

# FR1

## Datasheet

### Fiber Optic Noncontact Ratio Thermometers



*Two-color FR1 model shown with optional adjustable mounting bracket*

# FR1 Highlights

- Fiber optic cable field-replaceable without blackbody recalibration (non-laser modules)
- Laser aiming available on selected models
- Provides accurate measurement of targets that: are obstructed by smoke, steam or particulates, or are either moving or smaller than the instrument's field of view
- Measures from 500°C to 2500°C (932°F to 4532°F) with three models
- Fast response time of 10 mSec
- One or two-color operation
- Simultaneous analog and digital outputs

## Alarms:

- Programmable relay output (dual-temperature setpoints or "fail-safe")
- Unique "dirty window" alarm (attenuation measurement US Patent No. 5,815,410)

## Communications:

- Bi-directional RS485 communications
- Supports up to 32 Marathon Series sensors on a multipoint network
- Windows® Marathon Support Software (operates under WIN 3.1/95/98/NT4 Windows 2000, XP)
- Field Calibration Software

Marathon FR1 fiber optic ratio thermometers consist of a rugged fiber optic cable plus optical head assembly connected to a housing. The housing contains a detector, processing electronics, internal user interface/LED display, and termination connections for field wiring. FR1 thermometers permit target measurement in harsh industrial environments that are inaccessible, very hot, or located within strong electromagnetic fields.

The optional FR1 Optical Head consists of a small stainless steel cylindrical housing capable of withstanding ambient temperatures up to 200°C (392°F) or 315°C (600°F). The Optical Head accommodates an air-purge accessory to prevent lens contamination. The fiber optic cable is protected by stainless steel metal armor.

# Specifications

## Measurement

Models	Temperature Ranges
FR1A	500°C to 1100°C (932°F to 2012°F)
FR1B	700°C to 1500°C (1292°F to 2732°F)
FR1C	1000°C to 2500°C (1832°F to 4532°F)
Detector	Si/Si-layered detector, 1 µm
Fiber Cable Lengths	1m (3'), 3m (10'), 6m (19'), and 10m (32')
Accuracy	
No attenuation	± (0.3% Tmeas +2°C); Tmeas in °C
Up to 95% attenuation	± (1% Tmeas +2°C), FR1A and FR1B
Up to 95% attenuation	± (1.3% Tmeas +2°C), FR1C
Repeatability	±1°C
Temperature Resolution	±1°C or °F
Response Time	10 mSec; averaging selectable to 10 sec
Emissivity (one-color)	0.1 to 1.0 in 0.01 increments
Slope (two-color)	0.085 to 1.150 in 0.001 increments
Signal Processing	Peak Hold, Averaging, Advanced Peak Hold

## Optical

Models	Field of View Minimum Spot Size @ Focus Distance		
	D:S*	CF1	CF2 SF0
FR1A**	20:1	5mm (0.2 in) @ 102mm (4")	15mm (0.6 in) @ 305mm (12") 83mm (3.3 in) @ 1524mm (60")
FR1B**	40:1	3mm (0.1 in) @ 102mm (4")	8mm (0.3 in) @ 305mm (12") 44mm (1.7 in) @ 1524mm (60")
FR1C	65:1	1.6mm (0.06 in) @ 102mm (4")	5mm (0.18 in) @ 305mm (12") 27mm (1.05 in) @ 1524mm (60")

