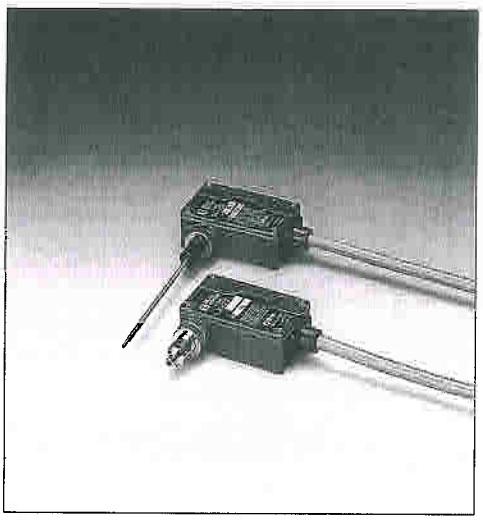
SX-23, LX-23 series Fiber optic sensors

- **Sturdiness**
  Sturdy construction allows the sensors to operate under unfavorable conditions.
- **Widened selections**
  - Fiber optics
    Four different types of fiber optics are available: Threaded, unthreaded with or without lens, stainless-steel heat resistant and stainless sleeve type.
  - Sensor units
    SX-23: Red or green LED (modulated) type
    LX-23: High speed (0.1ms) optical lamp type



SX-23 SERIES

- **Uncomparable easiness in handling**
  - Two modes of outputs dark-ON/light-ON.
  - A wide coverage of voltage (12 to 24V ± 10%)
  - NPN transistor with pull-up resistor by which either voltage output or current output is used.
- **Applicable with 22 kinds of fiber optics**
  Fiber optics are comprised of three series: A series, which has a threaded or stainless sleeve head; and B series which has a small, short head; and C series which has heat-resistant head. All series cover a remarkably wide range.

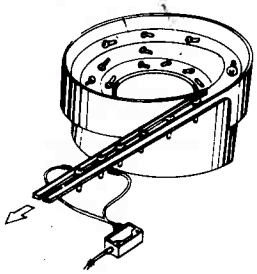
LX-23 SERIES

- **Ultra high response speed**
  As high as 0.1ms (100μs), enabling to detect high-speed-travelling small objects
- **High color-recognition performance**
- **Minituarized & long life**
  Even with the optical lamp type, sensor unit is surprisingly small, and the lamp lasts 20,000 hours on average.

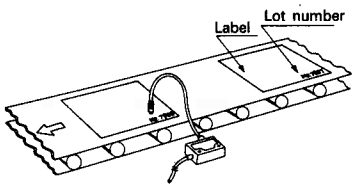
■ APPLICATIONS

SX-23 series

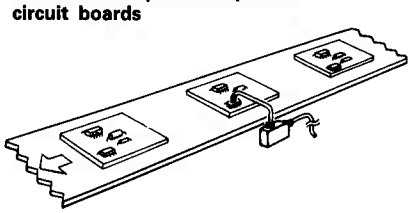
Detection of parts in parts feeder



Check of print on label sheets



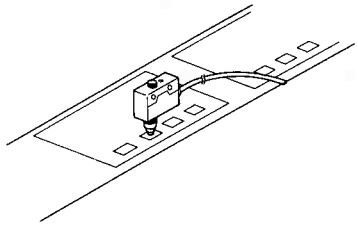
Check of the parts on printed circuit boards



Easy to handle with no need to fix sensing face because of flexible metallic sleeve.

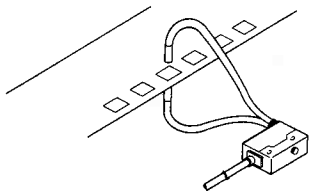
LX-23 series

Detection of color marks



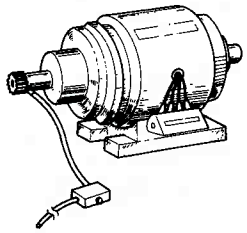
Detection of color codes and marks

Translucent mark detection



Mark detection of translucent (cellophane, nylon, etc.) objects.

Detection of revolutions

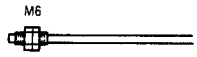
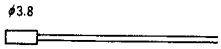
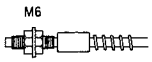
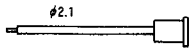


Detection of unevenness or glossiness of rotating parts.

SX-23, LX-23

Fiber Optic Selection Guide

SX-23 series

		Unit No.		Fiber length (mm)	Appearance (mm)		Max. sensing distance	
		Threaded	Unthreaded		Threaded	Unthreaded	SX-23-R	SX-23-G
Thru-beam		FT-3A	FT-3B	300	FT- ... A 	FT- ... B 	100mm	30mm
		FT-6A	FT-6B	600				25mm
		FT-10A	FT-10B	1000				20mm
		FT-20A	FT-20B	2000				15mm
	With lens		FT-6BL	600		FT- ... BL 	300mm	80mm
			FT-10BL	1000				70mm
			FT-20BL	2000				60mm
	Heat-resistant	FT-20H		2000			100mm	
Diffuse-reflective		FR-3A	FR-3B	300	FR- ... A 	FR- ... B 	50mm	8mm
		FR-6A	FR-6B	600			45mm	7mm
		FR-10A	FR-10B	1000			40mm	5mm
		FR-20A	FR-20B	2000			20mm	3mm
	Heat-resistant	FR-20H		2000			50mm	
	Stainless sleeve	FS-90A		90			15mm	2.5mm

LX-23 series

	Unit No.			Fiber length (mm)	Appearance (mm)	Max. sensing distance LX-23
	Threaded coaxial	Unthreaded	Fixed coaxial			
Thru-beam		FT-3		300		30mm
Diffuse-reflective	FR-3			300		3mm
			FF	–		3mm

■ OPTIONAL COMPONENT (available by separate order)

Article	Unit No.	Content
Fiber bender	**FB-1**	Easily bend **FS-90A** sleeve with suitable bending radius.

