

## MIRAGE Fiber Optic INFRARED THERMOMETER

### Introduction

The Mirage Fiber Optic offers the powerful features and affordable price of the standard Mirage infrared thermometer and the flexibility of an optical system using fiber optics. The fiber optic system allows measuring difficult-to-reach or obstructed targets with the three fiber optic models including a two-color model. The fiber optic system measures temperatures from 350 to 6500°F or 180 to 3500°C,

The Mirage fiber optics' unique focusable reimaging lens assembly and fiber optic cable offer the opportunity to sight on targets where direct sighting is otherwise impossible; where electromagnetic interferences are a problem; or where extremely high ambient temperatures are present.

The slender focusable reimaging lens allows infrared temperature measurement to be applied to processes that were never before suitable. It offers the opportunity to operate in small areas and narrow openings and can measure temperature of objects at distances ranging from 10 inches to infinity with a spot size as small as 0.1" (2.5 mm). An optical closeup lens allows focusing from 6 to 10 inches (150 to 250 mm).

The flexible fiber optic cable also allows operation through harsh environments such as through smoke, steam, and intense electrical fields.

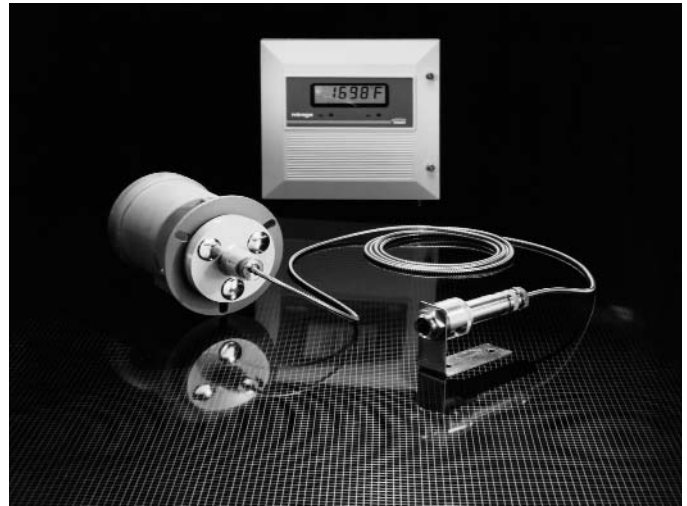
The focusable reimaging lens and fiber optic cable are designed to operate in ambient temperatures up to 400°F (200°C) without auxiliary cooling. An optional extension tip can be used up to 575°F (300°C).

The different series of the Mirage fiber optics cover three spectral regions and operate within specific wavelengths for a wide variety of applications. These series operate within discrete temperature ranges from 350 to 6500°F or 180 to 3500°C,

The Fiber Optic Mirage can be applied to a variety of processes including vacuum furnaces, induction heating, welding, semiconductor processing and other applications where conventional thermometers are impossible to use. Fiber Optic Mirage sensors are available as follows:

**20 Series** - for measuring temperatures ranging from 900 to 5000°F (500 to 3000°C)

**60 Series** - for measuring temperatures ranging from 350 to 1400°F (180 to 800°C)



Mirage indicator/processor with fiber optic cable and focusable reimaging lens mounted on angle bracket

**OR Series** - for measuring temperatures ranging from 1300 to 6500°F (700 to 3500°C). This series features two color operation that measures temperatures from the ratio of radiation signals of two adjacent wavelengths and not from absolute intensity. Such things as dust and smoke in the sight path, dirty viewing windows, emissivity changes and small, moving objects that don't fill the optical field of view have no effect on the temperature readings as long as they affect both wavelengths equally.

The Mirage Fiber Optic system consists of a fiber optic sensor, indicator/processor, and fiber optic cable assembly. Focusable reimaging lens assembly or extension tip, and an illuminator with a charger are optional.

