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ISOTECH

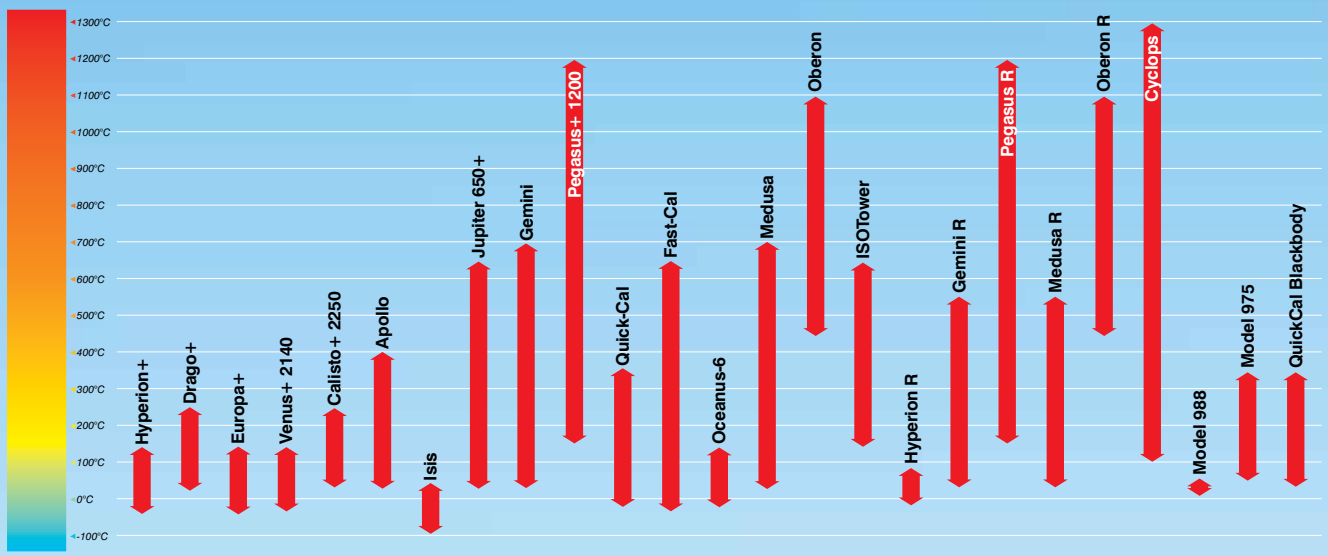
The Source for Calibration Professionals

Calibration Solutions for

- Temperature Sensors
- Infrared Thermometers
- Thermocouple Referencing Systems

Temperature Calibration Equipment & Services

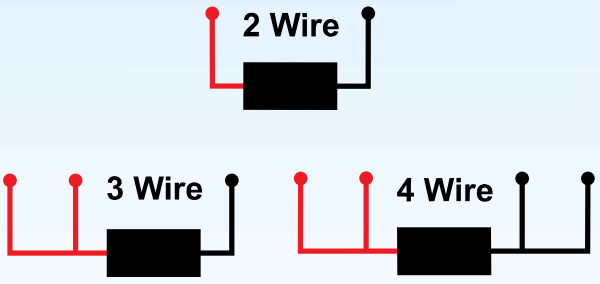
Thermometer & Thermocouple Reference



Minimum Calibration Points to Enable Coefficients to be calculated for a Platinum Resistance Thermometer

IPRTs	***Required Points***					***Number of Points***
Temp > 0°C	0°C and two positive values		$Rt=Ro(1 + At + Bt^2)$			3
Temp < 0°C to > 0°C	0°C, two positive values and one negative value		$Rt=Ro[1 + At + Bt^2 + C(t-100°C)\ t^3]$			4
ITS-90	***Required Points***					
0.01 – 29.76°C	0.01°C	29.76°C				2
0.01 – 156°C	0.01°C	156°C				2
0.01 – 232°C	0.01°C	156°C	232°C			3
0.01 – 419°C	0.01°C	232°C	419°C			3
0.01 – 660C	0.01°C	232°C	419°C	660°C		4
0.01 – 962°C	0.01°C	232°C	419°C	660°C	962°C	5
-38 – 29.76°C	-38°C	0.01°C	29.76°C			3
-189 – 0.01°C	-189°C	-38°C	0.01°C			3

Platinum Resistance Thermometer
Identification



Summary Table of some ITS-90 Fixed Points

Substance	*Temp. K*	*Temp.°C*	*State*
Argon	83.8058	-189.3442	Triple
Mercury	234.3156	-38.8344	Triple
Water	273.16	0.01	Triple
Gallium	302.9146	29.7646	Melt
Indium	429.7485	156.5985	Freeze
Tin	505.078	231.928	Freeze
Zinc	692.677	419.527	Freeze
Aluminium	933.473	660.323	Freeze
Silver	1234.93	961.78	Freeze

ISOTECH

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Contents

The company is always willing to give technical advice and assistance where appropriate.

Equally because of the program of continual development and improvement, we reserve the right to amend or alter characteristics and design without prior notice.

This publication is for information only.

Products in this catalogue are all CE Compliant

Introduction

Industrial Temperature Calibration

...our knowledge, product quality and integrity are the reasons for buying from Isotech

This catalogue describes Isotech products designed for Industrial Temperature Calibration. It has equipment for calibrating industrial sensors of widely varying size, temperature range, accuracies and type. In this book calibration solutions exist for accuracies from 1°C to less than 0.001°C, temperature ranges from below -100°C to 1200°C, from handheld to bench top devices. Products include Dry Block Calibrators, Liquid Baths, High Temperature Furnaces, Precision Temperature Indicators, Temperature Sensors with supporting services, UKAS Calibration and software.

■ Benefit from Isotech's premier UKAS Calibration Laboratory

Many manufacturers of temperature calibration equipment do not operate accredited laboratories. At Isotech we remain unique in that in addition to manufacturing equipment we also operate a full scale UKAS accredited laboratory calibrating both our own equipment and a full range of temperature equipment for our clients, from industrial thermocouples to primary standards.

■ Benefit from Experience

Isotech fully understand the calibration needs of our customers. We design and specify products accordingly. Isotech make available full evaluation reports with uncertainty calculations and publish uncertainty graphs. Dry Blocks from other manufacturers are sometimes specified in interesting ways, such as Minimum Operating Temperature -30°C but with an ambient of 5°C, Isotech labs and workshops are kept close to 20°C! We don't specify performances of thermometers only at 0°C we also tell you what it is like at high temperatures. Isotech understand the difference between resolution and accuracy, between accuracy and uncertainty, between "specmanship" and the firm evidence an auditor would expect to see.

As well as solutions for industrial sensors we have a full range of laboratory equipment and provide Primary Standards and Equipment to National Metrology Institutes all around the world

■ Solutions for Temperature Laboratories

A separate publication *"Volume 1: Solutions for Primary & Secondary Laboratories"* contains details of our laboratory equipment including Fixed Point Cells, Thermometry Bridges, SPRTs, Comparison Calibration Equipment and Software.

■ Isotech Innovation

Isotech is renowned for innovation, with products like the ISOCAL-6 - the multi function calibrator providing Dry Block, Liquid Bath, Surface Sensors, Blackbody and Fixed Point calibration in one piece of apparatus.

■ UKAS Accredited Laboratory (ISO/IEC 17025:2005)

Benefit from Isotech's experience and expertise, our laboratory was first accredited in 1985. The Isotech team of calibration engineers are available for pre and post sales support.

http://www.isotech.co.uk

Introduction [continued]

■ Industrial Calibrators -100°C to 1200°C

Isotech's range of calibrators for industrial probes includes a range of multi function calibrators that can calibrate all types of thermometer, resistance thermometers, thermocouples, surface sensors and infrared thermometers, the ISOCAL-6 Family.

A range of Dry Block Calibrators offer a variety of volumes from 25 x 115mm in a handheld device to 50 x 300mm in bench top apparatus.

■ ITS-90 Fixed Points -38.8344°C to 961.78°C

A range of Slim Fixed Point cells provide calibration uncertainties to less than 1mK, 0.001°C. These cells are lower cost, more robust and easier to use than the larger cells used by National Metrology Institutes. The affordable prices justify the use of ITS-90 Primary Standards to a wider range of laboratories.

The new ITS-90 Isothermal Towers are integrated devices combining cell and apparatus in an innovative design, the ultimate in simple to use high performance ITS-90 fixed point calibration.

■ Thermometer Read Outs -250°C to 2315°C

For Reference Platinum Resistance Thermometers and Thermocouples there is a range of precision thermometers and thermometry bridges offering performance to 1mk, 0.001°C.

There is also a Surface Temperature Thermometer that uses a thermally compensated probe to permit high accuracy surface measurement.

■ Reference Probes -200°C 1300°C

A range of probes covering from -200°C to 1300°C exist for use alongside the calibration products and for general purpose applications.

■ Software

Isotech have software to totally automate the calibration of temperature sensors, from recording the sensor output to printing certificates and calculating coefficients.

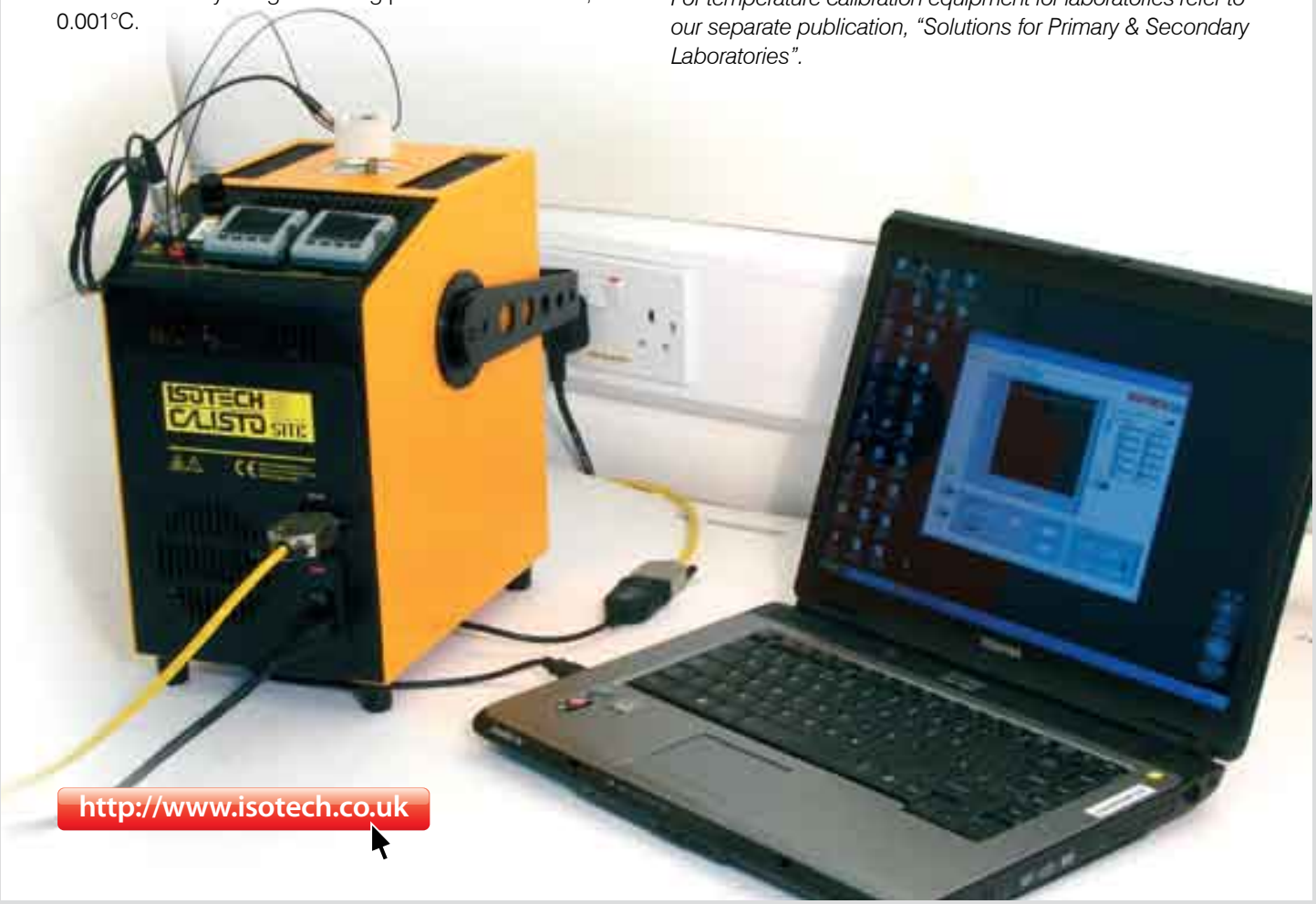
■ Blackbody Sources

For calibrating infrared thermometers a dedicated a series of blackbody sources are available covering up to 1300°C. A range Blackbody Cells, from Gallium 29.7646°C to Silver at 961.78°C allow calibration to ITS-90 Fixed Points.

■ Thermocouple Referencing

Models include those for use with Laboratory Standard Thermocouples to industrial systems and multi channel reference systems suitable for the largest of installations applications including power stations, boiler rooms, environmental monitoring and research.

For temperature calibration equipment for laboratories refer to our separate publication, "Solutions for Primary & Secondary Laboratories".



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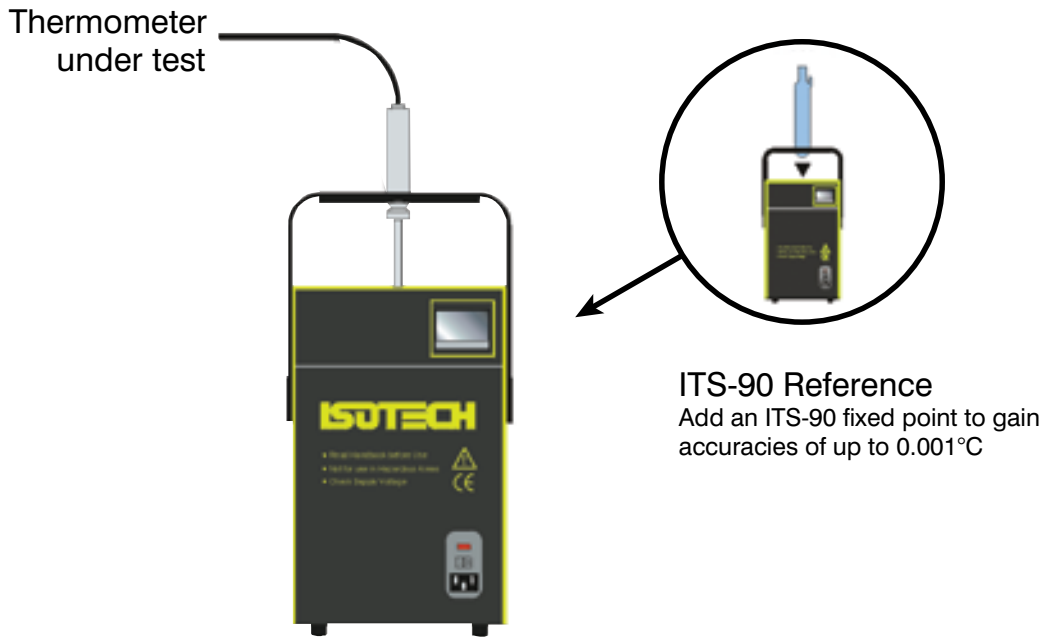
Alternative methods of operating an **Industrial Laboratory**

A Basic Dry Block Calibrator

The thermometer under test is compared to the dry block controller value.
Useful for moderate temperature ranges and quick testing.



ITS-90 Reference
Add an ITS-90 fixed point to gain
accuracies of up to 0.001°C

An ISO 9000 Calibration System

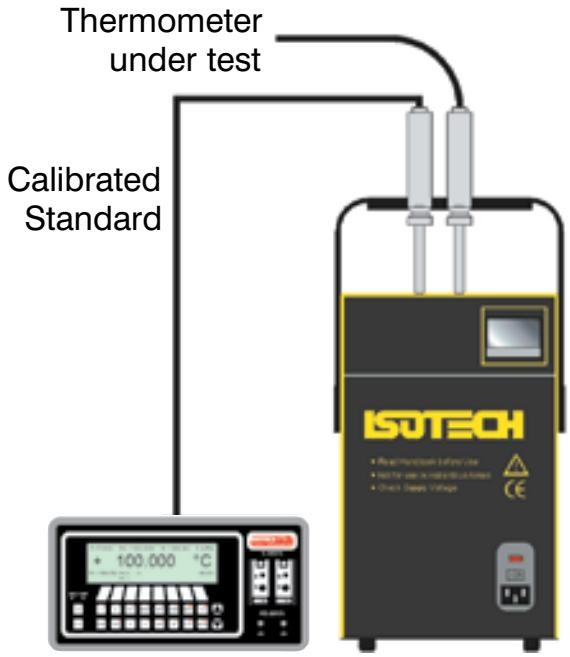
A thermometer under test is compared to a calibrated standard,
for true traceability and clearly meets the requirements of ISO9000

Surface Sensor
compared to standard

Blackbody Sources
compared to standard

Using an External Indicator

Similar to the previous configuration but an external indicator TTI is used - one TTI can be used with many calibration baths - the bath or baths do not need a calibration certificate, but they need an evaluation report.

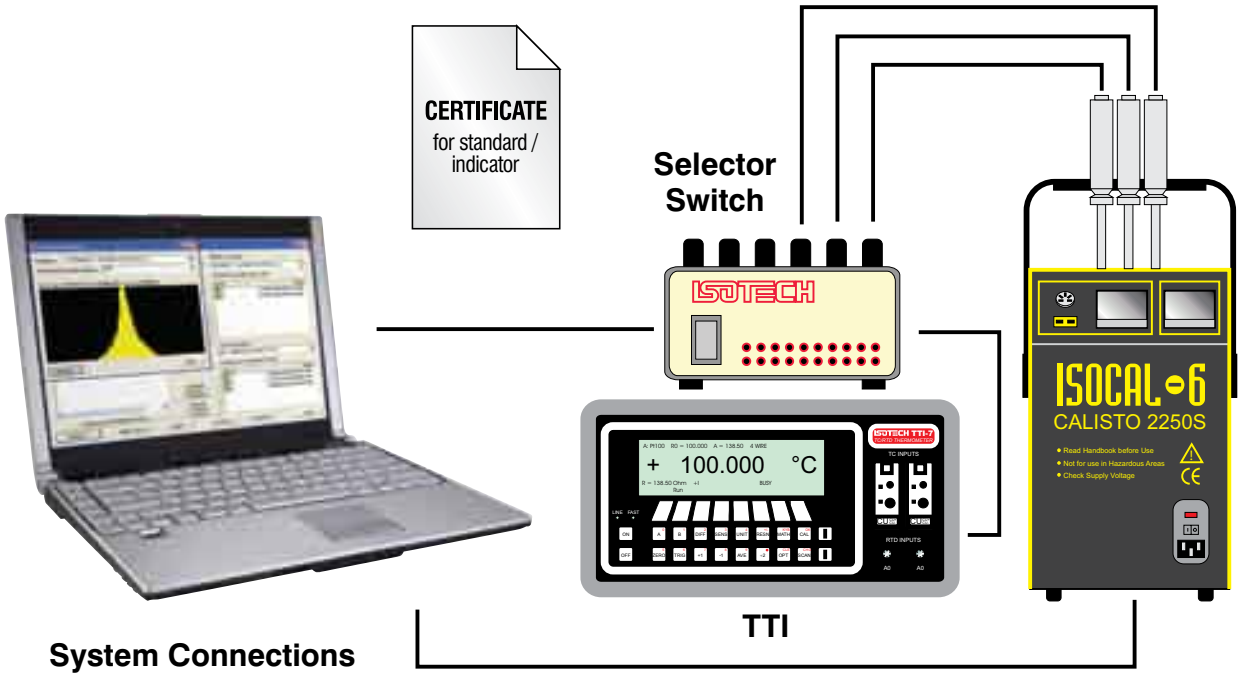


Here the B model is shown

Alternatively the S model may be used with the indicator free for use with a unit under test.

An example of Multiple Sensor Calibration

You can add the TTI and Selector Switch for multi-probe calibration - and add I-cal software for affordable automatic calibration systems.



■ Many of the products can be used as a **Dry Block Calibrator** or as a **Liquid Bath**

Isocal-6 Introduction:

The multifunction temperature calibration system

The award winning ISOCAL-6 consists of a range of temperature calibrators designed to calibrate all temperature sensors. As a multi function temperature calibrator it can be used as a Dry Block with accessories added to allow use as a Stirred Liquid Bath, a Blackbody Source, a Surface Temperature Calibrator, an ITS-90 Fixed Point System and for low temperatures a Stirred Ice Bath.

The ISOCAL-6 is a complete temperature calibration laboratory in a simple easy to use package.

A system designed to expand with you, to fulfill all future calibration needs. Giving the flexibility to add accessories when needed and meet current budgetary demands.

1 Metal Block Bath

A Metal Block Bath, (Dry Block Calibrator) provides fast and clean calibration of thermocouples, PRTs and other industrial temperature sensors. Isotech blocks use a combination of multi zone and advanced materials technology to ensure constant temperature zones to enable high accuracy calibration. Interchangeable 35mm diameter blocks allow several sensors to be calibrated simultaneously with fast heat up and cool down. For larger probes blocks are available up to 65mm diameter and with immersion depth of up to 300mm. An unmatched combination of leading performance and calibration capacity.

2 Stirred Liquid Bath

Remove the metal block and the Isocal-6 can be converted to a stirred liquid bath. Shown is the Drago with 65mm diameter well making it ideal as a portable liquid bath. Liquid bath operation allows angled or awkward shaped probes to be calibrated. Accuracies are much greater than those from Dry Blocks alone and with a suitable reference probe performance of 0.005°C is achievable. In stirred liquid bath mode a reference probe should be used connected to either the SITE indicator, or an external device.

3 Stirred Ice / Water Bath

The ISOCAL-6 models that operate below 0°C can be used to provide a 0°C stirred ice / water bath. This provides a simple low cost way of checking that standards have not drifted in between calibrations.

4 **Black Body** Source

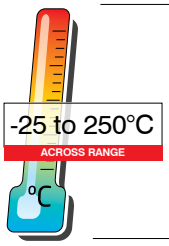
Adding the blackbody target allows the testing of infrared thermometers. Low cost non-contact IR thermometers are increasingly being used in industry and the ISOCAL-6 is ideal to test and check these devices. The IR thermometer is focused on the target and compared to a reference probe in the block pocket.

5 **Surface Sensor** Calibrator

With the Surface Sensor Kit the test sensor is compared to a platinum resistance thermometer located just below the surface of the block. Again save the cost of buying additional equipment by adding accessories as required to expand the ISOCAL-6 for new calibration applications.

6 **ITS-90 Fixed Point** Apparatus

For the best possible performance with uncertainties to 0.0005°C (0.5mK) add an ITS-90 Fixed Point Cell. The most popular is the B8 Water Triple Point Cell, it is surprisingly affordable and simple to use - the triple point can be both created and maintained in the apparatus without the need for any other equipment or supplies.



ISOCAL - 6 Range
Hyperion • Drago

- 65 x 160mm Diameter Calibration Volume
- Portable Liquid Bath
- Convertible for Dry Block Operation
- Calibrate all Sensor types

The Hyperion and Drago have a large calibration volume, 65mm x 160mm deep, which makes them ideal to use as portable liquid baths. Stirred liquid baths are suitable for temperature sensors of all types, sizes and shapes.

Liquid Baths can provide smaller calibration uncertainties than dry blocks and, when used with suitable reference thermometers, accuracies of up to 0.005°C can be achieved. The sensors can be placed directly into the stirred liquid thus avoiding the need for specially drilled blocks.

An ideal combination would be to use one of the Isotech TTI temperature indicators and semi standard probe, for example the 935-14-16 Semi Standard.

Alternatively, the SITE model includes an inbuilt temperature indicator and can be provided with a reference probe and calibration certificate thus giving a complete traceable solution in a single portable unit.

These models are part of the Isocal-6 family and with a reference probe can be used with different accessories for Dry Block, Infrared, Surface Calibration and even with ITS-90 Fixed Point Cells for uncertainties to 0.001°C.

In the optional Dry Block Mode, the large 65mm diameter block allows for the calibration of either larger probes or for calibrating many sensors simultaneously over the range -25°C to +250°C. Fully compatible with the leading I-Cal Easy automatic calibration software you can also benefit from the combination of award winning flexibility and large calibration capacity.

http://www.isotech.co.uk/industrial/

Specification

Model	936 Hyperion^{PLUS}	934 Drago^{PLUS}
Temperature Range	-25°C to 140°C (1)	30°C to 250°C (2)
Stability	Dry Block: ±0.03°C, Blackbody: ±0.3°C, Surface Sensor: ±0.5°C, Liquid Bath: +/0.025°C, ITS-90 Cells: ±0.0005°C, Ice Bath: ±0.001°C (not Calisto)	
Accuracy (3)	0.15°C	0.15°C
Uniformity - Between Wells Dry Block Mode (Radial)	<0.008°C	<0.008°C
Uniformity - Radial Liquid Bath Mode	<0.009°C	<0.007°C at 250°C
Uniformity - Lower 40mm (Axial) Dry Block Mode	<0.040°C	<0.040°C
Uniformity - Lower 40mm (Axial) As Liquid Bath	<0.011°C	<0.013°C at 250°C
Heating Time	-20°C to 140°C: 40 Mins	30°C to 250°C: 40 Mins
Cooling Time	140°C to 20°C: 90 Mins 20°C to -25°C: 80 Mins	250°C to 30°C: 90 Mins
Insert Diameter	65mm	
Immersion Depth	160mm	
Insert Types	Standard 8 x 8mm + 2 x 4.5mm, Undrilled or Custom	
PC Interface	Included - Supplied with PC Cable and Software	
Power	200 Watts	1000 Watts
Voltage	115Vac or 230 Vac 50/60Hz	
Dimensions	302 x 176 x 262 mm	
Weight	12kg	8kg

(1) In ambient of 20°C: Minimum Temperature is 45°C Below Ambient, Absolute Minimum -35°C
(2) In ambient of 20°C
(3) Dry Block Mode only: Comparing 4.5mm Well to Controller Display Value.

A three point traceable calibration certificate is included. UKAS calibration options available, contact Isotech for advice and options.

Features (Basic & Site)	936 Hyperion^{PLUS}	934 Drago^{PLUS}
Dry Block	✓	✓
Stirred Liquid Bath Option	✓	✓
Stirred Ice Bath Operation	✓	✓
Surface Sensor Option	✓	✓
Infrared Calibration Option	✓	✓
ITS-90 Fixed Point Cells	*Water, Gallium*	*Gallium*
Additional 8mm Pre-heat Pocket	✓	✓
Configurable Units: °C, °F and K	✓	✓
Supply Voltage Power Correction with Digital Filtering	*Provides High Stability protecting against noise and supply voltage variation*	

Additional Features (Site)		
Independant Temperature indicator	✓	✓
Universal Input Types PT100	✓	✓
Thermocouples Types K,N,R,S,L,PL2,T,J,E	✓	✓
Linear Process Inputs Including 4-20 mA	✓	✓
Stand Alone Thermostat Testing	✓	✓
Thermostat Testing With PC	✓	✓
Five Point Digital Probe Matching	✓	✓
Configurable Units: °C, °F and K	✓	✓

Isocal-6 Ultimate Flexibility - Hyperion & Drago

Calibrate all sensor types - Thermocouples, PRT's, Thermistors, Thermostats, Infrared, Surface Sensors...

1 Dry Block Mode with Inserts

936-06-01a Standard Insert is:
8 x 8mm + 2 x 4.5mm all 157mm Deep.
All Inserts have a 4mm tapped hole to suit supplied extractor tool.

Alternative Inserts

936-06-01b Blank Insert

936-06-01c Special Insert.
Contact Isotech with your requirements.

2 Stirred Liquid Mode with Liquid Container Kit

Allows liquid bath use, includes container, magnetic stirrer, probe guide and sealing cap. **936-06-02**

3 Stirred Ice Bath Mode with Liquid Container Kit

Uses same liquid kit to provide 0°C reference as a stirred ice bath.

Additional Accessories for use with the above kit

Thermometer Support Kit

936-06-08 Supports up to eight thermometers into liquid. Suits probes 5mm - 8mm in diameter.

C20 Oil

936-06-07	C10 Oil	-35°C – 140°C 1L
580-06-09	C20 Oil	20°C – 200°C 1L
915/09	VH Oil	150°C – 250°C 1L

4 Infrared Calibration Mode with Blackbody Target

936-06-03 Use optional Probe 936-14-61DB.

5 Surface Sensor Calibration with Surface Sensor Kit

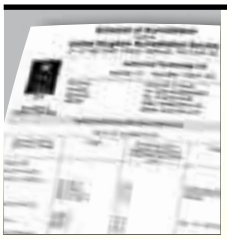
936-06-04 Includes an Insert and an angled platinum resistance thermometer.

6 ITS-90 Fixed Point Cells

B8 Water Triple Point Cell (Hyperion)

17401 Slim Gallium Slim Cell

936-06-09 Cell Holder Assembly



UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

Standard Probe

935-14-61/DB Platinum Resistance Thermometer.
4mm diameter.

Carrying Case

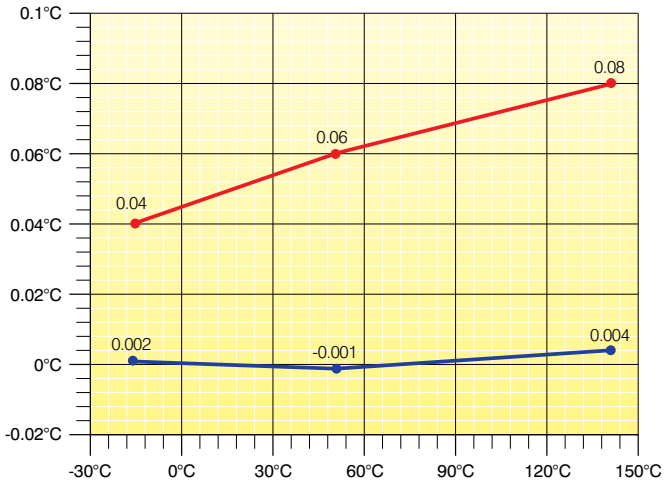
931-22-65 Sturdy case accommodates the unit with room for accessories

How To Order

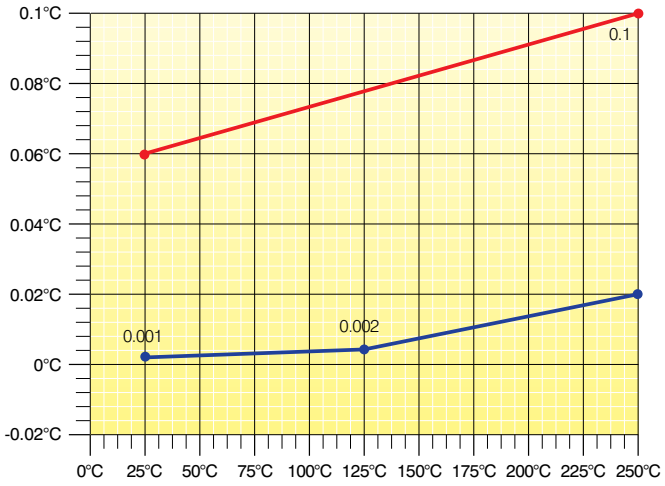
Specify Model, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.

Isocal-6 Performance and Use

Hyperion^{PLUS} Performance - Dry Block



Drago^{PLUS} Performance - Dry Block

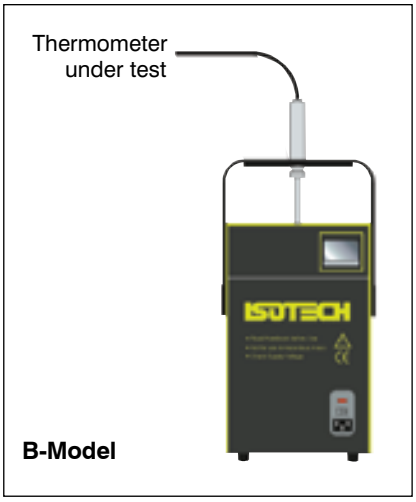


Audit Calibration (Similar Sensors) S model with UKAS option

Radial Homogeneity

See Evaluation Reports for full details
http://www.isotech.co.uk/refer.html

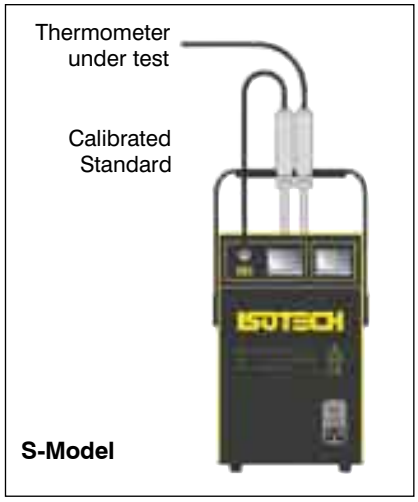
Alternative Methods of Calibrating with an Isocal-6



A Basic Dry Block Calibrator

For quick and easy Testing and Calibration. Relies on using the temperature controller value, “controller accuracy”.