■ SPECIFICATIONS (sensor unit)

Item \ Classification	Unit No.	NPN Output		
		SX-23-R	**SX-23-G**	**LX-23**
Power source		12 to 24V DC ± 10% Ripple P-P: Less than 10%		12V DC ± 10% Ripple P-P: Less than 10%
Consumption		Less than 45mA		Less than 150mA
Output		NPN transistor with pull-up resistor · Sink current: Max. 80mA · Residual voltage: Less than 1V at 80mA sink current		NPN transistor with pull-up resistor · Sink current: Max. 80mA · Residual voltage: Less than 1V at 80mA sink current
	Output operation	Light-ON or Dark-ON operation can be selected by two output wires		Light-ON
Response time		Approx. 3ms		0.1ms (max. response frequency: 10kHz)
Operation indicator		Red LED (illuminates when receiving lights)		Red LED (illuminates when receiving lights)
Sensitivity adjustor		Countinuously variable adjustor equipped		Optical multi-revolution adjustor equipped
Environmental resistance	Protection	IP62		IP62
	Ambient temperature	−10 to +60°C (with no dew or ice condensation) / −20 to +70°C (storage)		−10 to +40°C (with no dew or ice condensation)
	Ambient humidity	35 to 85%RH		35 to 85%RH
	Extraneous light	Sun light: 3,000 lx at light receiving face, Incandescent light: 1,000 lx at light receiving face		500 lx (variation of extraneous light can define white of 88% and 63% reflectivity.)
	Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y and Z directions for 2 hours each in power OFF state		1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y and Z directions for 2 hours each in power OFF state
	Shock	500m/s² (approx. 50G) impulse in each of X, Y and Z directions for 3 times each in power OFF state		300m/s² (approx. 30G) impulse in each of X, Y and Z directions for 3 times each in power OFF state
Emitting element		Red LED (modulated)	Green LED (modulated)	Optical tungsten lamp (average life: 20,000 hours)
Grounding method		Direct grounding		Direct grounding
Material		Enclosure: Zinc alloy die casting		Enclosure: Zinc alloy die casting
Cable		0.3mm² × 4 cores with 1m of cabtyre cable		0.3mm² × 3 cores with 1m of cabtyre cable
Cable extension		Extensible up to 100m using more than 0.3mm² cable		Extensible up to 50m using more than 0.3mm² cable
Weight		Approx. 150g		Approx. 150g
Accessories		Fixing ring: 1 pc. Screwdriver for sensitivity adjustment: 1 pc.		

■ SPECIFICATIONS (fiber optics)

SX-23

• Thru-beam

Item \ Classification		Thru-beam				With lens			Heat-resistant
Item \ Unit No.		FT-3A / FT-3B	FT-6A / FT-6B	FT-10A / FT-10B	FT-20A / FT-20B	FT-6BL	FT-10BL	FT-20BL	FT-20H
Sensing distance / Sensor unit	SX-23-R	100mm				300mm			100mm
	SX-23-G	30mm	25mm	20mm	15mm	80mm	70mm	60mm	
Min. detectable object		Opaque of ø1mm				Opaque of ø2mm			Opaque of ø1.5mm
Fiber length		30cm	60cm	100cm	200cm	60cm	100cm	200cm	200cm
Allowable bending radius		More than R30mm							More than R25mm
Ambient temperature		–20 to +70°C (with no dew or ice condensation)							–20 to +180°C (with no dew or ice condensation)
Ambient humidity		35 to 85%RH							
Material		Fiber optics: Acrylic resin Enclosure: Polyethylene				Fiber optics: Acrylic resin Enclosure: Polyethylene Lens: Acryl			Fiber optics: Multi-component glass Enclosure: Stainless spiral
Accessories		M4 nut: 4 pcs. (units suffixed with "A" only)							M6 nut: 4 pcs. Toothed lock washer: 2 pcs. Fixing ring: 1 pc.

