



TIR100

by INGLAS GmbH & Co. KG



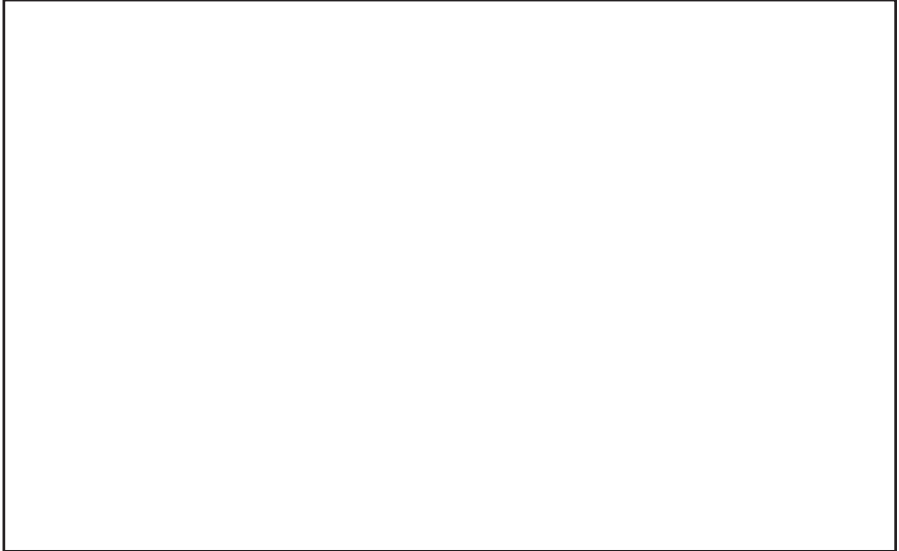
OPERATIONS MANUAL

Model TIR100-2

Version 2.1

www.3000buy.com

SERIAL NUMBERS AND VAC



**This is only valid with the included original Standard. Any new, refurbished or re-calibrated Standards could differ.*

IMPORTANT

Please study this manual carefully before operating the TIR100-2. Any warranty given shall be void due to non-compliance of this operations manual. INGLAS will not assume any liability for consequential damages or cost resulting from misuse.

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1. ABOUT THIS DOCUMENT

This operating manual provides the information required for the use and safe operation of the TIR100-2. Operating instructions must always be available to all users of the device.

The operating instructions should be followed and carried out by authorised personnel only. The device should only be operated if authorised personnel have read and fully understood the operating instructions and are familiar with applicable occupational safety and accident prevention regulations of the corresponding country.

2. INTRODUCTION

Thank you for purchasing a TIR100-2 from INGLAS GmbH & Co KG.

Included is:

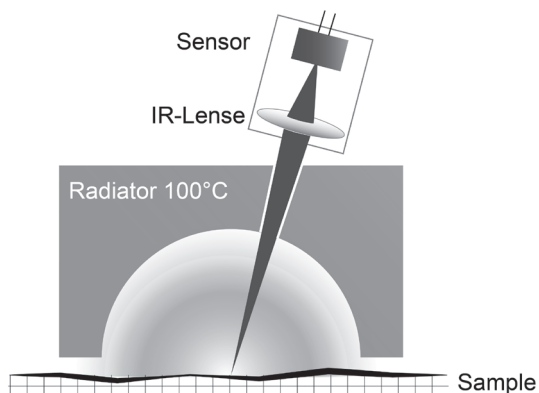
- TIR100-2 instrument
- Two-in-One certified Calibration Standard (with Certificate of calibration)
- Hard, portable and lockable aluminium storage case (keys included)
- USB-B cable



- Manual
- Microfiber Cleaning Cloth
- Optional: Sample Holder

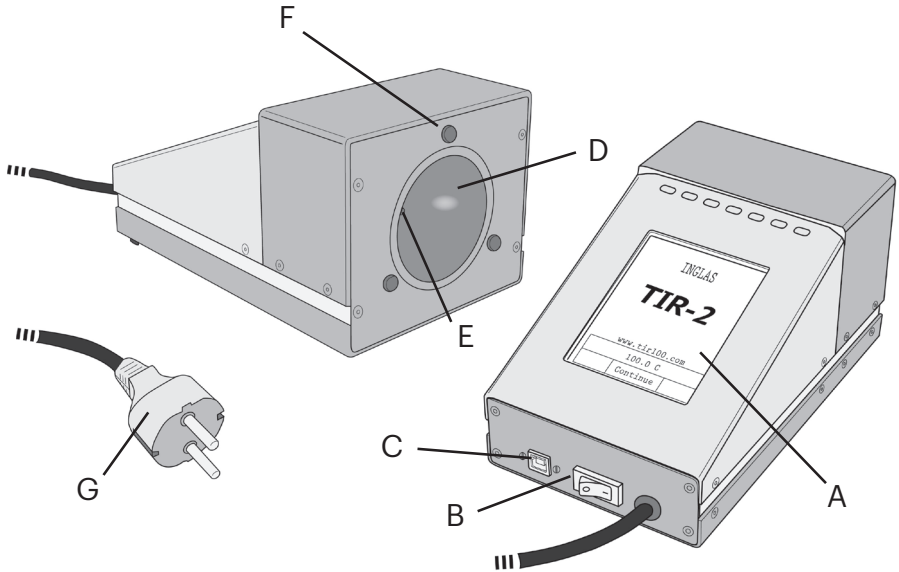
The TIR100-2 is a compact hand-held analytical instrument, which employs a non-destructive technique that measures thermal emissivity of surfaces within seconds. “Emissivity” refers to the energy that is transmitted through thermal radiation from a body.

