D-Series Handheld IR Scanners

TM

Microscanner

D-Series

The Only *Certified Accurate* Surface Temperature Instruments in the World

D501 and D501-RS

A MUST FOR
ISO 9001
ISO 9002
ISO 9003
TRACEABILITY PROGRAMS

Common Surface Temperature Measurement Errors	Microscanner D-Series IR Thermometers	Conventional IR "Point and Shoot" guns and probes, including laser aimed units	Conventional contact probes, thermocouples, RTDs, thermistors
1 Pre-set Emissivity errors?	no effect	very sensitive	no effect
2 Emissivity shift errors?	no effect	very sensitive	no effect
3 User adjustment errors?	no effect	very sensitive	no effect
4 Background reflection errors?	no effect	very sensitive	no effect
5 Contact errors?	no effect	no effect	very sensitive
6 Friction heating errors?	no effect	no effect	very sensitive
7 Heat sinking errors?	no effect	no effect	very sensitive
8 Time based errors?	no effect	no effect	very sensitive

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Clearwater Tech - Phone: 800.894.0412 - Fax: 208.368.0415 - Web: www.clrwtr.com - Email: info@clrwtr.com

D-Series Handheld IR Scanners

The D-Series is an entirely different type of instrument than conventional temperature measuring devices. Designed specifically for the highest possible accuracy, it is the only infrared instrument which can be certified as to NIST-tracable accuracy on real surfaces of unknown emissivity, while completely free of contact errors and heat sinking errors of contact devices.

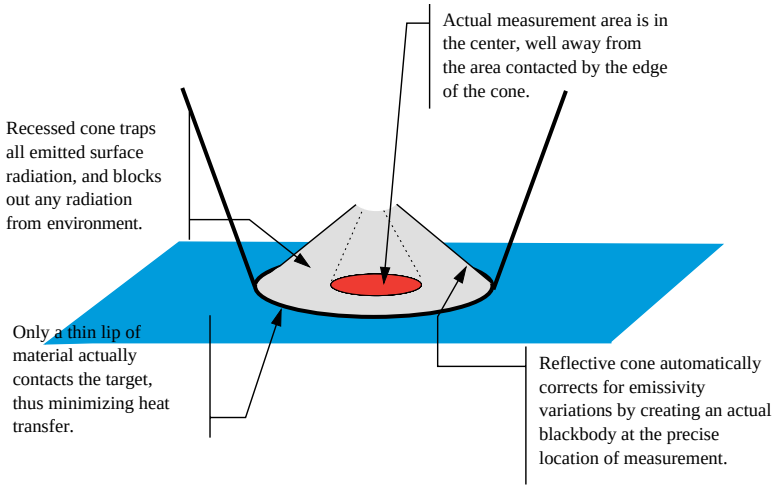


Figure 1. Unique Automatic Emissivity Compensation System (AECS) produces accurate temperatures everywhere the infrared probe is placed, by creating its own blackbody.

1. Emissivity errors

The true emissivity of a surface is known only approximately. Conventional IR devices without Exergen's Automatic Emissivity Compensation System can only display an approximate temperature over their entire temperature range.

The "accuracy" specifications given by most manufacturers are only for a "black body" calibration and do not hold outside laboratory conditions. Black body calibrations do not include emissivity shifts, ambient change effects on the target, and other phenomena that introduce significant errors.

Effect of Emissivity on Temperature Reading for a 500°F (260°C) Target in 70°F (21°C) ambient

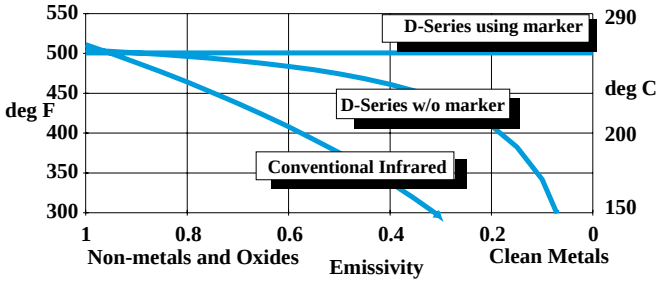
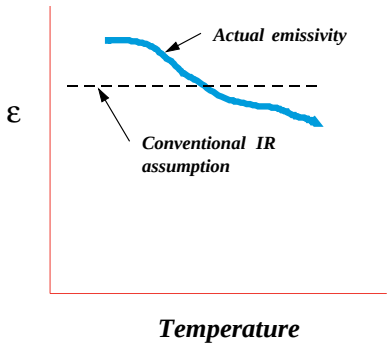


