

High-speed Fiber Optic: SA1C-F



Key features:

- Ideal for remote sensing applications
- Featuring quick-connect cable and easy-insert fiber optic units for simple installation
- Through-beam and reflected-light sensing available
- Sensing range up to 7.09" (180mm) for through-beam sensors
- Dual outputs: Select NPN and PNP transistor outputs or NPN transistor output combined with a self-diagnostic output
- Outputs selectable for light on or dark on
- High-speed, 50μs response time
- Featuring variable off-delay (0 to 100msec) and fine-tune sensitivity adjustment
- Stable LED makes alignment easy
- Red or green LEDs available for detecting color marks
- Mount on a 35mm DIN rail



The perfect fiber optic sensor for applications where you have difficulty mounting regular or miniature sensors or where accessibility is a problem.

Available in through-beam and retro-reflective models, the built-in variable off-delay (0 - 10ms) can help you bring your complete system in tune.

The 50μs response time ensures detection of fast moving targets in a high-speed manufacturing environment where speed counts.

Part Numbers

Function	Amplifier	Output	Light Source	Response	Through-Beam Units		Diffuse-Reflected Units	
					Part Number	Range	Part Number	Range
	SA1C-FN3E (Cable) SA1C-FN3EC (Quick-Connect)	30V DC NPN transistor: 100mA (maximum) Self-diagnostic: 50mA (maximum)	Red LED	Standard speed: 0.5 ms	SA9F-TS: ø0.16" (M4) Straight	180mm (7.09")	SA9F-DS: ø0.24" (M6) Straight	60mm (2.36")
					SA9F-TC: ø0.16" (M4) Coiled	150mm (5.91")	SA9F-DC: ø0.24" (M6) Coiled	25mm (0.98")
	SA1C-FD3F (Cable) SA1C-FD3FC (Quick-Connect)	30V DC NPN transistor: 100mA (maximum) PNP transistor: 200mA (maximum)	Red LED	Standard speed: 0.5 ms	SA9F-TT: ø0.12" (M3) Straight	50mm (1.97")	SA9F-DD: ø0.24" (M6) Coaxial	60mm (2.36")
					SA9F-TM: ø0.16" (M4) Multicore	150mm (5.91")	SA9F-DT: ø0.12" (M3) Straight	20mm (0.79")
	SA1C-FN3EG (Cable) SA1C-FN3EGC (Quick-Connect)	30V DC NPN transistor: 100mA (maximum) Self-diagnostic: 50mA (maximum)	Green LED	Standard speed: 0.5 ms	SA9F-TT: ø0.12" (M3) Straight	5mm (0.20")	SA9F-DM: ø0.01" (0.26mm) Multicore	60mm (2.36")
					SA9F-TM: ø0.16" (M4) Multicore	100mm (3.94")	SA9F-DH: Heat-resistant glass fiber	27mm (1.06")
	SA1C-FD3FG (Cable) SA1C-FD3FGC (Quick-Connect)	30V DC NPN transistor: 100mA (maximum) PNP transistor: 200mA (maximum)	Green LED	Standard speed: 0.5 ms	SA9F-TL: Side view	40mm (1.57")	SA9F-DL: Side view	10mm (0.39")
	SA1C-F1N3E (Cable) SA1C-F1N3EC (Quick-Connect)	30V DC NPN transistor: 100mA (maximum) Self-diagnostic: 50mA (maximum)	Red LED	High- speed: 50 µs	SA9F-TS: ø0.16" (M4) Straight	50mm (1.97")	SA9F-DS: ø0.24" (M6) Straight	20mm (0.79")
					SA9F-TC: ø0.16" (M4) Coiled	40mm (1.57")	SA9F-DC: ø0.24" (M6) Coiled	7mm (0.28")
	SA1C-F1D3F (Cable) SA1C-F1D3FC (Quick-Connect)	30V DC NPN transistor: 100mA (maximum) PNP transistor: 200mA (maximum)	Red LED	High- speed: 50 µs	SA9F-TT: ø0.12" (M3) Straight	15mm (0.59")	SA9F-DD: ø0.24" (M6) Coaxial	20mm (0.79")
					SA9F-TM: ø0.16" (M4) Multicore	40mm (1.57")	SA9F-DT: ø0.12" (M3) Straight	6mm (0.24")
			Red LED	High- speed: 50 µs	SA9F-TL: Side view	13mm (0.51")	SA9F-DL: Side view	3mm (0.12")



Function is determined by the fiber optic unit used.

For information on accessories, see page 203.

