

Introduction to Blackbody Sources

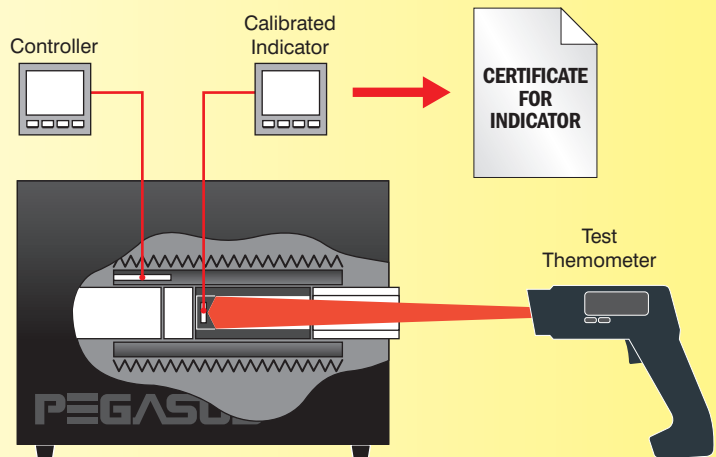
This section contains dedicated blackbody sources for low uncertainty calibration of infrared thermometers. A range of portable primary blackbody sources combine high emissivity with excellent temperature uniformity. The cylindrical cavity design minimises the effects of air movement and ambient changes.

Many of the sources can be used with high purity ITS-90 Fixed Point cells where the thermometer is calibrated against the freezing temperature of a pure metal.

How To Calibrate Infrared Thermometers

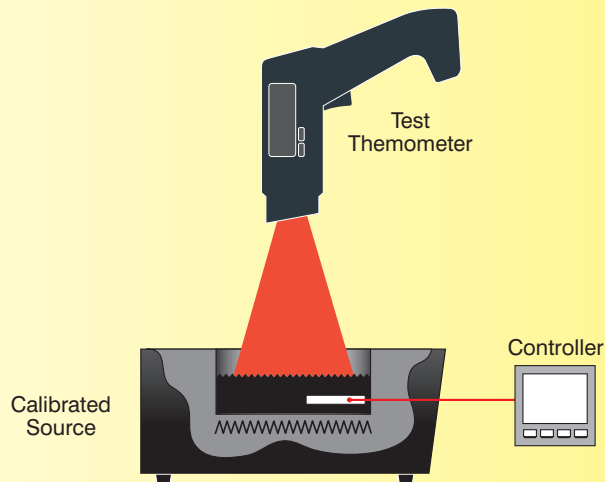
1 With a Primary Standard Source

The temperature source has an emissivity approaching unity and sufficient uniformity so that the test thermometer can be compared to a traceable contact thermometer.



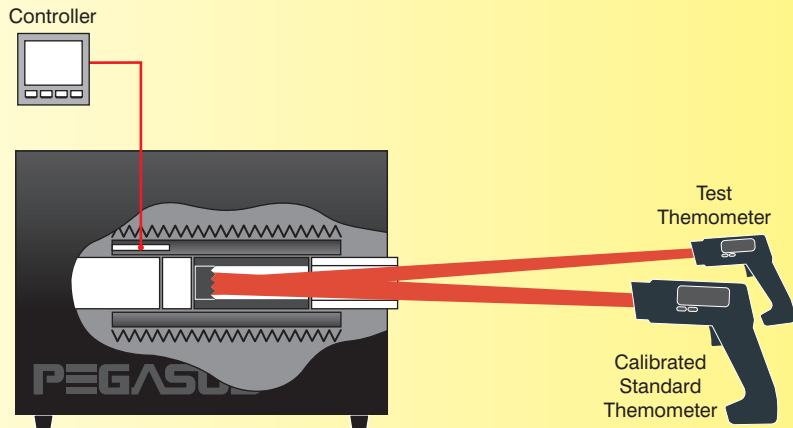
2 Calibration using a secondary standard source

With this method the blackbody is calibrated with a standard thermometer and the test thermometer is compared to the source.



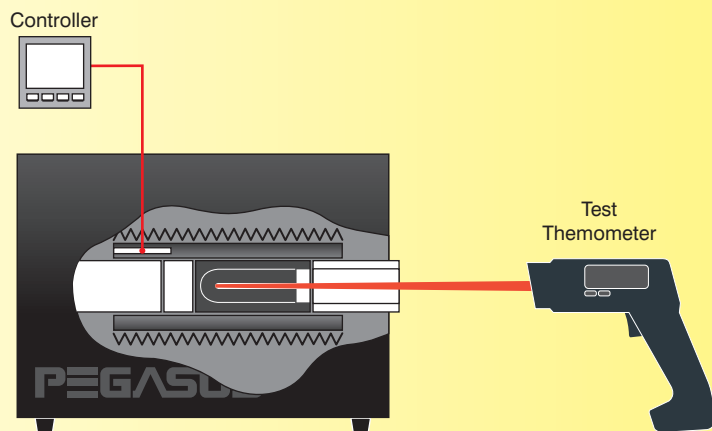
3 Calibration using a transfer standard source

With this method the test thermometer is compared to a standard radiation thermometer.



