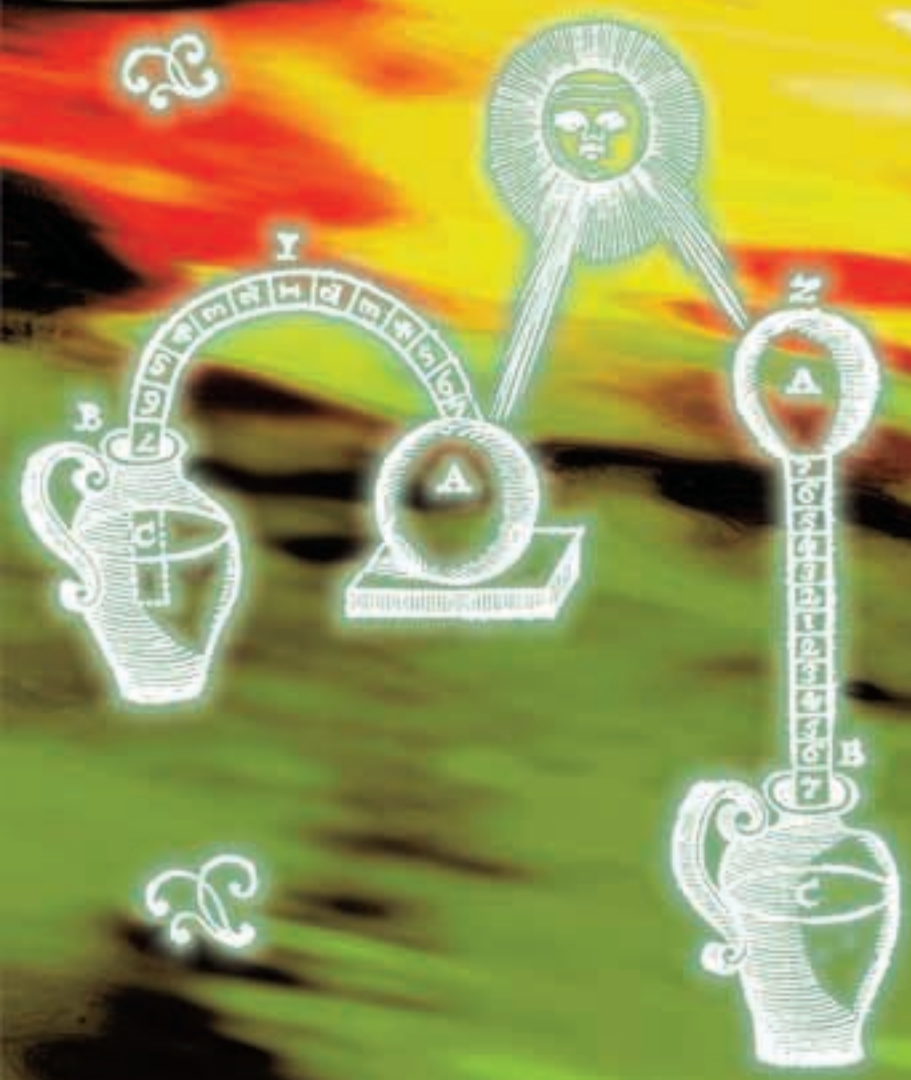
2 databooktwo



The Secondary Laboratory

Isotech's Millennium Collection of Products for the Secondary Temperature Laboratory

2006/07

temperature calibration equipment & services

ISOTECH

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.

The print on the front cover shows the development of the thermometer from Philo's experiment in Byzantium 200 years B.C.
The figure is credited to Fludd, a Welsh mystic in 1638.
For more information on the history of the thermometer the reader is referred to:-
'A History of the Thermometer and its Use in Metrology' by W.E. Knowles Middleton (The John Hopkins Press, Baltimore, Maryland).

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Products in this catalogue are all CE Compliant

Introduction

The Secondary Laboratory

In databook 2 Isotech describes the best Comparison Equipment available, together with Fixed Point Cells and Apparatus for the calibration of high quality industrial sensors, instruments, thermometers and resistors.

The comparison equipment described creates a volume of constant temperature into which a calibrated standard thermometer together with the unknown thermometers are situated.

The calibrated thermometer measures the temperature simultaneously to the unknowns which are compared to it.

A secondary laboratory needs apparatus, thermometers, a measuring instrument and some stable resistors. It also requires one or two Fixed Points to re-verify its thermometers.

All these will be found on the following pages.

Benefit from Isotech's Millennium Range of Products for the Secondary Laboratory.

At Isotech we operate three UKAS Accredited Laboratories.

Our Secondary Laboratory calibrates using the highest quality comparison techniques and by a series of slim fixed point cells and apparatus.

Benefit from our experience of running a UKAS accredited Secondary Laboratory since 1985. The wide choice of products presented on the following pages represent 20 years of development of products, and identification of the requirements of industry.

The Secondary Laboratory temperature range can be divided into three.
Low temperature range (-80°C to +250°C) using stirred, parallel tube liquid baths such as models 915 and 798, followed by **Medium temperature range** (+50°C to +700°C) typified by the model 875. Finally the **High temperature range** (150°C to 1300°C) is exemplified by the 877. These products are described briefly on the following pages.

Full evaluation reports are freely available describing in detail the performance of each product. Before you choose the apparatus for your Secondary Laboratory please ask for our evaluation reports.

