Mark Sensors

- MX10
- MX10F series
- MP2F (power supply unit)
- MS-S30W
- GR series
- MA series
- MC series
- MU10 series

Mark Sensors

These sensors detect the brightness and saturation of color print or paint on objects without making contact with the object and are mainly used on bag making machines, automatic wrapping machines, printing presses, etc. Color sensors are used for various types of control such as detection of register marks in red, blue, yellow, etc. for positioning for wrapping and cutting. A broad range of applications for these sensors also include differentiation between colors where incorrect colors may cause quality control problems and the detection of different levels of reflectance between paint colors on the front and back sides of objects (parts) in a production line checking for the incorrect side facing up.

● Luminescence mark sensor

Model GR12UVS

The ultraviolet LED used as the light source and the optical system integrating the light-sensitive element with enhanced sensitivity to visible light allow easy detection of fluorescent marks (hidden marks, fluorescent glue, etc.).

Applications:

Detection of fluorescent register marks
Detection of presence of fluorescent glue
Detection of presence of transparent sheet containing fluorescer

Detection Capability

Reference for selection of mark sensor for detecting register marks (correlation between mark colors, background colors and light source colors)

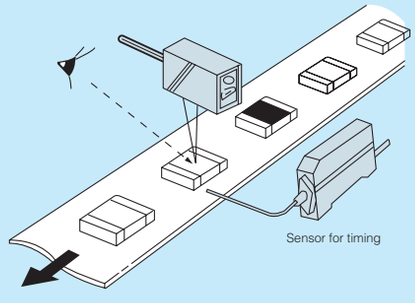
Sensor light source:
R: red light G: green light B: blue light

Background color \ Mark color	Black	Blue	Green	Red	Orange	Yellow	White
White	RGB	RGB	RGB	GB	B	B	
Yellow	RGB	RGB	RGB	G	G		B
Orange	RGB	RGB	RGB	GB		G	B
Red	RB	RB	R		GB	G	GB
Green	B	B		R	RGB	RGB	RGB
Blue	B		B	RB	RGB	RGB	RGB
Black		B	B	RB	RGB	RGB	RGB

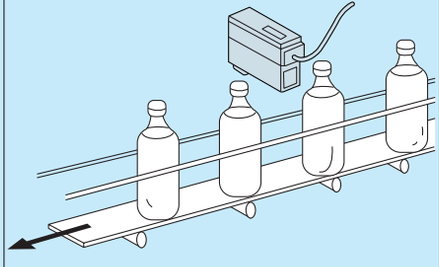
(*) Detection may not succeed depending on the shading, etc. Be sure to check the operation with samples.

Sample Applications

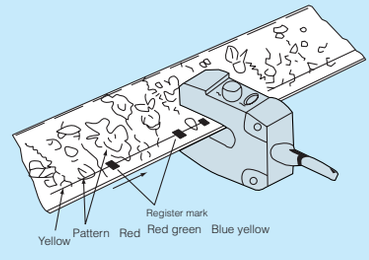
● Checking for upside-down electronic components



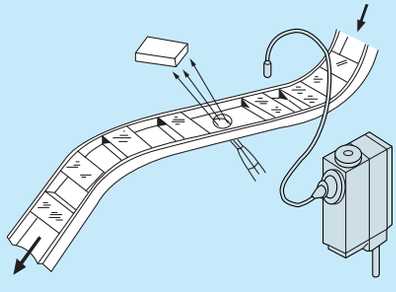
● Sorting by cap



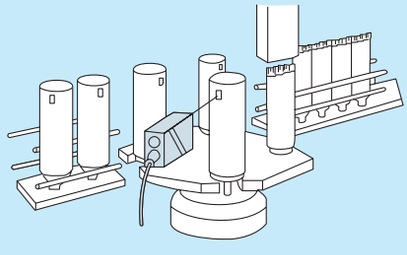
● Register mark detection with U-shaped through-beam sensor



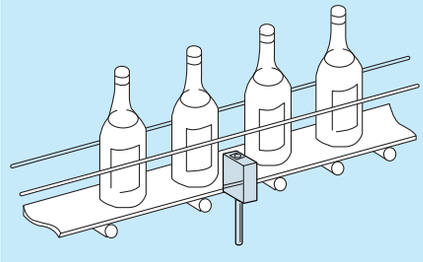
● Checking for upside-down chip resistors



● Detection of marks on laminated tubes



● Detection of labels on bottles



List of models

Type		Detection method	Model			Light source	Detecting distance	Smallest detectable mark width	Applicable power supply unit (amplifier)		See page...
Tungsten lamp	Generic type	Limited reflection type	**MX10**			Tungsten lamp	13mm (8 mm from lens hood)	0.1mm	MP2F		412
Tungsten lamp	Optical fiber	Through-beam type Reflective type (Depends on fiber optic cable)	**MX10F**	Fiber optic cable	**FT** (Through-beam)	Tungsten lamp	20mm	1mm	MP2F		412
					FR (Reflective)		5mm	0.1mm			
					FX (Coaxial reflective)		8mm				
					FS (SUS coaxial reflective)		1.5mm				
Power supply unit			**MP2F**			(Special power supply unit for MX Series)					415
LED	Amplifier built-in	Limited reflection type	**MS-S30W**			White LED	CE 30mm±2mm	0.5mm	PS Series IP Series		418
			GR12RS			Red LED	12mm±2mm	1mm			420
			GR12R								
			GR12GS			Green LED					
			GR12G								
			GR40R			Red LED	20~70mm	——			420
			GR60R				20~90mm				
			GR12UVS			Ultraviolet LED	12mm±2mm CE				420
		U-shaped through-beam	**MA-U2R**			Red LED	CE Interval between transmitter and receiver: 2 mm fixed	1mm			424
			MA-U2RPN								
			MA-U2G			Green LED					
			MA-U2GPN								
			MA-U2B			Blue LED					
			MA-U2BPN								
			MC-U2R			Red LED	CE Interval between transmitter and receiver: 2 mm fixed				428
			MC-U2RTC								
			MC-U2G			Green LED					
			MC-U2GTC								
			MC-U2B			Blue LED					
			MC-U2BTC								
			MU10N			Green LED	Interval between transmitter and receiver: 10 mm fixed	2mm			430
			MU10NR			Red LED					430

Tungsten lamp type provides high resolution

- **MX10 Series**
  is capable of detecting yellow marks on white background
- **MX10F Series**
  Fiber type allows flexible installation

- Response time of 20 µs max. and cyclic response frequency of 25 kHz provides high-speed response and detection of small “register” marks

Type

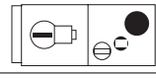
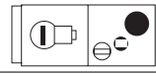
Detection method	Detecting distance		Model	Operation mode	Output mode
Reflective type	13mm (8 mm from lens hood surface)		**MX10**	Light-ON/Dark-ON selectable	Current output Voltage output
Through-beam type	20mm	* Fiber type	**MX10F-FT**		
Reflective type	5mm		**MX10F-FR**		
Coaxial reflective type	8mm		**MX10F-FX**		
	1.5mm		**MX10F-FS**		

* Model Nos. for fiber type sensors are set model Nos. respectively including an amplifier (MX10F) and a typical fiber optic cable.

- Power supply unit

Model	Power supply	Power supplied to sensor	Operation mode	Output mode
MP2F	AC／DC 100～240V	DC12V、100mA DC4.5V、780mA	Timer function selectable	Relay output Current output Voltage output Burnt-out lamp alert output

Optional Parts

Type	Model	Description
Standard lens	**L12**	Aspheric lens offering high resolution (accessory)
Standard lamp	**LM66**	 (accessory)
Lamp	**LM67**	 Filament orientation different from LM66