4 Using ITS-90 Fixed Point Cells

The test thermometer is calibrated, not against a source or other thermometer, but against a fixed temperature from an ITS-90 Fixed Point Cell. For example by melting a quantity of pure Gallium to obtain a fixed temperature of 29.7646°C



■ Blackbody

A blackbody has been defined as either a source with zero reflectivity or a source emitting the maximum possible radiation (at all wave lengths) for its temperature.

■ Emissivity

Emissivity is the ratio of the radiation emitted by a surface to that emitted by a black body at the same temperature.

Isotech has a range of sources having a high emissivity combined with thermal uniformity for use as Primary Standard Sources for low uncertainty calibration wavelength independent calibration.



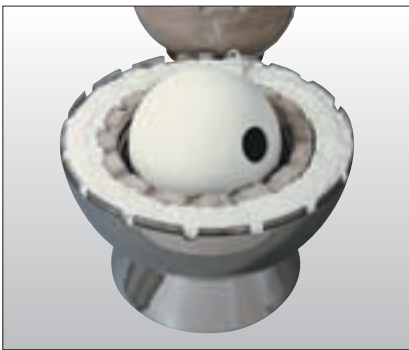
Types of Equipment

Primary Black Body Sources

■ **Hyperion R, Gemini R, Medusa R, Oberon R.**
 Black body sources covering the range from -10°C to 1100°C.
 Can also be used with fixed point cells.
 Aperture sizes ranging from 20 to 65mm.



■ **Cyclops**
 Temperature range from 100°C to 1300°C.



Special Applications

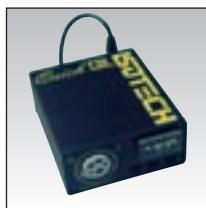
Model 988 Useful with Thermal Imaging Systems
 Covers Human Body Temperature



Model 975 Secondary Source
 Emmissivity 0.95



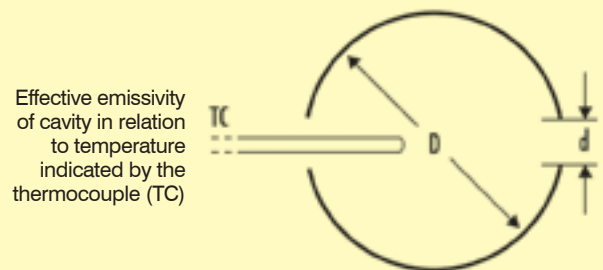
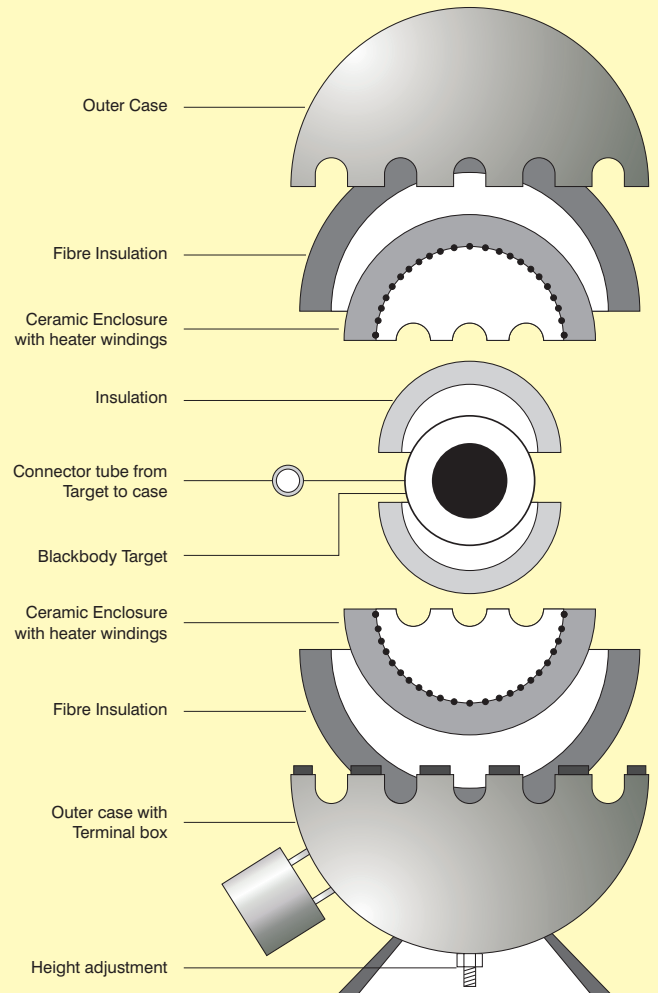
Model 550-02 Low Cost
 50 - 350°C



Calibration of Simple Low Cost Infrared Thermometers.

Many of Isotech's calibrators for PRTs and Thermocouples can also be used for testing simple Infrared devices, see Isocal-6 or Dry Block sections.

