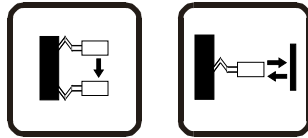


## Fiber Optic Analog: SA1C-FK



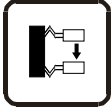
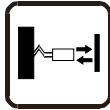
### Key features:

- High-speed, miniature photoelectric sensors with analog (4 - 20mA) and digital output
- Senses gradual color changes
- Available in red or green LEDs
- Through-beam and reflected-light sensing available
- Ideal for either color mark applications or simple presence and absence applications requiring analog output
- Compact size allows for DIN rail mounting
- Fiber optic units available to address specific application needs
- Simple to install
- IP66 protection rating

Built on the foundation of SA1C-F, SA1C-FK is ideal for either color mark applications or simple presence and absence applications requiring analog output.

Featuring analog and digital output, this sensor comes in through-beam or reflected-light sensing styles.

### Part Numbers

| Function  | Light Source Element | Output                     | Part Number |
|---|----------------------|----------------------------|-------------|
|   | Red LED              | Analog output + NPN output | SA1C-FK3    |
|   | Green LED            |                            | SA1C-FK3G   |

For information on accessories, see page 203.



Function is determined by the fiber optic unit used.

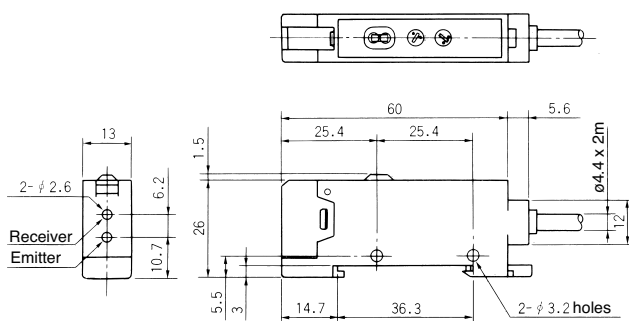
## Specifications

|                           |   | SA1C-FK3 | SA1C-FK3G |
|---------------------------|---|----------|-----------|
| Light Source Element      | Red LED   | √        | —         |
|                           | Green LED   | —        | √         |
| Sensing Distance          | Depends on the fiber unit (see page 204)  | √        | √         |
| Power Voltage             | 12 to 24V DC (Operating voltage: 10 to 30V DC) ripple 10% maximum   | √        | √         |
| Current Draw              | 80mA maximum  | √        | √         |
| Analog Current Output     | 4 to 20mA, 5V DC maximum <sup>1</sup>   | √        | √         |
| Digital Output            | NPN open collector 30V DC, 100mA maximum, 1.5V maximum with short circuit protection                              | √        | √         |
| Operation Mode            | Dark ON (connect MODE line to GND line)   | √        | √         |
|                           | Light ON (connect MODE line to power line)  | √        | √         |
| Response                  | 0.5ms maximum <sup>2</sup>  | √        | √         |
| Indicator                 | Operation LED: Red, Stable LED: Green   | √        | √         |
| Detectable Object         | Translucent object, opaque object   | √        | √         |
| Hysteresis                | 20% maximum (using reflex fiber unit)   | √        | √         |
| Sensitivity               | 4-turn adjustment   | √        | √         |
| Operation Point Control   | 1 turn  | √        | √         |
| Receiver Element          | Photo diode   | √        | √         |
| Operating Temperature     | −25 to +55°C (performance will be adversely affected if the sensor becomes coated with ice)                       | √        | √         |
| Storage Temperature       | −30 to +70°C (performance will be adversely affected if the sensor becomes coated with ice)                       | √        | √         |
| Operating Humidity        | 35 to 85% RH (avoid condensation)   | √        | √         |
| Extraneous Light Immunity | Sunlight: 10,000 lux maximum; Incandescent light: 3,000 lux (at the receiver)                                     | √        | √         |
| Noise Resistance          | Normal mode: 500V (50ns to 1μs, 100Hz: Using a noise simulator)   | √        | √         |
|                           | Common mode: 300V (50ns to 1μs, 100Hz: Using a noise simulator)   | √        | √         |
| Insulation Resistance     | Between live and dead parts: 20MΩ minimum, with 500V DC megger  | √        | √         |
| Dielectric Strength       | Between live and dead parts: 1,000V, 1 minute   | √        | √         |
| Vibration Resistance      | Damage limits: 10 to 55Hz; Single amplitude: 0.75mm 20 cycles in each of 3 axes                                   | √        | √         |
| Shock Resistance          | Damage limits: 500 m/sec <sup>2</sup> 10 cycles in each of 3 axes   | √        | √         |
| Degree of Protection      | IP66—IEC Pub 529  | √        | √         |
| Cable                     | Ø4.4mm 5-core vinyl cabtyre cable 0.2mm <sup>2</sup> , 6'–6-3/4" (2m) long  | √        | √         |
| Material                  | Housing: PBT  | √        | √         |
| Accessories               | Mounting bracket, adjusting screwdriver, load resistor (249Ω) for converting analog amperage to voltage (1 to 5V) | √        | √         |
| Interference Prevention   | Up to 2 units can be installed in close proximity. For analog output, interference prevention is not possible.    | √        | √         |
| Weight                    | Approximately 75g   | √        | √         |

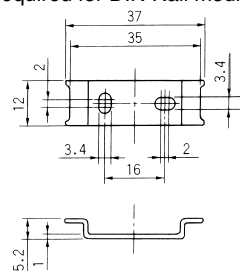


- Analog current output specification is based on the power voltage range from 12 to 24V DC (±10%). Use the attached resistor (249Ω, 1/4W) as a load resistance for converting analog output to voltage.
- Response time for analog current output is between 10% and 90% of the rise or fall of the voltage signal when using a 249Ω resistor.