Specifications

			SA1C-FN, -FD (Standard Speed)	SA1C-F1N, -F1D (High-speed)
General Specifications	Power Voltage	12V to 24V DC	√	√
	Operating Voltage	10V to 30V DC, ripple 10% (maximum)	√	√
	Current Draw	30mA (maximum)	√	—
		40mA (maximum)	—	√
	Operating Temperature	Amplifier only: -25° to +55°C Fiber optic cords (except heat-resistant types): -40° to +70°C Heat-resistant fiber optic cords: -40°C to +350°C (avoid ice coating)	√	√
	Operating Humidity	35 to 85% RH (avoid condensation)	√	√
	Extraneous Light Immunity	Sunlight: 10,000 lux (maximum); Incandescent light: 3,000 lux (maximum) on receiver surface— defined as incident or unwanted light received by a sensor, unrelated to the presence or absence of the intended object	√	√
	Material	Amplifier only: PBT resin (housing) with polycarbonate lens Fiber optic cords (except heat-resistant types): Nickel-plated brass (sensing head), polyethylene-covered PMMA (cord), and SUS304 stainless (sleeve) Heat-resistant fiber optic cords: SUS 304 stainless (sensing head) and SUS spiral tube around glass fiber cord	√	√
	Degree of Protection	IP66 — IEC Pub 529, sensors rated IP66 are dust-tight, water-resistant, and perform best when not subjected to heavy particle or water blasts	√	√
	Connection	Cable type: 0.2mm ² ; Vinyl cabtyre cable #24 AWG, 6'–6-3/4' (2m) long Connector type: Ø 0.31" (8mm) 3- or 4-pin connector (cable ordered separately for quick connect sensors)	√	√
	Light Source	Red or green LED (pulse-modulated)	√	√
	Output	NPN transistor: 30V DC (1.2V residual), 100mA (maximum) PNP transistor: 30V DC (2.0V residual), 200mA (maximum) Self-diagnostic: 30V DC (1.2V residual), 50mA (maximum)	√	√
	Response	0.5ms (maximum)	√	—
		50µs (maximum)	—	√
Function Specifications	Off Delay	0 to 100 ms (adjustable)	√	√
	Sensitivity	4-turn adjustment	√	√
	Minimum Bending Radius	Fiber optic cord (except SA9F-TT, -DT, -TL, and -DL): 1"R (25mm); Sleeve: 0.39"R (10mm) SA9F-TT and -DT: 0.59"R (15mm); Sleeve: 0.39"R (10mm) SA9F-TL and DL: 0.59"R (15mm); Sleeve: Unbendable	√	√
	Operation Mode	Light on or dark on (selectable by switch on amplifier)	√	√
	Indicator	Operation indicator: Red LED (out)	√	√
		Stable level indicator: Green LED (stable)	√	√
	Noise Resistance	Normal Mode		
		500V	√	—
		300V	—	√
		Common Mode		
		300V	√	—
		150V	—	√
		Pulse Width		
		50ns –1µs, 100Hz (using a noise simulator)	√	√
	Storage Temperature	-30 to +70°C (avoid freezing)	√	√
	Insulation Resistance	20M minimum with 500V DC megger (between live & dead parts)	√	√
	Dielectric Strength	1000V, 1 minute (between live & dead parts)	√	√
	Vibration Resistance	Damage limits: 10 – 55Hz Amplitude: 1.5mm p-p, 20 cycles in each of 3 axes crossed (one cycle = 5 minutes)	√	√
	Shock Resistance	Damage limits: 500m/s ² (approximately 49G), 10 shocks in each of 3 axes	√	√
	Weight	Cable type: Approximately 75g Quick-connect type: Approximately 30g	√	√



OI Touchscreens

PLCs

Automation Software

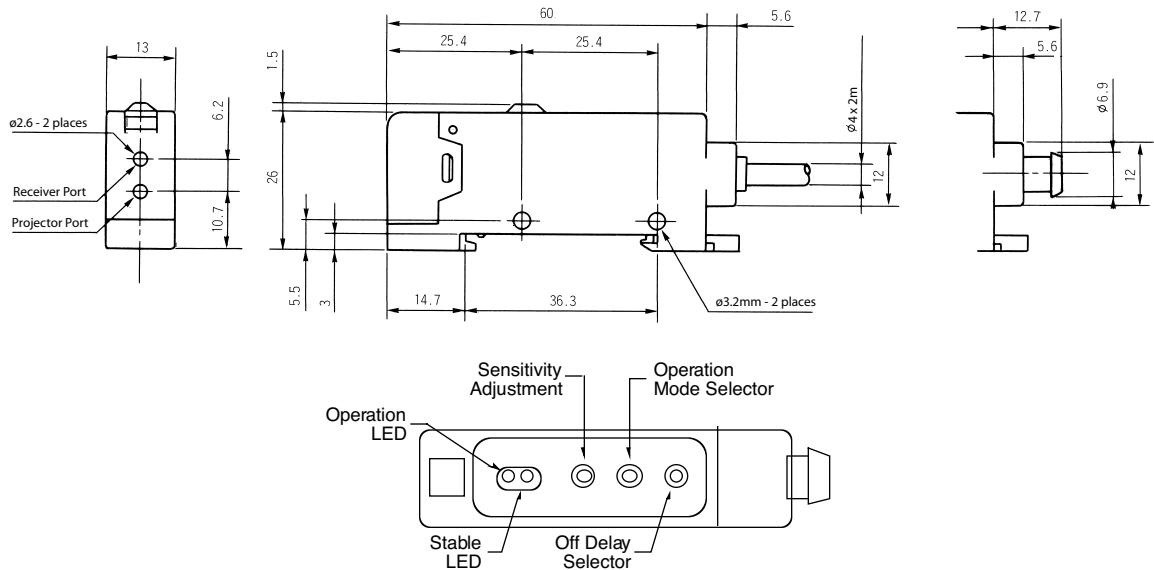
Power Supplies

Sensors

Communication

Barriers

Dimensions (mm)



Detecting Color Marks

Color of Mark	Background Color										
	White	Yellow	Chartreuse	Orange	Red	Magenta	Turquoise	Blue	Violet	Green	Black
White	—	❖	◆	❖	❖	◆	◆	◆	◆	◆	◆
Yellow	❖	—	◆	❖	❖	❖	◆	◆	◆	◆	◆
Chartreuse	◆	◆	—	□	□	❖	□	◆	❖	◆	◆
Orange	❖	❖	□	—	—	❖	□	◆	◆	◆	◆
Red	❖	❖	□	—	—	□	□	◆	◆	◆	◆
Magenta	◆	❖	❖	❖	□	—	□	□	—	□	◆
Turquoise	◆	◆	□	□	□	□	—	□	◆	❖	◆
Blue	◆	◆	◆	◆	◆	□	□	—	□	□	□
Violet	◆	◆	❖	◆	◆	—	◆	□	—	□	□
Green	◆	◆	◆	◆	◆	□	❖	□	□	—	□
Black	◆	◆	◆	◆	◆	◆	◆	□	□	□	—

□ = Use Red LED
❖ = Use Green LED
◆ = Use Red or Green LED
— = Not Detectable

Accessories

Reflectors

Appearance	Item	Use with	Part Number
	Standard reflector	SA1E	IAC-R5
	Small reflector		IAC-R6
	Large reflector		IAC-R8
	Narrow (rear/side mounting)		IAC-R7M
	Narrow (side mounting)		IAC-R7S
	Narrow (rear mounting)		IAC-R7B
	Tape (35 x 40mm)		IAC-RS1
	Tape (70 x 80mm)		IAC-RS2
	Standard	SA1E-X	IAC-R9
	Small		IAC-R10
	Ultra-small		IAC-R11