• Diffuse-reflective

Item \ Classification		Diffuse-reflective				Stainless sleeve	Heat-resistant
Item \ Unit No.		FR-3A / FR-3B	FR-6A / FR-6B	FR-10A / FR-10B	FR-20A / FR-20B	FS-90A	FR-20H
Sensing distance (*1) / Sensor unit	SX-23-R	50mm	45mm	40mm	20mm	15mm	50mm
	SX-23-G	8mm	7mm	5mm	3mm	2.5mm	
Min. detectable object		0.15mm wide black line on white paper (at setting distance of 1.5mm)				0.3mm wide (R type: 0.2mm width) black line on white paper (at setting distance of 1mm)	ø0.05mm copper wire
Hysteresis		Less than 15% of sensing distance					Less than 20% of sensing distance
Fiber length		30cm	60cm	100cm	200cm	9cm (Sleeve: 7cm)	200cm
Allowable bending radius		More than R30mm				More than R10mm	More than R25mm
Ambient temperature		–20 to + 70°C (with no dew or ice condensation)				–25 to +100°C (with no dew or ice condensation)	–20 to +180°C (with no dew or ice condensation)
Ambient humidity		35 to 85% RH					
Material		Fiber optics: Acrylic resin Enclosure: Polyethylene				Fiber optics: Multi-component glass Enclosure: Flexible stainless	Fiber optics: Multi-component glass Enclosure: Stainless spiral
Accessories		M6 nut: 2 pcs. (units suffixed with "A" only)					M6 nut: 2 pcs. Toothed lock washer: 1 pc. Fixing ring: 1 pc.

*1: Sensing distance is the value to a target of non-glossy white paper (50 × 50mm).

LX-23

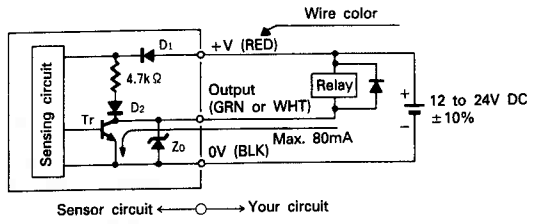
Item \ Classification	Thru-beam	Coaxial diffuse-reflective	Fixed coaxial diffuse-reflective
Item \ Unit No.	FT-3	FR-3	FF
Sensor unit to be combined	LX-23		
Sensing distance (*1)	30mm	1 to 3mm (center 1.5mm)	
Min. detectable object	ø1.5mm	0.1mm wide black line on white paper (at the optimum state)	
Hysteresis		Less than 10% of sensing distance	
Fiber length	30cm	30cm	
Allowable bending radius (*2)	More than R30mm		
Ambient temperature	–20 to +70°C (with no dew or ice condensation)		–10 to +40°C (with no dew or ice condensation)
Ambient humidity	35 to 85% RH		
Material	Enclosure: Silicon tube Fiber optics: Acrylic resin		Enclosure: Brass (nickel plated) Fiber optics: Acrylic resin

*1: Sensing distance of reflective type is the value to a target of non-glossy white paper (50 × 50mm).
*2: This is the value when the fiber optics are bent at a 90° angle.

■ INPUT/OUTPUT AND TYPICAL CONNECTION DIAGRAMS

• SX-23 series

• INPUT/OUTPUT Diagram

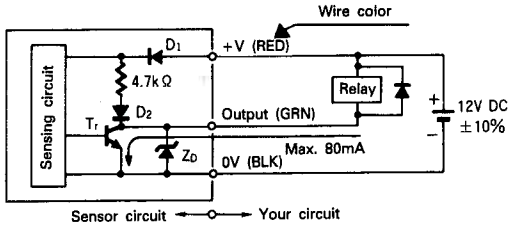


Where.....D_1 : Reverse polarity protection diode
D_2 : Reverse current prevention diode
Z_D : Surge absorption zener diode
T_r : Output transistor

- **Output operation**
  Green wire ..... Light-ON
  White wire ..... Dark-ON

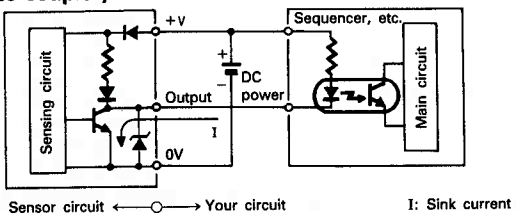
• LX-23

• INPUT/OUTPUT Diagram

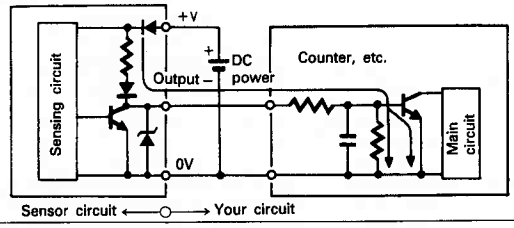


Where.....D_1 : Reverse polarity protection diode
D_2 : Reverse current prevention diode
Z_D : Surge absorption zener diode (Vz≒33V)
T_r : Output transistor

• For current-driven loads (sequencer, counter and photo-coupler)



• For voltage-driven loads (sequencer, counter and logic circuit)



■ SENSING FIELDS

(These are typical sensing fields, and are subject to slight changes from unit to unit.)

