INFRARED TRAINING CENTER

INFRAMATION

Infrared Training Center itc™

Volume 3, Issue 4
April, 2002

INFRAMATION CALL FOR PAPERS EXTENDED

Good news for those authors out there that needed some extra time to put that special paper together; we have extended the abstract due date for InfraMation! The new date is May 15, 2002. So don't delay!

You have the opportunity to be an active part of InfraMation 2002 as an author and presenter! We encourage you to participate by sharing your experiences with fellow and future thermographers.

We will have expanded exhibit areas and more of the very popular IR clinics. See the latest FLIR Systems cameras including the new E and P series cameras. InfraMation 2002 will be in Orlando, September 29 through October 2, 2002.

ABSTRACT DUE DATE: **MAY 15, 2002**

Notification of acceptance will be made by June 15, 2002

Abstracts must include:

- Author listing (principal author first)
- Abstract text (approximately 250 words)
- Brief principal author biography

MANUSCRIPT DUE DATE: **JULY 26, 2002**

SEND ABSTRACTS TO:

Infrared Training Center
16 Esquire Rd.
North Billerica, MA 01862
Attn: InfraMation 2002 Abstracts

abstracts@inframation.org◆

Inside this issue:

EMISSIVITY: THE COMMON PROBLEM FOR ALL THERMOGRAPHERS

By Roberto Rinaldi, ITC Italy

One of the most common questions asked by new thermographers is how to measure emissivity. Often there is a misunderstanding of emissivity and T_{amb} concepts, with obvious error on the measurement accuracy.

Other emissivity questions are related to measurements on metals such as:

- What is the emissivity for Aluminum, Copper or Iron, I found a table which is too wide? (surface condition and finish problem)
- I cannot get a proper thermal scale even though I am using the right emissivity value (0.25) for aluminium? (specific emissivity for measurement function not used or wrong T_{amb})
- I have a thermocouple on the component but the camera is reading far away from that value, why? (wrong T_{amb})

Definition

Emissivity (ε) is the ratio of the radiation emitted by a Blackbody (i.e. the camera calibration source) at certain temperature and the radiation emitted by the object under analysis at the same temperature.

Explanation

In simple words, it is the factor explaining how well an object radiates infrared energy; good radiators (i.e. objects easily seen by the camera) have an ε closer to 1. On the contrary, poor radiators (i.e. objects not easily seen by the camera) have an ε close to 0.

Emissivity depends on several factors. Here are several listed in their order of importance:

- Type of material
- Surface material finish (polished or oxidized)
- Surface geometry (cavity effect for instance)

Emissivity can also change for other reasons, but this is a less common measurement situation:

- Material temperature level
- Wavelength (IR short wave or long

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EMISSIVITY (CONTD.)

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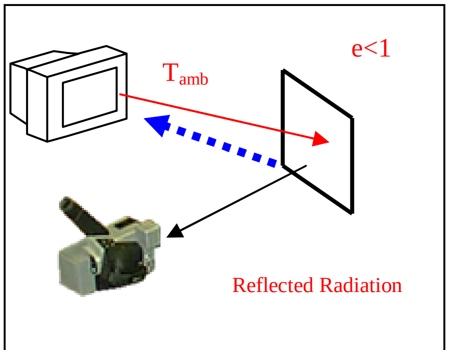
wave)

What exactly is T_{amb}?

An opaque object with a low emissivity value is a poor radiator but good reflector. This is the reason why it is so important to determine a correct T_{amb}. In all FLIR products there is a T_{amb} factor to input that is unfortunately misunderstood by the operators as a real temperature where the object or the camera are placed, or the room temperature as well. A better name for T_{amb} would be "Reflected apparent temperature". This is the apparent temperature of surfaces radiating to and reflecting off of the object under analysis, based on the camera recording position.

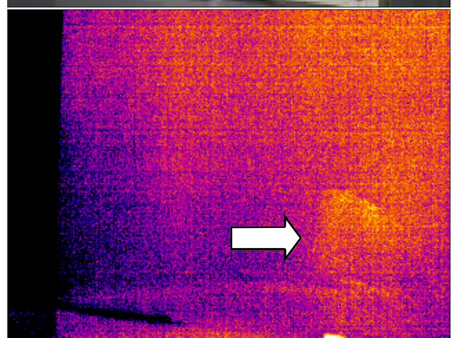
How to measure T_{amb}

To measure T_{amb} we need to follow a few steps. Figures 1 and 2 describe an example of a measuring situation.



Figures 1 and 2. The monitor is reflecting its radiation onto the white board

1. Set $\varepsilon=1$ in the object parameters.
2. Set an area with the average read out (Spot meter if area function is not available)



Figures 3 and 4. The monitor reflection on the infrared image.

(Continued on page 3)

FLIR SYSTEMS INTRODUCES FIRST CRANK-POWERED INFRARED CAMERA

Puts the power of thermal imaging literally in your hands!