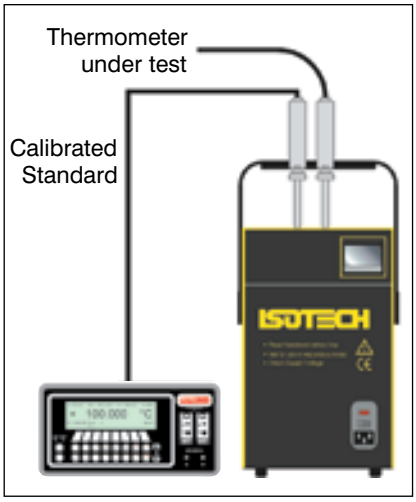
Using a standard thermometer (not shown) compensates for temperature gradients and loading errors giving best performance.



An ISO 9000 Calibration System

Thermometer under test is compared to a calibrated standard and inbuilt independent temperature indicator.

For best practice calibration with established traceability and uncertainty.



Using an External Indicator

Thermometer under test is compared to a calibrated standard and external temperature indicator.

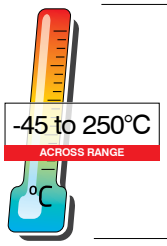
For best practice calibration with established traceability and uncertainty.

One indicator may be used with several Isocal-6 or similar.

Calibration is needed only for the probe and indicator.

For liquid bath, surface sensor or black body always use a standard thermometer conected to the S-model or stand alone indicator as above.

UKAS Calibration available for these systems - *International Traceability - Best Practice*



ISOCAL - 6 Range

Europa • Venus • Calisto

- 35 x 160mm Calibration Volume
- The Most Flexible Temperature Calibrator
- S model includes Universal Input Temperature Indicator
- Windows Software and PC Interface

These models will calibrate temperature probes from -45°C to 250°C with unrivalled flexibility. As a traditional Dry Block, several thermometers can be quickly calibrated. Accessories are available to convert to a stirred liquid bath, for surface sensor calibration, to calibrate infrared thermometers and even to use as an ITS-90 Fixed Point System with calibration uncertainties as small as 0.0005°C.

These award winning calibrators are easy to use - see the pictorial guide. For simple tests and checking of probes, these can be compared to the values shown on the advanced digital temperature controller. The SITE model includes an independent temperature indicator which, combined with a reference probe, ensures traceability, best practise, adherence to quality standards and calibration to the smallest of uncertainties. A three point traceable calibration certificate is included as standard with all models.

Isotech is a world leader in temperature calibration, providing many nations with their Primary Standards and operates a full scale UKAS accredited calibration laboratory. UKAS calibration at five points is optional and is provided from our in-house laboratory.

Benefit from our experience and understanding in calibration at all levels, our evaluation reports, our tutorials and uncertainty calculations.

These models meet the calibration capacity requirements of EURAMET/cg-13/v.01, “EA Guidelines on the Calibration of Temperature Block Calibrators, formerly EA10/13.

http://www.isotech.co.uk/industrial/

Specification

Model	Europa 6PLUS	VenusPLUS	CalistoPLUS
Temperature Range	-45°C to 140°C (1)	-35°C to 140°C (2)	30°C to 250°C (3)
Stability	Dry Block: ±0.03°C, Blackbody: ±0.3°C, Surface Sensor: ±0.5°C, Liquid Bath: +/0.025°C, ITS-90 Cells: ±0.0005°C, Ice Bath: ±0.001°C (not Calisto)		
Accuracy (4)	0.15°C	0.15°C	0.25°C
Uniformity - Between Wells Dry Block Mode (Radial)	<0.008°C	<0.008°C	<0.02°C at 250°C
Uniformity - Radial Liquid Bath Mode	<0.02°C	<0.02°C	<0.011°C at 250°C
Uniformity - Lower 40mm (Axial) Dry Block Mode	<0.040°C	<0.040°C	<0.25°C
Uniformity - Lower 40mm (Axial) As Liquid Bath	<0.026°C	<0.026°C	<0.02°C at 250°C
Heating Time	-30°C to 140°C: 15 Mins	-30°C to 140°C: 15 Mins	25°C to 250°C: 15 Mins
Cooling Time	140°C to 0°C: 15 Mins	140°C to 0°C: 15 Mins	250°C to 30°C: 25 Mins
Insert Diameter	35mm		
Immersion Depth	160mm		
Insert Types	Choice of Three - See Accessories		
PC Interface	Included - Supplied with PC Cable and Software		
Power	300 Watts	150 Watts	300 Watts
Voltage	115Vac or 230 Vac 50/60Hz		
Dimensions	302 x 176 x 262 mm		
Weight	14kg	10.2kg	8kg

(1) In ambient of 20°C: Minimum Temperature is 65°C Below Ambient, Absolute Minimum -55°C
(2) In ambient of 20°C: Minimum Temperature is 55°C Below Ambient, Absolute Minimum -45°C
(3) In ambient of 20°C
(4) Dry Block Mode only: Comparing 4.5mm Well to Controller Display Value.

A three point traceable calibration certificate is included. UKAS calibration options available, contact Isotech for advice and options.

Features (Basic & Site)	Europa 6PLUS	VenusPLUS	CalistoPLUS
Dry Block	✓	✓	✓
Stirred Liquid Bath Option	✓	✓	✓
Stirred Ice Bath Operation	✓	✓	–
Surface Sensor Option	✓	✓	✓
Infrared Calibration Option	✓	✓	✓
ITS-90 Fixed Point Cells	*Mercury, Water, Gallium*	*Water, Gallium*	*Gallium*
Additional 8mm Pre-heat Pocket	✓	✓	✓
Configurable Units: °C, °F and K	✓	✓	✓
Supply Voltage Power Correction with Digital Filtering	*Provides High Stability protecting against noise and supply voltage variation*		

Additional Features (Site)			
Independant Temperature indicator	✓	✓	✓
Universal Input Types PT100	✓	✓	✓
Thermocouples Types K,N,R,S,L,PL2,T,J,E	✓	✓	✓
Linear Process Inputs Including 4-20 mA	✓	✓	✓
Stand Alone Thermostat Testing	✓	✓	✓
Thermostat Testing With PC	✓	✓	✓
Five Point Digital Probe Matching	✓	✓	✓
Configurable Units: °C, °F and K	✓	✓	✓

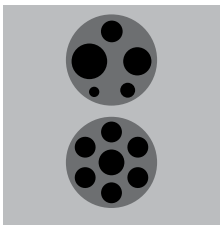
Isocal-6 Ultimate Flexibility - Europa, Venus & Calisto

Calibrate all sensor types - Thermocouples, PRT's, Thermistors, Thermostats, Infrared, Surface Sensors...

1 Dry Block Mode with Inserts

951-02-15 An Insert is included: (2 x 4.5mm, 2 x 6.4mm, 1 x 8mm & 1 x 9mm) x 157mm Deep.

All Inserts have a 4mm tapped hole to suit supplied extractor tool.



Alternative Inserts

951-06-07 Standard Insert type B 13mm, 10mm, 8mm, 5mm and 3.5mm dia. holes, all 157mm deep

951-06-08 Special Insert type C 8mm, 6 x 6.5mm dia. holes, all 157mm deep

951-02-15A Blank Insert without pockets for local machining. Includes M4 tapped hole for supplied extractor tool.

951-02-15C Custom insert. Isotech can provide custom drilled pockets, minimum of 3mm separation between holes. Contact with your requirements.

2 Stirred Liquid Mode with Liquid Container Kit

Allows liquid bath use, includes container, magnetic stirrer, probe guide and sealing cap. **915-06-01**

3 Stirred Ice Bath Mode with Liquid Container Kit

Uses same liquid kit to provide 0°C reference as a stirred ice bath (Not Calisto)

Additional Accessories for use with the above kit

Thermometer Support Kit

951-06-03 Allows three thermo-meters to be suspended in the bath, including liquid in glass types

C20 Oil

520-05-01 C10 Oil -35°C–140°C 0.1L
951-06-06 C20 Oil 20°C – 200°C 0.1L
953-04-01 VH Oil 150°C – 250°C 0.1L

4 Infrared Calibration Mode with Blackbody Target

951-06-04 Use optional Probe 935-14-82 placed in the auxiliary block pocket for use as a reference.

5 Surface Sensor Calibration with Surface Sensor Kit

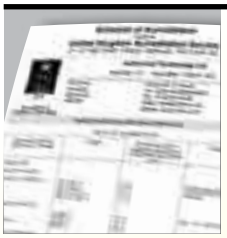
951-06-02 Includes angled platinum resistance thermometer.

6 ITS-90 Fixed Point Cells

17724M Slim Mercury Cell (Europa Only).

B8 Water Triple Point Cell (Venus and Europa)

17401M Slim Gallium Cell (Europa, Venus and Calisto)



UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

Standard Probe

935-14-82/DB Platinum Resistance Thermometer.

4.5mm diameter
Angled head feature avoids sensors in block.

Carrying Case

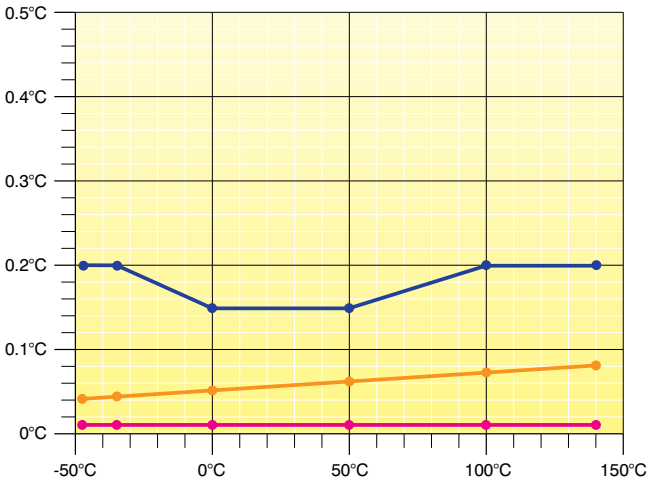
931-22-64 Sturdy case accommodates the unit with room for accessories

How To Order

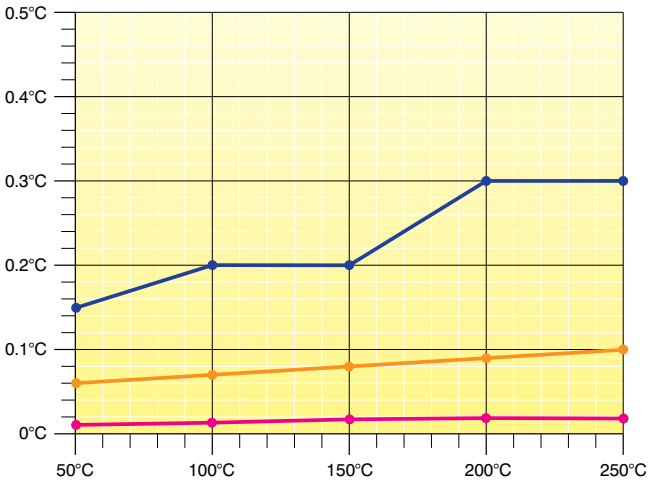
Specify Model, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.

Isocal-6 Performance and Use

Venus and **Europa**



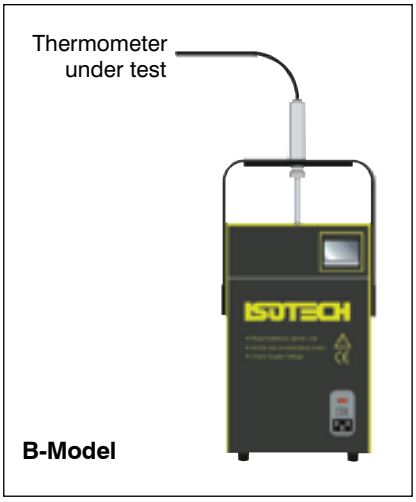
Calisto



- Uncertainty of Site Model and Reference Probe with optional UKAS Calibration
- Audit Calibration: Method comparing a PRT to UKAS Calibrated S model
- Radial Homogeneity. Use for similar probes and external indicator

See Evaluation Reports for full details
http://www.isotech.co.uk/refer.html

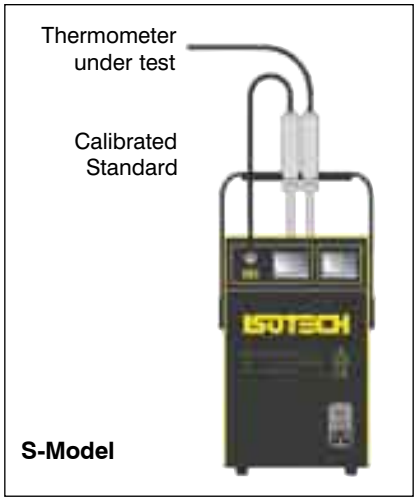
Alternative Methods of Calibrating with an Isocal-6



A Basic Dry Block Calibrator

For quick and easy Testing and Calibration. Relies on using the temperature controller value, “controller accuracy”.

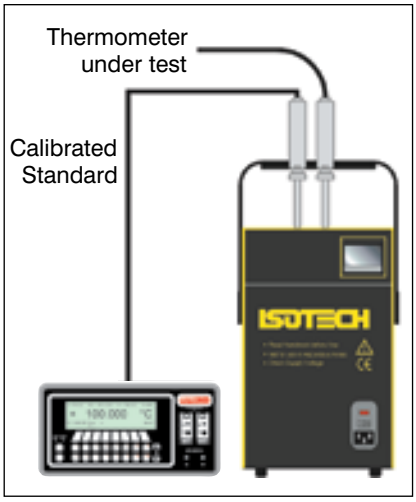
Using a standard thermometer (not shown) compensates for temperature gradients and loading errors giving best performance.



An ISO 9000 Calibration System

Thermometer under test is compared to a calibrated standard and inbuilt independent temperature indicator.

For best practice calibration with established traceability and uncertainty.



Using an External Indicator

Thermometer under test is compared to a calibrated standard and external temperature indicator.

For best practice calibration with established traceability and uncertainty.

One indicator may be used with several Isocal-6 or similar.

Calibration is needed only for the probe and indicator.

For liquid bath, surface sensor or black body always use a standard thermometer conected to the S-model or stand alone indicator as above.

UKAS Calibration available for these systems - *International Traceability - Best Practice*

A Guide to
Dry Block Calibration

Isothermal Technology manufacture a full range of temperature calibration equipment from Primary Standards used in National and Primary Laboratories, for Secondary Laboratory Equipment used in accredited calibration laboratories and through to the Dry Blocks featured here.

Our customers include the worlds largest Primary Standards Laboratories, Accredited Laboratories (UKAS, DKD etc), large multinational companies, research organisations, manufacturing etc. Eighty percent of Nations rely on Isotech to supply their country's standards. This is not a responsibility taken lightly and Isotech constantly invests in its own full scale UKAS accredited laboratory. Isotech issues UKAS certificates for fixed point cells, thermometers, indicators and dry blocks. Isotech have issued several thousand calibration certificates and carried out several thousand measurements on Dry Blocks. We calibrate all types, not just our own.

The benefit of this experience, and the knowledge of years of manufacturing Dry Blocks is invested back into these products with the goal of constant improvement. In recent years the number of producers of Dry Blocks has increased dramatically, whilst many look similar (and some look surprisingly similar to our established models) they are often very different inside and can perform very badly.

The Dry Block Calibrators complement the ISOCAL-6 range. Above temperatures of approximately 250°C it is not practical to use stirred liquids due to fumes, risk of ignition and safety considerations.

Isotech's higher temperature calibration baths incorporate as many of the Isocal-6 options as is safe and practical to provide.

Dry Block pre-purchase check list

1. **Does the supplier have an accredited laboratory?**
   UKAS accreditation, "the means by which, in the public interest, the integrity and competence of independent evaluators is confirmed and declared". Isotech can issue a UKAS certificate with the performance expressed in the manner that you will need, not to some confusingly expressed specification that is made with no confirmation of integrity and competence.
2. **Experience**
   Does the producer have experience? Do they understand the difference between accuracy and uncertainty? Can they tell you how to calculate the uncertainty of a probe being calibrated in the block? Isotech can.
3. **Expandable**
   Can the Dry Block be used with other sensors? Are there accessories available for future expansion? With Isotech products they are.
4. **PC Support**
   Can it be connected to a computer? Is there software available, can it be automated? Isotech Dry Block Calibrators have a range of software options.
5. **Documented**
   Is the bath fully documented? Can you download a full evaluation report from the Web Site? Does it come with a comprehensive handbook and tutorial? Is training available? Isotech provide all of these free of charge.
6. **Practical**
   Isotech Dry Blocks are practically designed with a strong metal case, and are a compact portable size. If you are going to carry it around don't forget to check the size and weights. It is surprising how large some other blocks are, even though they take the same number of probes. Beware if the specification does not include the weight.
7. **Value**
   Check the prices, all the above come at an amazingly competitive price when you choose ***Isotech.***

Isotech Dry Block Features

- Unit Selection - choose from °C, °F or K.
- Thermostat Testing - The Site models can test thermostats with or without a PC - on contact close the indicator display is frozen.
- PC Interface and Software

■ Plug-in Controllers

Isotech worked with a world leader in temperature control technology to develop easy to use Dry Block controllers and Indicators. Isotech controllers are exceptionally easy to use with a clear user interface. Power feedback is used to stabilise against supply voltage changes, a digital filter circuit ensures high integrity of measurement without drift, rejecting 50/60Hz pick up and filtering out other sources of noise. Resolution is increased. The indicators have PRT input, universal thermocouple inputs, a PC interface and are supplied with software as standard. Check the individual models for full details. Windows software is now provided as standard, with expandable options to calibrate up to 32 sensors at a time.

■ Inbuilt Indicator

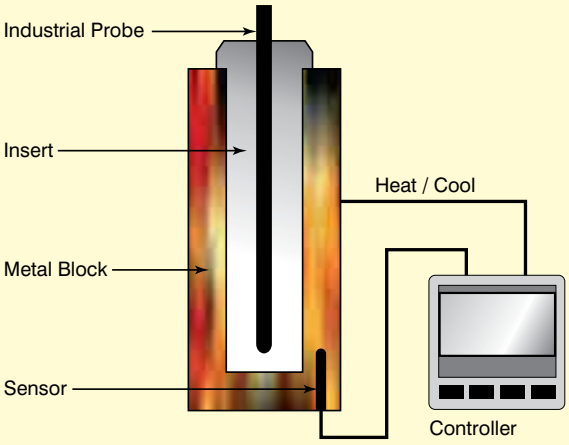
The SITE(S) models include an electronic temperature indicator that can be used with a 100Ω Resistance Thermometer, Thermocouples, (K, N, R, S, L, B, PL2, T, J and E) and DC process inputs including 4-20mA current transmitters. A reference thermometer can be connected or for complete flexibility the in-built indicator can be used to show the value from a sensor being calibrated.

■ Using Isotech's Dry Blocks Traceable Calibration

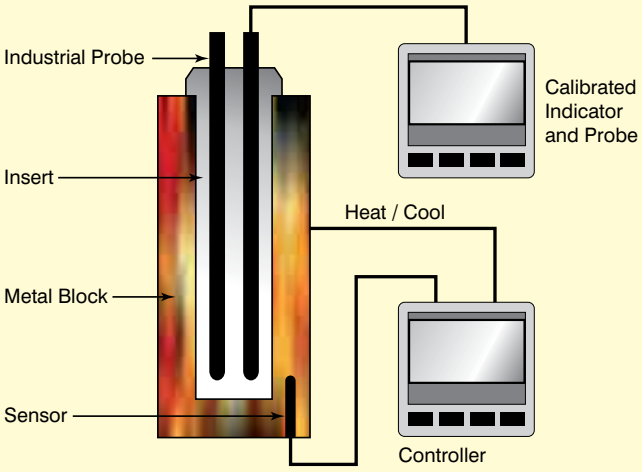
For best practice the recommendation is that a calibrated probe is placed into the Dry Block Insert and the thermometers under test "can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons". Thus meeting many quality systems including requirements of ISO 9000.

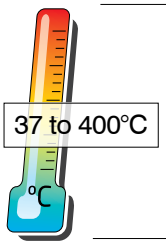
Using the Dry Bock itself as the Reference (or standard) raises a number of issues, such as how is the uncertainty of the Dry Block calculated. In practice, it can vary significantly, and there are some poor designs from many suppliers where it is not possible to achieve this in a satisfactory manner. Recently, International Guidelines have been published from EURAMET that give guidance, and requirements, for the calibration of Dry Blocks EURAMET/cg-13/v.01 (formerly EA10-13). For the most demanding applications we continue to recommend that a reference probe is used, the same method as used in secondary temperature laboratories, but for less demanding calibration, and the quick testing of sensors the Dry Block can be used without a reference probe, refer to the Dry Block's Evaluation Report for typical performance.

Dry Block Calibrator
of Poor Design



Dry Block Calibrator
Meeting ISO9000 Requirements





Dry Block Calibrators
Apollo 1 & 2

- Self Contained Reference
- UKAS Included
- Choice of Preset Temperatures

The Apollo Dry Block range offer a complete self contained and simple solution for the checking and calibrating of temperature sensors. The sensors under test are placed in the large block and one of the five preset temperatures is selected, the temperature from the sensor is then recorded against the value from the Apollo's UKAS Calibration Certificate. This calibration certificate is included as standard. The moderate temperature range, deep immersion depth and fixed block allow it to be issued without the need for an external standard.

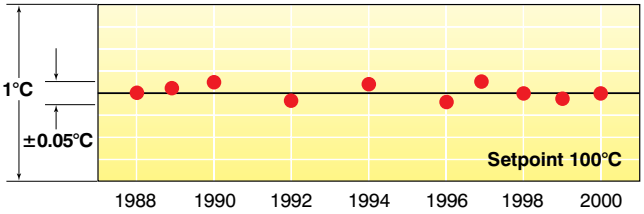
The Apollo is widely used as a reference standard in hospitals, local government and food industries etc. The Apollo has been developed from Isotech's very first dry block and has a long history of successful use. See the calibration history chart of a typical bath.

The block has four 8mm pockets and four 19.5mm pockets all 160mm deep.

The Apollo can be provided with customer selected temperatures in addition to the two standard models which have the following temperatures preset.

Apollo 1	37°C	65°C	100°C	121°C	130°C
Apollo 2	100°C	150°C	200°C	250°C	300°C

Apollo (R3) 12 Year Calibration History



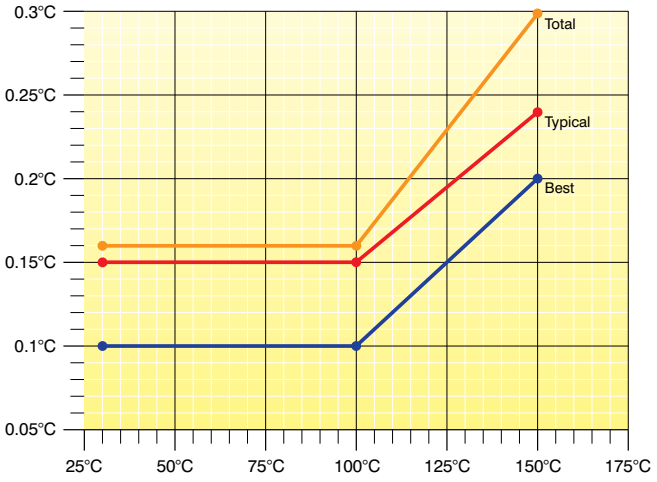
This graph shows the actual calibration history over 12 years of an Apollo, the deviation is ±0.05°C and all values fall comfortably within the uncertainty band, 0.15°C.

Features	Apollo 1	Apollo 2
High Capacity Block	✓	✓
Gold Plated Selector Switch	✓	✓
Exceptionally Low Drift	✓	✓
Includes UKAS Certificate as Standard	✓	✓
Option for Customer Specified Preset Temperature	✓	✓
Easy to use Temperature Reference	✓	✓
Self Contained, no further equipment necessary	✓	✓

Model	Apollo 1	Apollo 2
Temperature Range	37, 65, 100, 121, 130°C	100, 150, 200, 250, 300°C
Absolute stability over 30 minutes	At 100°C ±0.02°C	
Cools from 130°C to 65°C 300°C to 100°C	70 minutes N/A	N/A 160 minutes
Heats from 37°C to 130°C 100°C to 300°C	20 minutes N/A	N/A 30 minutes
Uncertainties	Refer to uncertainties graph below	
Calibration volume	Four 8mm pockets, 160mm deep and four 19.5mm pockets, 160mm deep	
Display	LED indicator showing At, Under & Over temperatures	
Power	100 to 120V (50 / 60Hz) or 200 to 240V (50 / 60Hz) 500 Watts	
Dimensions	Height 302mm Width 176mm Depth 262mm	
Weight	9.5kg	

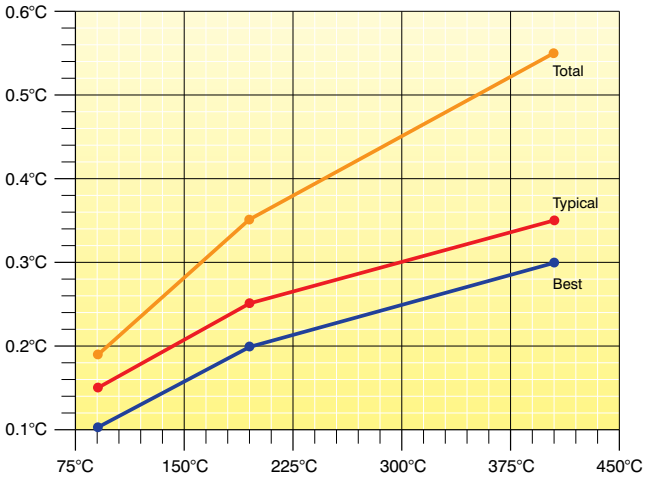
How To Order
Specify Model, Supply Voltage and Accessories.

Apollo 1 Uncertainty



Best *uncertainty - In the reference hole at the time of calibration*
Typical *uncertainty - In the reference hole, including 1 year of normal use*
Total *uncertainty - In the other 8mm diameter holes, including 1 year of normal use*

Apollo 2 Uncertainty



Best *uncertainty - In the reference hole at the time of calibration*
Typical *uncertainty - In the reference hole, including 1 year of normal use*
Total *uncertainty - In the other 8mm diameter holes, including 1 year of normal use*

Calibration and Uncertainty
A UKAS calibration certificate is included as standard.
The Apollo meets the Calibration Capacity requirements of EURAMET/cg-13/v.01, "*Guidelines on the Calibration of Temperature Block Calibrators*".

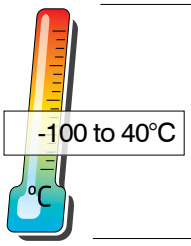
Options for Apollo 1 & 2

Customer Specified Temperatures
Select Five Points between 35°C and 400°C.

Point	Nominal Temperature Value
1	
2	
3	
4	
5	

Carrying Case

931-22-64 Sturdy case accommodates the unit with room for accessories



PROVISIONAL DATA

-100°C Dry Block
Isis

- 35 x 160mm Calibration Volume
- 20,000 hours testing, equal to 10 years use
- Minimum Temperature -100°C (-148°F)
- No expensive liquids

The Isis Dry Block offers operation to temperatures as low as -100°C, and is the only block bath working to such a low temperature. Now it is possible to calibrate temperature sensors such as PRTs, Thermocouples and Thermistors at ultra low temperatures without the need for a liquid bath.

Portability and Safety

Unlike a liquid bath the Isis requires no costly, or hazardous fluids and offers greater portability. This will be of particular value to calibration engineers working on site with low temperature freezers as encountered in pharmaceutical, aeronautical and food environments.

The minimum operating temperature is less than stirred liquid laboratory calibration baths and users in laboratories will also benefit by avoiding the ongoing need for expensive fluids.

The maximum operating temperature is 40°C, a little higher than the minimum operating temperature of Isotech Hot Blocks. This permits covering the range from -100°C to 650°C or higher with just two Isotech blocks. By limiting the maximum temperature the reliability and operating life of the cooling engine is maximised, and has been agreed in consultation with the licensee of the cooling technology, see below.

Cooling Technology

The Isis makes use of a Free Piston Stirling Cooler (FPSC) which provides a massive 80 Watts of cooling power to the calibration block. Specialist materials, patent applied for, are used for the heat transfer from the FPSC to the block.

Operating Life

Reliability is a prime attribute of this revolutionary new product. Testing at 20,000 hours (nominally equivalent to 10 years at 40 hours use each week) shows that -100°C is still possible, with an increase in cooling time <10%.

Benefits

Isotech can offer full support with options for UKAS / ILAC calibration, tutorial on getting the best calibration uncertainties and a full range of supporting reference thermometers, indicators and software.

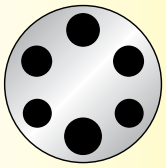
The Isis has a large insert 35mm diameter by 160mm deep. This allows for calibration of multiple sensors. For thermal validation applications there is an insert with pockets for a reference probe (6.5mm) and 20 x 3.5mm pockets for thermocouples. This allows a single calibration cycle to validate up to 20 probes at a time.

http://www.isotech.co.uk

The Isis Dry Block Model 525
The only Dry Block working to -100°C

METAL BLOCK INSERTS

Standard Insert A



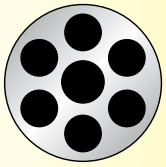
9.5mm, 8.0mm,
6.4mm, 6.4mm,
4.5mm, 4.5mm
All 157 deep

ALTERNATIVE INSERTS

Standard Insert B

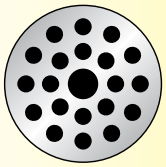
13mm, 10mm,
8mm, 5mm
and 3.5mm
All 157 deep

Standard Insert C



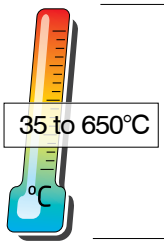
8mm and
6 x 6mm
All 157 deep

Validation Insert



6.5mm and
20 x 3.5mm
All 157 deep

Model	**525 Isis**	
Temperature Range	-100°C to +40°C	
Approximate time to Temperature from Ambient	-20°C	20 minutes
	-40°C	30 minutes
	-60°C	40 minutes
	-80°C	60 minutes
	-100°C	90 minutes
Absolute Stability	At 0°C ±0.03°C (30 minutes) At -90°C ±0.02°C (30 minutes)	
Radial Homogeneity (similar pockets)	0.01°C	
Vertical gradients (over bottom 40mm)	0°C 0.1°C -90°C 0.2°C	
Calibration Volume	35mm diameter x 160mm deep (Excludes Insulating Cap)	
Standard Insert	6 thermometer wells as standard (9.5mm, 8.0mm, 6.4mm, 6.4mm, 4.5mm and 4.5mm All 157 deep)	
Power	200W	
Voltage	100-240Vac, 50/60Hz	
Dimensions	215mm(W) x 420mm (D) x 640mm (H)	
Weight	22.7kg	



Dry Block Calibrator
Jupiter

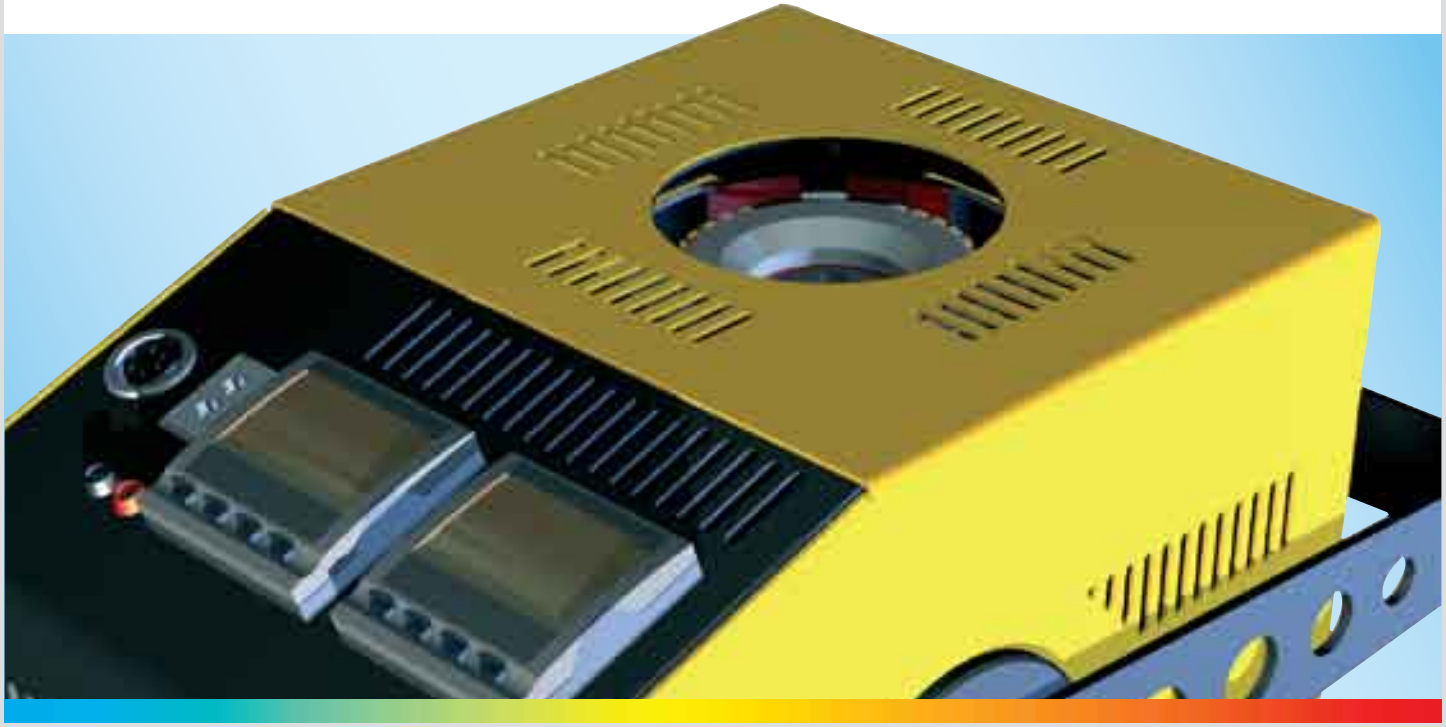
- 35 x 148mm Calibration Volume
- 35°C to 650°C
- Fast - Wide Operating Range
- PC Interface and Software

The Jupiter^{PLUS}650 Dry Block range offers industry-leading performance in an easy to use portable package - ideal for the calibration of thermocouples and platinum resistance thermometers. It has been designed for fast heating and cooling for convenient field use. For flexibility surface sensor and infrared thermometer accessories can be added.