### Fiber Optic Features and Benefits

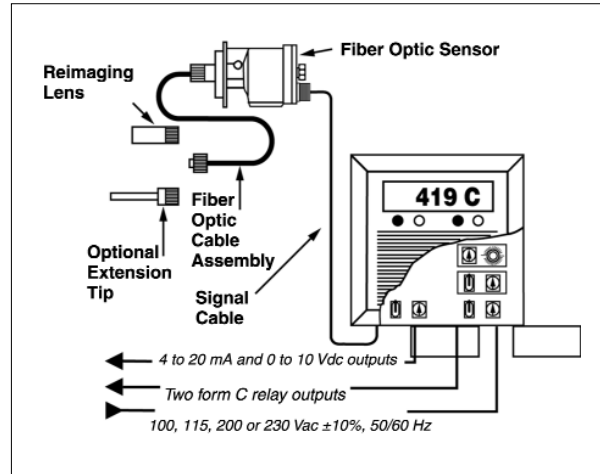
Provides all the features of the standard Mirage system plus the following fiber optic features:

- Choice of 3 model series for measuring temperatures between 350 and 6500°F (180 to 3500°C) with discrete temperature ranges.
- Compact stainless steel focusable reimaging lens assembly fits in tight places; withstands environments up to 400°F or 200°C without auxiliary cooling. Two focusable ranges of 6 to 10" (150 to 250mm) or 10" (250mm) to infinity are available.

# Mirage Fiber Optic System

## Features and benefits (cont'd)

- Spot size measurements as small as 0.1 inch (2.5 mm).
- Choice of optical resolution (model selectable) of D/30, D/60, or D/30 x D/150.
- Extension tip withstands ambient temperatures to 575°F (300°C) for high temperature applications
- Flexible fiber optic cable assembly provides optical line between sensor and reimaging lens. Cable lengths of 3 or 10 ft (standard) and up to 30 ft (special)
- Various mounting accessories are available for reimaging lens or extension tip assembly for easy mounting
- Optional air purge screws to front of reimaging lens to keep lens clean
- Sensor is designed and built to operate in hostile environments



Fiber Optic sensor and indicator/processor drawing

## Mirage 20, 60 and OR Fiber Optic Sensor

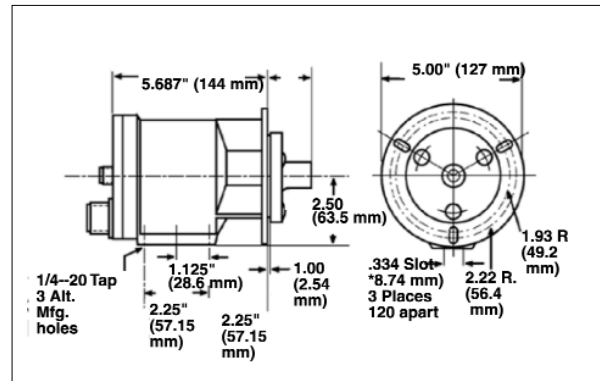
The Mirage fiber optic sensor is designed and built to operate in hostile environments. The sensor is specifically designed to accept the fiber optic cable assembly. The optical elements, detectors and electronic circuits are contained with the sensor. However, the focusable optics, rather than being an integral part of the fiber optic sensor, are located in the reimaging lens assembly at the measuring end of the fiber optic cable.

## Mirage Indicator/Processor

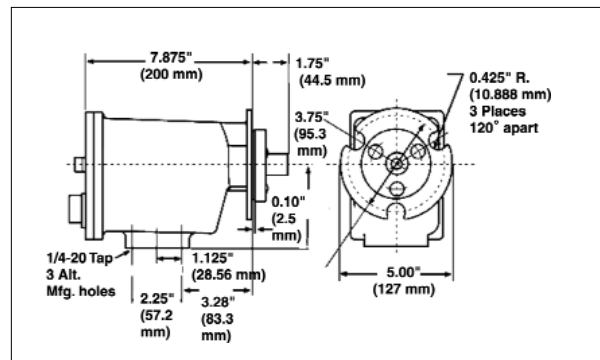
- Accuracy to 1% of full scale value
- Response times from 10 milliseconds to 10 seconds
- Meets EN 61010-1 and NEMA 12K standards
- DIN 43 700 panel cutouts
- Large 4-digit LCD display
- Linearized analog outputs consisting of 0 to 10 Vdc and 4 to 20mA or 0 to 20mA
- Optional on/off control