Brackets

Appearance	Item	Use with	Part Number
	Vertical mounting bracket	SA1E	SA9Z-K01
	Horizontal mounting bracket		SA9Z-K02
	Cover mounting bracket		SA9Z-K03
	Back mounting bracket		SA9Z-K04
	Reflector mounting bracket		IAC-L2
	Reflector mounting bracket		IAC-L3
photo not available	Reflector mounting bracket		IAC-L5

Slits

Appearance	Item	Slit Size	Use with	Part Number	Min. Order Qty
	Vertical slit	0.5mm x 18mm	SA1E	SA9Z-S06	2
		1.0mm x 18mm		SA9Z-S07	
		2.0mm x 18mm		SA9Z-S08	
	Horizontal slit	0.5mm x 6.5mm		SA9Z-S09	
		1.0mm x 6.5mm		SA9Z-S10	
		2.0mm x 6.5mm		SA9Z-S11	
	Round slit	ø0.5mm		SA9Z-S12	
		ø1.0mm		SA9Z-S13	
		ø2.0mm		SA9Z-S14	

Connector Cables (for connector model sensors)

Appearance	Number of Core Wires	Type & Length	Use with	Part No.
	4	Straight, 2m	SA1E	SA9Z-CM8K-4S2
		Straight, 5m		SA9Z-CM8K-4S5
		Right angle, 2m		SA9Z-CM8K-4L2
		Right angle, 5m		SA9Z-CM8K-4L5
photo not available	4	2m	SA1C-F	SA9C-CA4D2
		5m		SA9C-CA4D5
		2m		SA9C-CA4D2S
		5m		SA9C-CA4D5S

Air Blower Mounting Blocks

Appearance	Item	Use with	Part Number
	Air blower mounting block	SA1E	SA9Z-A02

Sensitivity Control Screwdriver

Item	Part No.	Package Quantity
Sensitivity Control Screwdriver	SA9Z-AD01	1
		

Diffuse-Reflected Light Fiber Optic Units - SA9F

Appearance	Part Number	Description	Use with	Range
	SA9F-DS31 No sleeve SA9F-DS32 3.54" (90mm) sleeve SA9F-DS33 1.77" (45mm) sleeve	Straight: Two fibers $\phi 1\text{mm}$ (0.04") Threaded mount: $\phi 6\text{mm}$ (M6) Detects: $\phi 0.03\text{mm}$ (0.0012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	60mm (2.36") 7mm (0.28")
	SA9F-DC31 No sleeve SA9F-DC32 3.54" (90mm) sleeve SA9F-DC33 1.77" (45mm) sleeve (All three not compatible with green LED)	Coiled: Two fibers $\phi 1\text{mm}$ (0.04") Threaded mount: $\phi 6\text{mm}$ (M6) Detects: $\phi 0.03\text{mm}$ (0.0012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	25mm (0.98") —
	SA9F-DT11 No sleeve SA9F-DT12 3.54" (90mm) sleeve SA9F-DT13 1.77" (45mm) sleeve (All three not compatible with green LED)	Straight: Two fibers $\phi 0.5\text{mm}$ (0.02") Threaded mount: $\phi 3\text{mm}$ (M3) Detects: $\phi 0.03\text{mm}$ (0.0012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	20mm (0.78") —
	SA9F-DD31	Coaxial: Core $\phi 1\text{mm}$ (0.04") + 16 fibers: $\phi 0.26\text{mm}$ (0.01") Threaded mount: $\phi 6\text{mm}$ (M6) Detects: $\phi 0.03\text{mm}$ (0.0012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	60mm (2.36") 7mm (0.28")
	SA9F-DM74 1 row = 32 fibers SA9F-DM75 2 rows = 16 each (Not compatible with green LED)	Multicore: 32 fibers $\phi 0.26\text{mm}$ (0.010") Detects: $\phi 0.06\text{mm}$ (0.0024") minimum object	SA1C-FK SA1C-FK3G SA1C-F (not compatible with SA9F-DM75, SA9F-DM76)	60mm (2.36") 4mm (0.16")
	SA9F-DH21 No sleeve SA9F-DH22 3.54" (90mm) sleeve (Both not compatible with green LED)	Heat-resistant glass: Two fibers $\phi 0.7\text{mm}$ (0.03") Threaded mount: $\phi 4\text{mm}$ (M4) Detects: $\phi 0.03\text{mm}$ (0.0012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	27mm (1.06") —

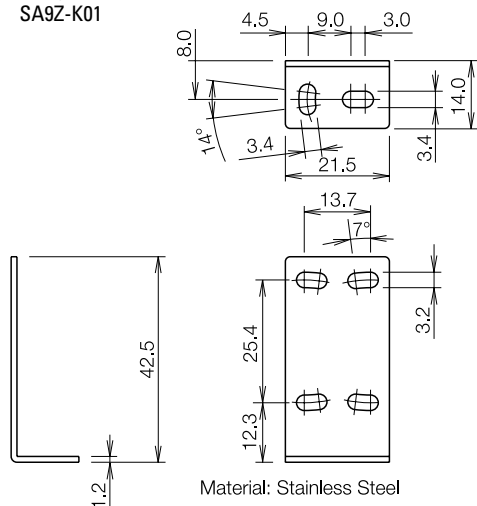
Through-Beam Fiber Optic Units - SA9F

Appearance	Part Number	Description	Amplifier	Range
	SA9F-TS21 No sleeve SA9F-TS23 1.77" (45mm) sleeve	Straight fiber: ø1mm (0.04") Threaded mount: ø4mm (M4) Detects: ø0.3mm (0.012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	180mm (7.09") 16mm (0.63")
	SA9F-TC21 No sleeve	Coiled fiber: ø1mm (0.04") Threaded mount: ø4mm (M4) Detects: ø0.3mm (0.012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	150mm (5.91") 14mm (0.55")
	SA9F-TT11 No sleeve	Straight fiber: ø0.5mm (0.02") Threaded mount: ø3mm (M3) Detects: ø0.15mm (0.006") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	50mm (1.97") 5mm (0.2")
	SA9F-TM21 No sleeve SA9F-TM22 3.54" (90mm) sleeve SA9F-TM23 1.77" (45mm) sleeve 16 fibers (cluster)	Multicore: ø0.26mm (0.010") Threaded mount: ø4mm (M4) Detects: ø0.3mm (0.012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	150mm (5.91") 14mm (0.55")
	SA9F-TM74 16 fibers in one row	Multicore: 16 fibers (one row) ø0.26mm (0.010") Detects: ø0.06mm (0.0024") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	150mm (5.91") 14mm (0.55")
	SA9F-TH21 No sleeve SA9F-TH22 3.54" (90mm) sleeve	Heat-resistant glass fiber: ø1mm (0.04") Threaded mount: ø4mm (M4) Detects: ø0.3mm (0.012") minimum object	SA1C-FK3 SA1C-FK3G SA1C-F	100mm (3.94") 8mm (0.31")