▽1 : Parallel deviation, thru-beam (mm, if not otherwise stated)

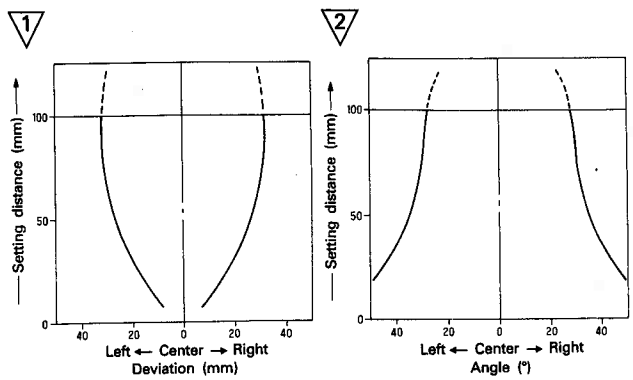
▽2 : Angular deviation, thru-beam (mm, for the axis of ordinates, degree for the axis of abscissas)

▽3 : Parallel deviàtion by a target, diffuse-reflective (mm, if not otherwise stated)

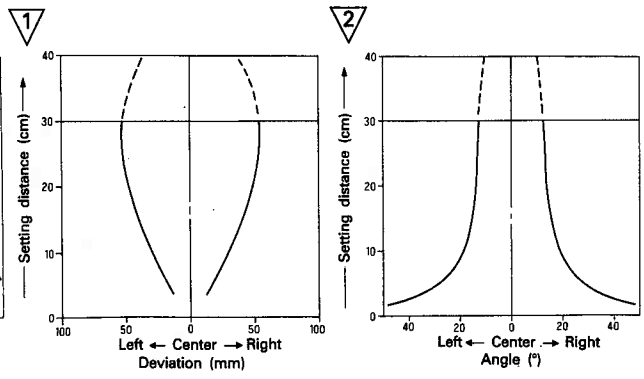
SX-23

Thru-beam

1 Sensor unit : SX-23-R
Fiber optics : FT-3A, FT-3B

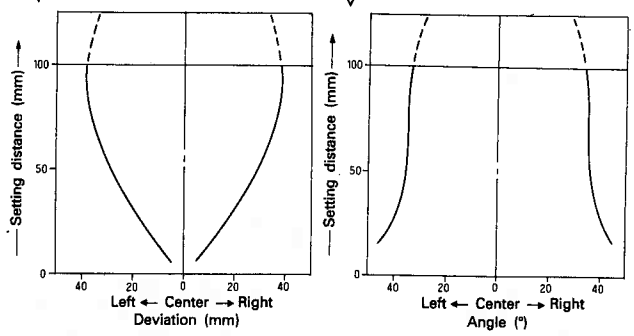


2 Sensor unit : SX-23-R
Fiber optics : FT-6BL

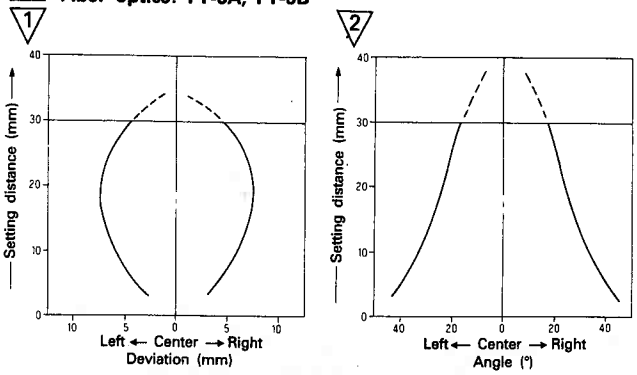


SX-23, LX-23

3 **Sensor unit: SX-23-R**
Fiber optics: FT-20H

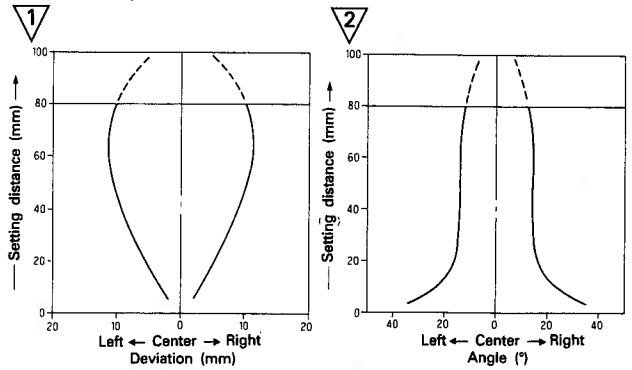


4 **Sensor unit: SX-23-G**
Fiber optics: FT-3A, FT-3B

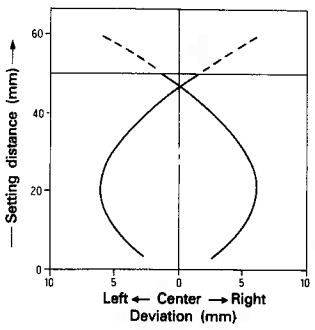


Diffuse-reflective

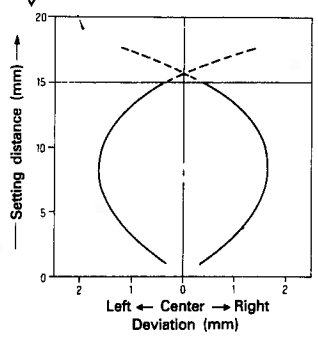
5 **Sensor unit: SX-23-G**
Fiber optics: FT-6BL



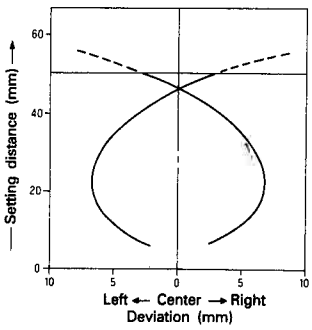
1 **Sensor unit: SX-23-R**
Fiber optics: FR-3A, FR-3B



