RCN 600-1050-1250-1350

RCN

Operating guidebook

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Revision

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Resion	Description	Date
a	Document creation	06/09/2010
b	Nouveau modèle – ajout Infratest LT – e BB et Coolspeed	30/06/2014
c	main power cable 16A ->10A	07/05/2015
d	Controller modification	24/07/2018
e	Spectral emissivity curve	16/11/2018
f	Notice about packaging	09/12/2019
g	Modification fusible et config 110V	19/10/2020

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1. GENERAL PRESENTATION

1.1. INTRODUCTION

Thanks to different optical systems (cameras, scanners, radiometers, thermal imaging systems...), infrared thermography allows the measurement of the emitted power of an object and possibly its temperature.

The reference IR source allows calibrating and testing the performances of these optical systems.

The RCN may also be used to measure the atmospheric transmission or the gas concentration in a chamber.

The RCN is a blackbody involving a cavity. The cavity is a fundamental element of the high temperature blackbody, as on one hand it allows well insulating the heated surface and on the other hand, it considerably amplifies the natural emissivity of its coating.

Therefore, the cavity blackbody is the blackbody that is the nearest to the theoretical one.

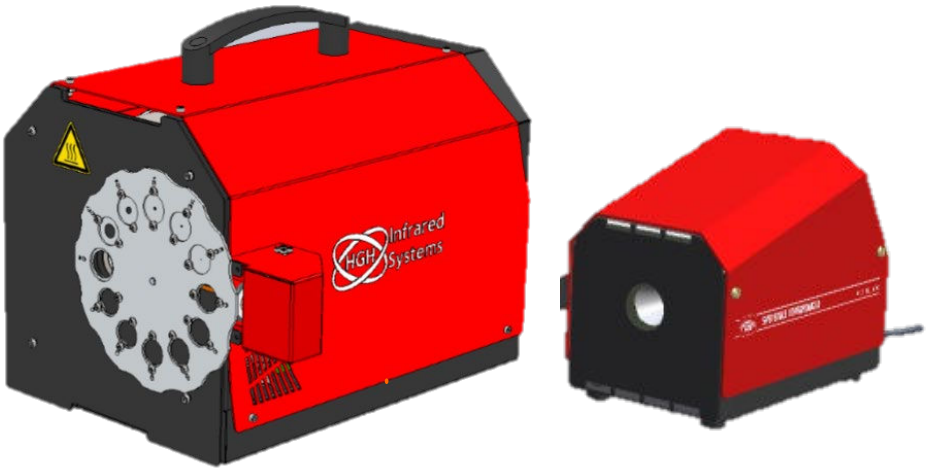


Figure 1: RCN heads

The reference name of the blackbody corresponds to its surface size and its absolute temperature range:

	RCN 600 N05	RCN 1250 N1	RCN 1350 N1	RCN 1050 N2	RCN 1250 N2
T° range	[50°C ; 600°C]	[50°C ; 1250°C]	[50°C ; 1350°C]	[50°C ; 1050°C]	[50°C ; 1250°C]
Reference surface diameter	12.5mm	25mm	25mm	50mm	50mm

The RCN can also be equipped with a multiple apertures wheel. The use of several apertures of which the diameter is known accurately is indeed quite useful to calculate the responsivity and the sensitivity of an IR detector.

The ability to connect the RCN controller to an external PC allows integrating the RCN onto test benches and to automate most measurements.

1.2. FEATURES

- Incomparable high uniformity,
- High display resolution to 10 mK for temperature measurements and set point,
- High speed heating
- High speed **cooling** down thanks to HGH's exclusive CoolSpeed system for RCN1050 to 1350 models (option),
- Very wide temperature range,
- Supplied with International Primary Standards traceable radiometric calibration valid for 2 years,
- Remote control through Ethernet, IEEE488 and RS232 communication links,
- Delivered with ready-to-use remote control software Infratest-LT,
- Exclusive drivers for LabVIEW v8 or higher for all communication types.

2. DESCRIPTION

The system consists in 2 different components:

- The Electronic Controller
- The Blackbody Head

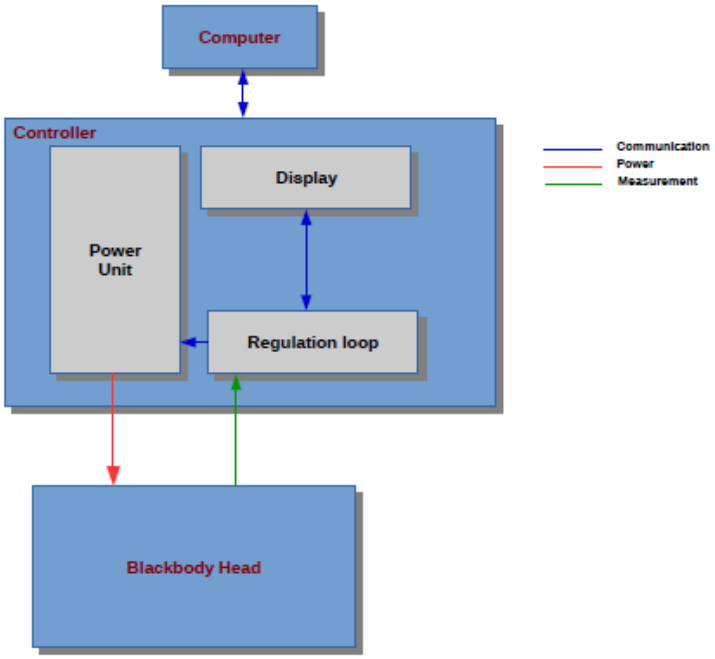


Figure 2: Synoptic scheme

2.1. ELECTRONIC CONTROLLER

The electronic controller processes the output data of the temperature sensors and controls the power supply and the temperature regulation of the blackbody through a microprocessor. Then the Electronic Controller sends the power to the Blackbody Head in order to regulate its temperature at the desired set-point.

Figure 3: Electronic Controller front panel

The front panel entails:

- A main bouton,
- A touchscreen

The mains button allows switching ON or OFF the controller. In user mode, the blackbody absolute temperature is displayed on the screen in real time.