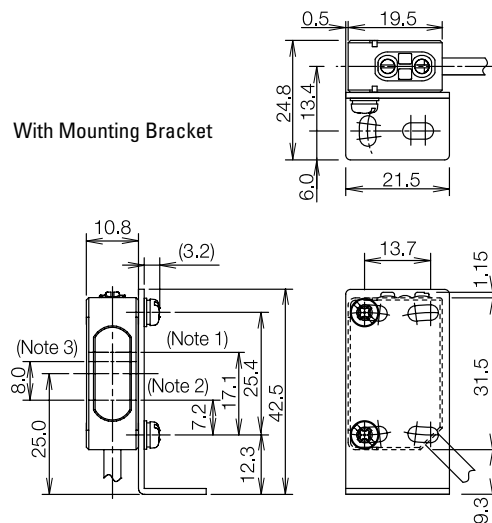
Miscellaneous Accessories

Description	Use with	Part Number
Fiber cutter	All fiber units except heat resistant	HxLxD: 23x 45 x 8mm (0.91" x 1.77" x 0.31") Included with fiber units; order replacement only
Set of 2 easy-insert adaptors	SA9F-TT, SA9F-TL, SA9F-DT, and SA9F-DL	ø2.2 x 24mm long (ø0.087" (OD) x 0.945") Included with applicable fiber optic units; order replacement set only
Lens attachment for long-range detection of opaque objects, minimum size: Ø 0.14" (3.5mm)	SA1C-F through-beam fiber unit only	
	Sensing ranges: Standard speed red LED: SA9F-TS21: 1.3m (4' – 3-3/16") SA9F-TC21: 1m (3' – 3-3/8") 0.1m (3.94") SA9F-TM21: 1.05m (3' – 5-3/8")	
	Sensing ranges: Standard speed green LED: SA9F-TS21: 0.135m (5.31") SA9F-TC21: 0.1m (3.94") SA9F-TM21: 0.13m (5.12")	SA9Z-F11
	Sensing ranges: High-speed red LED: SA9F-TS21: 0.4m (5.75") SA9F-TC21: 0.3m (1.81") SA9F-TM21: 0.38m (4.96")	
Side view attachment to rotate axis by 90° for detection of opaque objects, minimum size: Ø 0.14" (3.5mm)	SA1C-F through-beam fiber unit only	
	Sensing ranges: Standard speed red LED: SA9F-TS21: 200mm (7.87") SA9F-TC21: 130mm (5.12") SA9F-TM21: 160mm (6.30")	SA9Z-F12
	Sensing ranges: High-speed red LED: SA9F-TS21: 50mm (1.97") SA9F-TC21: 35mm (1.38") SA9F-TM21: 40mm (1.57")	
Side-on attachment for narrow clearance, Range: 1.26" (32mm), for detection of transparent or opaque objects	SA1C-F diffuse-reflected light fiber unit only	
	Sensing ranges: Standard speed red LED: SA9F-TS21: 35mm (1.38") SA9F-TC21: 30mm (1.81") SA9F-TM21: 35mm (1.38")	SA9Z-F13
Attachment for high-accuracy: Range: 0.4" ± 0.04" (10mm ± 1mm), for detection of transparent or opaque objects	SA1C-F through-beam fiber unit only	
	Sensing ranges: Standard speed red LED:	
	SA9F-TS21: 10mm ± 1mm SA9F-TC21: (0.394" ± 0.039") SA9F-TM21:	SA9Z-F14

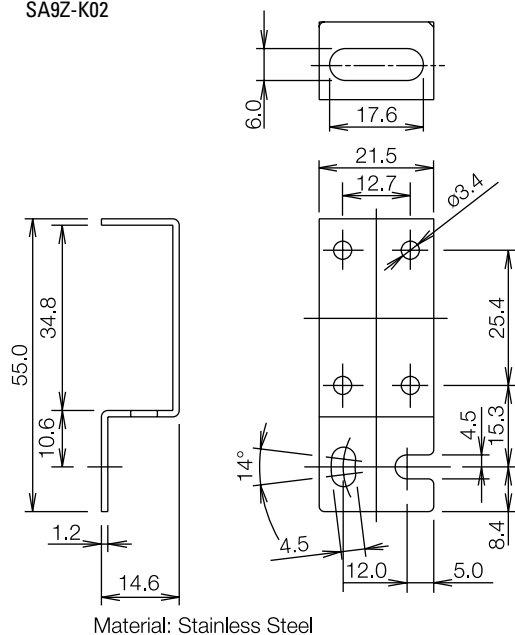
Accessory Dimensions (mm)

