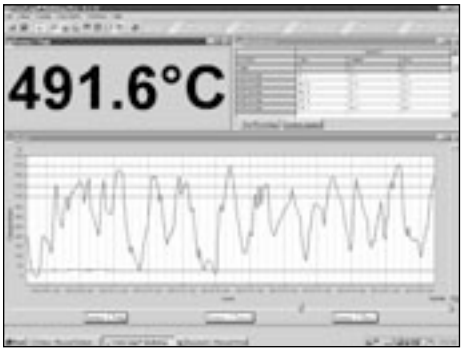
FR1
Datasheet

Fiber-Optic Ratio Thermometers



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 (some models)
- Provides accurate measurement of targets that are: obstructed by smoke, steam, or particulates, moving, smaller than the instrument field of view.
- Measures from 500ºC to 2500°C (932ºF to 4532°F) with three models
- Fast response time down to 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 FiberOptic 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 FR1 Optical Head consists of a small stainless steel cylindrical housing capable of withstanding ambient temperatures up to 200°C (392°F) or 315ºC (600ºF) (optional). 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	500ºC to 1100°C (932ºF to 2012°F)
FR1B	700ºC to 1500°C (1292ºF to 2732°F)
FR1C	1000ºC to 2500°C (1832ºF to 4532°F)
Detector	Si/Si-layered detector, 1 µm
Fiber Cable Lengths	1m (3'), 3m (10'), 6m (19'), and 10m (32'); consult factory for other lengths.
Accuracy	
No attenuation	± (0.3% Tmeas +2°C); Tmeas in ºC
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

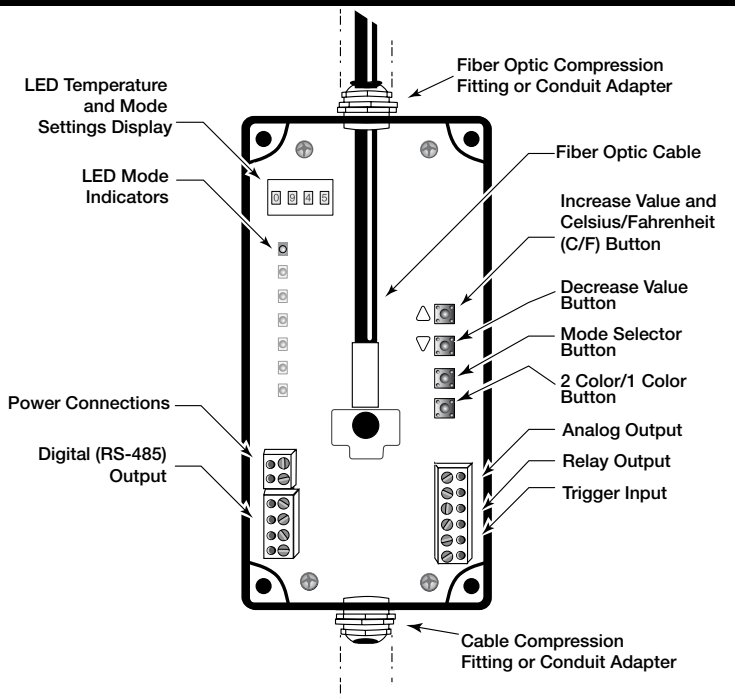
Electrical

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

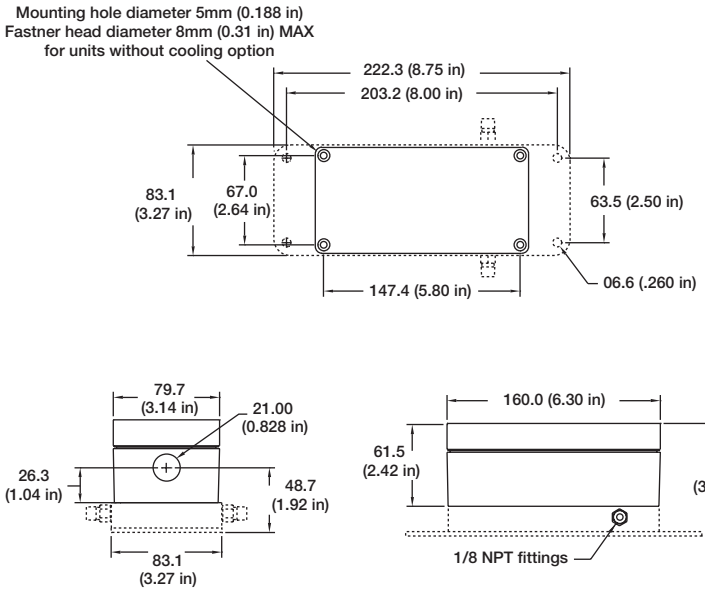
Environmental Rating	NEMA-4 (IEC 529, IP 65)
Ambient Temperature	
Electronics housing	0ºC to 60°C (32ºF to 140°F)
With water cooling option	0ºC to 150ºC (32ºF to 300ºF); 2 l (0.5 gal) per minute 16ºC (62ºF)
Fiber cable/Optical head	0ºC to 200°C (32ºF to 392°F); standard temperature rating 0ºC to 315ºC (32ºF to 600ºF); high temperature option
Air Purge	0.5 to 1.5 l/sec (1-3 CFM)
Storage Temperature	
Electronics housing	-20ºC to 70°C (-4ºF 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