Since these reports were prepared for UKAS followed by actual audits the figures presented in the reports are fully proven and not just wishful thinking.

Thermometers for the Secondary Laboratory.
We recommend the models 909 and 962 for the SPRT's in your Secondary Laboratory combined with the Standard Thermocouple model 1600.

Resistors and Measuring Instruments for the Secondary Laboratory.
The newly launched MicroK Precision Thermometer offers an unequalled combination of accuracy, stability and versatility. Supporting both resistance thermometers and thermocouples with accuracy to ±0.4ppm.

Automation and Scanning.
At Isotech we use and recommend our own 8 way Selector Switchs which can be manually or automatically switched between all 8 channels which can themselves be either Platinum thermometers or thermocouples.

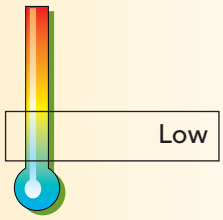
We also have software programs that can be used to control your Secondary Laboratory.

www.isotech.co.uk/secondary

Selection Guide

for the Secondary Laboratory

1. Comparison Baths



915 Parallel Tube Liquid Bath

Temperature range -65°C to 300°C, pages 7 - 10

Typical uncertainties of measurement ±0.0005°C over the complete temperature range of -65°C to 300°C. Wide temperature range using silicon oils and other liquids. All components in contact with liquid are 316 stainless steel. 7 litre capacity.

798 Hydra

Temperature range -80°C to 300°C, pages 11 - 13

Large depth of immersion, low vertical gradient, large working volume, 3 models available, calibrates thermocouples, thermistors and resistance thermometers. Variable flow rate.

820 Large Volume Liquid Calibration Bath

Temperature range 5°C to 200°C, page 15

Large volume for the calibration of a number of sensors. Wide temperature range of 30°C to 200°C. Ten page evaluation report available upon request. Good comparison accuracy ±0.01°C inside equalising block.

813 Stirred Ice Bath

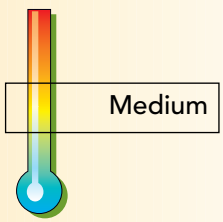
Temperature range 0°C, page 14

300mm depth of immersion. 0°C created by stirred ice/water mixture. Accuracy ±0.005°C absolute, ±0.001°C by comparison.

461 Simple Liquid N2 Apparatus

Temperature range -195.798°C, page 33

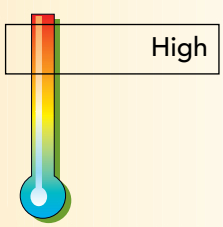
Typical ±.002°C temperature uniformity.
Four 8mm inside diameter wells as standard, others available to special order.



875 Fluidized Calibration Bath

Temperature range 50°C to 700°C, pages 16 - 17

Wide temperature range, high accuracy. Probably our most underestimated product. Absolute accuracy ±0.0005°C to ±0.004°C using Freeze Point Cells. Comparison calibration accuracy ±0.020°C to ±0.035°C at 660°C. No powder loss into the laboratory.



877 Thermocouple Calibration Facility

Temperature range 100°C to 1300°C, pages 18 - 19

For calibration of up to 15 thermocouples. Central zone of zero heat flux. Inserted radially thermocouple heads do not interfere.
Accuracy of ±0.25°C to ±0.1°C at 1000°C

Selection Guide

for the Secondary Laboratory

2. Fixed Points - POTTS

580 Oceanus-6

Temperature range 45°C below ambient to 110°C, pages 22 - 23

Automated calibration of Fixed Points, Ice/Water/Steam Bath, Metal Block Comparison Bath, Stirred Liquid Bath, Black Body Source, Surface Calibrator.

510 Medusa-1

Temperature range 30°C to 550°C, pages 24 - 25

Designed to create and maintain Fixed Points simply and economically. Can maintain Indium, Tin, Zinc and Lead Fixed Point Cells. Calibration of Fixed Points, Metal Block Comparison Bath.

520 Europa-6

Temperature range -45°C to 140°C, pages 26 - 27

Calibration of Fixed Points, Ice/Water/Steam Bath, Metal Block Comparison Bath, Stirred Liquid Bath, Black Body Source, Surface Calibrator.

426 Oberon

Temperature range 450°C to 1100°C, page 32

Calibration of Aluminium, Silver, Gold or Copper Fixed Points. Specially designed stress free isothermal heat-pipe providing a very low thermal gradient along the core working length.

3. Cells

Metal Clad Fixed Point Cells

Metal Clad Cells, see pages 28 - 29

Fixed Point Cells and Apparatus for Special Applications

Quartz Clad Slim Cells

Slim Fixed Point Cells, see pages 30 - 31

6N Quality (99.9999% purity)

4. Thermometers

SPRTs Model 909 - 25Ω / 100Ω working SPRTs
Model 962 - High Temperature SPRT (962°C), pages 34 - 36

Thermocouple Standard Thermocouple (to 1600°C), See page 37

5. Indicators

MicroK

Precision thermometer, see pages 38 - 40

High accuracy easy to use laboratory instrument for PRTs, SPRTs, thermometers and thermocouples

