

### SA1C-FK: Fiber Optic Analog Photoelectric Sensors

- High-speed, miniature photoelectric sensors with analog (4mA to 20mA) and digital output
- Senses gradual color changes
- Available in both red and 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
- Dozens of coordinating fiber optic units available to address specific application needs
- Simple to install and program
- IP66 protection rating



	SA1C-FK3	SA1C-FK3G
<b>Light Source Element</b>	Red LED	Green LED
<b>Sensing Distance</b>	Depends on the fiber unit (see pages 40–42)	
<b>Power Voltage</b>	12 to 24V DC (Operating voltage: 10 to 30V DC) ripple 10% maximum	
<b>Current Draw</b>	80mA maximum	
<b>Analog Current Output</b>	4 to 20mA, 5V DC maximum	
<b>Digital Output</b>	NPN open collector 30V DC, 100mA maximum, 1.5V maximum with short circuit protection	
<b>Operation Mode</b>	Dark ON (connect MODE line to GND line); Light ON (connect MODE line to power line)	
<b>Response</b>	0.5ms maximum	
<b>Indicator</b>	Operation LED: Red, Stable LED: Green	
<b>Detectable Object</b>	Translucent object, opaque object	
<b>Hysteresis</b>	20% maximum (using reflex fiber unit)	
<b>Sensitivity</b>	4-turn adjustment	
<b>Operation Point Control</b>	1 turn	
<b>Receiver Element</b>	Photo diode	
<b>Operating Temperature</b>	–25 to +55°C (performance will be adversely affected if the sensor becomes coated with ice)	
<b>Storage Temperature</b>	–30 to +70°C (performance will be adversely affected if the sensor becomes coated with ice)	
<b>Operating Humidity</b>	35 to 85% RH (avoid condensation)	
<b>Extraneous Light Immunity</b>	Sunlight: 10,000 lux maximum; Incandescent light: 3,000 lux (at the receiver)	
<b>Noise Resistance</b>	Normal mode: 500V (50ns to 1µs, 100Hz: Using a noise simulator) Common mode: 300V (50ns to 1µs, 100Hz: Using a noise simulator)	
<b>Insulation Resistance</b>	Between live and dead parts: 20MΩ minimum, with 500V DC megger	
<b>Dielectric Strength</b>	Between live and dead parts: 1,000V, 1 minute	
<b>Vibration Resistance</b>	Damage limits: 10 to 55Hz; Single amplitude: 0.75mm 20 cycles in each of 3 axes	
<b>Shock Resistance</b>	Damage limits: 500 m/sec <sup>2</sup> 10 cycles in each of 3 axes	
<b>Degree of Protection</b>	IP66 — IEC Pub 529	
<b>Cable</b>	Cable type: Ø4.4mm 5-core vinyl cable 0.2mm <sup>2</sup> , 6'–6-3/4" (2m) long	
<b>Material</b>	Housing: Polybutyleneterephthalate (PBT)	
<b>Accessories</b>	Mounting bracket, adjusting screwdriver, load resistor (249Ω) for converting analog amperage to voltage (1 to 5V)	
<b>Interference Prevention</b>	Up to 2 units can be installed in close proximity. For analog output, interference prevention is not possible.	
<b>Weight</b>	Approximately 75g	

General Specifications



1. Analog current output specification is based on the power voltage range from 12 to 24V DC ( $\pm 10\%$ ).
2. Use the attached resistor (249Ω, 1/4W) as a load resistance for converting analog output to voltage.
3. 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.

**Part Numbers: SA1C-FK Sensors**

Part Number	Light Source Element	Output
SA1C-FK3	Red LED	Analog output + NPN output (with short-circuit)
SA1C-FK3G	Green LED	

**Ordering Details**

The SA1C-FK series consists of the amplifier/receiver only. Fiber optic units must be ordered separately using part numbers beginning with SA9F. SA1C-FK amplifier/receivers can be used with either through-beam or diffuse-reflected fiber optic units.