The mains button is lighted when the power switch at the rear panel is ON.

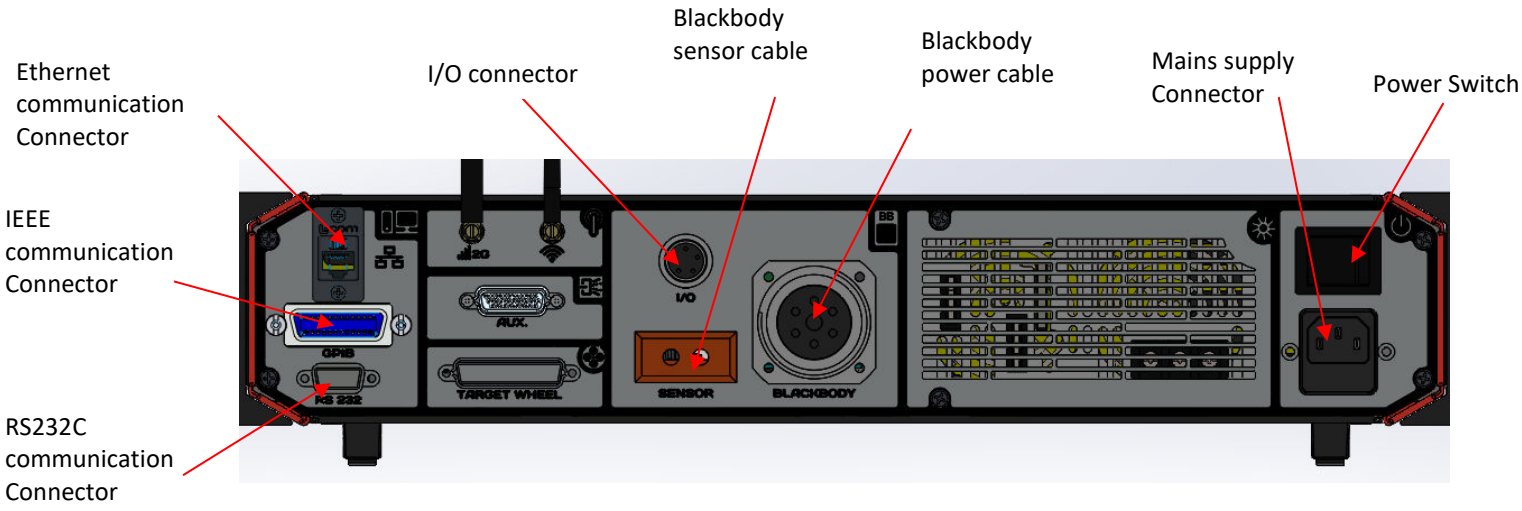


Figure 4: Electronic Controller rear panel

The Mains Supply connector, the power switch, the Blackbody Connector and the communication connectors are located on the rear panel.

The Power Switch allows the voltage supply of the controller.

I/O connector (RCN1050 to 1350 only): this connector is used for the CoolSpeed function and for security (power is cut if the temperature inside the blackbody is too high). No power is sent to the head if this connector is unplugged.

2.2. BLACKBODY HEAD

The blackbody head of the RCN entails an emissive cavity (emissivity >99%) which temperature is electronically controlled.

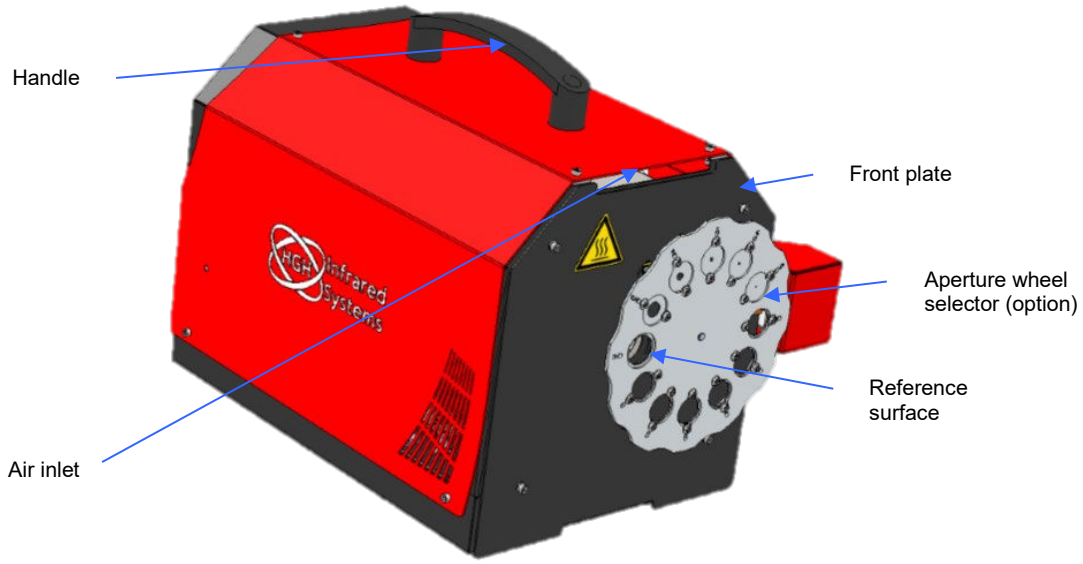


Figure 5: RCN head (front view)

