

PHOTOELECTRIC SENSOR
BEN SERIES
M A N U A L



Thank you very much for selecting Autonics products.
For your safety, please read the following before using.

Caution for your safety

- ⊗ Please keep these instructions and review them before using this unit.
 - ⊗ Please observe the cautions that follow;
 - Warning** Serious injury may result if instructions are not followed.
 - Caution** Product may be damaged, or injury may result if instructions are not followed.
 - ⊗ The following is an explanation of the symbols used in the operation manual.
 - ⚠ Caution: Injury or danger may occur under special conditions.
- Warning**
- In case of using this unit with machinery(Ex: nuclear power control, medical equipment, ship, vehicle, train, airplane, combustion apparatus, safety device, crime/disaster prevention equipment, etc) which may cause damages to human life or property, it is required to install fail-safe device. It may cause a fire, human injury or damage to property.
 - Do not disassemble and modify this unit, when it requires. If needs, please contact us. It may give an electric shock and cause a fire.

Caution

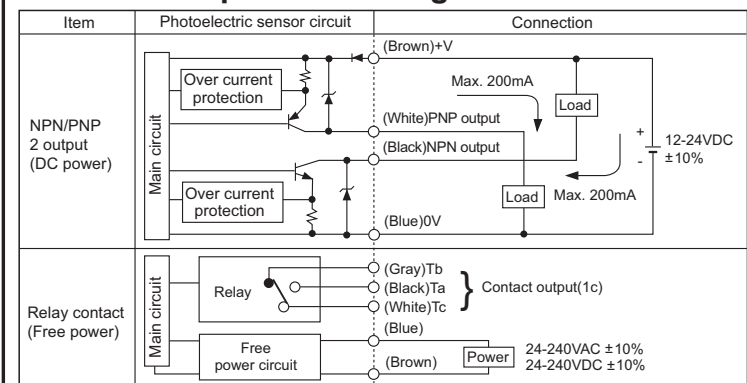
- This unit shall not be used outdoors. It might shorten the life cycle of the product or give an electric shock. Use this product inside only. Do not use the product outdoors or location subject to temperatures or humidity outside.(Ex: rain, dirty, frost, sunlight, condensation, etc.)
- Do not use this unit in place where there is flammable or explosive gas. It may cause a fire or explosion.
- Please observe voltage rating. It may shorten the life cycle or damage to the product.
- Do not use this unit beyond rated power and do not supply AC power(at DC power type). It may result in damage to this unit.
- Please check the polarity of power and wrong wiring. It may result in damage to this unit.
- Do not use this unit in place where there is vibration or impact. It may result in damage to this unit.
- In cleaning the unit, do not use water or an oil-based detergent. It might cause an electric shock or fire that will result in damage to the product.

Ordering information

BEN 10M - T D T

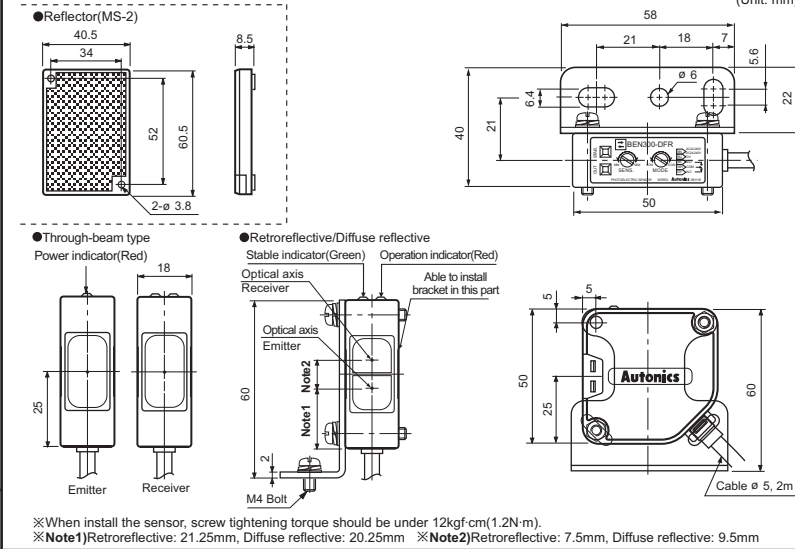
Output	R	Contact output(Relay)
	T	Solid-state output(Transistor)
Power supply	D	DC power
	F	Free power
Sensing type	T	Through-beam
	M	Retroreflective
	P	Retroreflective with polarizing filter
	D	Diffuse reflective
Sensing distance	M	Unit: m
		Unit: mm
Photoelectric sensor	BEN	Series name

Control output circuit diagram



⊗ The above specifications are subject to change without notice.