Figure 2. D-Series is accurate over a wide emissivity range, sufficient to include all non-metals. If a marker (or any other non-metal coating) is used, the D-series is accurate on clean metals as well. Conventional IR devices have considerable inaccuracy.

2. Emissivity shift errors

Even if an IR "gun" is set to the correct emissivity to read a surface accurately at a particular temperature, it does not mean that the IR "gun" will read the same target correctly at other temperatures. Emissivity of virtually all surfaces changes with temperature. A common assumption for conventional IR thermometry is that emissivity is constant with changes in target surface temperature. Real materials do not have this characteristic.



3. User adjustment errors

A setting of emissivity = 0.9 on an IR “gun” from one manufacturer will not necessarily match that of another IR “gun” from another manufacturer. There are no standards set in the industry on the precise measurement and meaning of “emissivity”.

Also, Quality Assurance programs should not rely upon any instrument that allows users to alter the instrument settings and to let it display whatever the user wishes.

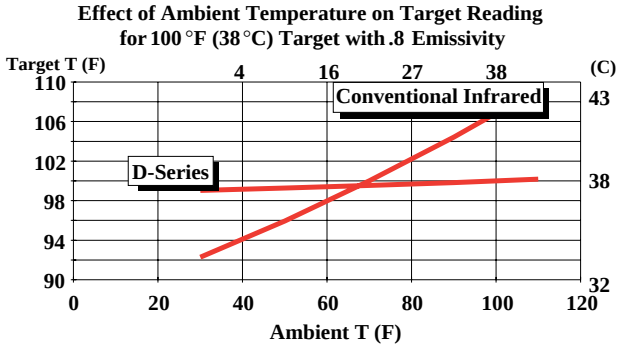


Figure 3. D-Series remains accurate even if the ambient temperature varies, while conventional IR devices have considerable inaccuracies.

4. Background reflection errors

Even if emissivity is constant (see #2), there are still errors induced by changing ambient temperatures. For example, with emissivity = 0.9, ambient reflections account for 10% of the signal that the IR “gun” will see. If ambient changes, the IR “gun” will display a different target temperature, even if the target remains at the same temperature.

5. Contact errors

Thermocouples, RTDs, thermistors and other contact devices only measure their own temperature. They do not measure surface temperature. Published “Accuracy” specifications are for the probes only, not the surfaces they must measure. Users must guarantee that the probes are brought to the same temperature as the surface. Can you guarantee that your probes are brought to the same temperature as the targets to be measured?

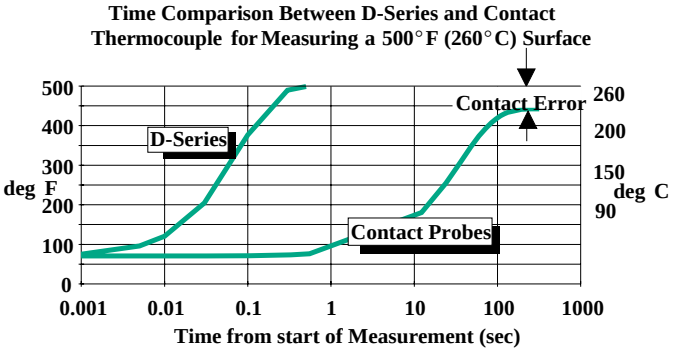


Figure 4. D-Series measures surface temperature in a fraction of a second, while contact probes (thermocouples, RTD’s, thermistors, etc.) require many minutes to acheive equilibrium. Contact probes always have a residual error due to imperfect heat transfer from the surface to probe.