954 Selector Switch

True Temperature Indicator Selector Switch, see page 41

May be used with TTI1, TTI2, or TTI5

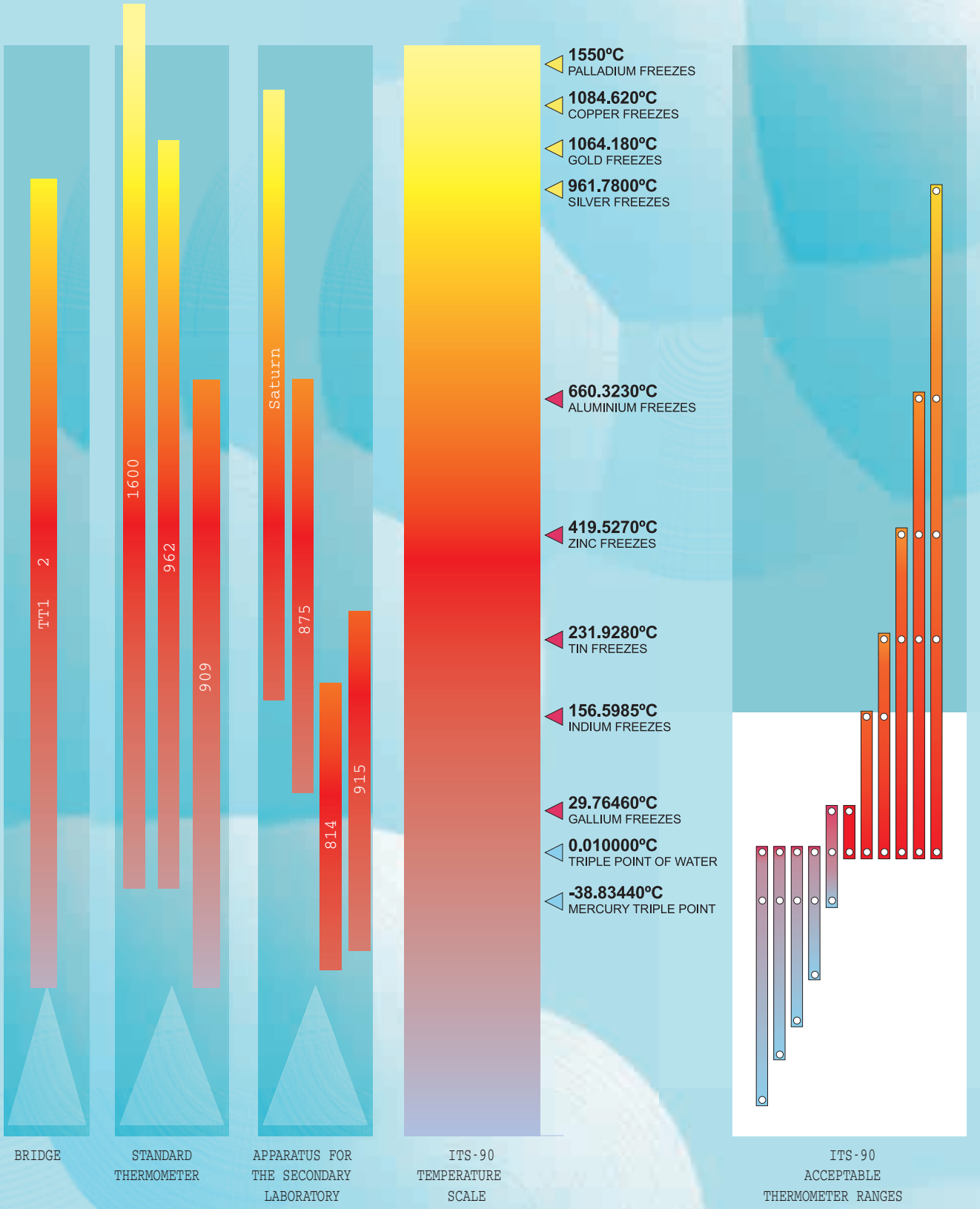
456 Fixed Resistors

Temperature Controlled Fixed Resistors, see page 42

The most precise and stable resistors available

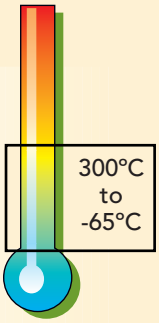
6. Software

see pages 43 - 46



915 Parallel Tube

Liquid Bath



The 915 is a stirred liquid bath, designed, refined and updated to meet CE standards, the 915 is, no question, the finest stirred liquid parallel tube bath produced.

Typical uncertainties of measurement are less than ±0.0005°C over the complete temperature range -65°C to +300°C.

915 PARALLEL TUBE LIQUID BATH

A full evaluation report is available upon request.

The Isotech Parallel Tube Liquid Bath is a development of the previous 815 model and has many features which enhance its performance and enable ease of operation. It is suitable for the calibration of Liquid in Glass thermometers, Industrial Platinum Resistance thermometers, Standard Platinum Resistance Thermometers, Thermocouples and Industrial Temperature sensors. It can also be used with fixed point cells.

The temperature range of the standard 915 liquid calibration bath (915H) is 40°C to 300°C. When the 915 is used in conjunction with our external chiller this temperature range can be extended from -65°C to 300°C, refer to model types available below.

The 915 has a wide temperature range using silicon oils and other suitable liquids. All components in contact with the liquid are of stainless steel and are insulated with materials which are completely safe in use. The 915 used in conjunction with a chiller, utilises the latest ozone friendly gases.

Liquids are circulated by a propeller which mixes and forces the liquid through a specially designed orifice in the rear of the two parallel tubes. A variable speed motor optimises the flow as the viscosity of the liquid changes. Below the orifice plate liquid is circulated over a mineral insulated heater and temperature sensors which control the temperature of the bath. The liquid flows up the calibration tube and weirs over the tube into a collection tray where it returns to the rear tube for recirculation. An angled side entry tube enables a refrigeration cooling probe to be inserted in the rear of the two parallel tubes.

