

SA Series Stand-Alone Infrared Thermometer

Introduction

To meet the increasing demand for stand-alone, non-contact infrared thermometers, IRCON offers the SA Series, consisting of the SA10 and the SA16. These models are rugged, reliable and extremely versatile, meeting a wide range of application requirements including raw material processing, steel making, primary and secondary mills, forging, induction heating, glass and ceramic manufacturing, vacuum furnace and other medium to high temperature applications.

The SA series are ideal for processes where panel space is at a premium because all components are self-contained within the sensor. The self-contained sensor includes optical elements, a detector that converts infrared radiation to electrical signals, and electronic circuits that provide a high-level 4-20 mA or 0-20 mA output signal to acquisition equipment and process instrumentation. A truly stand-alone line of infrared thermometers, the SA Series allows an operator to make adjustments to the instrument by making emissivity, response time and peak-picker decay rate settings directly on the back panel of each thermometer.

Available in single lens reflex (SLR) and fiber optic versions (see page 2 for system diagram), the SA provides 0.5% full-scale accuracy and allows operation in higher ambient temperatures than most IR thermometers without external cooling. Special signal compression circuits provide wide temperature spans within the overall series temperature range of 500 to 4800°F (250 to 2600°C).

These wide temperature spans make the SA ideal in applications where temperatures can vary within the process. For example, one SA can be used in a process where the temperature starts at 1200°F (650°C) and extends up to 2800°F (1548°C). Previously, a similar process would require three different types or models of infrared thermometers to span this temperature range. Because a single SA can be used for the entire process, equipment acquisition costs, installation expense and spare part requirements are reduced. See ordering information (page 11) for discrete temperature ranges to match a particular process.

Other features include:

- Choice of linearized 4-20 mA or 0-20 mA output



The self-contained SA Series models meet a wide range of application requirements

- Adjustable controls for peak-picker, emissivity and response time
- Choice of focusable, through-the-lens sighting or fiber optics with a focusable reimaging lens system.
- Rugged housing rated NEMA 4 or IP 66
- Choice of power input: ± 15 Vdc or 24 Vdc, or 100 to 230 Vac, 50/60 Hz

Model 10

The SA-10 utilizes a stable and reliable silicon detector, which is ideal for high temperature applications within discrete temperature ranges from 900 to 4800°F (500 to 2600°C). It operates within a spectral region of 0.7 to 1.0 μm and provides 0.5% accuracy of full-scale temperature. The optical resolution characteristics of the SLR version are D/50, D/100, D/200 and D/300. The fiber optic version offers a focusable reimaging lens or extension tip option with choice of optical resolutions: D/30, D/60, D/30 by D/150 or D/3. Refer to back page for more details.

Model 16

The SA 16 utilizes an indium gallium arsenide (InGaAs) detector operating at a spectral region of 1.5 to 1.6 μm that provides 0.5% full-scale accuracy for measuring temperatures within discrete ranges from 500 to 2500°F (250 to 1400°C). The InGaAs technology is superior to the widely used germanium detector because of its ability to operate in ambient temperatures up to 140°F (60°C) without external cooling while remaining stable and reliable. This range can be extended to 400°F (200°C) with fiber optic option or water cooling jacket.

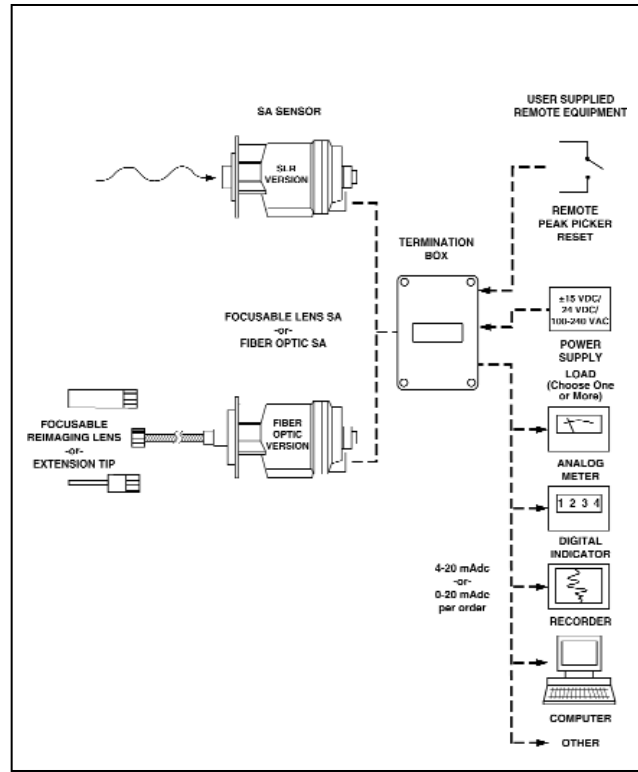
SA Series

The optical resolution characteristics of the model 16 are D/50, D/100 and D/150. The fiber optic optical characteristics are D/30, D/60, D/30 by D/150 and D/3. Refer to the optical resolution diagrams for more details.