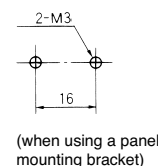
## Dimensions (mm)



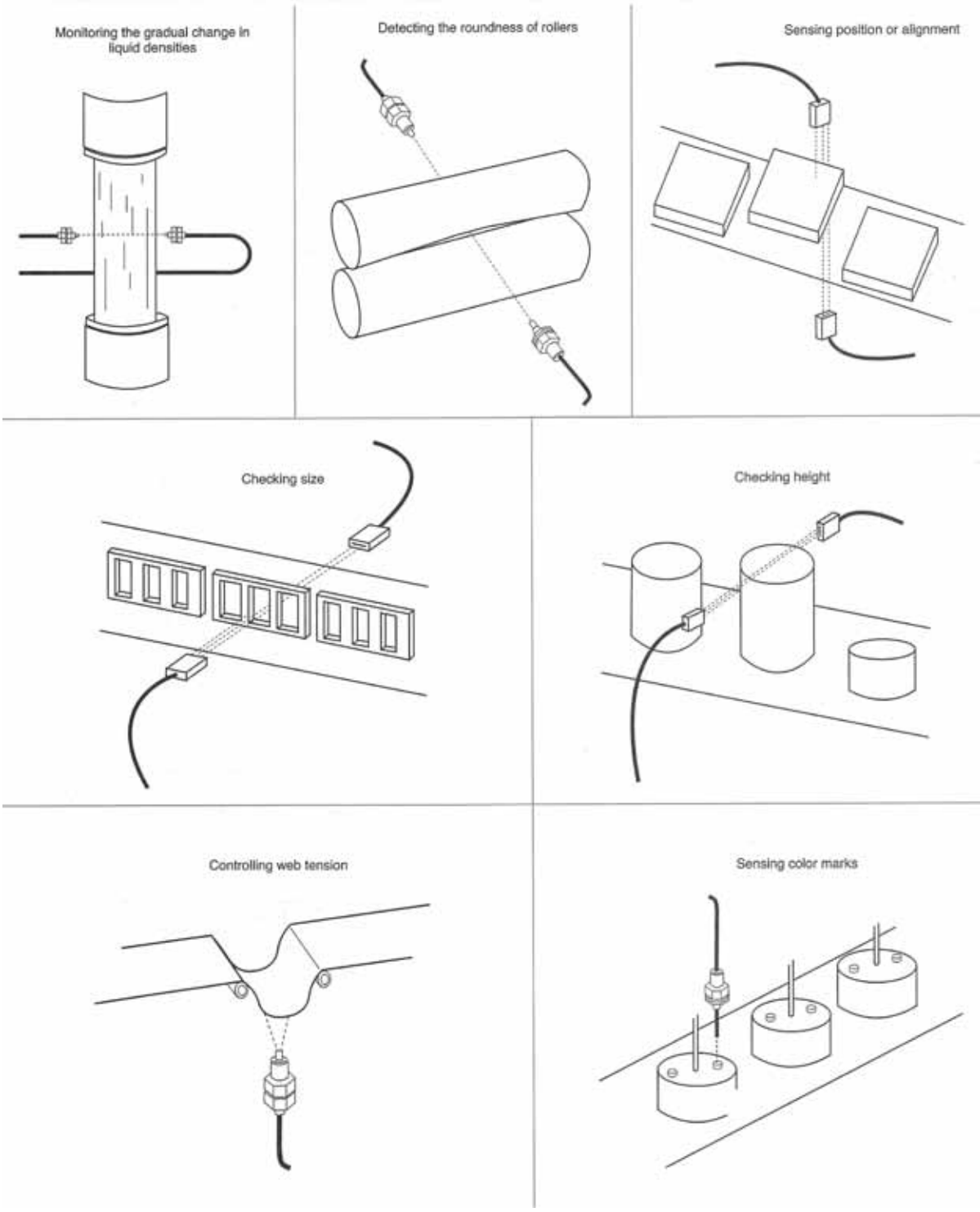
Panel Mounting Bracket (attachment)  
Not required for DIN Rail mounting



Mounting Hole Layout



Applications



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




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## 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  |             |         |




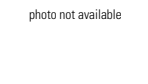




## Brackets

| 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      |  |
|  | Reflector mounting bracket  |          | IAC-L5      |  |
|  | Reflector mounting bracket  |          |             |  |
|  | Reflector mounting bracket  |          |             |  |
|  | Reflector mounting bracket  |          |             |  |