The temperature controller has resolution from 0.01°C to 0.1°C which auto scales to suit the four digit display (all digits can be read with the Cal NotePad Software). The 915 is fitted with serial communications for interfacing to a PC as standard.

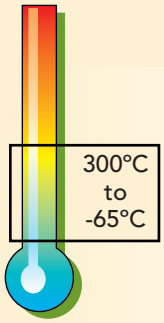
With the high cost of some silicon oils the 915's seven litre capacity makes it relatively inexpensive to fill compared to many other baths.

The changing of liquid is easily enabled by using the fitted drain. The design also allows for the expansion of liquids when being raised to a particular calibration temperature.

Model Types	915H Standard Unit, 915MWE supplied with chiller 915/10, 915 LW supplied with chiller 915/11
Temp Range	915H 5°C above ambient to 300°C 915MWE -30°C to 40°C 915LW -65°C to 40°C
Absolute	Using Fixed Point Cells ±0.0005°C Mercury Triple Point, Water Triple Point, Gallium Melt Point, Indium Freeze Point, Tin Freeze Point
Vertical Profile	At extreme temperatures ±0.003°C At close to ambient ±0.001°C
Temperature Stability by Comparison	Direct in Liquid ±0.001°C In Equalising Block ±0.0005°C
Communication	Supplied as standard with serial interface, PC adaptor cable and Cal NotePad. Refer to page 46
Liquid Capacity	Approximately 7 litres
Working Volume	100mm diameter by 400mm depth
Overall dimensions	Height 1020mm Width 580mm Depth 640mm
Weight	45kg approximately
Power	1kW (excluding Chiller) 108-130 or 208-240V, 50/60Hz
Installation	Via single phase supply
Safety	Variable set-point over-temperature trip. Automatic over-fill protection tube
How to Order	
	915H, 915MWE or 915LW Parallel Tube Liquid Bath
	Please specify voltage and frequency required

915 Parallel Tube

Liquid Bath



For customers who require lower temperatures the range of the 915 bath can be extended by the addition of a chiller unit, see photograph below and the chart of model types available.

The chiller unit's probe (203mm long by 32mm diameter) is inserted into the angled side entry tube, accessible from the top of the cabinet, leaving the calibration volume of the bath unchanged.

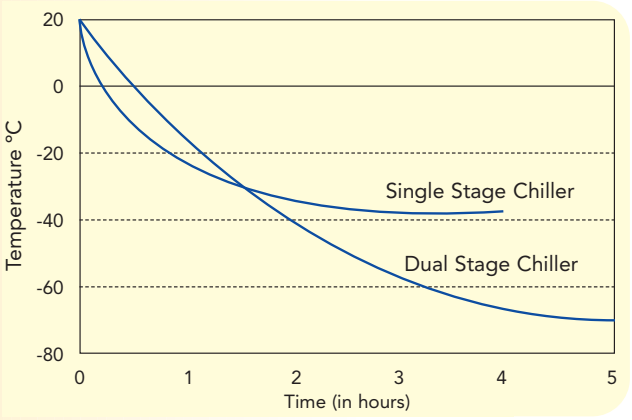
The following chiller options are available, we recommend and supply the following:

Order Code	Description	Temperature Range min/max	
915/10	Single Stage Wide Range Chiller	-30°C	40°C
915/11	Dual Stage Wide Range Chiller	-65°C	40°C

These chillers have both good reliability and wide operating ranges. They contain safe, ozone friendly gases.

The temperatures stated above assume an ambient within the range of 20°C to 25°C.

Single Stage and Dual Stage Chiller Cool Down Graph



Controller Note:

The controller includes features custom designed for Isotech by a world-leader in temperature control technology. Power feedback is used to stabilise against supply voltage changes, leading to greater stability. A digital filter circuit ensures high integrity of measurement correcting for drift, rejecting 50/60HZ pick-up and filtering out other sources of input noise. The four-digit display autoscales from 0.01° to 0.1°.

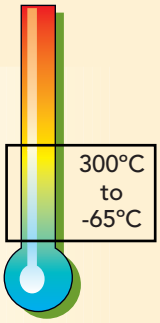
IMPORTANT
Chiller probes must be removed from the Calibration Bath when used above their maximum temperature as stated above.

HEALTH AND SAFETY NOTICE
Rooms in which high temperature liquids are used should be ventilated or have extraction facilities. Although the overall temperature range of the bath is -65°C to 300°C the practical temperature range which can be achieved is dictated by the liquid being used and the ambient temperature.

Accessories

915 Parallel Tube

Liquid Bath



ACCESSORIES
The following options are available:

915/01a Available for the Isotech parallel tube bath is a variable depth aluminium equalising block containing four drilled pockets 8mm diameter by 120mm deep in which temperature sensors can be placed and is suitable for use with silicon oils.

The equalising block is suspended centrally within the calibration tube and is easily removed.

915/01b As an alternative to the above a copper equalising block, dimensionally the same as 915/01a, may be supplied. This block is more suitable for use in water and other liquids.

915/D Increased depth Calibration Tube Assembly. Working volume is 100mm diameter by 530mm deep. This variant allows for the calibration of very long thermometers, typically the calibration of long liquid in glass thermometers. See also 915/02.