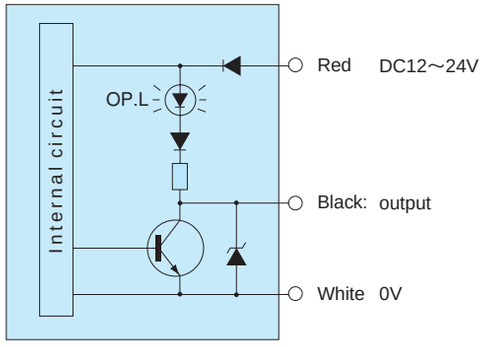
Rating/Performance/Specification

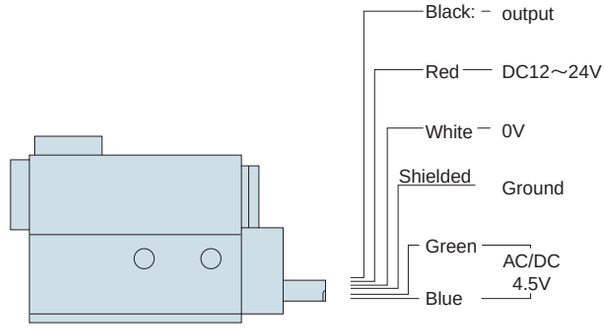
Rating/performance	Type	General-purpose type	Optical fiber type			
	Model	**MX10**	**MX10F**			
	Fiber unit type	——	**FT**	**FR**	**FX**	**FS**
	Detection method	Reflective (differential comparison)	Through-beam type	Reflective type	Coaxial reflective type	
	Detecting distance	13mm (8 mm from lens hood)	20 mm max (0～25mm)	5 mm max (0.5～8mm)	8 mm max (0.5～12mm)	1.5 mm max (0.2～3mm)
	Power supply	Sensor: 12 – 24V DC ±10% Ripple: 10% max. Lamp: 4.5V AC/DC4.5V ±10% 50/ 60Hz				
	Current consumption	Sensor: 35 mA max., Lamp: AC4.5V 3.6W(0.8A)				
	Output mode	Current output: Rating: sink current 100 mA (30 VDC) max. Voltage output: Rating: output impedance 3.9 kΩ (residual voltage: 1 V max.)				
	Operation mode	Light-ON/Dark-ON selectable (with switch)				
	Spot diameter	1 x 4mm	ø15mm	ø6mm	ø6mm	ø1.5mm
	Smallest detectable mark width	0.1mm (black mark on whit background)	1mm min. (opaque object)	0.1mm (black mark on whit background)		
	Activation position repeatability	0.1mm				
	Response time	20 µs				
	Cyclic response frequency	10 kHz max.				
Specification	Light source	Tungsten bulb				
	Adjustment	Sensitivity adjustment: multi-turn volume dial Position indication on dial: ruler on drum				
	Indicator	Operation indicator (red LED)				
	Case material	Zinc die-cast				
	Connection	Permanently attached cord (vinyl insulated ø6) Two 0.5 mm2 and three 0.3 mm2 cores, 4 m				
	Mass	600 g max.				
	Applicable amplifier	MP2F				
	Notes	MX10-30, MX10-60 and MX10-120 for minute object detection are also available. Contact Takex for details.	————			
		Tungsten bulb Replacement: insert socket Time for stabilization: about 30 minutes after illumination / Life: 10,000 hours av. (when used according to rating) Mounting: M5 x 5 screw (mountable in three orientations) Wiring: core extension: 20 m with standard cord, 50 m with cord of 1.25 mm2 or thicker [Lamp voltage must be 4.5 V min. Shielded wires must be used.]				

Environmental Specification

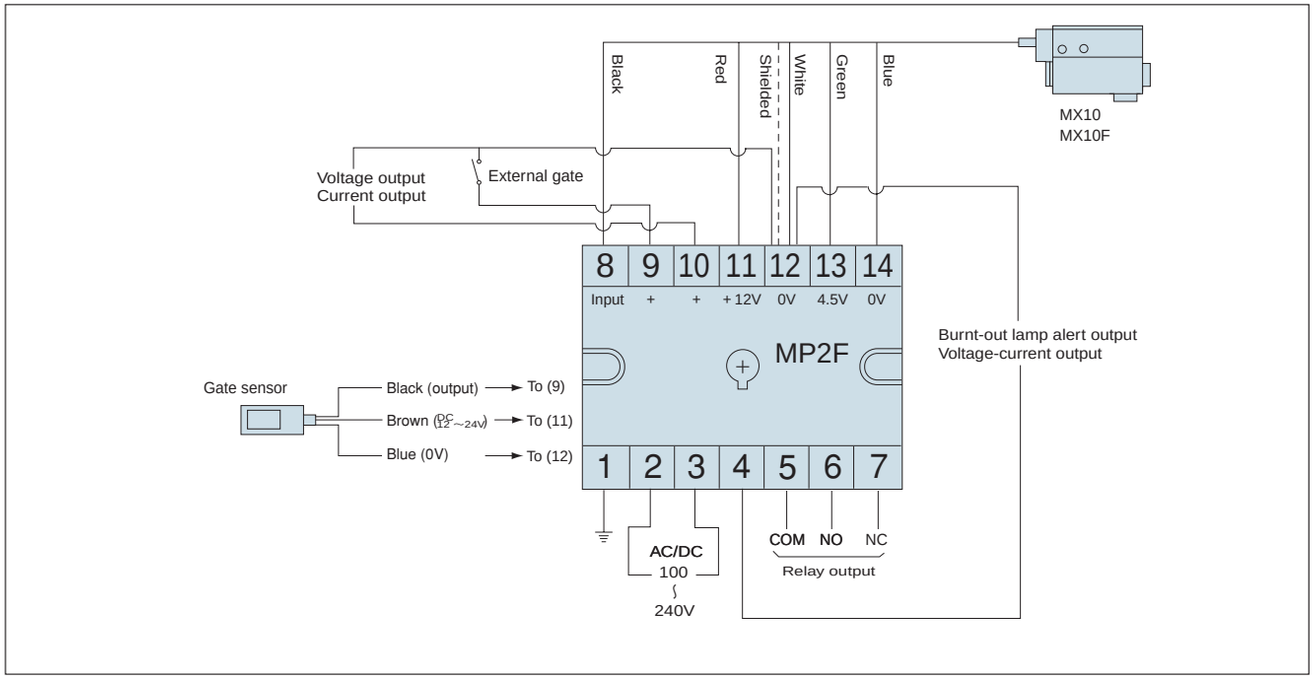
Environment	Ambient light	1,000 lx max. (radiation from above)
	Ambient temperature	Storage: –10- +50 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP66
	Temperature rise	15deg (Case temperature as mounted on iron plate of 60 x 80 x 1.6 (t))

Input/Output Circuit and Connection



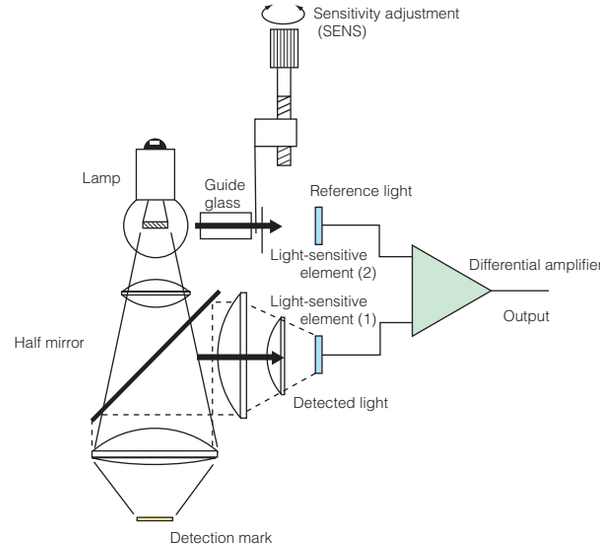


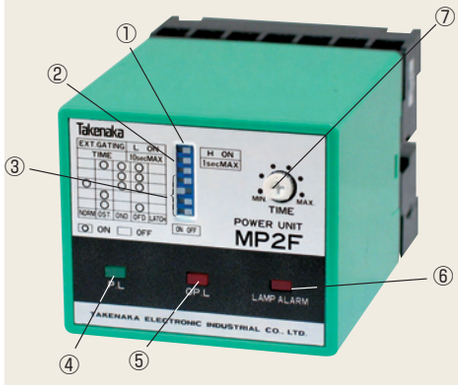
Connection Example



Principle of Operation

Light emitted from the lamp goes through the half mirror and object lens and then converges on the detection mark. Then the converged light is reflected as a beam according to the brightness, saturation, etc. of the mark and goes through the half mirror and object lens to enter the light-sensitive element (1), which is called detected light.
While the light from the lamp is radiated on the mark, some of it also goes through the guide glass and sensitivity adjustment mechanism to enter the light-sensitive element (2), which is called reference light.
The two types of light (detected light and reference light) are converted into electric signals in the individual light-sensitive elements (1) and (2), which are input into the differential amplifier for comparison and output as a detection signal.





① EXT. GATING
Polarity selector switch for external synchronization signal.
Set at ON for L mode and OFF for H mode.
② Delay time range selector switch
ON: 1-10 seconds / OFF: 0.1-1 second
③ Operation mode selector switch
Timer disabled, one-shot, on-delay, off-delay, latch
④ Power indicator (green LED)
⑤ Operation indicator (red LED)
⑥ Sensor lamp burnt-out bulb alert indicator (red LED)
⑦ Delay time adjustment

Rating/Performance/Specification

	Type	MP2F		
Rating/performance	Power supply	AC/DC100～240V ±10%		
	Power consumption	25 VA max. 25 W max.		
	Operation mode	Timer functions (on-delay, off-delay, one-shot, latch, timer disabled) Delay time: 0.1-1 s or 1- 10s		
	Output mode	Relay output 1c Rating: 3A (250 VAC) noninductive load	Current output/voltage output Rating: Current output: sink current 100 mV (30 VDC) max. Voltage output: output impedance 3.9 kΩ (12 VDC)	Burnt-out bulb alert output (current output/voltage output)
	Input mode	Voltage input Straight polarity H : 6～12V L : 0～1V Input impedance 4.7 KΩ		
	Minimum input duration	400 µs (in off-delay, one-shot and latch modes)		
	Power supplied to sensor	DC12V ±5% 100mA/DC4.5V ±5% 0.8A		
	External gate	Contact input/voltage input Voltage input H : 6～12V L : 0～1V H/L mode selectable		
	Response time	10 µs max. (with timer disabled)		
Specification	Indicator	P.L: power indicator (green LED) OP.L: operation indicator (red LED) LAMP ALARM: burnt-out bulb alert indicator (red LED)		
	Volume	TIME: delay time adjustment (0.1-1s/1-10s)		
	Switch	EXT. GATING switch: for external gating polarity switching; ON for L, OFF for H Delay time range selector switch: ON for 1-10s, OFF for 0.1-1 s Operation mode selector switch: for switching between timer disabled, one-shot, on-delay, off-delay and latch		
	Material	Resin		
	Connection	Plug-in terminal block		
	Mass	350 g max.		
	Applicable sensor	MX10/MX10F Series		