## 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    |                |
|   |                 | ø0.5mm        |          | SA9Z-S12    |                |
|   | Round slit      | 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 |
|  | 4                    | 2m              |             | SA1C-F        |
|  |                      | 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                       |
|---|---|--|--|-----------------------------|
|    | <b>SA9F-DS31</b><br>No sleeve<br><b>SA9F-DS32</b><br>3.54" (90mm) sleeve<br><b>SA9F-DS33</b><br>1.77" (45mm) sleeve   | Straight: Two fibers<br>$\varnothing 1\text{mm}$ (0.04")<br>Threaded mount:<br>$\varnothing 6\text{mm}$ (M6)<br>Detects:<br>$\varnothing 0.03\text{mm}$ (0.0012")<br>minimum object  | SA1C-FK3<br>SA1C-FK3G<br>SA1C-F  | 60mm (2.36")<br>7mm (0.28") |
|    | <b>SA9F-DC31</b><br>No sleeve<br><b>SA9F-DC32</b><br>3.54" (90mm) sleeve<br><b>SA9F-DC33</b><br>1.77" (45mm) sleeve<br>(All three not compatible<br>with green LED) | Coiled: Two fibers<br>$\varnothing 1\text{mm}$ (0.04")<br>Threaded mount:<br>$\varnothing 6\text{mm}$ (M6)<br>Detects:<br>$\varnothing 0.03\text{mm}$ (0.0012")<br>minimum object  | SA1C-FK3<br>SA1C-FK3G<br>SA1C-F  | 25mm (0.98")<br>—           |
|    | <b>SA9F-DT11</b><br>No sleeve<br><b>SA9F-DT12</b><br>3.54" (90mm) sleeve<br><b>SA9F-DT13</b><br>1.77" (45mm) sleeve<br>(All three not compatible<br>with green LED) | Straight: Two fibers<br>$\varnothing 0.5\text{mm}$ (0.02")<br>Threaded mount:<br>$\varnothing 3\text{mm}$ (M3)<br>Detects:<br>$\varnothing 0.03\text{mm}$ (0.0012")<br>minimum object  | SA1C-FK3<br>SA1C-FK3G<br>SA1C-F  | 20mm (0.78")<br>—           |
|  | <b>SA9F-DD31</b>  | Coaxial: Core<br>$\varnothing 1\text{mm}$ (0.04") +<br>16 fibers: $\varnothing 0.26\text{mm}$ (0.01")<br>Threaded mount:<br>$\varnothing 6\text{mm}$ (M6)<br>Detects:<br>$\varnothing 0.03\text{mm}$ (0.0012")<br>minimum object | SA1C-FK3<br>SA1C-FK3G<br>SA1C-F  | 60mm (2.36")<br>7mm (0.28") |
|  | <b>SA9F-DM74</b><br>1 row = 32 fibers<br><b>SA9F-DM75</b><br>2 rows = 16 each<br>(Not compatible<br>with green LED)   | Multicore: 32 fibers<br>$\varnothing 0.26\text{mm}$ (0.010")<br>Detects:<br>$\varnothing 0.06\text{mm}$ (0.0024")<br>minimum object  | SA1C-FK<br>SA1C-FK3G<br>SA1C-F<br>(not compatible<br>with SA9F-DM75,<br>SA9F-DM76) | 60mm (2.36")<br>4mm (0.16") |
|  | <b>SA9F-DH21</b><br>No sleeve<br><b>SA9F-DH22</b><br>3.54" (90mm) sleeve<br>(Both not compatible<br>with green LED)   | Heat-resistant glass: Two fibers<br>$\varnothing 0.7\text{mm}$ (0.03")<br>Threaded mount:<br>$\varnothing 4\text{mm}$ (M4)<br>Detects:<br>$\varnothing 0.03\text{mm}$ (0.0012")<br>minimum object                                | SA1C-FK3<br>SA1C-FK3G<br>SA1C-F  | 27mm (1.06")<br>—           |

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## Through-Beam Fiber Optic Units - SA9F

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

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## 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")<br>Included with fiber units; order replacement only  | SA9Z-F01    |
| 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")<br>Included with applicable fiber optic units; order replacement set only                                      | SA9Z-F02    |
| 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:<br>SA9F-TS21: 1.3m (4' - 3-3/16")<br>SA9F-TC21: 1m (3' - 3-3/8") 0.1m (3.94")<br>SA9F-TM21: 1.05m (3' - 5-3/8") | SA9Z-F11    |
|  |  | Sensing ranges: Standard speed green LED:<br>SA9F-TS21: 0.135m (5.31")<br>SA9F-TC21: 0.1m (3.94")<br>SA9F-TM21: 0.13m (5.12")                           |             |
|  |  | Sensing ranges: High-speed red LED:<br>SA9F-TS21: 0.4m (5.75")<br>SA9F-TC21: 0.3m (1.81")<br>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:<br>SA9F-TS21: 200mm (7.87")<br>SA9F-TC21: 130mm (5.12")<br>SA9F-TM21: 160mm (6.30")                             | SA9Z-F12    |
|  |  | Sensing ranges: High-speed red LED:<br>SA9F-TS21: 50mm (1.97")<br>SA9F-TC21: 35mm (1.38")<br>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:<br>SA9F-TS21: 35mm (1.38")<br>SA9F-TC21: 30mm (1.81")<br>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:   | SA9Z-F14    |
|  |  | SA9F-TS21: 10mm ± 1mm   |             |
|  |  | SA9F-TC21: (0.394" ± 0.039")<br>SA9F-TM21:  |             |