The standard insert can hold up to six thermometers. For larger blocks see the Gemini and Medusa models. The Jupiter^{PLUS}650 is available in two models, the BASIC (B) and the SITE (S). The B model includes a sophisticated temperature controller with a dual display for Set Temperature and Dry Block Temperature.

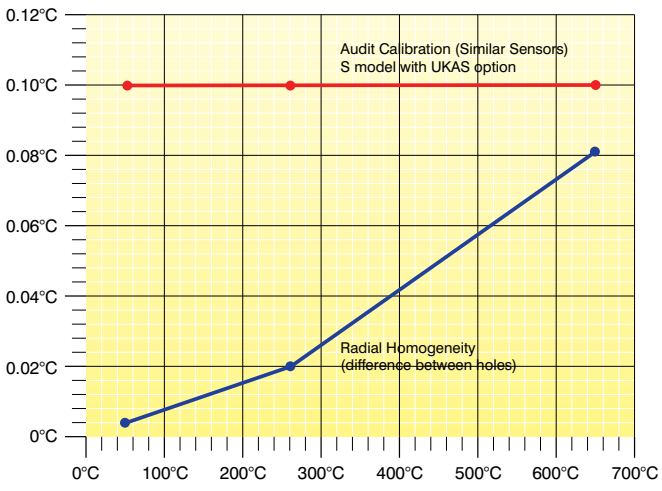
The S model includes a built in digital indicator to which an external standard thermometer can be connected giving greater accuracy eliminating temperature gradient and loading errors. For Surface Sensor and Blackbody use an external thermometer should always be used. For lab accuracy the Jupiter^{PLUS}650 can be used with a high-end temperature indicator such as one of the Isotech True Temperature Indicators (TTI).

http://www.isotech.co.uk/industrial/



Model	Jupiter^{PLUS} 650	
Temperature Range	35°C to 650°C	
Absolute stability over 30 minutes	At 50°C At 250°C At 650°C	±0.02°C ±0.02°C ±0.03°C
Blackbody Source	±0.3°C	
Surface Sensor Calibrator	±0.5°C	
Computer Interface	Included with Software	
Cools from 650°C to 150°C	in 60 minutes	
Heats from 30°C to 650°C	in 20 minutes	
Best Performance	See Graph	
Calibration volume	35mm diameter by 148mm deep	
Standard Insert	6 pockets, 2 x 4.5mm, 2 x 6.4mm, 1 x 8.0mm, 1 x 9.5mm diameter, all 140mm deep	
Display Resolution	0.01 0.1 PC can display 0.01 across whole range with the software included	to 99.99 100.0 to 650.0
Indicator units	°C, °F, K	
Power	100 to 120V (50 / 60 Hz) or 200 to 240V (50 / 60 Hz) 1000 Watts	
Dimensions	Height 302mm Width 176mm Depth 262mm	
Weight	8.5kg	

Jupiter^{PLUS} 650



Calibration and Uncertainty

A certificate, traceable to National Standards, is included as standard. Recommended is an optional UKAS five-point calibration.

The accuracy will depend very much on the mode of use and the types of sensor to be used. Please contact Isotech for tutorials and uncertainty calculations and comprehensive evaluation reports. The Jupiter^{PLUS} 650 meets the Calibration Capacity requirements of EURAMET/cg-13/v.01, “Guidelines on the Calibration of Temperature Block Calibrators”.

Features (Basic & Site)	Jupiter^{PLUS} 650
Calibrate Whole Calibration Loop	✓
Good Temperature Uniformity	✓
Wide Operating Range	✓
Simple to Use	✓
Site Includes Universal Input Temperature Indicator	✓
Windows Software and PC Interface	✓
Free Evaluation Report	✓

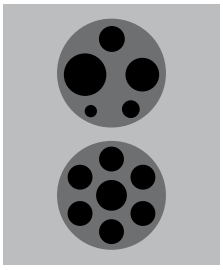
Accessories - Jupiter

Metal Block Insert 852-07-11
Standard Insert included

Alternative Inserts

852-07-07 Blank Insert *without pockets for local machining*. Includes M4 tapped hole for supplied extractor tool.

852-07-07C Custom Insert. Isotech can provide custom drilled pockets, minimum of 3mm separation between holes. *Contact with your requirements.*



852-09-03 Standard Insert type B 13mm, 10mm, 8mm, 5mm and 3.5mm diameter holes, all 140mm deep

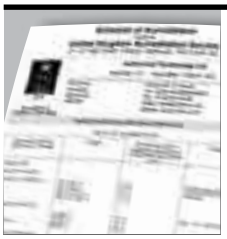
852-09-04 Standard Insert type C 8mm, 6 x 6.5mm diameter holes, all 140mm deep

Blackbody Kit

582-09-05 Includes a Blackbody target and Sensor.

Surface Sensor Kit

580-06-08 Includes angled thermocouple.



UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

Air Cooling

853-04-02 For use with an air supply this accessory allows air to be blown into the block for rapid cooling.

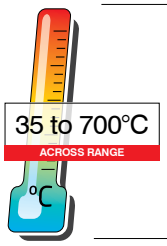
Standard Probe

935-14-72/DB Platinum Resistance Thermometer for use up to 650°C.

Carrying Case

931-22-64 Sturdy case accommodates the unit with room for accessories

How To Order
Specify Model, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.



Dry Block Calibrators
Gemini

- 64 x 160mm Calibration Volume
- Two Models - 35°C to 550°C and 50°C to 700°C
- High Capacity Block or Large Removable Block
- PC Interface and Software

The Gemini family of Dry Blocks have high capacity allowing a large number of probes to be calibrated together. They are also suitable to accept large diameter probes with the block volume of a nominal 65 x 160mm.

Whilst the large block takes longer to heat and cool than the Jupiter 650 and Fast-Cal models it can calibrate thermocouples, resistance thermometers, thermostats and sensors that are too large for the smaller blocks.

Available with a fixed block with four 8mm and four 19.5mm pockets or the LRI version which has a removable block. With the LRI model blocks can be drilled to custom configurations.

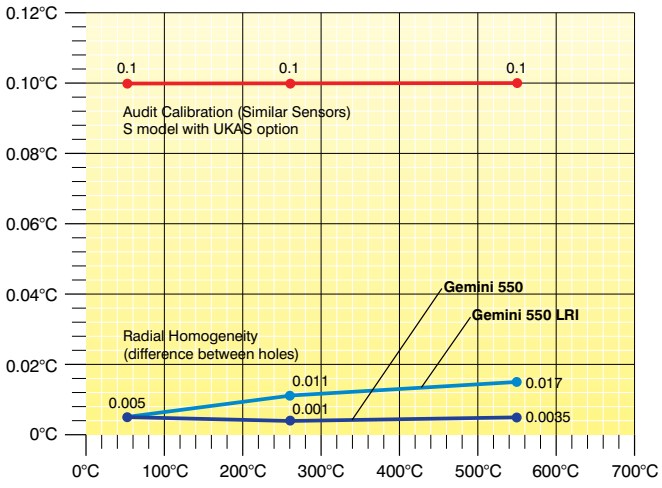
The Gemini is available in two temperature ranges with each available as a BASIC(B) or SITE(S) variant. The B model includes a sophisticated temperature controller with a dual display for Set Temperature and Dry Block Temperature.

The S model additionally includes a built in digital indicator to which an external standard thermometer can be connected giving greater accuracy eliminating temperature gradient and loading errors. For lab accuracy the Gemini ^{PLUS} can be used with a high-end temperature indicator such as one of the Isotech True Temperature Indicators (TTI).

http://www.isotech.co.uk/industrial/

Model - Gemini^{PLUS}	550	700	550LRI	700LRI
Temperature Range	35°C to 550°C	50°C to 700°C	35°C to 550°C	50°C to 700°C
Absolute stability over 30 minutes	At 35°C ±0.05°C At 250°C ±0.05°C At 550°C ±0.05°C At 700°C ±0.05°C		At 35°C ±0.02°C At 250°C ±0.03°C At 550°C ±0.04°C At 700°C ±0.05°C	
Computer Interface	Included with Software			
Cools from 550°C to 275°C from 550°C to 60°C	35 minutes 345 minutes	- -	132 minutes 420 minutes	-
Heats from 30°C to 550°C from 50°C to 700°C	35 minutes -	- 110 minutes	60 minutes -	- 120 minutes
Best Performance	See Graph			
Calibration volume	Fixed 4 x 8mm pockets 4 x 19.5mm pockets All 160mm deep		Removable 64mm Dia x 160mm deep (Standard insert 8 x 8mm pockets All 154mm deep)	
Display Resolution	0.01 to 99.99 0.1 100.0 to 700.0 PC can display 0.01 across whole range with the software included			
Indicator units	°C, °F, K			
Voltage	100 to 120V (50 / 60 Hz) or 200 to 240V (50 / 60 Hz)			
Power	600 Watts		1000 Watts	
Dimensions	Height 302mm Width 176mm Depth 262mm			
Weight	8.5kg	14kg	8.5kg	18kg

Gemini



Calibration and Uncertainty

A certificate, traceable to National Standards, is included as standard. Recommended is an optional UKAS five-point calibration.

The accuracy will depend very much on the mode of use and the types of sensor to be used. Please contact Isotech for tutorials and uncertainty calculations and comprehensive evaluation reports. The Gemini^{PLUS} 550/700/500LRI/700LRI meet the Calibration Capacity requirements of EURAMET/cg-13/v.01, "Guidelines on the Calibration of Temperature Block Calibrators".

UKAS Calibration available for these systems - *International Traceability - Best Practice*

Accessories - Gemini

Metal Block Sleeves

Gemini^{PLUS} 550

Set of four Sleeves to suit the block. Optional single hole sizes 4, 6, 8, 10, 12, 14mm diameter all 150mm deep.

857-07-01 Undrilled sleeves *for local machining.*

857-07-03 1 sleeve with 2 holes 4.5mm x 150mm deep.

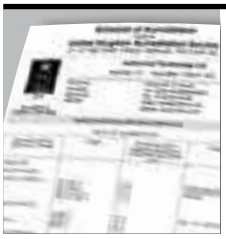
Gemini^{PLUS} 700

Set of four Sleeves to suit the block. Optional single hole sizes 4, 6, 8, 10, 12, 14mm diameter all 150mm deep.

857-07-02 Blank sleeves *for local machining.*

857-07-04 1 sleeve with 2 holes 4.5mm x 150mm deep.

Note: *The use of sleeves will introduce an additional thermal gradient into the block. This can be avoided by using the LRI model with a block drilled for specific probes.*



UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

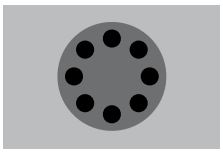
Standard Probe

935-14-72/DB Platinum Resistance Thermometer for use up to 650°C.

935-14-63 Type N Thermocouple for use up to 700°C.

Carrying Case

931-22-64 Sturdy case accommodates the unit with room for accessories



Removable Inserts

Gemini^{PLUS} 550 LRI

976-07-01a Included as Standard *Removable insert with eight 8mm pockets*

976-07-01b Blank Insert *Insert without pockets for local machining*

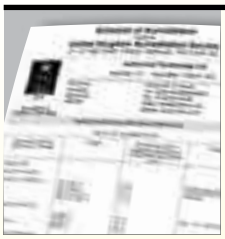
976-07-01c Custom Insert *Contact Isotech with your requirements*

Gemini^{PLUS} 700 LRI

976-07-02a Included as Standard *Removable block with eight 8mm pockets*

976-07-02b Blank Insert *Insert without pockets for local machining*

976-07-02c Custom Insert *Contact Isotech with your requirements*



UKAS Calibration

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Standard Probe

935-14-72/DB Platinum Resistance Thermometer for use up to 650°C.

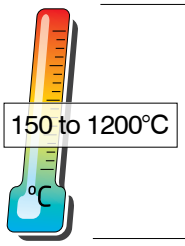
935-14-63 Type N Thermocouple for use up to 700°C.

Carrying Case

931-22-65 Sturdy case accommodates the unit with room for accessories

How To Order

Specify Model, Version, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.



Portable Calibration Furnace
Pegasus

- 33.5 x 130mm Calibration Volume
- 150 to 1200°C
- High Temperature Portable Calibration Furnace
- PC Interface and Software included

The Pegasus^{PLUS}1200 range offers extreme high temperature calibration in an easy to use portable package - ideal for the calibration of high temperature thermocouples. It has been designed for fast heating and finds applications in the glass, electrical power, automotive and material processing industries. A Blackbody target can be added for the calibration of infrared thermometers.

The standard insert has four 8mm pockets 80mm deep. The metal insert is strategically placed beneath 50mm of insulation to provide optimal performance over the radiant temperature range. For larger blocks see the Oberon model. The Pegasus is available in two models, the BASIC (B) and the SITE (S). The B model should be used with an external reference probe and indicator, such as the TTI 7. The thermocouples under test should be calibrated by comparison to the external probe.

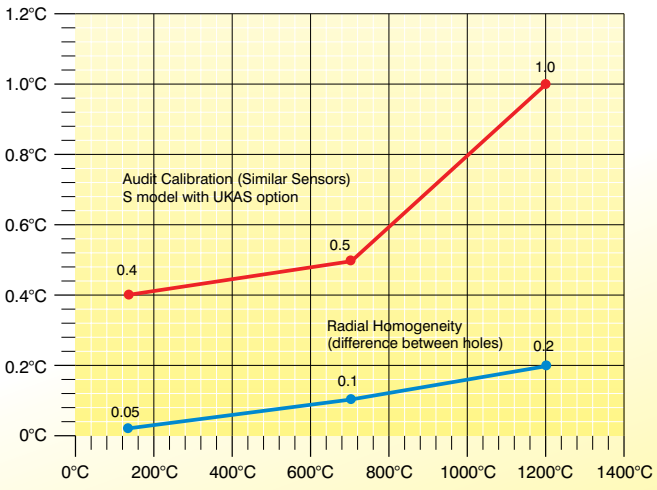
The S model includes a built in digital indicator to which an external standard thermometer should be connected, giving greater accuracy eliminating temperature gradient and loading errors. The recommended probe is a platinum Type R thermocouple. The optional Blackbody target is used with a specially angled Type R thermocouple that sits immediately behind the target area.

Includes as standard: Windows Software and a Computer Interface. Increased resolution of ±0.1 available throughout the range via the PC interface and from 150.0 to 999.9 locally on the autoranging front display. The controller features multi-point block to display correction giving good absolute accuracy.

The S model has universal sensor input allowing Platinum Resistance Thermometers, Thermocouples (Types K, N, R, S, L, B, PL2, T, J and E) along with Linear Process Inputs including 4-20mA current transmitters to be displayed on the inbuilt indicator. The indicator can be programmed with up to five calibration points to provide high accuracy digital probe matching. The indicator and controller are both addressable over the communications link.

The Site model can also be used with the supplied Cal Notepad software to test thermostats.

Pegasus^{PLUS} 1200



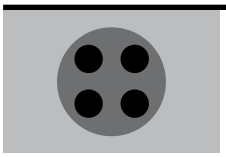
Calibration and Uncertainty

A certificate, traceable to National Standards, is included as standard. Recommended is an optional UKAS five-point calibration.

The accuracy will depend very much on the mode of use and the types of sensor to be used. Please contact Isotech for tutorials and uncertainty calculations and comprehensive evaluation reports. The Pegasus^{PLUS} 1200 meets the Calibration Capacity requirements of EA I0/13, “EA Guidelines on the Calibration of Temperature Block Calibrators”.

Model	Pegasus^{PLUS} 1200	
Temperature Range	150°C to 1200°C	
Absolute stability over 30 minutes	At 150°C At 1200°C Blackbody Source	±0.1°C ±0.2°C ±0.3°C
Cools from 1200°C to 800°C 1200°C to 200°C	in 50 minutes* in 180 minutes* *substantially reduced by the cooling adaptor	
Heating Rate	25°C/minute	
Calibration volume	33.5mm diameter by 130mm deep	
Standard Insert	4 pockets, 8.0mm diameter by 80mm deep	
Display Resolution	(0.1) to 999.9 and (1) 1000 to 1200 PC can display 0.1 across whole range with the software included	
Indicator units	°C, °F, K	
Computer Interface	Included with Software	
Voltage	100 to 120V (50 / 60 Hz) or 200 to 240V (50 / 60 Hz)	
Power	800 Watts	
Dimensions	Height 302mm Width 176mm Depth 262mm Weight 13kg	

Accessories - Pegasus



Metal Block Insert

853-06-01 Standard Insert Included

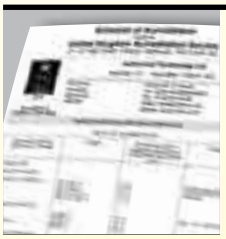
853-06-02 Blank Insert
Insert without pockets for local machining

853-06-02b Custom Insert
Contact Isotech with your requirements

Blackbody Kit

853-06-03 Includes a Blackbody target and Sensor

The Pegasus 1200 has to be used with the target vertical. The Pegasus 1200R is suitable for horizontal operation.



UKAS Calibration (S models only)

UKAS Calibration available to order, legally traceable in more than 70 countries.

Air Cooling

853-04-02 For use with a compressor this accessory allows air to be blown into the block for rapid cooling.

Ceramic Insulators

853-06-04 Spare insulation pack Includes 2 x standard tops and 2 x standard bottoms.

Standard Probe

935-14-91 Type R Platinum Thermocouple for use up to 1200°C.

Carrying Case

931-22-64 Sturdy case accommodates the unit with room for accessories

How To Order
Specify Model, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.

An Introduction to **Fast Calibrators**

This section focuses on the equipment needed for the rapid checking, testing and calibration of instrumentation and temperature sensors.

Service engineers and those working on site will appreciate the benefits of simple and fast temperature calibration. An engineer forced to carry a calibrator up a ladder or into a confined space will value the handheld QuickCal.

The Products Featured in this section have:

- Outstanding Value
- Compact Size with true handheld models
- Wide Operating Ranges
- Fast Response

Quick-Cals

There are two Quick-Cal models, handheld, portable and capable of operating from -12°C to 350°C

Fast-Cals

Fast-Cals work from -35°C to 650°C in three ranges, -35°C to 140°C, 30°C to 350°C and 35°C to 650°C.

During 2004, 20 experienced engineers from many parts of the world specified their ideal products for Industrial Calibration. Fast-Cal realizes their top ten requirements of:

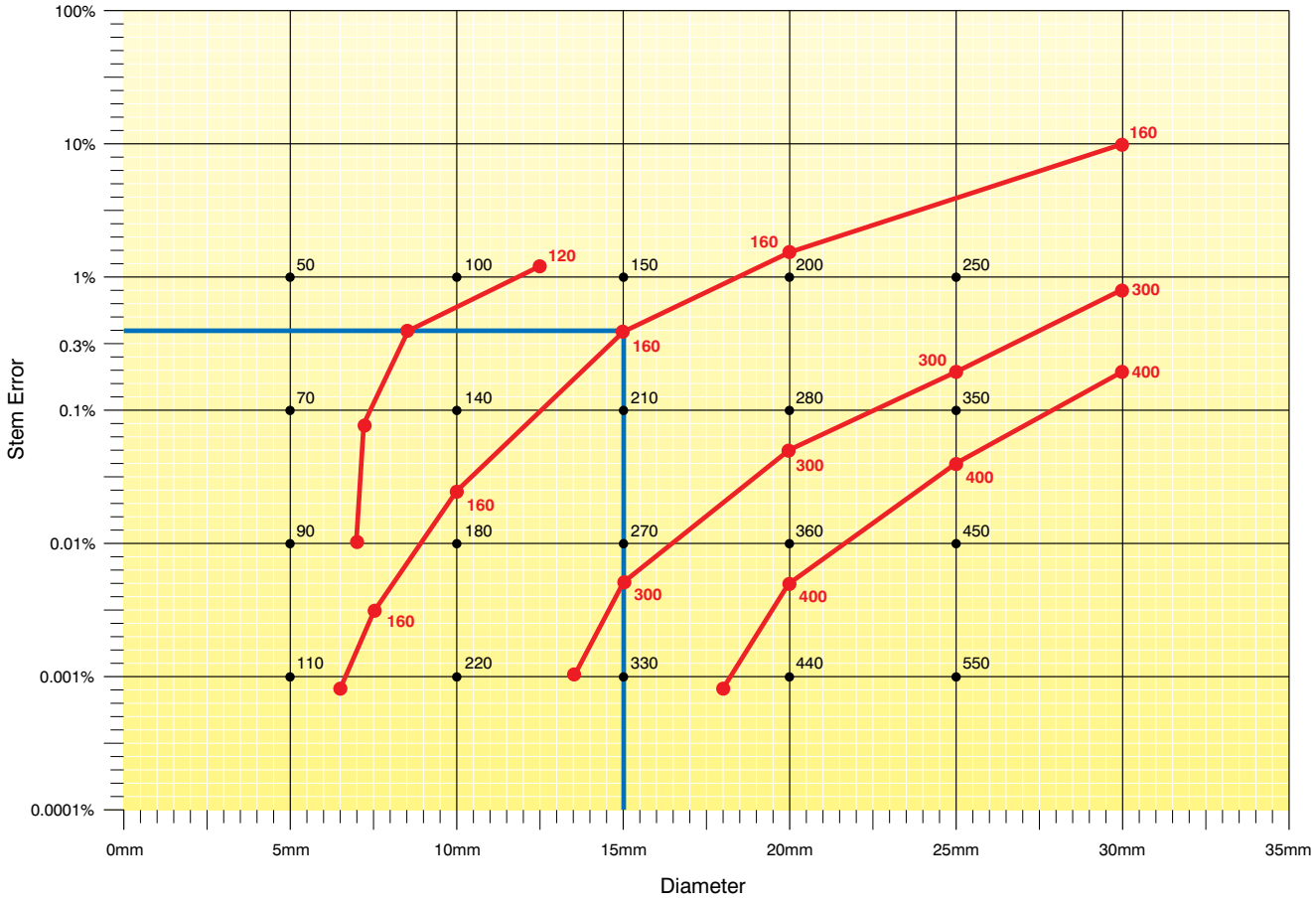
1 Rugged
2 Lightweight
3 Easy to use on site
4 Low cost/high benefit ratio,
5 Fast response, high stability
6 Time saving features
7 Multiple sensor testing
8 Software
9 Modern design
10 Compliant with latest regulations.

One model is ideal for the Validation of Washer Disinfectors, Steam Sterilisers and Autoclaves. In place of a removable insert it has a fixed block with pockets for a reference probe and the type of test sensor commonly used in validation applications.

■ Immersion depth is very important

When selecting a Dry Block Calibrator depth of immersion is very important. The chart below provides guidance in selecting a bath for immersion depth. Note that sensors with a long sensing length will require greater immersion. The chart is general and applies equally to all dry blocks - not to a particular model or manufacturer.

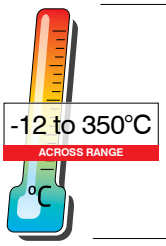
Immersion Depths for various diameter thermocouples or thermistors in a dry block bath



Example shows 0.3% stem error for a 15mm diameter thermocouple immersed 160mm in a dry block.

Note 1 *For sensors immersed in stirred liquids the diameter of sensor can be doubled, or the minimum depth halved.*
Note 2 *The sensing length must be added to the above immersion depth calculation*
N.B. *The above gives a good guide, however each sensor will be slightly different.*

For full information on selecting the correct immersion depth for all types of sensors ask for our free 8 page immersion tutorial.



Temperature Test Unit
Quick-Cal

- Fast
- Compact
- Two models -12°C to 350°C

Isotech's Quick Cal range of testers are ideally suited to the less exacting applications where our larger, better specified baths are unnecessary.

The Low Temperature Quick Cal covers the temperature range of -12°C to +140°C, making it ideal for the medical, sterilisation and food industries.

The High Temperature Quick Cal covers the temperature range from 30°C to 350°C.

Both have interchangeable inserts, so you don't have to buy another calibrator each time you find a new diameter sensor to calibrate. The Low Temperature Quick Cal is particularly exciting since it can work from a small 12 volt battery, making it truly portable, alternatively a mains supply is available with 100V - 240V, 50/60Hz input.

The Low Temperature Quick Cal comes complete with two inserts, one blank and one drilled 6.8mm diameter 120mm deep. Alternatively we can provide pre-drilled inserts to suit your needs. Each calibration well is 13mm diameter and 120mm deep.

The High Temperature Quick Cal has a single larger well and interchangeable inserts, 25mm in diameter by 120mm deep. Blank and other special drillings are available to order. The High Temperature Quick Cal is supplied 100-130 or 200-250V AC, 50/60Hz.

The manual which accompanies the Quick Cal contains helpful advice on how to get the best from your calibrator. Accessories for the above include a carry case, alternative inserts and a rechargeable battery for the Low Temperature Quick Cal.

Quick-Cal Low

Quick-Cal High

Specification

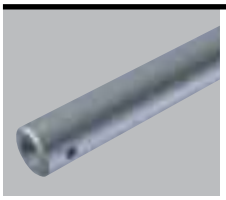
Model	Low Temperature Quick-Cal
Temperature Range	-12°C to +140°C In an ambient of 20°C The Quick-Cal will achieve lower temperature if used in a lower ambient temperature
Set Point Resolution	0.1°C over range
Accuracy	±0.1 to ±0.4°C using Comparison Techniques ±0.4°C against display temperature with a single probe in the 6.8mm drilled sleeve
Stability	±0.05°C
Time to Set Point	9 minutes from 0°C to 100°C
Additional Time for best stability	Typically 5 minutes
Calibration volume	Two 13mm diameter pockets 120mm deep. Supplied with two sleeves, one blank and one drilled 6.8mm diameter 120mm deep
Power	15Vdc or 100-240V, Switch mode power supply (50 / 60 Hz)
Dimensions	Height 65mm Width 152mm Depth 175mm Weight 1.5kg

Specification

Model	High Temperature Quick-Cal
Temperature Range	+30°C to +350°C In an ambient of 20°C
Set Point Resolution	0.1°C over range
Accuracy	±0.1 to ±0.4°C using Comparison Techniques <100°C ±0.4°C against display temperature with a single probe in the 4.5mm pocket >100°C ±1.5°C against display temperature with a single probe in the 4.5mm pocket
Stability	±0.05°C
Time to Set Point	9 minutes from Ambient to 350°C
Additional Time for best stability	Typically 5 minutes
Calibration volume	25mm diameter 120mm deep Supplied with insert, 5 pockets, 8mm, 6.5mm, 6.5mm, 4.5mm, 4.5mm, all 115mm deep
Power	100-130V or 200-240V, (50 / 60 Hz)
Dimensions	Height 65mm Width 152mm Depth 175mm Weight 1.5kg

How To Order

Specify Model, Low or High Temp, Supply Voltage, Accessories and if UKAS Calibration is required.



Extra Sleeves

560-06-01A Standard Sleeve
560-06-01B Blank Sleeve
560-06-01C Special Sleeve (maximum bore 10mm)

Carrying Case

931-22-71

UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

Fahrenheit Operation

Unit can be supplied for °F Operation

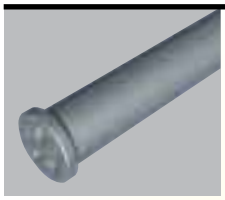
Rechargeable Battery & Charger

Battery is 12V 12Ah.

On full charge battery: 60 minutes when cooling, 90 minutes when heating

Longer life available with larger batteries - consult Isotech

Temperature Range is -10°C to 123°C with battery operation



Extra Inserts

550-06-01A Standard Insert
550-06-01B Blank Insert
550-06-01C Special Insert

Carrying Case

931-22-71

UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

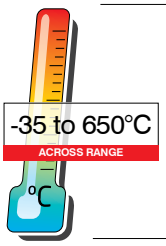
Fahrenheit Operation

Unit can be supplied for °F Operation

Semi Standard Platinum Resistance Thermometer

935-14-98

Note: Also suits Quick-Cal Low-temp



Industrial Temperature Calibrators
Fast-Cal

- 25 x 148mm Calibration Volume
- Rugged
- Lightweight
- Easy to use on Site

Fast-Cal - *the product range you designed !*

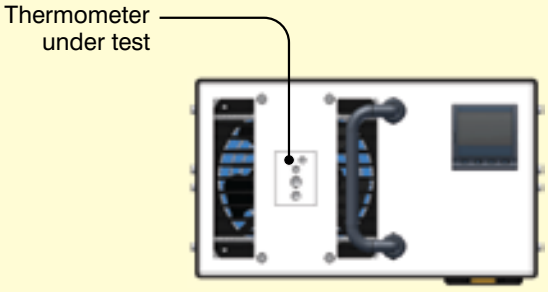
During early 2004, 20 experienced engineers from many parts of the world were asked to produce their ideal specification for industrial calibration. Their top ten requirements, in order of priority, are: ***Rugged, Lightweight, Easy to use on site, Low cost/high benefit ratio, Fast response, high stability, Time saving features, Multiple sensor testing, Software, Modern design, Compliant with the latest regulations.***

One model is ideal for the validation of Washer Disinfectors, Steam Sterilisers and Autoclaves. In place of a removable insert it has a fixed block with pockets for a reference probe and the type of test sensor commonly used in validation applications.

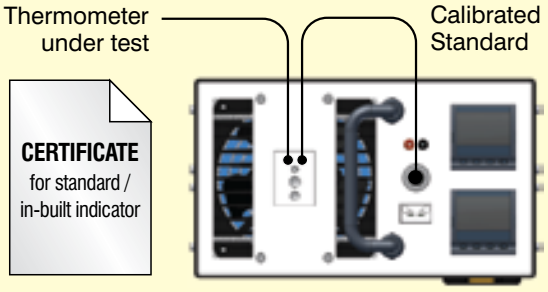
Fast-Cals are available in Basic or Complete models

■ **A Basic Dry Block Calibrator**
The thermometer under test is compared to the dry block controller value. Useful for moderate temperature ranges and quick testing.