SLR Version

The SLR models of the SA series contain focusable single lens reflex optics which allow the user to sight through-the-lens to view a target. A built-in reticle aids in defining the exact spot size to be measured. The focusable optics of this instrument permit temperature measurements of targets from varying distances. The standard objective lens allows measurement distances from 18 inches (457 mm) to infinity. A choice of three different lens options allow for operation at distances as close as 2 inches (50 mm) to match specific application requirements.

The choice of five optical resolutions provide for measurement of targets as small as 0.06 inch (1.6 mm).



System configuration for SLR and fiber optic versions

Sensor (SLR Version)

The optical system, detector, signal processing electronics and controls are housed within a rugged and sealed casting. The housing provides protection from dust, oil and water and is NEMA 4 rated. The SLR sensor features integral electro-optical circuitry and sophisticated electronics that provide an accurate means of converting the infrared energy received from a target into a calibrated temperature output signal. Since signal processing is performed internally, the need for a separate processing unit is eliminated.

Adjustments for peak picker decay rate, emissivity and response time are easily made on the back panel of the SLR version sensor. These easy-to-access controls are protected from harsh environments by an easily removable back panel that is sealed to maintain the unit's NEMA 4 rating.



SA series SLR version

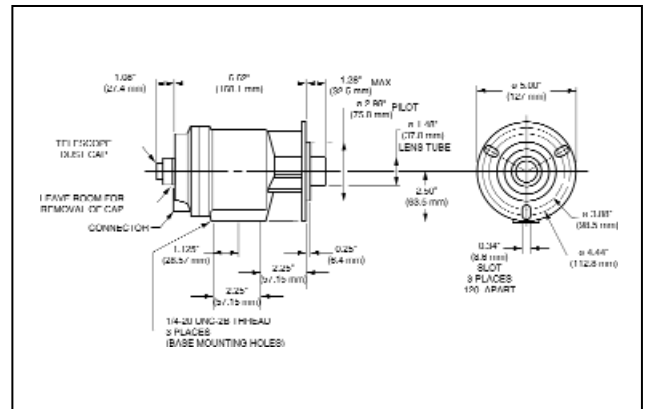
SA Series

Sensor (SLR Version) continued

The temperature signal is fed to a rugged connector on the back plate and transmitted by a shielded interconnecting cable to the termination box where it is available for external use. This cable is also used to carry the power to the sensor from the termination box.



Adjustments are easily made on the back panel of the sensor for both SLR and fiber optic versions.



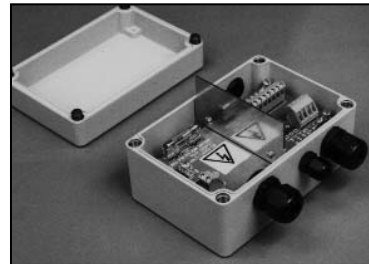
SLR sensor dimensional drawing

Signal/Power Termination Box (SLR and Fiber Optic versions)

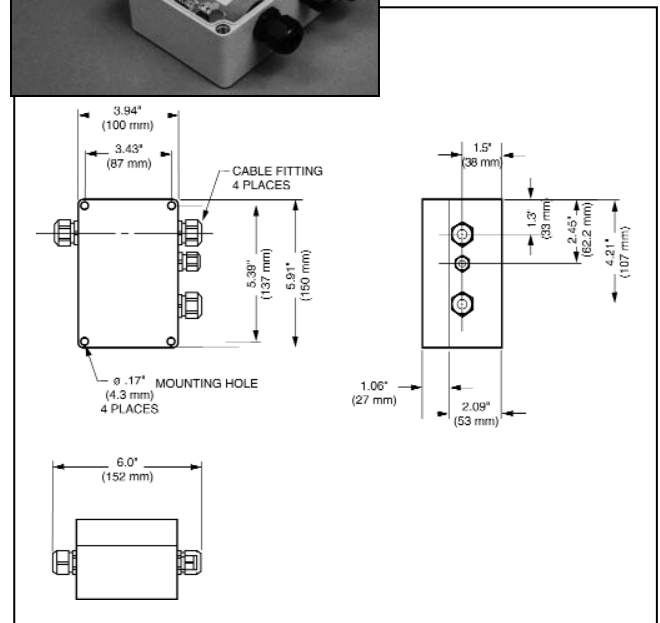
The signal/power termination box is a NEMA 4 rated enclosure that contains and protects the terminal strips from harsh industrial environments. The terminal strips offer an easy and convenient access to provide power to, and signals from, the sensor. It also allows for a convenient means to output signals to a PLC, recorder or other control instrumentation.

Optionally, the signal/power termination box is available with a built-in power supply that can power the sensor from either a 24 Vdc or 100 to 240 Vac source. In addition, this enclosure reduces the length of shielded interconnecting cable required to link the sensor and box.

The standard cable length is 33 feet (10 m) with optional 200 feet (60 m) available.



SA Series signal/power termination box photo and dimensional drawing



SA Series

SLR and Fiber Optic Accessories

Model WJ-5 Water Cooling Jacket

A water cooling jacket may be used to protect the sensor in ambient temperatures up to 400°F (200°C). Sensor cooling results from water circulating within heat exchanging coils in the jacket, while an air purge attached to the front plate of the jacket provides a stream of clean air to prevent dust, smoke and particles from collecting on the lens.