Mirage Fiber Optic OR sensor



Fiber Optic 20 and 60 series sensor dimensions



Fiber Optic OR series sensor dimensions

# Mirage Fiber Optic System

*Features and benefits (cont'd)*

## Fiber Optic Cable Assembly

The fiber optic cable is the optical link between the target being measured and the sensor. It consists of a multi-stand fiber bundle protected by a flexible stainless steel armor sheath. Available in 3 or 10 foot lengths (up to 30 ft as a special), the cable can be snaked around and through obstructions that would interfere with the sight path of a conventional line-of-sight thermometer. Quick-connect keyed couplings at both ends attach the cable to the sensor and reimaging lens assembly or extension tip.

## Focusable Reimaging Lens Assembly

The compact stainless steel focusable reimaging lens is designed to handle difficult conditions. It offers a NEMA 4 (IP66) rating and includes a protective window to guard the optics against exposure to dust, water, spray and other contaminants. The lens can be used in ambient temperatures up to 400°F (200°C) without cooling.

The focusable reimaging lens permits the measurement of objects from a distance of 10 in. (250 mm) to infinity. A focusable close focus lens is available with a focal range of 6 to 10 in. (150 to 250 mm). In addition to the conventional circular spot size, a rectangular spot size format option is available. The rectangular format, unique to Iron fiber optics, is ideal for long, narrow targets such as pipe or wire.

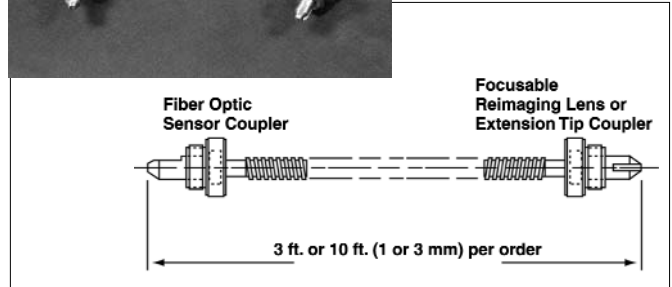
## Extension Tip

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

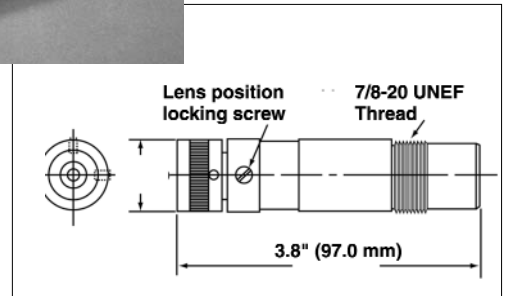
The fiber optic extension tip consists of a glass rod covered with a ceramic tube and mounted within a stainless steel ferrule. This rigid probe is 0.22 in. (5.6 mm) in diameter. Since the glass rod is immune to the electro-magnetic field of the coil, it can be inserted between the windings of an induction heating coil without disturbing the field or upsetting the sensor electronics. The ferrule is designed for easy coupling to the fiber optic cable. The entire extension tip assembly can be mounted easily to the model MB-5 mounting bracket or other panels.



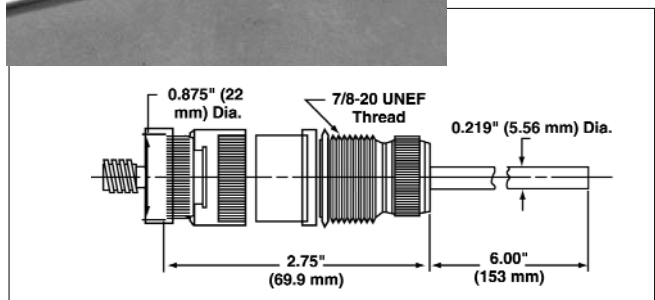
Fiber optic cable photo and cable assembly dimensional drawing



Fiber optic focusable reimaging lens photo and dimensional drawing



Fiber Optic extension tip photo and dimensional drawing



# Mirage Fiber Optic System

## Indicator/Processor

The Mirage Fiber Optic series indicator/processor is compact and self-contained and is as easy to install, operate and service as that of the standard Mirage series. The Mirage fiber optic consists of a state-of-the-art signal processing unit with a large and highly visible four-digit LCD display and can measure and control temperatures with response times ranging from 10 milli-seconds to 10 seconds.

