-beam	Reflective
	
Emitter - Receiver: Install facing each other	Sensor - Sensing target: Install facing each other (parallel with the sensing surface of the unit) BGS reflective type: Recommended to move the sensing target horizontally or back and forth

Diffuse / BGS Reflective Type

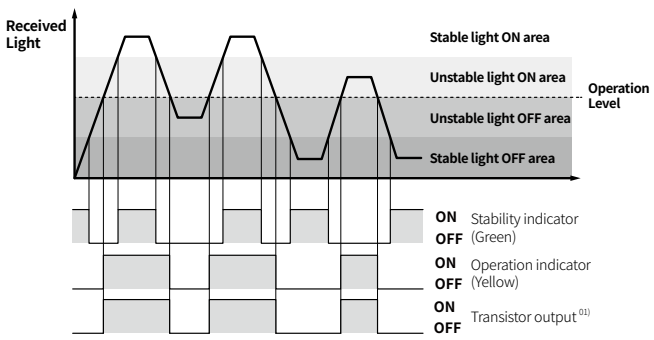
- When detecting glossy or mirror-like objects, install the sensor at an angle of 5 to 10°, and make sure that background objects do not affect detection.
- When detecting minimum sensing targets (copper wire or opaque objects), set the movement direction of the sensing target relative to the sensor. For stable detection, install the sensor or position the sensing target at an angle of 5 to 10°.



Operation Timing Chart and Indicators

■ Light ON Mode

- In Dark ON mode, the waveforms are reversed.



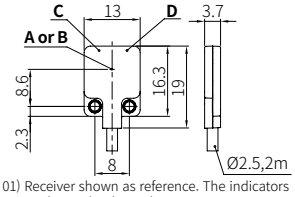
01) If the internal circuit is damaged or an overcurrent occurs, the control output will turn OFF, and the stability indicator will flash at 0.3 second intervals.

Dimensions

- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)
- Cable type shown as reference.
  Refer to the 'Specifications' section for details on the cable, wire, and connectors.

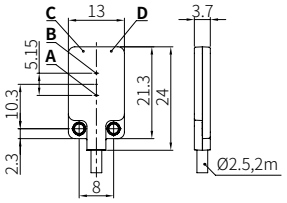
A	Emitter optical axis	C	Operation indicator (yellow)
B	Receiver optical axis	D	Stability indicator (green)

■ Through-Beam Type [01]

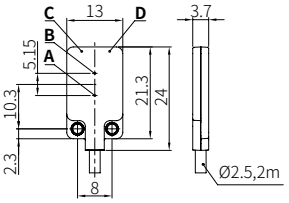


01) Receiver shown as reference. The indicators are located only on the receiver.

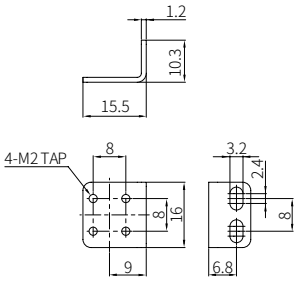
■ Diffuse Reflective Type



■ BGS Reflective Type

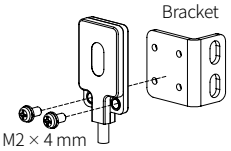


■ Bracket (BK-BTF-A)



Mounting to the Bracket

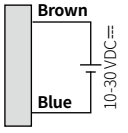
01. Align the mounting holes on the sensor with the included bracket.
02. Mount the sensor on the bracket using the included M2 bolts to prevent the sensors from optical axis distortion. (tightening torque: ≤ 0.3 N·m)



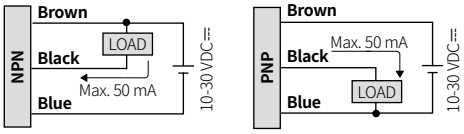
Connections

■ Cable Type

Emitter (Through-Beam)



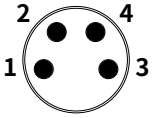
Receiver (Through-Beam), Diffuse Reflective, BGS Reflective



- The white wire of reflective type model is not used.

■ Cable Connector Type

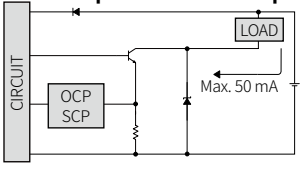
- For LOAD connection, refer to the cable type connection diagram.
- Tighten the connector completely so that the screw threads are not visible (tightening torque: ≤ 0.2 N·m)
- If subject to vibration, use PTFE tape to secure the connector and prevent it from loosening.
- Pins ② and ④ are not used (N.C.) on the through-beam type emitter.
- Pin ② is not used on the through-beam type receiver and reflective type models.