■ **An ISO 9000 Calibration System**
A thermometer under test is compared to a calibrated standard, for true traceability and clearly meets the requirements of ISO9000. Complete models include a semi-standard probe.



Basic



Complete

Model No.	HTM 2010	Low	Medium	High
Range at 20°C	-35 to +140°C	-35 to +140°C	30 to 350°C	35 to 650°C
Stability	0.02°C	0.02°C	0.03°C	0.03 to 0.05°C
Accuracy - Basic	±0.2°C	±0.2°C	±0.3°C	±1°C (500°C) ±2°C (650°C)
Accuracy - Complete*	±0.15°C	±0.15°C	±0.2°C	±0.5°C
Heating Time	-30 to +140°C In 15 minutes	-30 to +140°C In 15 minutes	50 to 350°C In 15 minutes	50 to 650°C In 20 minutes
Cooling Time	+140 to 0°C In 15 minutes	+140 to 0°C In 15 minutes	350 to 100°C In 40 minutes	650 to 300°C In 20 minutes
Calibration Capacity	145mm depth 8Ø, 6.5Ø, 3 x 4.5Ø	148mm depth 25mm Ø	148mm depth 25mm Ø	148mm depth 25mm Ø
Power	150W	150W	750W	750W
Traceable Certificate	Included	Included	Included	Included
UKAS Certificate	Extra	Extra	Extra	Extra
PC Communications	Included	Included	Included	Included
Software	Included	Included	Included	Included
4-20mA Input	Complete Models	Complete Models	Complete Models	Complete Models
Ramps and Dwells	Yes with Software	Yes with Software	Yes with Software	Yes with Software
Dimensions	228 x 248 x 143mm	228 x 248 x 143mm	228 x 248 x 143mm	228 x 248 x 143mm
Weight	6.60kg	6.60kg	6.35kg	6.35kg

*When used with a suitable Isotech Semi Standard PRT.

How To Order

Specify Model, Basic or Complete, Supply Voltage, Accessories and if UKAS Calibration is required.

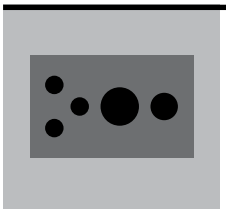
Features (Basic & Complete)	HTM 2010	LOW	MEDIUM	HIGH
Rugged, hard-wearing stainless steel case	✓	✓	✓	✓
Hygienic with no paint to chip or flake	✓	✓	✓	✓
No membrane keypads	✓	✓	✓	✓
Lightweight - less than 6.6kg	✓	✓	✓	✓
Thermal Switch Test - Complete Model with Software	✓	✓	✓	✓
Carrying Case included	✓	✓	✓	✓
Easy to use on site, effortless transporting	✓	✓	✓	✓
Fast response - high stability	✓	✓	✓	✓
Built-in Insert holder for ultra fast changes and restarts	-	-	✓	✓
Removable inserts, drilled to your requirements	-	✓	✓	✓
PC interface	✓	✓	✓	✓
Additional software available for automatic calibration	✓	✓	✓	✓
Certificate traceable to National Standards	✓	✓	✓	✓
Five point UKAS Certification available	✓	✓	✓	✓
Mains power variance immunity	✓	✓	✓	✓

***Note**: The Complete model can capture a thermostat trip temperature either as a stand alone unit or with a PC and the included software.*

Low, Medium & High

Standard Insert is:
2 x 4.5mm + 1 x 6.5mm x 140mm Deep.

All Inserts have a 4mm tapped hole to suit supplied extractor tool.



HTM2010 Fixed Block

3 x 4.5mm + 1 x 6.5mm + 1 x 8mm x 145mm Deep.

Extra Inserts

In addition to the standard insert, specially drilled or blank inserts are also available.

	Low & Medium	High
Standard	**907-02-03**	**907-02-03d**
Custom	**907-02-03c**	**907-02-03g**
Blank	**907-02-03b**	**907-02-03f**

Introducing Absolute Calibration with **ITS-90 Fixed Point Cells**

For calibration to the smallest of uncertainties thermometers are calibrated by placing them into a series of Fixed Point Cells. For example pure aluminum freezes at 660.323°C so by first melting a cell containing pure aluminum, then placing a thermometer into it as the metal changes state, from a liquid to a solid, a very precise calibration point is realized.

This absolute or fixed point calibration is performed by National Metrology Institutes providing primary standards and directly realizing the International Temperature Scale, ITS-90. Isotech's solutions for Primary Standards are found in a separate publication, *"Volume 1: Solutions for Primary & Secondary Laboratories."*

Isotech also offer a range of ITS-90 Fixed Point systems that are less expensive, easier to use and more robust than the larger cells used by the international NMIs.

For some countries, where the local industry needs are less demanding Slim Cells are used by NMIs and Isotech can offer UKAS calibration with uncertainties from 0.5mk to 2mK over the range -38°C to 660°C.

Users in industrial and secondary laboratories benefit from using Slim Cells to calibrate to smaller uncertainties than is possible with dry blocks or liquid baths. The Isotech Slim Water Triple Point Cell is comparable in cost to a specially drilled metal insert, putting it in the reach of all calibration engineers. Using a Water Triple Point Cell allows cost effective checking of standards between calibrations, and to help determine when a thermometer needs recalibration. Water triple point cells have uncertainties less than 0.001°C at a very modest cost.

In order to use an ITS-90 Fixed Point Cell, apparatus is needed, it must create a zone of constant temperature around the cell so that the cell can melt of freeze uniformly. Isotech equipment uses multi zone heating or for optimal performance a heat pipe or heat siphon. To calibrate a thermometer it must be sufficiently immersed that further immersion would make no temperature change to the thermometer.

A new innovation from Isotech is the Isothermal Tower, which combines apparatus, a heat siphon, fixed point cell and an immersion compensation device.* The Isothermal Towers are simple to use integrated devices providing optimal performance.

There are also ranges of apparatus that can accept a range of cells, see table opposite. These models can also be used without cells, including use as Dry Blocks for immersion depths of up to 300mm - ideal for larger sensors.

** Patents applied for*

Fixed Point	State	Temperature °C
Argon	Triple Point	-189.3442
Mercury	Triple Point	-38.8344
Water	Triple Point	0.010
Gallium	Melt Point	29.7646
Indium	Freeze Point	156.5985
Tin	Freeze Point	231.928
Zinc	Freeze Point	419.527
Aluminium	Freeze Point	660.323
Silver	Freeze Point	961.78

Equipment

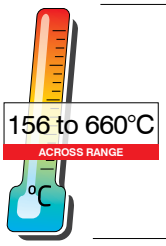
The ITS-90 Cell needs equipment in order to melt, freeze or maintain it. Many combinations of Isotech equipment can be used; liquid baths, dry blocks and furnaces.

Isotech have a range of Dry Blocks that allow the fixed points to be easily realized at an affordable price.

The combination allows you to calibrate at a “Point On The Temperature Scale” hence the name POTTS.

Point	Temperature	Suitable Apparatus	
Mercury	-38.8344°C	Europa	
B8 Water Triple Point	0.01°C	Europa Venus	
B12 Water Triple Point	0.01°C	Oceanus	
Gallium	29.7646°C	Europa Venus Calisto	
Indium	156.5985°C	Medusa 510 Medusa 511 ISOTower 490	 
Tin	213.928°C	Medusa 510 Medusa 511 ISOTower 491	 
Zinc	419.527°C	Medusa 510 Medusa 511 ISOTower 492	 
Aluminium	660.323°C	Medusa 510 Medusa 511 ISOTower 493	 
Silver	961.78°C	Oberon	
Copper	1084.62°C	Oberon	

ISOTowers are intergrated devices including the ITS-90 Fixed Point Cell



ITS-90 Isothermal Towers

ISOTower

- High accuracy
- Fast to temperature
- Simple to use

The most accurately defined temperatures are those defining points (fixed points) of ITS-90.

The leading Primary Laboratories use large fixed point cells in deep calibration furnaces that utilise Heat Pipes to eliminate temperature gradients. This combination of cell and furnace gives the smallest of uncertainties.

In Isothermal Towers the fixed point cell and heat pipe (or heat siphon) have been combined (patent applied for) to produce the ideal realisations for calibrating standard thermometers.

Thermometers can only be calibrated accurately if they are immersed sufficiently.

In Isothermal Towers a heated block (Immersion Compensator, patent applied for) sits on top the heat siphon/cell to fully compensate for the immersion characteristics of the unit under test.

The Isothermal Towers performance has been fully evaluated against the most detailed and demanding requirements ever written: CCT/2000-13.

All Isothermal Towers; Indium, Tin, Zinc and Aluminium meet all the requirements of CCT/2000-13 allowing laboratories to realise the smallest uncertainties, at a fraction of the cost of conventional Metrology Furnaces with Primary Standard Cells

You can purchase three Isothermal Towers; Tin, Zinc and Aluminium for a similar price as one conventional cell and heat pipe apparatus!

Isothermal Towers are simple to use, and very robust. Operation is risk free, as a combined apparatus there is no need to handle a fragile cell. No need for specialist training courses. Isothermal Towers remove the mystery from fixed point calibration.

Easily set to provide a melt or freeze of 24 hours or more, lending themselves for automatic calibration and providing your lab with an all day long plateau.

Perfect Audit Item

As an audit item, an accreditation authority can send the device to laboratories for intercomparison.

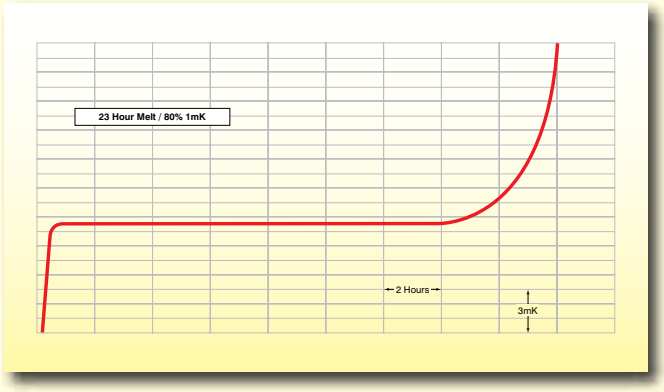
Because the cell, apparatus and immersion compensator are a single entity, the performance is unambiguous unlike existing systems where cell and apparatus are often separated during intercomparison. Accreditation authorities love them.

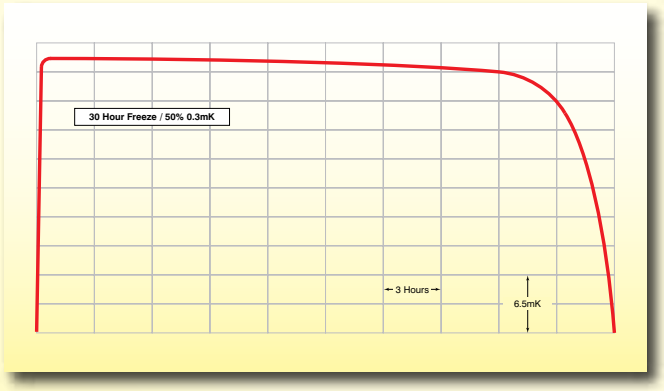
Available to Hire

Additionally Isothermal Towers are available to hire from Isotech and a growing number of Isotech Distributors to allow laboratories to audit themselves by intercomparing their cells and standard thermometers to a UKAS calibrated Isothermal Tower.

Transportable

ITS-90 Isothermal Towers are transportable by carrier; there are no fragile glass parts!



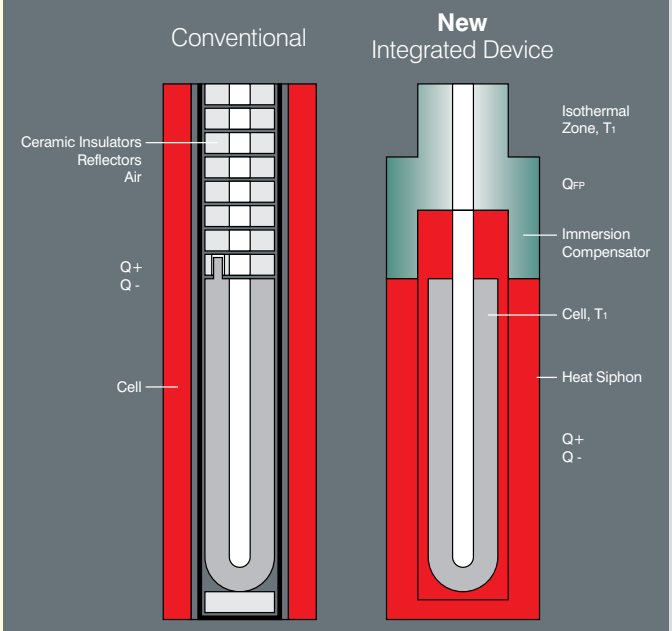


- Isothermal Towers include a traceable calibration certificate.

  This includes a graph of one freeze, one melt plateau and a certificate of purity for the metal inside the siphonic cell.

  As an option, UKAS calibration is available to one of two services, see table over for the uncertainties.

  Full data available at www.isotech.co.uk/isotower



A fixed point cell is not long enough to eliminate heat conductance along the thermometer calibrated in it. Currently, using long furnaces, heat shunts and reflective baffles an attempt is made to reduce these losses.

The ISOTower uses a combined metal clad fixed point cell and heat siphon, which when heated provides an isothermal environment for the metal within to change state. The outer wall of the cell becomes the inner wall of the heat siphon with cost as well as performance benefits.

Additionally an Immersion Compensator is used to compensate for the stem conduction problems caused when a thermometer under test is not sufficiently immersed into a fixed point cell.

Benefits of the ISOTower over a conventional Quartz Cell and Apparatus

ISOTower

- Robust - no glass parts
- Easily Transported
- Integrated Device - known immersion characteristics
- Uniquely integrated cell, apparatus and correction for thermometer stem conduction
- Simple and safe to use with increased confidence in results

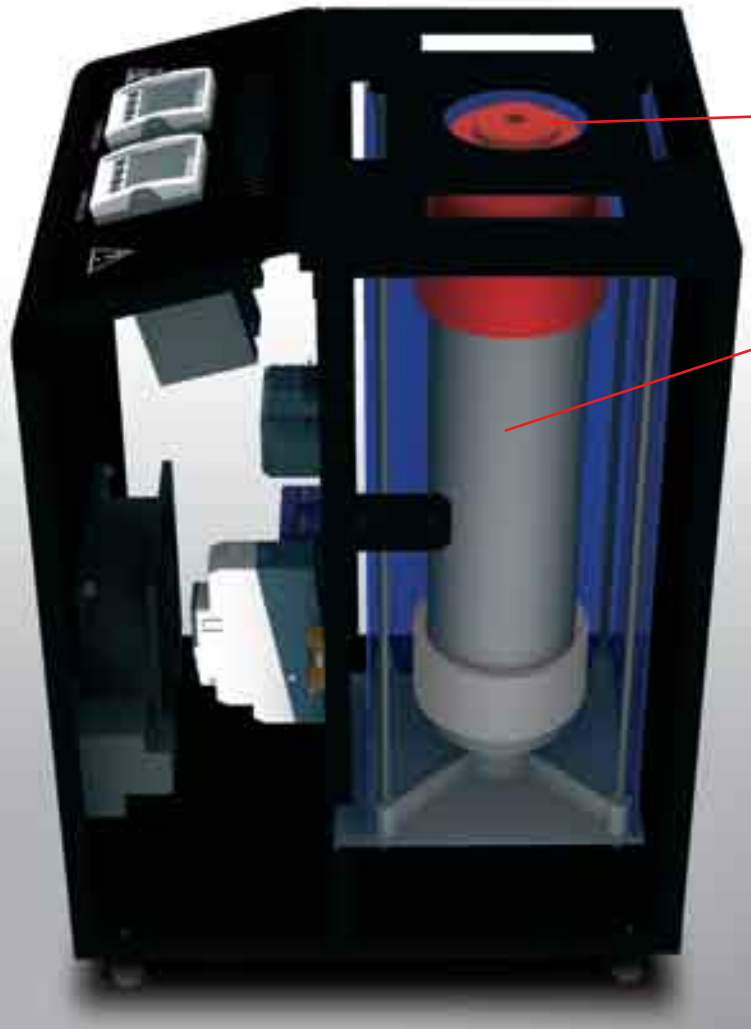
Conventional Quartz Cell and Apparatus

- Fragile and Risk of Breakage
- Difficult and expensive to Transport
- Cell certified separate from apparatus, stem conduction unknown

Specification

Model	490	491	492	493
ITS-90 Point	Indium	Tin	Zinc	Aluminium
Temperature	156.5985°C	231.928°C	419.527°C	660.323°C
Metal Purity	6N	6N	6N	6N
Plateau Duration	Up to 30 hrs			
UKAS Uncertainty: Premium Service*	±0.7mK	±0.8mK	±1mK	±2mK
UKAS Uncertainty: Standard Service*	±2mK	±2mK	±2mK	±6mK
Heating Time	2 hrs	2 hrs	2 hrs	2 hrs
Pocket Diameter	8 mm			
Total Immersion Depth	290 mm			
Depth of metal surface to bottom of reentrant tube	180 mm			
PC Interface	Supplied with PC Cable and Software			
Power	900 Watts			
Voltage	110 Vac or 230 Vac 50/60Hz			
Dimensions	H 430 mm x W 310 mm x D 300 mm			
Weight	15kg			

** UKAS Calibration is Optional, Uncertainties apply to whole system*



Immersion Compensator*

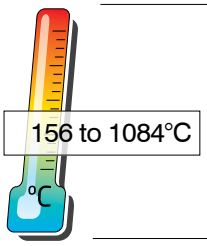
Fully compensates for the immersion characteristics of the thermometer under test.

Siphonic Cell*

A combined Fixed Point Cell and Heat Pipe

The outer wall of the fixed point cell is the inner wall of the heat pipe or siphon, thus integrating the cell and its apparatus, giving a guaranteed performance from the cell.

*Patent applied for



Slim Fixed Point Cells
Sealed

- Ultra Pure >99.9999% 6N
- 35 Year Plus History
- For Optimal Realisations

Water
The Isotech B8 30 130 Cell is small enough to fit into portable Dry Blocks such as the Venus and Europa models. For the larger blocks like the Oceanus Isotech recommend the B 12 46 210 with its increased immersion depth

Gallium and Mercury Cells
Like the B8 Cell the Slim Gallium Cell can be used in portable blocks like the Venus and Europa, or in stirred liquid baths. The Hydra and Orion have accessories available to support the cells.

Indium to Copper
Isotech's Slim Cells have been in constant use since their introduction in 1990. The cells have always been made from the highest quality graphite and 6N (99.9999%) pure metals.

After further investment in the lab, and gaining smaller uncertainties from UKAS, we reviewed and further refined our range of metal clad cells to give better accuracy and performance. The new professional ranges of cells have more metal inside providing an active immersion depth in the metal of 160mm.

Metal Clad
Isotech produced the first metal clad cells in 1990 and have much experience in the manufacture and calibration of high quality proven metal clad cells.

Metal clad cells are recommend for all points from Indium to Aluminium.

Quartz Clad
These cells are recommended for Silver and Copper points, whilst available for the lower temperature points the metal clad versions are recommended as they are more robust, have the same performance and are more cost effective.

Equipment for Slim Cells
The Slim Cells can be used in the same apparatus as the larger cells, and the greater immersion depth will give the lowest uncertainties.

Cost effective dedicated desktop apparatus like the POTTS, "Points on the Temperature Scale" can be used to automatically bring the cell to the plateau. These simple to use systems conveniently provide long flat plateau for low uncertainty calibration of thermometers.

UKAS certification of our Slim Cells
The metal clad fixed point cells are intercompared to our reference cells for smallest uncertainties. Isotech now offer two UKAS services depending on the amount of measurements we make on the cell under test.

In our standard and recommended service we perform one melt, one freeze and one intercomparison. In our premium service, in order to reduce uncertainties we perform two or three melts, two or three freezes and two intercomparisons.

The two optional UKAS services with the uncertainties are tabulated below:

Isotech UKAS Calibration Uncertainties (k=2)

Cell	Premium Service UKAS Schedule Note 4	Standard Service UKAS Schedule Note 5
Mercury	±0.5mK	±1mK
Water	±0.1mK (B12)	±0.5mK
Gallium	±0.5mK	±1mK
Indium	±0.7mK	±2mK
Tin	±0.8mK	±2mK
Zinc	±1mK	±2mK
Aluminium	±2mK	±6mK

UKAS CALIBRATION
0175

The latest schedule can be found on the Isotech website or at www.ukas.org

Available Types Cells	Temperature	Uncertainty[1]	Additional Uncertainty[2]	Model Metal Clad	Model
Water	0.01°C	±0.5mk	±0.3mk	N/A	B8 30 130
Water	0.01°C	±0.1mk	±0.3mk	N/A	B12 40 210
Water	0.01°C	±0.1mk	±0.3mk	N/A	B12 46 210
Gallium	29.7646°C	±0.5mk	±0.3mk	17401M	N/A
Mercury	-38.8344°C	±0.5mk	±0.1mk	17724M	N/A
Higher Temperature					**Quartz Clad**
Indium	156.5985°C	±0.7mk	±0.7mk	17668ML	17668QS
Tin	231.928°C	±0.8mk	±0.8mk	17669ML	17669QS
Zinc	419.527°C	±1mk	±1.5mk	17671ML	17671QS
Aluminium	660.323°C	±2mk	±3mk	17672ML	17672QS
Silver	961.78°C	±30mk		N/A	17673QS
Copper	1084.62°C			N/A	17674QS

Isotech cells are of the highest purity available. Open cells conform to CCT/2000-13. Sealed cells are sealed to one atmosphere with 6N pure argon at the freeze temperature.

Metal

- Robust
- Protected Against Contamination and Ambient Pressure Effects
- Easily Transportable Between Labs

Quartz

- Silver and Copper points available

Slim Gallium

- Robust
- Fits in Isotech Dry Blocks

Slim Mercury

- Robust
- Fits in Europa-6

Water Triple

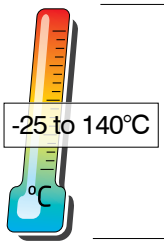
- Low cost
- Fits in Dry Blocks

Nominal Dimensions Cell	Outside Dia.	Inside Dia.	Height	Material Depth
Slim Metal	37	8	220	160
Slim Quartz	38	8	226	160
Slim Mercury	36	9	235+140	130
Slim Gallium	35	10	200+45	140
Water B8 30 130	30	8	160	130
Water B12 40 210	40	12	365	210
Water B12 46 210	46	12	365	210

A free report is available, **www.isotech.co.uk/pdfs/SlimCells.pdf**

N.B. Other SPRTs may give different results depending on the stem conduction properties.

1. *The uncertainty applies when the cells are sufficiently immersed in deep apparatus.*
2. *When these cells are used in bench-top apparatus the additional uncertainty should be included for stem conduction effects. The value is typical for the 670 SPRT, others SPRTs may give different results depending on the stem conduction properties.*



ISOCAL - 6 Range
Oceanus-6

- 50 x 300mm Calibration Volume
- Use with Water and Gallium Fixed Points
- Can also be used as a Dry Block, Liquid Bath...
- -25°C to 140°C

The Oceanus-6^{PLUS} has all the advantages of the Isocal-6 models but with a substantially larger calibration volume, 50mm diameter by 300mm deep. The Oceanus-6 can be used as a Dry Block, a Liquid Bath, a Blackbody Source for infrared thermometers, a Surface Sensor Calibrator and for performance to a few mK (0.001°C) ITS-90 Fixed Points. The Oceanus-6^{PLUS} is available in two models, the BASIC (B) and the SITE (S). The B model includes a sophisticated temperature controller with a dual display for Set Temperature and Dry Block Temperature.

The S model includes a built in digital thermometer to which an external standard thermometer can be connected, for Dry Block use this will give greater accuracy eliminating temperature gradient and loading errors.

For Liquid Bath, Surface Sensor or Blackbody use an external thermometer should always be used - either with the S model or the B model and a separate stand-alone indicator. For Lab use the Oceanus-6^{PLUS} can be used with a laboratory performance temperature indicator such as one of the Isotech True Temperature Indicators with performance, for similar sensors, down to hundredths of a degree. The Oceanus-6^{PLUS} offers unprecedented accuracies of ±0.0002°C (2 Sigma) at the Water triple point and the Gallium melt temperature of 29.7646°C and up to ±0.005°C in the stirred liquid bath option (by comparison).

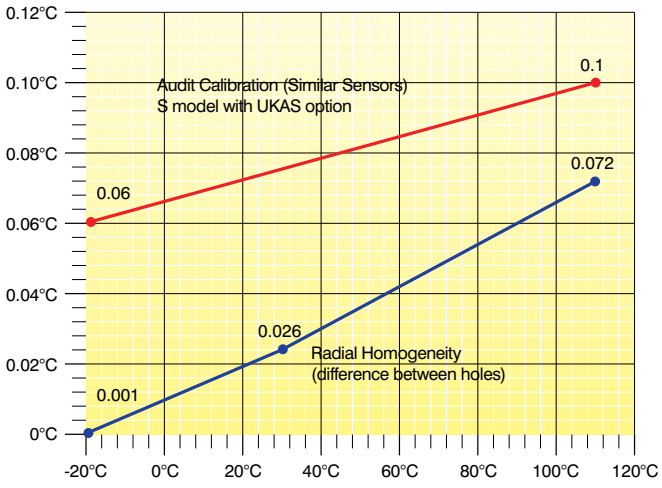
http://www.isotech.co.uk/industrial/

Specification

Model	Oceanus-6
Temperature Range	45°C below ambient to +140°C
Absolute stability over 30 minutes	Dry Block ±0.03°C Stirred Liquid Bath ±0.025°C Ice/Water Bath ±0.001°C Blackbody Source ±0.3°C Surface Sensor Calibrator ±0.5°C ITS-90 Fixed Point ±0.0002°C
Computer Interface	Included with Software
Cools from	20°C to -10°C in 90 minutes
Heats from	-10°C to 80°C in 60 minutes
Calibration volume	50mm diameter by 300mm deep
Standard Insert	6 pockets, all 8.0mm diameter and 250mm deep
Display Resolution	0.01 -19.99 to 99.99 0.1 100.0 to 140.0 PC can display 0.01 across whole range with the software included
Indicator units	°C, °F, K
Power	108 to 130V (50 / 60 Hz) or 208 to 240V (50 / 60 Hz) 300 Watts
Dimensions	Height 430mm Width 310mm Depth 300mm
Weight	17kg

Isocal-6 Performance and Use

580 Oceanus 6



Calibration and Uncertainty

A certificate, traceable to National Standards, is included as standard. Recommended is an optional UKAS five-point calibration.

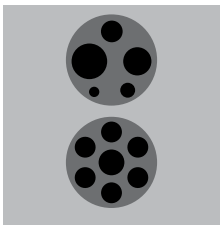
The accuracy will depend very much on the mode of use and the types of sensor to be used. Please contact Isotech for tutorials and uncertainty calculations and comprehensive evaluation reports. The 580 Oceanus-6^{PLUS} meet the Calibration Capacity requirements of EURAMET/cg-13/v.01, “Guidelines on the Calibration of Temperature Block Calibrators”.

Features (Basic & Site)	Oceanus 6+
Dry Block	✓
Stirred Liquid bath Option	✓
Stirred Ice Bath Operation	✓
Surface Sensor Option	✓
Infrared Calibration Option	✓
ITS-90 Fixed Point Cells	*Water, Gallium*
Additional 8mm Pre-heat Pocket	✓
Configurable Units: °C, °F and K	✓
Supply Voltage Power Correction	✓

Additional Features (Site)	Oceanus 6+
Independant Temperature indicator	✓
Universal Input Types PT100	✓
Thermocouples Types K,N,R,S,L,PL2,T,J,E	✓
Linear Process Inputs Including 4-20 mA	✓
Stand Alone Thermostat Testing	✓
Thermostat Testing With PC	✓
Five Point Digital Probe Matching	✓
Configurable Units: °C, °F and K	✓

Isocal-6 Ultimate Flexibility - Oceanus

Calibrate all sensor types - Thermocouples, PRT's, Thermistors, Thermostats, Infrared, Surface Sensors...



1 Metal Block Insert 580-06-03
Standard Insert included

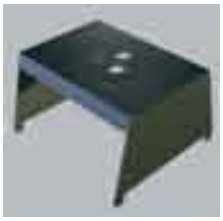
Alternative Inserts

580-06-04 Blank Insert without pockets for local machining. Includes M4 tapped hole for supplied extractor tool.

580-06-05 Custom insert. Isotech can provide custom drilled pockets, minimum of 3mm separation between holes. Contact with your requirements.

2 Stirred Liquid Mode with Liquid Container Kit 580-06-07
Allows liquid bath use, includes container, magnetic stirrer, probe guide and sealing cap.

3 Stirred Ice Bath Mode with Liquid Container Kit
Uses same liquid kit to provide 0°C reference as a stirred ice bath



Additional Accessories for use with the above kit

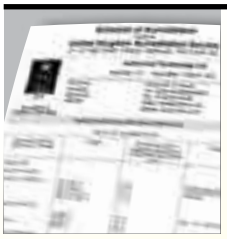
Thermometer Support Kit
580-06-00 Allows three thermometers to be suspended in the bath, including liquid in glass types

C10 Oil
936-06-07 1 Litre (-35°C to +140°C)

4 Infrared Calibration Mode with Blackbody Target
580-02-12 Use optional Probe **935-14-85** placed in the auxiliary block pocket for use as a reference.

5 Surface Sensor Calibration with Surface Sensor Kit
580-06-08 Includes angled platinum resistance thermometer.

6 ITS-90 Fixed Point Cells
B12/46/210 Water Triple Point Cell
17401 Gallium Cell

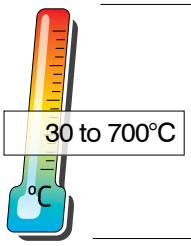


UKAS Calibration
UKAS Calibration available to order, legally traceable in more than 70 countries.

Standard Probe
935-14-85/DB Platinum Resistance Thermometer for use up to 250°C.
4.5mm diameter Angled head feature avoids sensors in block.

Carrying Case
931-22-58 Sturdy case accommodates the unit with room for accessories

How To Order
Specify Model, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.



Dry Block Calibrator
510 Medusa & 511 Medusa 3

- 45 x 285mm Calibration Volume
- Use for Comparison and Fixed Point Calibration
- Use with very long thermometers

Isotech have a wide range of Dry Blocks to suit probes requiring a large immersion depth. These products feature large and deep calibration volumes. As such they are less portable than the earlier Dry Blocks, but have higher capacities and retain outstanding temperature uniformity, this uniformity is so good that these larger products are also apparatus for Secondary Laboratories to realize the Fixed Points of ITS-90.

Medusa 510 has a maximum operating temperature of 550°C. The Medusa Model 511 can be used to 700°C and features three zone control. In addition to the main heating zone there are additional top and bottom heaters which compensate for the end losses creating a constant temperature zone across the well.

For Comparison Calibration the Medusa should be used with an insert, the standard insert has six 8mm pockets 250mm deep. Also available is an insert 44mm diameter x 170mm deep which is suspended from the top of the block so that the height is user adjustable. For flexibility the Medusa can also be used with accessories for infrared thermometers and surface sensors. The Medusa is available in two models, the BASIC (B) and the SITE (S). The B model includes a sophisticated temperature controller with a dual display for Set Temperature and Dry Block Temperature.

The S model includes a built-in digital thermometer to which an external standard thermometer can be connected giving greater accuracy, eliminating temperature gradient and loading errors. Also included in the site model is a timer which can set the bath between two temperatures, and automate ITS-90 fixed point operation. For Surface Sensor and Blackbody use an external thermometer is recommended. For laboratory accuracy the Medusa can be used with a high-end temperature indicator such as an Isotech TTI model.

Includes as standard: Windows Software, Computer Interface and a Ramp to Set Point Feature. Increased resolution of ±0.01 available throughout the range via the PC interface and from 0.01 to +99.99 locally on the auto-ranging front display. The controller features multi-point block to display correction giving good absolute accuracy.

The S model has universal sensor input allowing Platinum Resistance Thermometers, Thermocouples (types K, N, R, S, L, B, PL2, T, J and E) along with Linear Process Inputs including 4-20mA current transmitters to be displayed on the in-built indicator. The indicator can be programmed with up to five calibration points to provide high accuracy digital probe matching. The indicator and controller are both addressable over the communications link.