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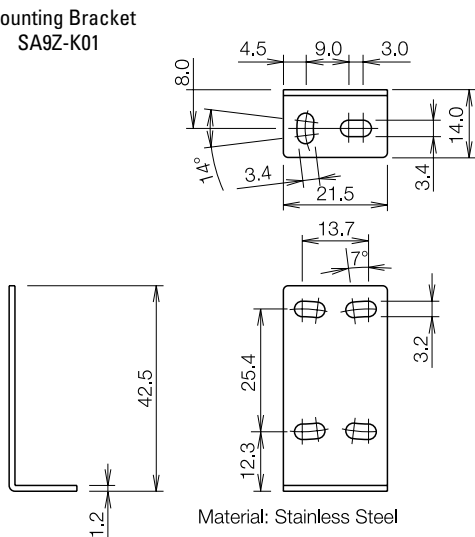
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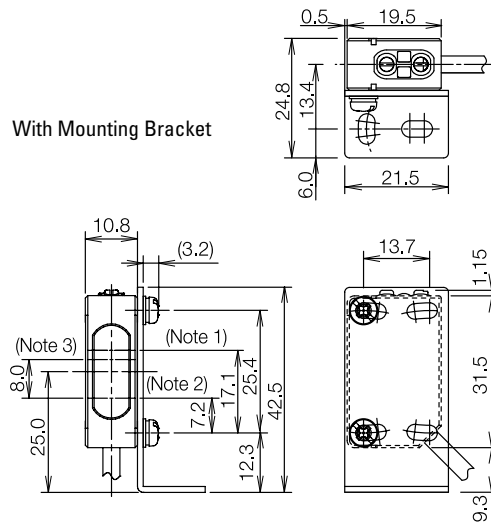
Accessory Dimensions (mm)

Mounting Bracket  
SA9Z-K01



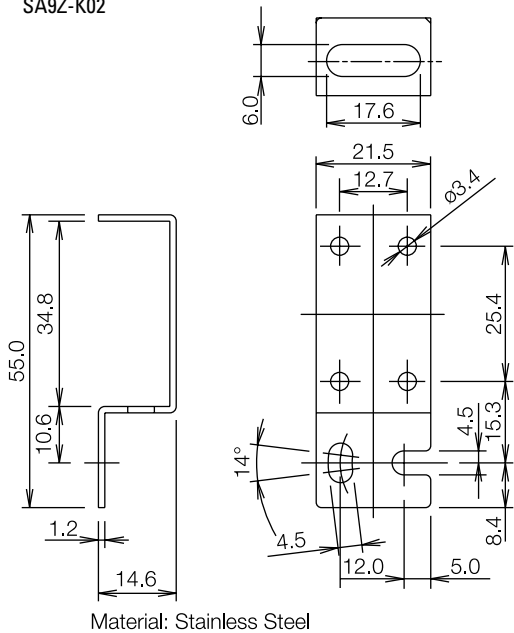
Material: Stainless Steel

With Mounting Bracket



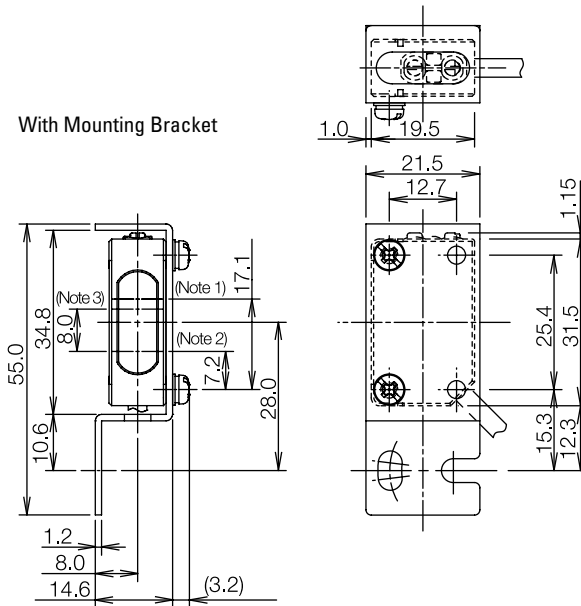
Note 1: Projector (through-beam)Receiver (through-beam)  
 Note 2: Projector (polarized retroreflective, background suppression)  
 Note 3: Receiver (polarized retroreflective)

SA9Z-K02



Material: Stainless Steel

With Mounting Bracket



Note 1: Projector (through-beam)Receiver (through-beam)  
 Note 2: Projector (polarized retroreflective, background suppression)  
 Note 3: Receiver (polarized retroreflective)

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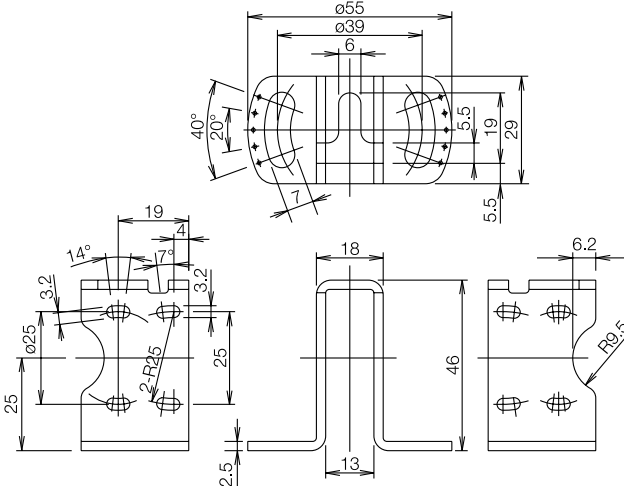
Power Supplies

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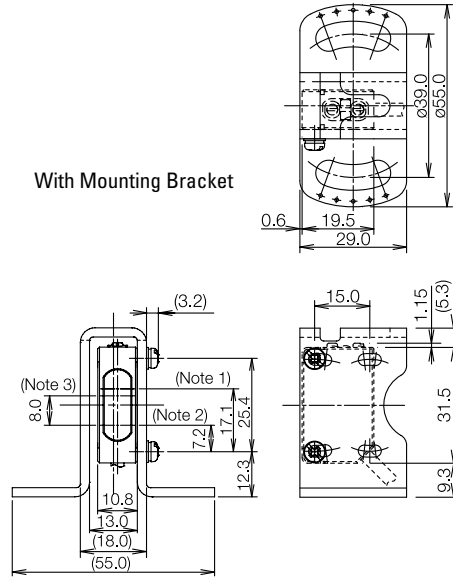
Barriers