Two 1/2-inch NPT tapped holes in the top of the enclosure accept water and accommodate inlet and outlet pipes or tubing. A nominal water flow rate of 20 gallons/hour (75 liters/hr) and a water temperature of 75°F (24°C) or less is required. A 1/2-inch NPT threaded air inlet on the air purge is provided for a pipe or tubing fitting. 1/4-20 tapped holes are provided in the base for mounting the jacket. The front flange of the air purge can act as a mounting flange for other accessories.

Model WA-3 Water Cooling Accessory

A water cooling accessory is recommended where ambient temperatures are expected to exceed the maximum rating of the SA series unit. A nominal water flow of 10 gallons/ hour (38 liters/hr) at water temperatures below 90°F (32°C) is suitable for most applications. Water cooling effectively raises the maximum ambient temperature limit by approximately 40°F (12°C) in most applications. Two 1/2-inch NPT tapped holes accept water inlet and outlet pipes. Machined flanges permit bolting to an SA unit's front flange and to other standard accessories.

Model AA-3 Air Purge

The air purge provides a stream of clean air that prevents dust, smoke and particles from collecting on an SA unit's lens. This accessory bolts to the front flange of the SLR version of the SA and can be used in combination with other accessories.

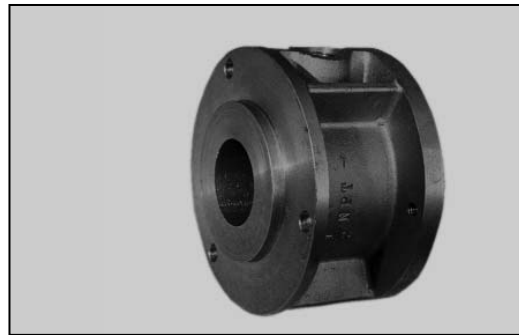
A 1/2-inch NPT tapped hole is provided for air intake. Air flow of about 6 cubic feet/minute (0.17 cubic meter/min) is suitable for most applications.

Model SB-1 Swivel Mounting Base

A swivel mounting base is recommended for installations requiring line of sight adjustment. The swivel mount permits both tilting and panning motions and may be locked firmly in place when optical alignment is complete.



Model WJ-5 water cooling jacket accessory



Model WA-3 water cooling accessory



Model AA-3 air purge accessory



Model SB-1 swivel mounting base accessory

SA Series

Fiber Optic Version

While SLR versions of the SA Series are ideal in many applications, fiber optic sensors are used when measuring targets in harsh environments, difficult-to-reach or obstructed areas. A slender, focusable reimaging lens or extension tip and flexible fiber optic cable allows temperature measurement of targets that are exposed to smoke, steam, intense electrical fields and where line-of-sight is difficult or impossible.

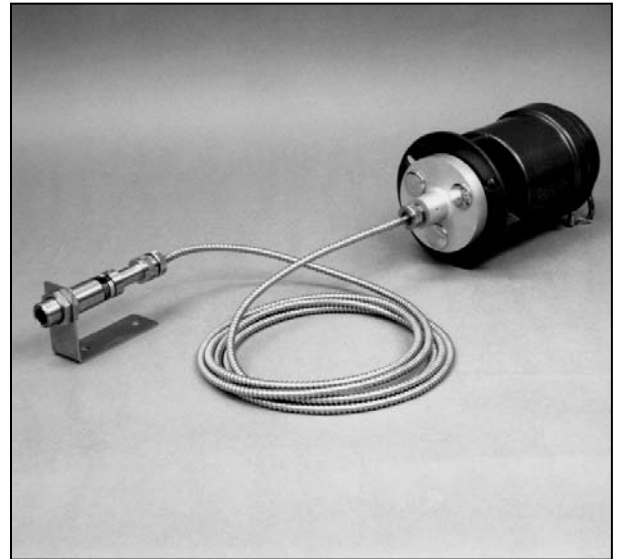
The fiber optic versions of the S-10 and 16 employ a flexible fiber optic cable to convey infrared radiation from a measurement point to the optical system within the SA sensor's housing. The optical system focuses the incoming radiation onto the detector assembly. The infrared detector "sees" the same energy viewed by the measuring tip of the fiber optic cable.

Components

- Self-contained sensor
- Fiber optic cable assembly with focusable reimaging lens or extension tip
- Signal/power termination box
- 33 feet (10 m) interconnecting cable
Note: optional 200 feet (60 m) maximum cable length available
- Optional illuminator with charger
- Optional mounting accessories

Features and Benefits

- Compact, stainless steel, focusable reimaging lens assembly fits in tight places and withstands environments to 400°F (200°C) without auxiliary cooling.
- Extension tip withstands ambient temperatures up to 575°F (300°C); ideal for high temperature applications or hard to reach targets.
- A choice of mounting accessories is available for the focusable reimaging lens and extension tip assembly.
- Optional air purge easily mounts to front of reimaging lens to keep lens clean.
- Flexible fiber optic cable assembly provides an optical link between the sensor and the focusable reimaging lens, and is available in standard length of 10 feet (3 m) or special order lengths.
- Optical resolutions based on model selection: D/30; D/60; D/30 by D/150 (*focusable reimaging lens*); or D/3 (*extension tip*).