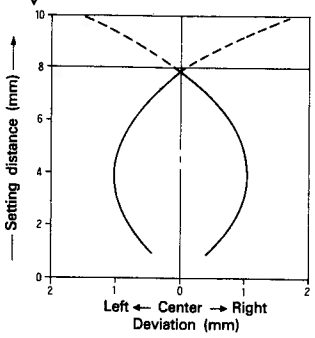
2 **Sensor unit: SX-23-R**
Fiber optics: FS-90A



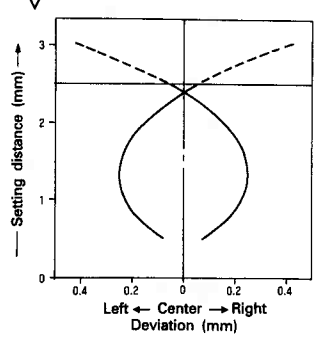
3 **Sensor unit: SX-23-R**
Fiber optics: FR-20H



4 **Sensor unit: SX-23-G**
Fiber optics: FR-3A, FR-3B



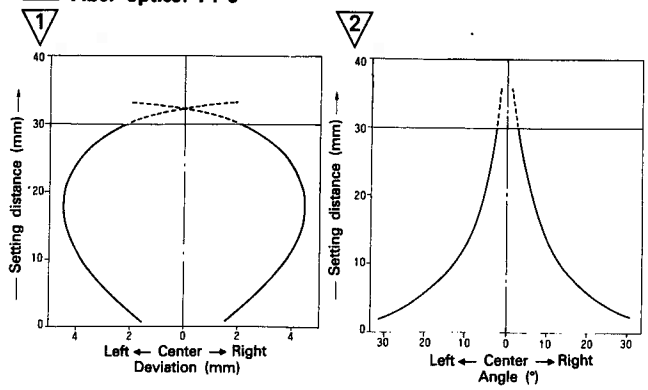
5 **Sensor unit: SX-23-G**
Fiber optics: FS-90A



LX-23

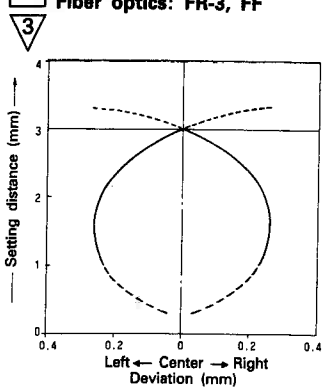
Thru-beam

1 **Sensor unit: LX-23**
Fiber optics: FT-3

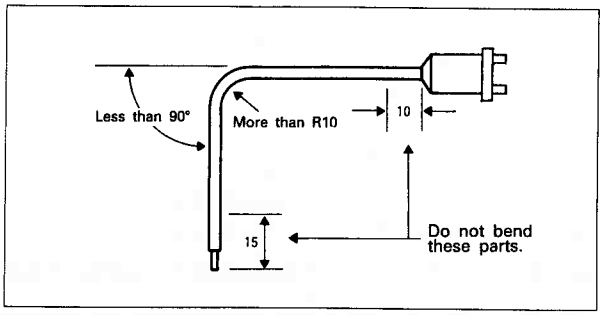


Diffuse-reflective

1 **Sensor unit: LX-23**
Fiber optics: FR-3, FF

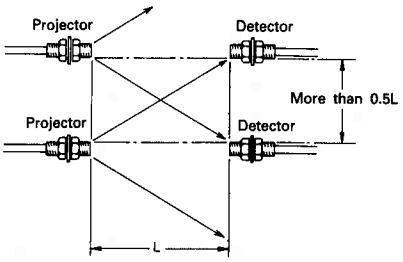


- **How to bend FS-90A**
  The bending radius should be more than R10mm. It is possible to bend easily by pressing it against a rod with more than ø20mm.
  (A device for bending the fiber optics (fiber bender **FB-1**) is available optionally.)

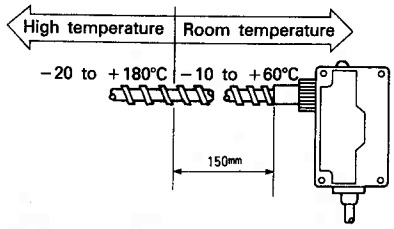


- Bending repetition should be less than 3 times.

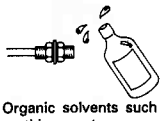
- **Mutual interference**
  When using plural thru-beam type fiber optics side by side, follow the sketch below for installation.

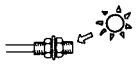


- **Notice on heat-resistant fiber optics**
  Place at least 150mm of the spiral part in the temperature zones as shown below in order to protect sensor units. Protect the sensor unit from radiation heat and heat blast.



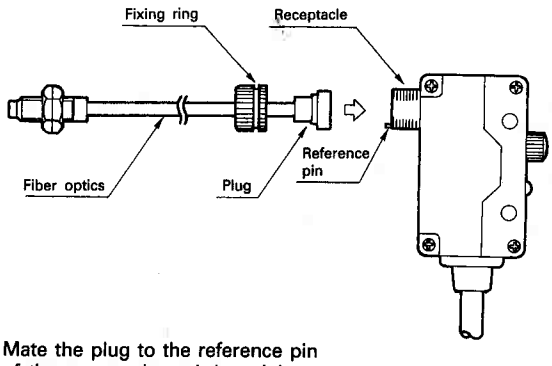
- **Notes on use**
  - Do not hit anything against the sensing surface. Damaged may shorten the sensing distance.
  - Do not expose the fiber optics to organic solvents.
  - Avoid letting water get through the surface because water may reduce sensing performance.
  - Protect the light receiving face from intense extraneous light.
  - Avoid places where the units are exposed to direct fluorescent lights with the rapid-starters or high frequency starters.
  - Do not place the fiber optics under excessive tensile force.