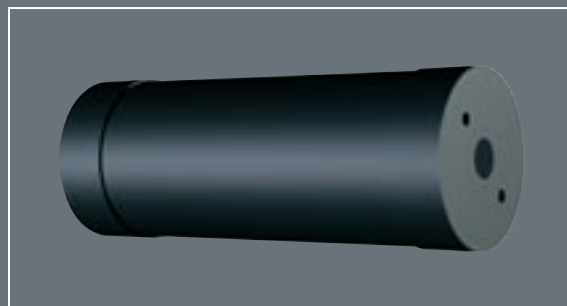
Cyclops Blackbody Source



Isotech Blackbody Fixed Point Cells

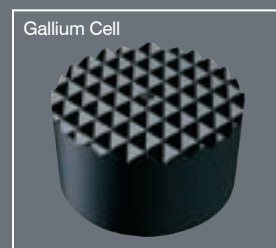
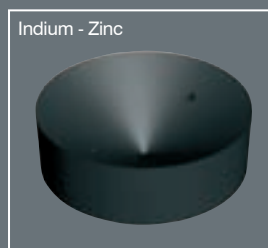
Primary Standard Cells

Point	Part Number	Temperature	Apparatus
Indium	998-06-00A	156.60°C	Medusa R
Tin	998-06-00B	231.93°C	Medusa R
Zinc	998-06-00C	419.53°C	Medusa R
Aluminium*	998-06-00D	660.32°C	Oberon R
Silver*	998-06-00E	961.78°C	Oberon R
Copper*	998-06-00G	1084.62°C	Oberon R



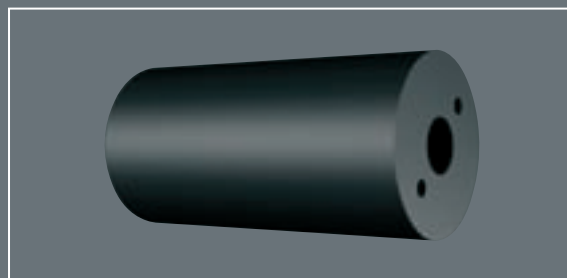
Medium Temperature "Hockey Puck" Cells

Point	Part Number	Temperature	Apparatus
Gallium	431-03-00	29.7646°C	Gemini R
Indium	976-05-00A	156.60°C	Gemini R
Tin	976-05-00B	231.93°C	Gemini R
Zinc	976-05-00C	419.53°C	Gemini R



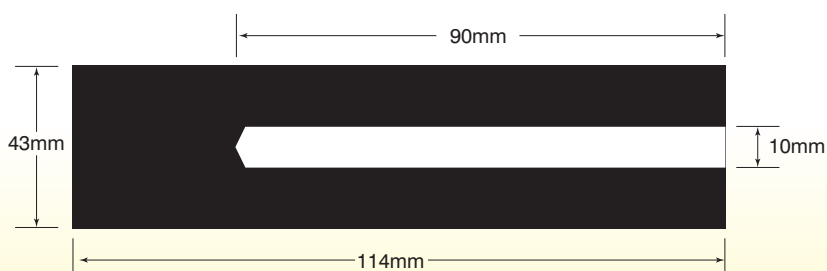
High Temperature Cells for the Pegasus R

Point	Part Number	Temperature	Apparatus
Indium	970-06-00A	156.60°C	Pegasus R
Tin	970-06-00B	231.93°C	Pegasus R
Zinc	970-06-00C	419.53°C	Pegasus R
Aluminium*	970-06-00D	660.32°C	Pegasus R
Silver*	970-06-00E	961.78°C	Pegasus R

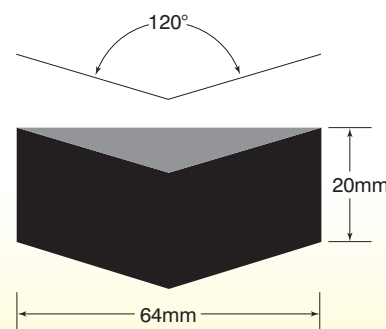


* These cells are required to be surrounded by gas for protection at high temperatures (See model 984)

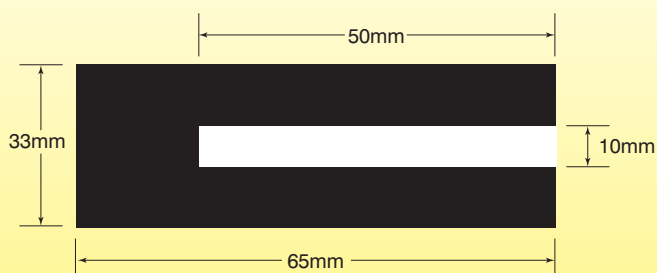
Gallium Cells for Medusa R or Hyperion R to special order.
Cells are provided with Certificate of Metal Analysis.



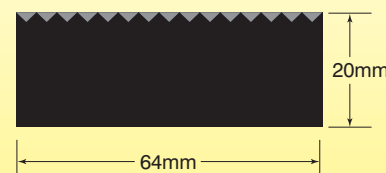
Primary Standard Cell



Hockey Puck Cells



Pegasus R Cell



Gallium Cell

Gas Flow System Model 984

- Designed for Isotech Blackbody Cells
- Protect High Temperature Cells
- Gas flow interruption alarm

The higher temperature Isotech Blackbody Fixed Point Cells consist of high purity metals within a graphite body. Graphite reacts with air to form Carbon Dioxide. The rate of the reaction is temperature dependant. The effect is small at low temperatures but increases at higher temperatures.