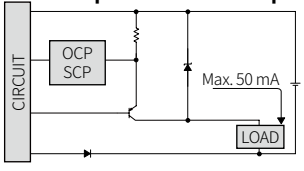
Pin	Color	Function
①	Brown	+V
②	White	N.C
③	Blue	0 V
④	Black	OUT

Circuit Diagram

■ NPN Open Collector Output



■ PNP Open Collector Output



- OCP (over-current protection), SCP (short-circuit protection)
- If the control output terminal is short-circuited or a current exceeding the rated current is supplied, normal control signals will not be output due to the protection circuit.

Specifications

Model	BTF□-TDT□-□-□		BTF□-DDT□-□-□	
Sensing type	Through-beam		Diffuse reflective	
Sensing distance	500 mm	1 m	30 mm 01)	100 mm 01)
Sensing target	Opaque materials		Opaque materials, translucent materials	
Min. sensing target	≥ Ø 1.3 mm 02)	≥ Ø 2 mm 02)	≥ Ø 0.15 mm 03)	≥ Ø 0.4 mm 04)
Hysteresis	-		≤ 10% of sensing distance	
Response time	≤ 0.5 ms		≤ 0.5 ms	
Light source type	Red LED		Red LED	
Light source wavelength	650 nm		650 nm	
Mutual interference prevention	-		≤ 4 units	
Operation mode	Light ON, Dark ON models			
Indicator	Operation indicator (yellow), stability indicator (green)			
Certification	CE UK CA c UL us		CE UK CA c UL us LISTED	
Unit weight (with packaging)	≈ 40 g (≈ 70 g)		≈ 24 g (≈ 40 g)	

01) Non-glossy white paper 50 × 50 mm
02) Rated sensing distance in 'Specifications'
03) Sensing distance 10 mm
04) Sensing distance 30 mm

Model	BTF□-GDT□-□-□	
Sensing type	BGS reflective	
Sensing distance	1 to 15 mm 01)	1 to 30 mm 01)
Sensing target	Opaque materials, translucent materials	
Min. sensing target	≥ Ø 0.1 mm 02)	
Hysteresis	≤ 5% of sensing distance	
Black/white error	≤ 10% of sensing distance	
Response time	≤ 0.7 ms	
Light source type	Red LED	
Light source wavelength	650 nm	
Mutual interference prevention	≤ 4 units	
Operation mode	Light ON, Dark ON models	
Indicator	Operation indicator (yellow), stability indicator (green)	
Certification	CE UK CA c UL us LISTED	
Unit weight (with packaging)	≈ 24 g (≈ 40 g)	

01) Non-glossy white paper 50 × 50 mm
02) Sensing distance 10 mm

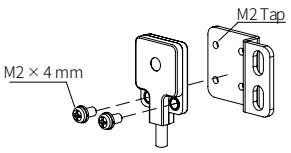
Power supply	10 - 30 VDC (ripple P-P: ≤ 10%)
Current consumption	Varies by sensing type
Through-beam type	Emitter: ≤ 10 mA, Receiver: ≤ 20 mA
Reflective type	≤ 20 mA
Control output	NPN open collector output, PNP open collector output models
Load voltage	≤ 30 VDC⎓
Load current	≤ 50 mA
Residual voltage	NPN: ≤ 2 VDC⎓, PNP: ≤ 2 VDC⎓
Protection circuit	Reverse power protection circuit, output short overcurrent protection circuit, reverse output protection circuit
Insulation resistance	≥ 20 MΩ (500 VDC⎓ megger)
Noise immunity	Square-wave noise generated by noise simulator (pulse width: 1 μs) ±240 VDC⎓
Dielectric strength	Between charging part and case: 1,000 VAC~ 50/60 Hz for 1 min
Vibration resistance	1.5 mm double amplitude or 300 m/s² at frequency of 10 to 2,000 Hz in each X, Y, Z direction for 0.5 hours
Shock resistance	1000 m/s² (≈ 100 G) in each X, Y, Z direction for 3 times
Ambient illuminance (Receiver)	Sunlight: ≤ 10,000 lx, incandescent lamp: ≤ 5,000 lx
Ambient temperature	-25 to 55 °C, Storage: -30 to 70 °C (rated at no freezing or condensation)
Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH (rated at no freezing or condensation)
Protection rating	IP67 (IEC standard)
Connection	Cable type, cable connector type models
Cable specifications	Ø 2.5 mm, emitter: 2-wire, receiver: 3-wire, reflective type: 4-wire
Cable length	Cable type: 2 m / Cable connector type: 300 mm
Wire specifications	AWG 28 (0.08 mm, 19 PCS)
Insulator diameter	Standard type: Ø 0.68 mm (2-wire, 3-wire, 4-wire) Flexible type: Ø 0.86 mm (2-wire), Ø 0.8 mm (3-wire), Ø 0.74 mm (4-wire)
Connector specification	M8 4-pin plug type
Material	Case: PC / sensing part: PC / bracket, bolt: stainless steel 304