The fiber optic cord is 6'-6-3/4" (2m) long. Fiber optic cords can be cut to the desired length using a fiber cutter, except for heat-resistant glass fiber cords. A fiber cutter is included with fiber optic units (order SA9Z-F01 separately for replacement). A set of two easy-insert adaptors is included with the following fiber optic units: SA9F-TT, SA9F-TL, SA9F-DT, and SA9F-DL (order SA9Z-F02 for replacement set).

**Part Numbers: SA9F Diffuse-Reflected Light Fiber Optic Units**

Part Number	Description	Amplifier	Range	Dimensions
<b>SA9F-DS31</b> No sleeve <b>SA9F-DS32</b> 3.54" (90mm) sleeve <b>SA9F-DS33</b> 1.77" (45mm) sleeve	Straight: Two fibers Ø 0.04" (1mm) Threaded mount: Ø 0.24" (M6) Detects: Ø 0.0012" (0.03mm) minimum object	SA1C-FK3 SA1C-FK3G	2.36" (60mm) 0.28" (7mm)	
<b>SA9F-DC31</b> No sleeve <b>SA9F-DC32</b> 3.54" (90mm) sleeve <b>SA9F-DC33</b> 1.77" (45mm) sleeve (All three not compatible with green LED)	Coiled: Two fibers Ø 0.04" (1mm) Threaded mount: Ø 0.24" (M6) Detects: Ø 0.0012" (0.03mm) minimum object	SA1C-FK3 SA1C-FK3G	0.98" (25mm) —	
<b>SA9F-DT11</b> No sleeve <b>SA9F-DT12</b> 3.54" (90mm) sleeve <b>SA9F-DT13</b> 1.77" (45mm) sleeve (All three not compatible with green LED)	Straight: Two fibers Ø 0.02" (0.5mm) Threaded mount: Ø 0.12" (M3) Detects: Ø 0.0012" (0.03mm) minimum object	SA1C-FK3 SA1C-FK3G	0.78" (20mm) —	
<b>SA9F-DD31</b>	Coaxial: Core Ø 0.04" (1mm) + 16 fibers: Ø 0.01" (0.26mm) Threaded mount: Ø 0.24" (M6) Detects: Ø 0.0012" (0.03mm) minimum object	SA1C-FK3 SA1C-FK3G	2.36" (60mm) 0.28" (7mm)	

Sensors

(continued on following page)

### Part Numbers: SA9F Diffuse-Reflected Light Fiber Optic Units, continued

Part Number	Description	Amplifier	Range	Dimensions
<p><b>SA9F-DM74</b> 1 row = 32 fibers <b>SA9F-DM75</b> 2 rows = 16 each (Not compatible with green LED) <b>SA9F-DM76</b> 3 rows = 16 center + 8 fibers each side (Not compatible with green LED)</p>	<p>Multicore: 32 fibers Ø 0.010" (0.26mm) Detects: Ø 0.0024" (0.06mm) minimum object</p>	<p>SA1C-FK SA1C-FK3G (not compatible with SA9F-DM75, SA9F-DM76)</p>	<p>2.36" (60mm) 0.16" (4mm)</p>	
<p><b>SA9F-DH21</b> No sleeve <b>SA9F-DH22</b> 3.54" (90mm) sleeve (Both not compatible with green LED)</p>	<p>Heat-resistant glass: Two fibers Ø 0.03" (0.7mm) Threaded mount: Ø 0.16" (M4) Detects: Ø 0.0012" (0.03mm) minimum object</p>	<p>SA1C-FK3 SA1C-FK3G</p>	<p>1.06" (27mm) —</p>	

### Measuring Conditions

Amplifier = Applicable Amplifier

Range = Sensing Range  
Sensing a 50 x 50mm piece of white paper

Minimum detectable object:  
Sensing a copper-stranded wire with the SA1C-FK3

The sensing range varies depending upon the sensing conditions.