LX-23

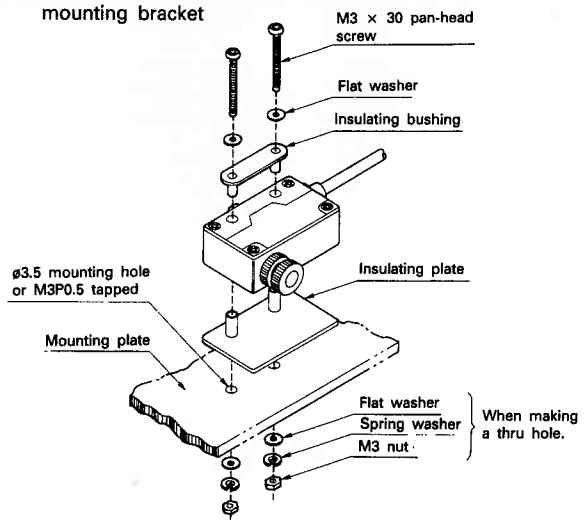
- **Sensor unit**
- **How to hook up a fiber optics to a sensor unit**



- Mate the plug to the reference pin of the receptacle and then tighten the fixing ring onto the receptacle. (Do not remove O-ring in fixing rings.)

- **Enclosure grounding**
  In **LX-23** series, a direct grounding method (circuit 0V and enclosure is connected directly) is used to improve noise resistance. When DC 0V should not be electrically connected with mounting bracket, use insulating fittings. (Please contact our dealer.) Do not use power source with autotransformer (single volume transformer).

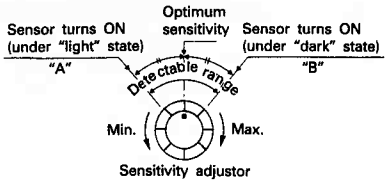
- How to attach insulation mounting bracket

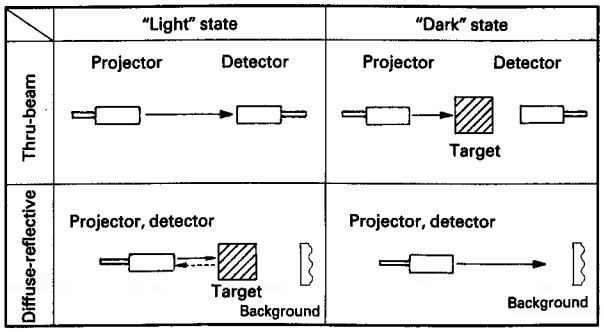


• Sensitivity adjustment

1. First turn the adjustor to the min. position (full counter-clockwise).
2. Then, turn it slowly clockwise and check the point "A" at which the sensor becomes light receiving state with "light-state".
3. Remove the target to make "dark-state".
4. Turn the adjustor further clockwise to find the point "B" where the sensor becomes light receiving state due to the reflected lights from the background.
   If there exists no point where the sensor becomes light receiving state, the max. point (full clockwise point) is regarded as the point "B".
5. The optimum sensitivity is obtained by setting the reading at a midway between "A" and "B".

To make this adjustment, use the supplied screwdriver and turn the adjustor slowly. Too much force to the adjustor may cause damage.





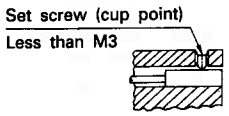
- Please replace lamp quickly should it burn out or decrease in output intensity. The average life expectancy of the lamp is approx. 20,000 hours.
  (Decrease of light intensity is compensated for by the sensor. However, a marked decrease will lead to deterioration of detecting sensitivity.)
- The output of the **LX-23** series is not equipped with short-circuit protection circuit. Do not connect the power source or the capacitive load to it.
- Please warm up for 30 to 60 mins. for very fine detection immediately after the power source is supplied as sensitivity drifts.
- If a switching regulator is used for the power source of the unit, be sure to ground the frame ground (F.G.) terminal to an actual ground.
- Do not use the unit where it may be exposed to steam or dust, or where it may come in direct contact with water.
- Do not run unit cables parallel to high-voltage lines or power lines, or put them together in the same raceway. This warning should be strictly observed to prevent malfunctions caused by inductive interference.

• Fiber optics

• Tightening torque

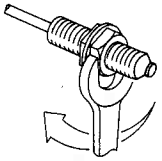
Tightening torque should be less than the values below.

FT-3: Mounting by fixing screw



• Tightening torque should be less than 5kgf·cm.

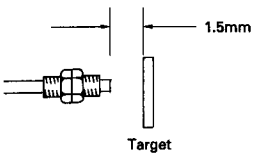
FR-3: Mounting by nut



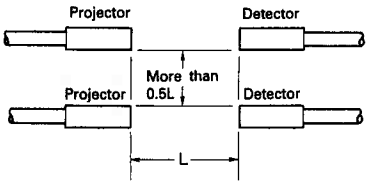
• Tightening torque should be less than 10kgf·cm.

