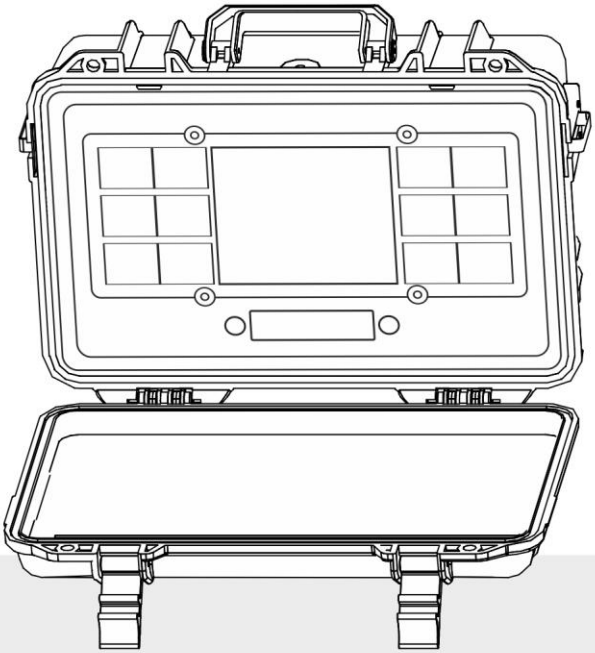
Sonel®



USER MANUAL

DEMONSTRATION BOARD

DB-THERMO

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DEMONSTRATION BOARD
DB-THERMO

SONEL S.A.
Wokulskiego 11
58-100 Świdnica, Poland

Version 2.02 03.07.2023

CONTENTS

1 Safety

When infrared temperature meters are used in measurements, the emissivity of the measured objects influences the result significantly. DB-THERMO demonstration board illustrates the differences in emissivity of some materials and their surfaces.

In order to provide conditions for correct operation of DB-THERMO and accuracy of obtained results, the following recommendations must be observed:

- Before you proceed to operate the demonstration board, acquaint yourself thoroughly with the present manual and observe the safety regulations and specifications defined by the manufacturer.
- Any application that differs from those specified in the present manual may result in damage to the device and constitute a source of danger for the user.
- DB-THERMO must not be used in rooms where special conditions are present e.g. fire and explosion risk.
- It is unacceptable to operate the device when:
  - ⇒ it is damaged and completely or partially out of order,
  - ⇒ its lid is closed,
  - ⇒ its cords and cables have damaged insulation,
  - ⇒ it was stored for an excessive period of time in disadvantageous conditions (e.g. excessive humidity) After moving DB-THERMO from a cool to a warm place with a high level of relative humidity, do not start measurements until the device is warmed up to the ambient temperature (approximately 30 minutes)
- Do not touch the heating plate during the test.
- Repairs may be performed only by an authorized service point.
- Only accessories dedicated for DB-THERMO should be used (**sec.** Błąd! Nie można odnaleźć źródła odwołania.). Using other accessories may result in damage to the device and may constitute a source of danger for the user.

Due to continuous development of the device, its actual appearance may slightly differ from the one presented in this manual.

2 Application

DB-THERMO allows to observe:

- the differences in infrared radiation generated by different materials,
- the impact of ambient temperature and atmosphere on measurements,

including two types of surfaces, heated to the same temperature.

3 Preparing the demonstration board for operation

NOTE!

DO NOT CONNECT DB-THERMO TO THE POWER SUPPLY NETWORK WITH CLOSED LID.

- Release 4 plastic hooks to remove the housing lid of DB-THERMO.

NOTE!

Do not touch heating plate of DB-THERMO. Fingerprints and other marks will be difficult to remove.

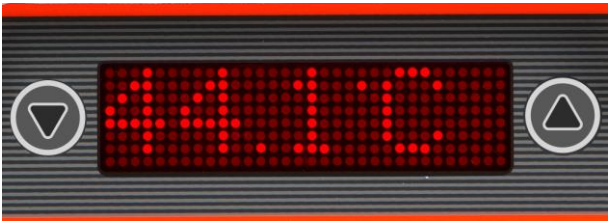
- Connect the power supply to DB-THERMO and power network.