POINTS ON THE TEMPERATURE SCALE

Fixed Point Cells Available

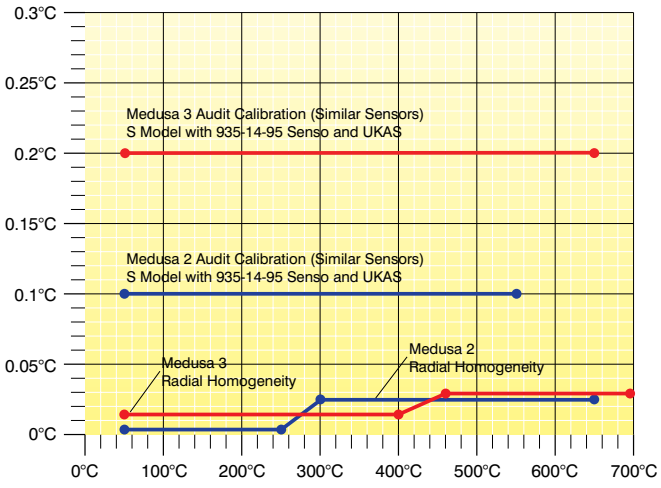
Material	Temperature
Gallium	29.7646°C
Indium	156.5985°C
Tin	231.928°C
Zinc	419.527°C
Aluminium	660.323°C

Specification

Model	510 Medusa	511 Medusa 3
Temperature Range	30°C to 550°C	50°C to 700°C
Absolute stability over 30 minutes	Metal Block Bath Blackbody Source Surface Sensor Calibrator ITS-90 Fixed Point	±0.03°C ±0.1°C ±0.5°C ±0.001°C
Computer Interface	Included with Software	
Cools from	550°C to 30°C in 5 hours	
Heats from	30°C to 550°C in 90 minutes	
Uncertainties	Refer to Uncertainties Graph	
Calibration volume	45mm diameter by 285mm deep	
Standard Insert	Six 8mm pockets all 250mm deep	
Display Resolution	(0.01) to 99.99 (0.1) 100.0 to 650.0 PC can display 0.01 across whole range with the software included	
Indicator units	°C, °F, K	
Power	108 to 130V or 208 to 240V 50 / 60Hz 1000 Watts	1800 Watts
Overall dimensions	Height 430mm Width 310mm Depth 300mm	
Weight	17kg	25kg

Performance and Use

510 Medusa



Calibration and Uncertainty

A certificate, traceable to National Standards, is included as standard. Recommended is an optional UKAS five-point calibration.

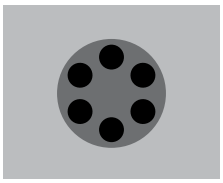
The accuracy of the Medusa will depend very much on the mode of use, see the Uncertainty Graph for typical uncertainties. NTPL calculate the uncertainties to UKAS requirements. The Medusa meets the Calibration Capacity requirements of EA-10/13, "EA Guidelines on the Calibration of Temperature Block Calibrators."

Features (Basic & Site)	Medusa
Dry Block	✓
Surface Sensor Option	✓
Infrared Calibration Option	✓
ITS-90 Fixed Point Cells	✓
Additional 8mm Pre-heat Pocket	✓
Configurable Units: °C, °F and K	✓
Supply Voltage Power Correction	✓

Additional Features (Site)	Medusa
Independant Temperature indicator	✓
Universal Input Types PT100	✓
Thermocouples Types K,N,R,S,L,PL2,T,J,E	✓
Linear Process Inputs Including 4-20 mA	✓
Stand Alone Thermostat Testing	✓
Thermostat Testing With PC	✓
Five Point Digital Probe Matching	✓
Configurable Units: °C, °F and K	✓

510 Medusa & **511** Medusa 3

Calibrate all sensor types - Thermocouples, PRT's, Thermistors, Thermostats, Infrared, Surface Sensors...



510 Metal Block Insert

510-06-01	Standard Insert included
510-06-02	Blank Insert without pockets for local machining
510-06-03	Special Insert. Contact Isotech with your requirements
510-06-04	Adjustable Equalising Block

511 Metal Block Insert

511-06-01	Standard Insert Included
511-06-02	Blank Insert without pockets for local machining
511-06-03	Special Insert. Contact Isotech with your requirements
511-06-04	Adjustable Equalising Block

Blackbody Kit

510-06-05	For 510. Includes a Blackbody target and Sensor.
511-06-05	For 511. Includes a Blackbody target and Sensor.

510 Surface Sensor Calibration with Surface Sensor Kit

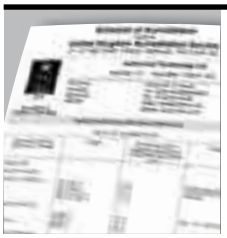
510-06-06	Includes an insert and an angled thermocouple.

511 Surface Sensor Calibration with Surface Sensor Kit

511-06-06	Includes an insert and an angled thermocouple.

ITS-90 Fixed Point Cells

ITL17401M	Gallium Slim Cell (510)
ITL17668M	Indium Slim Cell
ITL17669M	Tin Slim Cell
ITL17670M	Lead Slim Cell
ITL17671M	Zinc Slim Cell
ITL17672M	Slim Aluminium Cell (511)
510-05-00	Cell Basket for 510
510-05-01	Cell Basket for 511



UKAS Calibration

UKAS Calibration available to order, legally traceable in more than 70 countries.

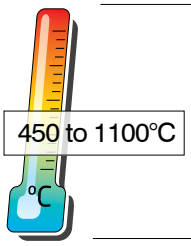
Standard Probe

935-14-95/DB Platinum Resistance Thermometer for use up to 650°C.

Carrying Case

931-22-58 Sturdy case accommodates the unit with room for accessories

How To Order
Specify Model, Basic or Site, Supply Voltage, Accessories and if UKAS Calibration is required.



POTTS
Oberon

- 50 x 300mm Calibration Volume
- Compact Heatpipe Furnace
- Suits Aluminium, Silver or Copper Fixed Points
- Can be used for comparison and infrared calibration

Model 426 is for Aluminium, Silver or Copper slim fixed point cells as well as for comparison calibration. Heatpipes provide the ideal conditions for the creation and maintenance of slim ITS-90 cells.

The furnace core is a specially-designed stress-free isothermal heat pipe, which provides a very low thermal gradient along the core working length.

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.

The Oberon can be used with Blackbody Fixed Point Cells.

Oberon for Aluminium or Copper Slim Fixed Point Cells

Model	**426**
Temperature Range	450°C to 1100°C
Stability	±0.05°C
Display resolution	0.1°C
Cavity size	50mm diameter 300mm deep
Time to temperature	4 hours
Communications	Supplied as standard with serial interface, PC adaptor cable and Cal NotePad
Power	110 Vac, 1.5kW, 50/60Hz (230 Vac Transformer available)
Dimensions	Height 410mm Width 415mm Depth 280mm Weight 30.5kgs

Accessories	
Metal Block Bath	Standard Insert 6 x 8mm holes x 250mm deep Non-standard Insert - please consult Isotech
ITS-90 Fixed Point	ITL M 17672QS Aluminium Quartz Clad Slim Cell
Apparatus	ITL M 17673QS Silver Quartz Clad Slim Cell
	ITL M 17674QS Copper Quartz Clad Slim Cell
Inconel Basket including insulators	426-04-00
230/110V Transformer	935-19-43

How to order
426 Oberon High Temperature Furnace
Please specify voltage required

Precision Thermometers

Isotech have a range of innovative precision thermometers to match the calibration requirements of all labs, from most demanding of National Metrology Institutes through to the needs of those calibrating industrial sensors.

TTI Family

The True Temperature Indicator family includes the TTI-22 and TTI-7 PLUS. The TTI-22 offers performance to 1mK at a ground breaking new price. The TTI-7 can be used with SPRTs, PRTs and all the major thermocouple types.

True Surface Temperature Measuring System

This is a true temperature indicator for use with surface temperature measurement, ideal for use with the Small Hot-Plate Model 983.

Semi Standard Resistance Thermometers and Thermocouples

This section includes a range of “Semi Standard” thermometers that can be used with the TTI’s. These precision semi standards are more rugged and affordable than the standard thermometers and ideal for industrial applications.

Fixed Resistors

Isotech have a miniature resistor with an ultra low temperature coefficient, model 836, with accuracies of ±0.005% and temperature coefficients of less than 1ppm. These resistors offer an outstanding cost to performance ratio and will find use alongside a model from our TTI range and in other areas of industrial calibration.

Thermometer Selection Guide

Model	SPRTs	PRTs	Thermistors	Thermocouples	Accuracy at 0°C	Features
TTI-22	■	■			0.001°C	Sets new Standard for Price to Performance
TTI-7	■	■		■	0.01°C	SPRTs, PRTS and Thermocouples
Model 954						8 Channel PRT Switch for TTI-22 and TTI-7 PLUS
Model 958						8 Channel Thermocouple Switch for TTI-22 and TTI-7 PLUS

True Surface
Temperature Measuring System

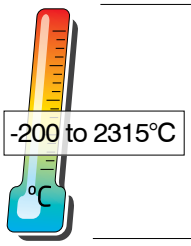
- Indicates True Surface Temperature
- 30°C to 350°C
- Resolution 0.1°C

Semi Standard
Resistance Thermometers and Thermocouples

- Ideal for Industrial Applications
- Can be supplied with UKAS
- Choice of temperature ranges and sizes

Fixed
Resistors

- Wide range of Values
- Oil Filled
- Precise and Stable for Industrial References



PRT and Thermocouple Thermometer
TTI - 7 PLUS

- Accepts 25 and 100 Ohm Resistance Thermometers - Conversion to ITS-90 and IEC 751
- Eliminate unwanted thermal EMFs with current reversal
- Expandable to have 10 input channels
- Inbuilt data logger stores up to 4000 measurements
- Portable - 10 hours use from internal battery

The TTI-7 PLUS is a very high accuracy multi purpose digital thermometer for both platinum resistance thermometers and thermocouples. Laboratory users will welcome the features to eliminate Thermal EMF Errors and Self Heating Errors along with provision to store the calibration data of up to 20 PRT probes. The rugged aluminum case, internal battery pack and integrated power supply ensure reliable portable field use for demanding measurement applications all at great value for money.

Dual Channel input allows a probe on Channel B to be calibrated against a standard on Channel A - directly compare any combination of PRT and Thermocouple. The TTI-7 PLUS supports thirteen thermocouple types, B, C, D, E, J, K, L, N, R, S, T, U, Au/Pt along with 25 and 100 Ohm platinum resistance thermometers.

Data Logging and Statistical Analysis

The TTI-7 PLUS includes an inbuilt data logger internally storing up to 4,000 date and time stamped readings. Recall the data from the front panel or send to a PC or Printer via the PC interface which is included as standard. The powerful math function enables statistical analysis of the captured data, mean, max, min, peak and standard deviation. The TTI-7 PLUS now also includes a real time rolling display.

Usability

Ease of use, password protected digital calibration and a large clear backlit LCD graphics panel ensure the TTI-7 PLUS is a delight to use. Resistance thermometer connections are via LEMO connectors. Both sub miniature thermocouple and standard thermocouple plugs are accepted directly into the thermocouple inputs with no need for further adapters.

Why the TTI-7 PLUS ?

The TTI-7 PLUS has the features you need for high accuracy temperature measurement. With resistance thermometers used at high temperatures unwanted thermal EMFs are generated, the TTI-7 PLUS can take two measurements switching the polarity then computing the average to eliminate this error source. Many other instruments lack the ability to eliminate thermal EMFs. The thermal EMF error can be greater than the quoted accuracy of an instrument, if you need small measurement uncertainty for high temperature PRT work you need this feature. Add the internal scanner to expand the instrument to have up to 10 channels - any or all can be scanned and lodged with the internal data logger.

High Accuracy

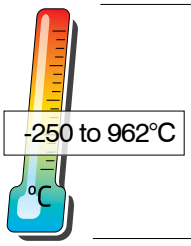
Highest accuracy is for Pt100 inputs, the TTI-7 PLUS Uncertainty of Measurement (1 Year) in the range -100°C to 500°C is 0.01°C. Watch for specifications that quote the value at -100°C and then get larger as the temperature rises. The TTI-7 PLUS is optimized over the most frequently used and useful temperature range. For thermocouple measurements the automatic CJC is far better than 0.1°C at 20°C. Great design care was taken, both thermocouple inputs are measured with separate Pt100 sensors. This approach gives outstanding CJC performance, again a point to check against other instruments which can have significantly less performance.

Sensor	Range (°C)	Resistance (Ohm)	Current	Resolution °C °F K	Uncertainty 1 year @ 20 ±5°C
Pt25	-200 to -100	2.5 to 15	1mA	0.001	0.02°C
Pt25	-100 to +500	15 to 75	1mA	0.001	0.01°C
Pt25	+500 to +670	75 to 115	1mA	0.001	0.02°C
Pt100	-200 to -100	10 to 60	0.5mA	0.001	0.02°C
Pt100	-100 to +500	60 to 280	0.5mA	0.001	0.01°C
Pt100	+500 to +670	280 to 460	0.5mA	0.001	0.02°C

Type	Range °C	Common Name	Resolution °C °F K	Standard	Uncertainty @20°C ±5°C 1 Year	Uncertainty @20°C ±5°C 60 Days
B	+250°C to +1820	Platinum / Rhodium	0.01	NIST 175	±(0.025% Rdg + 0.006%FS)*	±(0.02% Rdg + 0.006%FS)*
C	0 to +2315	Tungsten / Rhenium	0.01	ASTM E988	±(0.075% Rdg + 0.005%FS)	±(0.05% Rdg + 0.005%FS)
D	0 to +2315	Tungsten / Rhenium	0.01	ASTM E988	±(0.075% Rdg + 0.005%FS)	±(0.05% Rdg + 0.005%FS)
E	-200 to +1000	Chromel / Constantan	0.01	NIST 175	±(0.026% Rdg + 0.004%FS)	±(0.01% Rdg + 0.004%FS)
J	-210 to +1200	Iron / Constantan (SAMA)	0.01	NIST 175	±(0.03% Rdg + 0.005%FS)	±(0.008% Rdg + 0.005%FS)
K	-200 to +1372	Chromel / Alumel	0.01	NIST 175	±(0.035% Rdg + 0.006%FS)	±(0.01% Rdg + 0.006%FS)
N	-200 to +1300	Nicrosil / Nisil	0.01	NIST 175	±(0.035% Rdg + 0.005%FS)	±(0.01% Rdg + 0.005%FS)
R	-50 to +1768	Platinum / Rhodium	0.01	NIST 175	±(0.02% Rdg + 0.015%FS)	±(0.005% Rdg + 0.015%FS)
S	-50 to +1768	Platinum / Rhodium	0.01	NIST 175	±(0.02% Rdg + 0.015%FS)	±(0.005% Rdg + 0.015%FS)
T	-200 to +400	Copper / Constantan	0.01	NIST 175	±(0.025% Rdg + 0.015%FS)	±(0.005% Rdg + 0.015%FS)
U	-200 to +600	Copper / Constantan	0.01	DIN 43710	±(0.025% Rdg + 0.015%FS)	±(0.005% Rdg + 0.015%FS)
L	-200 to +500	Iron / Constantan	0.01	DIN 43710	±(0.03% Rdg + 0.005%FS)	±(0.008% Rdg + 0.005%FS)
Au/Pt	0 to +1000	Gold / Platinum	0.01	NIST - Burns	±(0.02% Rdg + 0.015%FS)	±(0.005% Rdg + 0.015%FS)

TC input for external CJC, automatic CJC is better than 0.1°C at 20°C, typically 0.01°C / °C over the range 0°C to 100°C
**Apply to readings above 600°C*

Model	**TTI-7 PLUS**
Temperature	Depending on Sensor
Range	-200 to 2315°C
Indicator units	°C, °F, K
Display	LCD Graphics Panel, 240 x 64 Dot with LED backlight contrast control via keyboard
Maths	Display Min / Max, Peak to Peak and Standard Deviation
PC Interface	RS232 and Software Included
Data Logging	Includes a data logging function, enabling up to 4000 single channel (2000 dual channel) readings to be stored together with a date and time stamp. The stored values can be recalled to the instrument display, downloaded to a PC file or printer.
Inputs	Thermocouples via sub miniature and standard connectors. Reference Junction Compensation - Automatic with internal sensor, or with external Pt100 probe. PRTs Lemo Socket.
Working Temperature	0°C to 40°C rel. humidity 80% max non condensing
Storage Temp.	-20°C to +50°C.
Main Supply	100/120/220/240 Volts +10% -13% 47 to 63Hz max. 40VA
Dimensions	Height 110mm Width 219mm Depth 315mm Weight 8kg
Battery	Sealed lead acid, rechargeable cell giving approximately 10 hours continuous operation. Internal battery charger.
Scanner Option	With the scanner option fitted, scanner cards may be inserted into slots on the rear panel, cards for thermocouples and Platinum Resistance Thermometers are available, giving a maximum of 10 measuring channels. Each scanner card has 4 channels and up to 2 cards may be fitted, either thermocouple or PRT in any combination.



True Temperature Indicator
TTI - 22

Simple to use
High Accuracy
High Resolution

- Accuracy to 0.001°C, 1mK
- Warns if calibration due date exceeded
- No mechanical relays, long life

Quite simply the Isotech TTI-22 High Accuracy Thermometer sets new standards in the price to performance ratio for industrial and secondary resistance thermometry. If you need high accuracy at an affordable price you have to look at the TTI-22.

The TTI-22 has an accuracy of 0.001°C and a resolution of 0.0001°C (0.00004 Ohms). It has two input channels, is lightweight (1.8kg) and will operate for more than 10 hours from two small AA cells. It has both RS232 and Ethernet ports.

Simple to use, supporting both Industrial 100 Ohm probe and SPRTs to ITS-90, 25.5 and 100 Ohm. Up to 30 probe calibrations can be stored along with the calibration expiry date so the instrument can warn when the calibration time has been exceeded.

Built in statistics calculation can show you both the measured and average values along with the standard deviation over previous measurements.

The Isotech TTI-22 is ideal as a reference standard alongside liquid calibration baths, for the smallest uncertainty calibration with Dry Blocks or for demanding stand alone measurement applications.

Previously this level of performance was confined to specialist laboratories with expensive thermometry bridges; TTI-22 delivers 5 to 10 times the performance of comparably priced instruments.

- The TTI-22 uses the same patented measurement technique as the earlier TTI-2.
- Each measurement performs a zero point and gain correction.
- The switched polarity DC measuring current (0.4mA) eliminates thermal EMFs.
- Surface mount construction ensures long term reliability.

Model	**TTI-22**
Inputs	2 channel Pt100 (BS EN 60751 / IEC 751) or 25.5/100Ω SPRT to ITS-90
Measuring Current	0.41mA
Self Heating Test Current	0.29mA (0.41mA / √2)
Measuring Time	1.44 seconds for both channels
Measuring Range	-250 to 960°C (0 to 440 Ohm)
Resolution	Temperature: 0.0001°C, 0.1mK Resistance: 0.00004Ω, 40 μΩ
Uncertainty of Measurement	Temperature: 0.001°C, 1mK 100 Ohm PRT Resistance: 0.4mΩ @ 20°C *Instrument only, uncertainty with sensor dependant on range and sensor type.*
Reference Resistor	Internal 380Ω TCR ±0.3ppm / °C Stability ±5ppm / year
Interface	RS232, Ethernet, built-in web server provides simple temperature display
Ambient Temp. Range	10°C to 30°C
Power Supply	7.5VDC, 250mA power adaptor or 2 x AA batteries (typically >10 hours operating time)
Case Dimensions	Width: 190mm Height: 112mm Depth: 240mm Weight: 1.8kg

The TTI-22 continually compares the connected sensor to a highly stable precision internal reference resistor. For a Pt100 at 0°C the annual stability for absolute measurement is typically ±1.3mK (5ppm x 100Ω = 0.5mΩ / 1.3mK).

For comparison calibration, when a reference probe is compared to a calibrated standard, the long term stability is not important as any change of value is cancelled in the comparison. The temperature coefficient is 0.3ppm / °C and the measuring time, for both channels, is just 1.44 seconds.

The instrument can be configured to measure ratio of the measured resistance of the two input channels, a technique familiar to users of older style thermometry bridges.

The overall uncertainty of the instrument and probe together will be determined by the model of probe and the temperature range. For the majority of applications the contribution of the instrument uncertainty will be negligible compared to the uncertainty of the calibrated probe.

Recommended probes include the Isotech 909/100 and 670SQ /100, 935-14-16, 935-14-95L and H.

The TTI-22 includes Cal Notepad software for easy monitoring and logging of data. It is fully compatible with Isotech I-Cal Easy which can automate comparison calibration.

http://www.isotech.co.uk

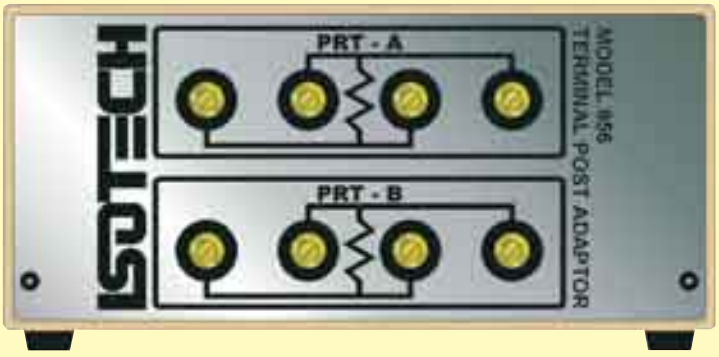
Terminal Adaptor
Model 956

- Accepts Bare Wire, Spades or Banana Plugs
- Gold Plated Connectors
- Suits TTI-7 or TTI-22

Our TTI range use high quality 'Lemo' connectors for the Pt100 inputs. This simple accessory provides 4mm Terminal Posts for the connection of bare wires, spade terminals or 4mm plugs - useful if a lot of probes are going to be used with the instrument.

The adaptor connects to the TTi via two flexible cables, terminated with the appropriate Lemo connector.

There are two models, one for the TTI-7 and the earlier TTI-6 and a second for the TTI-22.



Specifications

Dimensions	Height 68mm (including feet) Width 140mm Depth 185mm (including connectors)
Weight	0.660kg

How to Order

956 Terminal Adaptor for TTI-7 / TTI-6 or
956 Terminal Adaptor for TTI-22

Miniature Fixed Resistor
Model 836

- Wide range of Values
- Oil Filled
- Precise and Stable for Industrial References

Isotech produces a miniature resistor with ultra-low temperature coefficient and ultra-high stability.

This is achieved because the resistors are oil filled and hermetically sealed.

The function of hermetic sealing is to eliminate the ingress of moisture and oxygen both of which play a role in both short and long term degradation of unsealed resistors. A further enhancement in both short and long term stability is achieved by oil filling. The oil also acts as a thermal conductor allowing the device to accept short periods of overload without degradation.

With accuracies of ±0.005% and long term drift of less than 5ppm, these devices are virtually secondary standards that can be carried in sets for daily or periodic calibration of factory systems.

Resistance Values

We keep in stock the following standard values:
10Ω, 25Ω, 100Ω, 1000Ω, 10,000Ω

UKAS Calibration

For the highest quality traceability we recommend that the 836 be UKAS Certified.

Measured Quantity Instrument or Gauge Range	Frequency	Best measurement Capability expressed as an Expanded Uncertainty (*k*=2)
DC Resistance		
0.1 Ω to 1000 Ω		±10ppm
1 KΩ to 100 MΩ		±20ppm
AC Resistance		
2.5 Ω to 400 Ω	75 Hz	±15ppm
400 Ω to 1000 Ω	75 Hz	±100ppm

The latest schedule can be found on the Isotech website or at www.ukas.org.

0175

Please Note:
We offer other Resistor Ranges including the models 456, the SRA and the SRB ranges.

For more information please contact Isotech, or visit our website ***www.isotech.co.uk***

Model	**836 Miniature Fixed Resistor**
Power Rating	0.5 watt
Nominal Temperature Coefficient of Resistance	+0.6ppm/°C (0°C to +25°C) -0.6ppm/°C (+25°C to +60°C)
Resistance Tolerance	(Initial Resistance Accuracy) ±0.005%
Resistance Range	5 ohms to 3.3 megaohms
Current Noise	<0.010μV (RMS) / Volt of applied voltage
Thermal EMF	0.1μV/°C maximum 0.05μV/°C typical
Connections	Screw Terminal Posts
Stability	Typically 1ppm per year at 1mA
Dimensions	Height 30mm Width 89mm Depth 58mm (including terminals)
Weight	90g

How to Order
836 Miniature Fixed Resistor
Please state Ohms Value Required
Please state if UKAS Certification is required

Selector Switch
8 Way

- Eight Channel - Local and RS232 Control
- PRT and Thermocouple Models
- Use with Isotech TTIs and Automation Software

Isotech produces two eight way selector switches, one for resistance thermometers Model 954 and Model 958 for thermocouples.

These switches have been designed for use in conjunction with our TTI range. The switches allow easy selection of connected sensors. They can be operated from either the front panel switch or from an RS232 interface that is provided as standard. Channel status is indicated via front panel LEDs. The Selector Switches can be located adjacent to the sensors being calibrated, giving more flexibility than a permanently connected or stacked system.

The PRT Switch has 4mm terminal posts that can accept bare wires or 4mm plugs. The thermocouple switch has eight miniature thermocouple connectors. These thermocouple connectors are thermally bonded to a platinum resistance thermometer that measures the temperature of the connector and hence the “cold junction”.

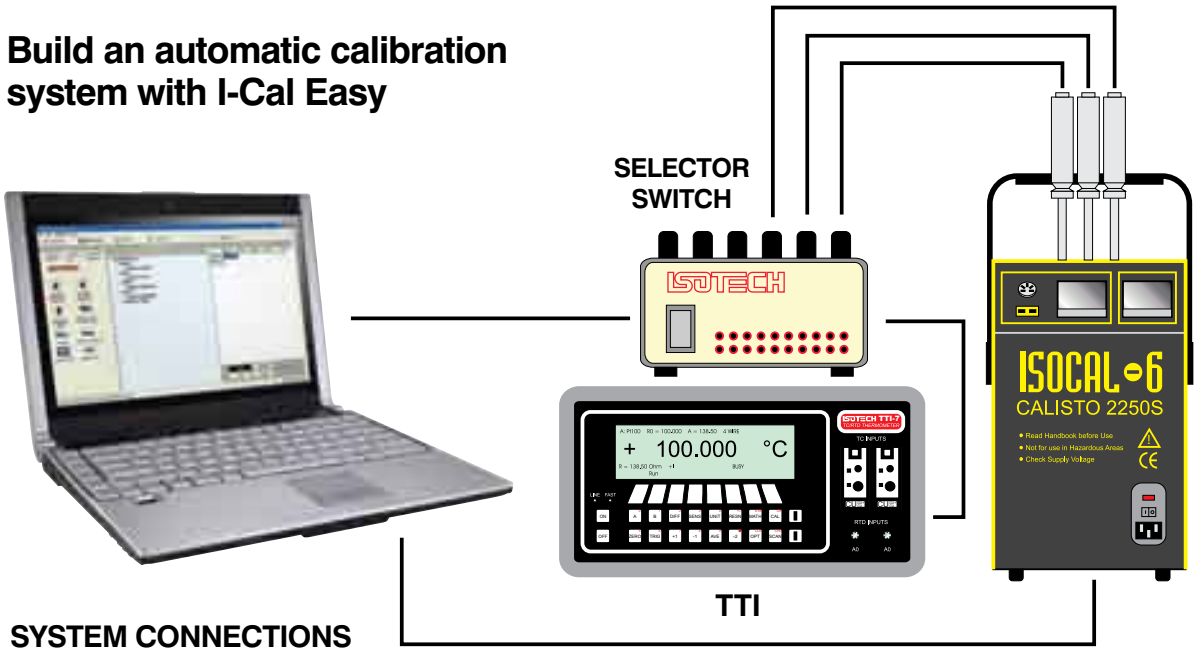
The TTI range temperature indicators feature the ability to measure a remote cold junction and this permits a mixture of thermocouple types to be connected through the box. The I-Cal Easy Software supports Switchbox models 954 and 958 and, for automatic operation, two boxes can be connected together with a “master / slave” lead allowing them to be controlled from a single RS232 port and up to 16 sensors to be switched.

The software can automatically switch between the boxes and connect the appropriate output to the TTI. This 16 channel operation is not convenient without the software and manual operation of two boxes together is not recommended.

Advantages

- Use with TTI-6 and TTI-7 PLUS easily switch up to eight sensors manually or with RS232.
- RTD and Thermocouple Models.
- Use with I-Cal Easy Software for automatic switching and temperature calibration, add a second box (either type) to calibrate up to 16 sensors.
- Switches are stand-alone allowing them to be positioned anywhere in a laboratory for most efficient operation.

Build an automatic calibration system with I-Cal Easy



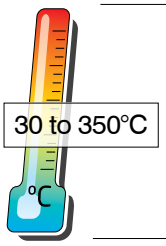
SYSTEM CONNECTIONS

Model	**954 RTD Selector Switch**
Channels	Eight - four wire (four pole)
Control	Front panel switch And RS232
Connectors	4mm Terminal post
Internal Circuit Resistance	<250mΩ
Thermal EMF, typical	2μV after 1 minute of channel set 6μV after 30 minutes of channel set
Power	5 VDC 100-250 VAC, 50 / 60Hz Power Supply Included
Dimensions	Height 91mm Width 141mm Depth 165mm Weight 1kg

How to Order
954 RTD Selector Switch

Model	**958 TC Selector Switch**
Channels	Eight - two wire (two pole)
Control	Front panel switch And RS232 (Also compatible with Isotech VLT system)
Connectors	Miniature Thermocouple Connectors
Internal Circuit Resistance	<250mΩ
Thermal EMF, typical	2μV after 1 minute of channel set 6μV after 30 minutes of channel set
Reference Junction Measuring Device	100Ω 1/10 Din Pt100
Thermal Coupling	<0.2°C* *Basis of test. At ambient 20°C ±2°C the internal Pt100 agreed with the connected thermocouples to ±0.2°C (including all measurement errors) using IEC584-1995 and IEC751-1995. The uncertainty of this test was ±0.3°C which includes the reproducibility of the test thermocouples.
Power	5 VDC 100-250 VAC, 50 / 60Hz Power Supply Included
Dimensions	Height 64mm Width 141mm Depth 165mm Weight 1kg

How to Order
958 TC Selector Switch



Surface Measurement
Model 944

- Indicates True Surface Temperature
- 30°C to 350°C
- Resolution 0.1°C

The fundamental problem with surface temperature measurement is that it is subject to large stem conduction errors, also because heat conducted from the surface of the hot-plate causes a localised cold spot to be created which means that the temperature indicated by the hot plate is not necessarily the temperature at the point of measurement.

An ideal system would not disturb the heat-flux from the hot-plate.

During 1993 such a system was described (ref. “Progress in Contact Thermometry” 1993 B. D. Foulis) and Isotech have the inventors permission to make and market the device World-wide.

Principal of Operation

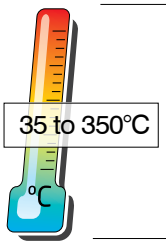
A fine wire type N thermocouple is used as the surface temperature sensor, a second junction 2 to 3mm along the thermocouple, senses the temperature difference due to heat flux along the sensor.

A heater heats the thermocouple stem until the temperature gradient is zero, thus creating a measurement without stem conduction, or disturbance of the hot-plate’s surface.

The 944 can be used with the Isotech Small Hot Plate model 983. A traceable calibration certificate is available to order.

Model	**944 True Surface Temperature Measurement System**
Temperature Range	30°C to 350°C
Resolution of display	0.1°C or 0.1°F
Stability	±1°C
Accuracy	±2°C with TRACEABLE Certification ±5°C without Certification
Probe Assembly	Probe Diameter 7.5mm Probe Length 150mm Lead Length 850mm
Power Supply	100V - 120V, 50 / 60Hz or 200V - 240V, 50 / 60Hz
Dimensions	Height 90mm Width 153mm Depth 265mm (excluding plugs)
Weight	4kg

How to Order
Model 944 & Probe 935-14-81
Please state supply voltage required
Please state if Calibration is required



Surface Sensor Calibrator
Small Hot Plate

- Low Cost Portable Hot Plate
- PC Interface and Software
- Stable to ± 0.1°C

The Isotech Small Hotplate is a lightweight portable calibration system purpose designed for surface mounted sensors. The flat surface plate is made from precision-machined aluminum. The sensor to be tested is simply placed on the surface, for higher accuracy a calibrated surface sensor can be placed alongside and the two compared.