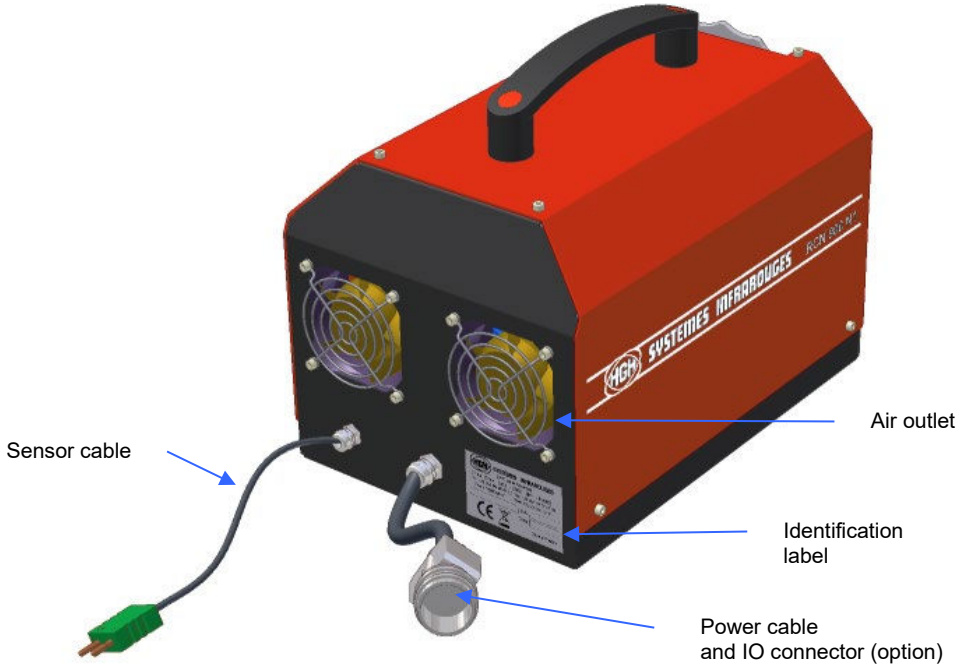


Figure 6: RCN head (rear view)

The reference surface considered during the calibration and tests is the field aperture plane. For RCN N2 models, this aperture plane is a fixed part. For RCN N1 models, the aperture plane is the plane of apertures of the wheel.

The temperature of the emissive surface is measured with a high precision thermometric thermocouple.

The coating of the cavity is highly emissive but this property is highly amplified by the cavity confinement effect operating as a perfect absorber. The cavity is maintained in a thermally

insulating shell, and is heated at a very high temperature using high performance heating resistances.

During the cooling phases, the amount of power is reduced or stopped. The heat is evacuated thanks to the blowing fans. Note that the maximum temperature of the blowing air is 50°C.

The constant operation of the fans is absolutely necessary to ensure the equipment safety. It ensures a moderate temperature heating of the external surface of the insulating shell. Fans still blow once the controller is switched OFF. It is necessary that they effectively blow several hours after the controller was switched OFF.

The Blackbody Head is connected to the Electronic Controller using:

- The Power Cable
- The Sensor Cable

2.2.1. Aperture Wheel (RCN N1 only)

The front plate of the blackbody is equipped with a 12 position wheel that contains 6 apertures of different diameters. Other 6 apertures remain free for operator's use adding other apertures or filters.

The selection of the aperture is performed using the selection button. Turn the button and then change manually the wheel position. The figure that is displayed corresponds to the diameter of the aperture in use (in mm).

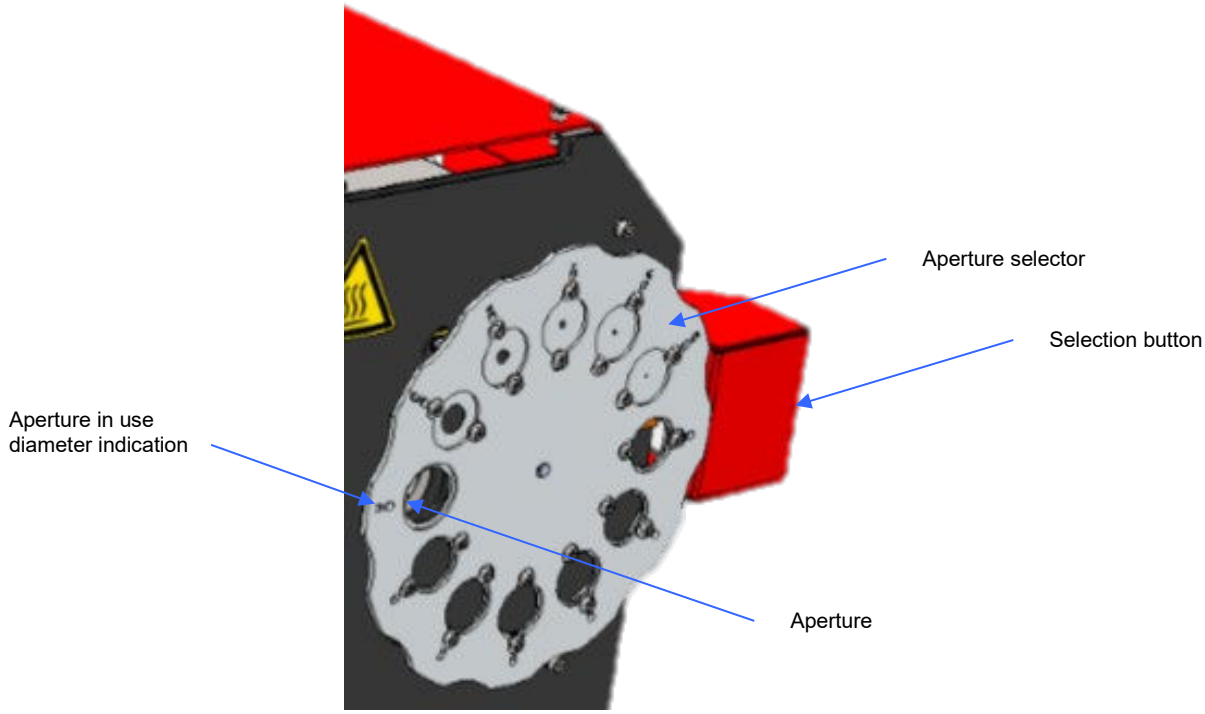


Figure 7: Aperture Wheel

2.2.2.CoolSpeed function (option)

The CoolSpeed function divides by 2 the cooling duration of cavity blackbodies without altering their technical features such as high emissivity, high speed warm up and high stability.

The CoolSpeed function is only activated during the decreasing phase of the temperature of the emissive head. The electronic controller automatically controls the CoolSpeed operation. It starts from 700°C only down to ambient temperature.