Sold Separately: Bracket (BK-BTF-B)

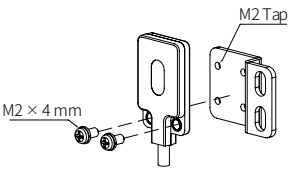
■ Mounting to the Bracket

01. Align the mounting holes on the sensor with the included bracket.
02. Mount the sensor on the bracket using the included M2 bolts to prevent the sensors from optical axis distortion. (tightening torque: ≤ 0.3 N·m)

• Through-beam

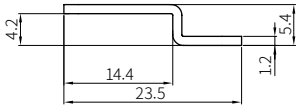


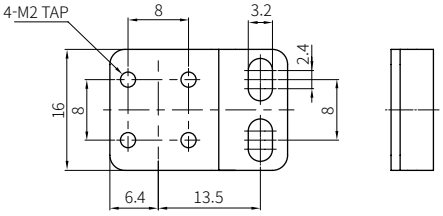
• Reflective



■ Dimensions

- Material: SUS304
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)



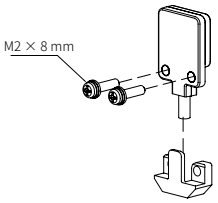


Sold Separately: Bracket (BK-BTF-C)

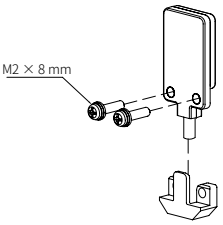
■ Mounting to the Bracket

01. Align the mounting holes on the sensor with the included bracket.
02. Mount the sensor on the bracket using the included M2 bolts to prevent the sensors from optical axis distortion. (tightening torque: ≤ 0.3 N·m)

• Through-beam

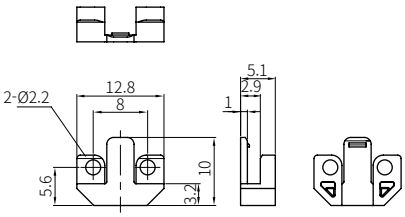


• Reflective



■ Dimensions

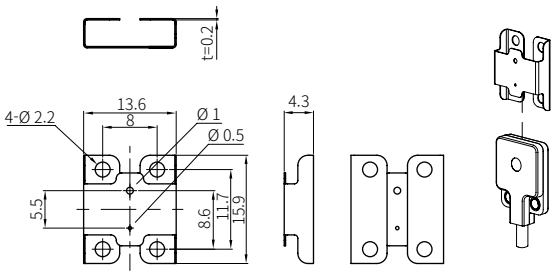
- Material: SUS304
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)



Sold Separately: Slit for Through-beam Type

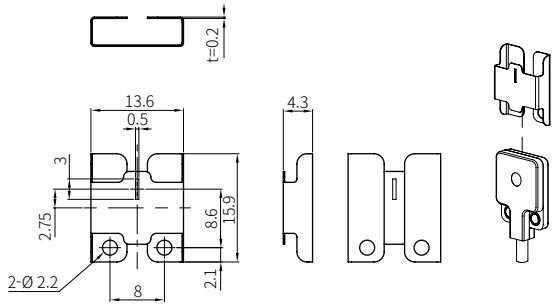
- Material: SUS301
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)

■ Round-Shaped Slit: ST-BTF-R0.5/1



Slit size	Apply	Sensing distance		Min. sensing target	
		BTF500	BTF1M	BTF500	BTF1M
Ø 0.5 mm	Emitter	350 mm	520 mm	Ø 1.3 mm	Ø 2 mm
	Emitter/ Receiver	50 mm	100 mm	Ø 0.5 mm	
Ø 1 mm	Emitter	500 mm	1000 mm	Ø 1.3 mm	Ø 2 mm
	Emitter/ Receiver	200 mm	400 mm	Ø 1 mm	

■ Rectangular-Shaped Slit: ST-BTF-S0.5



Slit size	Apply	Sensing distance		Min. sensing target	
		BTF500	BTF1M	BTF500	BTF1M
0.5×3 mm	Emitter	400 mm	910 mm	Ø 1.3 mm	Ø 2 mm
	Emitter/ Receiver	210 mm	520 mm	0.5×3 mm	

Sold Separately: M8 Connector Cable

- For more information, refer to the M8/M12 Connector Cable product manual.