SA series fiber optic version shown with fiber optic cable and focusable reimaging lens mounted on an angle bracket

SA Series

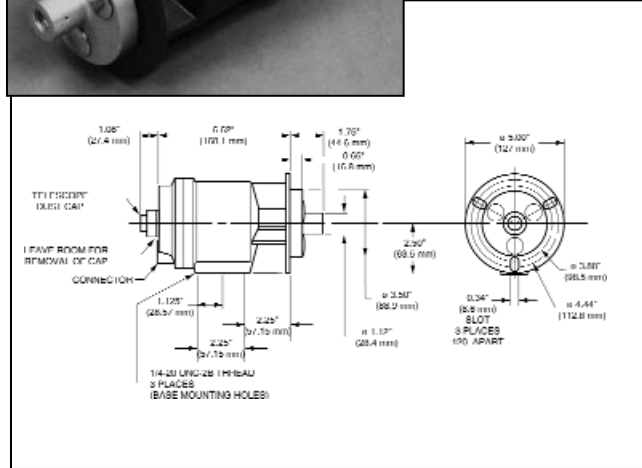
Sensor (Fiber Optic Version)

The optical elements, infrared detector assembly and electronic circuits of the fiber optic version are housed in a die cast, gasketed sensor housing. The sensor has a spectral response of 0.7 to 1.0 μm , or 1.5 to 1.6 μm . The ambient temperature range is 32 to 140°F (0 to 60°C) with a full-scale temperature accuracy within 0.5%. The fiber optic mounting fixture is on the front flange of the sensor housing. An internally threaded, keyed well retains and aligns the tip of the fiber optic cable with the optical elements inside the housing.

The temperature signal is fed to a rugged connector on the back plate and transmitted by a shielded interconnecting cable to the termination box where it is available for external use. This cable is also used to carry the power to the sensor from the termination box.



SA sensor fiber optic version self contained infrared thermometer photo and fiber optic housing dimensional drawing



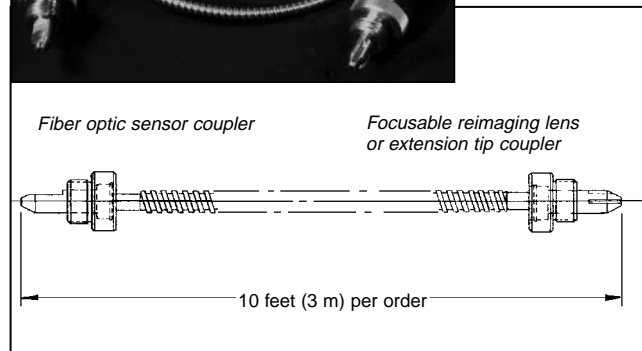
Fiber Optic Cable

The fiber optic cable links the target being measured and the optical system inside the SA unit's housing. The cable consists of a 0.080-inch (2.0 mm) diameter fiber bundle protected by a flexible stainless steel armor sheath. Standard cable length is 10 feet (3 m), while optional longer lengths are available.

Both ends of the fiber optic cable are fitted with quick-connect couplers which are keyed to simplify installation and guarantee alignment.



Fiber optic cable photo and dimensional drawing



SA Series

Focusable Reimaging Lens

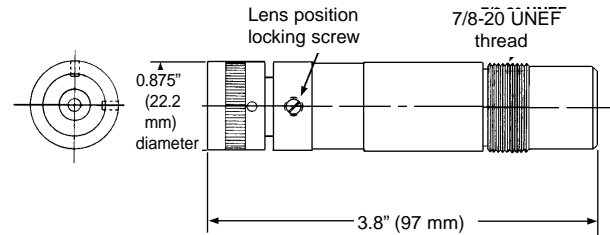
The focusable reimaging lens* functions in conjunction with the fiber optic cable to provide an adjustable field of view in difficult installations. In addition, the focusable reimaging lens is housed in a NEMA 4 rated compact, stainless steel cylinder. A protective window guards the lens against dust, water, spray and contaminants. The lens can be used in ambient temperatures up to 400°F (200°C) without cooling.

The focusable reimaging lens permits measurement of objects from a distance of 10 inches (250 mm) to infinity. A focusable, close-focus lens is available with a focal range of 6 to 10 inches (150 to 250 mm). For long, narrow targets such as pipe or wire, IRCON offers a unique, optional rectangular spot size format lens (D/30 by D/150).

* U.S. Patent #4919505 and 5011296



Focusable reimaging lens photo and dimensional drawing



*Rear section of lens assembly pressed all the way into forward section (maximum focus distance). Length increases up to 4.7" (120 mm) when rear section is withdrawn (minimum focus distance).