915/02 This assembly will hold up to 12 liquid in glass thermometers (maximum diameter 12.7mm) radially and a centre mounted standard sensor. The assembly may be rotated allowing systematic calibration. The assembly is designed for partial or full immersion of thermometers.

915/03 Monocular and Support. Useful for viewing and magnifying the liquid column within the thermometer being calibrated. This ancillary piece of equipment is used in conjunction with 915/02 Liquid in Glass Thermometer Support Kit.

915/05 Calibration Tube Cover. The cover consists of a square enclosure containing baffles and fits over the calibration tube area insulating the circulating liquid from ambient air. Access for temperature probes remains at the top of the enclosure. An equalising block may also be supported from this assembly. Maximum operating temperature 180°C.

915/07 Medium Temperature Silicon Oil. Temperature Range 40°C to 180°C.
Supplied in 9 litre containers. Flash Point 300°C.

915/08 High Temperature Silicon Oil. Temperature Range 150°C to 250°C.
Supplied in 9 litre containers. Flash Point 315°C.

915/09 Very High Temperature Silicon Oil. Temperature Range 40°C to 288°C.
Supplied in 2 x 5 litre containers. Flash Point 288°C.

915/E Hybrid Analog / Digital Controller available. Includes RS232 as standard, 0.01°C resolution over the full temperature range. Provides enhanced short term temperature stability.

NOTE: Read all safety information concerning liquids which you intend to use in the bath and use only approved liquids.

Fixed Point Calibration ITS-90 Cell Basket Assemblies (Excluding Cells)

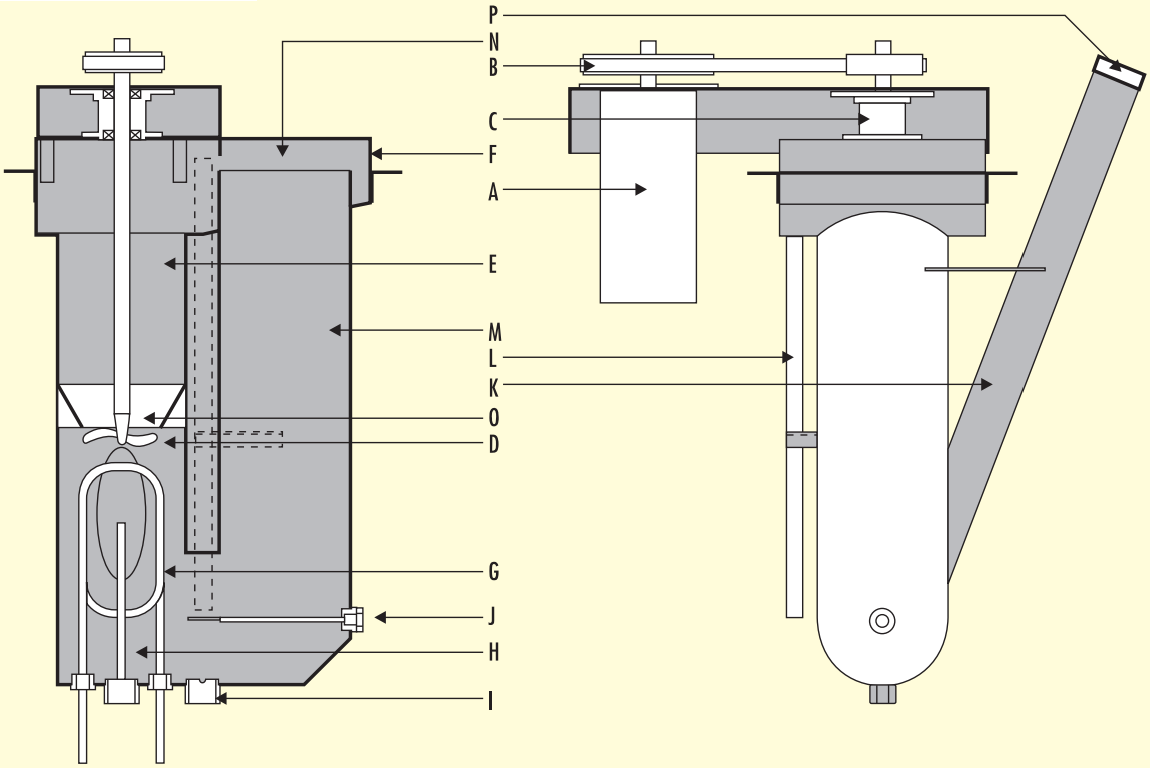
915-05-43	Small Mercury Cell Kit
915-05-44	Large Mercury Cell Kit
915-05-41	Small Water Triple Point Cell Kit
915-05-40	Large Water Triple Point Cell Kit
915-05-39	Small Gallium Cell Kit
915-05-38	Large Gallium Cell Kit
915-05-42	Slim Cell Kit

For information on Fixed Point Cells please refer to Databook One and pages 28 - 31 of this Databook.

915 Parallel Tube

Liquid Bath Schematic

915 PARALLEL TUBE LIQUID BATH DIAGRAMMATIC



915 CALIBRATION ASSEMBLY DEVELOPMENT, INFORMATION REFERENCE

A Motor (Low Voltage) Variable Speed Controlled.