The Mirage fiber optic is designed to meet international standards (EN 61010-1 and NEMA 12K specifications). The enclosure fits standard 43 700 DIN panel cutout and easily mounts on either a wall or pipe for maximum installation flexibility. All wiring is through the front of the unit, providing quick and simple wiring hookup to a terminal board.

Linearized analog temperature outputs consisting of 0 to 10 Vdc and either a 4-20 mA or 0 to 20 mA are provided as a standard feature. Temperature indicator is available in both °C or °F with emissivity adjustments from 0.1 to 1.0 (OR series E-slope adjustments from 0.85 to 1.15).

## Fiber Optic Optional Features

**Peak Picker** - a peak picker is a circuit that retains peak measured temperature value and ignores momentary decreases in measured temperature. The peak-picker eliminates erratic measurements due to moving target objects, gaps in workpieces or bursts of smoke and steam in front of the field of view. A three position control switch permits "off", "peaking" and "reset" functions with remote reset available through user-supplied contact closure.

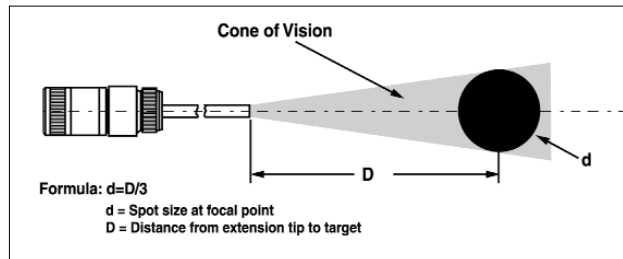
**On/Off Control** - The control is a two-point "on/off" control with a 3-position control switch per point that permits "on", "Off" and "setting" functions. Two sets of LEDs on the front panel indicate the above and below temperatures for each setpoint. This optional control function provides the most economical and simplest type of control.

**Analog Outputs** - There are isolated analog outputs for eliminating ground loop and electrical noise interferences from external instrument signals.

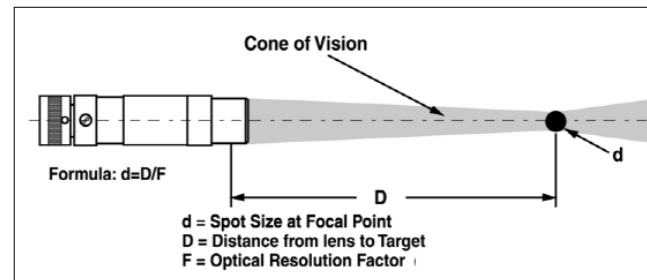
*Note: See Mirage catalog MR-05 for more complete information on the optional features.*