The HP (Human Power) 695 CrankIR™ utilizes a winding handle to energize a constant force spring. Sixty turns of the handle, taking 20-30 seconds, fully energizes the spring. The spring energy may be used to power the infrared camera directly, or to charge the battery. When used to charge the battery, consecutive spring discharge cycles may be dumped into the battery to increase its charge level.

One spring discharge provides 3 minutes of scanning time. Multiple spring discharges into the battery allows extended continuous operation. The spring may be stored indefinitely in the wound condition. This allows instantaneous thermal imaging operation whenever required. The spring is equipped with a mechanical brake. If the camera is switched off before the spring is fully discharged, any winding still on the spring will be preserved.

HP 695 CrankIR™

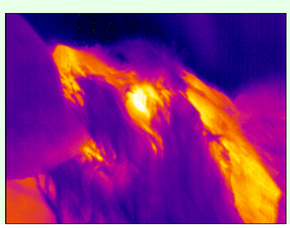
As if this isn't' enough, the built-in AM/FM radio may be operated during thermal imaging operation as well.◆

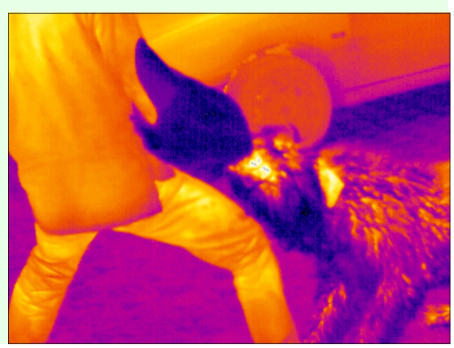
LAST MONTH'S BRAINTEASER

March's Brainteaser is a Police Dog Brigade (K9 Police Unit) at a night attack exercise of a "bad guy".

You see a car (wheel), and a helper ("criminal") who is attacked by a Bouvier des Flandres. Thanks to Herman Devos of Belgium for these thermograms.

Congratulations to last month's winner, John Dunn of United Spectrographics in Little Rock, Arkansas. ◆





EMISSIVITY (CONTD.)

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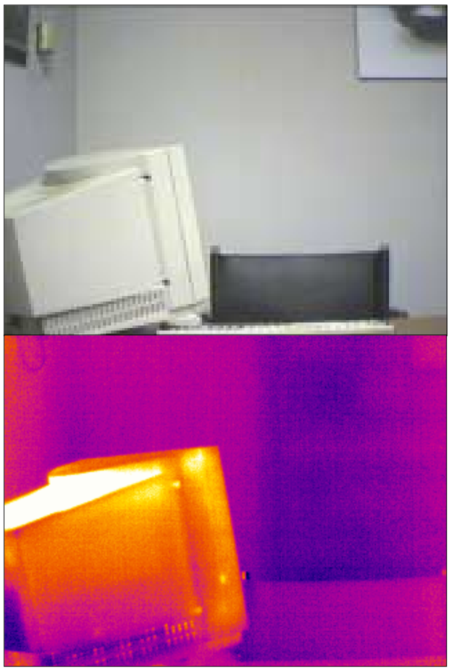
3. Place the camera against the back radiating surface to the object, according to the blue arrow shown in Figure 1.
4. Note the average area value (or, as an alternative, an average of several different spot readings)
5. Set that value in the object parameters.



Figures 5 and 6. The radiation produced by the monitor is part of T_{amb} together with the walls.

This procedure should always be carried out any time we want accurate object temperature measurement from our camera. We can then measure the object temperature, by setting the proper ε value for the object surface and aiming at the object itself.

Measuring object emissivity

To properly measure the object emissivity we need to go through the following procedure.

1. Place a material with a well known emissivity on the object like electrical tape (ε=0.95) or black paint: this will be our reference point.

Figure 7. Electrical components taken out from the oven at 80°C

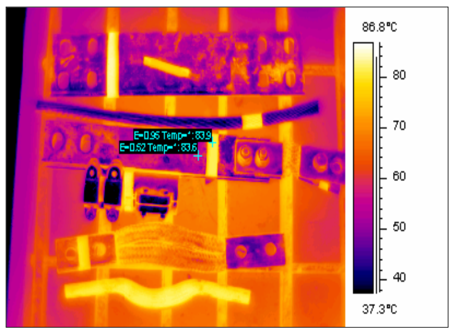
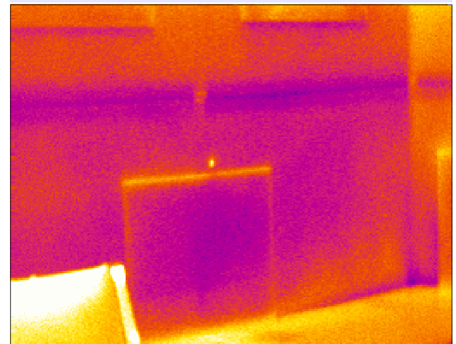


