

Model PRT-5

PRECISION RADIATION THERMOMETER



ACCURATE, HIGHLY SENSITIVE TEMPERATURE MEASUREMENTS OF EXTENDED AREAS FROM -50°C TO +150°C

APPLICATIONS

- Ground Truth Measurements
- Thermal Mapping of Ground Targets
- Pollution Site Location
- Sea Surface Temperature Studies
- Airborne Scanner Calibration
- Cloud Temperature Measurement
- Water Evaporation Studies
- Air Temperature Measurement
- Thermal Studies of Agricultural Areas
- Forest Fire Detection

FEATURES

- Better than 0.1°C Sensitivity at All Temperatures
- Absolute Accuracy of $\pm 0.5^\circ\text{C}$
- Rugged Construction
- Special Versions for Narrow Band Measurements
- Powered by Rechargeable Batteries
Optional: AC 115/230, 28 vdc
- .14°, 2° or 20° Field of View

DESCRIPTION

The Model PRT-5 Precision Radiation Thermometer is a battery-powered, infrared radiometer. Extremely versatile, this instrument makes highly sensitive, non-contact temperature measurements in any selected range between -50°C and 150°C.

The PRT-5 can be employed from aircraft, land vehicles, ships or other platforms. It is completely portable, requires no set-up time, and does not depend upon external power.

Typical targets for the PRT-5 are sea surface, clouds, sky background, terrain and similar large-area subjects that are difficult or impossible to measure by conventional methods.

The PRT-5 consists of a 3.5 pound optical head and a rack-mounted, solid-state electronic control unit. The optical head may be hand-held, by means of a pistol grip attachment, or tripod mounted. It is linked to the electronic control unit by an 8-foot interconnecting cable. When not in use, the optical head is stored in a rugged, protective carrying case, which also contains the control unit and all cables.

The standard PRT-5 has a 2-degree field of view, a spectral range of 8 to 14 microns, and a three-range, overlapping temperature scale graduated in degrees C or F which covers:

-20°C to +15°C		-10°F to +60°F
+10°C to +45°C	or	+50°F to +120°F
+40°C to +75°C		+110°F to +180°F

This instrument provides a target spot size of 35 feet at typical working distance of 1,000 feet. With all versions of the PRT-5, measurements are independent of distance as long as the target fills the instrument's field of view.



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TECHNOLOGY

The PRT-5 utilizes a high-performance, immersed thermistor detector located in its optical head to sense target temperature. Because of the sensitivity of this infrared detector, the PRT-5 can sense thermal differences as small as 0.1°C over its entire temperature range.

Absolute system accuracy of $\pm 0.5^\circ\text{C}$ is achieved by precisely controlling (to within 0.1°C) the temperature of a heated, in-line reference cavity within the PRT-5's optical head. This cavity is closed at one end by the infrared detector and sealed at the other by the spectral module. A rotating chopper outside the cavity interrupts the incoming radiation and allows the detector to "see" alternately, the incoming radiation and the known, reflected radiation, from the internal reference cavity. The difference between known and incoming radiation is converted by the detector into an electrical signal related to target temperature. This electrical signal is displayed on a panel readout located on the electronic control unit. Signal display may be in degrees Centigrade, Fahrenheit, or in the corresponding value of target radiance or irradiance, as specified.

High and low level electrical outputs are available on the PRT-5's electronic unit. These signals can be used to drive two recorders simultaneously.

The PRT-5 also offers three selectable response times (bandwidths)—5 msec. (30 Hz), 50 msec. (3.0 Hz), and 500 msec. (0.3 Hz).

Power for the PRT-5 is supplied by rechargeable, nickel-cadmium batteries. Charging is from a built-in converter which can be operated from any 115 or 230 volt a.c. source (50 to 400 Hz). A panel meter on the PRT-5's electronic unit displays the charge state of the batteries, and, as a second function, also indicates when the internal reference cavity is up to temperature for normal operation.

For high reliability, the PRT-5's design and construction are compatible with MIL environmental specifications for airborne electronic equipment.