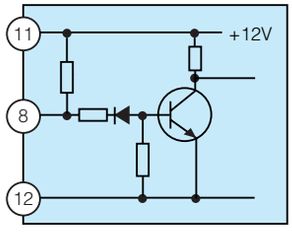
Environmental Specification

Environment	Ambient temperature	–10 - +50 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP20
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
	Shock	1000m / s^2 / 2 times each in 3 directions
	Dielectric withstanding	Between power supply terminal and contact terminal: 1,500 VAC for 1 minute / Between contacts: 1,000 VAC for 1 minute
	Insulation resistance	Between power supply terminal and contact output terminal/contacts: 500 VDC, 100 MΩ or higher

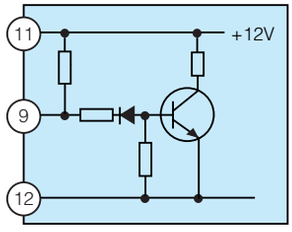
MP2F

Input Circuit

Sensor input

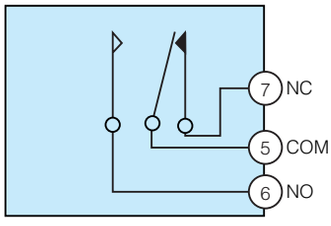


Gating input



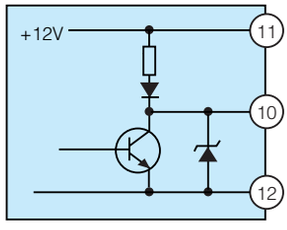
Output Circuit

Relay output

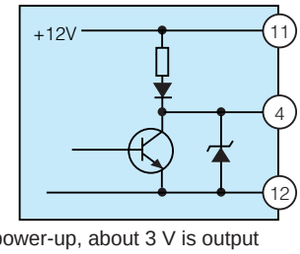


Contact capacity: 250 VAC 3 A
(noninductive load)

Voltage output



Burnt-out bulb alert output



(Note) At power-up, about 3 V is output until the lamp is illuminated.

Operation

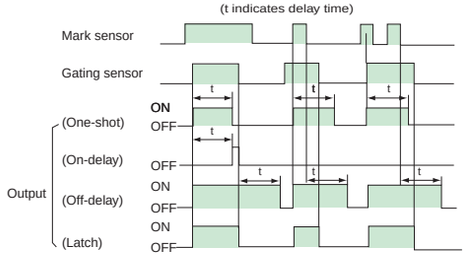
(1)When not using external gating in modes other than the latch mode, set H for EXT. GATING.

(2)In the latch mode, gating input can be used for reset with EXT. GATING setting "H" (L input).

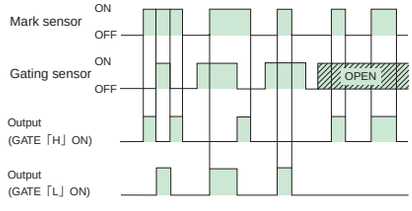
(3)In the latch mode with EXT. GATING setting "L," the output signal is activated when the mark sensor and gating sensors are activated and the output is held until the gating sensor is deactivated.

(4)Delay time can be set with the TIME volume.
Minimum/maximum delay time can be set at "MIN"/"MAX."

(Timer operation)



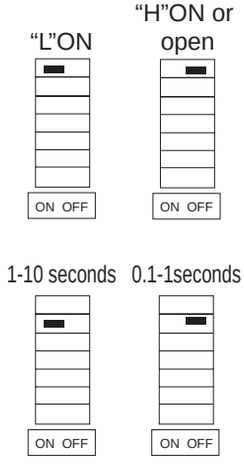
(Operation with timer disabled)



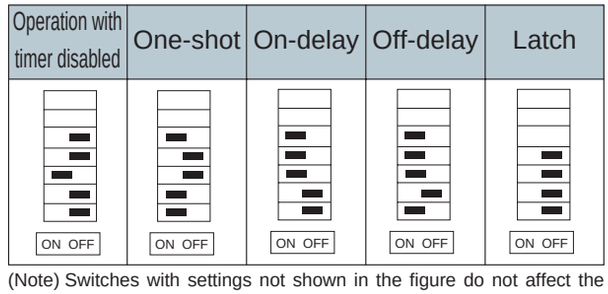
Selector Switches

(1) EXT. GATING
Polarity selector switch for external synchronization signal.
Set at ON for L mode and OFF for H mode.

(2)TIME
Delay time range selector switch.
Setting at ON specifies a range between 1 and 10 seconds, OFF between 0.1 and 1 second.
(Timer is disabled when NORM is ON.)



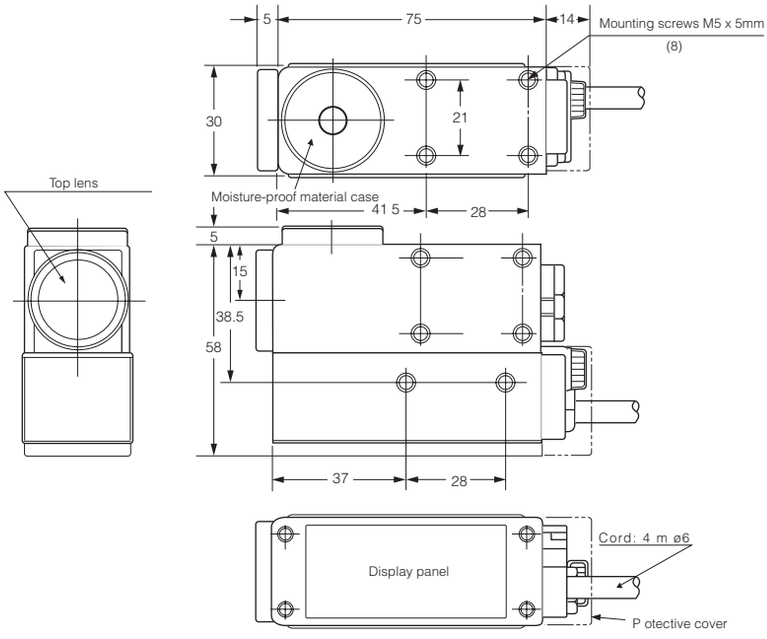
(3)Operation mode switching
Set the selector switches according to the output mode.



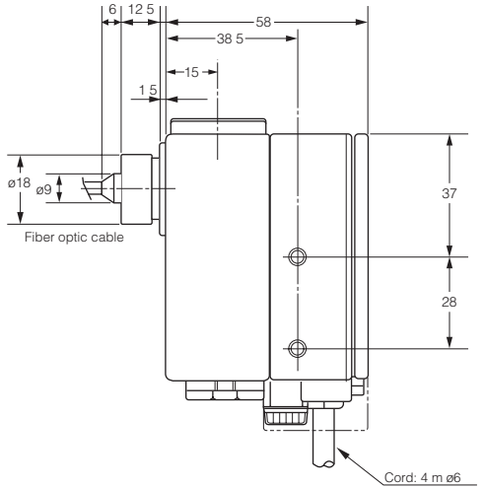
(Note) Switches with settings not shown in the figure do not affect the operation of the respective modes.

Dimensions (in mm)

MX10



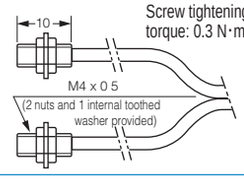
MX10F



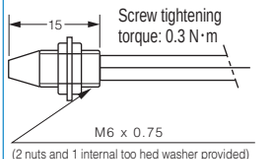
- The orientation of the attachment of fiber optic cable is fixed.
- Same as for MX10 except for fiber optic cable attachment.

- Fiber optic cable (enlarged view of tip)

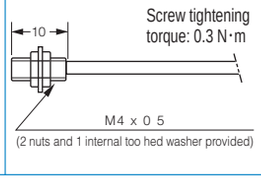
Model FT (through-beam) 500 mm



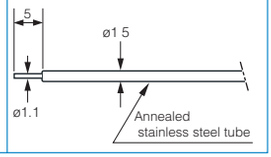
Model FR (reflective) 500 mm



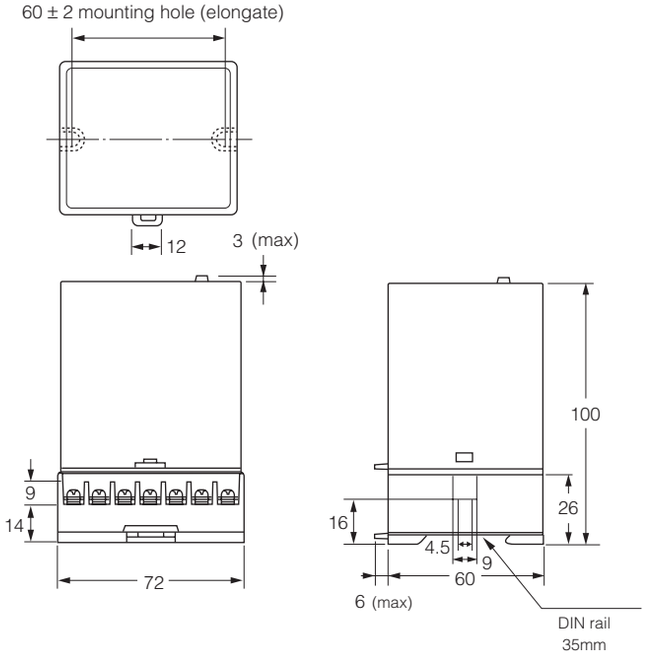
Model FX (coaxial reflective) 500 mm



Model FS (Annealed stainless steel tube 70 mm)