SA9Z-K03



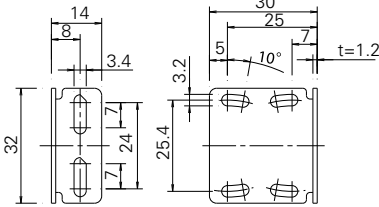
Material: Stainless Steel

With Mounting Bracket



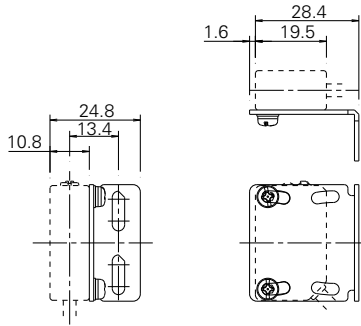
Note 1: Projector (through-beam)/Receiver (through-beam)  
 Note 2: Projector (polarized retroreflective, background suppression)  
 Note 3: Receiver (polarized retroreflective)

SA9Z-K04

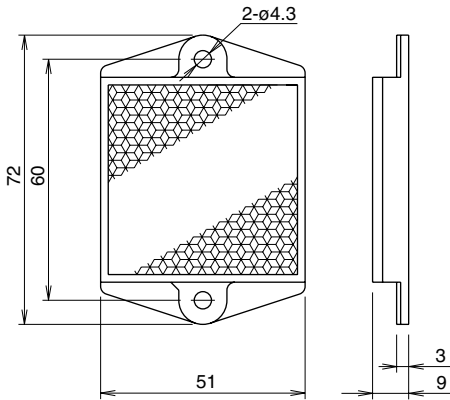


Material: Stainless Steel

With Mounting Bracket



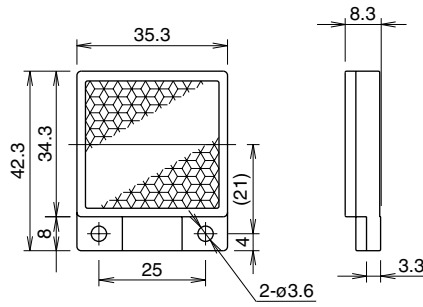
Reflector  
IAC-R5



(Effective reflecting area: 47.2 x 47.2)

Material: PMMA (reflector), ABS (base)

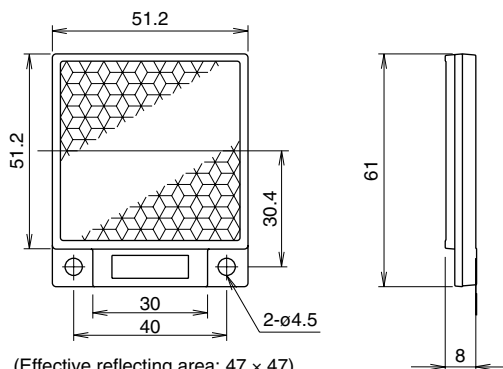
IAC-R6



(Effective reflecting area: 30 x 31)

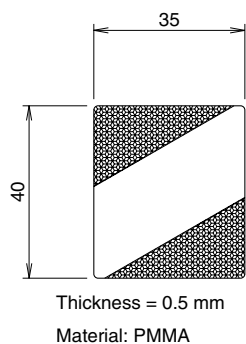
Material: PMMA (reflector), ABS (base)

Reflector  
IAC-R8

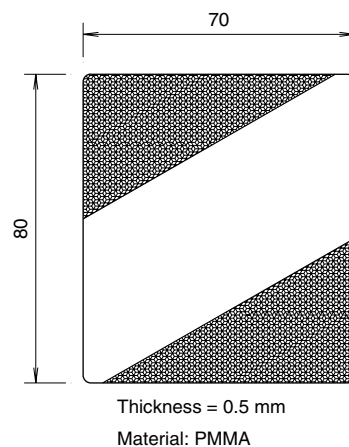


(Effective reflecting area: 47 × 47)  
Material: PMMA (reflector), ABS (base)

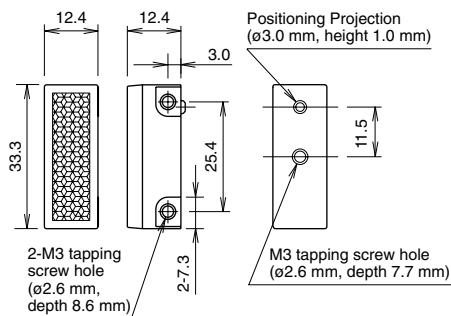
IAC-RS1



IAC-RS2



IAC-R7M (rear/side mounting)

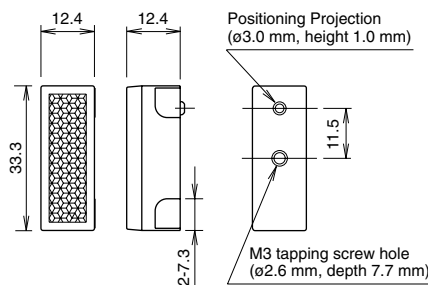


Material: PMMA (reflector), ABS (base)

Effective reflecting area: 8.6 × 29.5

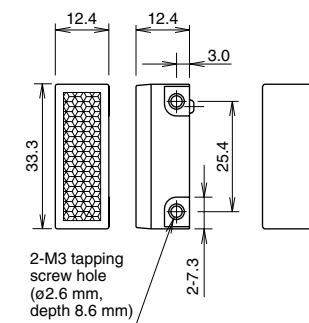
The mounting plate for reflector must be 0.8 to 2.5 mm in thickness.