SPECIAL VERSIONS

Narrow Band Measurement: The PRT-5 is inherently highly sensitive and, thus, may be modified to permit the operator to utilize a narrow wavelength region for special measurement programs.

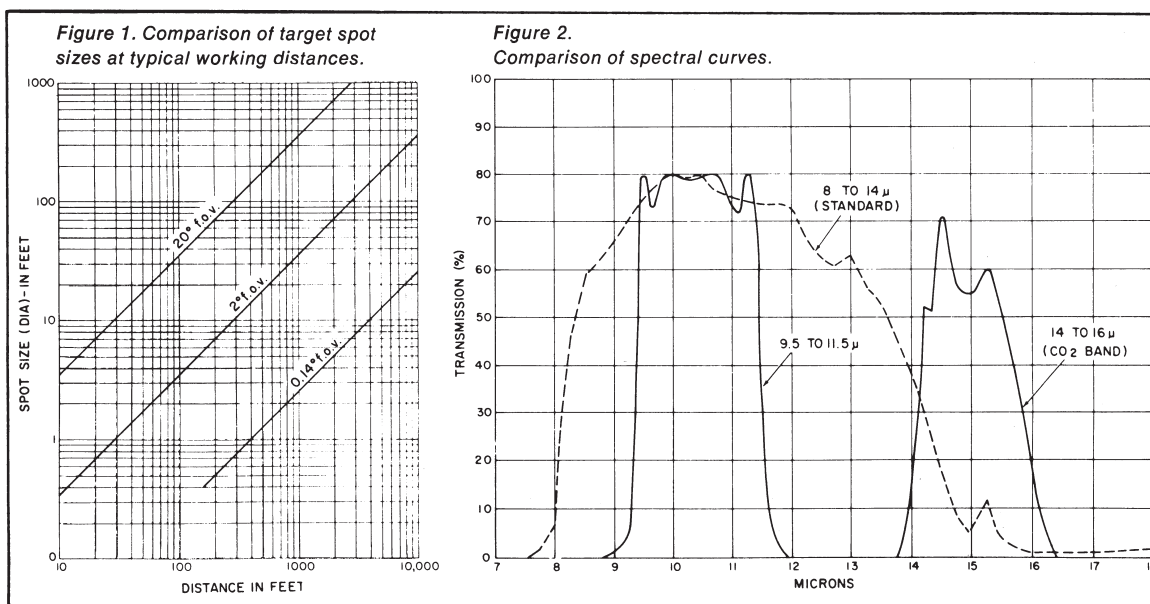
9.5 to 11.5 microns – For airborne (long path) measurements of sea and land surfaces, a spectral module that restricts the PRT-5 to narrow band operation in the 9.5 to 11.5 micron region is recommended. This module serves to substantially reduce errors, which are normally induced by atmospheric absorption, emission and reflectivity. With this modification, such errors are reduced to less than 0.5°C up to an altitude of approximately 1,000 feet.

14 to 16 microns – The PRT-5 can also be converted for the measurement of free air temperature. This conversion requires a special spectral module which restricts the instrument's bandpass to the 14 to 16 micron CO₂ absorption band—the wavelength region where air becomes opaque in a relatively short path

Typically, this version of the PRT-5 has a sensitivity of 0.25°C (at e Hz) and is supplied with a meter scale for air temperature from -50°C to +30°C, or alternately, from -40°C to +15°C. Factory installation of this module is recommended.

Linearized Recorder Output: Both the standard (8 to 14 micron) PRT-5 and the narrow band (9.6 to 11.5 micron) PRT-5 are available with linearized recorder outputs and a special, three-range, meter scale with covers.

-30°C to +10°C
-10°C to +40°C
+20°C to +80°C

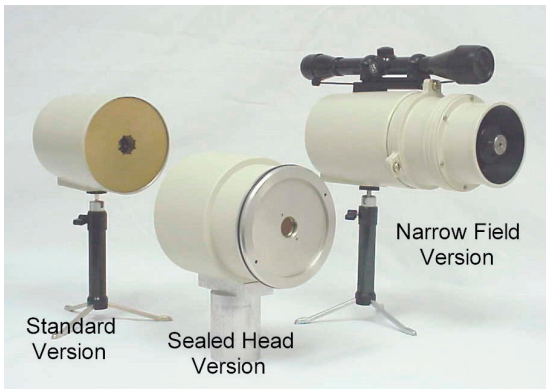


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Specifications¹

Average Measurements of Large Areas: As an option, the standard PRT-5 can be converted to a wide-field instrument by equipping it with a 20-degree field of view. In this configuration, it provides a target spot of 350 feet at 1,000 feet.