Part Numbers: SA9F Through-Beam Fiber Optic Units

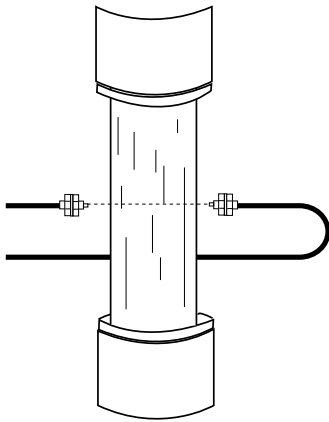
Part Number	Description	Amplifier	Range	Dimensions
<b>SA9F-TS21</b> No sleeve <b>SA9F-TS22</b> 3.54" (90mm) sleeve <b>SA9F-TS23</b> 1.77" (45mm) sleeve	Straight fiber: Ø 0.04" (1mm) Threaded mount: Ø 0.16" (M4) Detects: Ø 0.012" (0.3mm) minimum object	SA1C-FK3 SA1C-FK3G	7.09" (180mm) 0.63" (16mm)	<p>Ø 0.32" (8.1mm), 0.12" (3mm), 0.28" (7mm), Ø 0.04" (1mm), 0.12" (3mm), 0.47" (12mm), 0.09" (2.4mm), 6" - 6-3/4" (2m), Ø 0.10" (M2.6), Ø 0.16" (M4), Ø 0.087" (2.2mm), Ø 0.06" (1.5mm), TS22: 3.54" (90mm), TS23: 1.77" (45mm)</p>
<b>SA9F-TC21</b> No sleeve <b>SA9F-TC22</b> 3.54" (90mm) sleeve <b>SA9F-TC23</b> 1.77" (45mm) sleeve	Coiled fiber: Ø 0.04" (1mm) Threaded mount: Ø 0.16" (M4) Detects: Ø 0.012" (0.3mm) minimum object	SA1C-FK3 SA1C-FK3G	5.91" (150mm) 0.55" (14mm)	<p>Ø 0.06" (1.5mm), Ø 0.32" (8.1mm), 0.12" (3mm), 0.28" (7mm), Ø 0.04" (1mm), 0.12" (3mm), 0.47" (12mm), 0.09" (2.4mm), 6" - 6-3/4" (2m), 15.75" (400mm), 3.54" (90mm), Ø 0.16" (M4), Note: All dimensions, except those shown, are the same as straight fiber (TS21/22/23, above), TC22: 3.54" (90mm), TC23: 1.77" (45mm)</p>
<b>SA9F-TT11</b> No sleeve <b>SA9F-TT12</b> 3.54" (90mm) sleeve <b>SA9F-TT13</b> 1.77" (45mm) sleeve	Straight fiber: Ø 0.02" (0.5mm) Threaded mount: Ø 0.12" (M3) Detects: Ø 0.006" (0.15mm) minimum object	SA1C-FK3 SA1C-FK3G	1.97" (50mm) 0.2" (5mm)	<p>Ø 0.25" (6.4mm), 0.10" (2.5mm), 0.22" (5.5mm), Ø 0.02" (0.5mm), 0.12" (3mm), 0.47" (12mm), 0.07" (1.8mm), 6" - 6-3/4" (2m), Ø 0.09" (M2.2), Ø 0.12" (M3), Ø 0.04" (1mm), Ø 0.035" (0.9mm), TT12: 3.54" (90mm), TT13: 1.77" (45mm)</p>
<b>SA9F-TM21</b> No sleeve <b>SA9F-TM22</b> 3.54" (90mm) sleeve <b>SA9F-TM23</b> 1.77" (45mm) sleeve	Multicore: 16 fibers (cluster) Ø 0.010" (0.26mm) Threaded mount: Ø 0.16" (M4) Detects: Ø 0.012" (0.3mm) minimum object	SA1C-FK3 SA1C-FK3G	5.91" (150mm) 0.55" (14mm)	<p>Ø 0.32" (8.1mm), 0.12" (3mm), 0.28" (7mm), Ø 0.010" (0.26mm) 16 Fibers, 0.12" (3mm), 0.47" (12mm), 0.09" (2.4mm), 6" - 6-3/4" (2m), Ø 0.10" (M2.6), Ø 0.16" (M4), Ø 0.087" (2.2mm), Ø 0.06" (1.5mm), TM22: 3.54" (90mm), TM23: 1.77" (45mm)</p>
<b>SA9F-TM74</b> 16 fibers in one row	Multicore: 16 fibers (one row) Ø 0.010" (0.26mm) Detects: Ø 0.0024" (0.06mm) minimum object	SA1C-FK3 SA1C-FK3G	5.91" (150mm) 0.55" (14mm)	<p>0.04" (1mm), 0.79" (20mm), 6" - 6-3/4" (2m), 0.39" (10mm), 0.21" (5.25mm), Ø 0.126" (3.2mm) Two Places, 0.20" (5mm), 0.20" (5mm), 0.59" (15mm), 0.16" (4mm), Ø 0.09" (2.2mm), 0.12" (3mm)</p>
<b>SA9F-TH21</b> No sleeve <b>SA9F-TH22</b> 3.54" (90mm) sleeve	Heat-resistant glass fiber: Ø 0.04" (1mm) Threaded mount: Ø 0.16" (M4) Detects: Ø 0.012" (0.3mm) minimum object	SA1C-FK3 SA1C-FK3G	3.94" (100mm) 0.31" (8mm)	<p>Ø 0.102" (M2.6), 1.30" (33mm), 6" - 6-3/4" (2m), 0.63" (16mm), 0.55" (14mm), Ø 0.083" (2.11mm), 0.12" (3mm), 0.12" (3mm), 0.79" (20mm), Ø 0.16" (M4), 0.43" (11mm), Ø 0.24" (6mm), Ø 0.086" (2.2mm), TH22: 3.54" (90mm)</p>
<b>SA9F-TL53</b> (Not compatible with green LED)	Side view: one fiber 0.02" (0.5mm) Optical axis at 90° Detects: Ø 0.0024" (0.06mm) minimum object	SA1C-FK3 SA1C-FK3G	1.57" (40mm)	<p>1.77" (45mm), 6" - 6-3/4" (2m), 0.02" (0.5mm), 0.59" (15mm), 0.04" (1mm), 0.033" (0.85mm), Ø 0.08" (2mm), Ø 0.04" (1mm)</p>