The TIR100 measures the emissivity by directly subjecting the surface to infrared thermal energy of 100°C. The reflected infrared radiation is observed and converted into a numeric value between 0 and 1. The black body half-sphere radiator is used to capulate the sample to ensure homogenous illumination.



3. OVERVIEW

3.1 DIAGRAM 1: TIR100-2



Description

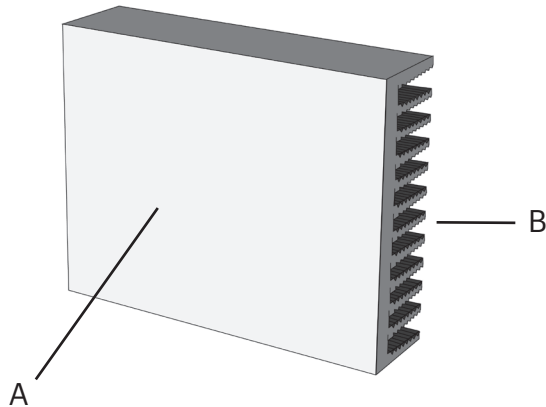
| | |
|---|--------------------------------------------------|
| A | Touch Screen |
| B | On / Off Power Switch |
| C | USB -B Connector |
| D | Black Body Half Sphere (100°C when in use) |
| E | Measuring Probe |
| F | 2mm Spacer (3) around the Black Body Half Sphere |
| G | Power plug (may vary depending on your country) |



WARNING

Black body half sphere reaches high temperatures during operation. Caution must be taken to avoid burns.

3.2 DIAGRAM 2: TWO-IN-ONE CALIBRATION STANDARD



Description

| | |
|---|-------------------------------------------------------------------------|
| A | High precision milled aluminium (smooth surface) Low Emissivity Side |
| B | Black light trap (textured surface) High Emissivity Side |

All Calibration Standards are calibrated against a certified reference material from the PTB (Physikalisch-Technische Bundesanstalt) in Berlin, Germany

All Calibration Standards come with certification that is valid for 2 years (please see your Certificate of Calibration) when used and stored correctly (please refer to section 9. *STORAGE AND MAINTANANCE* for information on storage). It is strongly recommend once this time has elapsed or if damages have occurred, that the Standard is sent back to the manufacturer for re-certification/ refurbishing. Please contact INGLAS for details.

4. TECHNICAL DATA

| | |
|---------------------------------|---------------------------------------------------------------------------------------------------------|
| Serial Number | See page two of this booklet for the serial number of your TIR100-2 and two-in-one Calibration Standard |
| Voltage rating of your device | See page two of this booklet for the Voltage rating (VAC)* |
| Voltage range | 90 VAC - 260 VAC |
| Power rating | 240 VAC max. 130 W 120 VAC max. 260 W |
| Measuring range | As Calibration Standard |
| Measure uncertainty | + - 0,005 (lowE) ... + - 0,01 (hiE) |
| Spectral range | 2,5 μm - 40 μm |
| λ max of radiant energy | 7,8 μm |
| Radiator temperature | 100°C |
| Measuring duration | approx. 5 sec. |
| Measuring spot | approx. 5mm |
| Interface | USB-B |
| Dimension | 230mm x 140mm x 120mm |
| Weight | TIR100-2: approx. 2,0kg Total weight with calibration standard and storage case: approx. 9,0kg |
| Power cord length | 1,5m |

The TIR100-2 is made in Germany

**Please check the voltage rating of your instrument before use. If the TIR100-2 is operated in a country with a different voltage range, the power consumption of the instrument will need to be adjusted accordingly. There are two switches inside the TIR100 that will need to be alternated. Please see section 10.2 CHANGING THE VOLTAGE SETTINGS.*

5. OPERATING INSTRUCTIONS

5.1 START INSTRUMENT

1. Plug power cord (G) into power socket
2. Turn on the device using the power switch (B) on the back of the instrument.
3. The instrument will start heating up automatically to reach a radiator temperature of 100°C and an inside temperature of approx. 45°C. During this process, “heating up...” will be displayed on the screen. Please note, this may take over an hour due to external factors. Please be patient.
4. When both temperatures are reached and are stable, a “Continue” button will be displayed. This signals that the instrument is ready for operation. Press “Continue” to proceed to the calibration mode.