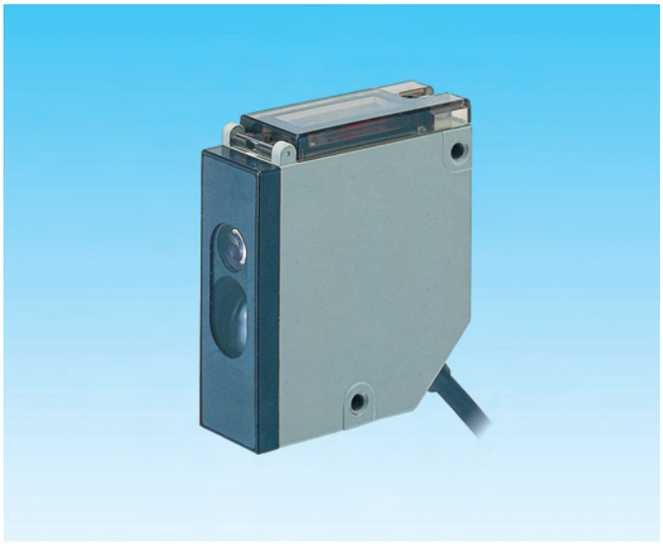


MP2F



MS-S30W

White LED mark sensor



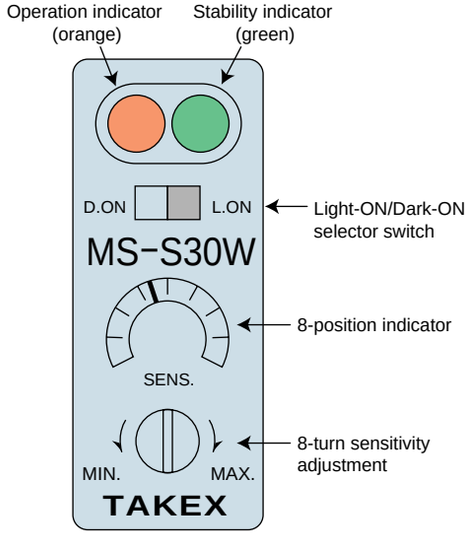
High-response sensor supporting a wide range of colors

- White LED
- Detecting distance 30 mm
- High response 30 µs
- Multi-turn pot. for easy adjustment

Type

Detection method	Detecting distance	Model	Operation mode	Output mode
Limited reflection type	30mm±2mm	**MS-S30W**	Light-ON/Dark-ON selector switch	NPN/PNP open collector

Panel Layout and Functions



- SENS.
  Adjustment pot. for fine tuning. Turning clockwise increases the amplifier sensitivity and allows detection of marks in dark colors.
  Turning beyond the MIN. or MAX. makes a clicking sound.

- 8-position indicator
  Allows reading of the current sensitivity setting made with the 8-turn adjustment.

- L.ON/D.ON
  Light-ON/Dark-ON selector switch

- Stability indicator
  Illuminated when the received light intensity level is 90% or lower or 110% or higher of the operation level.

- Operation indicator
  Illuminated when the output transistor is activated.

MS-S30W

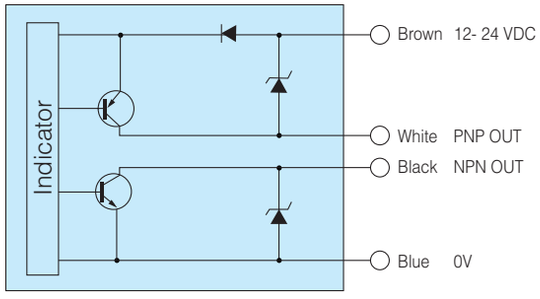
Rating/Performance/Specification

	Model		MS-S30W
Rating/performance	Detection method		Limited reflection type
	Detection distance		30mm±2mm (standard detection object: 50 x 50 mm white drawing paper)
	Spot diameter		1 x 3mm (Position: detecting distance 30 mm / Direction: see Dimensions)
	Minimum detectable mark width		0.5mm (black mark on white background) (at detecting distance 30 mm)
	Power supply		12 – 24 VDC ±10% Ripple: 10 % max.
	Current consumption		40 mA max.
	Output mode		NPN/PNP open collector (2 outputs) Rating: sink/source current 100 mA (30 VDC) max. Residual voltage: 1 V max. for NPN output / 2 V max. for PNP output
	Operation mode		Light-ON/Dark-ON selectable
	Response time		30 µs max.
Specification	Light source		White LED
	Indicator		Operation Indicator: orange LED Stability indicator: green LED
	Volume (VR)		Sensitivity adjustment (8-turn)
	Switch (SW)		Light-ON/Dark-ON selector switch provided
	Short circuit protection		Provided
	Material	Case	Main unit: zinc die-cast, aluminum Head: heat-resistant ABS Display: polycarbonate
		Lens surface	Polycarbonate (lens: glass)
	Connection		Permanently attached cord (Outer dimension: dia.4.5) 0.2 mm² x 4 cores, 2 m
	Mass		About 250 g
	Accessory		Mini screwdriver for sensitivity adjustment, mounting bracket, operation manual

Environmental Specification

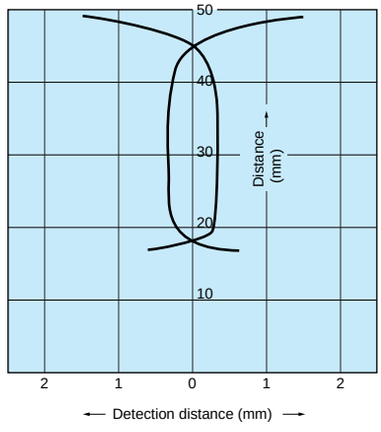
Environmental specification	Ambient light	5,000 lx max.
	Ambient temperature	–25 - +55 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP66
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction

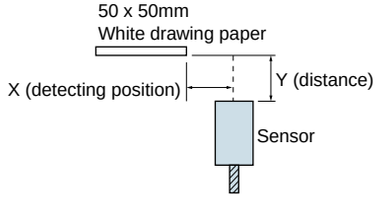
Input/Output Circuit and Connection



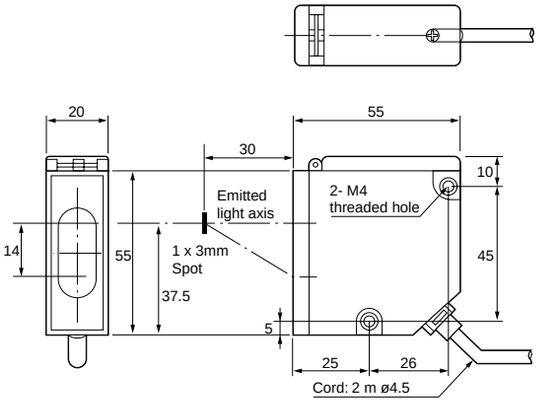
Note) Capacitor provided between main unit case and 0 V

Activation Area Characteristics (Typical Example)

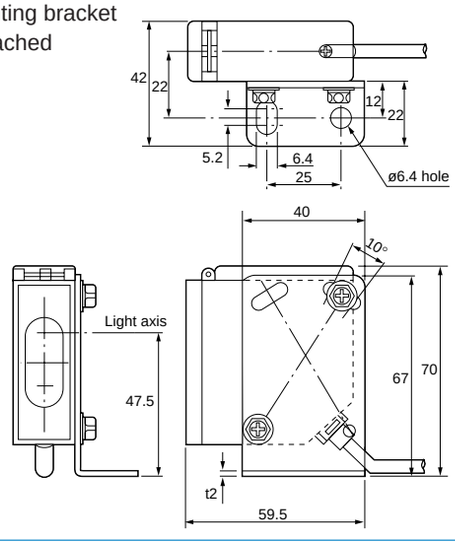




Dimensions (in mm)



With mounting bracket
NE-B1 attached



● Generic type with LED

- Water resistance to IP 67 standard allows washing together with line equipment.
  This is achieved by complete resin filling

- Ultraviolet luminescence mark sensor
  Model: GR12UVS
  Ideal for detection of hidden or fluorescent marks

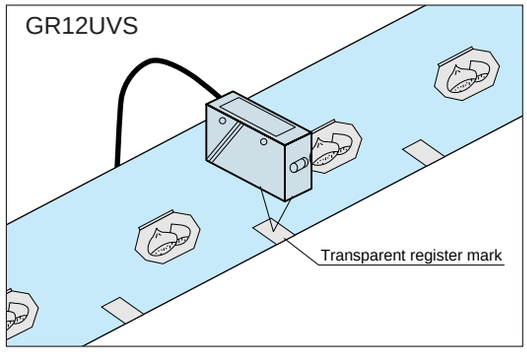
Type

Detection method	Detecting distance	Model	Light source	Operation mode	Output mode
Limited reflection type	12mm±2mm	**GR12RS**	Red LED	Light-ON/Dark-ON selector switch	NPN open collector
		GR12R			
		GR12GS	Green LED		
		GR12G			
	20～70mm	**GR40R**	Red LED		
	20～90mm	**GR60R**			
	12mm±2mm	**GR12UVS**	Ultraviolet LED		

Sample Application

Detection of transparent register marks or stickers containing fluorescer

Marks reliably detected without influence of background color or pattern



- Mark sensor with detecting distance of 30-120 mm also available
  Model: GR100R (PN)