Figure 8. The spot meter reading on the tape is 83.9°C (e=0.95); the adjusted emissivity on the bar is 0.53 to get the same read out. In this way it is possible to calculate the Emissivity values for all the other components

2. Measure T_{amb} according to the general procedure described in the example above.
3. The object to be measured needs to be warmed up about at least 50° C above the room temperature. To do this we can use for an oven (Figure 7), or a tank with hot water, by submerging the object enclosed in a plastic bag.
4. Freeze the image of the warm object.
5. Set a spot meter on the reference emissivity point.
6. Set the correct emissivity and T_{amb} values in the object parameter table and note the spot read out.
7. Move the spot meter just outside the reference emissivity point.

BRAINTEASER OF THE MONTH

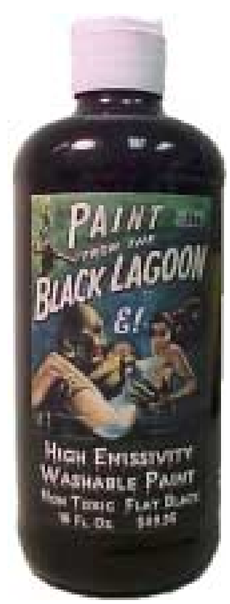


Here is this month's brainteaser. I am interested in the hot spot on the wall. First reader to email me with the correct explanation wins $20 in Infrabucks. Please put "Brainteaser" as the subject of the message.◆

Mailto: Gary.Orlove@infraredtraining.com

8. Adjust the Emissivity value in the object parameters to obtain the same spot reading noted in point 6. This is the wanted emissivity value.◆

HIGH EMISSIVITY WASHABLE PAINT



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"Delivering world-class training and knowledge about thermography"

About the Infrared Training Center

The Infrared Training Center offers training and certification in all aspects of infrared thermography use. Our world-class training facilities are located near Boston, Massachusetts, USA and Stockholm, Sweden and have the world's most extensive hands on laboratories for infrared applications. Please join us in exploring the fascinating world of infrared!

Your comments and suggestions about this newsletter are welcomed and encouraged. If you have an interesting application or case study to share, we encourage you to submit it for publication.

Please e-mail mailto:Gary.Orlove@infraredtraining.com or regular mail to the USA office

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Upcoming Classes - Americas

Remember we also teach customer site training courses at your convenience. Please contact us for more information.

April 2002
- 1-5 – Level I – Boston, MA
- 8-11 - Level II - New Orleans, LA
- 15-19 – Level I – Peru
- 15-19 – Level II – Boston, MA
- 22-25 – Level II – Denver, CO
- 22-26 – Level I – Mexico

May 2002
- 4/29-3 – Level I – Boston, MA
- 6-10 – Level I – Brazil
- 7-10 – Level III – Boston, MA
- 7-10 – Level I – Anchorage, AK
- 20-23 - Level I - Los Angeles, CA
- 20-23 - Level I - Montreal, Canada
- 21-24 – Level I – Lake Charles, LA
- 21-24 – Level I – Cleveland, OH
- 27-31 - Level I - Chile

June 2002
- 3-6 - Level II - Miami, FL
- 3-7 – Level I – Boston, MA
- 10-14 – Level II – Boston, MA
- 10-13 – Level II – Indianapolis, IN
- 24-27 – Level I – Las Vegas, NV
- 24-28 - Level I - Trinidad

July 2002
- 15-19 – Level I – Boston, MA
- 15-18 – Level I – Portland, OR
- 15-19 – Level I – Venezuela
- 22-25 – Level I – Nashville, TN
- 29-8/1 – Level I – Detroit, MI

Upcoming Classes - International

April 2002
- 15-19 - Level I - China
- 22-26 - Level I - Hong Kong
- 22-26 - Level I - UK
- 29-May 3 - Level I - Australia

May 2002
- 13-17 - Level I - Indonesia
- 20-24 - Level I - Japan

June 2002
- 3-7 - Level I
- 10-14 - Level II - South Africa
- 17-21 - Level II - UK
- 24-28 - Level I

July 2002
- 1-5 - Level I - Italy
- 1-5 - Level I - South Africa (ABB)

Upcoming Classes - Germany

April 2002
- 9-11 - R&D
- 22-24 - Operator CM
- 22-27 - Level I EN 473

May 2002
- 14-16 - Operator CM
- 14-16 - Level I EN 473 (part 1)
- 22-24 - Level I EN 473 (part 2)

June 2002
- 24-26 - Operator CM
- 24-29 - Level I EN 473

July 2002
- 9-11 - R&D
- 22-24 - Operator CM
- 22-27 - Level I EN 473

Upcoming Classes - France

April 2002
- 8-10 - Operator CM
- 22-24 - Operator CM

May 2002
- 27-29 - Operator CM

June 2002
- 10-12 - Operator CM