If both final temperatures are not reached or are unstable, measurement results will be inaccurate.



WARNING

Black body half sphere may cause burns when instrument is on, due to high temperatures.

5.2 CALIBRATION MODE



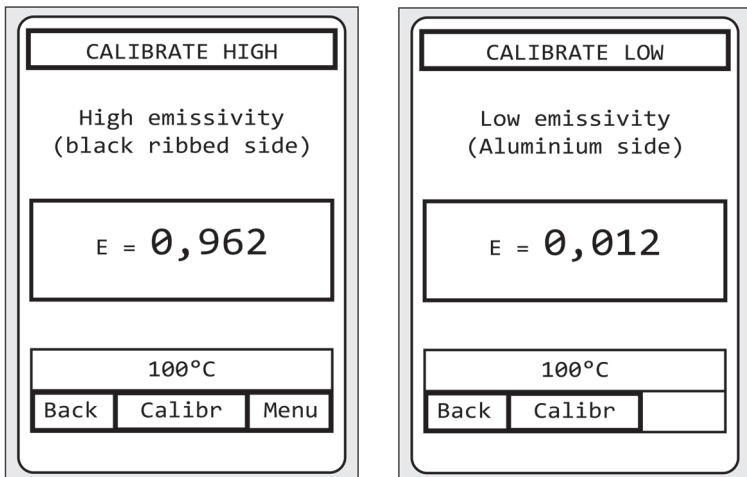
A robust calibration routine will reduce any external bias and greatly increase the reliability of measured results.

Calibration is usually conducted with the Two-in-One Calibration Standard included. For your convenience, the High and Low values of your Calibration Standards have been pre-pro-

grammed into your TIR100-2 instrument (you can find these values on the label of your Calibration Standard and Certificate). When using your own Standards, please refer to section 10.1 USE OF OWN CALIBRATION STANDARDS for instructions.

IMPORTANT In order to ensure accurate measurements, the temperature of the calibration standards **must be the same** as that of the measured sample! Therefore it is strongly recommended that the calibration standard and the sample to be measured are allowed to come to ambient temperature together. This process usually takes 20 to 40 minutes prior to measurement. During a measurement session, the Calibration Standards must be allowed to cool back down to ambient temperature before next measurement/calibration. INGLAS has designed the Calibration Standard from a single aluminium block to help with the dispersion of heat after measurement.

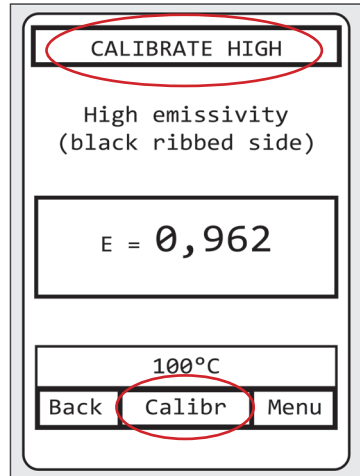
Calibration Mode consists of two calibration steps/displays. First, the “Calibrate High” which refers to the black ribbed surface and second is the “Calibrate Low” which refers to the polished aluminium side.



Please ensure, that the values in the “Calibrate High” and “Calibrate Low” display are the current values of your Calibration Standard, which is stated on the label.

5.2.1 Start Calibration:

1. When “Calibrate High” is displayed, place the black ribbed side of the Calibration Standard in front of the instrument so that the Standard is touching the Spacers (F). Use the standard so that the ribs are horizontally positioned.



2. Start the calibration by touching either “**CALIBRATE HIGH**” or “**Calibr**”. A correct calibration is followed by a short beep. Remove Standard from the hot radiator to avoid build-up of heat.
3. When “Calibrate Low” is displayed, place the polished aluminium side of the Calibration Standard in front of the instrument so that the Standard is touching the Spacers (F). Start the calibration by touching either “**CALIBRATE LOW**” or “**Calibr**”. A correct calibration is followed by a short beep. Remove Standard from the hot radiator to avoid heating.
4. After calibrating has been successfully performed, the TIR100 will proceed into Measurement Mode.

Note: In case of significant deviations from the indicated Standard values the calibration procedures should be repeated.



WARNING

Do not leave the Calibration Standard in front of the

100°C radiator for an extended period of time. Prolonged heat at 100°C may cause oxidation to occur on the polished aluminium side.