Dimension

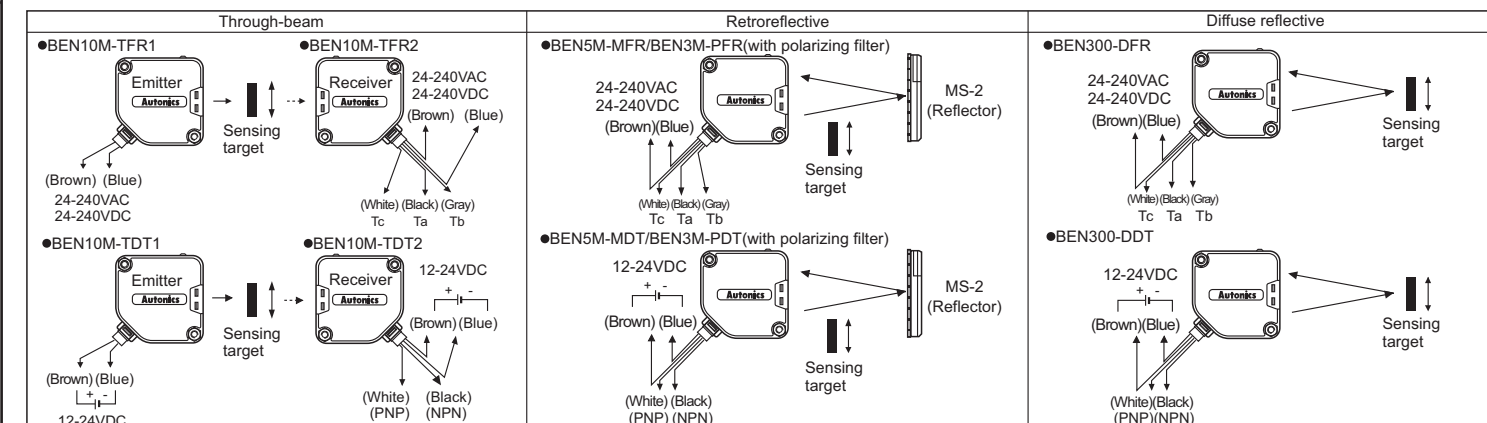


Specification

Type	Free power, Relay contact output				DC power, Solid state output		
	Through-beam	Retroreflective ×1	Retroreflective ×1 (with polarizing filter)	Diffuse reflective	Through-beam	Retroreflective ×1	Diffuse reflective
Model	BEN10M-TFR	BEN5M-MFR	BEN3M-PFR	BEN300-DFR	BEN10M-TDT	BEN5M-MDT	BEN300-DDT
Sensing distance	10m	0.1 to 5m	0.1 to 3m	300mm(100×100mm non-glossy white paper)	10m	0.1 to 5m	300mm(100×100mm non-glossy white paper)
Sensing target	Opaque materials of Min. φ 16mm	Opaque materials of Min. φ 60mm	Transparent, Translucent, Opaque materials Max. 20% at sensing distance	Transparent, Translucent, Opaque materials of Min. φ 16mm	Opaque materials of Min. φ 60mm	Opaque materials of Min. φ 60mm	Transparent, Translucent, Opaque materials Max. 20% at sensing distance
Hysteresis							
Response time	Max. 20ms				Max. 1ms		
Power supply	24-240VAC ± 10% 50/60Hz, 24-240VDC ± 10%(Ripple P-P: Max. 10%)				12-24VDC ± 10%(Ripple P-P: Max. 10%)		
Power consumption	Max. 4VA						
Current consumption					Max. 50mA		
Light source	Infrared LED(modulated)		Red LED (modulated: 660nm)	Infrared LED (modulated)	Infrared LED(modulated)		Red LED (modulated: 660nm)
Sensitivity adjustment			Adjustable VR				Adjustable VR
Operation mode	Selectable Light ON or Dark ON by switch						
Control output	<Relay contact output> •Relay contact capacity: 30VDC 3A of resistive load, 250VAC 3A of resistive load •Relay contact composition: 1c				<NPN/PNP 2 output> •NPN open collector output ≡ Load voltage: Max. 30VDC, Load current: Max. 200mA, Residual voltage: Max. 1V •PNP open collector output ≡ Output voltage Min. (Power supply-2.5V), Load current: Max. 200mA		
Service life(Relay output)	Mechanically: Min. 50,000,000 operation, Electrically: Min. 100,000 operation						
Protection circuit	Reverse polarity protection, Short-circuit protection						
Light receiving element	Built-in IC type photo diode						
Indication	Operation indicator: Red, Stable indicator: Green(The red lamp on Emitter of through-beam type is for power indication)						