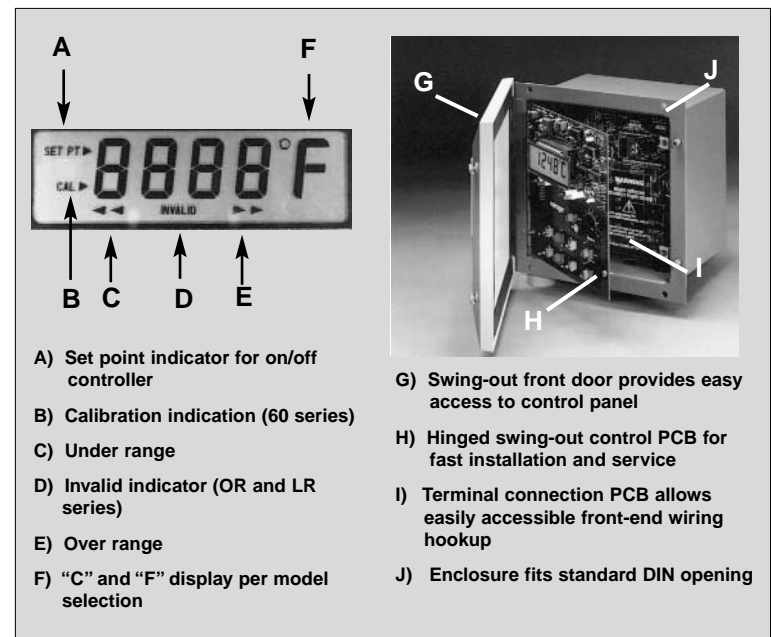
Mirage Fiber Optic Indicator/Processor



Cone of Vision formula for D over 3



Cone of Vision formula for D over F



# Mirage Fiber Optic System

## Fiber Optic Accessories

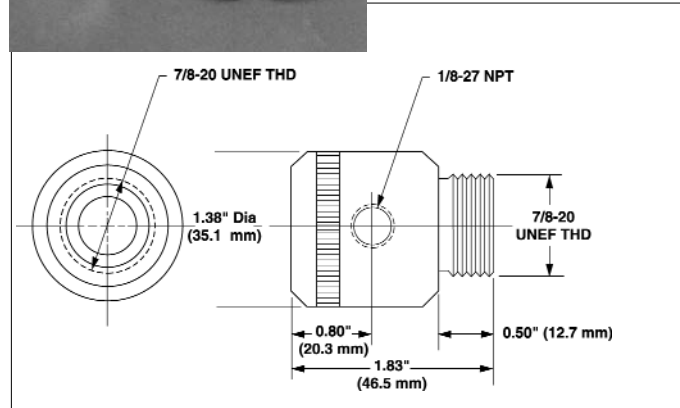
### Air Purge

Model AA-5 air purge attaches to the focusable reimaging lens and protects it from condensation and provides a positive pressure, thereby preventing dust, smoke and other particulate from collecting on the lens.

The accessory screws directly to the front end of the reimaging 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. Generally, 1 ft<sup>3</sup>/min. (0.02m<sup>3</sup>/min.) of air is suitable for most applications.



AA-5 Air Purge photo and dimensional drawing



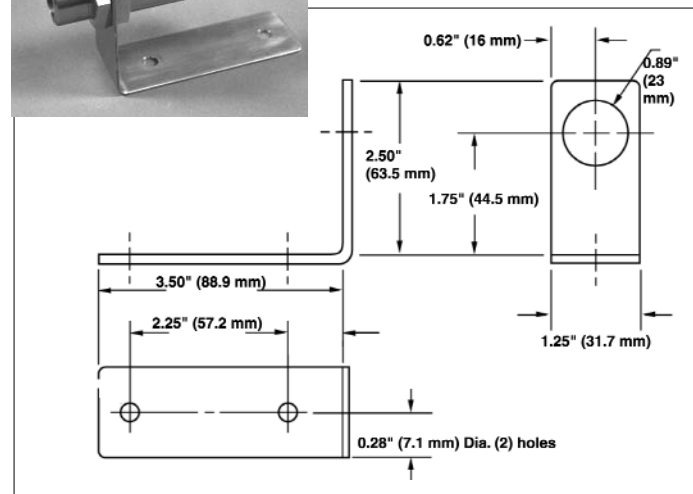
## Mounting Accessories

### Angle Mounting Bracket

Model MB-5 angle mounting bracket is a stainless steel angle bracket that serves as an inexpensive mounting base for the reimaging lens assembly or extension tip. The bracket base plate is designed for bolting the bracket to almost any fixed mounting surface. The hole in the bracket face will accept the threaded end of the reimaging lens assembly or extension tip. Two mounting nuts are supplied with either assembly and are generally used to secure these devices to the bracket.

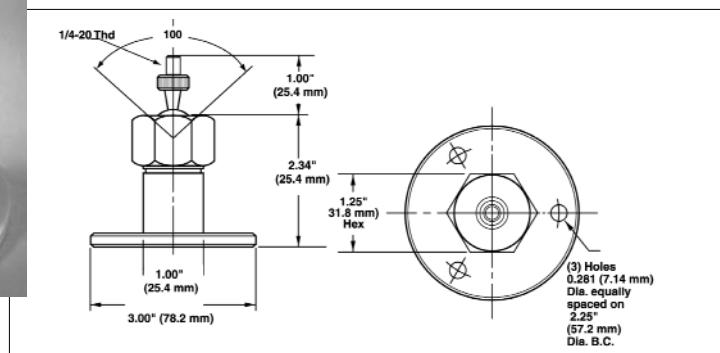


Model MB-5 angle mounting bracket photo (focusable reimaging lens attached) and dimensional drawing