IAC-R7B (rear mounting)



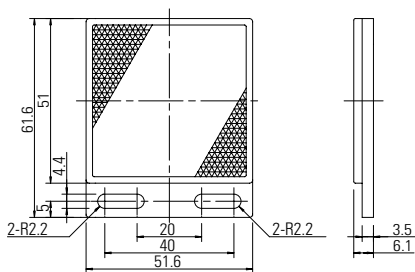
Material: PMMA (reflector), ABS (base)

IAC-R7S (side mounting)



Material: PMMA (reflector), ABS (base)

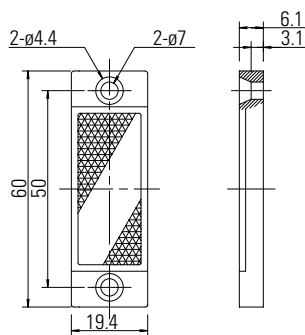
IAC-R9



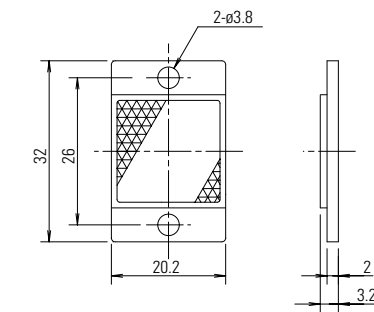
(Reflecting surface 47×47.6)

Material: PMMA (reflector), ABS (base)

IAC-R10



IAC-R11



(Reflecting surface 18×18.2)

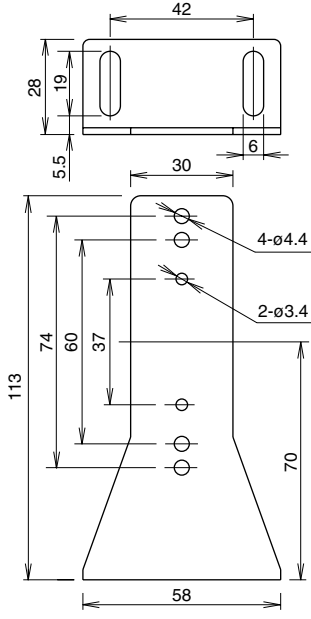
Material: PMMA (reflector), ABS (base)

01 Touchscreens

PLCs

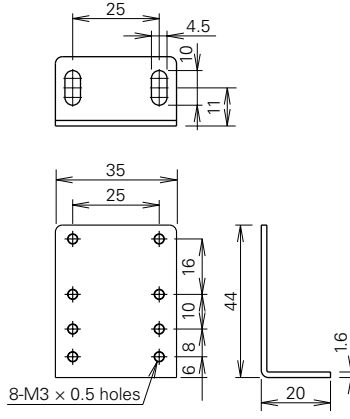
Automation Software

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



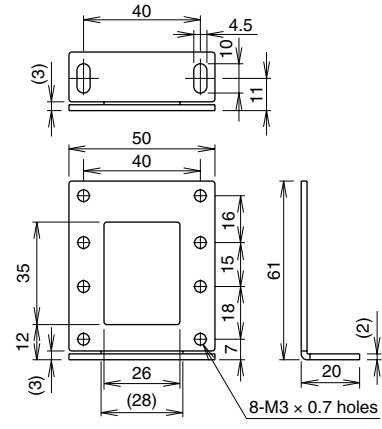
Material: SPCC (zinc chromate plating, black)

IAC-L3 (for IAC-R6)



Material: SPCC (zinc plating)

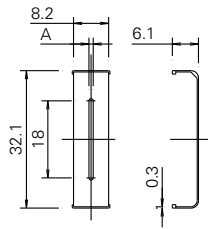
IAC-L5 (for IAC-R8)



Material: SPCC (zinc plating)

Power Supplies

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

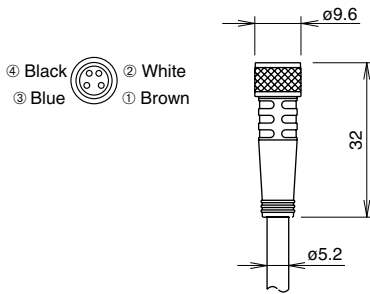


Material: Stainless Steel

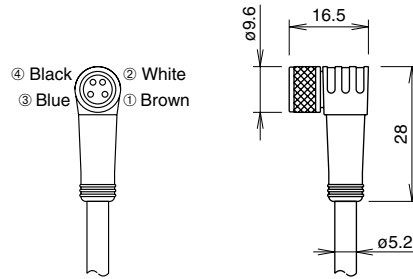
| Slit     |               |
|----------|---------------|
| Part No. | Slit Width: A |
| SA9Z-S06 | 0.5 mm        |
| SA9Z-S07 | 1.0 mm        |
| SA9Z-S08 | 2.0 mm        |

Sensors

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



Right-angle (SA9Z-CM8K-4L□)