- Change the temperature unit if necessary. To do this, press and hold button ▽ for 5 seconds.
- Using △ enable temperature adjustment mode. Using ▽△ set the temperature of the heating plate. The temperature is limited to range 40…60°C.

NOTE!

DO NOT TOUCH HEATING PLATE OF DB-THERMO – RISK OF SCALDING.

- Set DB-THERMO in upright position.
- After the heating plate reaches the set temperature, DB-THERMO is ready to use. The current temperature is shown on the display.



The **Exxx** message (where each “x” stands for a numeral within range 0…4) indicates a damage or error concerning memory, heater or thermometer. If the device remains in this state for a long time, contact the service center.

4 Infrared measurements

4.1 DB-THERMO features

Measurements must be made using infrared meters (pyrometers, thermal imagers). The best results of thermographic measurements on materials included in DB-THERMO case (and also on other real objects) may be obtained by using devices manufactured by Sonel.

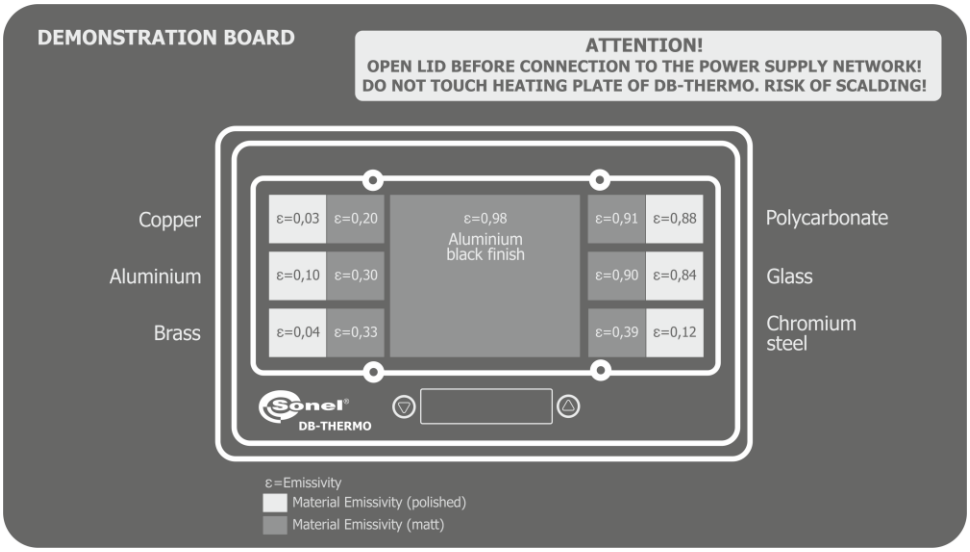
Thermal imaging involves non-contact evaluation of temperature distribution on the surface of the tested object. Thermographic test is based on measuring electromagnetic waves that are emitted by objects with temperature above the absolute zero (0 K).

The temperature of the object translates proportionally to the intensity of infrared (thermal) radiation. Its spectrum is transformed by the IR detector and electronics of the measuring instrument into electrical signals. These are then presented on the screen in the form of numerical data (temperature values of the examined object) and/or the corresponding image.

The emissivity coefficient means the degree of absorption of electromagnetic radiation. If radiation is completely absorbed, then ε = 1, but objects with such a factor - perfectly black bodies - do not exist in reality. Real objects absorb less radiation, so their coefficient ε is smaller. Therefore, it should be determined in order to correct readings respectively.

Other parameters that affect the measurement result are: ambient temperature, background temperature, humidity, distance from the object, the angle of observation.

