FR1
Datasheet

Fiber Optic Noncontact Ratio Thermometers

Two-color FR1 model shown with optional adjustable mounting bracket

Raytek ®
A Fluke Company

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	D:S*	Field of View Minimum Spot Size @ Focus Distance 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
** Available with laser aiming
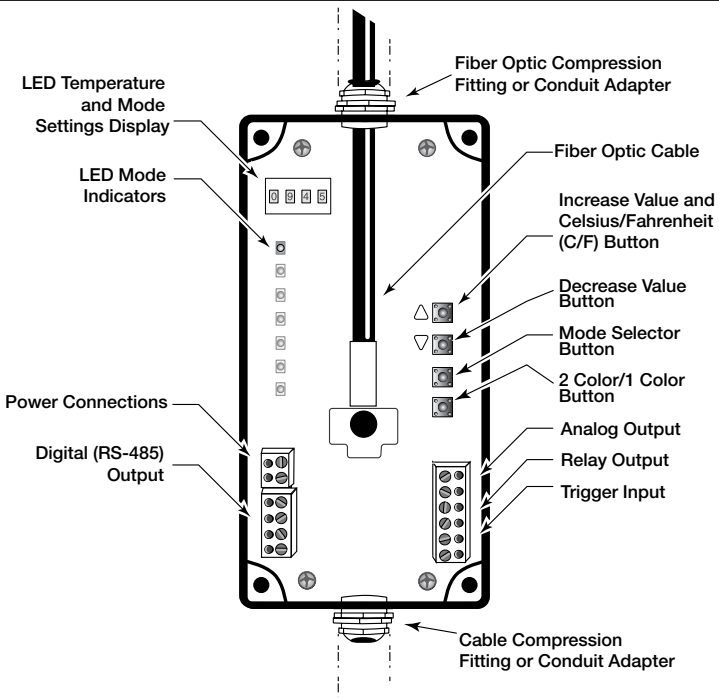CF=close focus; SF=standard focus

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
Air Purge	0.5 to 1.5 l/sec (1-3 CFM)

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)

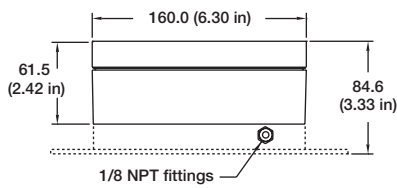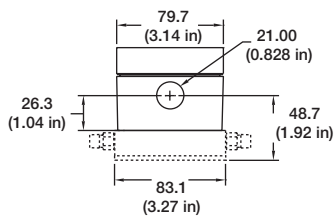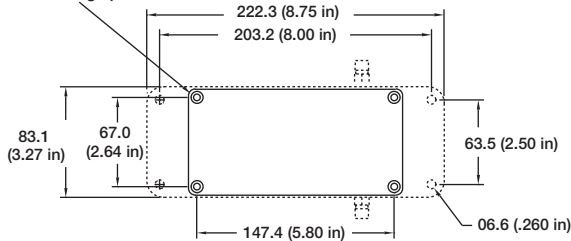| Cable protection	Rated to 200°C; stainless steel armor; Viton coating, rubber "boot", and NEMA-4 (not available on high temperature cable); provision for conduit to protect fiber cable

User Interface

- LED Temperature and Mode Settings Display
- LED Mode Indicators
- Power Connections
- Digital (RS-485) Output
- Fiber Optic Compression Fitting or Conduit Adapter
- Fiber Optic Cable
- Increase Value and Celsius/Fahrenheit (C/F) Button
- Decrease Value Button
- Mode Selector Button
- 2 Color/1 Color Button
- Analog Output
- Relay Output
- Trigger Input
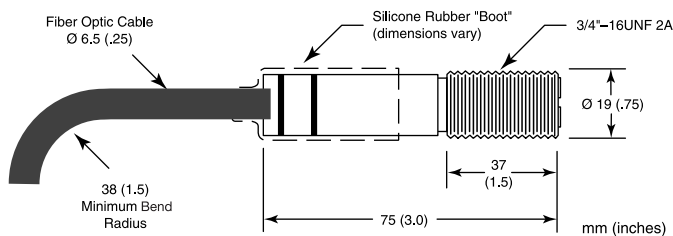- Cable Compression Fitting or Conduit Adapter