Good thermal contact is ensured by the flat disc that is recessed to allow the optional use of a heat transfer paste or fluid. Uniform heat distribution is achieved with a flat spiral heater clamped to an integrating block below the surface of the plate. The typical accuracy that can be achieved 1°C but this will be influenced by the type of sensor to be calibrated.

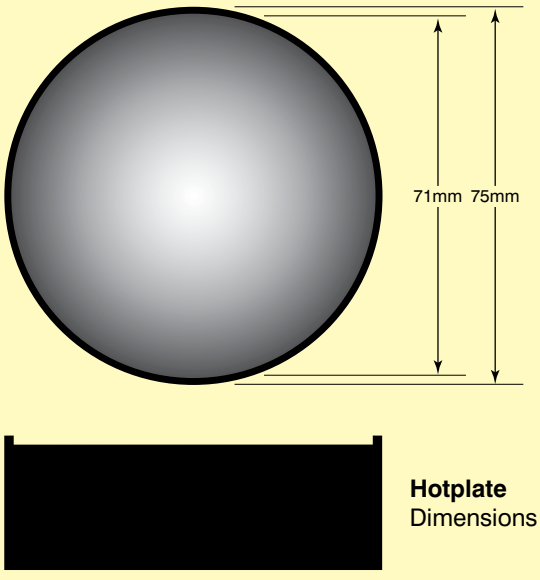
The internal control sensor is located immediately below the plate's surface.

A protective cover that can fit over the block is included along with a comprehensive handbook.

The temperature range is from 35°C to 350°C, which is set by an advanced, but easy to use temperature controller. The controller has 0.01 resolution below 100°C (0.1° above 100°). A PC interface is included as standard along with an RS232 converter lead and Windows software.

Notes:
A similar model but with a black high emissivity surface is available.

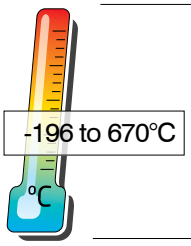
Many of the dry block calibrators featured within this book have accessories available for surface sensor calibration.



Hotplate
Dimensions

Model	**983 Small Hot Plate**
Temperature Range	35°C to 350°C
Stabilisation Time	10 minutes
Cools from	350°C to 100°C in 125 minutes
Heats from	50°C to 350°C in 20 minutes
Uncertainties	Dependant on sensors and method of use 1°C typical
Calibration volume	Flat Plate 71mm diameter
Display Resolution	0.01 to 99.99 0.1 100 to 350.0 PC can display 0.01 across whole range with the software included
Units	°C, °F, K
Power	100 to 115V (50 / 60 Hz) or 200 to 230V (50 / 60 Hz) 200 Watts
Dimensions	Height 115mm Width 230mm Depth 225mm
Weight	3.9kg

How to Order
983 Small Hot Plate
Please specify voltage required



Reference Probes - Semi Standards
Platinum Resistance Thermometers

- High Stability Reference Probes
- Wide Temperature Ranges
- High Stability Platinum Coil Elements

These industrial platinum resistance thermometers are ideal for field and lab use. Suitable for use as working standards in Dry Blocks and Liquid Baths or as high accuracy probes for our range of True Temperature Indicators.

All the thermometers are metal sheathed and both less fragile and more affordable than the Isotech range of true Standard Platinum Resistance Thermometers that are used in laboratories and are found in our publication *"Solutions for Primary and Secondary Laboratories".*

All the thermometers use handmade coil wound platinum sensing elements to give high accuracy and low drift. Isotech's UKAS accredited lab can calibrate to the smallest of uncertainties.

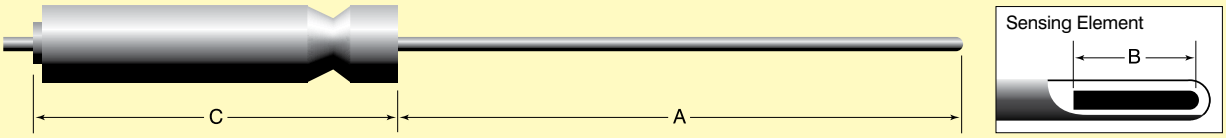
Calibration should be specified to suit the particular operating range and application. Isotech can advise on which service is appropriate to match the temperature range and application.

http://www.isotech.co.uk

Universal Specifications

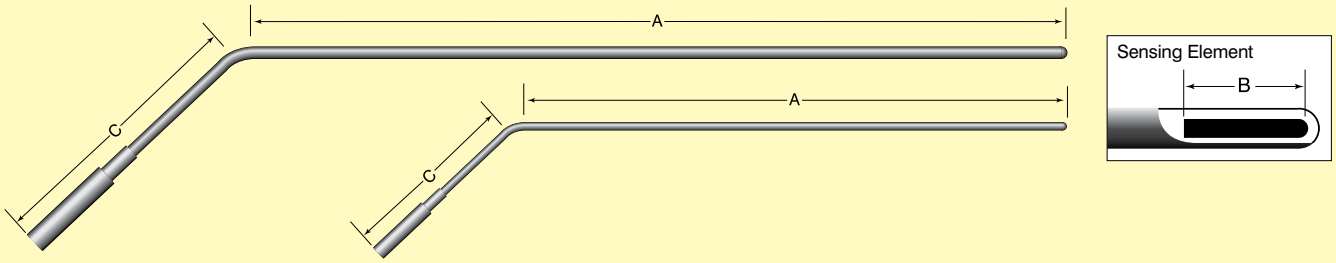
Ro	100Ω ± 0.05 Ω
Alpha	0.003850 ± 0.000005
Standard	IEC 60751
Stability	0.010 Ω/year
Recommended Current	1mA
Self Heating at 1mA	0.004°C
Calibration	Optional UKAS Calibration at extra cost. See table for typical uncertainties
Connection	Four Wire

After manufacture all Isotech Semi Standard PRTs are thermally pre-conditioned to provide optimal stability.



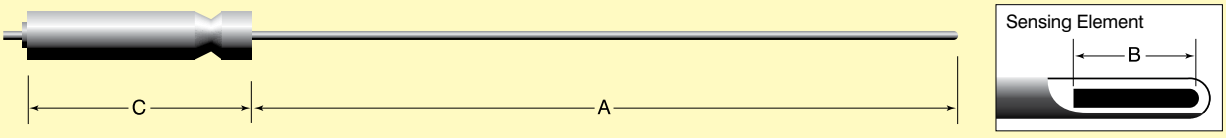
■ **General Purpose** Probes

Model	Range	Diameter	Length (A)	Sensing Length (B)	Handle (C)	Cable	Application
935-14-61	-50°C to 250°C	4mm	300mm	6mm	19 x 30mm	2m PTFE	Fast Response, Low Stem Conduction
935-14-13	-196°C to 250°C	6mm	350mm	25mm	19 x 30mm	2m PTFE	Low Temperature
935-14-16	-100°C to 450°C	6mm	450mm	25mm	19 x 30mm	2m PTFE	General Purpose
935-14-72	-50°C to 670°C	6mm	375mm	25mm	No Handle	2m PTFE	Fits Jupiter / Gemini Carry Case
935-14-98	-50°C to 350°C	4mm	300mm	8mm	No Handle	2m PTFE	Low Stem Conduction



■ **Angled** Probes - *angled head provides maximum clearence at top of calibration bath*

Model	Range	Diameter	Length (A)	Sensing Length (B)	(C)	Cable	Application
935-14-82	-50°C to 250°C	4mm	210mm	6mm	50mm	1.5m PTFE	Europa - Venus - Calisto
935-14-85	-50°C to 250°C	6mm	420mm	25mm	35mm	0.54 m PTFE	Oceanus-6



■ **Working** Industrial Standards

These thermometers use premium grade wire wound elements to IEC-751 and the same internal construction as our working Standard SPRTs. The 95L is optimised for low temperature with minimum stem conduction. The 95H is optimised for high temperature operation. Both models employ strain free construction.

Model	Range	Diameter	Length (A)	Sensing Length (B)	Handle (C)	Cable
935-14-95L	-200°C to 165°C	6mm	480mm	25mm	19 x 30mm	2m PTFE
935-14-95H	-80°C to 670°C	6mm	480mm	25mm	19 x 30mm	2m PTFE

Termination Options

Bare Wire (BW)
TTI suit TTI-1 to TTI-7, TTI-b – suits TTI-22
DB Connector for Dry Block Calibrator Site Indicator

How to Order

Please Specify Model Type and Termination Option
(for example 935-14-13/BW)
Please state whether UKAS Certification is required

Typical Uncertainties of PRT Semi Standards with Range

Temperature	Uncertainty mK				
Model	935-14-95L*	935-14-61* 935-14-13	935-14-13*	935-14-95H* 935-14-72 935-14-16	935-14-95H* 935-14-72
-196	25	N/A	25	N/A	N/A
-80	20	N/A	20	25	25
-50	15	15	15	20	20
0	10	10	10	15	15
50	10	10	10	15	15
156	10	10	10	15	20
232	N/A	15	15	20	25
420	N/A	N/A	N/A	40	40
550	N/A	N/A	N/A	N/A	50
660	N/A	N/A	N/A	N/A	50

*Preferred Models

The above uncertainties do not include long term drift
Typical Stability of correctly used semi standard is 0.01°C/year at 0°C
Actual uncertainty of a probe determined at time of calibration

Isotech have generated a long history of many of our semi-standards.

Here are a few documented facts:

The 935-14-95 model has the widest temperature range and in consequence is likely to suffer the largest changes in characteristics.

Guy Snelling sent the following email about the 935-14-95.

ISOTECH

I though that you might like to see the calibration history of one of our probes from the past 12 years.

You may recall that we purchased this probe to use as a laboratory standard when our company was still young. This particular probe is still in daily use and is regularly taken to 600°C in our dry block calibrator. While we handle it with care, being in daily use for 12 year it has take the occasional mild knock and accidental abuse - I believe that it was even taken to close to 700°C once, although I wasn't involved so I can't testify to the temperature reached.

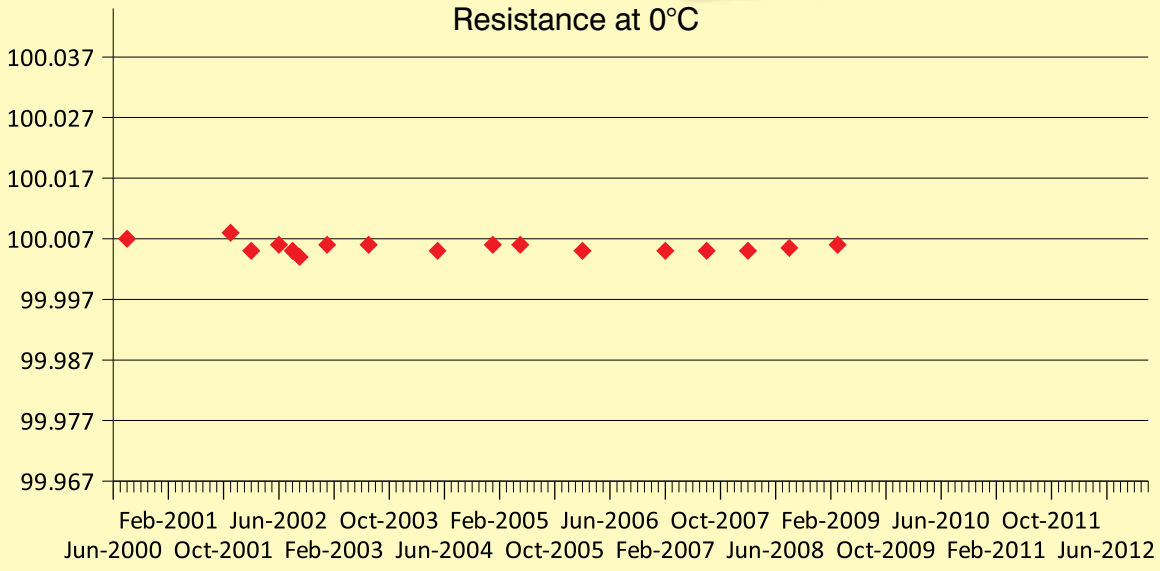
You'll see from the attached history of the calibration by our NMI that the probe has remained stable and accurate, and bearing in mind the daily variations in temperature that it has undergone, these results are testimony to the high quality of this product.

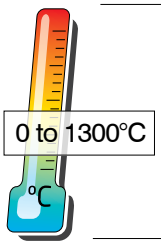
John, you are to be congratulated on developing and producing such a fine measuring instrument, and feel free to use us as a product reference any time.

Kind regards,

Guy Snelling
Temperature Metrologist
InterCal (South Africa)

UKAS Calibration
available for these systems
International Traceability - Best Practice





Reference Probes - Semi Standards

Thermocouples

- Wide Temperature Ranges
- Noble Metal & Type N for best life, stability and reproducibility
- Can be supplied with UKAS calibration

These thermocouples are suitable for use as references in Isotech Dry Blocks and for use with temperature indicators. Details of our laboratory grade Standard Thermocouples with separate cold junctions can be found in our publication *"Solutions for Primary and Secondary Laboratories"*.

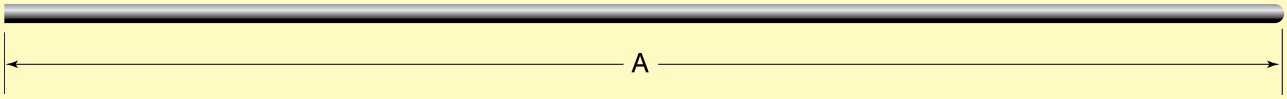
These semi standards are lower cost and suitable for a variety of industrial applications.

The 935-14-91 is constructed from Platinum and Platinum Rhodium alloys and can be used to 1300°C. Recommended for the Pegasus 1200 and general purpose applications. It has 1M of compensating cable terminated with a miniature thermocouple plug. The 935-14-88 is similar to the 14-91 but is made entirely from precious metals, with platinum wires all the way to the miniature plug.

There is a range of high quality mineral insulated metal sheathed (MIMS) Type N thermocouples. These devices are lower cost than the noble metal types and can be bent to a desired shape if required. They are suitable for use in Isotech Dry Blocks and for general purpose measurement and calibration applications.

The system accuracy or uncertainty will depend on the application and what instrument they are used with. The table shows the uncertainties that we can offer with optional UKAS calibration from our accredited laboratory.

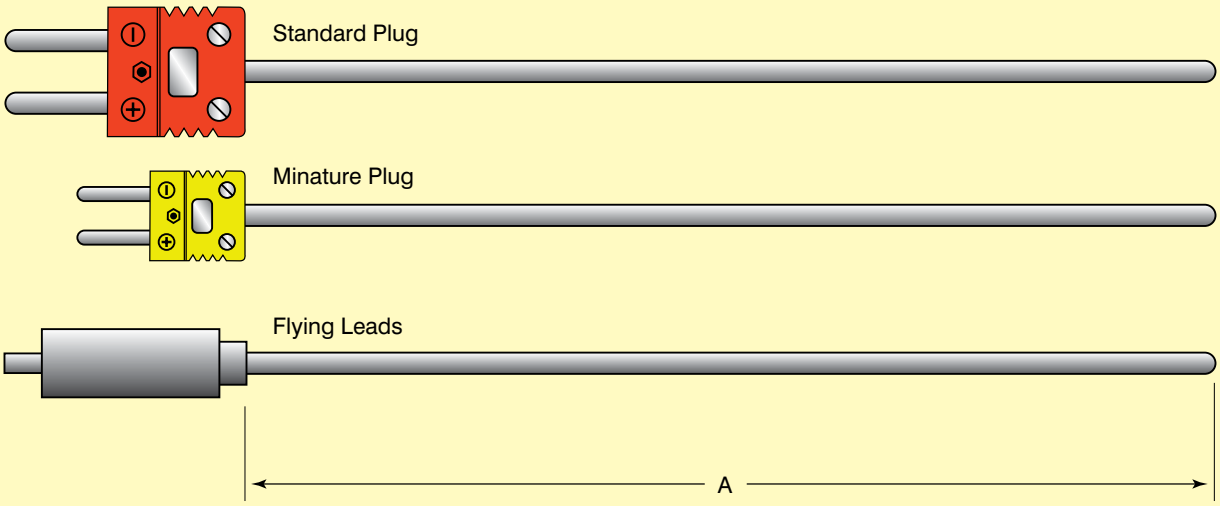
http://www.isotech.co.uk



■ **Noble** Metal Thermocouples

Platinum wire for best performance, ceramic sheath construction. Carry case included.

Model	Diameter	Length (A)	Range	Application	Type
935-14-91/R	5mm	300mm	0 to 1300°C	Pegasus	R
935-14-91/S	5mm	300mm	0 to 1300°C	General Purpose	S
Termination: 1M extension cable to miniature plug					
935-14-88/R	5mm	300mm	0 to 1300°C	Working industrial standard	R
935-14-88/S	5mm	300mm	0 to 1300°C		S
Termination: 1M platinum cable to miniature plug					



■ **Type N** Thermocouples

Recommended base metal thermocouple, low cost metal sheathed.

Model	Diameter	Length(A)	Termination	Range	Application	Type
935-14-63	3mm	300mm	1M Cable Miniature Plug	0 to 1300°C	Gemini 700 Jupiter 650	N
935-14-64	3mm	300mm	Miniature Plug	0 to 1300°C	General Purpose	N
935-14-65	3mm	300mm	Standard Plug	0 to 1300°C	General Purpose	N
935-14-66	3mm	500mm	1M Cable Miniature Plug	0 to 1300°C	General Purpose	N
935-14-67	3mm	500mm	Miniature Plug	0 to 1300°C	General Purpose	N
935-14-68	3mm	500mm	Standard Plug	0 to 1300°C	General Purpose	N

Isotech UKAS Calibration Uncertainties (*k*=2)

Item	Measured Quantity Instrument or Gauge	Temperature Range	(*k*=2) Best measurement capability expressed as an uncertainty (±)
1	Temperature	-50°C to 0°C	0.5K
	Platinum Thermocouples	0°C to 50°C	0.45K
		50°C to 660°C	0.4K
		660°C to 1100°C	0.7K
		Above 1100°C to 1300°C	1.7K
2	Other Thermocouples	-196°C	0.3K
		-80°C to 300°C	0.25K
		Above 232°C to 420°C	0.3K
		Above 420°C to 660°C	0.4K
		Above 660°C to 1100°C	0.8K
		Above 1100°C to 1300°C	2.2K

UKAS 0175

The latest schedule can be found on the Isotech website or at www.ukas.org.

UKAS 0175

UKAS Calibration available for these systems - *International Traceability - Best Practice*

Model	Refer to Chart
Temperature Range	Refer to Chart
Calibration	A UKAS Calibration Certificate can be provided at extra cost
Dimensions	Refer to Chart

How to Order
Please Specify Model Type (for example 935-14-65)
Please state whether UKAS Certification is required

Introduction to Temperature Calibration Software

Software
Isothermal Technology's range of calibration software saves you time and lowers calibration costs. Isotech have a tested solution to calculate coefficients for Industrial Probes, for SPRTS, fit thermocouple error curves and fully automate the calibration of sensors.

ITS-90 Software
Icarus is software for the ITS-90 Laboratory to calculate between resistance and temperature for SPRTs. It allows for the calculation of coefficients and the printing of charts and certificates, *see our publication "Solutions for Primary and Secondary Laboratories"*

Cal NotePad
Isotech calibration equipment is supplied with Cal NotePad. This software allows equipment to be remotely controlled, monitored and the logging of data which can be imported into spreadsheet software. Cal NotePad supports the connection of both an Isotech Furnace, Bath, Block and an Isotech TTI Temperature Indicator.

I-Cal Easy Software
I-Cal Easy allows for the automatic calibration of temperature sensors, from controlling the calibration run to printing certificates and calculating coefficients.

Software Comparison Chart

	Cal NotePad	I-Cal Easy*
Included with Isotech equipment	✓	Demo
Monitor and record data	✓	✓
Automatic sensor calibration	×	✓
Maximum number of sensors	N/A	32
Save results to file	✓	✓
Capture images with camera	×	✓
Print certificates	×	✓
Design custom certificates	×	✓
Calculate coefficients to IEC 751	×	✓
Calculate coefficients to ITS-90	×	✓
Regression calculation	×	✓

See **www.isotech.co.uk/software.html for a version of I-Cal Easy that interfaces to third party instruments.*

Demonstration versions of our software are available to download for evaluation:

http://www.isotech.co.uk/software.html

Calibration Software
Cal NotePad

- Easy to use
- Interface to Isotech Block Baths & Temperature Indicators
- Log Chart and Export data - Control Calibration Bath - Read Standard

The purpose of Cal NotePad (CNP) is to automatically log and display the temperature of an Isotech calibration bath together with the unit under test. Cal NotePad can be used with baths (or indicators) without PC interfaces by the user typing in values from the keyboard. The Cal NotePad can be used to identify the operator and the unit under test. With the click of a button data is logged with time information, it is also possible to log continually.

The calibration bath temperature can be changed from the PC or from the calibration bath's controller - Cal NotePad will display the temperature changes as they occur on the re-scalable chart display.

For traceable calibration the unit under test should be compared to a calibrated standard thermometer. Cal NotePad can record the actual temperature of the bath from either the in-built indicator of an Isotech SITE model or from a variety of external instruments see list. If the external instrument has two channels e.g. Isotech TTI then the unit under test may be connected to channel B for logging with CNP. Alternatively the value can be typed in from the keyboard. Similarly the calibration bath controller value, actual temperature, SITE indicator value or unit under test value may also be entered manually.

Then the manually entered data is combined with that gathered automatically and the resultant file can be opened in an external application such as Excel for the preparation of reports, certificates etc.

Cal NotePad is designed for ease of use, it will give a chart of the system. When the operator determines the system is stable - easily seen from the chart, then clicking a button will record time, operator, serial numbers of unit under test along with controller and indicator values.

Cal NotePad can be used for semi-automatic calibration, see I-Cal Easy for a fully automated calibration solution.

http://www.isotech.co.uk/calnotepad.html

System Requirements
Laptop or Desktop
Windows 98/2000/XP
Serial Ports: RS232 or Adapaters

CNP is compatible with the following Isotech calibration equipment:-
Calibration Baths, Furnaces, Dry Block and POTT models with a serial interface.

Temperature Indicators:
Isotech TTI-1, TTI-2, TTI-5, TTI-6, TTI-7 and-TTI 22

Calibration Software
I-Cal Easy

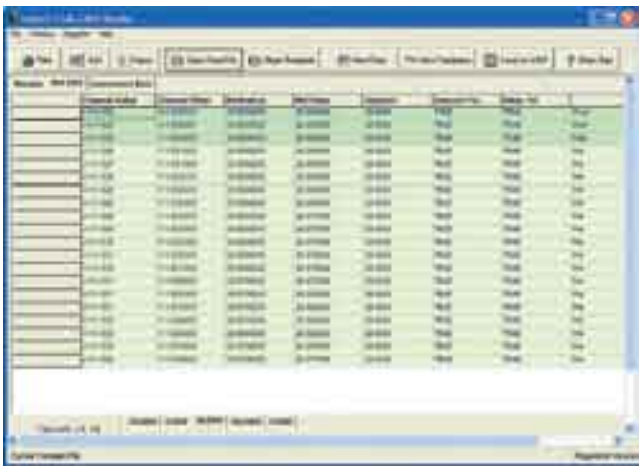
- Fully Automatic Calibration
- Design and Print Certificates
- Calculate Coefficients
- Prints PRT and TC tables
- Supports more equipment
- Try the full version free for 30 days

Use I-Cal Easy to automate sensor calibration, enter up to 20 calibration points and let the software set the bath, wait for stability and log the data automatically. Choose the stability criteria and how many points to record at each calibration temperature. Automatic temperature calibration the easy way.

I-Cal Easy lets you use a built-in template or design your own certificate. Add text, data fields and graphics on single or multiple pages, then publish the calibration data to the certificate. Do you want to include or calculate coefficients? Then drag your data to the ITS-90 or Callendar Van Dusen calculators. For thermocouples use the powerful regression calculator to fit error curves.

Other systems have limited the user with a built-in template and the need to pay extra for any changes, with I-Cal Easy just build in your own certificate in minutes!

http://www.isotech.co.uk/icaleasy



I-Cal Easy supports the TTI-7, TTI-22, microK and Isotech Dry Blocks, Liquid Baths and Calibration Furnaces. Additional support for other and third party instruments is available, contact Isotech for details.

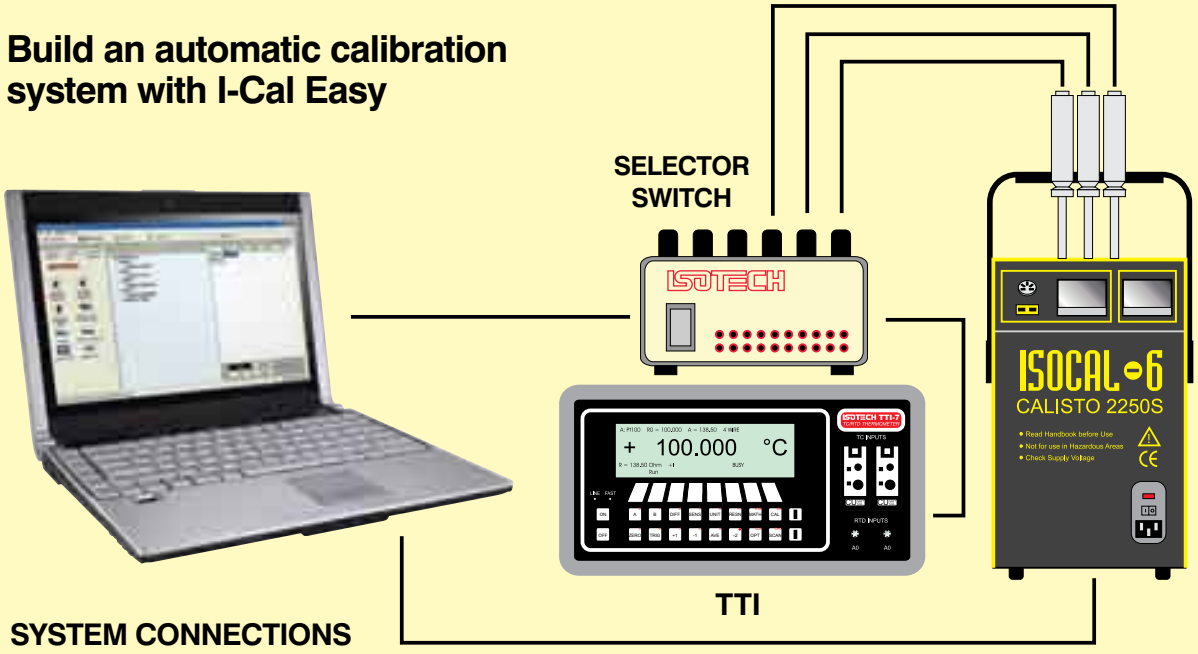
I-Cal Easy provides a powerful but easy to use automatic calibration system. A graphical setup lets you drag and drop instruments and equipment onto the appropriate PC port - no need to create config files. In addition to the comprehensive manual balloon tips guide you as to the operation of each control. Once familiar with the system this balloon help feature can be turned off.

The criteria for stability can be set to suit all types of equipment; Dry Blocks, Liquid Baths and High Temperature Furnaces. Once the system is stable choose how many measurements to take at each calibration point and have the average value appear on the certificate. Create one or multiple page certificates, as many as required to suit different customers and different types of calibration, Thermocouple, Industrial PRTs and SPRTs. Drag and drop data and text fields onto the certificate, link to logos and other graphic elements.

The in-built calculator will calculate coefficients for both IEC 751, ITS-90 and for thermocouples you can choose what order of regression to fit an error curve. Try the demo version and see how easy it is to drag data to the calculator and export the results straight to a certificate.

Judge for yourself how this compares to any other software. The demonstration version will run without restriction for 30 days and enable you to learn how to use I-Cal Easy and save time by rapidly producing certificates to your own requirements. Try it and see why we are confident that I-Cal Easy is the market leader.

Build an automatic calibration system with I-Cal Easy



SYSTEM CONNECTIONS

The number of sensors that can be calibrated depends upon the equipment used. Calibrate up to 16 sensors with two switch boxes, expandable to 32.

System Requirements

Computer	Laptop or Desktop
Operating System	Windows 98/2000/XP
Display	1024 x 768 or greater
Optional Camera:	Check for supported types
Serial Ports	Serial Ports A maximum of three ports are required. One for the Dry Block, one for the TTI and one for the switchboxes. (Two switchboxes can be operatede from a single port)

Note:
Available in different languages - Spanish and Chinese currently available.

http://www.isotech.co.uk/icaleasy

Introduction to **Blackbody Sources**

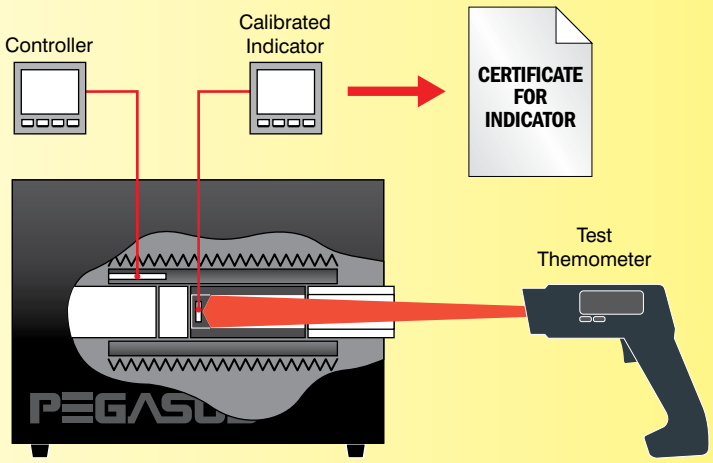
This section contains dedicated blackbody sources for low uncertainty calibration of infrared thermometers. A range of portable primary blackbody sources combine high emissivity with excellent temperature uniformity. The cylindrical cavity design minimises the effects of air movement and ambient changes.

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

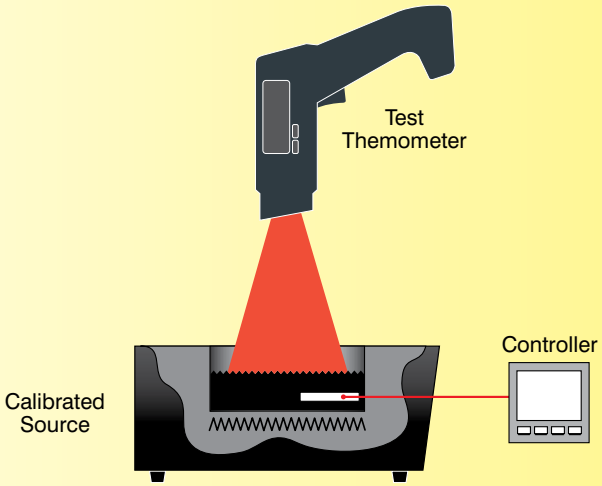
1 With a Primary Standard Source

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



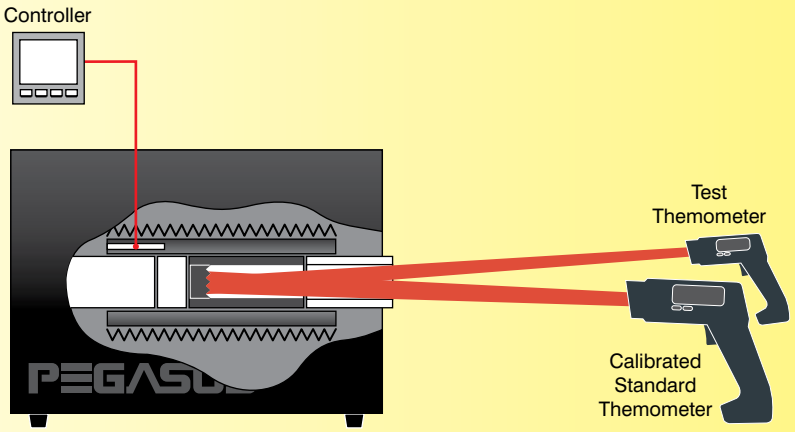
2 Calibration using a secondary standard source

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

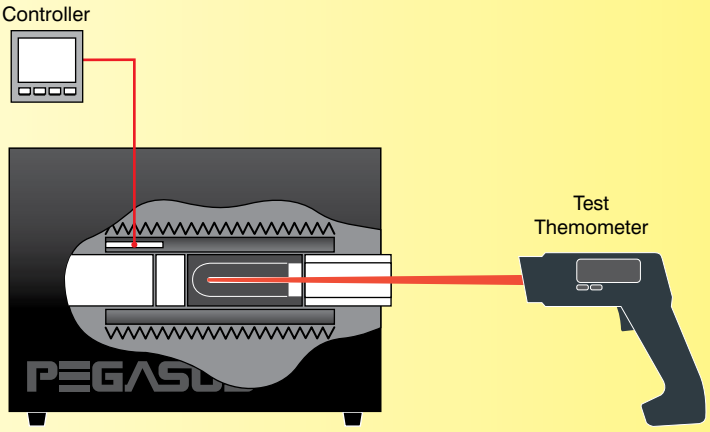
With this method the test thermometer is compared to a standard radiation thermometer.