The list of materials included in DB-THERMO



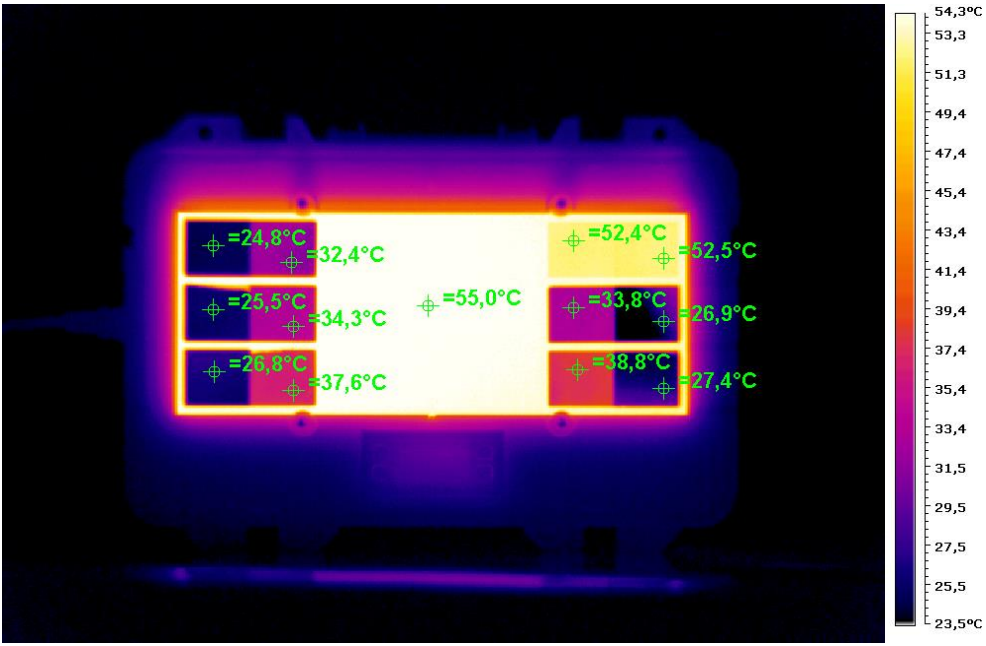
Emissivity table for materials present on the heating plate of DB-THERMO

Material	Emissivity (matt)	Emissivity (polished)
Aluminium black finish	0.98	-
Copper	0.20	0.03
Aluminium	0.30	0.10
Brass	0.33	0.04
Polycarbonate	0.91	0.88
Glass	0.90	0.84
Chromium steel	0.39	0.12

DB-THERMO allows to observe:

- the difference in emissivity of materials placed on the panel,
- how ambient temperature influences the measurement results.

When a thermogram is ready, the user may analyze the results - appropriately adjust obtained temperature values (changing the parameters that affect the compensation of the emissivity or atmosphere impacts) and compare them to the temperature indicated by the display of DB-THERMO.



4.2 Adjusting readings

Remember that infrared cameras (thermo imaging cameras) do not measure the temperature, but infrared radiation. Infrared thermography is the science of acquiring and analyzing information from non-contact thermal imaging devices.

Apparent temperature is an uncompensated read-out from a thermal imaging camera and it contains whole radiation spectrum received by the camera matrix, regardless of its source.

Emissivity is the ability or capability of an object to emit its own energy in the form of radiation and it is always equal to its absorption i.e. the capacity to absorb the energy that the object is exposed to. The emissivity of the object changes along with temperature changes.

Some objects have also the ability to **transmit** or conduct IR radiation. This feature is called "transmission".

Every object always reflects (to a lesser or greater extent) a part of the radiation that it is exposed to. Here the **ambient temperature** is an important factor. It is not the temperature of air surrounding the tested object or the camera during the measurement. It is the apparent temperature of all objects. It generates reflected radiation emitted by objects and recorder by thermal imaging cameras.

Thus, tested objects may:

- absorb radiation (α – alpha) - which is equal the ability to emit radiation (ε – epsilon),
- transmit radiation - it is called the "transmission" of radiation (ρ – ro),
- reflect radiation (τ – tau).