Refer to page Q-41 for the measuring conditions.

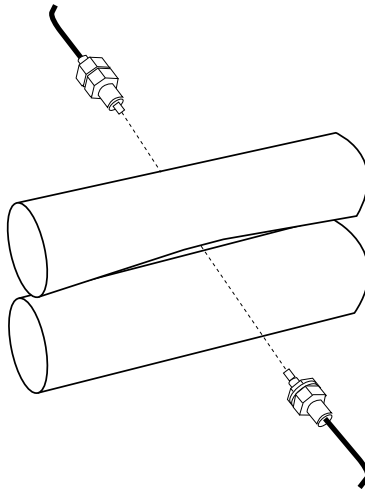


**Applications**

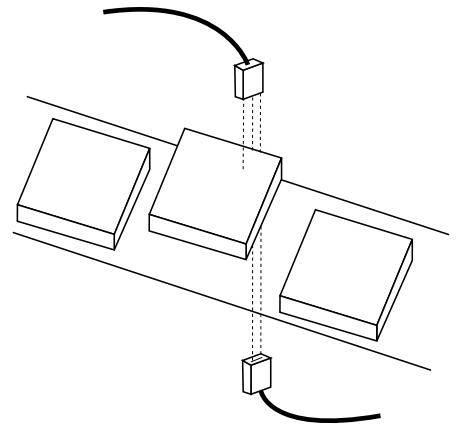
Monitoring the gradual change in liquid densities