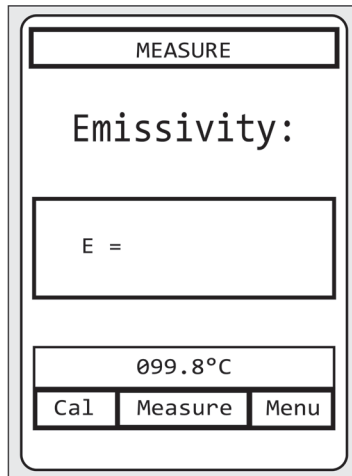


To compensate for thermal drift from the environment, we strongly suggest that you periodically re-calibrate the TIR100-2 every 10 minutes. This will ensure high precision in your results in a session.

IMPORTANT The Calibration Standard is fragile. Both sides are susceptible to scratches and dents, if used and stored improperly. This may cause false readings and reduced accuracy and precision. Please refer to section 9. *STORAGE AND MAINTANANCE*.

5.3 MEASUREMENT MODE

Once a calibration has successfully been performed, the TIR100-2 will automatically enter Measurement Mode. In this mode, the TIR100-2 will have the following display:

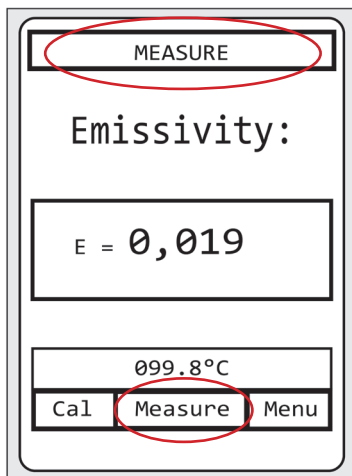


Within this display, there are two “Measure” buttons. One at the top and one bottom centred.

There is also a “Cal” button bottom left to return back to Calibration mode and a “Menu” button bottom right to enter Menu mode.

5.3.1 Taking Measurements

1. When “Measure” is displayed, place the sample in front of the instrument so that the sample is touching the Spacers (F).
2. Start the measurement by touching either **“MEASURE”** buttons. A correct measurement is followed by a short beep. For best practise, make sure the temperature is $100^{\circ}\text{C} \pm 0,5^{\circ}\text{C}$, which is shown on the display. Remove the sample from the hot radiator to avoid build-up of heat.



3. The Emissivity value for the sample measured will be displayed in the centre denoted as E = “result”, as shown above. This measurement will range between 0,000 ... 1,000.
4. For measuring any additional samples, please allow approx. 30 sec to compensate for any thermal heat build-up

in the black body half sphere, then repeat steps 1 through to 3.

Please note: The last measurement will be displayed until the next measurement or calibration is performed.

IMPORTANT During a measurement session, if the ambient condition changes, it is strongly recommended to allow the calibration standard and sample to once again reach room temperature and recalibrate.



Please remember!

To compensate for thermal drift from the environment, we strongly suggest that you periodically re-calibrate the TIR100-2 every 10 minutes. This will ensure high precision in your results in a session.

5.4 MENU MODE

To reach Menu Mode, touch the “Menu” button in the Measurement Mode, which is displayed in the bottom right hand corner.

In the Menu Mode you will find the display as shown on the right picture.

This display shows an overview of the Calibration Standards emissivity values and the last known calibration results.

Please note: When using a Calibration Standard supplied by INGLAS, make sure the values found in the Menu Mode for the Standards correlate with the actual emissivity values of the supplied Cali-

| MENU | |
|---------------|-------|
| Standard High | 0.952 |
| Standard Low | 0.012 |
| Calibr. High | 1.000 |
| Calibr. Low | 3.500 |

100.1°C

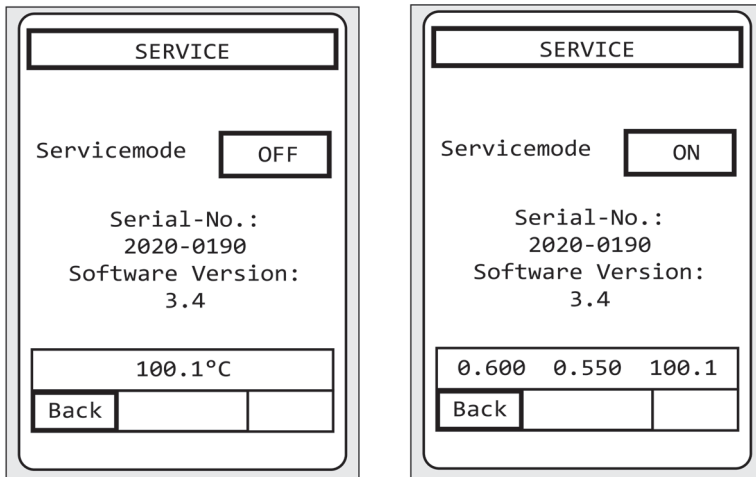
| | |
|---------|------|
| Measure | Serv |
|---------|------|

bration Standards, which are located on the first page of this manual and labelled on the Calibration Standards itself.