Mounting Bracket
SA9Z-K01

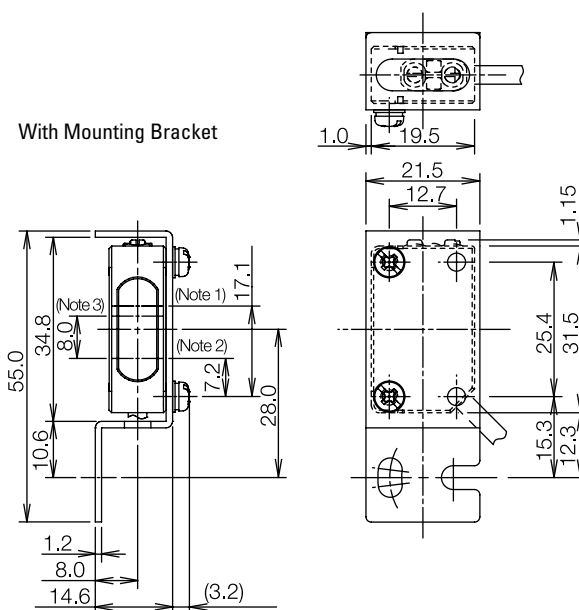
With Mounting Bracket



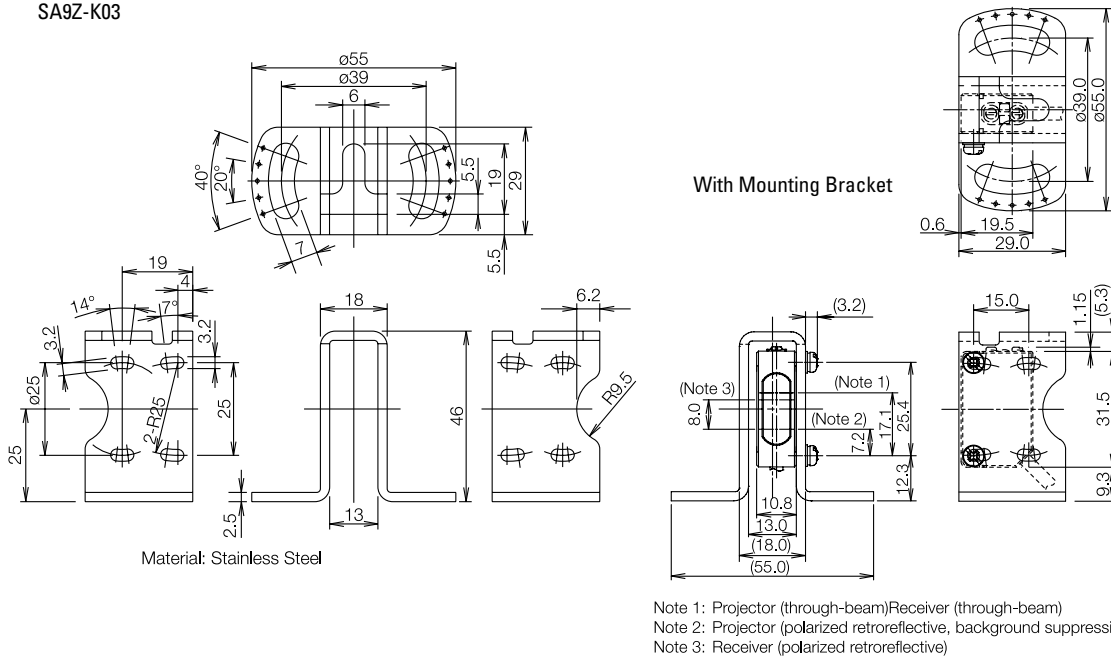
SA9Z-K02



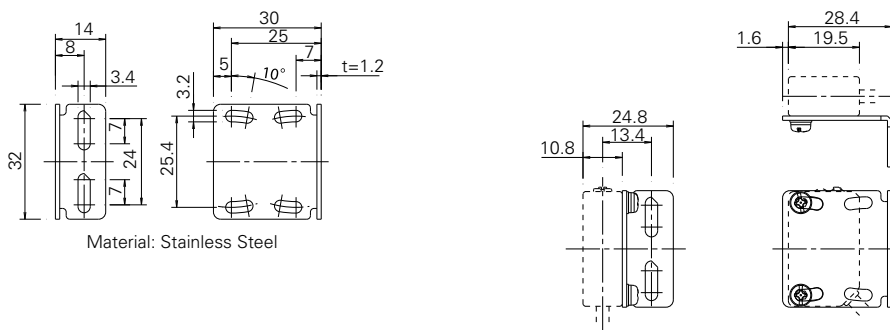
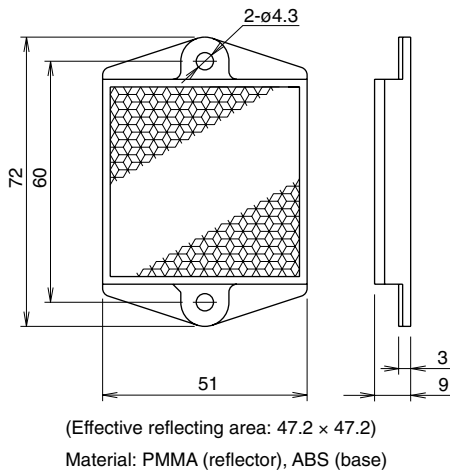
With Mounting Bracket



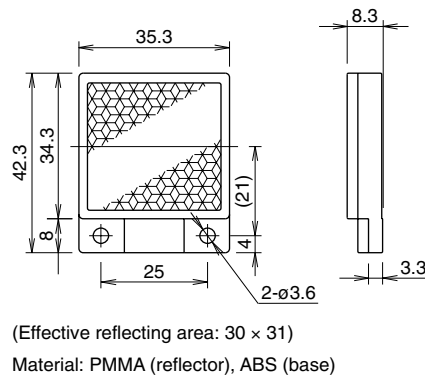
SA9Z-K03

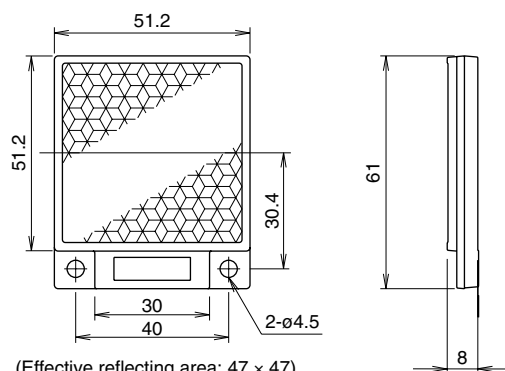


SA9Z-K04

Reflector
IAC-R5

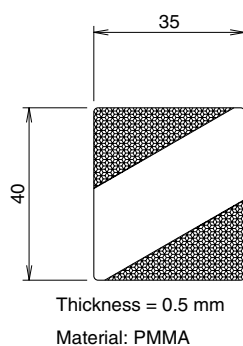
IAC-R6



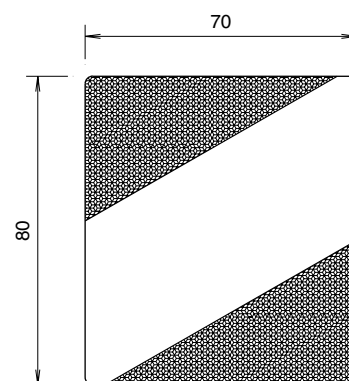
Reflector
IAC-R8(Effective reflecting area: 47×47)