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

Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin	2 m	PVC, black	C1D4-2EB
				5 m		C1D4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin, L type	2 m	PVC, black	C2D4-2EB
				5 m		C2D4-5EB
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin, L type	2 m	PVC, black	C3D4-2EB
				5 m		C3D4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin	2 m	PVC, black	C4D4-2EB
				5 m		C4D4-5EB

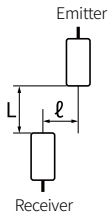
Appearance	Power	Connector 1	Connector 2	Length	Feature	Model
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin	2 m	Oil resistant PVC, dark gray	C1DH4-2EB
				5 m		C1DH4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin, L type	2 m	Oil resistant PVC, dark gray	C2DH4-2EB
				5 m		C2DH4-5EB
	DC	M8 (Socket-Female) 4-pin	M12 (Plug-Male) 4-pin, L type	2 m	Oil resistant PVC, dark gray	C3DH4-2EB
				5 m		C3DH4-5EB
	DC	M8 (Socket-Female) 4-pin, L type	M12 (Plug-Male) 4-pin	2 m	Oil resistant PVC, dark gray	C4DH4-2EB
				5 m		C4DH4-5EB

Product Characteristics

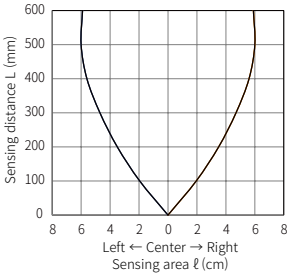
This data is based on internal testing and for reference only. Performance may vary by installation and usage environment. Product testing prior to use is recommended.

Through-Beam Type (TYPICAL)

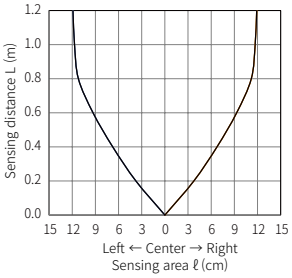
■ Detection Area



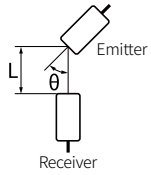
• BTF500-T



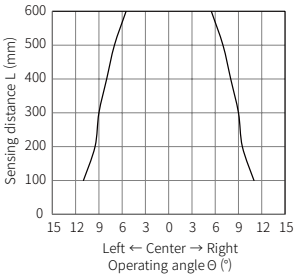
• BTF1M-T



■ Emitter Angle



• BTF500-T

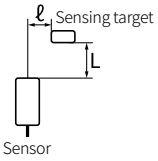


• BTF1M-T

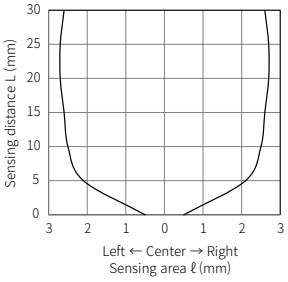


Diffuse Reflective Type(TYPICAL)

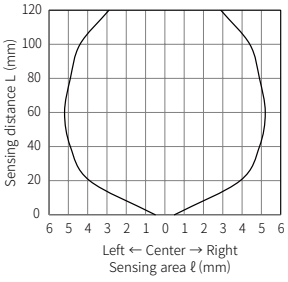
■ Detection Area



• BTF30-D

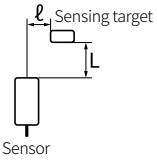


• BTF100-D

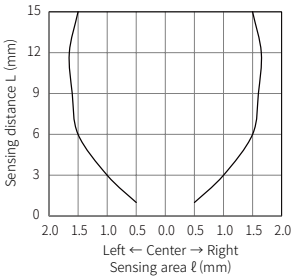


BGS Reflective Type (TYPICAL)

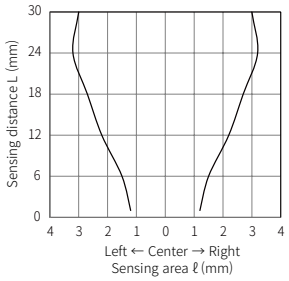
■ Detection Area



• BTF15-G

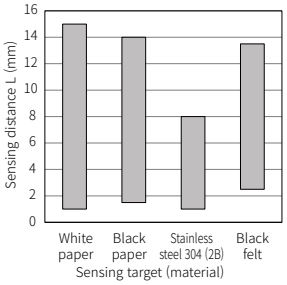


• BTF30-G

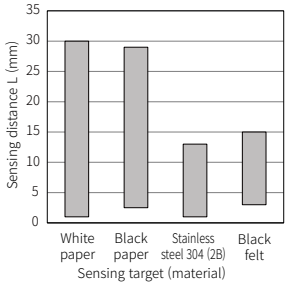


■ Detection Distance by Material

• BTF15-G



• BTF30-G



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