The sum of these three attributes is always 1. That is:

$$\alpha + \rho + \tau = 1 \text{ or } \varepsilon + \rho + \tau = 1$$

Assuming that most of the solid bodies (majority of IR-tested objects are solids) has no IR transmission properties, or they are very low and practically negligible, we may state that $\rho = 0$ In practice, we are interested in the amount of radiation emitted by an object (as it allows us to determine its temperature), therefore we may assume that:

$$\varepsilon + \tau = 1 \text{ (for } \rho=0)$$

And these parameters are subject to adjustments and corrections in the camera to compensate the radiation received from the tested object. As we may see, the lower the emissivity of the object the greater its ability to reflect radiation from the surrounding environment. Low emissivity causes a significant error - without adequate compensation of obtained image the results are far from the actual values.

In addition, we must take into account (compensate) the impact of the atmosphere. To do so, we must consider the following parameters: distance, relative humidity, air temperature.

Therefore, obtained thermograms must be carefully analyzed to obtain correct results and conclusions.

4.3 DB-THERMO cover

DB-THERMO case is provided with a plastic cover.

The plastic cover allows the user to observe two phenomena:

1. Objects that are transmissive for visible light are not always transparent to infrared. Plastic is not transparent.
2. Various sizes of openings allow the user to observe the impact of the distance/size of the tested area combined with the resolution of the camera on the measured values. The greater the distance (and smaller the object), the temperature reading is more prone to errors, especially for cameras with low-resolution of IR matrix. This effect is related to spatial resolution of an image: the smallest size of the target point from which an IR imaging device may take measurements.

In order to perform the above tests, install the cover as shown on the following picture.

5 Cleaning and maintenance

NOTE!

Use only the maintenance methods specified in this manual.

The casing of the device may be cleaned with a soft, damp cloth using all-purpose detergents. Do not use any solvents or cleaning agents which might scratch the casing (powders, pastes, etc.).

The electronic system does not require maintenance.

6 Dismantling and disposal

Worn-out electric and electronic equipment should be gathered selectively, i.e. it must not be placed with waste of another kind.

Worn-out electronic equipment should be sent to a collection point in accordance with the law of waste electrical and electronic equipment.

Before the equipment is sent to a collection point, do not dismantle any elements.

Observe local regulations concerning disposal of packages, waste batteries and accumulators.

7 Technical specifications

a) type of insulation acc. to EN 61010-1 ..... CAT II 300 V
b) ingress protection acc. to EN 60529 ..... IP20 (IP65 with closed lid)
c) power supply ..... 24 V DC
d) max. power consumption ..... 100 W
e) heating plate temperature
   - adjustment range ..... 40…60ºC
   - indication accuracy ..... ±2%
   - indication resolution 0,1ºC
   - settings resolution 1ºC
   - hysteresis ..... ±1,5°C
   - stabilization time for (23±2)°C and humidity of 40…60% ..... <5 min
f) thermal protection ..... 85°C
g) dimensions of the heating plate ..... 275 x 110 mm
h) dimensions of the device ..... 330 x 260 x 140 mm
i) weight ..... ca. 0.5 kg
j) operating temperature ..... +10…+40ºC
k) storage temperature ..... -20…+70ºC
l) display ..... LED
m) quality standard ..... design, construction and manufacturing are ISO 9001 compliant
n) the product meets EMC requirements acc. to ..... EN 61000-1 3-2, 3-3

The emissivity of the materials used in DB-THERMO structure was determined at:
- ambient temperature: 20°C,
- relative humidity: 70%,
- temperature of the heating plate: 52°C.

and was measured at newly installed material samples.

8 Manufacturer

The manufacturer and provider of warranty and post-warranty service:

SONEL S.A.
Wokulskiego 11
58-100 Świdnica
Poland
tel. +48 74 884 10 53 (Customer Service)
e-mail: customerservice@sonel.com
web page: www.sonel.com

NOTE!

Service repairs must be performed only by the manufacturer.

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