Material: PMMA (reflector), ABS (base)

IAC-RS1



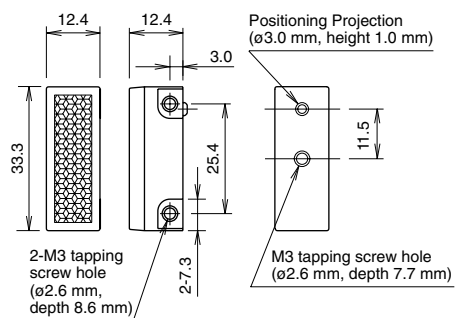
IAC-RS2



Thickness = 0.5 mm

Material: PMMA

IAC-R7M (rear/side mounting)

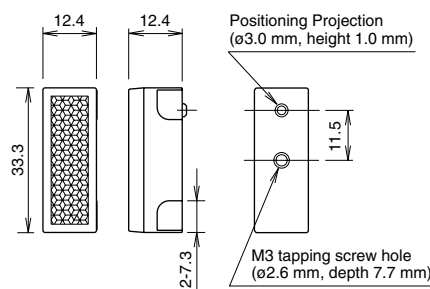


Material: PMMA (reflector), ABS (base)

Effective reflecting area: 8.6×29.5

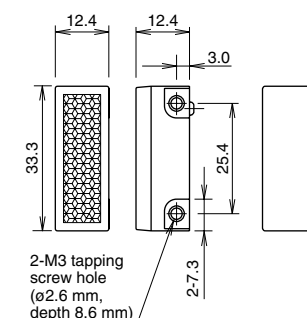
The mounting plate for reflector must be 0.8 to 2.5 mm in thickness.

IAC-R7B (rear mounting)



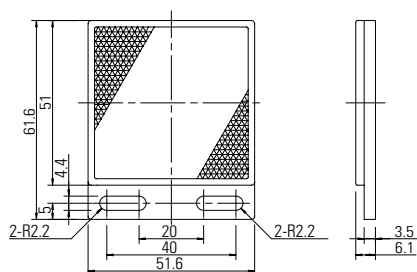
Material: PMMA (reflector), ABS (base)

IAC-R7S (side mounting)



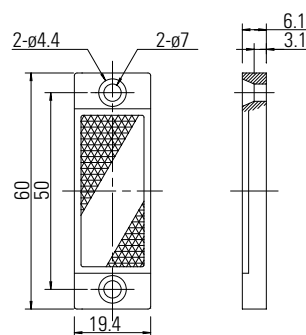
Material: PMMA (reflector), ABS (base)

IAC-R9

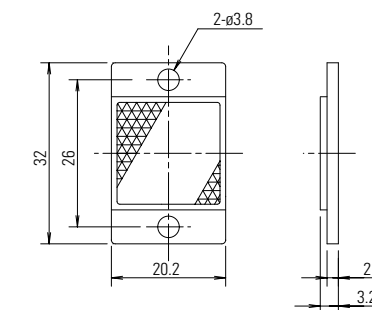
(Reflecting surface 47×47.6)

Material: PMMA (reflector), ABS (base)

IAC-R10



IAC-R11

(Reflecting surface 18×18.2)

Material: PMMA (reflector), ABS (base)

01 Touchscreens

PLCs

Automation Software

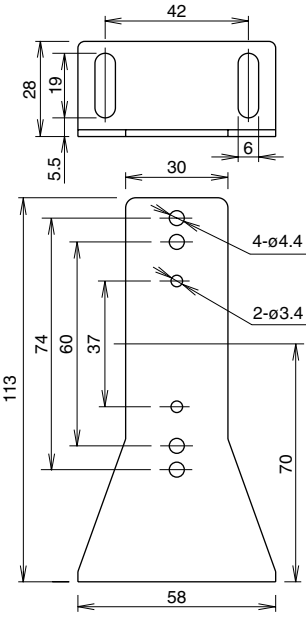
Power Supplies

Sensors

Communication

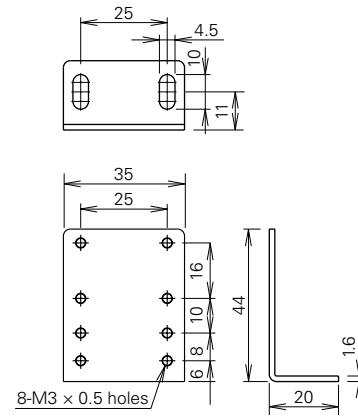
Barriers

Reflector Mounting Bracket
IAC-L2 (for IAC-R5)



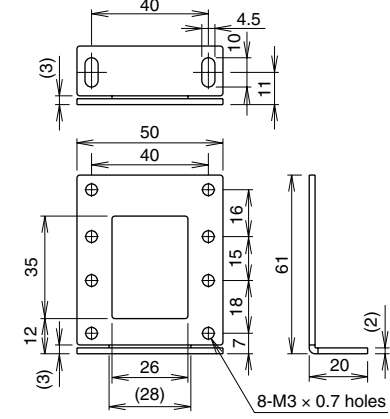
Material: SPCC (zinc chromate plating, black)

IAC-L3 (for IAC-R6)



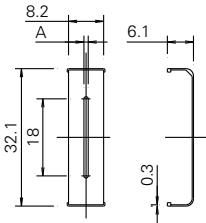
Material: SPCC (zinc plating)

IAC-L5 (for IAC-R8)



Material: SPCC (zinc plating)

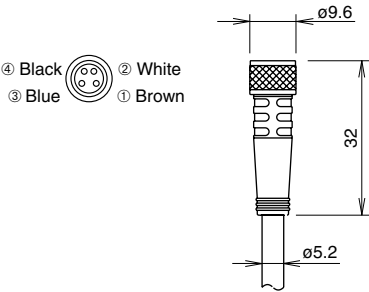
Slit (Vertical Slit)
SA9ZS06, -S07, -S08