For Indium and Tin cells the effect is small and for Indium, Tin and Zinc cells in general no attention needs to be made. Yet for Aluminium, Silver and Copper Cells the oxygen must be excluded or the cells would be quickly damaged.

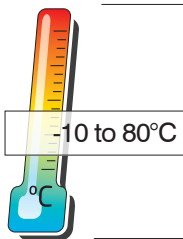
The Model 984 Gas Flow System connects between an inert gas supply, such as Argon or Nitrogen and the Cell in its apparatus.

The Model 984 has a regulator and a flow meter optimised to easily set the flow to 0.2 L/min and features an audible alarm should the gas flow be interrupted.



Model	984
Input - Output Connectors	Genevac 16KF
Alarm	Audible
Power	15W
Voltage	12Vdc
Dimensions	Height 240mm Width 120mm Depth 220m (excluding connection pipes)
Weight	2.5kg

How To Order
 Model 984 Gas Flow System
 Supplied with external power supply, 2 x connecting pipes and fittings



Blackbody Source Hyperion R

- Low Temperature Radiation Pyrometer Primary Source
- 50mm Diameter Cavity
- 0.995 Emissivity

The Hyperion R Portable Blackbody Calibration Source allows for calibration of noncontact infrared thermometers over the temperature range -10°C to 80°C.

It is suitable for use as a primary radiation source for infrared thermometers from sub zero to 80°C.

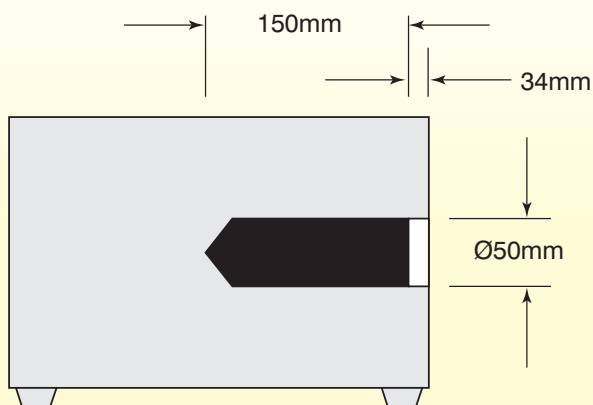
Laboratory performance and low uncertainty calibrations are ensured by the combination by high emissivity and excellent temperature uniformity.

The digital temperature controller allows the block temperature to be set to any value from -10°C to 80°C.

Traceability of the radiance temperature is established by a separate, built-in temperature indicator and included platinum resistance thermometer.

A three point traceable calibration certificate is included. UKAS calibration of the resistance thermometer is available, as is radiometric calibration.

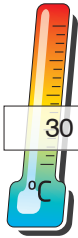
Uniformity of the block is ensured by using distributed thermoelectric heat pumps with the benefit of solid state, vibration free cooling.



Hyperion R

Model	982
Temperature Range	-10°C to 80.0°C
Emissivity	Greater than 0.995
Stability	±0.1°C
Display Resolution	0.01°C
Heating Time	40 minutes to 80°C
Cooling Time	45 minutes to -10°C
Aperture Diameter	50mm
Cavity Depth	150mm
PC Interface	included
Power	200 Watts typical
Voltage	100-130 or 208-240 Vac
Dimensions	H 310mm W 265mm D 200mm
Weight	10kg
Options	
Orifice Plates 10, 20, 30, 40mm (Restricts Cavity Aperture)	812-01-06
Carrying Case	931-22-64

How To Order
 Model 982 Hyperion R
 State Supply Voltage
 Please state any special calibration requirement



30 to 550°C

- 30°C to 550°C
- Emissivity > 0.995
- 65mm Diameter Cavity

The Gemini R 550 Portable Blackbody Calibration Source allows for calibration of noncontact infrared thermometers over the temperature range 30°C to 550°C.

It is suitable for use as a primary radiation source for infrared thermometers.

Laboratory performance and low uncertainty calibrations are ensured by the combination by high emissivity and excellent temperature uniformity.

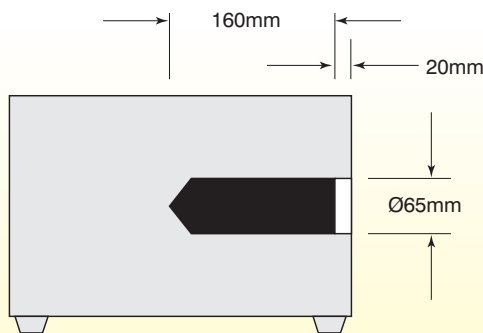
The digital temperature controller allows the block temperature to be set to any value from 30°C to 550°C.

Traceability of the radiance temperature is established by a separate, built-in temperature indicator and included platinum resistance thermometer.

A three point traceable calibration certificate is included. UKAS calibration of the resistance thermometer is available, as is radiometric calibration.

Uniformity of the block is ensured by using distributed heating technology.

For the smallest of uncertainties the Gemini R may be used with Isotech ITS-90 Fixed Point Cells, Gallium 29.7646°C, Indium 156.5985°C, Tin 231.928°C and Zinc 419.527°C. The cells are provided with a certificate of metal purity.