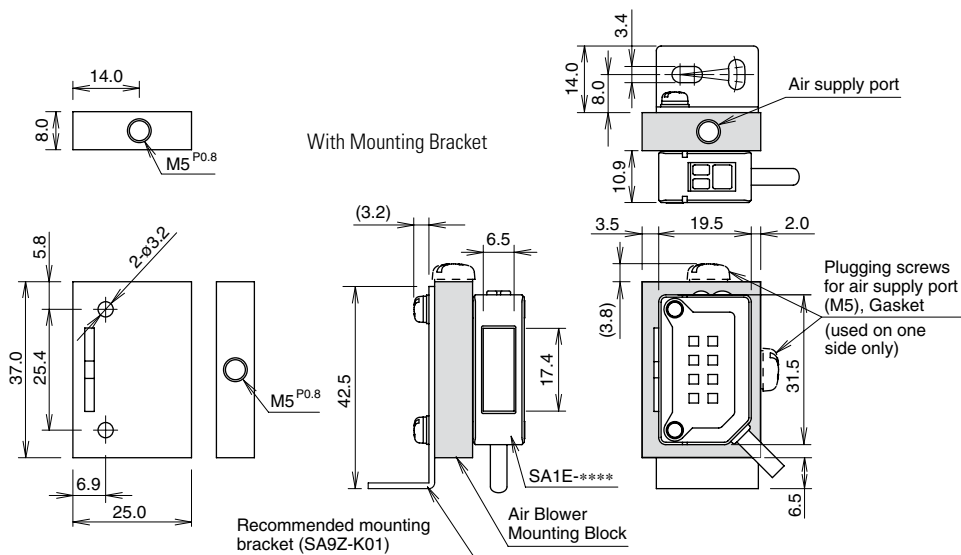


Dielectric strength when installed on the SA1E: 1000V AC (between live part and mounting bracket, except between live part and tightening ring)

Communication

Barriers

Air Blower Mounting Block

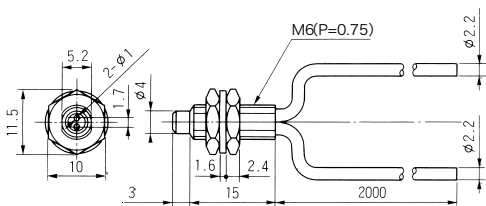


- The SA9Z-A02 air blower mounting block is supplied with two mounting screws (M3 × 20 mm sems screws), one screw for plugging the air supply port (M5 × 6 mm), and one gasket for plugging the air supply port.
- An air tube fitting (M5) can be installed to either the top or side. Tighten the fitting to 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).

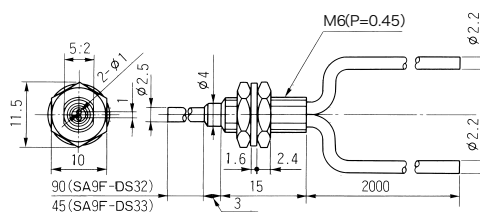
(Material: Anodized aluminum surface)