6. Friction heating errors

For moving surfaces, a contact probe is prone to frictional heating. The size of the error is dependent on the roughness of the surface, the speed, the coating on the probe, and so on. It is impossible to control all the variables.

7. Heat sinking errors

For most non-metals, heat sinking errors can be quite large. The heat transfer rate of the metal leads required on “contact probes” conducts heat faster than the target material can replace, resulting in unknown and fairly large errors. In general, the less dense the target material, the larger the heat sinking error with a contact probe.

8. Time based errors

Contact temperature probes are slow. The temperature of a target can change more quickly than most probes, resulting in errors in real time measurement.

D-Series Handheld IR Scanners

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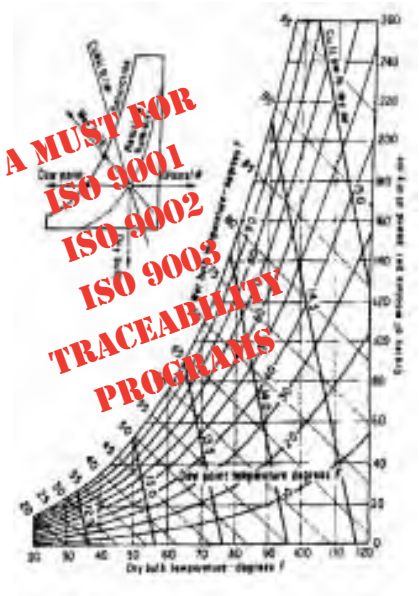
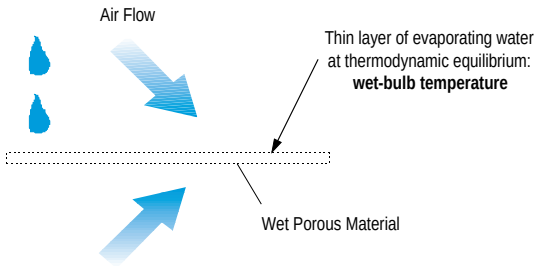
Infrared Psychrometry with the Microscanner D-Series:

Measure Relative Humidity to Certified Accuracy ±0.5% RH

Psychrometrics, the science of measurement and control of moisture in air, is based entirely on thermodynamics of air and water: the properties and *temperature*. Relative humidity (RH) is one of the common parameters used to describe the psychrometric state of air in an environment, in an oven, or any area where moisture content can influence product quality or personnel comfort.

The accurate and reliable measurement of RH is one of the most challenging tasks in industry, and has included devices such as chilled mirrors, lithium chloride cells, aluminum oxide sensors, capacitance polymer sensors, hair hygrometers, carbon hygristors, and a wide variety of technologies to meet the requirements. Calibration and certification has been even more difficult, due to the fact that most humidity measuring devices employ *indirect* methods and therefore have limited traceability.



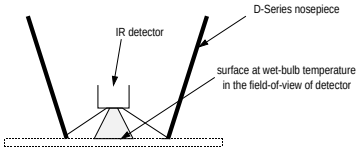


The Infrared Psychrometry method with the D-Series is a direct application of the thermodynamics and mathematics that defines humidity: the D-Series is capable of measuring the true wet-bulb temperature accurately, and with the dry-bulb temperature, the RH can be computed to a very high accuracy via standard psychrometric equations. The process is as follows:

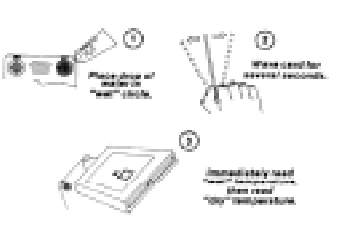
A porous material (filter paper is suitable) is wetted with water (purity is not important), and air from the environment flows across the surface to bring the surface to thermodynamic equilibrium with the air, i.e. to the lowest possible temperature produced by the evaporating water, which is the wet-bulb temperature.