### Swivel Mounting Base

Model SB-5 swivel mounting base provides an adjustable mounting base for the focusable reimaging lens assembly. This mounting facilitates orienting the lens assembly for correct optical alignment. A locking feature firmly locks the reimaging lens in position when optical alignment is completed or permits realignment when necessary. The MC-5 mounting clamp accessory (see following page) is an integral part of the swivel mounting base.



Model SB-5 swivel mounting base photo and dimensional drawing

# Mirage Fiber Optic System

## Mounting accessories (cont'd)

### Mounting Clamp

Model MC-5 mounting clamp is a rugged stainless steel mounting support which can either be used to mount the reimaging lens assembly or extension tip to a support structure. It can also be screwed into the base of the model TM-6 tripod for general laboratory or engineering use.

### illuminator

Model IL-5 illuminator is a portable precision device designed to transmit bright light through the fiber optic cable and focusable lens assembly to aid in aligning and focusing the lens on a target object. The light projected on the target accurately defines the spot size to be measured. This compact hand-held illuminator utilizes a rechargeable, battery-powered quartz halogen lamp with variable intensity control. The illuminator utilizes a precision adapter that quickly connects to the fiber optic cable. A battery recharger is supplied with the illuminator for 115 Vac or 220 Vac operation.

*Note: The illuminator does not meet CE directive.*

### Temp View DC/AC input panel meter

Model TV-VIEW remote digital indicator accepts the 4 - 20 mA output signal from the Mirage fiber optic series to provide a remote digital temperature display. The temperature range can be scaled for any Mirage fiber optic series ordered.

Temperature Range - all Mirage fiber optic series

Signal Input - 4 - 20 mA (zero to full scale)

Ambient Temperature - 32 to 125°F (0 to 50°C)

Digits - 5 digit, red LED, 0.56" high (14.2 mm)

Conversion Rate - 20 times per second

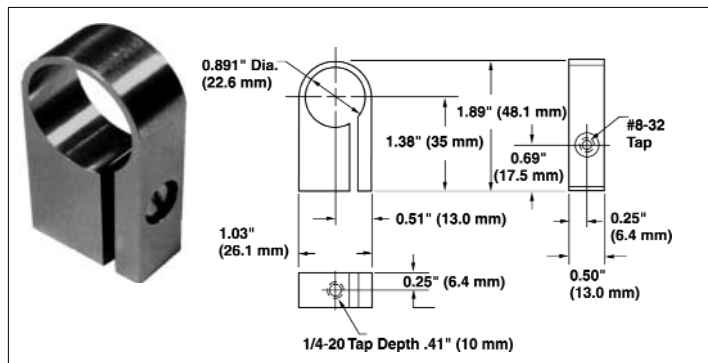
Rating - NEMA 4, IP65

#### Power

TV VIEW VAAC 85 to 250 Vac, 50/60 Hz, 15 VA

TV VIEW VADC 11 - 36 Vdc, 11W

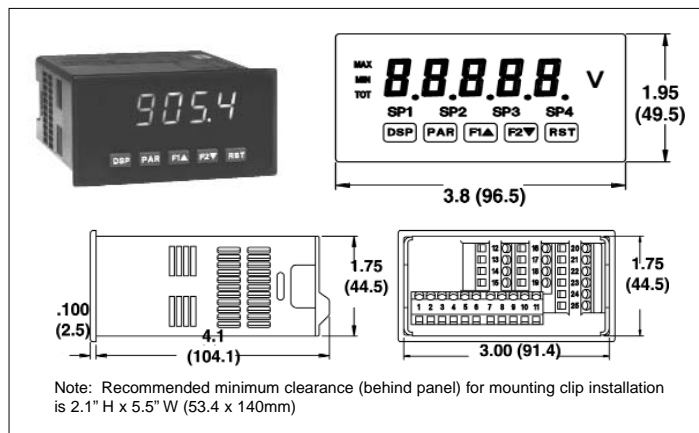
Approval - CE, UL



Model MC-5 mounting clamp photo and dimensional drawing



Model IL-5 illuminator



Temp View input panel meter and dimensional drawing

### CE Directives of Conformity

The Mirage system meets CE Directives of Conformity for EMI/RFI and Safety compliance.