Gemini R

■ Test Report

The variation seen on the controller's temperature indication over a 5 minute period was $\pm 0.2^\circ\text{C}$. Similar variations were detected by a radiation thermometer looking into the cavity.

Using a portable radiation thermometer having a target diameter of 13mm, the 65mm target was surveyed.

Maximum temperature differences of $\pm 1^\circ\text{C}$ were found for set temperatures in the range 100°C to 500°C.

Temperatures along the inner 100mm of the 160mm long cavity were measured at 400°C and 500°C, using a hand held fibre-optic radiation probe. Maximum temperature differences of $\pm 4^\circ\text{C}$ were found.

The temperature, as shown on the controller, agrees with the cavity temperature as measured by a radiation thermometer, where calibration is traceable to National Standards, to within $\pm 2^\circ\text{C}$.

Blackbody Source Gemini R



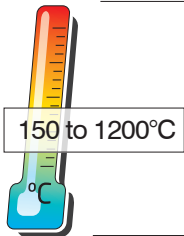
Model	976
Temperature Range	30°C to 550.0°C
Emissivity	Greater than 0.995
Stability	$\pm 0.1^\circ\text{C}$
Display Resolution	0.01°C to 99.99; 0.1°C from 100 to 550
Heating Time	45 minutes
Aperture Diameter	65mm
Cavity Depth	160mm
PC Interface	included
Power	1000 Watts typical
Voltage	100-130 or 208-240 Vac 50/60Hz
Dimensions	H 310mm W 265mm D 200mm
Weight	10kg

Options

Fixed Point Cell	
Gallium Hockey Puck Cell	431-03-00
Indium Hockey Puck Cell	976-05-00A
Tin Hockey Puck Cell	976-05-00B
Zinc Hockey Puck Cell	976-05-00C
Orifice Plates 10, 20, 30, 40, 50mm (Restricts Cavity Aperture)	976-01-05
Carrying Case	931-22-64

How To Order

Model 976 Gemini R
State Supply Voltage
Please state any special calibration requirement



Blackbody Source Pegasus R

- 150°C to 1200°C
- Compact 20mm Diameter Cavity
- Emissivity > 0.995 Cavity 20 x 65mm

The Pegasus R is a compact furnace for calibrating radiation pyrometers.

The temperature of the furnace is set on a controller, whilst an independent indicator, whose sensor fits into the cavity, indicates the actual radiance temperature. The sensor can be removed for external calibration or the complete system can be calibrated.

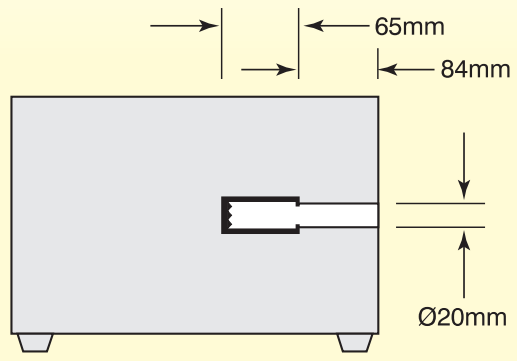
The cavity diameter is 20mm, the depth 65mm. Emissivity is 0.995. The cavity is removable and a fixed point cell may be put in its place. The cavity inside the fixed point cell is 10mm in diameter by 65mm deep to the tip of a 120° cone.

Blackbody target radiation source for use with Pegasus R.

For calibration radiation thermometers in the wavelength range 0.9 to 14 micrometres. A blackbody radiation source 'based on a design study by England's National Physical Laboratory (NPL)' for Isothermal Technology Ltd is housed, with suitable insulation, in the Pegasus tube furnace. The aperture is 20mm in diameter.

A Pegasus blackbody source has been calibrated at NPL (Nat. Physical Laboratory) with an uncertainty of $\pm 2^\circ\text{C}$ and the calibration was found to be reproducible after a period of about 2 months. A scan across the aperture at 444°C showed that the source was uniform to better than 0.3°C.

Traceability may be established with a UKAS certificate for the in-built indicator and supplied probe (935-14-40).

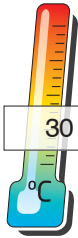


Pegasus R

Model	970
Temperature Range	150°C to 1200°C
Emissivity	0.995
Stability	$\pm 0.1^\circ\text{C}$
Display resolution	0.1°C to 999.9; 1°C from 1000 to 1200
Cavity size	20mm diameter 65mm deep
Heating Rate	25°C/minute
PC Interface	Included
Power	800W typical 100-130 or 208-240 Vac 50/60Hz
Dimensions	Height 310mm Width 265mm Depth 200mm
Weight	13 kg

Options	
Indium Blackbody Cell	970-06-00A
Tin Blackbody Cell	970-06-00B
Zinc Blackbody Cell	970-06-00C
Aluminium Blackbody Cell	970-06-00D
Silver Blackbody Cell	970-06-00E
Probe	935-14-40
Carrying Case	931-22-64
Gas Flow System	984-00-00

How to order
 Model 970 Pegasus R
 Please state supply voltage required
 Please state any special calibration requirement



30 to 550°C

- 30°C to 550°C
- Emissivity > 0.995 Cavity 45 x 285mm
- Accepts Isotech Primary Blackbody Cells

The Medusa R Blackbody Calibration Source allows for calibration of noncontact infrared thermometers over the temperature range 30°C to 550°C.