2.3. SUPPLY

The blackbody is delivered in two transport cases: one for the head and cables, the other for the Electronic Controller.

The supply consists in:

- Blackbody head equipped with cables (Power and Sensor),
- Electronic controller,
- Mains power cable,
- A USB key including remote control software Infratest-LT, the operating manual of the communication protocols and this operating manual,
- Calibration Certificate,
- Control sheet,
- Ethernet to PC cable,
- A Quick Start Sheet,
- HGH Declaration of Conformity.

3. OPERATION

3.1. PREPARATION OF BLACKBODY

First, keep the packaging used for sending the blackbody. It must be used if the blackbody is sent back to HGH for maintenance or calibration purposes. If HGH Customer Support receive a blackbody not properly packed, cost of a new packaging may be charged at that time.

Before connection, check on the electronic controller that both switches (power and mains) are *OFF*.

Set the blackbody head on a stable surface. HGH recommends to fix it using the dedicated holes in its base plate.

Check that air inlets and fans outlets are not obstructed.

Check on the identification labels that both head and electronic controller have the same type (example: RCN1250N1). Never try to connect a head that has not the same type as the Electronic controller.

Correctly connect the cables in the following order:

High voltage, do not put your fingers into the connectors.

1. Connect the communication cable if required.
2. Connect the Sensor Cable and the Power Cable.
3. Connect the I/O connector (option)
4. Check that the mains supply is correct and that the line is able to deliver the maximal current (refer to paragraph 6.2.3.1) and make the connection.

Switch *ON* the controller. Never switch the controller ON if no head is connected to it.

The main screen is then displayed. This is the screen on which the temperatures are displayed.

Important remark: the accuracy performance of the RCN blackbody is fully reached after a 30-minutes warm up.

3.2. USER INTERFACE

3.2.1.Starting procedure

Switch on the power switch at the rear panel of the controller. The main button at the front panel of the controller becomes red. Then turn on this main button. During the starting procedure this button is blinking blue. This procedure may last a few seconds before the HGH logo appears.

Some tests are set up in the controller. The result of these tests is displayed. Please refer to the Quick Start Sheet supplied with the blackbody or to the paragraph 5.3.2.

By validating the result screen, the main screen is displayed.

3.2.2.Main screen

The screen is a touch screen: areas with possible action are surrounded by a rectangle or a circle. This rule is applicable whatever the displayed page.

From this screen, the user can read the actual blackbody temperature:

Figure 8: Main screen

ABS : indicates the absolute temperature in °C of the emissive surface of the blackbody.

Temperature set point (*30.00* in the above example): indicates the current temperature set point). Press this button to get to set point modification keypad (refer to paragraph 3.2.3).

C : indicates if the temperature is displayed in °C, °F or K. Press the button to change the temperature unit.

SET : This button gives access to predefined set-points.

 : This button gives access to protected parameters (administrator only) and user parameters.

STEP : Press this button to choose the value of the step between two set points.

 : Press these buttons to move on the previous or the next set point. The gap is the STEP value  or ten times the STEP value  .

●: The temperature set point is characterized by the red circle. The second circle (which can be either green or white as on the screen) describes the state of the blackbody. It appears in green when the temperature of the blackbody has reached the set point and is stabilized (blue area around the setpoint - the default value can be modified in the administrator menu, refer to paragraph 3.2.5). If the blackbody hasn't reach the set point yet the circle is white.

3.2.3.Numeric keypad

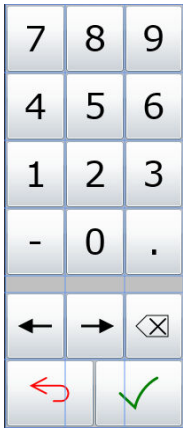


Figure 9: Numeric keypad

This screen is the numeric keypad that appears anytime the user presses a numerical value he wants to modify or the temperature set point button in the main screen. It allows entering a new value for the corresponding variable. When a new value is entered, the user must press to take it into account and then press Return ( ) to get back to the screen from which the keypad was called. If different values can be changed in the same screen, press to get from one value to the next.

Press this button to suppress the previous variable.

Press these buttons to select any variable in the number.

Press the variable anywhere you want to set the cursor at this position.

Figure 10: Letter keypad

This screen is the keypad that appears anytime the user presses a not-only numerical value like a password. When a new value is entered, the user must press to take it into account.

Press this button to suppress the previous variable.

Press the variable anywhere you want to set the cursor at this position.

3.2.4.Predefined set-points

In this screen, there are predefined temperature set points that can be chosen by the user instead of entering them manually from the main screen. Its purpose is to make it faster and more convenient for the user to select the temperature set points that he often uses.

Figure 11: Predefined temperature table

The different predefined temperature set points can be changed by the user:

Press  to select the temperature set-points. Press one of these temperatures to change the temperature set point to the corresponding value. In this example, the current mode is ABS, so for instance, pressing a temperature changes the absolute temperature set point from 30.000°C to the value on the button.

Remark: the set point values of the table can be applied either to absolute or to differential mode.

Warning: it is not possible to change from one mode to the other from this screen; it must be done from the main screen.

Press ✕ to get back to the main screen.

3.2.5.Advanced menu

This menu gives access to protected parameters such as calibration parameters. Some can't be modified (user menu), some can be modified by an advanced customer administrator, others are factory parameters and only HGH has an access to them.