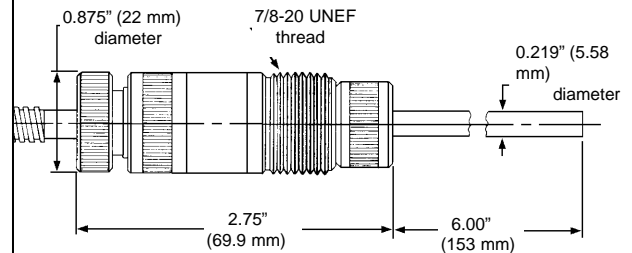
Extension Tip

The extension tip option is available for applications where the focusable reimaging lens can not be used or for high ambient temperatures up to 575°F (300°C). In addition, the extension tip is ideal for small openings and hard-to-reach objects.

The extension tip consists of a glass rod within a ceramic tube mounted in a stainless steel ferrule. The tip forms a rigid probe 0.22-inch (5.6 mm) in diameter, extending 6 inches (153 mm) from the front of the ferrule. The rod consists of inert glass with no organic binders and is immune to electromagnetic fields. As a result, the tip can be easily inserted between the windings of an induction heating coil without disturbing the electromagnetic field, or coupling the field to the sensor's circuits.



Extension tip photo and dimensional drawing



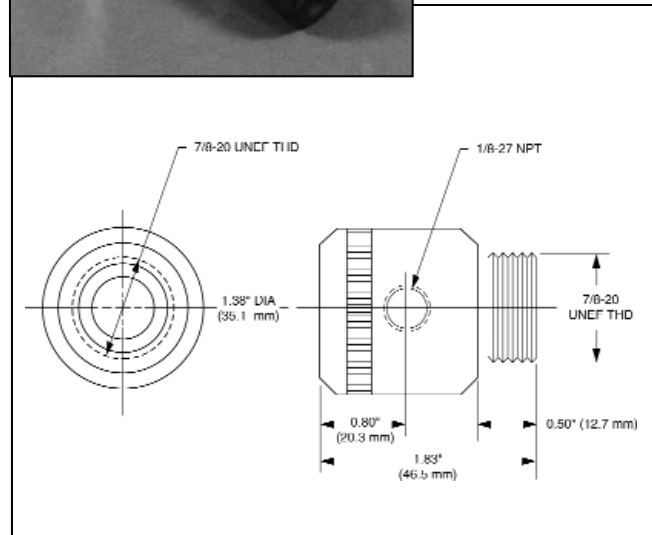
Fiber Optic Accessories

Model AA-5 Air Purge

The air purge attaches to the front end of the focusable reimaging lens and provides positive pressure, preventing dust, smoke and other particulate matter from collecting on the lens. The threaded portion of the air purge can be used for easy mounting to the model MB-5 mounting bracket or into a panel cutout. In most applications, one cubic foot of air per minute (0.03 cubic meter/min.) is suitable.



Model AA-5 air purge photo and dimensional drawing



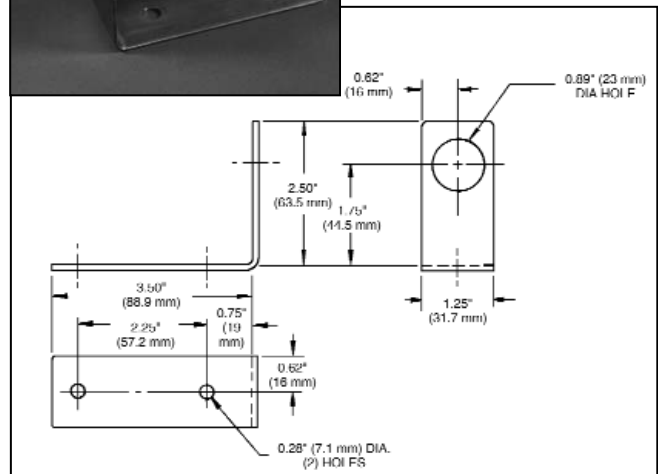
Mounting Accessories

Model MB-5 Angle Mounting Bracket

The angle mounting bracket serves as an inexpensive mounting base for attaching the focusable reimaging lens or extension tip. The bracket can be bolted to any desired surface for fixed mounting. The hole in the bracket face will accept the threaded end of the focusable reimaging lens assembly or extension tip. Two mounting nuts are supplied with either assembly and are generally used to secure these devices to the mounting bracket.