\*At 90% energy

CF=close focus; SF=standard focus

\*\* Available with laser aiming

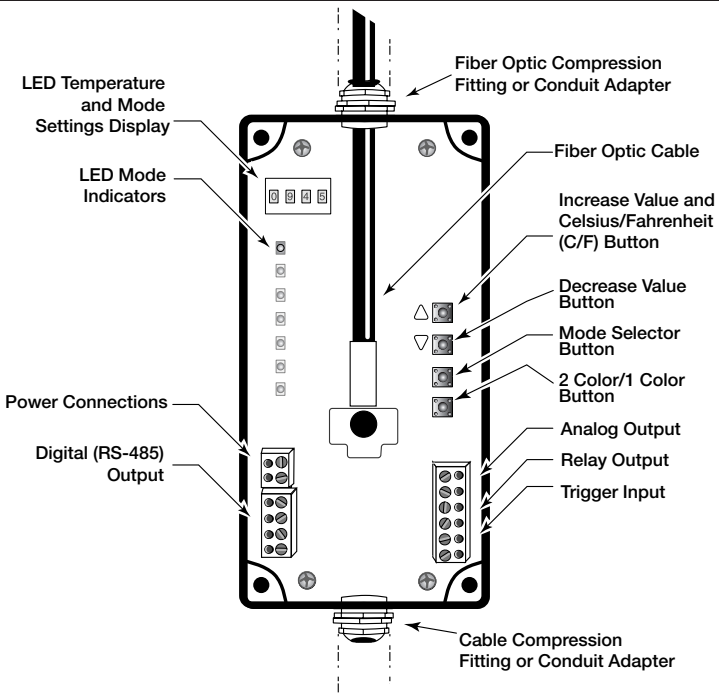
## Electrical

Outputs	0/4–20 mA; RS-485, 2-wire/4-wire, networkable to 32 sensors; Relay (SPST 48V, 300 mA, response time < 2 mSec)
Power Requirements	24 VDC, 500 mA, ±20%
Compliance	CE low voltage directive; EN 61326

## General

Environmental Rating	NEMA-4 (IEC 529, IP 65)
Ambient Temperature	
Electronics housing	0°C to 60°C (32°F to 140°F)
With water cooling option	0°C to 150°C (32°F to 300°F); 2 l (0.5 gal) per minute 16°C (62°F)
Fiber cable/Optical head	0°C to 200°C (32°F to 392°F); standard temperature rating 0°C to 315°C (32°F to 600°F); high temperature option 0.5 to 1.5 l/sec (1-3 CFM)
Air Purge	
Storage Temperature	
Electronics housing	-20°C to 70°C (-4°F to 158°F)
Relative Humidity	10% to 95% non-condensing
Shock	
(Electronics Housing)	MIL-STD-810D (IEC 68-2-27)
Vibration	
(Electronics Housing)	MIL-STD-810D (IEC 68-2-6)
Weight	
Electronics Housing	0.71 kg (25 oz)
Optical Head	0.10 kg (3 oz)
Cable protection	Rated to 200°C; stainless steel armor; Viton coating, rubber "boot", and NEMA-4 (not available on high temperature cable); provision for conduit to protect fiber cable

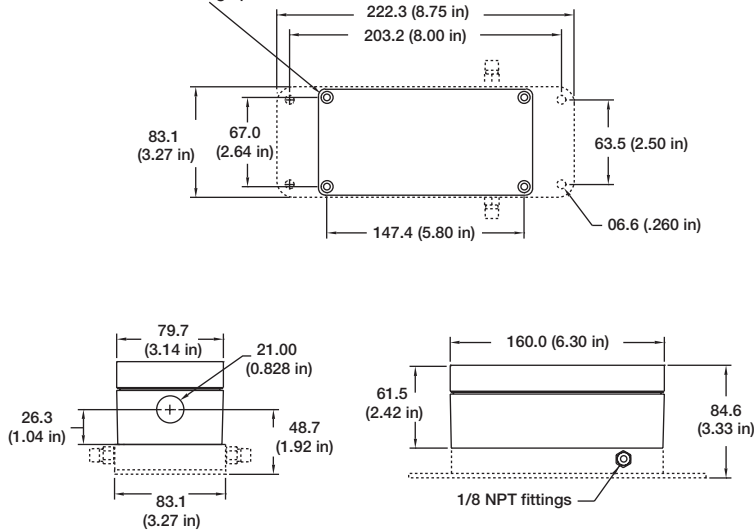
# User Interface



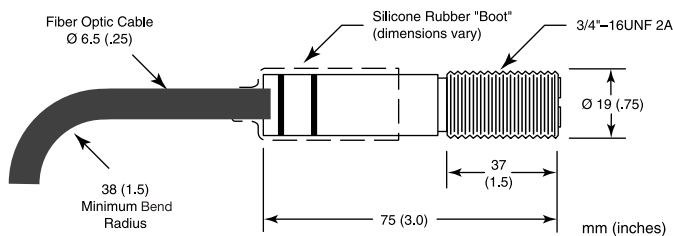
# Physical Dimensions

**Electronics Housing**  
(Cooling Platform option "W" shown as a dotted line)

Mounting hole diameter 5mm (0.188 in)  
Fastener head diameter 8mm (0.31 in) MAX  
for units without cooling option



## Optical Head



# Accessories

## Air Purge Collar

Air purge collar and stainless steel sighting-tube, 150mm (6 in) long, 25mm (1 in) diameter: (XXXFOHAPA).