Connection	Outgoing cable						
Insulation resistance	Min. 20MΩ (at 500VDC megger)						
Insulation type ×2	□						
Noise strength	±1000V the square wave noise(pulse width: 1μs) by the noise simulator				±240V the square wave noise(pulse width: 1μs) by the noise simulator		
Dielectric strength	1000VAC 50/60Hz for 1minute						
Vibration	Mechanical 1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours Malfunction 1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 10 minutes						
Shock	Mechanical 500m/s ² (50G) in X, Y, Z directions for 3 times Malfunction 100m/s ² (10G) in X, Y, Z directions for 3 times						
Ambient illumination	Sunlight: Max. 11,000lx, Incandescent lamp: Max. 3,000lx						
Ambient temperature	-20 to +65°C(non-freezing condition), Storage : -25 to +70°C						
Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH						
Protection	IP50(IEC standard)						
Material	Case, Case cover: Heat resistant ABS, Lens: PC(with polarizing filter: PMMA)						
Cable	φ 5.0mm, 5P, Length: 2m(Emitter of through-beam type: φ 5.0mm, 2P, Length: 2m) (AWG 22, Core wire diameter: 0.08mm, No. of core wire: 60, Insulator out diameter: φ 1.3mm)				φ 5.0mm, 4P, Length: 2m(Emitter of through-beam type: φ 5.0mm, 2P, Length: 2m) (AWG 22, Core wire diameter: 0.08mm, No. of core wire: 60, Insulator out diameter: φ 1.3mm)		
Accessory	Individual	Reflector(MS-2)			Individual	Reflector(MS-2)	
Approval	CE						
Unit weight	Approx. 354g	Approx. 208g	Approx. 195g	Approx. 342g	Approx. 200g	Approx. 187g	

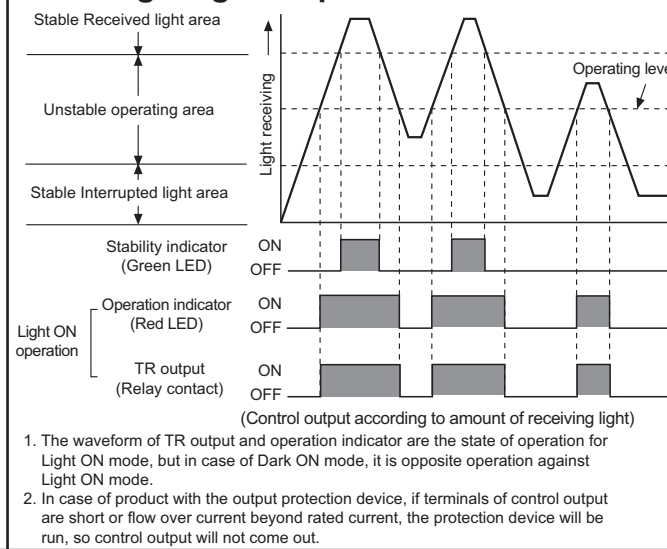
⊗1: The sensing range and the sensing object of the retroreflective sensor are specified with using the MS-2 reflector. The sensing ranges of the retroreflective sensor in the above table are identified as the possible setting ranges of the MS-2 reflector. The sensor can detect an object under 0.1m apart.
 ⊗2: □ Mark indicated that equipment protected throughout by double insulation or reinforced insulation.
 ⊗ The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

Connection



⊗ Non-using wires must be insulated.