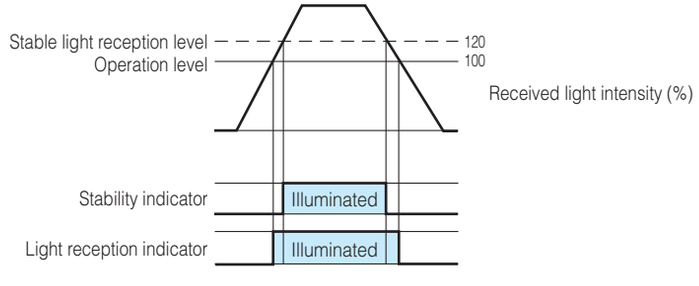
Rating/Performance/Specification

Rating/performance	Type	Side-on	GR12RS	GR12GS	GR40R	GR60R	GR12UVS
		Head-on	GR12R	GR12G	————	————	————
	Detection method		Zone-reflective type				
	Detecting distance		12mm ±2mm		20～70mm	20～90mm	12mm ±2mm
	Power source		12 – 24 VDC ±10% Ripple: 10 % max.				
	Current consumption		25 mA max.	30 mA max.	25 mA max.		26 mA max.
	Output mode		NPN open collector output Rating: sink current 100 mV (30 VDC) max.				
	Operation mode		Light-ON/Dark-ON selectable (with switch)				
	Spot diameter		ø1mm		ø1.5mm *1	ø4mm *1	ø0.5mm
	Smallest detectable mark width		1 mm (black mark on white background)	1 mm (red mark on white background)	————		
	Response time		1 ms max.				
Specification	Light source (Light wavelength)		Red LED (680nm)	Green LED (568nm)	Red LED (660nm)		Ultraviolet LED (375nm) *2
	Volume (VR)		4-turn sensitivity adjustment without stopper provided				
	Indicator		Light reception indicator (red LED) Stability indicator (green LED)				Light reception indicator (orange LED) Stability indicator (green LED)
	Short circuit protection		Provided				
	Case material		Polycarbonate (lens of GR12UVS: glass)				
	Connection		Permanently attached cord (outer diameter: dia.4.2) 0.3 mm² x 3cores, 3 m				
	Mass		About 100 g max.				
	Notes		*1 At detecting distance 40 mm *2 (Note) Do not look straight into the light source while illuminated. The strong UV ray may damage the eye if seen only for a short time. If it is unavoidably necessary to look, be sure to use glasses, etc. with UV protection.				

Environmental Specification

Environment	Ambient light	3,000 lx max
	Ambient temperature	–25 - +55 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP67
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction

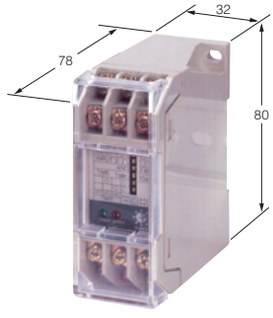
● Stability indicator and light reception indicator



- The stability indicator (green LED) is illuminated when the received light intensity at light reception is well above (120 % of) the output operation level.
- While the stability indicator is illuminated, stable detection is unaffected by change in environment such as ambient temperature.

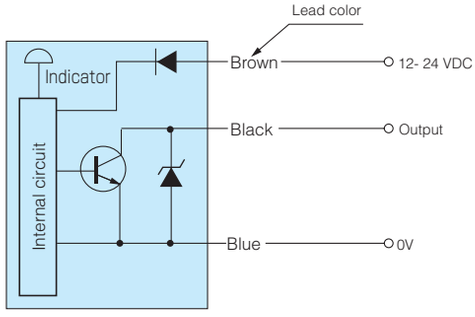
● Applicable power supply unit

PS Series
High capacity of 200 mA at 12 VDC



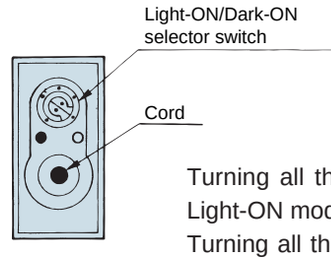
(General-purpose type) PS3N
PS3N-SR
(Multifunctional type) PS3F
PS3F-SR

Input/Output Circuit and Connection



- The output transistor turns off when load short circuit or overload occurs.
- Check the load and turn the power back on.

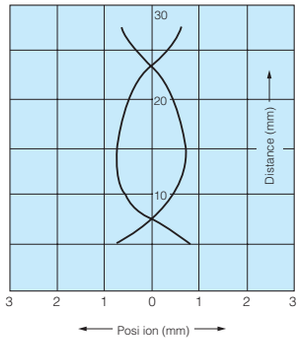
Operation mode switching



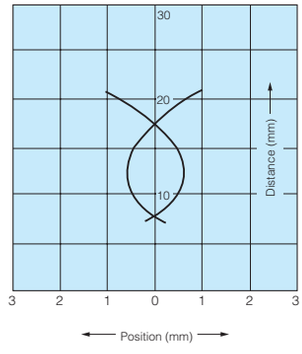
Turning all the way to the left enables the Light-ON mode.
Turning all the way to the right enables the Dark-ON mode.

Activation Area Characteristics (Typical Example)

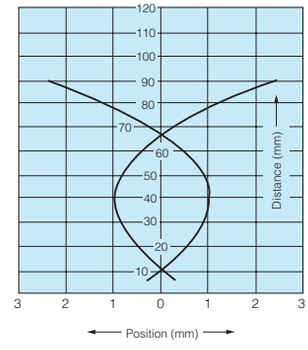
GR12RS • GR12R
(50 x 50 White drawing paper)



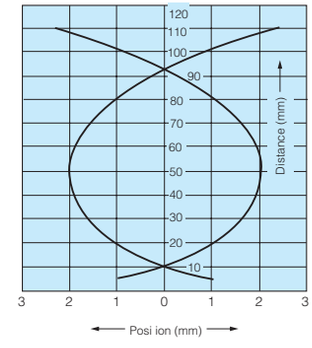
GR12GS • GR12G
(50 x 50 White drawing paper)



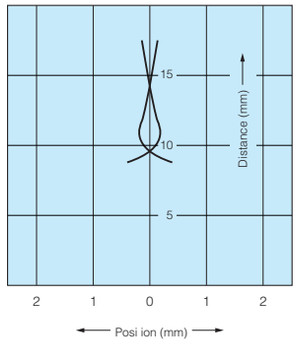
GR40R
(50 x 50 White drawing paper)



GR60R
(50 x 50 White drawing paper)



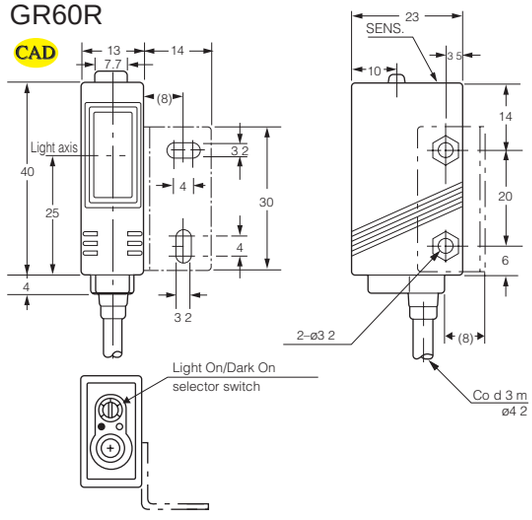
GR12UVS
(50 x 50 White drawing paper)



Dimensions (in mm)

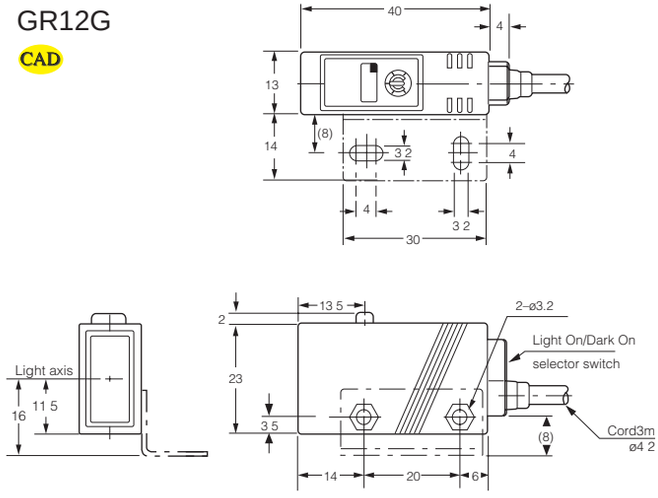
Side-on type
GR12RS
GR12GS
GR40R
GR60R

CAD

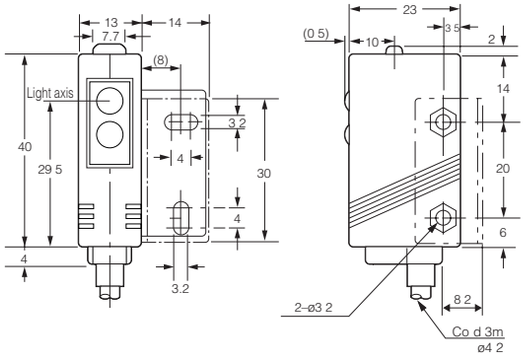


Head-on type
GR12R
GR12G

CAD



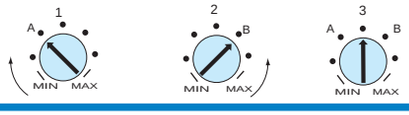
GR12UVS



Sensitivity adjustment

The sensitivity adjustment is a 4-turn pot. without stopper. Turning four revolutions clockwise (to LIGHT) enables the maximum sensitivity and turning four revolutions counterclockwise (to DARK) enables the minimum sensitivity. There is no stop on the pot. and it can be turned more than four revolutions. Turning the pot the other way immediately makes the adjustment effective and there is no play in the adjustment.