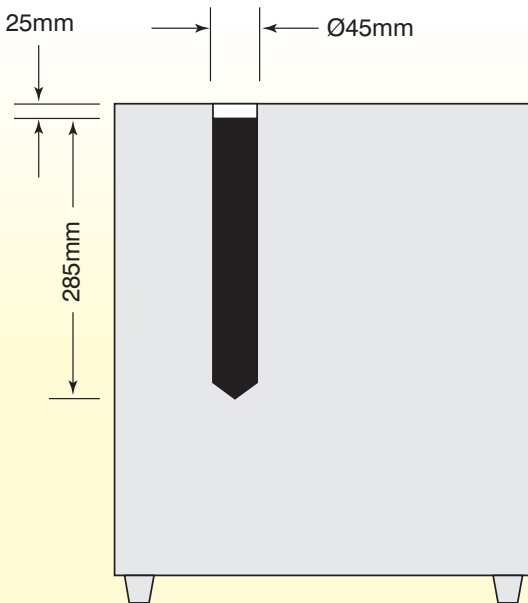
It is suitable for use as a radiation source for infrared thermometers. The cavity is 45 x 285mm deep and suitable for use with the larger Isotech fixed point cells.

Laboratory performance and low uncertainty calibrations are ensured by the combination by high emissivity and excellent temperature uniformity.

The digital temperature controller allows the block temperature to be set to any value from 30°C to 550°C.

Uniformity of the large block is ensured by using distributed heating technology.

For the smallest of uncertainties the Medusa R may be used with Isotech ITS-90 Fixed Point Cells, Gallium 29.7646°C, Indium 156.5985°C, Tin 231.928°C and Zinc 419.527°C. The cells are provided with a certificate of metal purity.



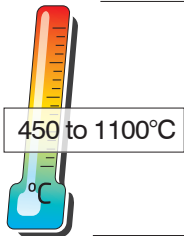
Medusa R

Blackbody Source Medusa R



Model	999
Temperature Range	30°C to 550.0°C
Emissivity	Greater than 0.995
Stability	±0.1°C
Display Resolution	0.01°C to 99.99; 0.1°C from 100 to 550
Heating Time	45 minutes
Aperture Diameter	45mm
Cavity Depth	285mm
PC Interface	included
Power	1000 Watts typical
Voltage	100-130 or 208-240 Vac 50/60Hz
Dimensions	H 480mm W 425mm D 260mm
Weight	17kg
Options	
Fixed Point Cells	
Indium Large Primary Cell	998-06-00A
Tin Hockey Large Primary Cell	998-06-00B
Zinc Large Primary Cell	998-06-00C

How To Order
 Model 999 Medusa R
 State Supply Voltage
 Please state any special calibration requirement



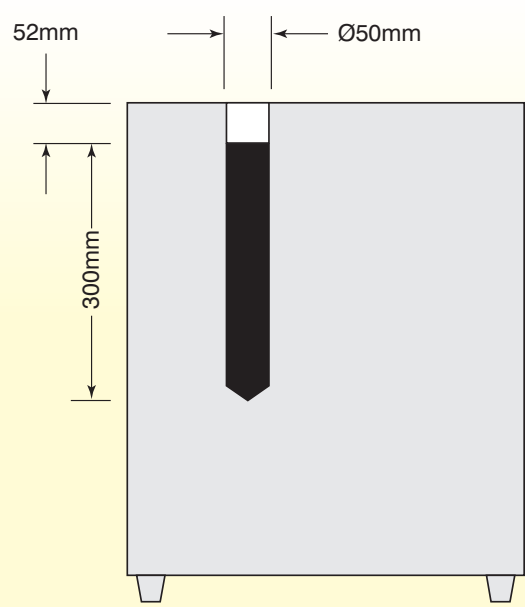
Blackbody Source Oberon R

- 450°C to 1100°C
- For High Temperature Blackbody Fixed Points
- Utilises a Sodium Heatpipe

The Oberon R uses a Sodium Heat Pipe to ensure an exceptionally low temperature gradient along the furnace core. It is ideal for the realization of Aluminium, Silver or Copper ITS-90 Fixed Points.

It may be used as a blackbody source over the range 450°C to 1100°C.

The furnace heater is of the non-inductive bird-cage design insulated by twin bore alumina tubes. The heatpipe is designed so that the inner wall is not subject to thermal expansion stresses from the outer wall before the heat pipe reaches conduction temperature. The working fluid is permanently and safely sealed within the plasma-arc welded enclosure.