D-Series Handheld IR Scanners

The porous material, cooled on both sides by evaporating water, reaches wet-bulb temperature throughout the material, thus maintaining wet-bulb temperature at the surface for several seconds after the air flow stops. Since the water is opaque to infrared wavelengths, in as thin a layer as .002 in. (.05 mm), and the D-Series is able to measure the temperature with a time constant of 0.1 seconds, an accurate measurement of the wet-bulb temperature is obtained. The same procedure is employed on a non-porous material to obtain an accurate dry-bulb temperature.



With the appropriate psychrometric equations, the RH is immediately calculated. Each D-Series is equipped with, as a standard accessory, an RH Kit, which includes a convenient card with the wet and dry materials, simple RH and Dewpoint calculator, and handy tube of water.



Maximum accuracy for RH measurement is obtained with the D-Series models measuring 0.1° resolution. Though the absolute accuracy of the D-Series is not 0.1°, the RH is most sensitive to wet-bulb depression, i.e. the difference between dry-bulb and wet-bulb temperature. In its differential mode, the D-Series is accurate to 0.1°, which translates to an RH accuracy of approximately 0.5% for the normal range of RH.

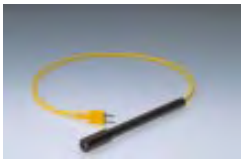
Also Manufactured by Exergen Industrial Division

IRt/c Infrared Thermocouples

Low-cost, high-quality sensors for non-contact temperature measurement and control. IRt/c sensors are used by more customers worldwide for process control, factory automation and OEM applications than any other IR device in the world. The small, easy to use IRt/c sensors require no power and connect directly to standard thermocouple devices available worldwide. Over 300 models offered, covering temperature ranges from -50 to 5000F (-45 to 2760C) with up to 0.01C precision.

For more information and pricing, please request a free copy of ***The IRt/c Book*** catalog from your local distributor, or Exergen.

Microscanner E-Series



Microscanner E-Series and IR.1Probe for Electrical Inspection

These unique handheld instruments are used by professionals for fast, accurate scanning of electrical equipment. The Microscanner Super E with a 200:1 lens, color-coded display and optional pointing laser is the fastest and most powerful pocket-sized electrical IR scanner in the world. The IR.1Probe is a low cost electrical IR scanner for use with standard digital multimeters. Contact Exergen or your local distributor for more information.

Distributed by:

PN818103 REV.3

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D-Series Handheld IR Scanners Specifications

Model	D501	D1001	D1201	D1601
Temperature Range	-50 to 550F & -45 to 287C	0 - 1000F & -18 to 540C	186 - 1207F & 86 to 653C	186 - 1600F & 86 to 871C
Relative Humidity Measurement	Kit Included	Kit Included	No	No
Emissivity Adjustment	Automatic Emissivity Compensation System			
Calibration Requirement	None			
Linearity Error	+/-1% of Reading - maximum		+/-3% maximum	
Emissivity Error	+/-1% maximum of Difference between target temperature and instrument temperature when touching, for emissivity of 0.8 to 1.0			
Repeatability	+/-0.1°F & +/-0.1°C			
Resolution	0.1°F & 0.1°C			
Display / Update	Bright LEDs at 10 times per second			
Response Time	80 msec approximately			
Field of View	1:1 (53° approximately)			
Minimum Spot Size	1/4 inch (6.4 mm) approximately			
Spectral Sensitivity	2 to 20 microns			
Analog Output*	1 Mv / OF (1mV/°C) Optional			
°F/°C Conversion	Yes	Yes	Yes	Yes
Remote Sensor**	Available on all models; standard on D1201 and 1601			
Instrument Operating Temperature	32 to 122°F (0 to 50°C)			
Battery Life	Approximately 5000 Readings from on 9V Alkaline Battery			
Dimensions	Main Case: 3 3/8 X 5 X 3/4" (8.5 X 12.5 X 2cm)			
Weight (Remote Sensor Version)	7 oz (.2 kg) approx. 9 oz (.25 kg) approx.			

Microscanner D501& D501RS

D501

D1001

D1201

D1601

*Optional Analog Output - Specify "AO" example: Microscanner D501-AO
**Remote Sensor - Specify Model "RS" example: Microscanner D501-RS

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Consult factory or distributor for special duty models with special accuracies and temperature ranges for OEM and volume applications.