From the Menu Mode, you can re-enter the Measurement Mode by touching the “Measure” button located bottom centre. Alternatively you can enter the Service Mode by touching “Serv” on the bottom right.

6. SERVICE MODE

To reach Service Mode, touch the “Serv” button in the Menu Mode, which is displayed in the bottom right hand corner. In the Service Mode you will find the following displays:



In this mode you will find the Serial number of your TIR100-2 and the software version.

Also displayed is the Service mode “OFF” / “ON” button. For routine operation with the TIR100-2, this button should remain on the “OFF” position, so that the temperature of the TIR100-2 is displayed (Refer to the left picture).

If circumstances arise and there is a problem with your TIR100-2, it may be required to switch the Service mode button to the "ON" position. The information displayed will assist our technicians in assessing and solving the issue. The "ON" position is a diagnostic tool only and has no influence on operations.

To exit the Service Mode and re-enter the Menu Mode, touch the "Back" button on the bottom left.

7. CONNECTING THE TIR100-2 TO A PC

The TIR100-2 has the capability to record measured results to a PC via the USB-B port.

Firstly, the PC will need a terminal program. Any terminal program should suffice, for example:

```
HTerm.exe >> http://www.der-hammer.info/terminal/
```

The following perimeters will need to be inputted into the terminal program:

Rate of transmittance: 9600 Baud

Data length: 8 Bit

Stop bit: 1

Parity: none

Once the terminal program is open, connect the TIR100-2 with the provided USB-B cord to the PC USB bus.

Note: The first time the TIR100-2 is connected to a PC, a visual serial port will automatically be installed.

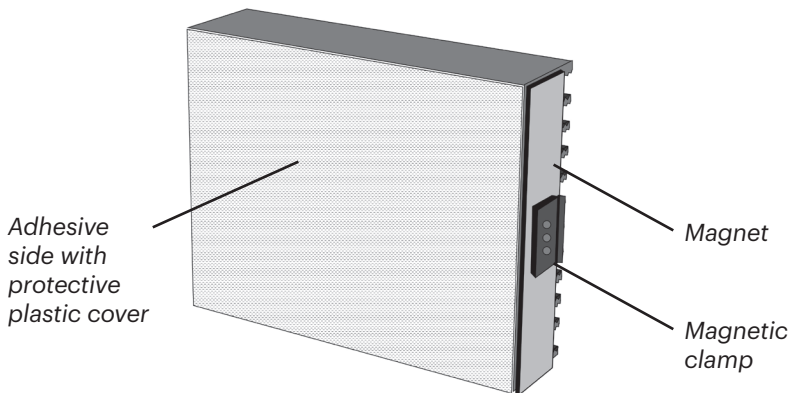
8. OPTIONAL ACCESSORY

8.1 SAMPLE HOLDER

The TIR100-2 can be used to measure the Emissivity of foils, textiles, fabrics and other thin materials. To obtain an accurate result, it is necessary to have the sample as flat/smooth as possible and mounted on a background with an Emissivity value close to 1.

The sample holder (diagram 3) is made from the same material as the black body trap of the Calibration Standard. This ensures that the background is as close as $E=1$ as possible and helps with the dispersion of heat after measurement.

8.1.1 Diagram 3: Sample Holder



The flat surface of the Sample Holder has an adhesive material that the sample can be carefully stuck to wrinkle-free. Mounted on either sides of the Sample Holder are two magnetic clips, which can be utilised for larger samples.

9. STORAGE AND MAINTANANCE

Following the below suggestions on maintenance and storage will contribute to the longevity of the TIR100-2 instrument and ensure that a high level of accuracy and precision is maintained.

When the TIR100-2 and its accessories are not in use or are in transit, they should be stored in the provided robust transportation case.

9.1 INSTRUMENT

Regularly check the TIR100-2 and the black body half sphere for dents, loss of black coating and other damages as these may affect measurement results.

If visible dirt or grit is detected in the black body half sphere, we recommend the use of the microfiber cloth provided or to clean with low compressed air.

After use please allow sufficient time for the TIR100-2 to reach ambient conditions.

IMPORTANT Do not store the instrument when black body half sphere is hot, as this may damage the interior of the transportation case.

Please note:

The TIR100-2 for all purposes is a sealed unit. There are no serviceable/ interchangeable parts inside. Making any unwarranted adjustments and/or modifications to the TIR100-2 will void any warranty given. INGLAS will not assume any liability for consequential damages or cost resulting therefrom.