Oberon R

Model	426
Temperature Range	450°C to 1100°C
Emissivity	greater than 0.995
Stability	±0.05°C
Display resolution	0.1°C to 999.9; 1°C from 1000 to 1090
Cavity size	50mm diameter 300mm deep
Time to temperature	4 hours
PC Interface	Included
Supply	110Vac, 3kW, 50/60Hz CTE (230Vac and 110Vac to 110Vac Isolating Transformers available)
Dimensions	Height 410mm Width 415mm Depth 280mm
Weight	30.5kgs

Options	
Aluminium Primary Blackbody Fixed Point Cell	998-06-00D
Silver Primary Blackbody Fixed Point Cell	998-06-00E
Copper Primary Blackbody Fixed Point Cell	998-06-00G
Gas Flow System	984-00-00
230v/110v Transformer	935-19-43
110v/110v Transformer	935-19-48

How to order
 Model 426 Oberon R
 Please state voltage required
 Please state any special calibration requirement



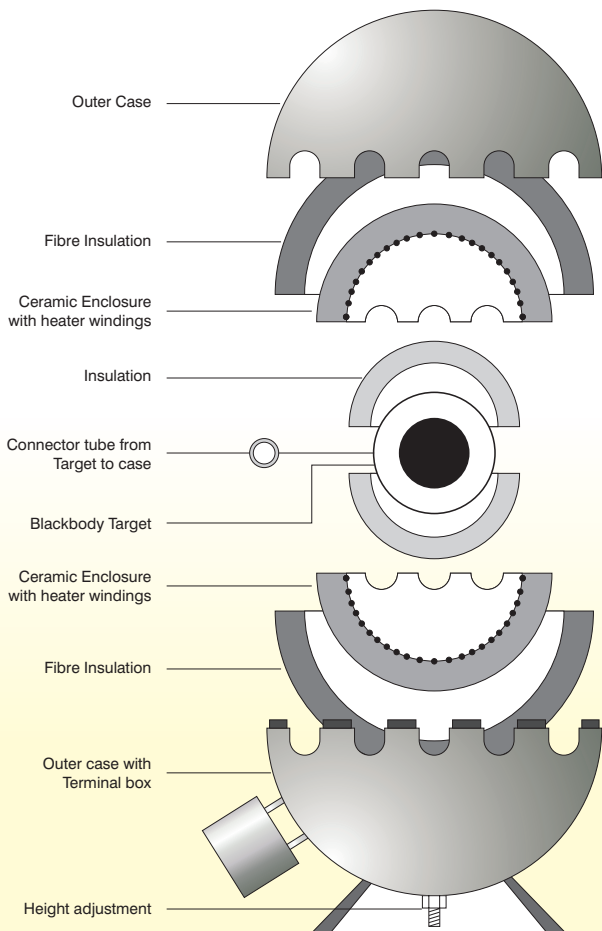
100 to 1300°C

- Spherical Blackbody Source
- Wide Temperature Range 100°C to 1300°C
- Can be adapted for Thermocouple Calibration

The Cyclops Model 878 is a spherical blackbody source. It consists of an inner black sphere that sits inside a spherical furnace and is suitable for use as a radiation source for infrared thermometers.

The inner sphere has a nominal diameter 230mm and is accessed by an optical sighting tube. The furnace can be supplied in one of two constructions, one providing an aperture size of 17mm and one of 45 mm.

The furnace can be adapted for thermocouple operation by replacing the inner sphere with an equalizing block and using a different control sensor.



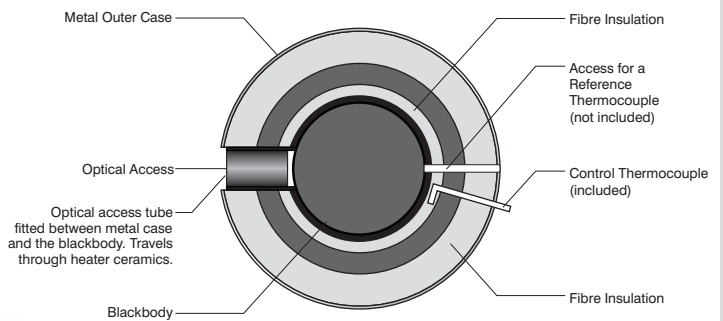
The external control system uses power feedback to stabilise against supply voltage changes providing greater stability. A digital filter circuit ensures high integrity of measurement, correcting for drift and noise



Blackbody Source Cyclops



Cyclops Assembly Diagram Plan View (shown in section)



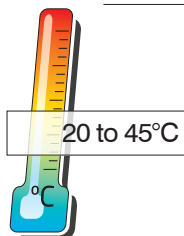
Model	878
Temperature Range	100°C to 1300°C
Emissivity	Greater than 0.999
Stability	±0.1°C
Display resolution	0.1°C to 999.9; 1°C from 1000 to 1300
Time to temperature	90mins hour to 700°C 4 hours to 1300°C
PC Interface	included
Power	3kW typical
Voltage	100-130 or 208-240 Vac 50/60Hz
Dimensions	425mm Diameter
Weight	25 kg

Options

Ceramic Equalising Block to accept up to 8 thermocouples 878-02-08.