- EMC Directive 89/336/EEC
- Tested to EN-50081-1: 1992
- Generic Emission Standard
- EN 50082-1:1992
- Generic Immunity Standard
- EN 61010-1:1993
- Safety Standard

# Mirage Fiber Optic System

## Specifications - Fiber Optic Sensor and Indicator / Processor

**Spectral Response** - With the exception of the OR series, each Mirage series is designed to operation in a discrete wavelength band. Refer to "Blocks B and C Sensor Series, fiber optic options and temp range chart" on back page for operating wavelengths.

*OR series only:* two adjacent bands - 0.7 to 1.08 microns narrow band centered at 1.08 microns

**Calibration Accuracy** - Within 1% of full scale temperature or 10°F (6°C), whichever is greater

**Repeatability** - Within 0.3% of full scale temperature, ±1°

**Response Time at Output** - Adjustable from 10 msec to 10 seconds, depending on series (*consult Ircon factory for specifics*)

### Ambient Temperature Range

*Fiber optic sensor*

20 series 0 to 200°F (-17 to 90°C)  
60 series 50 to 130°F (10 to 55°C) \*  
OR series 30 to 130°F (0 to 55°C) \*

\* *see back page for restrictions*

*Fiber optic cable and focusable reimaging lens*

20 & OR series 0 to 400°F (0 to 200°C)  
60 series 300°F (150°C)

*Extension Tip* 0 to 575°F (0 to 300°C)

*Indicator /Processor (all series)* 30 to 125°F (0 to 50°C)

**Relative humidity** - 10 to 90% non-condensing

### Optical characteristics

*Reimaging lens focal range*

standard: 10" (250 mm) to infinity  
optional: 6 to 10" (150 to 250 mm)

*Optical Resolution*

D/30, D/60, D/30 x D/150 per model selection

*Extension Tip*

Focal range - fixed focus  
Optical resolution D/3

### Analog Outputs

0 to 10 Vdc non-isolated (3 mA max.)

4 to 20 mA or 0 to 20 mA non-isolated (500 ohm load max)

50 Vdc maximum differential between ground and optional isolated outputs

### Emissivity Control Range

0.1 to 1.0 adjustable (*consult Ircon factory for specific model restrictions on emissivity*)

### E-slope Adjustment (*OR series only*)

0.85 to 1.15 adjustable e-slope with greybody switch position

### Signal Reduction Range (*OR series only*)

(*caused by low emissivity, non-resolved or obliterated target*)  
Above 1500°F (800°C) will tolerate approximately 95% reduction in radiation intensity

### Invalid Alarm (*OR series only*)

Relay contact ratings - 1A at 24 Vdc; 0.5A at 120 Vac, non-inductive load

### Power Requirements

100, 115, 200 or 230 Vac, plus/minus 10%, 50/60 Hz

### Weight

*sensor* - 7 to 8 lbs (3.2 to 3.6 kg)

*indicator / processor* - under 7 lbs. (under 3.2 kg)

### Construction

Sensor: NEMA 4 (IP66)

Indicator/Processor - NEMA 12K (IP 52)

## Fiber Optic Model Ordering Information

A B C D E F G H  
MR - 2010 - 13C - 1 - 2 / 0 - 1 - 0

### Determining the Model Number

Ex: Model MR-ORF4-25F1-2/0-1-2

This is an OR Fiber Optic series (ORF) model; with an extension tip and a 3 ft. fiber optic cable operating in a temperature span of 1300 to 2500°F with a peak picker 0-20 mAdc, 0-10 Vdc output non-isolated, 115 Vac input with a 2-point on/off controller; and German language operating instructions.