Click on the  button of the main screen to get to the administrator selection screen:

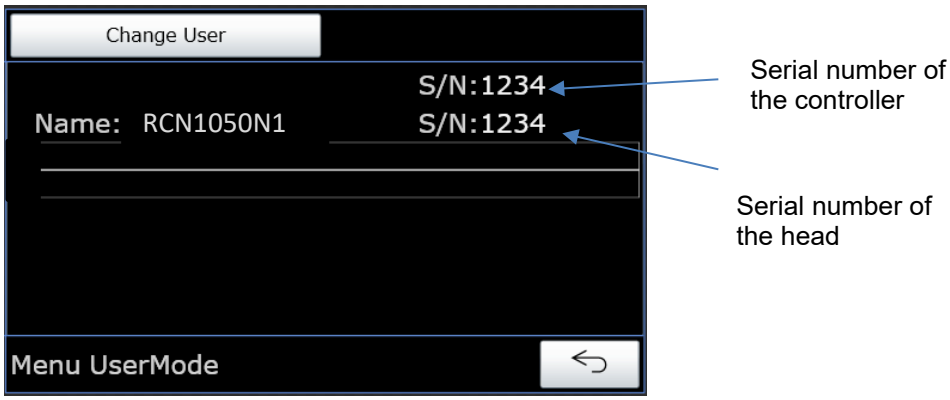
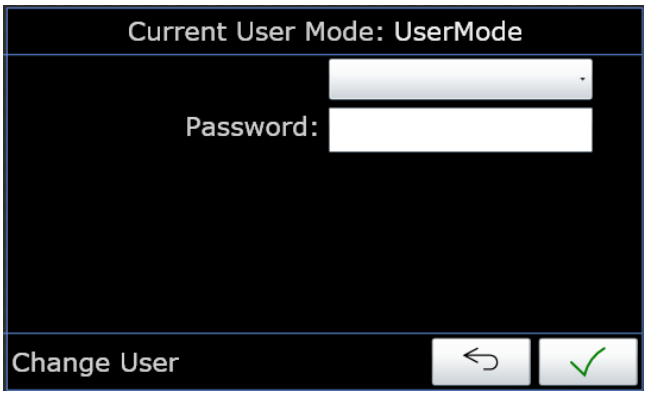


Figure 12: Administrator selection screen

The menu by default is the user menu. To switch on Advanced menu click on *Change User* to display the following screen.



Choose Advanced in the drop menu. Then enter the customer password using the numeric keypad. The Advanced password is provided in the control sheet of the blackbody.

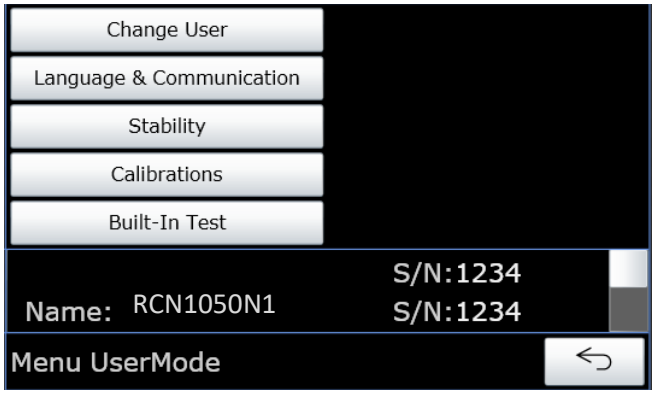


Figure 13: Customer administrator menu screen

3.2.5.1. Language & communication menu

Click on *Language & communication* on the advanced menu to display the following screen.

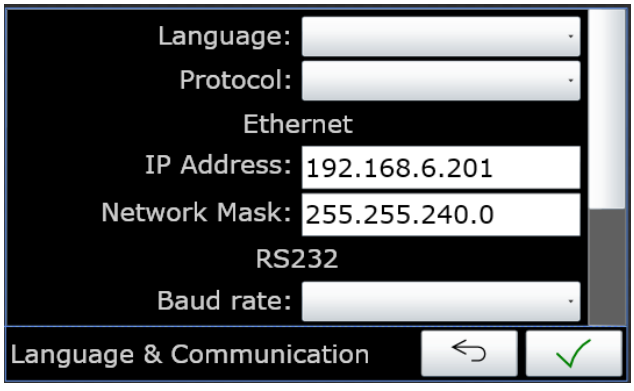


Figure 14 : Language & communication menu

Language : Choose the operation language of the controller (English or French).

Protocol is the communication protocol of the controller.

Ethernet, RS232, GPIB are the configurations of each remote control interface.

Default values are described in paragraph 4.

3.2.5.2. *Stabilization menu*

Click on *Stabilization* on the advanced menu to display the following screen:

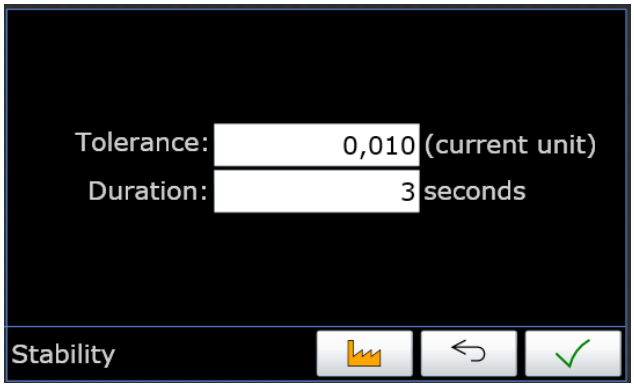


Figure 15: Stabilization menu screen

This menu allows modifying the stabilization criteria.

Tolerance is the temperature tolerance (in °C) into which the blackbody is considered as stabilized.

Duration is the time in seconds during which the temperature error needs to be into the tolerance range so that the blackbody is considered as stabilized.

In the case both criteria are satisfied the circle at the top of the main screen becomes green and remains in the blue area stabilization.

Default values are:

Stabilization tolerance: 0.500°C

Stabilization counter: 20s

: Press this button to validate the new parameters and get back to the advanced menu.

: Press this button to get back to the advanced menu.

: Press this button to get back to the default values.

3.2.5.3. *Calibration parameters menu*

Click on *Calibration* on the advanced menu to display the following screen.

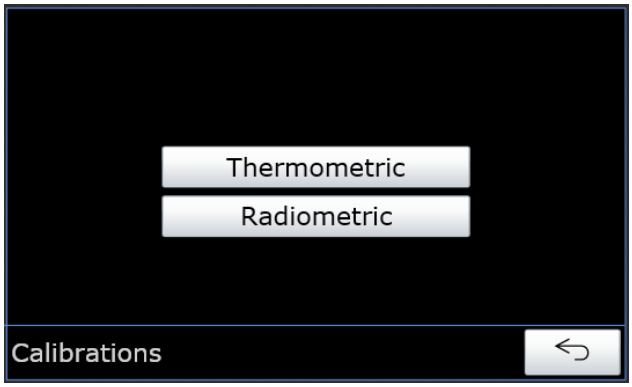


Figure 16 : Main calibration menu

3.2.5.3.1. Thermometric calibration menu

Click on Thermometric on the calibration menu to display the following screen.