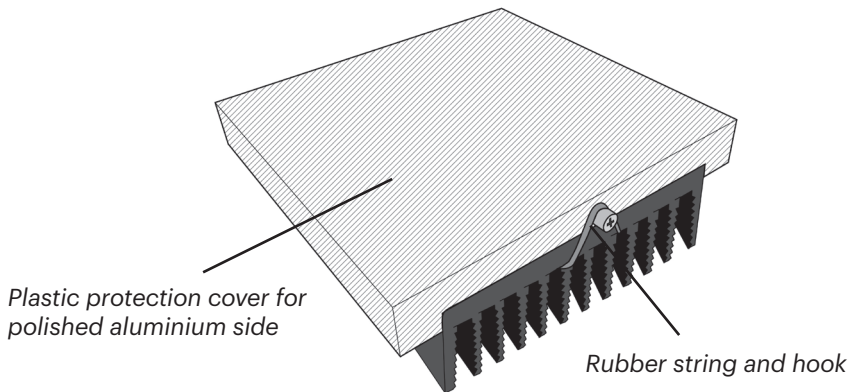
WARNING

Operating the TIR100-2 whilst open carries the risk of electric shock!

9.2 TWO-IN-ONE CALIBRATION STANDARD

Always store the Calibration Standard with its protection cover on the polished aluminium surface as shown in diagram 4.

9.2.1 Diagram 4: Two-In-One Calibration Standard



Caution! The polished aluminium is an extremely fragile and scratch-prone surface. We recommend wearing cotton gloves when handling the Two-In-One Calibration Standard.

Before use, the polished aluminium surface should be cleaned with the use of the microfiber fabric cloth provided. If visible dirt or grit is detected, we recommend the use of Isopropanol or deionised water as a cleaning liquid.

Never use paper or any household cleaning products!

To clean the black light trap surface of the Calibration Standard, it is recommended to use the microfiber cloth provided or to clean with low compressed air.

All Calibration Standards come with a Certification that is valid for 2 years. Once this time has elapsed, as good practise it is strongly recommended to re-certify at the manufacturers. For more information please contact INGLAS.

Excessive scratches or damages to the Two-In-One Calibration Standard will reduce accuracy and sensitivity of measurements. If this occurs, it is strongly recommended that the Standard is sent back to the manufacturer for refurbishing. Please contact INGLAS for details.

If the Standard has sustained severe damages it may not be possible to refurbish and thus a new Calibration Standard is required.

9.3 SAMPLE HOLDER (OPTIONAL ACCESSORY)

Over time, the adhesive side will become less adhesive. To prolong the usage of the adhesive side, make sure to recover with the plastic sheet provided after each use.

Please store the sample holder in the plastic sleeve provided after each use and store in the transportation case.

Caution: Never stack the back of the sample holder to the black light trap side of the Two-In-One Calibration Standard, as both sides are ribbed, which can interlock and thus damaging both apparatuses.

10. ADDITIONAL INFORMATION

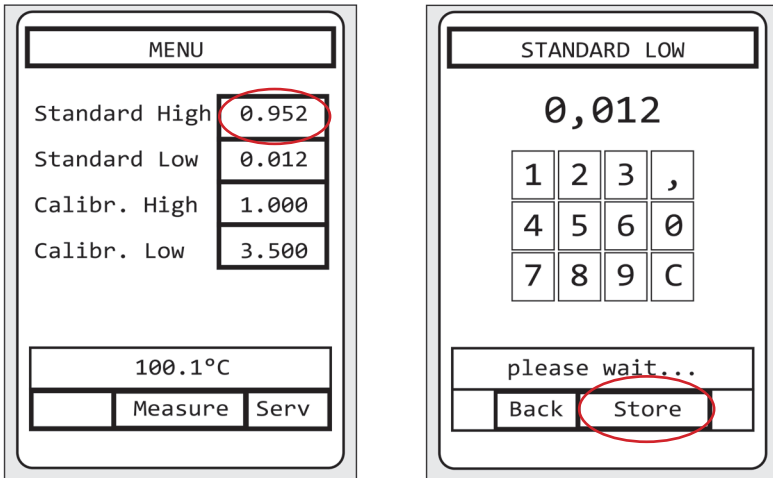
10.1 USE OF OWN CALIBRATION STANDARDS

It is possible to use different standards for the TIR100-2 in place of the Two-In-One Standard that is provided.

Please note, the use of a two-point calibration standard system (i.e. high vs. low) is required.

To manually set the values of the different calibration standards, please go into the "Menu Mode" in the TIR100-2. Touch the "Standard High" button (denoted below in the below diagram) and enter a value between 0.000 and 0.999.

The fractional digits are typed with the numeric keys and confirmed with "Store".



Repeat the process for the "Standard Low" value.

IMPORTANT After changing the reference values, calibration must be performed immediately with the new corresponding standards!

Please remember the Two-In-One Standard values are labelled on the standard and noted on page 1 of this manual.