Detailed Studies of Small Areas at Long Distances: This version of the PRT-5 is supplied only with a narrow field of view. A factory modification, accomplished at time of original order, is required. This modification adds a 4-inch Cassegrain optical system to the front of the standard PRT-5's optical head. This reduces the instrument's field of view to 0.14-degree and results in a typical target spot of 2.5 feet at 1,000 feet. Minimum working distance is 160 feet.



ACCESSORIES

Unless otherwise noted, all versions of the PRT-5 can be equipped with the following, off-the-shelf accessories which extend their usefulness:

- Sealed Optical Head
Both standard and wide-field PRT-5s are available with sealed optical heads, which permit instrument operation at high altitudes, in adverse weather, or under vacuum conditions (10^{-3} torr).
- Custom Length Cables
- Continuous AC Line Power Supply
- Linearized Recorder Output
- Tripod (Model TR-8B)
- 6X Sighting Telescope (2° F.O.V.)
- Precision Laboratory Calibrator
- Precision Airborne Calibration System

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PERFORMANCE ²	
Maximum Temperature Range ³	-50°C to +150°C
Standard Temperature Scales	-20°C to +75°C
or	-10°F to +180°F
Optional Irradiance Scale	4.0 to 17.0 μ watts/cm ²
Optional Radiance Scale	2.0 to 8.5 mw/cm ² Steradian
Absolute Accuracy:	
Temperature	$\pm 0.5^\circ\text{C}$
Irradiance	$\pm 0.04 \mu$ watts/cm ²
Radiance	+0.02 mw/cm ² Steradian
Temperature Sensitivity: ⁴	
Above 0°C	.05°C
Below 0°C	.10°C
Response Time	5 milliseconds (30 Hz)
	50 milliseconds (3 Hz)
	500 milliseconds (0.3 Hz)
Ambient Temperature Limits	-20°C to +40°C
OPTICAL DATA	
Detector:	
Type	Immersed Thermistor Bolometer
Flake Size	.05 x .05 mm
Field of View ⁵	.14°, 2° or 20°
Spectral Bandpass	8 to 14 μ (Standard instrument)
Target Range ⁶	One foot to infinity
ELECTRICAL DATA	
Battery Recharge	115 or 230 volts, 50-400 Hz
	Single phase, 20 watts
Standard Recorder Outputs	1 v.d.c. at 10K ohms impedance
	50 m.v.d.c. at 500 ohms impedance
Optional Linearized Recorder Outputs	5 v.d.c. at 10K ohms impedance
	250 m.v.d.c. at 500 ohms impedance
MECHANICAL DATA	
Optical Head:	
Size ⁷	5.25" (D) x 6.75" (L)
Weight	4.25 lbs.
Rack-Mounted Electronic Unit:	
Size	19" (L) x 5.25" (H) x 10" (D)
Weight	24 lbs.
Rugged Carrying Case:	
Size	22" (L) x 9.75" (H) x 23" (D)
Weight	34 lbs.

NOTES

1. These applications are typical of units currently manufactured. Please request confirmation of any critical specifications at time of purchase.
2. The performance specifications are applicable in the ambient temperature range between -20°C and +40°C.
3. Any non-standard temperature scale, falling within the PRT-5's maximum range, is available at extra cost.
4. The NET (RMS Noise Equivalent Temperature) is .005°C at the recorder input. This is measured in a 3 Hz bandwidth using a 25°C target.
5. 2° or 20° field of view is standard. Field of view must be specified at time of purchase.
6. Target must fill the field of view.
7. The narrow-field version of the PRT-5 is 10 inches in length.