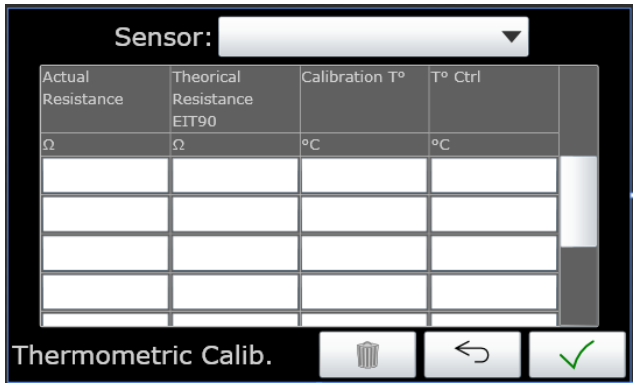


Figure 17 : Thermometric calibration table

This menu allows modifying the parameters of the targets.

In the drop menu select the target temperature sensors that are used with the blackbody.

Actual Resistance, Theorical Resistance, Calibration T° and T° ctrl are the calibration parameters of the temperature sensor of the current target.

Don't modify the TSES sensor without HGH advice.

3.2.5.3.2. Radiometric calibration menu

Click on Radiometric on the calibration menu to display the following screen.

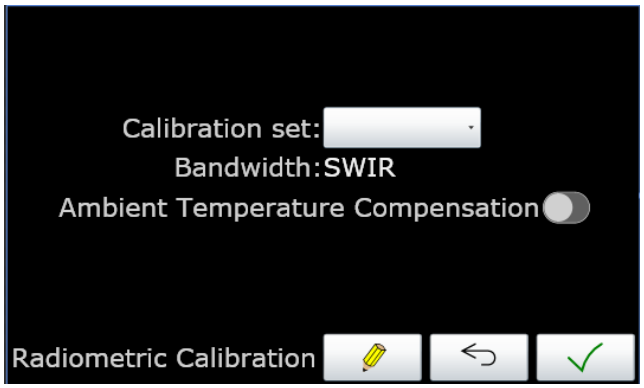


Figure 18 : Radiometric calibration menu

This menu gives access to parameters allowing calibrating the whole blackbody system so that the radiance temperature corresponds to the actual displayed temperature.

On the drop menu choose the calibration set. When no calibration set, the displayed value is the physical temperature of the emissive surface. But as the emissivity can't be exactly 100%, it is possible to select a calibration set.

Each calibration set adjusts the radiance temperature in one spectral bandwidth. The selected bandwidth is written below the calibration set.

You can find the corrected radiance in the calibration certificate provided with the BlackBody.

4. REMOTE CONTROL

The remote communication with HGH's blackbody is available through several communication links:

- Ethernet,
- RS232,
- IEEE488,

Ethernet, RS232 and IEEE488 protocols are available through dedicated user manuals. Moreover, a dedicated remote control freeware Infratest-LT is available for Ethernet, IEEE488 and RS232 links. Please refer to the Infratest-LT user manual to configurate and use your blackbody using one of this communication link.

LabVIEW drivers are also available for Ethernet, RS232 and IEEE488 communication links.

4.1. ETHERNET INTERFACE

Ethernet interface is the standard communication link. It enables to connect several blackbodies on a network and to control them from a distant PC.

The communication protocol is defined in the user's manual of the DCN, ECN and RCN Ethernet protocol.

The freeware INFRATEST - LT is available to configure and control the blackbody using RS232 interface

The blackbody is delivered with default IP address **192.168.1.201**. You can change this IP address using INFRATEST – LT.

4.2. RS232C INTERFACE

RS232C interface enables to connect one blackbody and to control it from a distant PC.

The communication protocol is defined in the user's manual of the DCN, ECN and RCN RS232C protocol.

The freeware INFRATEST - LT is available to configure and control the blackbody using RS232 interface.

4.3. IEEE488 INTERFACE

The communication protocol is defined in the user's manual of the DCN, ECN and RCN RS232C protocol.

The configuration of the converter is the following;

- IEEE address: default 10,
- IEEE configuration: no SRQ,
- Mode: device,

The address by default is 10. It is accessible in the Language and communication menu.

In the case Infratest software is used, make sure the NI IEEE488.2 drivers are installed.

4.4. LABVIEW DRIVERS (OPTION)

These LabVIEW drivers of the blackbody are compatible with LabVIEW v8 or higher and for all available communication links Ethernet, RS232 and IEEE.
The supply includes all the required VIs directly available from the LabVIEW menu. These functions allow the operator to send a temperature setpoint, read the current temperature, check the stabilization status and many other functions.
The supply also includes an example program built from all the available VIs.
Refer to dedicated LabVIEW drivers operating manual for further information.

5. PRECAUTIONS OF USE AND MAINTENANCE

5.1. Electronic controller

High voltage, do not put your fingers into the connectors.

Connect the Electronic controller on a mains plug equipped with a **ground** terminal.

Never switch ON the Electronic Controller if the head is not connected to it.

Control the correct connection of the connectors on back panel.

Never unplug the Electronic Controller before a long period of head cooling. Considering the example of the RCN 1250N1, about 12 hours are necessary so that the cavity cools from 1250°C to 100°C. The fans continue blowing as long as the controller is plugged to the mains, even if it is switched OFF.

Do not cover the aeration holes.

Clean the controller once unplugged, with a humid soft cloth. Do not use solvent or alcohol.

Do not press the touch switches of the screen with a force greater than 30N.

Do not use benzene, paint thinner or other volatile solvents and do not use chemically treated cloths to clean the screen.

Never try to open the controller without HGH advice.