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

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.



■ *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.

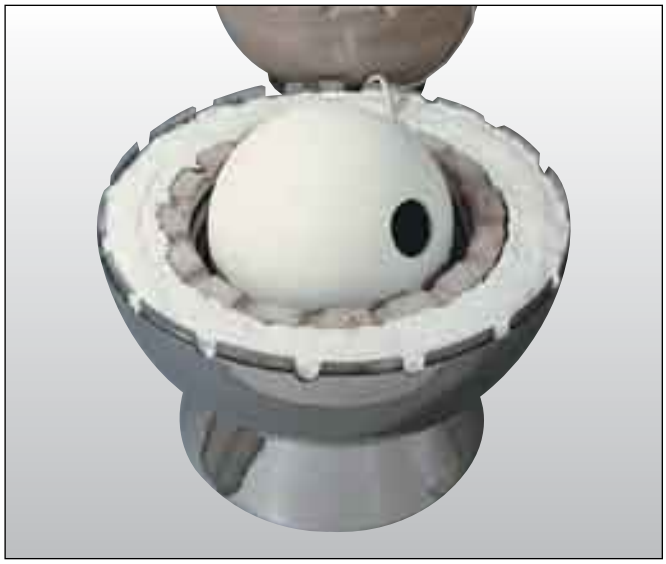
Types of **Equipment**

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.



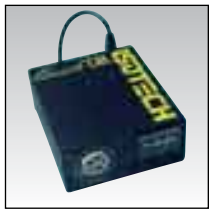
Special Applications

Model 988 Useful with Thermal Imaging Systems

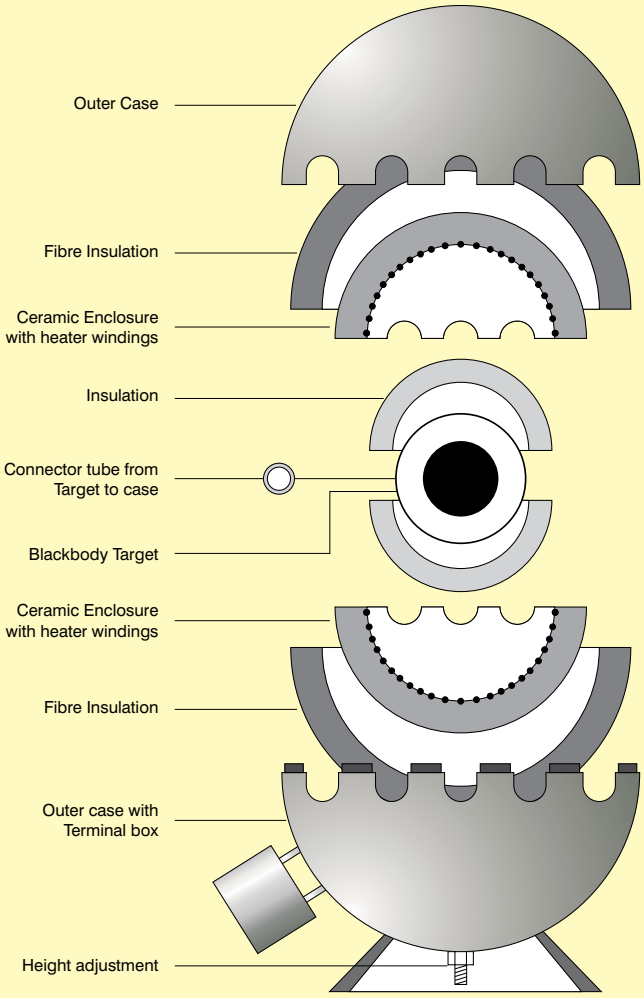
Covers Human Body Temperature

Model 975 Secondary Source Emissivity 0.95

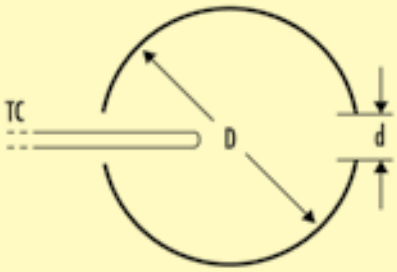
Model 550-02 Low Cost 50 - 350°C



Cyclops Blackbody Source



Effective emissivity of cavity in relation to temperature indicated by the thermocouple (TC)



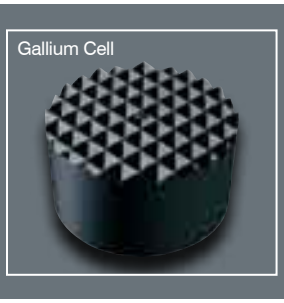
Isotech Blackbody Fixed Point Cells

■ 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

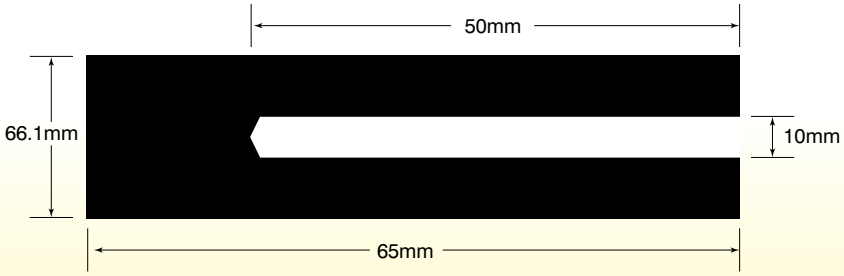


■ High Temperature Cells for the Pegasus R

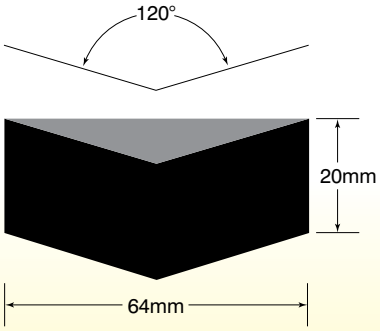
Point	Part Number	Temperature	Apparatus
Indium	970-06-00A	156.60°C	Pegasus R
Tin	970-06-00B	231.93°C	Pegasus R
Zinc	970-06-00C	419.53°C	Pegasus R
Aluminium*	970-06-00D	660.32°C	Pegasus R
Silver*	970-06-00E	961.78°C	Pegasus R

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

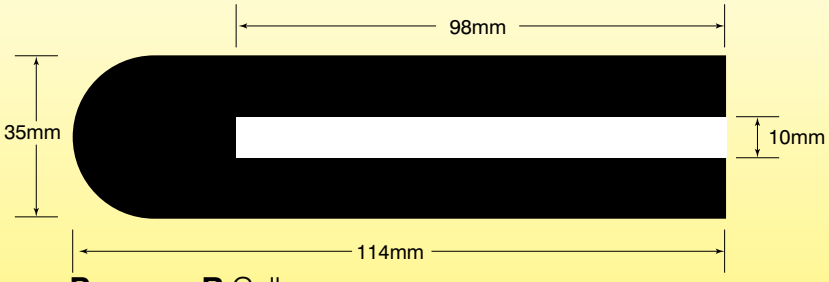
Gallium Cells for Medusa R or Hyperion R to special order.
Cells are provided with Certificate of Metal Analysis.



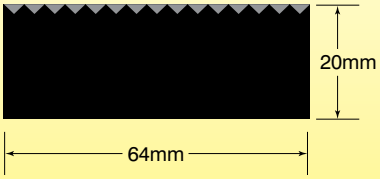
Primary Standard Cell



Hockey Puck Cells



Pegasus R Cell



Gallium Cell

Gas Flow System
Model 984

- Designed for Isotech Blackbody Cells
- Protect High Temperature Cells
- Gas flow interuption 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.

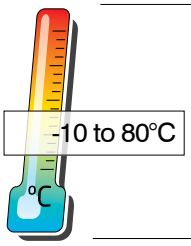
For Indium and Tin cells the effect is small and for Indium, Tin and Zinc cells in general no attention needs to be made. Yet for Aluminium, Silver and Copper Cells the oxygen must be excluded or the cells would be quickly damaged.

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.

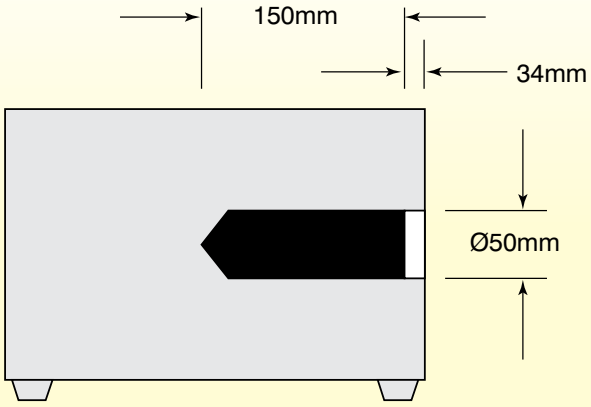
Laboratory performance and low uncertainty calibrations are ensured by the combination by high emissivity and excellent temperature uniformity.

The digital temperature controller allows the block temperature to bet 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.



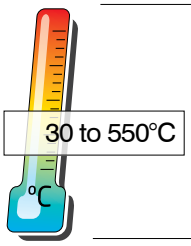
Hyperion R

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



Blackbody Source
Gemini R

- 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.

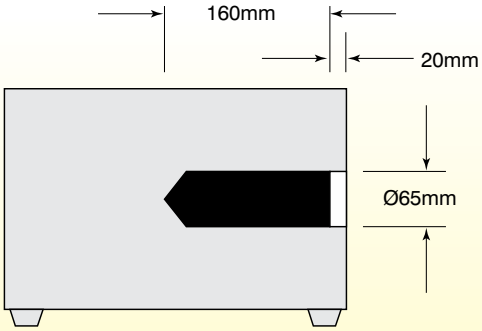
The digital temperature controller allows the block temperature to bet set to any value from 30°C to 550°C.

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 ±0.2°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 ±1°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 ±4°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 ±2°C.

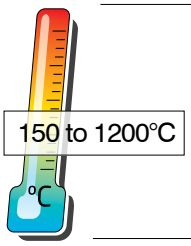
Model	**976**
Temperature Range	30°C to 550.0°C
Emissivity	Greater than 0.995
Stability	±0.1°C
Display Resolution	0.01°C to 99.99; 0.1°C from 100 to 550
Heating Time	45 minutes
Aperture Diameter	65mm
Cavity Depth	160mm
PC Interface	included
Power	1000 Watts typical
Voltage	100-130 or 208-240 Vac 50/60Hz
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.

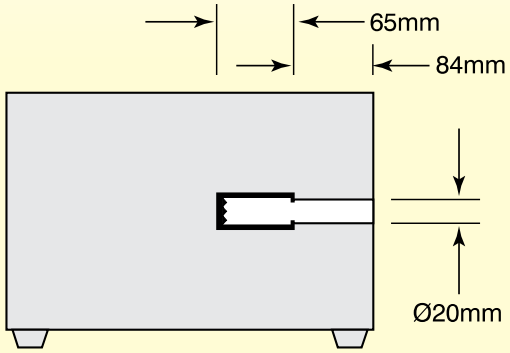
The cavity diameter is 20mm, the depth 65mm. Emissivity is 0.995. The cavity is removable and a fixed point cell may be put in its place. The cavity inside the fixed point cell is 10mm in diameter by 65mm deep to the tip of a 120° cone.

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 ±2°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

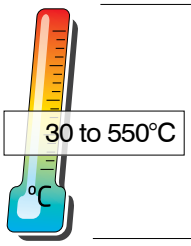
Model	**970**
Temperature Range	150°C to 1200°C
Emissivity	0.995
Stability	±0.1°C
Display resolution	0.1°C to 999.9; 1°C from 1000 to 1200
Cavity size	20mm diameter 65mm deep
Heating Rate	25°C/minute
PC Interface	Included
Power	800W typical 100-130 or 208-240 Vac 50/60Hz
Dimensions	Height 310mm Width 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



Blackbody Source
Medusa R

- 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.

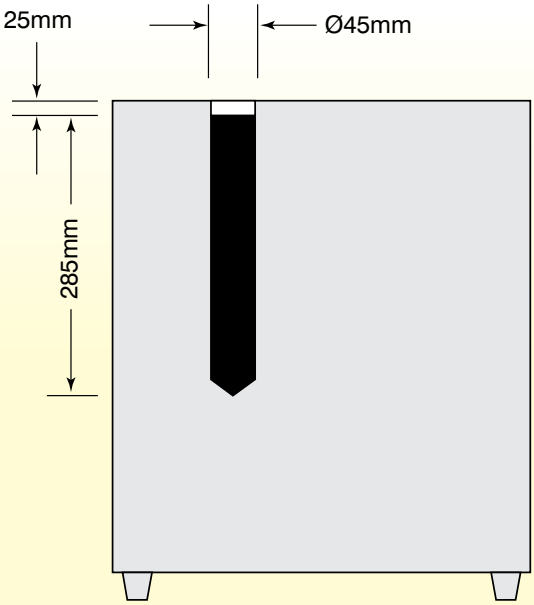
It is suitable for use as a radiation source for infrared thermometers. The cavity is 45 x 285mm deep and suitable for use with the larger Isotech fixed point cells.

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 bet 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

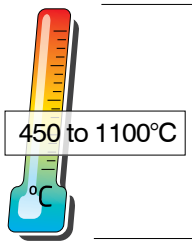
Model	**999**
Temperature Range	30°C to 550.0°C
Emissivity	Greater than 0.995
Stability	±0.1°C
Display Resolution	0.01°C to 99.99; 0.1°C from 100 to 550
Heating Time	45 minutes
Aperture Diameter	45mm
Cavity Depth	285mm
PC Interface	included
Power	1000 Watts typical
Voltage	100-130 or 208-240 Vac 50/60Hz
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



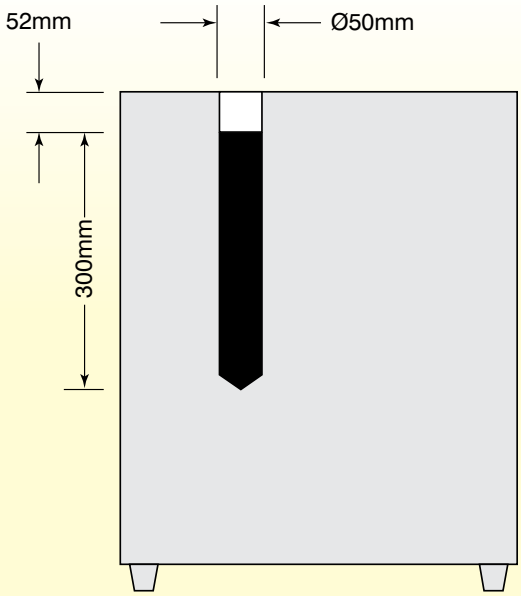
Blackbody Source
Oberon R

- 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

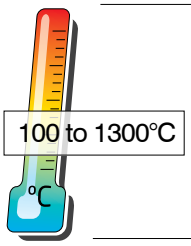
Model	**426**
Temperature Range	450°C to 1100°C
Emissivity	greater than 0.995
Stability	±0.05°C
Display resolution	0.1°C to 999.9; 1°C from 1000 to 1090
Cavity size	50mm diameter 300mm deep
Time to temperature	4 hours
PC Interface	Included
Supply	110Vac, 3kW, 50/60Hz CTE (230Vac and 110Vac to 110Vac 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



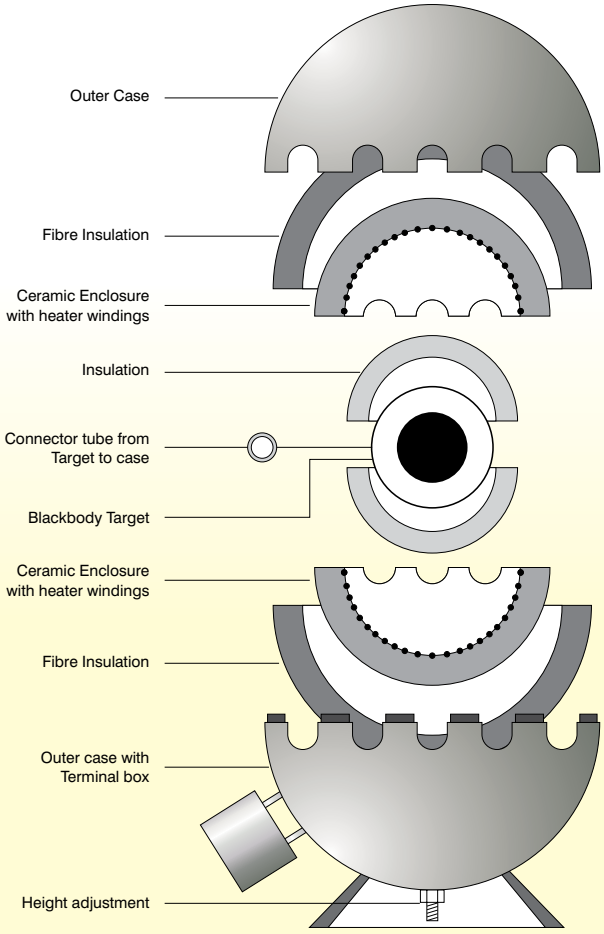
Blackbody Source
Cyclops

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

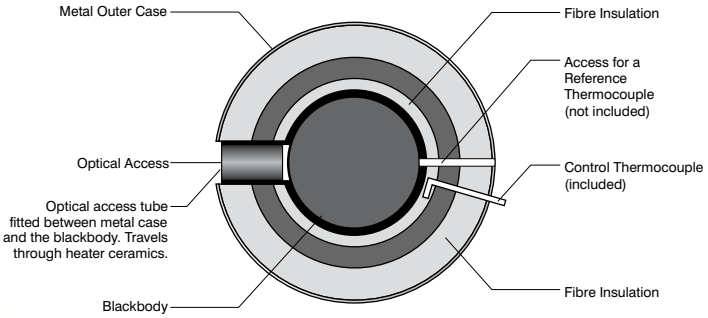
The Cyclops Model 878 is a spherical blackbody source. It consists of an inner black sphere that sits inside a spherical furnace and is suitable for use as a radiation source for infrared thermometers.

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.



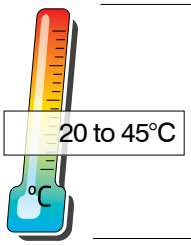
Cyclops Assembly Diagram Plan View (shown in section)



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



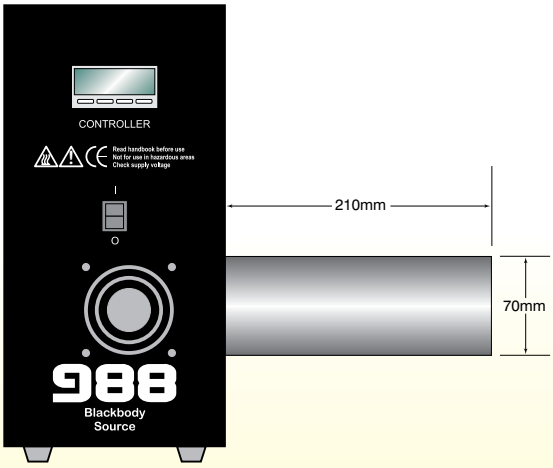
Blackbody Source
Model 988

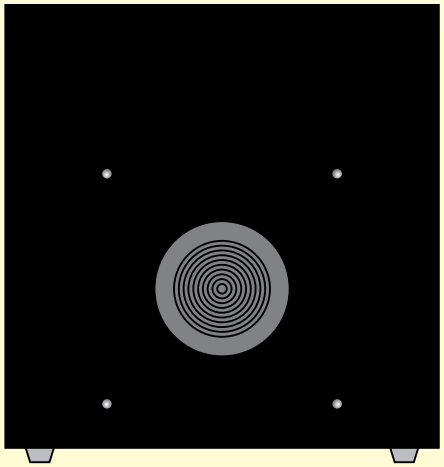
- 20°C to 45°C
- Emissivity better than 0.97 ±0.02
- Controller Resolution 0.01°C

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.





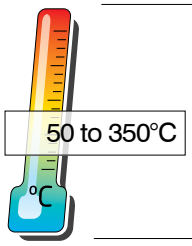
http://www.isotech.co.uk

Model	988
Temperature Range	20°C to 45°C
Resolution	±0.01°C
Target Size	70mm Diameter
Emissivity	0.97 ± 0.02
Combined	±0.2°C
Accuracy / Stability	(±0.3°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



Greybody Source
Model 975

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

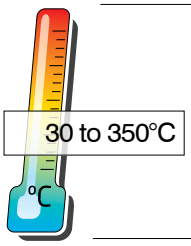
When the high accuracy of the Gemini R is not necessary this product offers a cost effective solution for the calibration and testing of infrared thermometers.

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.

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

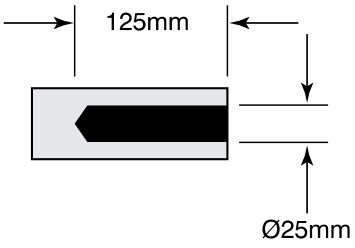


Blackbody Source
QuickCal Blackbody

- 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

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 931-22-51

Thermocouple Referencing Techniques

Isotech has a world leading range of thermocouple referencing equipment. From laboratory models for standard thermocouples through to large scale installations used in power stations, aeronautical, industrial and research institutes.

Types of Equipment

Automatic Ice Point

The junctions are maintained at a fixed temperature of 0°C

Features

- Provides 0°C reference as adopted by thermocouple tables
- Reference from one to a 100 Junctions
- Will reference any type or combination of thermocouple types
- Can be bench or rack mounted.

Constant Temperature Ovens

The junctions are maintained at a fixed temperature typically in the range 40 to 75°C

Features

- The junctions are maintained at a fixed elevated temperature.
- Reference up to 100 Junctions
- Will reference any type or combination of thermocouple types
- Can be provided as bench, rack mounted or in a weatherproof wall mounting case to IP66

Isothermal Systems

The junctions are not maintained at a fixed temperature, but are held in a thermal reservoir with an output signal which is fed to the instrumentation system.

Features

- The junctions float at ambient temperature in an isothermal block - no loading errors
- Can be fully passive with no power requirement
- Will reference any type or combination of thermocouple types
- Can be provided as bench, rack mounted or in a weatherproof wall mounting case to IP66

Types of Housing

Bench Mounting

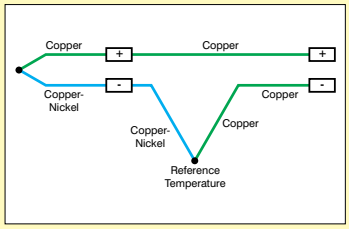
Wall Mounted

Rack Mounted

Types of Junction

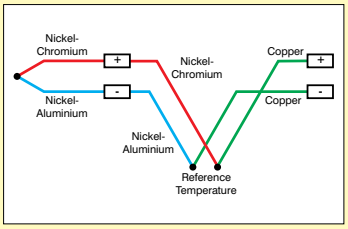
Single Junction

This is particularly useful with Type T thermocouples. With Type T one leg is copper, so only the Copper / Constantan wire needs to be processed thermally.



Double Junction

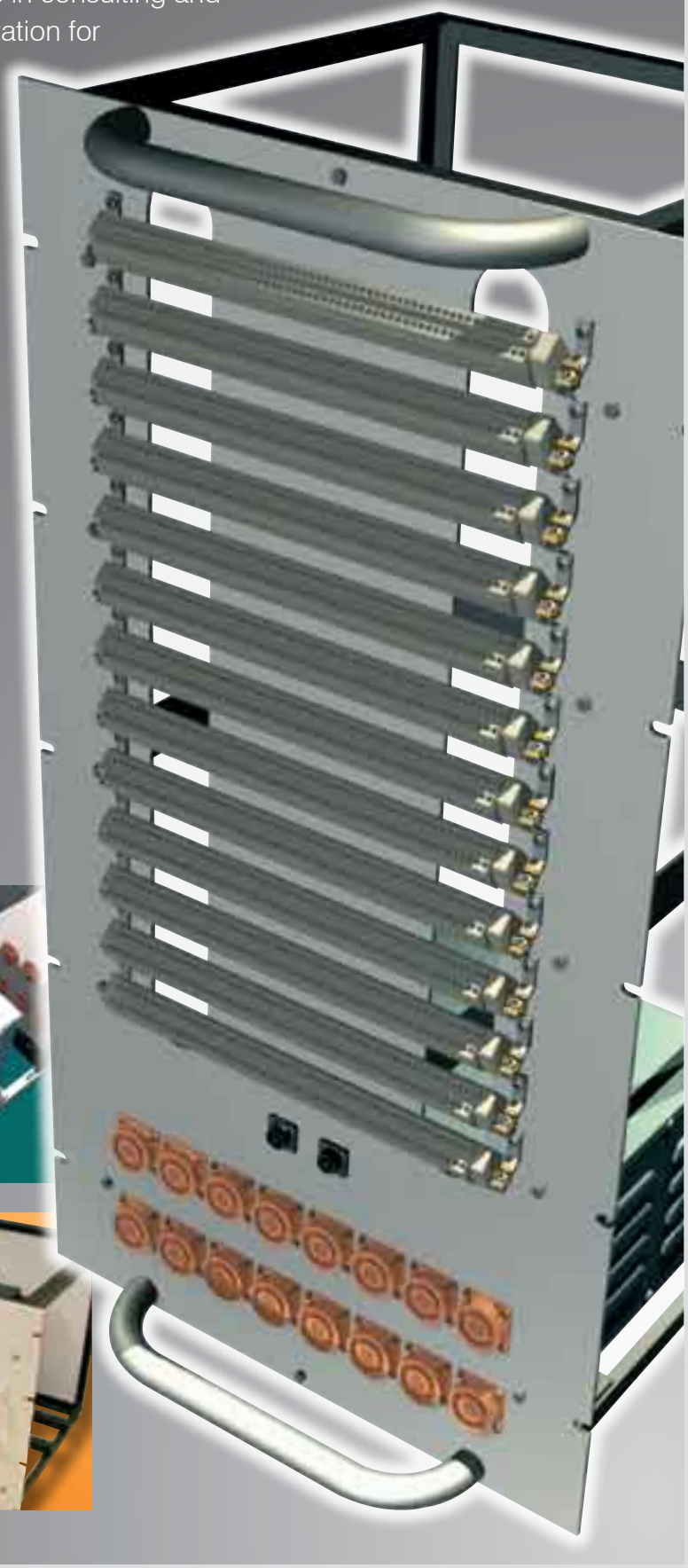
This is the most commonly used method. The input signal being connected to the "double junction" with the output on copper wires.

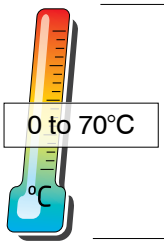


Isotech Custom Engineering

Isotech have more than 30 years experience in consulting and designing referencing systems. With a reputation for outstanding reliability, long term support and excellence Isotech can provide systems from a single, to several thousand junctions.

Solutions for Aeronautical, Power Stations, Environmental Monitoring, Space, Boiler Rooms, Maritime...





Thermocouple Probes
Cold Junction

- Looms for Compensation Units
- Saves on On Site Wiring
- Maintains Accuracy of Unit

Probes are suitable for use with all Isotech thermocouple reference units or may be used with any other equipment including ice flasks and ice point reference units.

They can be supplied to suit a single thermocouple, or up to ten double junctions in a single assembly.

These probes are normally specified to order, or are made to match the reference equipment to which they will be fitted. Normal lead length, L2, is 1M but can be specified at the time of order along with the probe length, L1.

All wire material is to the highest grade available and PTFE insulated, numbered and colour coded for the appropriate thermocouple type.

Double junctions are most commonly supplied (four wire connections per junction). Single junctions (two wire connections per junction) can also be supplied.

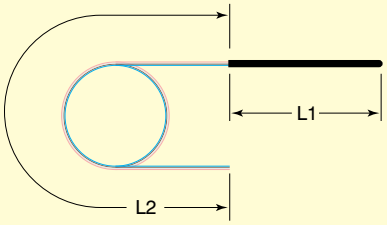
For Types R & S cold junctions are most commonly made from low cost compensating cable but can be supplied in platinum material to special order.

Standard thermocouple Types are, K, E, J, T, N, U, S and R.

Other materials available on request

For Isotech reference units simply advise which model the junctions are for, and the types and number required. For custom junctions the following information is required.

Number of Junctions Required	
Thermocouple Type	
Single or Double Junction	
Length of Probe, L1	
Length of Lead, L2	
Maximum Probe Diameter	



Standard Combinations Available

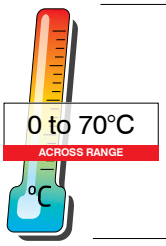
Code	Single Junction Probes
K	Nickel Chromium vs Nickel Aluminium
E	Nickel Chromium vs Copper Nickel (Constantan)
J	Iron vs Constantan
T	Copper vs Constantan
N	Nicrosil vs Nisil
U	Copper vs Cupronic
S	Platinum vs Platinum 10% Rhodium
R	Platinum vs Platinum 13% Rhodium

Code	Double Junction Combinations examples
K	Nickel Chromium vs Copper
K	Nickel Aluminum vs Copper
J	Iron vs Copper
J	Constantan vs Copper
U	Cupronic vs Copper
S/R	Platinum vs Copper
S	Platinum 10% Rhodium vs Copper
R	Platinum 13% Rhodium vs Copper

("U" is a substitute metal alloy combination for Pt/Pt Rh types in the range 0 to 50°C).

Other materials are available on request.

How to order
Model 880 Cold Junction Probes are normally specified for each order. Please discuss your exact requirements with us before ordering.



Thermocouple Reference Unit
TRU Model 938

- Suitable for Laboratory or High Capacity Applications
- Works in high ambients up to 65°C
- Reliable Solid State Design

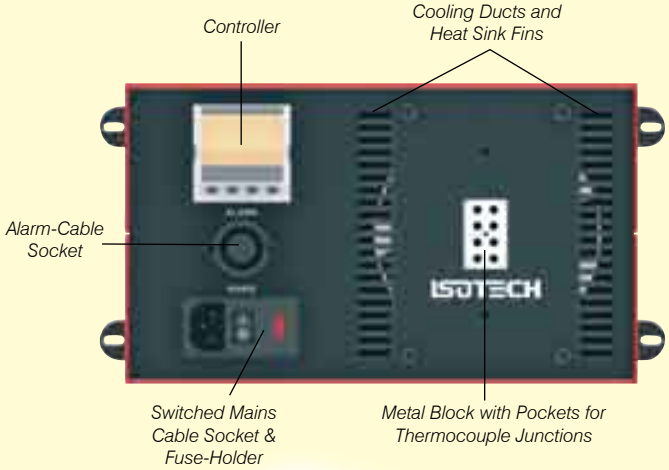
The TRU (Thermocouple Reference Unit) supplies a stable and accurate 0°C, or elevated reference temperature.

It is a self-contained all solid-state unit using Peltier technology which provides maintenance free operation.

The TRU features rapid temperature shift even from high ambient temperatures and is stable within 10 minutes from switch on.

An alarm will be activated should the reference temperature deviate by more than 0.2°C.

The 938 can be ordered with a choice of one of two block types. B1 is recommended for laboratory use and has 6 pockets 6.2mm x 130mm deep and a 4.2mm pocket and can accommodate up to 36 junctions. Block B2 is for higher capacity applications and can accommodate up to 100 junctions with 8 8.2mm pockets x 76mm deep and a 4.2 pocket for an optional monitoring PRT.