Physical Dimensions

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

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

- 222.3 (8.75 in)
- 203.2 (8.00 in)
- 83.1 (3.27 in)
- 67.0 (2.64 in)
- 63.5 (2.50 in)
- 147.4 (5.80 in)
- 06.6 (.260 in)

- 79.7 (3.14 in)
- 21.00 (0.828 in)
- 26.3 (1.04 in)
- 48.7 (1.92 in)
- 83.1 (3.27 in)

- 160.0 (6.30 in)
- 61.5 (2.42 in)
- 84.6 (3.33 in)
- 1/8 NPT fittings

Optical Head

- Fiber Optic Cable Ø 6.5 (.25)
- Silicone Rubber "Boot" (dimensions vary)
- 3/4"–16UNF 2A
- Ø 19 (.75)
- 37 (1.5)
- 38 (1.5) Minimum Bend Radius
- 75 (3.0)
- mm (inches)

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)
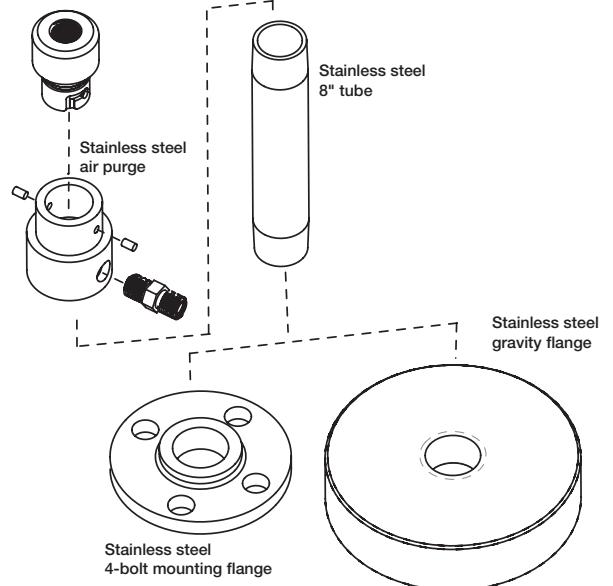
SMART RS485/RS232 CONVERTERS
DB25 to Terminal Strip Interface Converter, recommended for direct wiring between a serial interface and the Marathon terminal block **(XXX485CVT)**
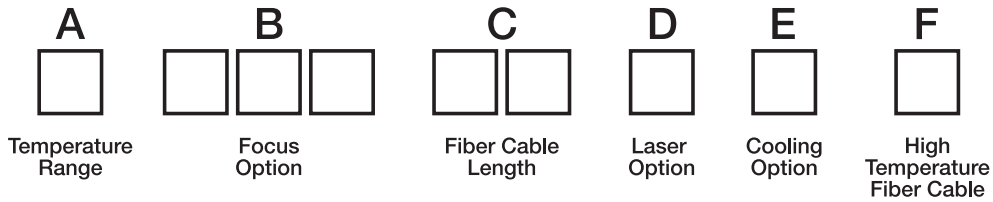
Rooftop Mounting/Purging
Available with flange **(XXXFORFMF)** or gravity-held base **(XXXFORFMC)** with quick-release fitting for Optical Head, sapphire window, stainless steel pipe-cap or flanged mounting base.

- Stainless steel quick disconnect and sapphire protective window
- Stainless steel 8" tube
- Stainless steel air purge
- Stainless steel gravity flange
- Stainless steel 4-bolt mounting flange

RAYFR1

A	B		C		D	E	F
Temperature Range	Focus Option		Fiber Cable Length		Laser Option	Cooling Option	High Temperature Fiber Cable

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

Raytek Automation Products: Noncontact Temperature Measurement for Industrial Applications

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CAUTION
LASER RADIATION – DO
NOT STARE INTO RATIO BEAM
OUTPUT < 1mW
WAVELENGTH 635 nm
CLASS II LASER PRODUCT

Raytek is an ISO 9001 certified company