1. Place the detection object at the given position and direct the spot on a region with high reflectance. Turn up the sensitivity adjustment gradually from MIN and find the point at which the light reception indicator (LIGHT) is illuminated (Point A).
2. Direct the spot on a region with low reflectance, further turn up the sensitivity adjustment gradually from Point A until the light reception indicator is illuminated. Turn down the adjustment gradually from that point and find the point at which the light reception indicator goes out (Point B).
   If the light reception indicator is not illuminated even after turning four revolutions, the point reached after turning four revolutions is regarded as Point B.
3. Set the adjustment at midway between Points A and B.

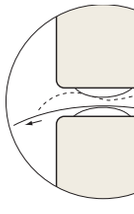


- Teaching function available for adjustment
- Automatic setting of optimum sensitivity for stable detection
  - Full auto teaching: set without stopping mark
  - Auto teaching: set with mark stopped
  - External teaching: setting from a distant location

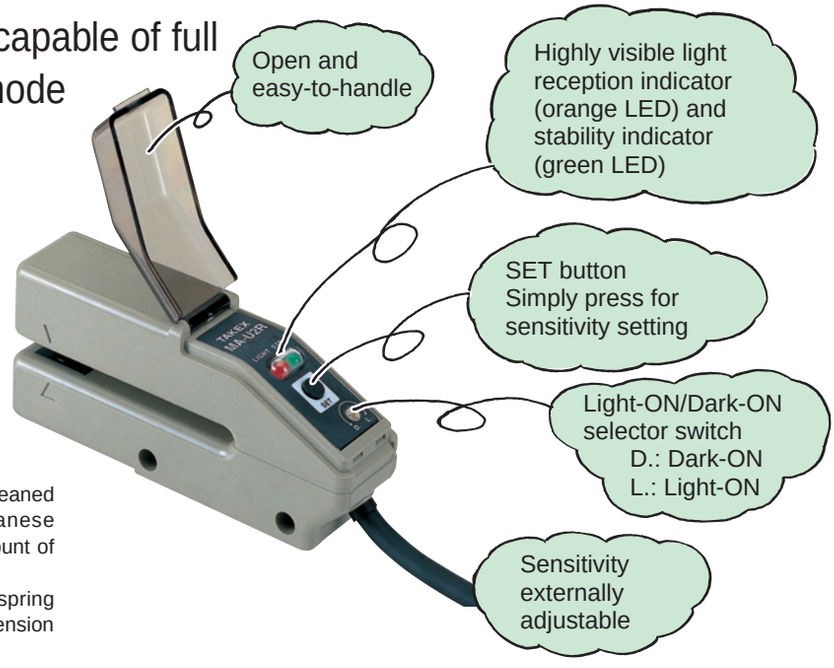
Type

Detection method	Detection interval	Model	Operation mode	Output mode	Light source
U-shaped through-beam	2 mm fixed	**MA-U2R**	Light-ON/ Dark-ON selector switch	NPN open collector	Red LED
		MA-U2G			Green LED
		MA-U2B			Blue LED
		MA-U2RPN		PNP open collector	Red LED
		MA-U2GPN			Green LED
		MA-U2BPN			Blue LED

Through-beam sensor capable of full auto or auto teaching mode



- The center of detection is constantly cleaned for stable detection, even with Japanese paper, etc., that generates a large amount of dust.
- The top lens is also cleaned by the “spring effect” of work caused by release of tension that occurs when the work runs out.



Rating/Performance/Specification

Rating/performance	Type	NPN type	**MA-U2R**	**MA-U2G**	**MA-U2B**
		PNP type	**MA-U2RPN**	**MA-U2GPN**	**MA-U2BPN**
	Detection method		Through-beam type (U-shaped)		
	Detection interval		2 mm fixed		
	Power supply		12 – 24 VDC ±10% Ripple: 10 % max.		
	Current consumption		NPN output type: 40 mA max. / PNP output type: 45 mA max.		
	Output type	NPN type	NPN open collector output Current output: Rating: sink current 100 mA (30 VDC) max. (residual voltage: 1 V max.)		
		PNP type	PNP open collector output Current output: Rating: source current 100 mA (30 VDC) max. (residual voltage: 2 V max.)		
	Operation mode		Light-ON/Dark-ON selectable (with switch)		
	External teaching input		No-voltage input (contact/non-contact)		
	Response time		0.7 ms max.		
	Minimum detectable mark width		1 mm		
Specification	Light source (light wavelength)		Red LED (660nm)	Green LED (570nm)	Blue LED (450nm)
	Indicator		LIGHT: light reception indicator (orange LED) STB: stability indicator (green LED)		
	Sensitivity adjustment		Full auto teaching/auto teaching with SET button or external teaching input		
	Short-circuit protection		Provided		
	Switch (SW)		Light-ON/Dark-ON selector switch provided		
	Material	Lens	Glass		
		Case	Heat resistant ABS		
	Connection		Permanently attached cord (outer diameter: dia.4) 0.2 mm^2 x 4 cores, 3 m, black		
	Mass		120 g max.		

Environmental Specification

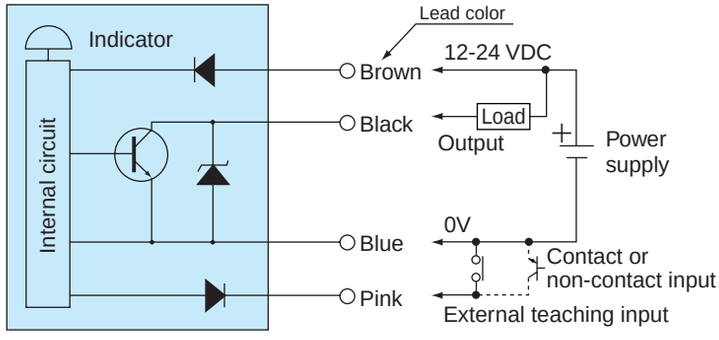
Environment	Ambient light	5,000 lx max.
	Ambient temperature	–25 - +55 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP67
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
	Shock	1000m / s^2 / 2 times each in 3 directions
	Dielectric withstanding	1,000 VAC for 1 minute
	Insulation resistance	500 VDC, 20 MΩ or higher

● White LED type

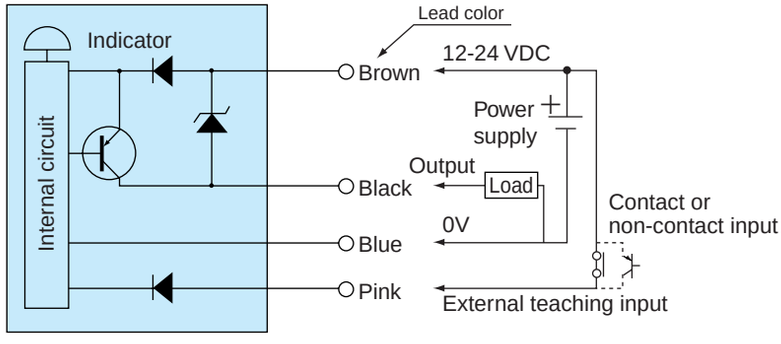
A model with white LED used as the light source is available.
For detection involving large variations, stable operation is available fairly regardless of mark colors.
Test the operation with an evaluation unit before use.
Model MA-U2W (PN)

Input/Output Circuit and Connection

- NPN output type



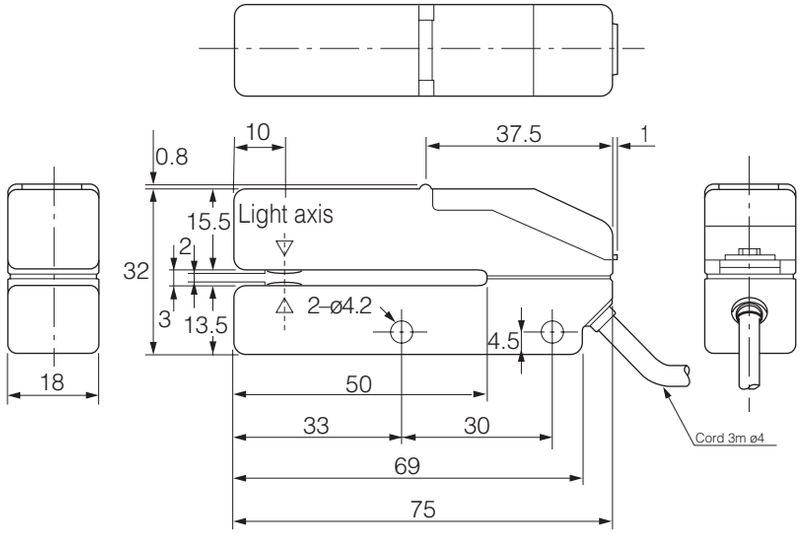
- PNP output type



- The output transistor turns off when load short circuit or overload occurs.
  Check the load and turn the power back on.
- When not using external teaching method, cut the pink lead at the base or connect it to the positive terminal of the power supply.