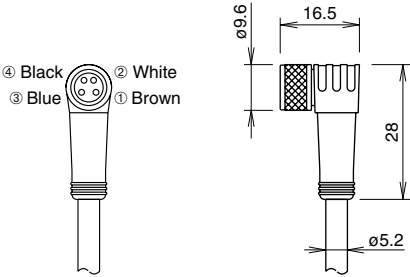
Material: Stainless Steel

Slit	
Part No.	Slit Width: A
SA9Z-S06	0.5 mm
SA9Z-S07	1.0 mm
SA9Z-S08	2.0 mm

Connector Cable (connector on one end)
Straight (SA9Z-CM8K-4S□)

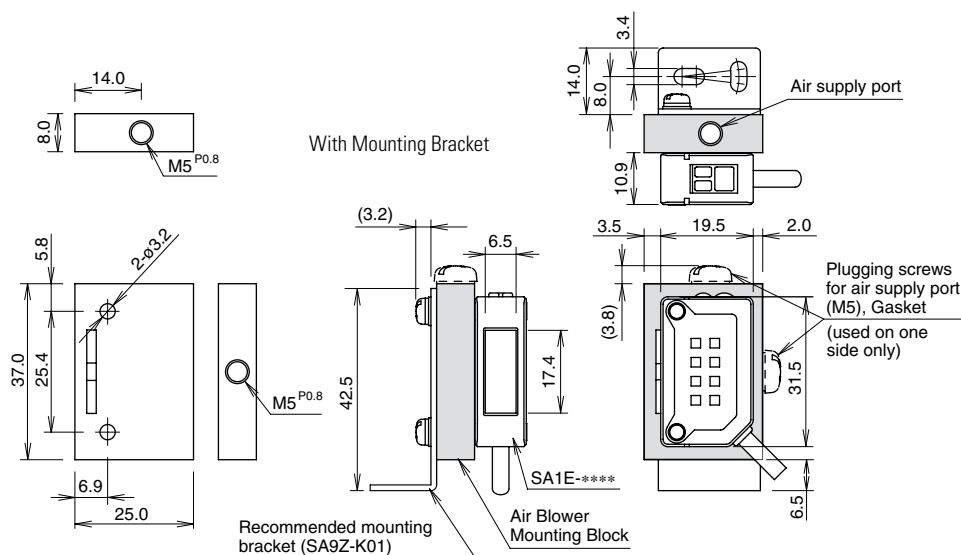


Right-angle (SA9Z-CM8K-4L□)



Dielectric strength when installed on the SA1E: 1000V AC (between live part and mounting bracket, except between live part and tightening ring)

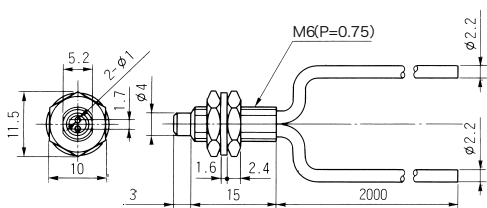
Air Blower Mounting Block



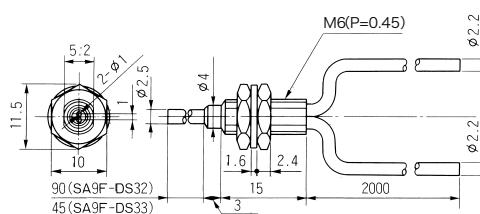
- The SA9Z-A02 air blower mounting block is supplied with two mounting screws (M3 × 20 mm sems screws), one screw for plugging the air supply port (M5 × 6 mm), and one gasket for plugging the air supply port.
- An air tube fitting (M5) can be installed to either the top or side. Tighten the fitting to a torque of 0.5 N·m maximum.
- The air tube fitting and mounting bracket are not supplied and must be ordered separately (recommended mounting bracket: SA9Z-K01).

Diffuse-Reflective Light Fiber Optic Units

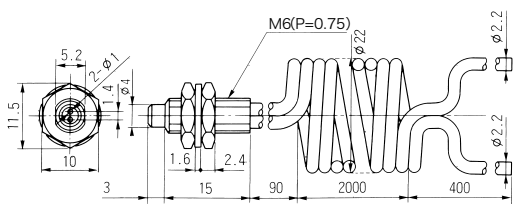
SA9F-DS31



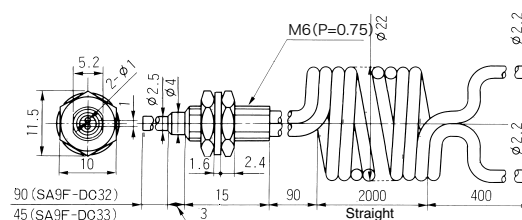
SA9F-DS32, SA9F-DS33



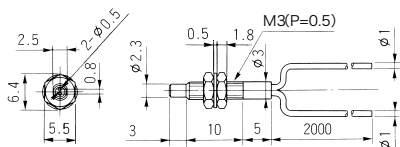
SA9F-DC31



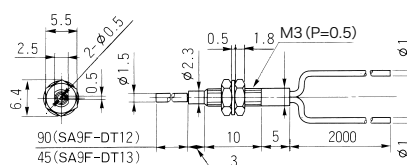
SA9F-DC32, SA9F-DC33



SA9F-DT11



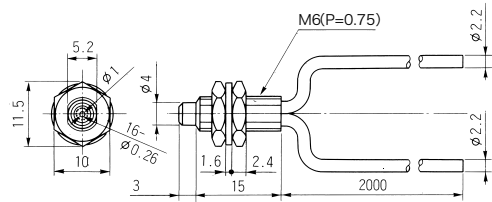
SA9F-DT12, SA9F-DT13



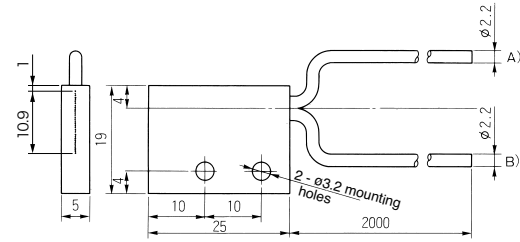
Dimensions (mm)