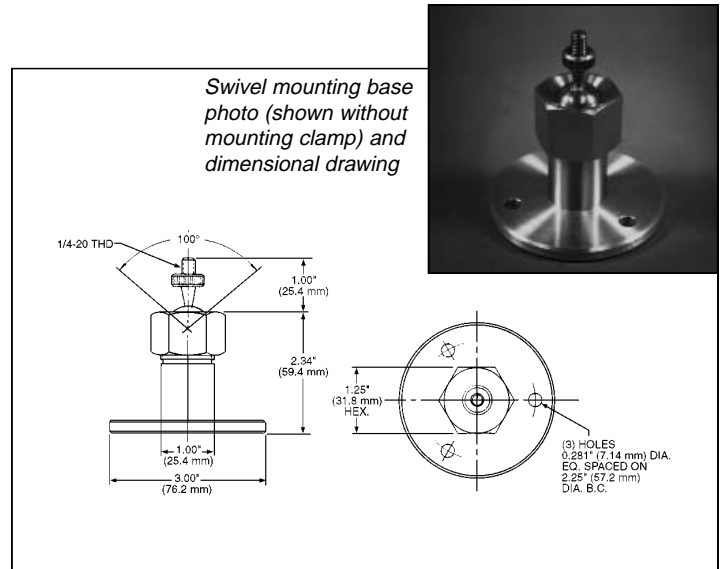
Focusable reimaging lens attached to angle mounting bracket photo and angle mounting bracket dimensional drawing



Mounting Accessories (continued)

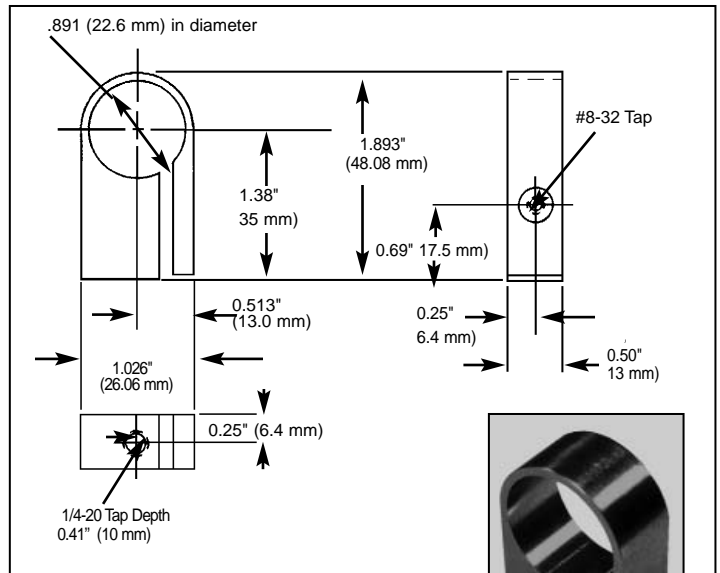
Model SB-5 Swivel Mounting Base

The swivel mounting base provides an adjustable mounting base for the focusable reimaging lens and is ideal for applications requiring easy line-of-sight adjustment. The base permits both tilting and panning motions, and may be locked firmly in place when optical alignment of the reimaging lens is complete. Model MC-5 mounting clamp (described below) is an integral part of the swivel mounting base.



Model MC-5 Mounting Clamp

The mounting clamp is a sturdy mounting support for the focusable reimaging lens or extension tip. The mounting clamp can be attached to a vertical or horizontal support structure with a 1/4-20 mounting screw inserted in the bottom of the support. The reimaging lens or tip slides into the mounting collar and is then tightened to hold the assembly. Panning the mounting clamp aligns the focusable reimaging lens or extension tip on the target and is then locked in position when alignment is complete. The mounting base can also be used with the TM-6 tripod for general laboratory use.



Model MC-5 mounting clamp dimensional drawing and photo

Model IL-5 Illuminator

A compact, hand-held illuminator designed to transmit a bright light through the fiber optic Cable and focusable reimaging lens, the illuminator aids in aligning and focusing the lens on a targeted object. The light that falls on the target is an accurate representation of the image area that will be picked up by the fiber optic system during operation. As a result, an accurate determination of spot size and spot position can be made during installation and routine maintenance. A rechargeable, battery-powered, quartz halogen lamp with variable intensity control produces the illuminator's light. The illuminator option includes a battery recharging accessory that is available for 115 Vac or 220 Vac operation.



Model L5- illuminator

SA Series

SLR and Fiber Optic Specifications

Temperature Measuring Range

500 to 4800°F or 250 to 2600°C
(see ordering information chart on following page
for discrete temperature ranges)

Calibration Accuracy

Within 0.5% of full scale temperature

Repeatability

Within 0.3% of full scale temperature

Response Time at Output (to 95% of any change in input)

Continuously adjustable from 0.01 to 10 seconds

Analog Output

4 to 20 mAdc or 0 to 20 mAdc (500 ohm max), non
isolated but common to ground

Spectral Response

Model 10 - 0.70 to 1.00μ m
Model 16 - 1.50 to 1.60μ m

Emissivity Control Range

Adjustable from 0.10 to 0.99 in 0.01 increments
(see model restrictions on following page)

Optical Resolution

SLR models
D/50, D/100, D/150, D/200, or D/300
per model selection

Fiber Optic models
D/30, D/60 or D/30 by D/150 per model selection
(focusable reimaging lens); D/3 (extension tip)

Power Requirements

DC - ± 15 Vdc ± 5% @ 125 mA,
or optional 24 Vdc ± 5% @ 180 mA
AC - 100 - 240 Vac, 50/60 Hz @ 0.3 A

Ambient Temperature Range

Sensor
32 to 140°F or 0 to 60°C
without auxiliary cooling
32 to 180°F or 0 to 82°C
with optional WA-3 water cooling accessory
32 to 400°F or 0 to 200°C
with optional WJ-5 water cooling jacket