10.2 CHANGING THE VOLTAGE SETTINGS

The TIR100-2 can operate with voltages of 100-115 VAC and 220-240 VAC. The TIR100-2 will be set with the voltage corresponding to the destination of the buyer, if not otherwise requested.

If it is necessary to use a different voltage to the one that was originally set, it will be necessary to adapt the TIR100-2 in order to operate. Without the correct voltage settings, the temperature regulation of the radiator will not be stable.

The TIR100-2 has two switch converters, which are located on the printed circuit board (PCB) inside, see diagram 5.

In order to operate the TIR100-2 at a set voltage, these switches need to be flipped to the corresponding voltage by following the instructions below.

Only staff with prior knowledge of electronic appliances and safe handling of high voltage devices should carry out the following works!

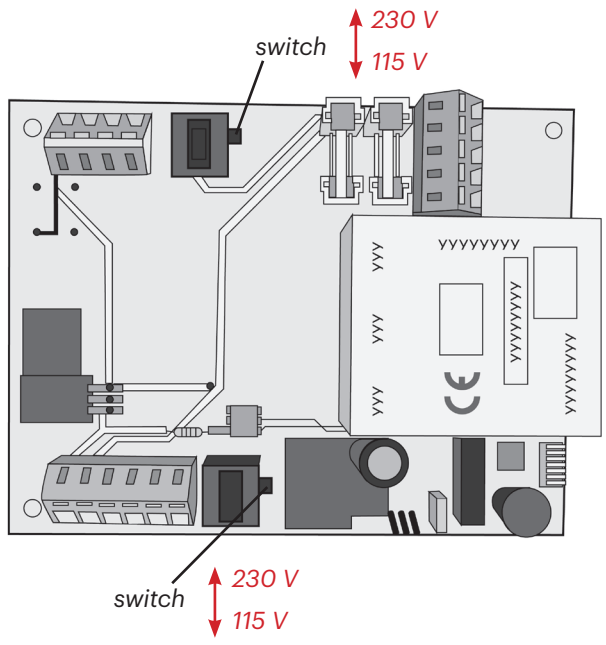


WARNING Instrument must be unplugged before opening! High Voltage!

1. Open the silver housing of the TIR100-2 (4 Inbus screws type 2)

2. The two switches are located on the bottom PCB. Flip both switches to the corresponding voltage, as shown in diagram 5. Please note, the switches are accessible without dismounting/ removing any components.
3. Close silver housing.

10.2.1 Diagram 5: Printed Circuit Board (PCB)



11. MEASURING OF DIFFERENT MEDIUMS

11.1 MEASURING OF LARGE SAMPLES

One major advantage of the TIR100-2 is its portability. When measuring oversized/ fixed samples, it is not always possible to bring the sample into a laboratory. In these cases the TIR100-2 can take measurements directly on site. Keep in mind the following guidelines:

1. The reference Calibration Standard must be the same temperature as the sample
2. The distance between sample and TIR100-2 must be kept constant, i.e. the sample touches the spacers (see diagram (F))
3. Between measurements avoid sudden and fast movements, as this will cause thermal instability in the black body half sphere radiator.

It is also possible to use the TIR100-2 in the vertical direction. When doing so, the calibration measurement must also be taken in the same vertical direction.

11.2 MEASURING OF SMALL SAMPLES

When measuring samples smaller than the black body radiator opening of 70 x 70mm, it is advised to use the sample holder. However, the sample should not be smaller than 20 x 20 mm and should be placed in the middle of the sample holder during measurement.

11.3 MEASURING OF TRANSPARENT SAMPLES

Avoid direct light behind transparent samples. If not possible, please insert a non-transparent backing between the sample and the light source. Any infrared radiation source transmitted through the sample and reaching the sensor will interfere with the emissivity measurements.

11.4 MEASURING OF THIN SAMPLES AND FOILS

Thin foil samples have the tendency to heat up very quickly

during measurement. This can cause deviations of results. The table below shows these deviations when the sample surface temperature is higher than that of the Reference Standard.

| Emissivity | Difference in Temperature (°C) | TIR Results |
|------------|--------------------------------|-------------|
| 0,0200 | +5 | 0,0187 |
| 0,0200 | +10 | 0,0175 |
| 0,800 | +5 | 0,748 |
| 0,800 | +10 | 0,700 |

From this table, it can be concluded that the higher the sample temperature relative to the standard, the lower the emissivity is reported by the TIR100-2.

As absorption is directly correlated to emissivity, the higher the emissivity, the stronger the deviation in results due to the temperature difference.

To avoid heat build-up in foil samples, we recommend the use of our sample holder. It is made from one piece of aluminium block that helps with the dispersion of excess heat.