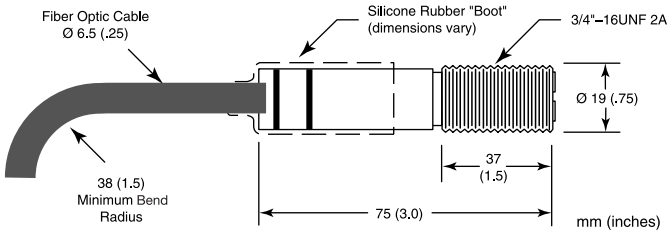


Physical Dimensions

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



Optical Head



Accessories

Fiber-Optic Accessory Kit (XXXMFAK)
Adjustable mounting bracket, EMT conduit fitting for electronics housing, and rubber gland to seal fiber-cable at enclosure.

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.

Sighting Tube Conduit Accessory (XXXFOSTCA)
Length: 300mm (12 in); Diameter: 32mm (1.25 in) with connection to standard electrical conduit.

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.

NIST Calibration Certification XXXFRCERT

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)

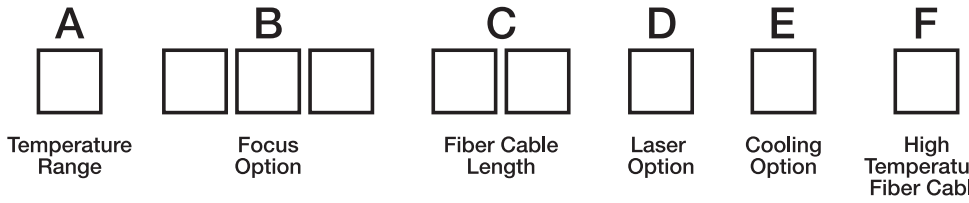
Spare Marathon Terminal Block in a NEMA-4 enclosure (XXXMATBN4)

SMART RS485/RS232 CONVERTERS
DB25 to Terminal Strip Interface Converter, recommended for direct wiring between a serial interface and the Marathon terminal block **(XXX485CVT)**

TEFLON 12-CONDUCTOR CABLE (XXXHTCB ☐☐)
High temperature (200ºC rated), 12-conductor Teflon jacketed cable suitable for providing connections to all inputs/outputs of the FR/FA electronics. The cable is cut to specified lengths. One end of the 12-conductor cable has its wires stripped and prepared for termination into the FR/FA terminal strip.
☐☐ Cable length (in meters) = 1,3,5,10,15,20,...,60

PVC 4-CONDUCTOR CABLE (XXXLTCB ☐☐)
For installations requiring only 24VDC and 0/4-20mA output, 4-conductor PVC wiring cables (2 twisted pairs; each pair shielded) provides connection to 24VDC power, ground, and the +mA and -mA output of the FR/FA electronics. Nominal temperature rating is -20ºC to 60ºC. the cable is cut to specified lengths (see below). One cable end has wires stripped and prepared for termination into the FR/FA terminal strip. ☐☐ Cable length (in meters) = 1,3,5,10,15,20,...,60

RAYFR1



Model	Description
RAYFR1	Raytek Fiber-optic Ratio Thermometer
Code A	**Temperature Range**
A	500ºC to 1100ºC (932ºF to 2012°F) minimum temperature specified at 50% attenuation; D:S≥ 20:1
B	700ºC to 1500ºC (1292ºF to 2732°F) minimum temperature specified at 50% attenuation; D:S≥ 40:1
C	1000ºC to 2500ºC (1832ºF 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

Raytek Corporation
Worldwide Headquarters
1201 Shaffer Rd. PO Box 1820
Santa Cruz, CA 95061-1820 USA
Tel: 1 800 866 5478
1 831 458 1110
Fax: 1 831 458 1239
solutions@raytek.com

www.raytek.com
for up-to-the-minute features

To find a Raytek office near you please visit www.raytek.com

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