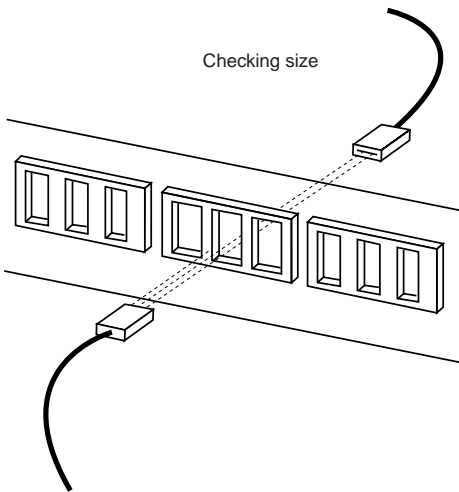
Detecting the roundness of rollers



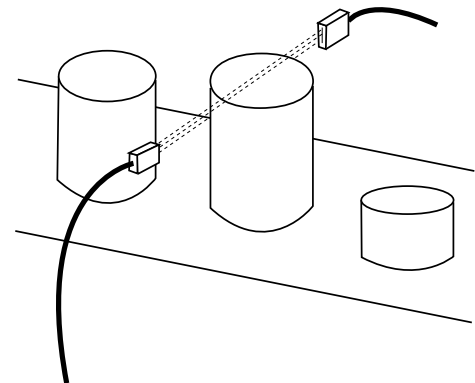
Sensing position or alignment



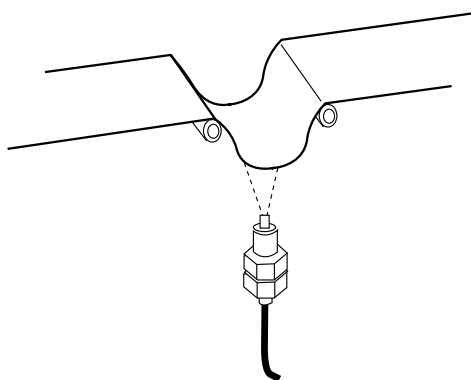
Checking size



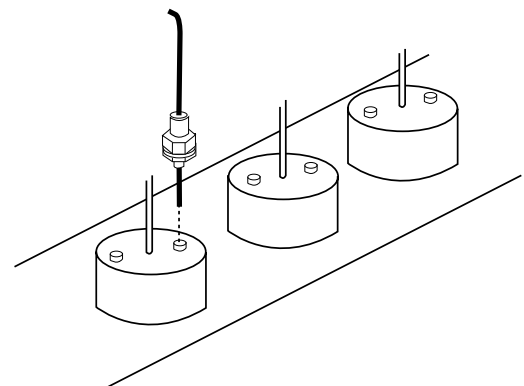
Checking height



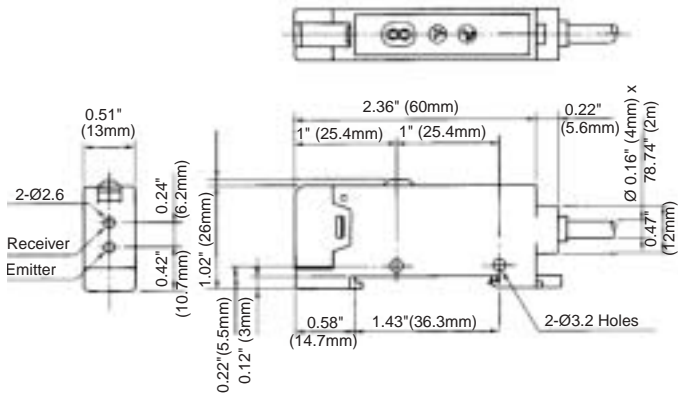
Controlling web tension



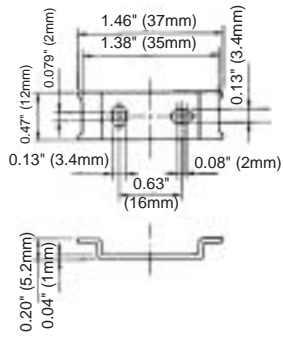
Sensing color marks



**Dimensions**



**Mounting Bracket (attachment)  
Not Required for DIN Rail Mounting**



**Mounting Hole Layout**