Diffuse-Reflective Light Fiber Optic Units con't

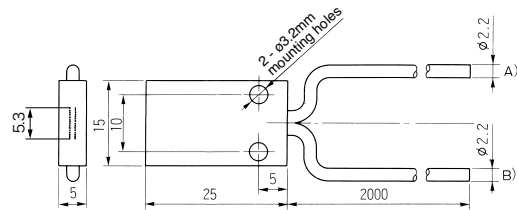
SA9F-DD31



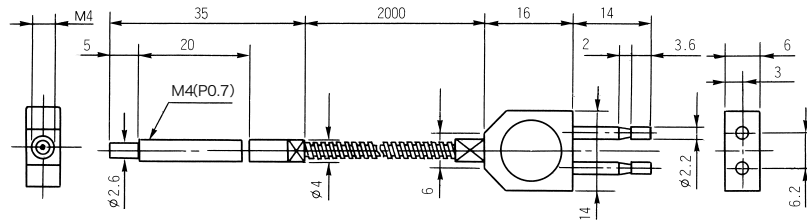
SA9F-DM74



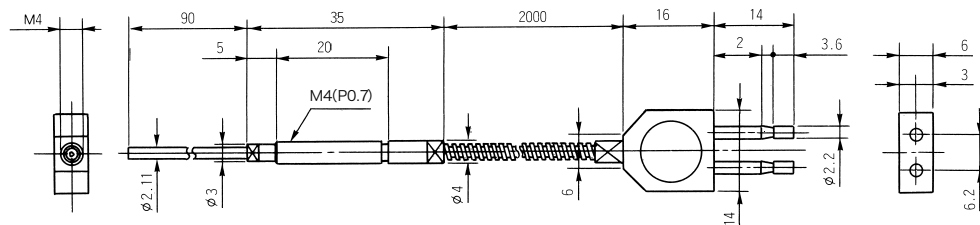
SA9F-DM75



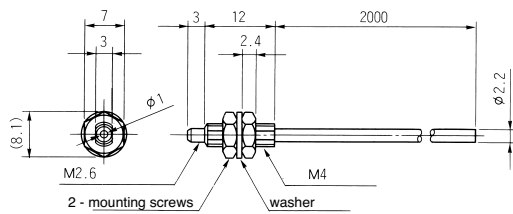
SA9F-DH21



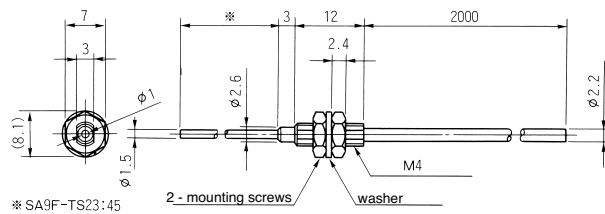
SA9F-DH22



SA9F-TS21



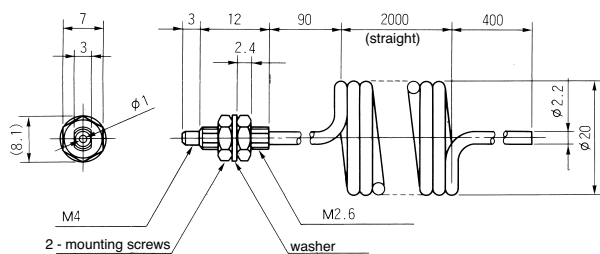
SA9F-TS23



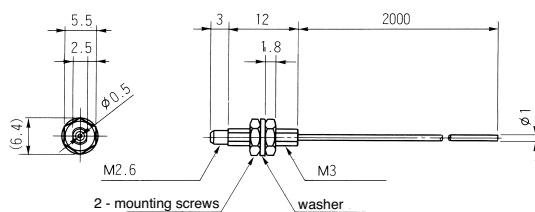
Diffuse-Reflective Light Fiber Optic Units can't

Dimensions (mm)

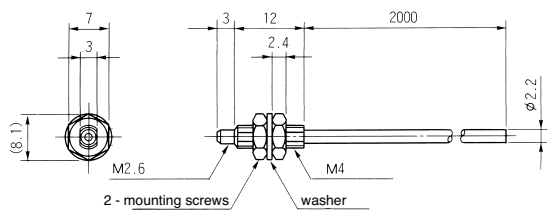
SA9F-TG21



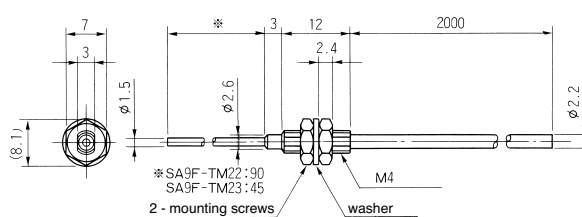
SA9F-TT11



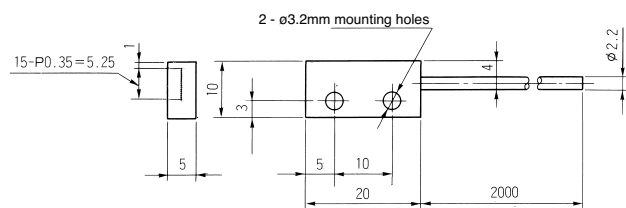
SA9F-TM21



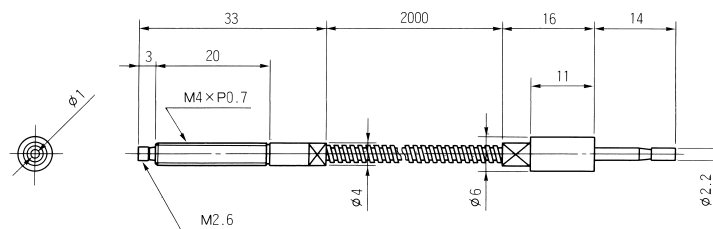
SA9F-TM22, SA9F-TM23



SA9F-TM74



SA9F-TH21



I/O Touchscreens

PLCs

Automation Software

Power Supplies

Sensors

Communication

Barriers