B Drive Belt

C Bearing Housing

D Propeller

E Circular Mixing, Cooling and Heating Chamber. Circular Profile to prevent uncirculated pockets of liquid

F Large Volume Liquid Tray, which caters for the expansion of the liquid when heated

G Mineral Insulated Heater

H Over-Temperature Sensor

I Large Capacity Drain

J Control Sensor

K Cooling Probe Entry Tube, allowing total probe immersion. Intended for use with an external chiller unit

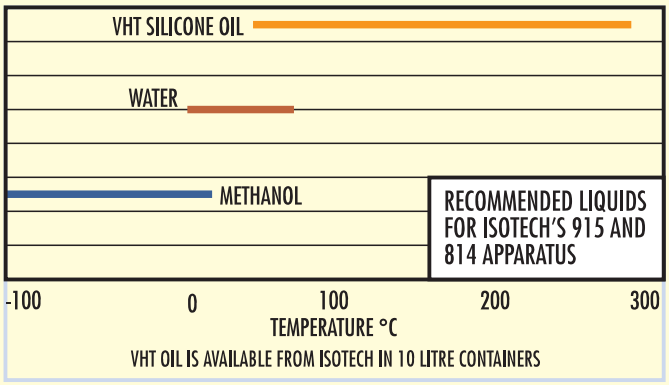
L Overflow Pipe

M Calibration Area

N Liquid Weir. An extension is available to enable the calibration of Mercury and Glass Thermometers

O Orifice Plate, increases the differential height of the liquid between front and rear tubes

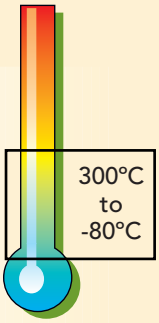
P Screw Cap. Fitted when cooling Probe is removed



Note: Methanol has serious health & safety problems. Consult safety documentation before use.

Hydra 798

Range of Stirred Liquid Baths



Precision calibration of thermometers calls for the use of stirred liquid calibration baths. The new Hydra models set new standards in terms of price to performance ratio. Now Calibration Engineers and Metrologists can choose from a range of baths that offer good immersion depth, parallel tube action, giving the best uniformity and smallest calibration uncertainties, and wide temperature ranges.

Hydra offers these features in a new price class, don't settle for a bath with shallow immersion or simple stirred action when with these Isotech baths provide good depth of immersion and good temperature uniformity along with the other benefits Isotech baths offer.

The immersion depth of 300mm allows the requirements of "Supplementary Information to the ITS-90" to be met. This publication from BIPM recommends immersion depths of 15 to 20cm from -50°C to 50°C, and from 20 to 27cm at 200°C. Many baths in this price range are simply not deep enough to meet this requirement. Rather than simply stirring a square tank of liquid the Hydra uses parallel tube action for superior temperature uniformity. Like other Isotech Liquid baths the calibration volume is cylindrical to suit thermometers, not a large square tank. The bath is filled with just 5 litres of liquid reducing filling and ongoing cost of ownership as liquids are replenished. The 798H and 798EHT feature a cooling coil which can be attached to an external source of either cold water or gas to further reduce cool down times.

Hydra benefits from Isotech's experience, it drains faster, is easier to use, is safer, and is more convenient. Accessories allow a wide range of thermometers, for example, to be readily clamped by the Sensor Support and ITS-90 fixed points cells are accommodated with the adjustable cell holder.

Key Features...

- Parallel Tube Action...
  Liquid flows up the rear volume of the bath and down the working volume. This action creates very small vertical and axial gradients. This gives the smallest overall uncertainties.
- Heating...
  All heating is outside the container. By using a large area nickel foil heater the complete bath wall is heated uniformly.
- Cooling...
  The cooling is built-in and also surrounds the calibration volume creating a low temperature ambient in which the heater can function efficiently.
- Wider Temperature Range...
  A unique cooling system cools the unit as well as enabling the bath to heat up to 125°C (121°C is a key sterilization temperature).
- Commercial Grade Chillers...
  The chillers are one third horse power commercial grade units, not cheaper domestic grade as used by some manufacturers.
- Stability...
  Better than ±0.01°C over the complete temperature range.
- Calibration Depth...
  Double the depth of some baths. The Hydra Range has up to 300mm depth of immersion.
- Circular Design...
  The circular design eliminates 'cold corners' found in tank shaped calibration baths.
- Fast Cool Down...
  The Hydra cools from ambient to -80°C in just 180 minutes.

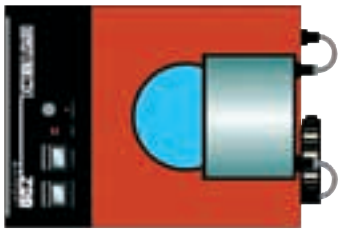
Good Immersion Depth, reducing stem conduction errors