Diffuse-Reflective Light Fiber Optic Units

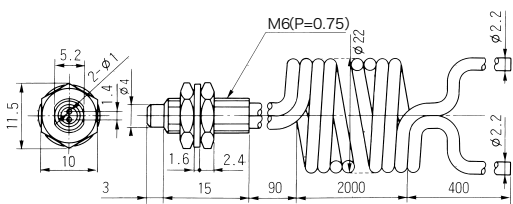
SA9F-DS31



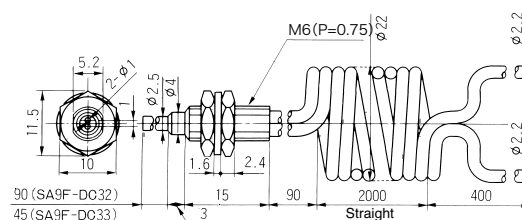
SA9F-DS32, SA9F-DS33



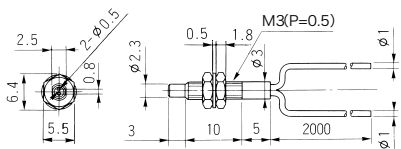
SA9F-DC31



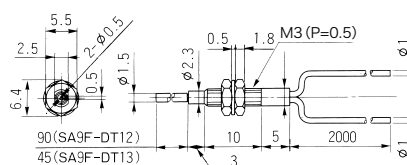
SA9F-DC32, SA9F-DC33



SA9F-DT11



SA9F-DT12, SA9F-DT13



01 Touchscreens

PLCs

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Power Supplies

Sensors

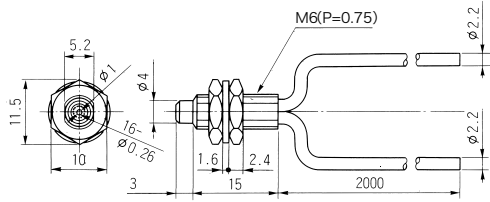
Communication

Barriers

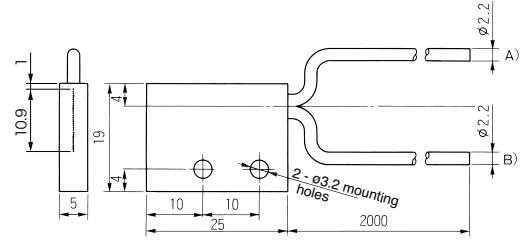
0I Touchscreens

**Diffuse-Reflective Light Fiber Optic Units con't**

**SA9F-DD31**

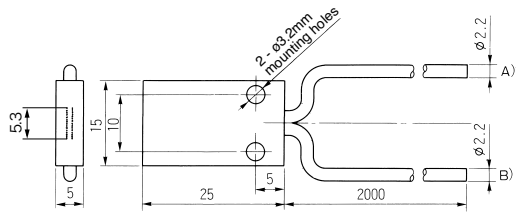


**SA9F-DM74**



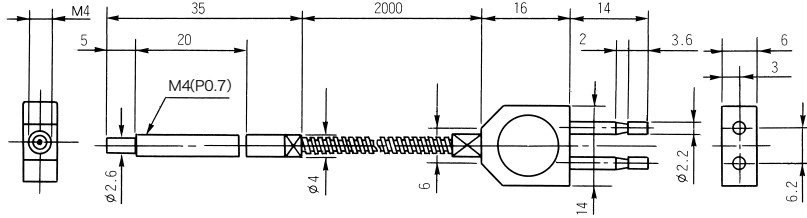
PLCs

**SA9F-DM75**



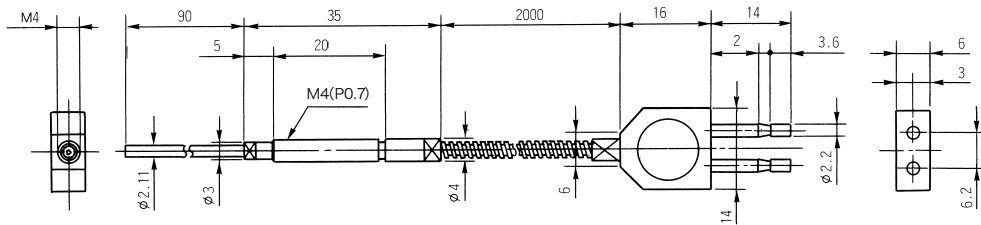
Automation Software

**SA9F-DH21**



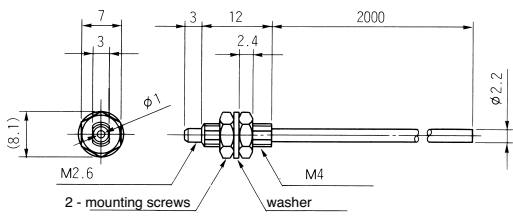
Power Supplies

**SA9F-DH22**



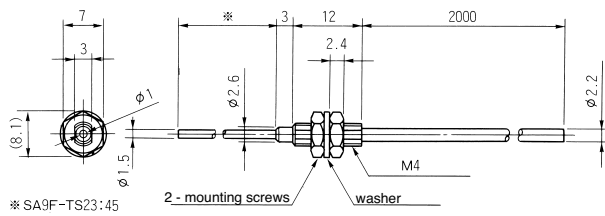
Sensors

**SA9F-TS21**



Communication

**SA9F-TS23**

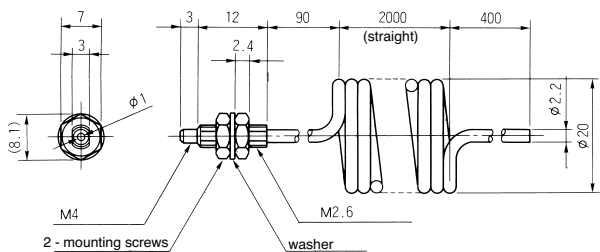


Barriers

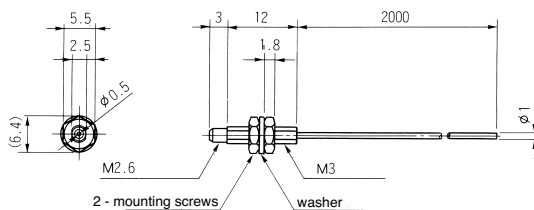
Diffuse-Reflective Light Fiber Optic Units con't

Dimensions (mm)

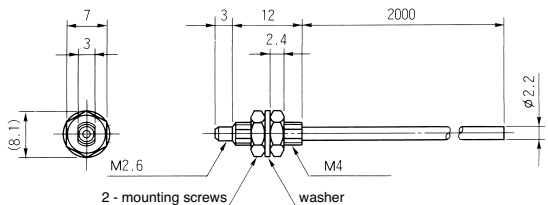
SA9F-TG21



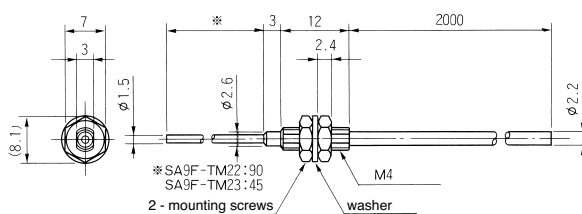
SA9F-TT11



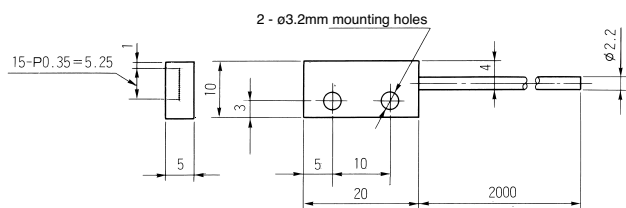
SA9F-TM21



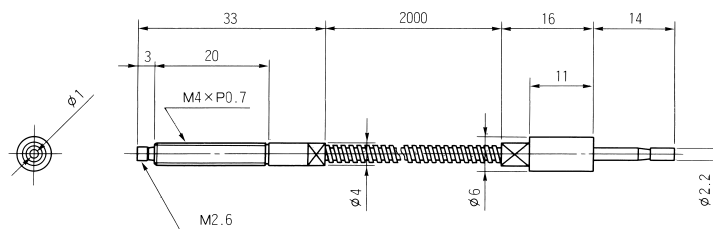
SA9F-TM22, SA9F-TM23



SA9F-TM74



SA9F-TH21



IO Touchscreens

PLCs

Automation Software

Power Supplies

Sensors

Communication

Barriers