• How to mount fiber optics

· The most suitable setting distance for diffuse-reflective type is 1.5mm (center of sensing distance).

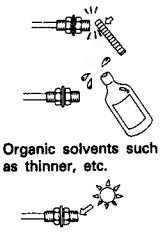


When using several thru-beam fiber optics side by side, allow a space of over half the setting distance.



• Notes on use

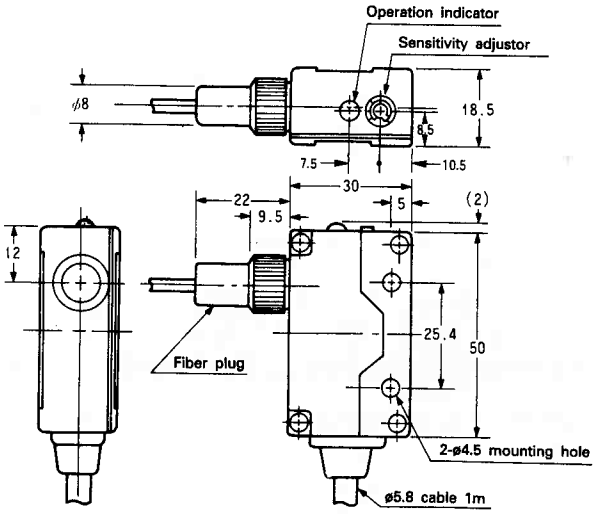
- Do not hit anything against the sensing surface.
  Damaged may shorten the sensing distance.
- Do not expose the fiber optics to organic solvents.
- Avoid letting water get through the surface because water may reduce sensing performance.
- Protect the light receiving face from extraneous light.
- Do not place the fiber optics under excessive tensile force.



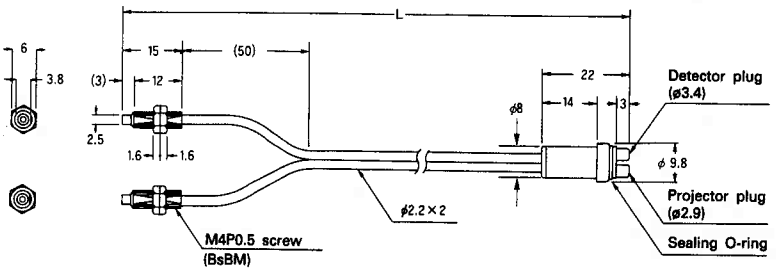
■ DIMENSIONS (mm)

• SX-23

SX-23-R
SX-23-G

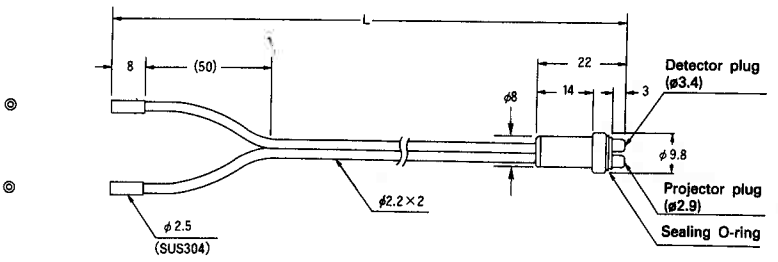


FT-...A



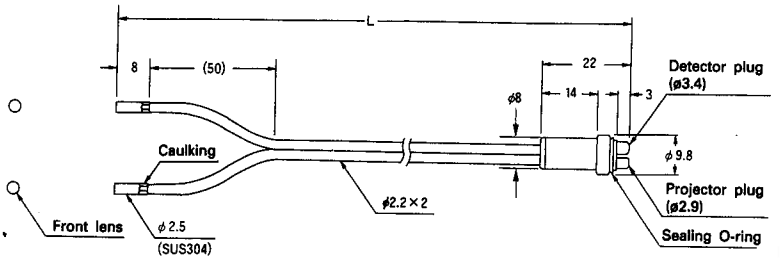
	L (mm)
FT-3A	300^{+30}_{-0}
FT-6A	600^{+30}_{-0}
FT-10A	$1,000^{+50}_{-0}$
FT-20A	$2,000^{+50}_{-0}$