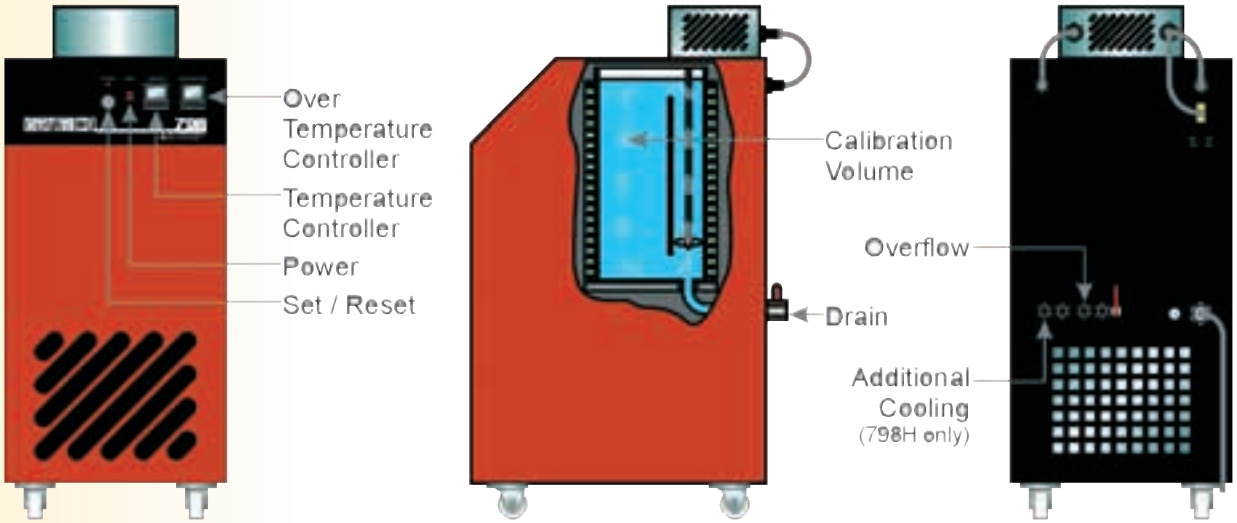
Parallel Tube Action, giving the best uniformity and smallest calibration uncertainties

Wide Temperature Ranges, -80°C to 300°C

Hydra 798

Range of Stirred Liquid Baths

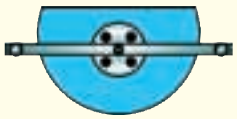
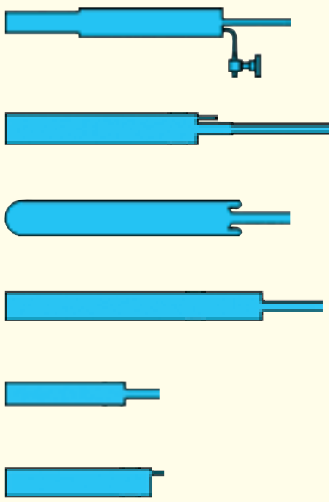




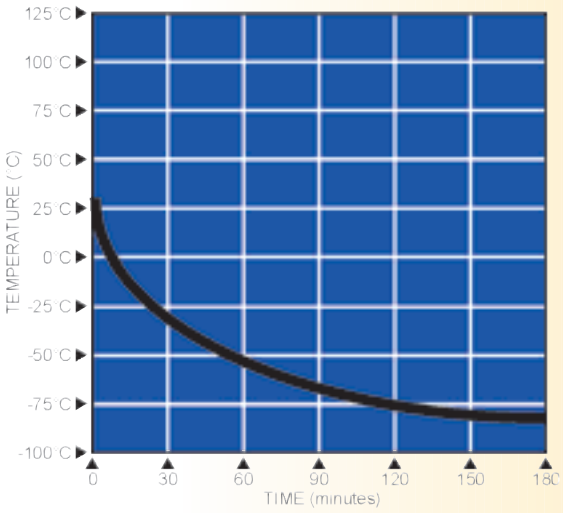
Model No.	HYDRA 798L	HYDRA 798M	HYDRA 798H	HYDRA 798EHT
Temperature Range	-80°C to 125°C	-40 C to 125°C	Ambient to 200°C	Ambient to 300°C
Volume	150mm Diameter, 300mm Deep, (5 Litres)			
Absolute Stability	±0.01°C	±0.01°C	±0.01°C	±0.01°C
Best Comparison Accuracy	±0.002°C	±0.002°C	±0.002°C	±0.002 to ±0.005°C
Communications	RS422 as standard			
Uniformity (125°C Oil)	Vertical 0.002°C, Horizontal 0.001°C to 0.0025°C			
Uniformity (200°C Oil)	Vertical 0.005°C, Horizontal 0.001°C to 0.0035°C			
Dimensions	405mm Wide, 610mm Deep, 940mm Tall (870mm to Top Panel)			
Safety	Compliant to CE Regulations			
Power	2.5KW 110V 50/60Hz or 230V 50/60Hz	1.5KW 110V 50/60Hz or 230V 50/60Hz	800W 110V 50/60Hz or 230V 50/60Hz	800W 110V 50/60Hz or 230V 50/60Hz
How to Order	**798L** Please state Voltage required. Please state Accessories required.	**798M** Please state Voltage required. Please state Accessories required.	**798H** Please state Voltage required. Please state Accessories required.	**798EHT** Please state Voltage required. Please state Accessories required.