## Right Angle Mirror (XXXCIACRA)

Connects to Optical Head

## NIST Calibration (2132558)

**Power Supply** (24VDC, 110/220VAC input) and Marathon Terminal Block mounted in a NEMA 4 (IP65) enclosure (RAYMAPB)

**Power Supply** 24VDC 1.1A Switching power supply with universal input (110/220V) (XXX2CDCPSS)

## Spare Marathon Terminal Block Accessory (XXXMATB)

**Spare Marathon Terminal Block in a NEMA-4 enclosure** (XXXMATBN4)

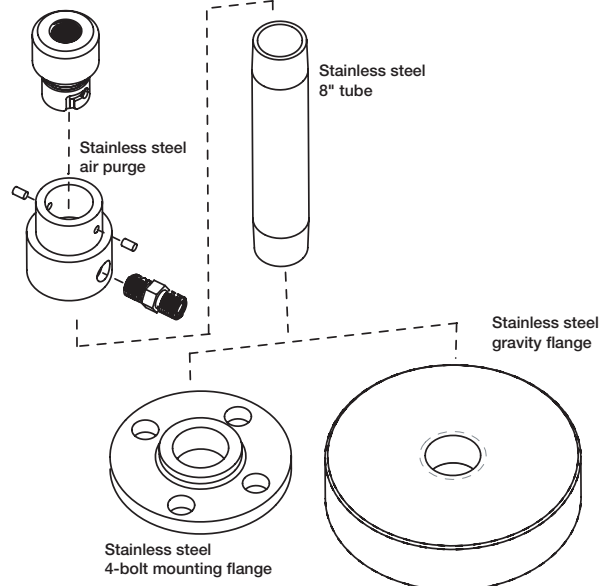
## SMART RS485/RS232 CONVERTERS

DB25 to Terminal Strip Interface Converter, recommended for direct wiring between a serial interface and the Marathon terminal block (XXX485CVT)

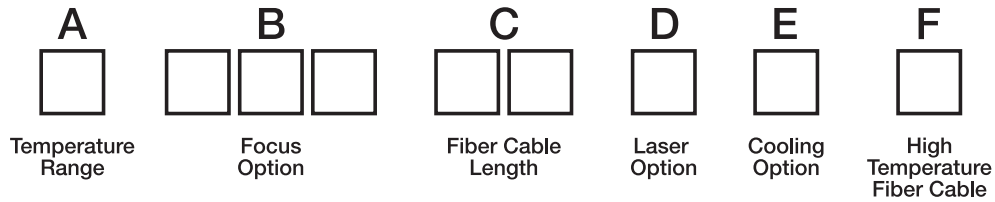
## Rooftop Mounting/Purging

Available with flange (XXXFORFMF) or gravity-held base (XXXFORFMC) with quick-release fitting for Optical Head, sapphire window, stainless steel pipe-cap or flanged mounting base.

Stainless steel quick disconnect and sapphire protective window



# RAYFR1



Model	Description
RAYFR1	Raytek Fiber-optic Ratio Thermometer
<b>Code A</b>	<b>Temperature Range</b>
A	500°C to 1100°C (932°F to 2012°F) minimum temperature specified at 50% attenuation; D:S≥ 20:1
B	700°C to 1500°C (1292°F to 2732°F) minimum temperature specified at 50% attenuation; D:S≥ 40:1
C	1000°C to 2500°C (1832°F to 4532°F) minimum temperature specified at 50% attenuation; D:S≥ 65:1
<b>Code B</b>	<b>Focus Option</b>
SF0	Standard Focus Head-focus distance: ∞
CF1	Close Focus Head-focus distance: 100mm (4 inch)
CF2	Close Focus Head-focus distance: 300mm (12 inch)
<b>Code C</b>	<b>Fiber Cable Length</b>
01	1m (≈ 3') length fiber-optic cable with connector
03	3m (≈ 10') length fiber-optic cable with connector
06	6m (≈ 19.7') length fiber-optic cable with connector
10	10m (≈ 32.8') length fiber-optic cable with connector
<b>Code D</b>	<b>Laser Aiming Option</b>
L	NOTE: Laser aiming option available only on FR1A and FR1B models
<b>Code E</b>	<b>Cooling Platform Option</b>
W	Water cooled mounting platform for FR1 housing
<b>Code F</b>	<b>High Temperature Fiber Cable</b>
H	Rated to 315°C (600°F); option excludes Viton Sheath and NEMA-4 rating
<b>Typical Model Number</b>	<b>RAYFR1BCF103LW</b>

## Raytek Automation Products: Noncontact Temperature Measurement for Industrial Applications

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