Fiber Optic Reimaging Lens
32 to 400°F or 0 to 200°C

Fiber Optic Extension Tip
32 to 575°F or 0 to 300°C

Fiber Optic Cable
Model 10 - 32 to 400°F or 0 to 200°C
Model 16 - 32 to 300°F or 0 to 150°C

Signal/Power Termination Box
32 to 130°F or 0 to 55°C

Signal Power Cable Length

33 feet (10m) standard
200 feet (60m) maximum (*optional*)

Enclosure

Rated NEMA 4 or IP 66

CE Directives:

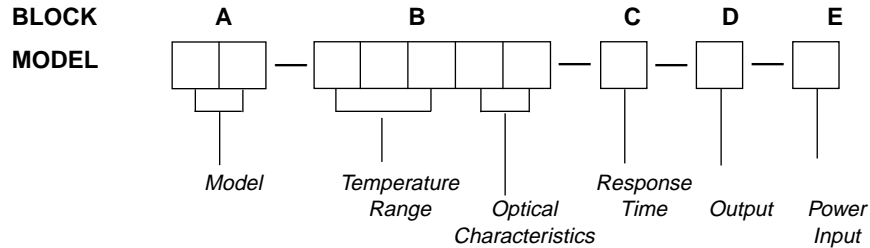
Meets EMC Directive 89/336/EEC for EMI/RFI and Safety Compliance tested to
EN 50081-1: 1992 Generic Emissions Standard
EN 50082-1: 1992 Generic Immunity Standard
EN 61010-1: 1993 Safety Standard

SA Series

SLR and Fiber Optic Ordering Information

Model 10 and Model 16

The following is an example of how to select the proper model number that matches your application requirements. Refer to the selector chart below for specific information. *For example:* Model 10-24F10-0-1-1 indicates a single lens reflex SA Series model 10 that operates within a temperature range of 1000 to 2400°F, with an optical resolution of D/100, response time from 0.01 to 10 seconds, 0-20 mA output, and a 24 Vdc $\pm 5\%$ power input.



BLOCK A – Model Designation					
<table border="1"><tr><td>1</td><td>0</td></tr></table> Model 10 (0.7 to 1.0 μm)	1	0	<table border="1"><tr><td>1</td><td>6</td></tr></table> Model 16 (1.5 to 1.6 μm)	1	6
1	0				
1	6				

SA Series Model 10 (SLR) *

BLOCK B - Temperature Range and Optical Characteristics

2	0	F	0	5	= 900 to 2000°F D/50
2	4	F	1	0	= 1000 to 2400°F D/100
3	0	F	2	0	= 1200 to 3000°F D/200
4	8	F	3	0	= 1400 to 4800°F D/300
1	1	C	0	5	= 500 to 1100°C D/50
1	3	C	1	0	= 550 to 1300°C D/100
1	4	C	1	0	= 600 to 1400°C D/100
1	5	C	2	0	= 650 to 1500°C D/200
1	6	C	3	0	= 800 to 1600°C D/300
2	6	C	3	0	= 750 to 2600°C D/300

SA Series Model 10 (Fiber Optic) **

BLOCK B - Temperature Range

2	5	F			= 1200 to 2500°F
3	0	F			= 1300 to 3000°F
4	8	F			= 1800 to 4800°F
1	5	C			= 650 to 1500°C
2	0	C			= 700 to 2000°C
2	6	C			= 750 to 2600°C

FIBER OPTIC OPTIONS			
F5	F6	F7	F8
•			•
	•	•	•
	•	•	•
•			•
	•	•	•
•	•	•	•

OPTICAL RESOLUTIONS

- F5 = D/30 • F6 = D/60 • F7 = D/30 x D/150
- F8 = Extension Tip • All Fiber Length 10 Feet

SA Series Model 16 (SLR) *

BLOCK B - Temperature Range and Optical Characteristics

1	8	F	0	5	= 500 to 1800°F D/50
2	0	F	1	0	= 600 to 2000°F D/100
2	5	F	1	5	= 700 to 2500°F D/150
1	0	C	0	5	= 250 to 1000°C D/50
1	1	C	1	0	= 350 to 1100°C D/100
1	4	C	1	5	= 400 to 1400°C D/150

SA Series Model 16 (Fiber Optic) **

BLOCK B - Temperature Range

2	2	F			= 650 to 2200°F
2	5	F			= 800 to 2500°F
1	2	C			= 350 to 1200°C
1	4	C			= 450 to 1400°C

FIBER OPTIC OPTIONS			
F5	F6	F7	F8
•			•
	•	•	•
•			•
	•	•	•

OPTICAL RESOLUTIONS

- F5 = D/30 • F6 = D/60 • F7 = D/30 x D/150 • F8 = Extension Tip
- All Fiber Length 10 Feet

* Emissivity span is restricted to 0.3 - 1.0 for the first 100°F (55°C) for all temperature ranges