How to Order

Model 878 Cyclops. Please state supply voltage required
Please state target diameter either 17mm standard or 45mm to special order



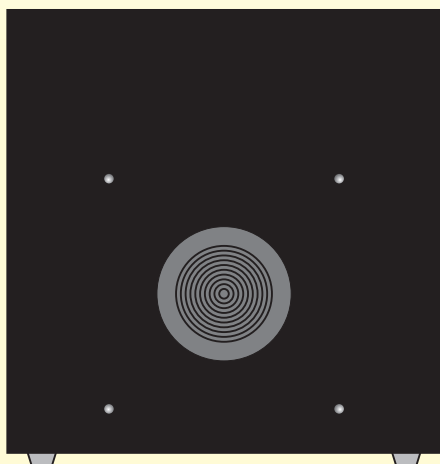
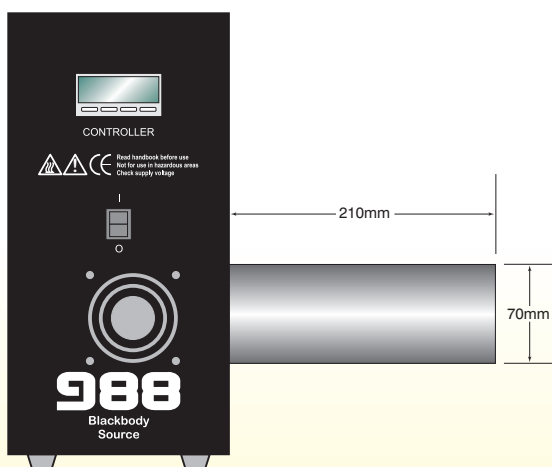
Blackbody Source Model 988

- 20°C to 45°C
- Emissivity better than 0.97 ± 0.02
- Controller Resolution 0.01°C

This blackbody source has been introduced to meet the demand for a simple, cost effective but high accuracy calibrator for the calibration of thermal imagers and infrared thermometers used at temperatures around ambient.

A 70mm diameter ridged plate is heated or cooled with an internal solid state thermoelectric heat pump. The temperature of the plate can be set from 20°C to 45°C to a resolution of 0.01°C.

Evaluation showed the advantages of fitting a stainless steel tube around the plate to give better uniformity and less sensitivity to draughts and ambient temperature effects.



<http://www.isotech.co.uk>

Model	988
Temperature Range	20°C to 45°C
Resolution	$\pm 0.01^\circ\text{C}$
Target Size	70mm Diameter
Emissivity	0.97 ± 0.02
Combined	$\pm 0.2^\circ\text{C}$
Accuracy / Stability	($\pm 0.3^\circ\text{F}$)
Power	60 Watts
Voltage	12 Vdc
Dimensions	H 230mm W 225mm D 115mm
Weight	4kg

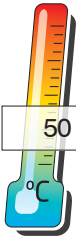
Optional PC Interface

Accessories

Switch Mode Power Supply Supplied as Standard
100 - 240 VAC

How to Order

Model 988



50 to 350°C

- 50°C to 350°C
- Emissivity > 0.95
- 70mm Ridged Plate Target

When the high accuracy of the Gemini R is not necessary this product offers a cost effective solution for the calibration and testing of infrared thermometers.

The Greybody Model 975 gives fast accurate results with a larger sensing area. A temperature sensor sits just under the target surface and controls the temperature of the source. A custom designed surface sensor is used to set the controller calibration and a traceable certificate is supplied with each source.

Greybody Source Model 975

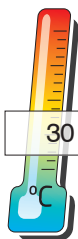


<http://www.isotech.co.uk>



Model	975 Greybody
Temperature Range	50°C to 350°C
Display Resolution	0.01°C 50 to 99.99 0.1°C 100 to 350
Heating time	35 minutes
Target Size	Ridged Plate, 70mm Diameter
Stability	±0.2°C
Accuracy	±2
Emissivity	>0.95
Power	180 Watts
Voltage	100-130 or 208-240 Vac
PC Interface	Included
Dimensions	H 115mm W 230mm D 225mm
Weight	3.9kg

How to Order
Model 975 Greybody Source
Please state voltage required



30 to 350°C

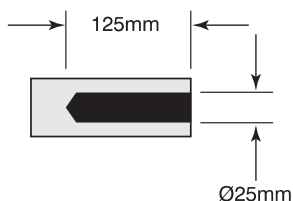
Blackbody Source

QuickCal Blackbody

- 30°C to 350 °C
- Emissivity > 0.99
- Controller Resolution 0.1°C

When the high accuracy of the Gemini R is not necessary this product offers a cost effective solution for the calibration and testing of infrared thermometers. The Quick Cal Blackbody is ideal for rapid and portable checking of infrared thermometers.

It features a cylindrical cavity 25mm diameter by 115mm deep.



Quick-Cal



931-22-100 Optional Carrying Case



<http://www.isotech.co.uk>



Model	550 QuickCal Blackbody
Temperature Range	30°C to 350°C
Display Resolution	0.1°C
Heating time	9 minutes
Target Size	25 x 115mm Cavity with end cone
Stability	±0.2°C
Accuracy	±0.5
Emissivity	>0.99 Surface coating 0.98 - cavity gives overall emissivity of >0.99
Power	300 Watts
Voltage	100-130 or 208-240 Vac
Dimensions	H 65mm W 152mm D 175mm
Weight	1.5kg

How to Order

Model 550-02 Blackbody Source
Please state voltage required
Optional Carry Case 931-22-71