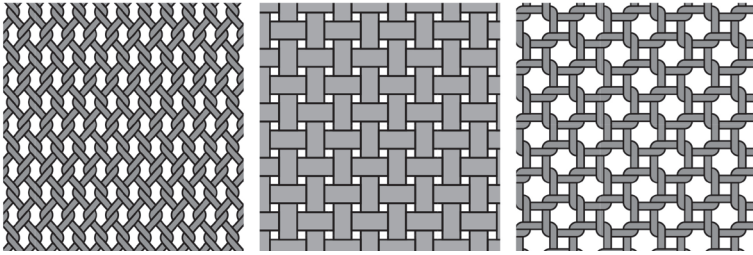
When it is not practical to use the sample holder, a foil sample can be moved slowly along the radiator at a constant speed during measurement. This will avoid any excess heat that can build up on any given spot.

Please note:

1. The distance between sample and TIR100-2 must be kept constant, i.e. the sample touches the spacers (see diagram (F))

2. The surface of the sample must remain flat
3. Make sure when moving the foil sample it is at a slow, gentle and constant speed. This will avoid any thermal instability in the black body half sphere radiator.

11.5 MEASURING OF TEXTILES OR SAMPLES WITH OPEN PORES



A= approx. 0.6

A= approx. 0.9

A= approx. 0.4

Measuring textiles and/ or samples with open pores requires a background substrate of emissivity value close to 1.

We recommend the use of our sample holder as it is made from the same material as the black body trap of the Calibration Standard. This ensures that the background is as close as $E=1$ as possible.

This will ensure that the background will absorb all excess radiation so that only the emissivity from the sample will be measured by the TIR100-2.

The emissivity result (ϵ_{TIR}) is proportional to the emissivity of the textile sample (ϵ_{sample}) and the percentage area (A) that the textile sample covers.

$$\epsilon_{TIR} = A \times \epsilon_{sample}$$

11.6 MATERIALS THAT ARE TRANSPARENT IN THE INFRARED REGION

Certain materials such as thin polyethylene foils and semiconductors are transparent in the infrared region and cannot be accurately measured by the TIR100-2. This is due to loss of radiation through transmittance.

12. TROUBLESHOOTING

Should you experience any issues with your TIR100-2, please visit our homepage www.tir100.com/FAQ for frequently asked questions and information on troubleshooting. You can also contact us via email: info@tir100.com for any questions or problems you may have.

Please check our website regularly for updates on the operations manual. They will be denoted by a different version number. The version stated on our website will replace and supersede any previous version issued.

13. SAFETY INSTRUCTIONS

This device was constructed in accordance to safety class I of the European Safety standard DIN EN 61010 VDE 0411-1 and has left our facilities in proper safety operational conditions. It is equipped with a VDE-approved mains power line (UL approved connector for the U.S.) with protective conductor. The device should only be connected and operated at 230 VAC (optional 115 VAC) voltage with a protective earthing connection.

Care must be taken, that the protective conductor (yellow/green coated wire) be kept intact throughout the device,

through the power cord and into the power socket. Any interruptions/damages in the protective conductor or its insulating cover can cause high voltage electric shock.

The thermostat in the device is fitted with a electric overheating protection mechanism in accordance to VDE 0631/1 and a redundant second temperature switch at 125°C. This device runs normally at 100°C, and must not be used near easily combustible materials, flammable liquids or explosives.

Commercial entities must submit the device for risk assessment for in-house use. They must adhere to any regulations associated to the country of use, regarding electrical appliances.

Before using the device the instruction manual must be read and adhered by every individual user. It is the responsibility of the purchaser to make available the instruction manual to each individual user.

14. DECLARATION OF CONFORMITY

We,

INGLAS GmbH & Co. KG
Muschelweg 19
88697 Bermatingen

declare under our sole responsibility that the product

TIR100-2

to which this declaration relates is in conformity with the requirements of the following directives:

2014/30/EU Electromagnetic Compatibility
2014/35/EU Low Voltage Directive

The following harmonised standards were applied:

EN 61000-6-3: 2011
EN 61000-6-2:2006
EN 61010-1:2020-03

Bermatingen, 29th of May, 2020



A. Kirmes
CEO



A. Anderson
CEO

15. WARRANTY

All warranty claims must be made in writing.

The TIR100-2 with a 2-year product warranty, starting from the date of delivery. This includes the free of charge repairs and/ or replacement of any faulty parts.

Incorrect handling and/or usage of the product, non-compliance of the operating manual or any damages due to unforeseeable circumstances is not covered under this warranty.

INGLAS does not assume any liability for consequential damages or cost resulting therefrom.

INGLAS will assess all written claims and will repair or replace the product at its own discretion, on the basis set out in this warranty.

16. DISPOSAL

Electrical and electronic appliances should not be disposed of as part of the household garbage.

This device must be properly disposed of in accordance with your national regulations and laws.

The device can also be sent back to the manufacturers for disposal:

INGLAS GmbH & Co KG
Muschelweg 19
88697 Bermatingen
GERMANY