5.2. Blackbody head


Danger OF HEAT BURN

Avoid shocks to preserve the heating elements.

Do not touch the surroundings of the cavity : it may be very hot.

In the general case, avoid touching the external housing of the blackbody when in operation. In the case it is necessary to change the aperture selection or to displace the head, it is advised to wear gloves.

Do not cover aeration holes.

Don’t use the blackbody in a wet or dusty environment.

Clean the head of the blackbody with a humid soft cloth. Do not use solvent.

Never pack the Blackbody head if its cavity temperature (the one displayed on the Electronic Controller) exceeds 60°C.

5.3. TROUBLE SHOOTING

5.3.1. The main button remains off

When the user switches ON the power switch a red light appears around the main button. If not, the controller may be misconnecting from the main supply. Press the main button. If nothing happens, the system remains silent and the screen off, check that the mains line is correctly 230V powered. Try again.

Unplug the mains of the controller. Remove the fuse and check its status thanks to an ohmmeter. If required, replace the faulty fuse by a delayed fuse according to the type of blackbody:

Type of blackbody	Type of fuse
RCN 600 N05	T3A Ø6.3x32
Other models	T20A Ø6.3x32

Re-plug and restart the controller.

If the light indicator still remains off, please contact HGH.

5.3.2. Autotest

Startup and continuous tests are set up in the controller. Press the *Built-in-test* button in the Advanced menu to display the following screen.

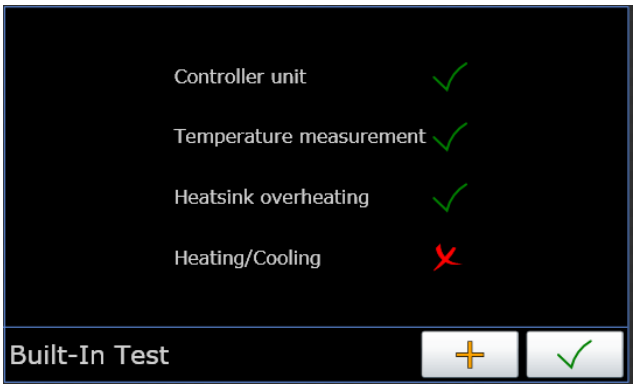


Figure 19 : Built-in-test result

If a red cross appears, press the  button to get the detail of the *Built-in-test*.

Controller unit :

- If an error appears on this part, turn the blackbody off and on. If the error remains, please contact HGH.

Temperature measurement : Sensor failure (Emissive Surface Temperature Sensor (TSES) or Ambient Temperature Sensor (TSA)).

- Check that the blackbody cable (between the Electronic controller and the head) is correctly connected. Try again. If the error remains, please contact HGH.

Heatsink overheating :

- Check that the fans are working, and that the fans inlets and outlets are not obstructed. Try again. If the error remains please contact HGH.

Heating/cooling :

PWR0 : Power failure

- Check that the blackbody cable (between the Electronic controller and the head) is correctly connected. Try again. If the error remains, please contact HGH.

ID0 : Wrong head connected. If so, please connect the good head.

5.3.3.Fans don't work

You connected the blackbody to the main power but the fans remain static.

- Check that the blackbody cable (between the Electronic controller and the head) is correctly connected. Try again.
- Swich OFF the Electronic controller. Unplug the blackbody cable.
- Use an ohmmeter to measure the resistance between pin n°6 and pin n°7 on the blackbody connector of the head. If the resistance is more than 1kΩ, the fans might be damaged.

Otherwise, the controller might be faulty. Please contact HGH.

5.3.4.Inactive touchscreen

You switched on the controller and its touch screen remains inactive, it remains empty or the display is fixed, the measured temperatures don't change.

- The touchscreen communication may be interrupted. Switch OFF and ON the controller, then the operation may be normal.
- The measured temperatures display seems to be normal but when you touch the screen it doesn't react.
- The touch screen may be locked. Actually, the touch screen can be locked by INFRATEST - LT through the computer interface. You can unlock the touch screen through the same interface (refer to INFRATEST - LT manual). Anyway, if you switch OFF then ON the controller, the touch screen will be unlocked.

5.3.5.Limited temperature range

You tried to set an extreme value in the specified working range but the blackbody can't reach this temperature.

- Check that the blackbody head is in a quiet environment protected from wind.
- If the temperature range is still limited, refer to the following table and use an ohmmeter to measure the resistance between the pins of the Power Cable:

Type of blackbody	RCN 600 N05	Other models
R between pins :	2 and 3	R_1 between 1 and 2 R_2 between 3 and 4
Default if :	>350Ω	>0.5Ω

If the resistance exceeds the limit value, it means that the heating elements may be damaged. Please contact HGH.

– If the values are normal, the Power circuit may be checked. Please contact HGH.

5.3.6. The blackbody is unstable

You switched on the blackbody and set a temperature, the blackbody reaches the temperature but the stability is not good.

– Check that the blackbody head is in a quiet environment protected from wind.

– Check that the cables are correctly plugged and locked.

– Check that cables path is not near from a powerful electromagnetic emitter (unprotected electronic device).

– Check that ground is effectively connected to the controller.

– For perturbed atmospheric conditions (climatic chambers with circulating air), HGH offers different solutions like shelters or lens to blackbody head sleeve interface. Please contact HGH.

6. MAIN CHARACTERISTICS

6.1. CONDITIONS OF USE

PARAMETER		RANGE OF REFERENCE	RANGE OF USE	RANGE OF STOCKING
Climatic conditions	Ambient temperature	20°C ± 5°C	+5°C to +45°C	-20°C/+70°C
	Relative humidity without condensation	45% to 75%	20% to 80% (70% at 45°C)	10% to 80%
Supply	Mains voltage	100-250 VAC	90 VAC to 260 VAC	-
	Frequency	50Hz/60Hz	45Hz to 65 Hz	-

Remark: the above conditions apply to the Electronic Controller and the blackbody head.