**Block A:** Mirage System identification

**Block B:** First 2 digits = MR series (20, 60 or OR)  
Last 2 digits = Fiber Optic options

**Block C:** Temperature range (degree F or C)

**Block D:** Signal conditioning options (peak picker with decay rate)

**Block E:** Output type (Isolated or non-isolated mAdc and Vdc)

**Block F:** Input power (Vac plus/minus %)

**Block G:** Control (two point on/off or none)

**Block H:** Language (English, French or German)

# Mirage Fiber Optic System

## Model Ordering Information (cont'd)

### Block B and C Sensor series, fiber optic options and temperature ranges

Fiber Optic Options			F1	F2	F3	F4	F5	F6	F7	F8
Fiber length			3 ft	3 ft	3 ft	3 ft	10 ft	10 ft	10 ft	10 ft
Focusable Spot Size			D/30	D/60	D/30 x D/150	-----	D/30	D/60	D/30 x D/150	-----
Other			--	--	----	Ext. tip	--	--	----	Ext. tip
<b>B</b>	<b>C</b>	<b>Temperature Range</b>								
<b>20 Series (0.70 to 1.08 microns)</b>										
20□□	22F	1300 to 2200F° *	•			•	•			•
20□□	25F	1500 to 2500F°	•			•	•			•
20□□	32F	1800 to 3200F°		•	•			•	•	
20□□	40F	2000 to 4000F°		•	•			•	•	
20□□	50F	2500 to 5000F°		•	•			•	•	
20□□	11C	700 to 1100C° *	•			•	•			•
20□□	13C	800 to 1300C°	•			•	•			•
20□□	16C	900 to 1600C°		•	•			•	•	
20□□	20C	1100 to 2000C°		•	•			•	•	
Note: * Models are restricted to sensor ambient of 0 to 150°F (-17 to 65°C) with a minimum emissivity setting of 0.3										
<b>60 Series (2.0 to 2.25 microns)</b>										
60□□	07F	350 to 700F° *		•		•				
60□□	09F	400 to 900F°		•		•				
60□□	10F	500 to 1000F°		•		•				
60□□	14F	600 to 1400F°		•		•				
60□□	04C	180 to 400C° *		•		•				
60□□	06C	250 to 600C°		•		•				
60□□	08C	350 to 800C°		•		•				
Note: * Models are restricted to sensor ambient of 50 to 113°F (10 to 45°C) with a minimum emissivity setting of 0.4 and minimum response time of 1.0 sec. The fiber optic cable and focusable reimaging lens of all 60 series models are restricted to an ambient range of 0 to 300°F (0 to 150°C)										
<b>OR Series (0.70 to 1.08 microns)</b>										
OR□□	25F	1300 to 2200F°	•			•	•			•
OR□□	32F	1800 to 3200F°	•			•	•			•
OR□□	40F	2000 to 6500F°	•			•	•			•
OR□□	65F	2500 to 6500F°		•	•			•	•	
OR□□	14C	700 to 1400C°	•			•	•			•
OR□□	16C	900 to 1600C°	•			•	•			•
OR□□	20C	1100 to 2000C°	•			•	•			•
OR□□	24C	900 to 2400C°		•	•			•	•	
OR□□	35C	1500 to 3500C°		•	•			•	•	

### Optical Resolution

Focusable Reimaging Lens: D/30, D/60, D/30 x D/150 per model selection

Extension Tip: D/3

Optical Resolution Formula (spot size is determined by formula)

$$d = \frac{D}{F}$$

Where d = spot size; D = Distance from lens or extension tip  
F = Optical resolution factor

Note: Consult factory for special temperature range and optical resolution of fiber length.

### Fiber Optic Accessories Availability Chart

All accessories listed below are suitable for use with the Mirage 20, 60 and OR Fiber Optic series of instruments

AA-5 Air Purge  
AAQ-1 Air Purge with Quick Disconnect  
MB-2, MB-5 angle mounting base  
SB-5 swivel mounting base  
AP-5 adapter plate  
MC-5 mounting clamp  
TM-6 heavy duty tripod  
IL-5 Illuminator  
SI-12, SI-24, SS-14 sight tubes  
Close focus lens  
Fiber Optic cable and extension tip



ISO 9001 : 2000  
Quality System  
Certified

NIST Calibration Provider



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