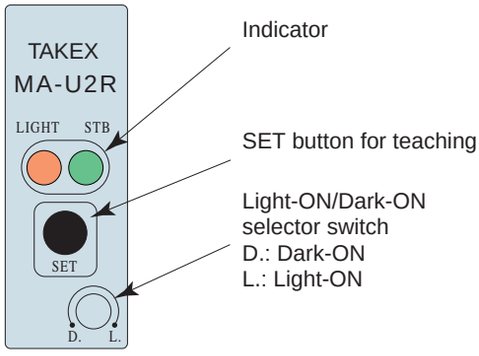
Dimensions (in mm for all models)

CAD



Operation panel

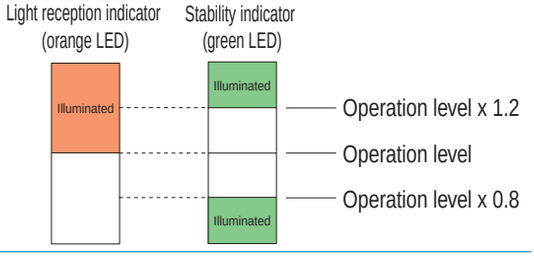
Operation panel



Indicators

LIGHT: light reception indicator (orange LED)
Illuminated when a certain amount of light is received.

STB: stability indicator (green LED)
Illuminated when the received light intensity is in a range that allows stable light reception or blocking.
Flashes during teaching.

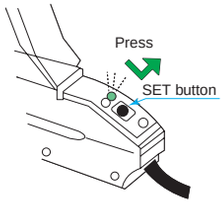


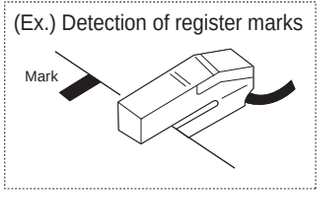
Sensitivity Setting

●Sensitivity full auto teaching with mark in passage

–Convenient for detection of marks passing at high speed–

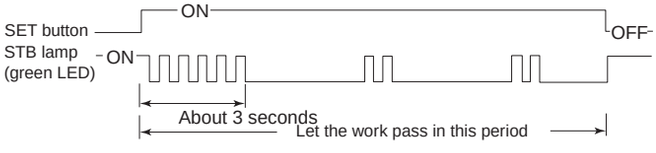
①Press and hold down the SET button.
The green LED (indicator) flashes, indicating that the sensor is in the standby mode.





②Let the mark pass while holding down the SET button.
When the slow flashing of the green LED has been confirmed, release the button. Sensitivity setting is complete.

STB lamp (green LED)
The green LED (indicator) shows teaching processes.
When the SET button has been held down for a certain period of time, the STB lamp starts flashing and, about 3 seconds later, the flashing becomes slower.

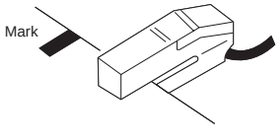


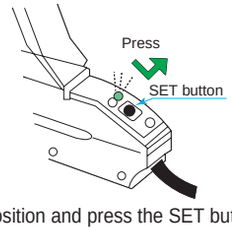
* Releasing the SET button before the flashing of the green LED becomes slow, the full auto teaching mode is exited and the STB lamp keeps flashing.
In this case, press the SET button again and repeat the procedure from (1).
* In full auto teaching, a variation in the receiver light intensity is captured for the CPU to set the optimum sensitivity and operation level.
For this reason, the mark may be passed anytime as long as the SET button is held down even if the STB lamp is flashing slowly.

●Sensitivity auto teaching with stationary mark

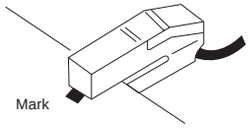
–Example of detection of register marks–

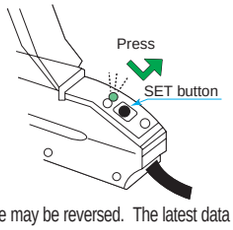
①Press the SET button once with no mark (object) present.
The STB lamp (green LED) starts flashing, indicating that a data has been stored.





②Place the mark (object) at the given position and press the SET button again.
The flashing of the STB lamp changes to illumination, indicating that sensitivity setting is completed.





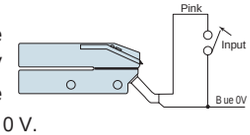
* The order of the steps (1) and (2) mentioned above may be reversed. The latest data are always effective no matter how many times teaching has been performed.

●External sensitivity setting

・External input may be used for sensitivity setting in the same way as sensitivity setting with the SET button of the sensor.
The basic operation is exactly the same as with the SET button.
・Ensure an input duration of at least 100 ms.
・The external teaching input is connected with the SET switch on the operation panel by OR logic.

NPN output type

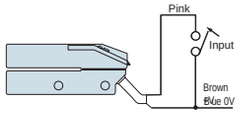
・ Place a switch, etc. between the external input line (pink) and 0 V (blue). Input is activated when the external input line is short-circuited to 0 V.



・When not using external teaching, connect the pink line with H (+).

PNP output type

・ Place a switch, etc. between the external input line (pink) and + V (brown). Input is activated when the external input line is short-circuited to + V.

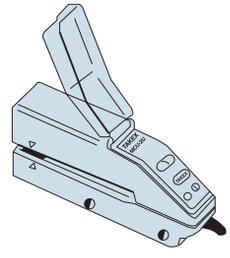


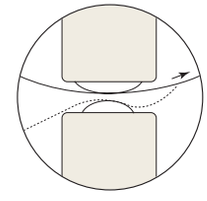
・When not using external teaching, connect the pink line with L (–).

- A Blue LED type is now available
  (ideal for detecting yellow register marks)
- Lens surface is constantly cleaned
- Large curved Glass lens will not cause damage to work
  - Water resistance to IP 67 standard for washability, multi-turn manually adjustable without tool for fine adjustment

Type

Detection method	Detection interval	Model	Light source	Operation mode	Output mode		Remarks
U-shaped through-beam	2 mm fixed	**MC-U2R**	Red LED	Light-ON/Dark-ON selector switch	Open collector	NPN	For detection of labels
		MC-U2R-TC				NPN and PNP outputs	
		MC-U2G	Green LED			NPN	For detection of register marks
		MC-U2G-TC				NPN and PNP outputs	
		MC-U2B	Blue LED			NPN	Effective for detection of yellow marks
		MC-U2B-TC				NPN and PNP outputs	

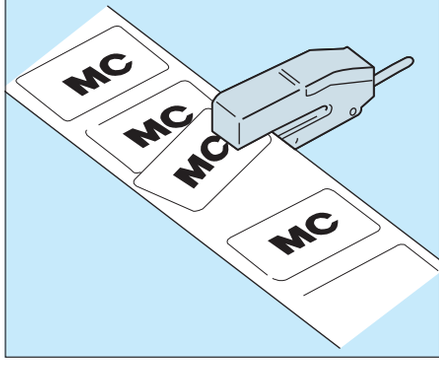




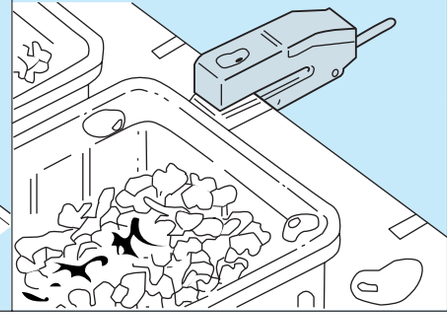
- The center of detection is constantly cleaned for stable detection, even with Japanese paper, etc., that generates a large amount of dust.
- The top lens is also cleaned by the “spring effect” of work caused by release of tension that occurs when the work runs out.

Sample Application

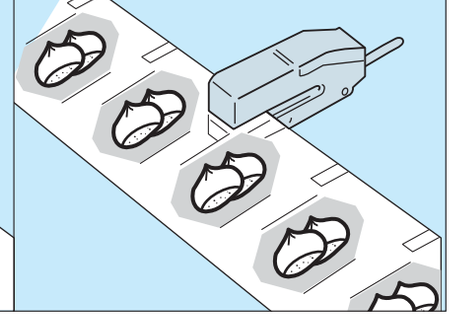
- Detection of overlapped labels



- Positioning of register marks on film wrapper (transparent or translucent) in a place subject to splashing water



- Detection of register marks on wrappers of Japanese confectionary (Japanese paper)



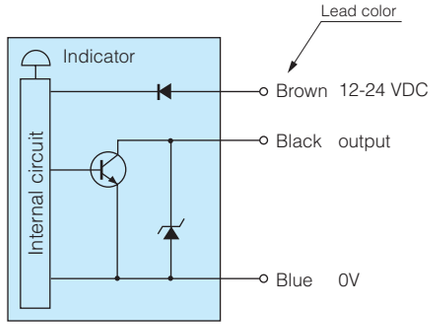
Rating/Performance/Specification

	Type	For detection of labels	Register mark detection	
Rating/performance	Model	**MC-U2R**	**MC-U2G**	**MC-U2B**
	Detection method	U-shaped through-beam		
	Detection interval	2 mm fixed		
	Power supply	12 – 24 VDC ±10% Ripple: 10 % max.		
	Current consumption	20 mA max.	28 mA max.	22 mA max.
	Output mode	NPN open collector output Rating: sink current 100 mA (30 VDC) max. (*1)		
	Operation mode	Light-ON/Dark-ON selectable (with switch)		
	Response time	0.5 us max.		
Specification	Light source (light wavelength)	Red LED (680nm)	Green LED (570nm)	Blue LED (450nm)
	Indicator	OPL: Operation indicator (Red LED), STB: Stability indicator (Green LED)		
	Volume (VR)	SENS: 4-turn sensitivity adjustment without stopper provided		
	Switch (SW)	● Light-ON/Dark-ON selector switch provided L: Light-ON, D: Dark-ON	● Emission intensity selector switch provided L.: low powered, H: high powered	
	Short-circuit protection	Provided		
	Material	Case: heat-resistant ABS, Lens: Glass		
	Connection	Permanently attached cord (outer diameter: dia.4) 0.2 mm2 x 3 cores, 3 m, black		
	Mass	120 g max.		
	Notes	(*1) Models that provide PNP and NPN outputs are also available. Model Nos.: MC-U2R-TC and MC-U2G-TC.		