** Emissivity span is restricted to 0.2 - 1.0 for the first 100°F (55°C) for all temperature ranges

SA Series Model 10 and Model 16

BLOCK C - Response Time

0	= 0.01 to 10.0 seconds, continuously adjustable
---	---

BLOCK D - Output

0	= 4 - 20 mA (500 ohm max. grounded)
1	= 0 - 20 mA (500 ohm max. grounded)

BLOCK E - Power Input

0	= ± 15 Vdc, $\pm .5\%$ @ 125 mA (customer supplied)
1	= 24 Vdc $\pm .5\%$ @ 180 mA
2	= 100 - 240 Vac 50/60 Hz @ 0.3 A

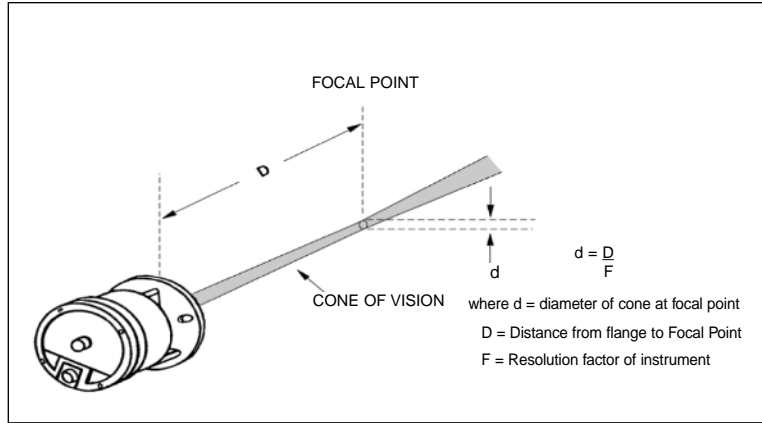
SA Series

SA Series Optical Resolution

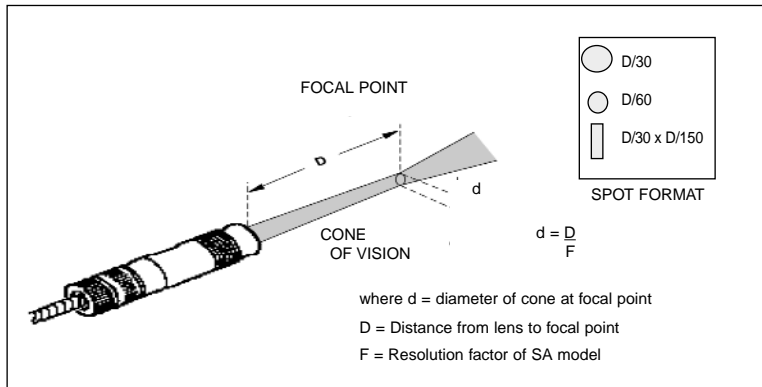
Optical Resolution Diagrams

The SA series models are sensitive to infrared radiation in an area indicated by the cone of vision. The diameter of the cone at any point will determine the area of measurement (spot size) at that point. Anything within that area will be focused on the detector element and will therefore produce a temperature signal.

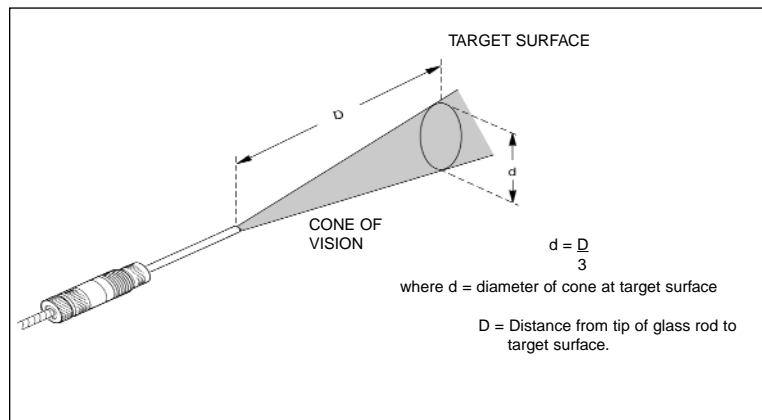
When an SA model is sighted on an object, the cone of vision is "aimed" so that it falls on the object. When focusing the lens, adjustments are made so the focal point is at the surface of the object. The formula shown in the diagram defines the spot size at the focal point. Simply divide the "working distance" (D) by the "resolution factor" (F) to determine the "spot size" (d). The resolution factor is described by the last two digits in block B of the order information chart on page 11.



Cone of vision for SA Series SLR version



Cone of vision for fiber optic reimaging lens



Cone of vision for fiber optic extension tip



ISO 9001 : 2000
Quality System
Certified

NIST Calibration Provider



World Headquarters

7300 North Natchez Ave. • Niles, IL 60714 USA
Phone: 847 967 5151 or 800 323 7660 • Fax: 847 647 0948
Web site: www.ircon.com • E-mail: info@ircon.com

European Headquarters

Databankweg 6C • 3821 AL • Amersfoort • The Netherlands
Phone: 31 33 450 4320 • Fax: 31 33 450 4321
E-mail: ircon@ircon.nl