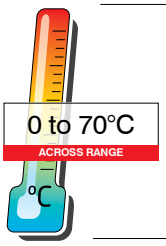
Model	938
Operating Temp.	0°C (or 45° to 70°C)
Ambient Range °C	2°C to 65°C
Stability	±0.03°C, Errors introduced by thermocouple loading can be removed by adjusting controller offset
Stabilising Time	10 minutes from 44°C
Capacity	B1 6 x 6.2mm Pockets + 4.2mm pocket 130mm deep or B2 8 x 8.2mm Pockets +4.2mm pocket 76mm deep.
Alarm Facilities	Non-latching relay rated 5 Amps 240V
Power	100 Watts typical 100-130 or 208-240 VAC 50/60Hz
Dimensions	Height 228mm Width 253mm Depth 148mm
Weight	5.5kg

Accessories

935-14-54	Platinum Resistance Thermometer suits Block B1: Includes UKAS Calibration at 0.01°C
935-14-55	Platinum Resistance Thermometer suits Block B2: Includes UKAS Calibration at 0.01°C
935-17-32	Fan Filter - recommended for high dust environments

How to order

TRU Model 938
Normally uniquely specified for each order.
Please discuss your exact requirements with us before ordering.



Thermocouple Reference Unit
TRU Model 937

- Up to 100 Channels
- Compact, Pre Wired Thermocouples
- Operates in High Ambients

The TRU 937 (Temperature Reference Unit) supplies a stable and accurate 0°C or elevated Reference Temperatures between 45°C and 70°C.

It is a self-contained all solid state unit using peltier technology which provides maintenance free operation. The TRU 937 features rapid cool down from high ambient temperatures and is stable within 10 minutes from switch on.

An alarm will be activated should the reference temperatures deviate by more than the user definable span. Thermocouple Reference Junctions are located in a reference block and connected to their marked input and output terminals in an isothermal enclosure. The uniform temperature throughout the enclosure ensures that no thermoelectric EMFs are generated at the terminals.

One advantage of the TRU 937 is that the user need not be concerned with the supply and installation of reference junctions since it is only necessary to connect the thermocouple compensation cables to the input terminals and the measuring instrument to the output terminals of the TRU 937.

There are two models, the TRU 937/50 with up to 50 junctions with a single terminal cover door, and the TRU 397/100 which has doors on the front and rear, as shown in the photograph.

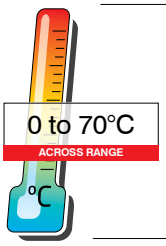
Note:
Thermocouple Referencing to ISO9000 at 0°C in Ambients up to 65°C or elevated reference temperatures between 45°C and 70°C
References up to 100 Thermocouples
Pre-wired Thermocouples, Compact Design

Model	**937**
Operating Temp.	0°C (or 45° to 70°C)
Ambient Range	2°C to 65°C
Stability	±0.03°C, Errors introduced by thermocouple loading can be removed by adjusting controller offset
Stabilising Time	10 minutes from 44°C
Capacity	Up to 100 Double Junction Channels
Input/Output Connections	Klippon Terminals, type 1.5 AKZ
Alarm facilities	Non-latching relay rated 5 Amps 240V
Power	100 Watts typical 100-130 or 208-240 VAC 50/60Hz
Dimensions	Height 265mm Width 253mm Depth TRU 937/100 312mm Depth TRU 937/50 312mm
Weight	TRU 937/100 11kg TRU 937/50 8kg

Accessories

935-14-55	Platinum Resistance Thermometer suits Block B2: Includes UKAS Calibration at 0.01°C
935-17-33	Fan Filter - recommended for high dust environments

How to order
TRU Model 937
Normally uniquely specified for each order.
Please discuss your exact requirements with us before ordering.



Thermocouple Reference Unit
TRUrac Model 847

- Rack Mounted
- Large Capacity
- Approved for Power Station Use

The TRUrac is a 0°C or elevated temperature thermocouple reference system mounted in a 19" chassis. It has been developed for situations where ambient temperature can be up to 65°C.

The reference temperature is normally set to 0°C or between 45°C and 70°C. For other temperatures please contact Isotech.

An alarm will be activated should the reference temperatures deviate by more then 0.2°C.

Inside the rack case is a high stability thermal block which has a capacity of up to 100 thermocouple channels, the probe wires being terminated at the rear of the unit on rail mounted screw terminals.

To special order a second thermal block may be fitted to allow a capacity of 200 channels in a single unit.

The customer simply connects their thermocouple wires and copper output wires to these terminals. All the thermocouple cold junctions are inserted into a metal oven block which is accurately temperature controlled.

Model	**847**
Operating Temp.	0°C (or 45° to 70°C)
Ambient Range	2°C to 65°C
Stability	±0.03°C, Errors introduced by thermocouple loading can be removed by adjusting controller offset
Stabilising Time	10 minutes from 44°C
Capacity	Up to 100 Double Junction Channels
Input/Output Connections	Klippon Terminals, type 1.5 AKZ
Alarm facilities	Non-latching relay rated 5 Amps 240V
Power	100 Watts typical 100-130 or 208-240 VAC 50/60Hz
Dimensions 50 to 100 Channels	Height 400mm Width 483mm Depth 312mm
Weight	24kg

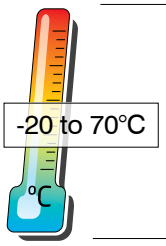
Accessories

935-14-54	Platinum Resistance Thermometer Includes UKAS Calibration at 0.01°C
935-17-32	Fan Filter - recommended for high dust environments

How to order

Should be specified uniquely on each order.
Please discuss your exact requirements with us before ordering.

Note:
Rack mounted Temperature Thermocouple Referencing System
Large Capacity. Approved for Power Station Use.
Reference temperatures set to 0°C or between 45°C and 70°C.



Thermocouple Reference Unit
Isobox Model 842

- Water Proof Cased
- Large Capacity
- Approved for Power Station Use

The function of this reference unit differs from other cased systems in that the temperature of the metal block in which the thermocouple and copper leads are inserted, actually varies with ambient temperature. A separate output signal is produced which is proportional to the difference between the environmental temperature and the actual reference temperature. The output signal can be fed directly into a computer/data logger to give accurate compensation over a large ambient range. A thermal reservoir, heavily insulated, contains the reference junction probes. The reservoir temperature slowly follows the ambient temperature; an electrical compensation device is thermally integrated with the reservoir and thus senses the reservoir temperature. The device produces an output proportional to the difference between the reservoir temperature and the reference temperature (usually 0°C).

This is the signal the computer/data logger uses to compensate for the temperature of the reference probes junctions.

The output signal can be in the form of a DC mV output, 4-20 mA or from a platinum resistance thermometer. Please discuss prior to order.

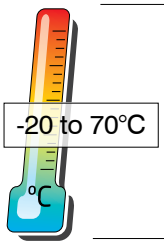
Units are housed in robust weatherproof enclosures to IP66 incorporating bottom gland plate. Fixing lugs for wall mounting are provided. Easy access to terminal rails and block assembly is via a lockable hinged front door.

Note:
Waterproof Cased Ambient Temperature Thermocouple Referencing System.
Large Capacity up to 100 Thermocouples.
Wide Ambient Range.
Approved for Power Station Use.

Model	**842**
Referencing Temp	Effectively 0°C
Accuracy	±0.1°C per 10° ambient span
Long Term Stability	±0.05°C per 1000 Hours
Temperature Gradient	±0.1°C between Junctions
Stabilisation Time	10 minutes
Ambient Temperature	-20°C to +70°C
Thermocouple	0 to 100 channels
Capacity	Double junction referencing
Power	10 Watts typical 100-130 or 208-240 VAC 50/60Hz Low level D.C. Consumption 6VA typical Passive Option Available
Dimensions	Height 600mm Width 600mm Depth 300mm
Weight	40kg

Note:
Numerous special versions are available and can be supplied either in their existing form or modified to customers' requirements.

How to order
Model 842
Isoboxes are normally uniquely specified for each order.
Please discuss your exact requirements with us before ordering.



Thermocouple Reference Unit
Isorac Model 844

- Rack Mounted Ambient Referencing System
- Large Capacity
- Approved for Power Station Use

The function of this reference unit differs from other rack mounted systems in that the temperature of the metal block in which the thermocouple and copper leads are inserted actually varies with ambient temperature. A separate output signal is produced which is proportional to the difference between the environmental temperature and the actual reference temperature. The output signal can be fed directly into a computer/data logger to give accurate compensation over a large ambient range.

A thermal reservoir, heavily insulated, contains the reference junction probes.

The reservoir temperature slowly follows the ambient temperature; an electrical compensation device is thermally integrated with the reservoir and thus senses the reservoir temperature.

The device produces an output proportional to the difference between the reservoir temperature and the reference temperature (usually 0°C). This is the signal the computer/data logger uses to compensate for the temperature of the reference probes junctions.

The output signal can be in the form of a DC mV output, 4-20 mA or from a platinum resistance thermometer. Please discuss prior to order.

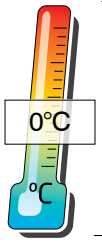
Model No.	**844**
Reference Temperature	Effectively 0°C
Temperature Gradient	±0.1°C between Junctions
Stability	±0.05°C per 1000 Hours
Ambient Range	-20°C to +70°C
Accuracy	±0.1°C per 15°C ambient span
Stabilisation Time	10 mins
Thermocouple Capacity	0 to 100 channels double junction referencing
Power	10 Watts typical 100-130 or 208-240 VAC 50/60Hz Low level D.C. Consumption 6VA typical Passive Option Available
Dimensions Up to 50 channels	Height 255mm Width 483mm Depth 312mm
Weight	17.2kg
50 to 100 channels	Height 309mm Width 483mm Depth 312mm
Weight	20.4kg

Numerous special versions are available and can be supplied either in their existing form or modified to customers requirements.

How to order
Model 844
Isoracs are normally uniquely specified for each order.

Please discuss your exact requirements with us before ordering.

Note:
Rack Mounted Ambient Temperature Referencing System.
19" Rack Mounting.
Large capacity up to 100 Thermocouples.
Approved for Power Station Use.



Thermocouple Compensation
Trio Model 885

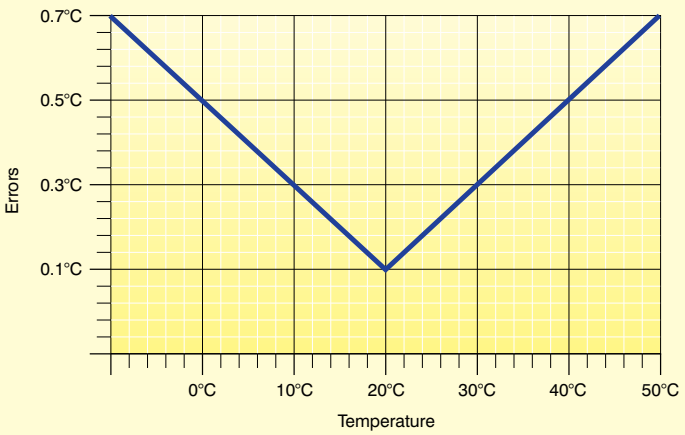
- Three Channel Referencing System
- Accurate
- Convenient

The Isotech Trio is a low-cost, accurate, portable unit designed to compensate three thermocouples for the variations in EMF caused by the cold junction not being at the standard reference temperature of 0°C.

Tables are available for each thermocouple combination which give the voltage versus temperature variation. The Trio senses the ambient temperature and generates an electrical voltage to cancel out the variation, thus providing equivalent of a 0°C cold junction reference bath. The Isotech Trio contains three electronic networks, incorporating a temperature-sensitive element which is thermally integrated with the thermocouple cold junction for maximum precision.

The unit is mains operated. The Trio is manufactured to the highest standards and after assembly each unit is calibrated to ensure conformance to the relevant thermocouple table. A wide range of thermocouple types are available. As standard, six thermocouple combinations are offered to customer requirements. The internal structure of the Trio allows either one, two or three thermocouple types to be compensated.

Accuracy of Compensation (Base Metals)



Note:
The Trio has a common power supply and in some circumstances with grounded thermocouples earth loops can form causing apparent errors in compensation.

Model	**885**
Reference Temperature	0°C (others by arrangement)
Operating Temperature	0 to 55°C
Output Impedance	Less than 200 ohms
Power	10 Watts typical 100-130 or 208-240 VAC 50/60Hz
Accuracy	See Graph
Error due to Supply Variations	Negligible
Compensation for type	K, T, J, E, U, N U Wire used for R & S types unless otherwise specified
Stability	Typically 0.02% p.a.
Dimensions	Height 38mm Width 80mm Depth 150mm
Weight	349g

How to order
Trio Model 885
Specify 3 thermocouple types and supply voltage
e.g. Trio K.K.E. 220V 50Hz.

About the Laboratory

Isotech's UKAS accredited calibration laboratory, Northern Temperature Primary Laboratory (NTPL), was established in 1980 and has grown to be a full scale laboratory providing calibration to the smallest of uncertainties. Isotech was the first UKAS laboratory to be accredited to calibrate ITS-90 Fixed Point Cells. Our accredited uncertainties are now smaller than many the scope of other accredited laboratories and smaller than most National Measurement Institutes.

NTPL comprises of three physically separate laboratories, A Primary Laboratory, A Secondary Laboratory and Calibration laboratory for Industrial Products

Summary of Accreditation

Electrical

Bridges and similar instruments, resistance
Calibrators, temperature simulation
Resistance boxes
Resistors, AC
Resistors, DC
Temperature indicators, electrical calibration
Voltmeters, DC

Temperature

Block calibrators
Fixed point cells
Resistance thermometers, calibration by comparison
Resistance thermometers, fixed point calibrations
Temperature indicators and recorders, electrical calibration without sensor
Temperature indicators and recorders, with temperature sensor(s)
Thermocouples, base metal types, e.g. K, N, T
Thermocouples, gold/platinum
Thermocouples, platinum/rhodium types, e.g. S, R

http://www.isotech.co.uk/lab

NTPL calibrate both Isotech equipment and devices from other manufacturers to the smallest of calibration uncertainties. The latest UKAS schedule can be downloaded from our website, a brief summary follows.

■ Calibration of Thermometers

Measured Quantity Instrument or Gauge	Range	Best Measurement Capability Expressed as an Expanded Uncertainty (k=2)	Remarks
Calibration by comparisons	-80°C to -40°C	7.0 mk	
	-40°C to 50°C	4.0 mk	
	50°C to 156°C	5.0 mk	
	156°C to 300°C	6.5 mk	
	300°C to 420°C	20 mk	
	420°C to 660°C	35 mk	
Calibration at Fixed Points *(See Note 1)*			
BP Nitrogen	-195.798°C	5 mK	*Note 1: Suitable only for HT/SPRTs with high stability. Includes extrapolation to zero power and immersion checks.*
TP Argon	-189.3442°C	0.50 mK	
TP Mercury	-38.8344°C	0.24 mK	
TP Water *(See Note 2)*	0.01°C	0.07 mK	
MP Gallium	29.7646°C	0.15 mK	
FP Indium	156.5985°C	1.0 mK	*Note 2: Suitable for most SPRTs using nominal current.*
FP Tin	231.928°C	1.0 mK	
FP Zinc	419.527°C	1.2 mK	
FP Aluminium	660.323°C	2.0 mK	
FP Silver	961.78°C	7 mK	

■ Calibration of Thermocouples

Measured Quantity Instrument or Gauge	Range	Best Measurement Capability Expressed as an Expanded Uncertainty (k=2)	Remarks
Platinum thermocouples			
Calibration by comparisons	-50°C to 0°C	0.5°C	*Thermocouples without a cold junction will have increased uncertainty*
	0°C to 50°C	0.45°C	
	50°C to 660°C	0.4°C	
	660°C to 1100°C	0.7°C	
	1100°C to 1300°C	1.7°C	
Calibrations at fixed points			
FP Tin	231.928°C	0.4°C	
FP Zinc	419.527°C	0.4°C	
FP Aluminium	660.323°C	0.4°C	
FP Silver	961.78°C	0.4°C	
Gold/Platinum thermocouples			
Calibration at fixed points			
TP Water	0.01°C	0.06°C	
FP Zinc	419.527°C	0.05°C	
FP Aluminium	660.323°C	0.05°C	
FP Silver	961.78°C	0.05°C	
	0°C to 1000°C	0.10°C	*Including uncertainty of interpolation/extrapolation*
Other thermocouples	-196°C	0.3°C	
	-80°C to 0°C	0.25°C	
	0°C to 50°C	0.1°C	
	50°C to 300°C	0.25°C	
	300°C to 420°C	0.30°C	
	420°C to 660°C	0.4°C	
	660°C to 1100°C	0.8°C	
	1100°C to 1300°C	2.2°C	

TP = Triple Point FP = Freezing Point MP = Melting Point BP = Boiling Point

0175

The latest schedule can be found on the Isotech website or at www.ukas.org.

Isotech Training Course

From Industry to ITS-90

Isotech Training Course, "From Industry to ITS-90"

Isotech is widely recognized as a leading provider of training for temperature calibration, Isotech's new course is now available.

- Isotech: A brief introduction and history
- Fundamental Questions: What is Temperature?
- The Two Methods of Calibration
- Equipping for Industrial Calibration
- Equipping a Secondary Laboratory
- Equipping a Primary Laboratory
- Degrees of Automation
- Understanding Sources of Error
- Traceability
- Uncertainty

Who is it aimed at?

- People who are considering starting to calibrate sensors
- Those new to Temperature Calibration
- Industrial Users seeking a fuller picture of calibration
- People who are planning to purchase new equipment

Benefits

- An understanding of temperature calibration
- The methods of calibration
- The types of equipment available
- How to select the appropriate equipment
- How to avoid common pitfalls

Where?

The course is available at Isotech and is also being offered in conjunction with Isotech Distributors across the globe. For those not able to attend the training is also offered as an internet E-learning opportunity via online modules.

The online training modules explain Isotech's work and products and provide an invaluable insight into areas such as calibrating sensors and equipping calibration laboratories.

The resources have been developed as part of the e-Learning Place. This £3million project has enabled Isotech, in partnership with the University of Liverpool and Connect Internet Solutions, to create high-quality courses incorporating multimedia features and on-line interactive assessment.

An access pack which gives 12 month access to the course along with a full set of written notes is available

To learn more please visit
www.isotech.co.uk/elearning

Industrial Platinum Resistance Thermometer Tables - R(0) = 100.00Ω

IEC 60751 Ed2 2008

°C ITS 90	0	1	2	3	4	5	6	7	8	9	10	°C ITS 90
-200	18.52											-200
-190	22.83	22.40	21.97	21.54	21.11	20.68	20.25	19.82	19.38	18.95	18.52	-190
-180	27.10	26.67	26.24	25.82	25.39	24.97	24.54	24.11	23.68	23.25	22.83	-180
-170	31.34	30.91	30.49	30.07	29.64	29.22	28.80	28.37	27.95	27.52	27.10	-170
-160	35.54	35.12	34.70	34.28	33.86	33.44	33.02	32.60	32.18	31.76	31.34	-160
-150	39.72	39.31	38.89	38.47	38.05	37.64	37.22	36.80	36.38	35.96	35.54	-150
-140	43.88	43.46	43.05	42.63	42.22	41.80	41.39	40.97	40.56	40.14	39.72	-140
-130	48.00	47.59	47.18	46.77	46.36	45.94	45.53	45.12	44.70	44.29	43.88	-130
-120	52.11	51.70	51.29	50.88	50.47	50.06	49.65	49.24	48.83	48.42	48.00	-120
-110	56.19	55.79	55.38	54.97	54.56	54.15	53.75	53.34	52.93	52.52	52.11	-110
-100	60.26	59.85	59.44	59.04	58.63	58.23	57.82	57.41	57.01	56.60	56.19	-100
-90	64.30	63.90	63.49	63.09	62.68	62.28	61.88	61.47	61.07	60.66	60.26	-90
-80	68.33	67.92	67.52	67.12	66.72	66.31	65.91	65.51	65.11	64.70	64.30	-80
-70	72.33	71.93	71.53	71.13	70.73	70.33	69.93	69.53	69.13	68.73	68.33	-70
-60	76.33	75.93	75.53	75.13	74.73	74.33	73.93	73.53	73.13	72.73	72.33	-60
-50	80.31	79.91	79.51	79.11	78.72	78.32	77.92	77.52	77.12	76.73	76.33	-50
-40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70	80.31	-40
-30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67	8427	-30
-20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62	88.22	-20
-10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55	92.16	-10
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48	96.09	0

0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	103.90	0
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	119.40	40
50	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	123.24	50
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	127.08	60
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	130.90	70
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	134.71	80
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	138.51	90
100	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	142.29	100
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69	146.07	110
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46	149.83	120
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21	153.58	130
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95	157.33	140
150	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68	161.05	150
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40	164.77	160
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11	168.48	170
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.43	171.80	172.17	180
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49	175.86	190
200	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16	179.53	200
210	179.53	179.89	180.26	180.63	180.99	181.36	181.72	182.09	182.46	182.82	183.19	210
220	183.19	183.55	183.92	184.28	184.65	185.01	185.38	185.74	186.11	186.47	186.84	220
230	186.84	187.20	187.56	187.93	188.29	188.66	189.02	189.38	189.75	190.11	190.47	230
240	190.47	190.84	191.20	191.56	191.92	192.29	192.65	193.01	193.37	193.74	194.10	240
250	194.10	194.46	194.82	195.18	195.55	195.91	196.27	196.63	196.99	197.35	197.71	250
260	197.71	198.07	198.43	198.79	199.15	199.51	199.87	200.23	200.59	200.95	201.31	260
270	201.31	201.67	202.03	202.39	202.75	203.11	203.47	203.83	204.19	204.55	204.90	270
280	204.90	205.26	205.62	205.98	206.34	206.70	207.05	207.41	207.77	208.13	208.48	280
290	208.48	208.84	209.20	209.56	209.91	210.27	210.63	210.98	211.34	211.70	212.05	290
300	212.05	212.41	212.76	213.12	213.48	213.83	214.19	214.54	214.90	215.25	215.61	300
310	215.61	215.96	216.32	216.67	217.03	217.38	217.74	218.09	218.44	218.80	219.15	310
320	219.15	219.51	219.86	220.21	220.57	220.92	221.27	221.63	221.98	222.33	222.68	320
330	222.68	223.04	223.39	223.74	224.09	224.45	224.80	225.15	225.50	225.85	226.21	330
340	226.21	226.56	226.91	227.26	227.61	227.96	228.31	228.66	229.02	229.37	229.72	340

Industrial Platinum Resistance Thermometer Tables - R(0) = 100.00Ω

°C ITS 90	0	1	2	3	4	5	6	7	8	9	10	°C ITS 90
350	229.72	230.07	230.42	230.77	231.12	231.47	231.82	232.17	232.52	232.87	233.21	350
360	233.21	233.56	233.91	234.26	234.61	234.96	235.31	235.66	236.00	236.35	236.70	360
370	236.70	237.05	237.40	237.74	238.09	238.44	238.79	239.13	239.48	239.83	240.18	370
380	240.18	240.52	240.87	241.22	241.56	241.91	242.26	242.60	242.95	243.29	243.64	380
390	243.64	243.99	244.33	244.68	245.02	245.37	245.71	246.06	246.40	246.75	247.09	390
400	247.09	247.44	247.78	248.13	248.47	248.81	249.16	249.50	249.85	250.19	250.53	400
410	250.53	250.88	251.22	251.56	251.91	252.25	252.59	252.93	253.28	253.62	253.96	410
420	253.96	254.30	254.65	254.99	255.33	255.67	256.01	256.35	256.70	257.04	257.38	420
430	257.38	257.72	258.06	258.40	258.74	259.08	259.42	259.76	260.10	260.44	260.78	430
440	260.78	261.12	261.46	261.80	262.14	262.48	262.82	263.16	263.50	263.84	264.18	440
450	264.18	264.52	264.86	265.20	265.53	265.87	266.21	266.55	266.89	267.22	267.56	450
460	267.56	267.90	268.24	268.57	268.91	269.25	269.59	269.92	270.26	270.60	270.93	460
470	270.93	271.27	271.61	271.94	272.28	272.61	272.95	273.29	273.62	273.96	274.29	470
480	274.29	274.63	274.96	275.30	275.63	275.97	276.30	276.64	276.97	277.31	277.64	480
490	277.64	277.98	278.31	278.64	278.98	279.31	279.64	279.98	280.31	280.64	280.98	490
500	280.98	281.31	281.64	281.98	282.31	282.64	282.97	283.31	283.64	283.97	284.30	500
510	284.30	284.63	284.97	285.30	285.63	285.96	286.29	286.62	286.95	287.29	287.62	510
520	287.62	287.95	288.28	288.61	288.94	289.27	289.60	289.93	290.26	290.59	290.92	520
530	290.92	291.25	291.58	291.91	292.24	292.56	292.89	293.22	293.55	293.88	294.21	530
540	294.21	294.54	294.86	295.19	295.52	295.85	296.18	296.50	296.83	297.16	297.49	540
550	297.49	297.81	298.14	298.47	298.80	299.12	299.45	299.78	300.10	300.43	300.75	550
560	300.75	301.08	301.41	301.73	302.06	302.38	302.71	303.03	303.36	303.69	304.01	560
570	304.01	304.34	304.66	304.98	305.31	305.63	305.96	306.28	306.61	306.93	307.25	570
580	307.25	307.58	307.90	308.23	308.55	308.87	309.20	309.52	309.84	310.16	310.49	580
590	310.49	310.81	311.13	311.45	311.78	312.10	312.42	312.74	313.06	313.39	313.71	590
600	313.71	314.03	314.35	314.67	314.99	315.31	315.64	315.96	316.28	316.60	316.92	600
610	316.92	317.24	317.56	317.88	318.20	318.52	318.84	319.16	319.48	319.80	320.12	610
620	320.12	320.43	320.75	321.07	321.39	321.71	322.03	322.35	322.67	322.98	323.30	620
630	323.30	323.62	323.94	324.26	324.57	324.89	325.21	325.53	325.84	326.16	326.48	630
640	326.48	326.79	327.11	327.43	327.74	328.06	328.38	328.69	329.01	329.32	329.64	640
650	329.64	329.96	330.27	330.59	330.90	331.22	331.53	331.85	332.16	332.48	332.79	650
660	332.79	333.11	333.42	333.74	334.05	334.36	334.68	334.99	335.31	335.62	335.93	660
670	335.93	336.25	336.56	336.87	337.18	337.50	337.81	338.12	338.44	338.75	339.06	670
680	339.06	339.37	339.69	340.00	340.31	340.62	340.93	341.24	341.56	341.87	342.18	680
690	342,18	342.49	342.80	343.11	343.42	343.73	344.04	344.35	344.66	344.97	345.28	690
700	345.28	345.59	345.90	346.21	346.52	346.83	347.14	347.45	347.76	348.07	348.38	700
710	348.38	348.69	348.99	349.30	349.61	349.92	350.23	350.54	350.84	351.15	351.46	710
720	351.46	351.77	352.08	352.38	352.69	353.00	353.30	353.61	353.92	354.22	354.53	720
730	354.53	354.84	355.14	355.45	355.76	356.06	356.37	356.67	356.98	357.28	357.59	730
740	357.59	357.90	358.20	358.51	358.81	359.12	359.42	359.72	360.03	360.33	360.64	740
750	360.64	360.94	361.25	361.55	361.85	362.16	362.46	362.76	363.07	363.37	363.67	750
760	363.67	363.98	364.28	364.58	364.89	365.19	365.49	365.79	366.10	366.40	366.70	760
770	366.70	367.00	367.30	367.60	367.91	368.21	368.51	368.81	369.11	369.41	369.71	770
780	369.71	370.01	370.31	370.61	370.91	371.21	371.51	371.81	372.11	372.41	372.71	780
790	372.71	373.01	373.31	373.61	373.91	374.21	374.51	374.81	375.11	375.41	375.70	790
800	375.70	376.00	376.30	376.60	376.90	377.19	377.49	377.79	378.09	378.39	378.68	800
810	378.68	378.98	379.28	379.57	379.87	380.17	380.46	380.76	381.06	381.35	381.65	810
820	381.65	381.95	382.24	382.54	382.83	383.13	383.42	383.72	384.01	384.31	384.60	820
830	384.60	384.90	385.19	385.49	385.78	386.08	386.37	386.67	386.96	387.25	387.55	830
840	387.55	387.84	388.14	388.43	388.72	389.02	389.31	389.60	389.90	390.19	390.48	840
850	390.48											850

The temperature/resistance relationships used in this standard are as follows:

for the range -200°C to 0°C.

$R_t = R_0 [1 + At + Bt^2 + C (t - 100°C) t^3]$

for the range of 0°C to 850°C.

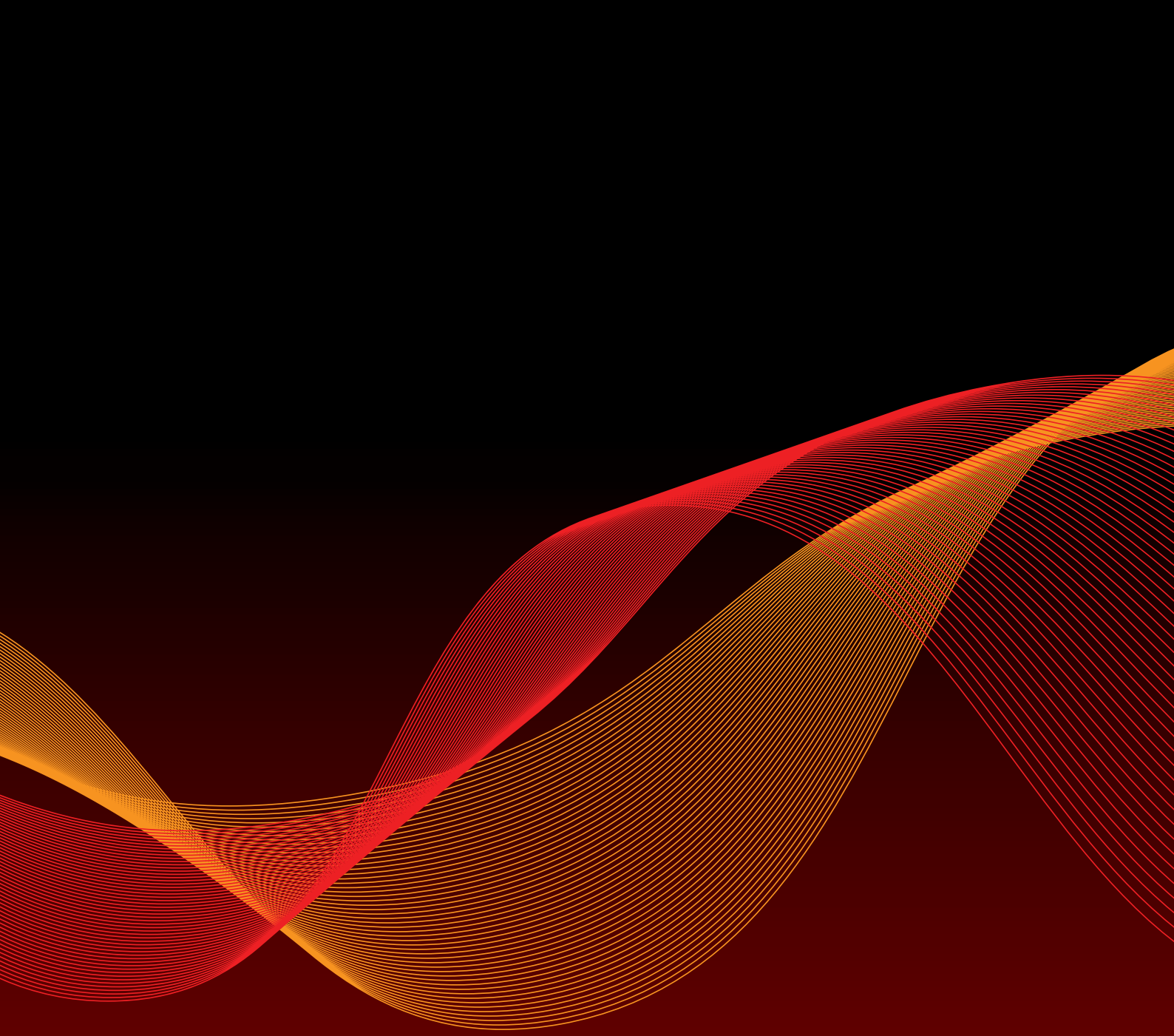
$R_t = R_0 (1 + At + Bt^2)$

For the quality of platinum commonly used for industrial resistance themometers the values of the constants in these equations are:

$A = 3.9083 \times 10^{-3}\ °C^{-1}$

$B = -5.77\ 5 \times 10^{-7}\ °C^{-2}$

$C = -4.183 \times 10^{-12}\ °C^{-4}$



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