Environmental Specification

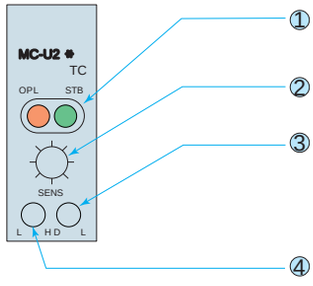
Environment	Ambient light	5,000 lx max.
	Ambient temperature	–25 - +55 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP67
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
	Shock	100 m/s² / 2 times each in 3 directions
	Dielectric withstanding	500 VAC for 1 minute
	Insulation resistance	500 VDC, 20 MΩ or higher

Input/Output Circuit and Connection



- The output transistor turns off when load short circuit or overload occurs.
- Check the load and turn the power back on.

Panel Layout



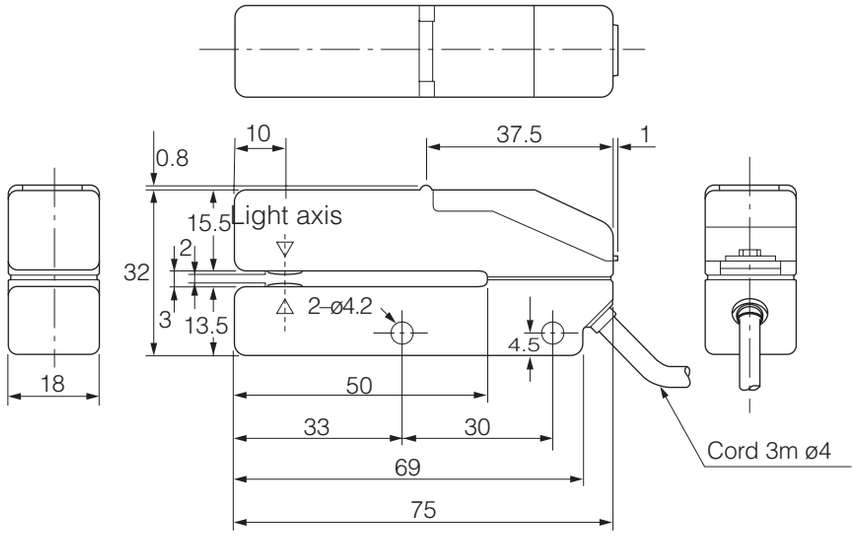
①Indicators OP.L: operation indicator (red LED)
STB.: stability indicator (green LED)

②Sensitivity adjustment: 4-turn volume without stopper

③Light-ON, Dark-ON selector switch D: Dark ON
L: Light ON

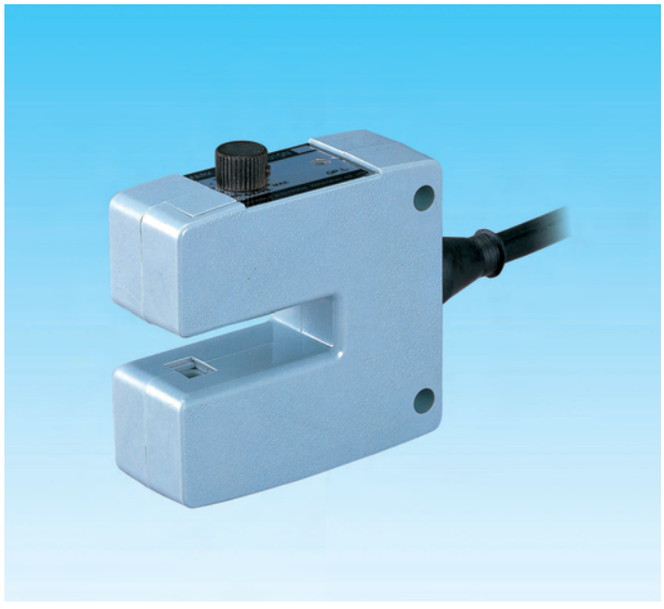
④Emission intensity selector switch L.: low powered
H: high powered

Dimensions (in mm for all models)



MU10 series

U-shaped mark sensor



For detection of marks on edge of transparent or translucent film

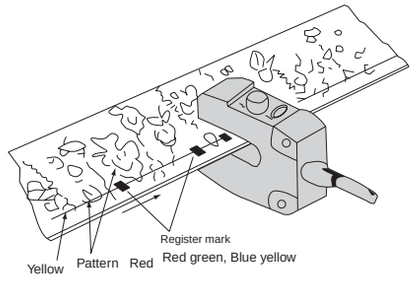
Both Light-ON and Dark-ON outputs available

- U-shaped sensor requiring no light axis alignment, eliminates the possibility of misalignment caused by vibration
  Distance: 10 mm fixed
- Light reception indicator and easy-to-use sensitivity adjustment provided, also excellent resistance to noise

Type

Detection method	Detection interval	Model	Light source	Operation mode	Output mode
U-shaped through-beam	10 mm fixed	**MU10NR**	Red LED	Light-ON and Dark-ON 2 outputs (by 2 output leads)	Current output Voltage output
		MU10N	Green LED		

- MU10NR uses a red LED as the light source, which allows detection of black register mark printed on opaque paper. Applications may include detection of paper double feed on labeling machines, etc.
- MU10N uses a green LED as the light source, which allows detection of register marks printed on transparent or translucent paper with transmission factor of 10-100%.



Detection Capability

- Reference for selection of model

Detection object	Film sheet with transmission factor of 10-100%						Film sheet with transmission factor of 10% or lower					
Mark color / Model	赤	黒	茶	紺	緑	青	赤	黒	茶	紺	緑	青
MU10N	○	○	○	○	△	○	—					
MU10NR	—						×	○	×	○	○	○

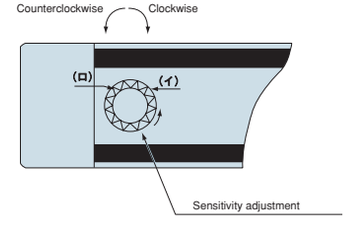
○: detectable
△: may be detectable depending on shade
×: unlikely to be detectable
—: inappropriate application

Detection may not succeed depending on the shading. Be sure to provide samples.

Sensitivity Adjustment

* The following example shows the procedure to adjust for light blocking condition with a register mark. For light reception condition with register marks, adjust in a reverse manner.

1. Turn the sensitivity adjustment counterclockwise to the minimum sensitivity.
2. With no mark present, turn up (clockwise) the sensitivity adjustment gradually from the minimum position and find the point at which the indicator is illuminated (Point b).
3. With the mark present, turn down (counterclockwise) the sensitivity adjustment gradually from the maximum position and find the point at which the indicator is illuminated (Point a). If the indicator is not illuminated even at the maximum, the maximum is regarded as Point a.
4. Set the adjustment at midway between Points a and b.



Rating/Performance/Specification

	Type	Red LED type	Green LED type
Rating/performance	Model	**MU10NR**	**MU10N**
	Detection method	U-shaped through-beam	
	Detection interval (between transmitter and receiver)	10 mm fixed	
	Power supply	12 – 24 VDC ±10% Ripple: 10 % max.	
	Current consumption	35 mA max.	
	Output mode	Current output/Voltage output (Rating): Current output: sink current 100 mA (30 VDC) max. Voltage output: output impedance 4.7 kΩ	
	Operation mode	Light-ON/Dark-ON 2 outputs (by 2 output leads)	
	Response time	3 ms max.	
Specification	Light source	Red LED (680nm)	Green LED (570nm)
	Sensitivity adjustment	Provided	
	Indicator	Light reception indicator (red LED)	
	Material	Polycarbonate	
	Connection	Permanently attached cord (outer diameter: dia.6) 0.3 mm² x 4 cores, 3 m	
	Mass	220 g max.	

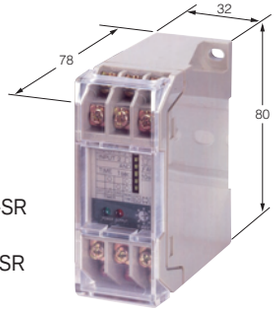
Environmental Specification

Environment	Ambient light	3,000 lx max.
	Ambient temperature	–10 - +55 °C (non-freezing)
	Ambient humidity	35-85%RH (non-condensing)
	Protective structure	IP40
	Vibration	10-55 Hz / 1.5 mm amplitude / 2 hours each in 3 direction
	Shock	1000 m/s² / 2 times each in 3 directions
	Dielectric withstanding	1,500 VAC for 1 minute
	Insulation resistance	500 VDC, 20 MΩ or higher

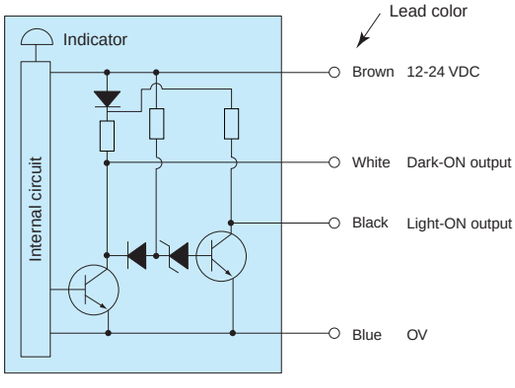
Applicable power supply unit

PS Series
High capacity of
200 mA at 12 VDC

(General-purpose type) PS3N
PS3N-SR
(Multifunctional type) PS3F
PS3F-SR



Input/Output Circuit and Connection



Dimensions (in mm)