FT-...B



	L (mm)
FT-3B	300^{+30}_{-0}
FT-6B	600^{+30}_{-0}
FT-10B	$1,000^{+30}_{-0}$
FT-20B	$2,000^{+30}_{-0}$

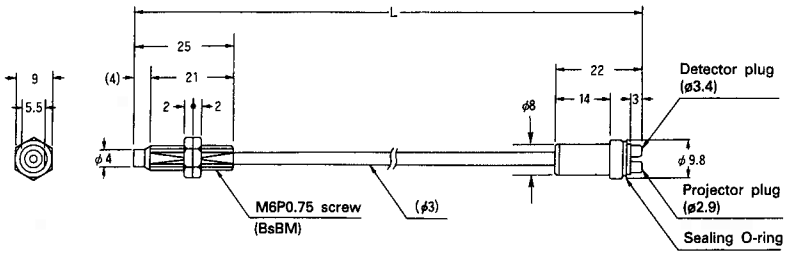
FT-...BL



	L (mm)
FT-6BL	600^{+30}_{-0}
FT-10BL	$1,000^{+30}_{-0}$
FT-20BL	$2,000^{+30}_{-0}$

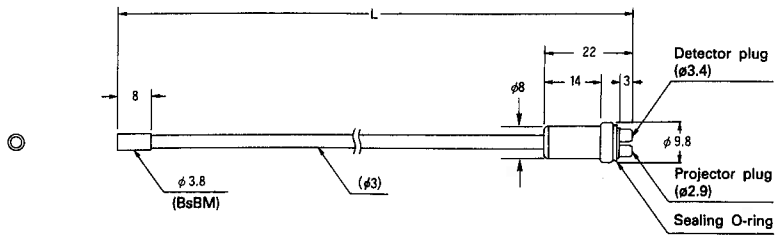
(mm)

• FR-...A



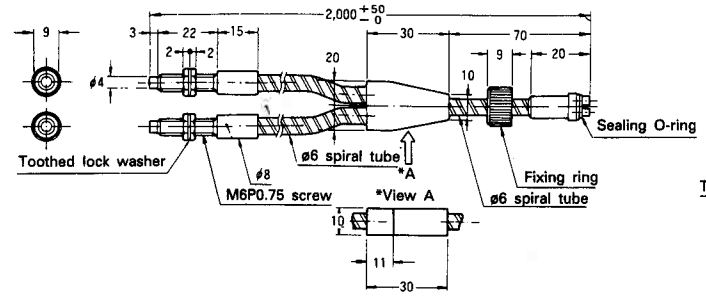
	L (mm)
FR-3A	300^{+30}_{-0}
FR-6A	600^{+30}_{-0}
FR-10A	$1,000^{+30}_{-0}$
FR-20A	$2,000^{+30}_{-0}$

• FR-...B

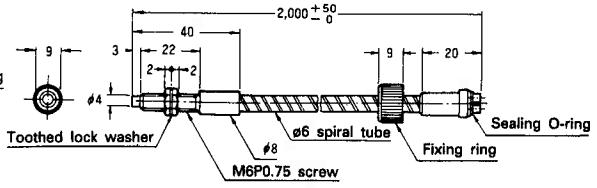


	L (mm)
FR-3B	300^{+30}_{-0}
FR-6B	600^{+30}_{-0}
FR-10B	$1,000^{+30}_{-0}$
FR-20B	$2,000^{+30}_{-0}$

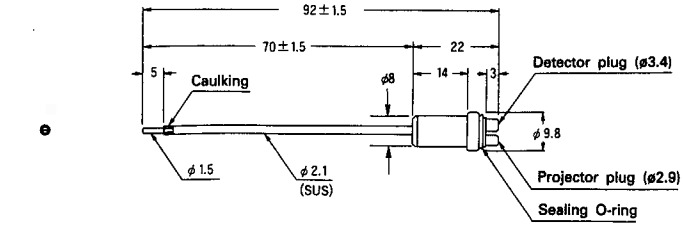
• FT-20H



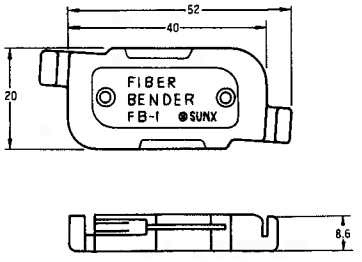
• FR-20H



• FS-90A



• FB-1

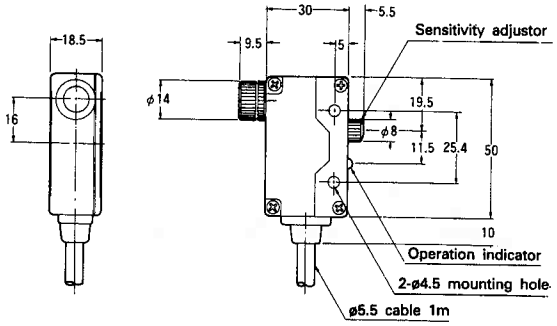


Material: PP with iron core

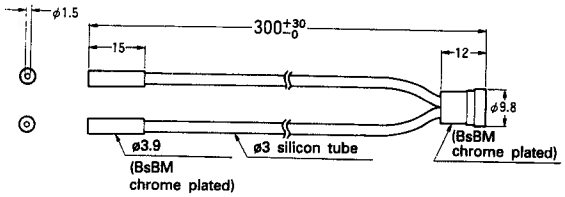
LX-23

(mm)

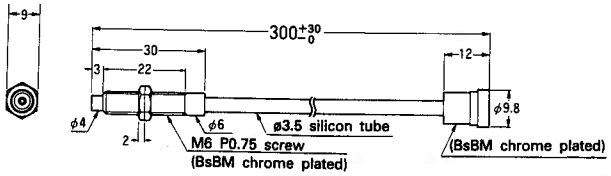
• LX-23



• FT-3

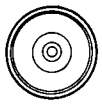


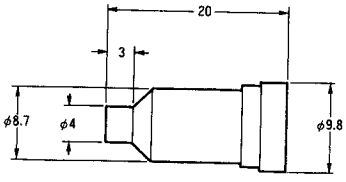
• FR-3



• FF

Shown here is **FF** fiber as it is assembled onto **LX-23**





Material: BsBM (chrome plated)