6.2. MAIN SPECIFICATIONS

6.2.1.Mechanical characteristics

6.2.1.1. Electronic controller

Waterproofness: IP 20 according to CEI 529

Main cable: 15A (UL) SJT E67601

Format: 2U rack case, 19 inches (84 F) according CEI 297.3

Dimensions: H 85 x L 450 x P 412 mm with19" fixation braces.

Weight: 8.5 kg

6.2.1.2. Blackbody head

Emissive surface diameter:

- RCN 600 N05: 12.5mm
- RCN 1250 to 1350 N1: 25mm
- RCN 1050 to 1250 N2 : 50mm

Minimum radius of curvature of cables: R = 110 mm

Weight:

- RCN 600 N05: 3 kg
- RCN 1050 to 1350: 17 kg

6.2.1.3. Aperture wheel

The aperture wheel entails a series of apertures of different diameters. Find the list by Blackbody type below:

RCN 600 N05 (no wheel)	RCN 1250 N1 to 1350 N1	RCN 1050 N2 to 1250 N2
Ø12.5mm	Ø25mm	Ø50mm
	Ø12.5mm	
	Ø6mm	
	Ø3mm	
	Ø1.5mm	
	Ø0.7mm	

6.2.2. Electric characteristics

- Main supply: 100/250V 50/60 Hz
- Suppressor: according to VDE 0871-A

Blackbody type	RCN 600 N05	Other models
Power	300 VA	1.8 kVA
Fuse	T3A Ø6.3x32C	T20A Ø6.3x32

6.2.3. Functional characteristics

6.2.3.1. Electronic controller

- Temperature measurement: 1 input for thermocouple sensor type K (RCN 600 N05), type S (RCN1050 to 1350), linearization according to CEI 584.1 (NF EN 60584.1).
- Resolution: 0.01°C
- Display range: 0.00°C to 1350.00°C
- Temperature measurement accuracy: ± 1.5°C up to 375°C, ± 0.4%xT above (RCN 600 N05), 1°C up to 1050°C, 1+0.4%.(T-1100) above (RCN 1050 to 1350)
- Resolution of the temperature set points: ± 0.01°C
- Regulation: PID adapted to the set point temperature
- Rising time:

Blackbody type	RCN 600 N05	RCN 1050 to 1350
Gap	from 20°C to 600°C	from 20°C to 1000°C
Duration	<20min	<65min

- Stabilisation time :

Blackbody type	RCN 600 N05	RCN 1050 to 1350
Gap	from 20°C to 1000°C	from 20°C to 1200°C
Stability criterion	± 0.3°C	± 0.5°C
Duration	<25min	<75min

Long term stability at the max set-point temperature (900°C for other models): ± 0.1°C RMS

– Cooling time (RCN1050 to 1350 only thanks to CoolSpeed system): between 150 min and 185 min from maximum temperature to 100°C.

6.2.3.2. Blackbody

Temperature range (for a 20°C ambient temperature) :

Blackbody type	RCN 600 N05	RCN 1250/1350 N1	RCN 1050/1250 N2
Range	[50°C ; 600°C]	[50°C ; 1050/1250/1350°C]	[50°C ; 1050/1250°C]

Emissivity : > 0.99

Thermal uniformity

Blackbody type	RCN 600 N05	RCN N1	RCN N2
Uniformity RMS	< 0.3°C (@ 600°C)	< 2°C (@ 900°C)	< 4°C (@ 900°C)

7. Appendix

Spectral emissivity of RCN blackbody sources.

Following testing report K021353 – Document DMSI/1 issued by LNE : Laboratoire National de métrologie et d'essais (French National Metrology Institute), spectral emissivity curve of RCN blackbodies is:

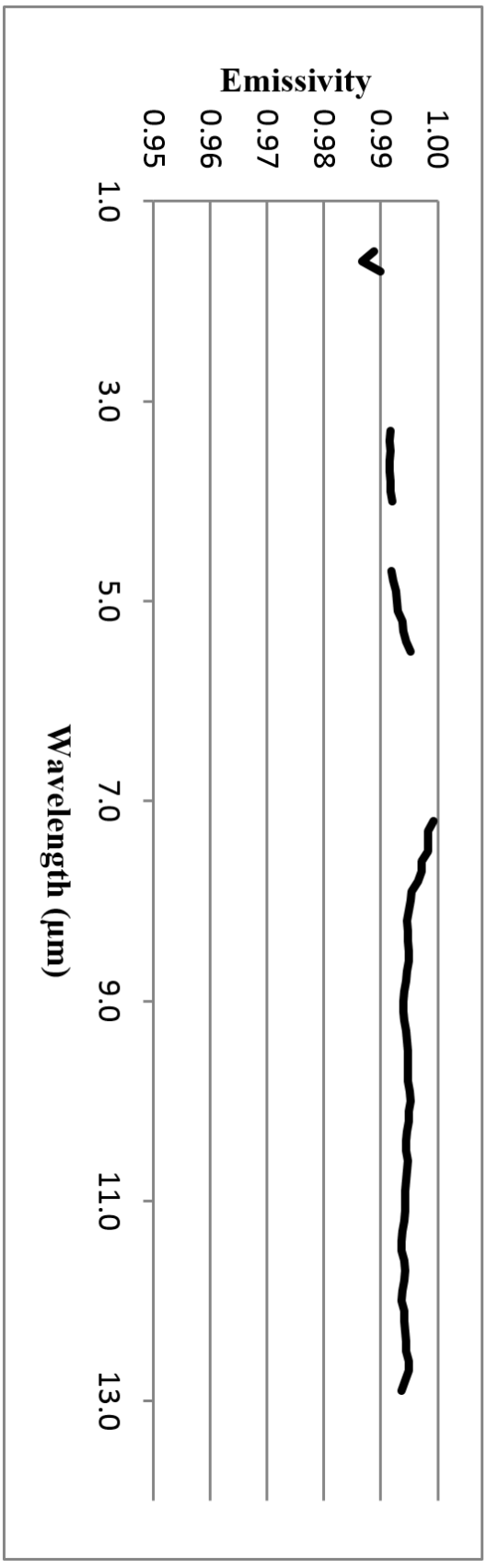


Figure 20 : Spectral emissivity of RCN blackbodies