Timing diagram operation



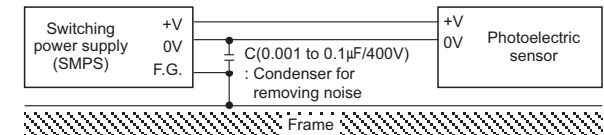
1. The waveform of TR output and operation indicator are the state of operation for Light ON mode, but in case of Dark ON mode, it is opposite operation against Light ON mode.
 2. In case of product with the output protection device, if terminals of control output are short or flow over current beyond rated current, the protection device will be run, so control output will not come out.

Mounting & Adjustment

- Through-beam type**
 - Supply the power to the photoelectric sensor, after setting the emitter and the receiver in face to face.
 - Set the receiver in center of position where indicator turns on, as adjusting the receiver and the emitter right and left.
 - Adjust up and down direction as the same.
 - After adjustment, check the stability of operation putting the object at the optical axis.
- ⊗ If the sensing target is translucent body or smaller than φ 16mm, it might not detect the target cause light passed.
- Retroreflective type**
 - Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector(MS-2) in face to face.
 - Set the photoelectric sensor in the position which indicator turns on, as adjusting the mirror or the sensor right and left.
 - Adjust up and down direction as the same.
 - After adjustment, check the stability of operation putting the object at the optical axis.
- ⊗ If use more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.
- ⊗ If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and photoelectric sensor or the surface of target should be installed at an angle of 30 to 45° against optical axis. (When sensing target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)
- ⊗ Sensitivity adjustment: Please see the diffuse reflective type.
- Diffuse reflective type**
 - Even though the diffuse reflective type is set at max. sensitive position, sensitivity of the sensor must be adjusted the according to the existence of the reflective material in background.
 - Set the target at a position to be detected by the beam, then turn the adjuster until point ⊙ where the indicator turn on from min. position of the adjuster.
 - Set the target out of the photoelectric sensor, then turn the adjuster until point ⊙ which the indicator turns on, if the indicator does not turn on, max. sensitive position will be point ⊙.
 - Set the adjuster at the middle of two switching point ⊙, ⊙.
- ⊗ The sensing distance indicated on specification chart is against 100×100mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.

Caution for using

- Intercept a strong source of light as like sunlight, spotlight within inclination angle range of photoelectric sensor.
- The photoelectric sensor may cause malfunction under the fluorescent lamp light, so be sure to use cut-off light with panel.
- When more than 2 sets of Through-beam types sensors are used closely, it might cause interference each other. Be sure to install the emitter and the receiver to shift by each set in order to avoid malfunction.
- When more than 2 sets of diffuse reflection types are installed adjacently, it may cause malfunction by light beam from the other target. So it must be installed at an enough interval.
- If photoelectric sensor is installed at flat part, it might cause malfunction by reflection light from flat part. Be sure to put space between photoelectric sensor and ground.
- When wire the photoelectric sensor with high voltage line, power line in the same conduit, it may cause malfunction or mechanical trouble.
- Therefore please wire separately or use different conduit. Avoid installing the unit as following place. Corrosive gas, oil or dust, strong flux, noise, sunlight, strong alkali, acid.
- In case of connect DC relay as inductive load to output, please remove surges by using diode or varistor.
- The photoelectric sensor cable shall be used as short as possible, if not it may cause malfunction by noise through the cable.
- When it is stained by dirt at lens, please clean the lens with dry cloth, but do not use an organic materials such as alkali, acid, chromic acid.
- When use switching power supply as the source of supplying power, Frame Ground(F.G.) terminal shall be good earth ground and condenser for removing noise shall be installed between 0V and F.G. terminal.



- Installation environment
 - ⊙ It shall be used indoor
 - ⊙ Altitude Max. 2,000m
 - ⊙ Pollution Degree 2
 - ⊙ Installation Category II
- ⊗ It may cause malfunction if above instructions are not followed.

Major products

- Proximity sensors
- Area sensors
- Door/Door side sensors
- Counters
- Rotary encoders
- Power controllers
- Panel meters
- Temperature controllers
- Temperature/Humidity transducers
- Tachometer/Pulse(Rate) meters
- Stepping motors/drivers/motion controllers
- Laser marking system(CO₂, Nd:YAG)
- Laser welding/soldering system
- Photoelectric sensors
- Fiber optic sensors
- Pressure sensors
- Timers
- Display units
- Sensor controllers
- Graphic/Logic panels

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