Hydra 798

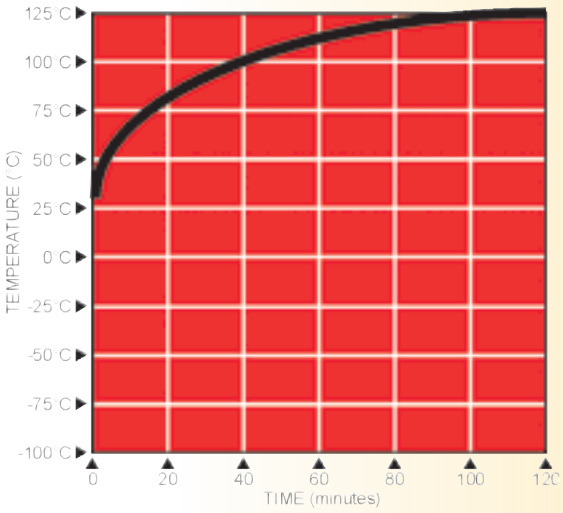
Range of Stirred Liquid Baths

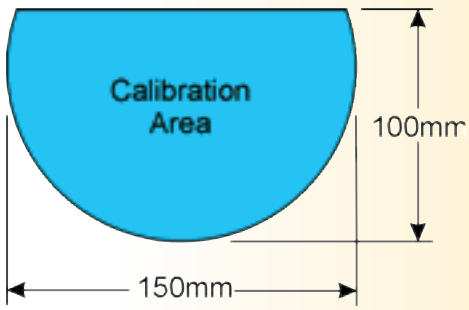
1. Lid 	798-05-01	Liquid Volume Lid *Included*
2. Equalizing Block 	798-05-02A	Aluminium Equalizing Block, 4 pockets, 8mm diameter, 160mm deep
	798-05-02B	Copper Equalizing Block, 4 pockets, 8mm diameter, 160mm deep
	798-05-02C	Special Aluminium Equalizing Block *To suit customer requirements.*
	798-05-02D	Special Copper Equalizing Block *To suit customer requirements.*
3. Dual Cell Holder 	798-05-03	Standard Dual Cell Holder *Includes interchangeable Cell adaptors*
4. Sensor Holder 	798-05-04	Standard Sensor Holder *Holds up to 12 sensors between 3mm diameter and 8mm diameter*
5. Fixed Point Cells 	463	Carbon Dioxide Triple Point Cell *-56.602°C*
	17724	Mercury Triple Point Cell *-38.8344°C*
	B12	Water Triple Point Cell *0.01°C*
	17401	Gallium Melt Point Cell *29.7646°C*
	17401M	Slim Gallium Melt Point Cell *29.7646°C*
	17668M	Indium Freeze Point Cell *156.5985°C*

Cool Down Graph...

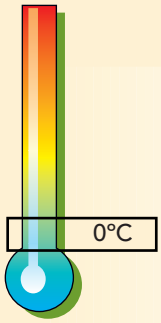


Warm Up Graph...





813 Stirred Ice Bath



The most used temperature for calibration is 0°C.

The normal way of creating 0°C is via a mixture of ice and water in a Dewar Flask.

However, this can give errors of up to 4°C because water is densest at 4°C and so as the ice melts the temperatures at the bottom of the flask can rise to 4°C.

In the design of the ice flask offered by Isothermal Technology Ltd., these problems have been eliminated by stirring the water/ice mixture and segregating the ice from the water in the measuring zone.

This stirred ice/water bath is designed and built according to National Laboratory recommendations.

Using demineralised water, accuracies of ±0.005K are obtainable. Typically the bath will last for 4 hours before recharging with ice.

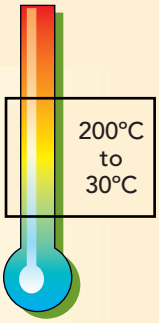
The ice is contained around and below the compartment where up to 4 probes can be placed for calibration or referencing purposes.

An option permits a water triple point cell to be maintained within the stirred ice bath. See pages 30 - 31 for more details.

Model No.	813
Accuracy using Demineralised water	0°C ±0.005K
Capacity	8 litres (approx.)
Depth of immersion	350 mm
Accuracy using comparison techniques	±0.001°C
Power	50W, 108-130 or 208-240VAC, 50/60Hz
Dimensions	Height 580 mm Width 420 mm (including handle) Depth 250 mm
Weight	15 kgs
Options	
814/01b	Copper Equalising Block
814/02	Mercury Thermometer Support Kit
814-06-02	Small Water Triple Point Cell Kit
How to Order	
	813 Stirred Ice Bath
	Please specify voltage required

350 mm depth of immersion
0°C created by stirred Ice/water mixture
Accuracy ±0.005°C absolute, ±0.001°C comparison

820 Large Volume Liquid Calibration Bath



If you have a large number of sensors to calibrate then this new economically priced stirred liquid bath is the solution.

The Aquarium bath has been introduced to provide a liquid calibration bath with a large volume. This is to allow the bath to be used with many temperature probes simultaneously immersed in the bath or with accessories it may be used to maintain standard resistors at a constant temperature.

The liquid in the bath is heated to the set temperature and circulated by a propeller system.

The Aquarium is of robust construction and the liquid is contained in a stainless steel insulated enclosure which has a calibration volume 185mm long x 140mm wide x 300mm deep.

Controller Note:

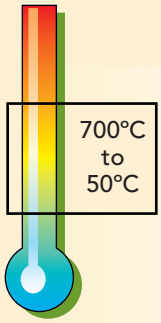
The controller includes features custom designed for Isotech by a world-leader in temperature control technology. Power feedback is used to stabilise against supply voltage changes, leading to greater stability. A digital filter circuit ensures high integrity of measurement correcting for drift, rejecting 50/60HZ pick-up and filtering out other sources of input noise. The four-digit display autoscales from 0.01° to 0.1°.

Large volume for the calibration of a number of sensors,
Wide temperature range 30°C to 200°C, 10 page evaluation report on request,
Good comparison accuracy ±0.01°C inside equalising block

Model No.	820
Accuracy	Better than ±0.01°C by comparison in equalising block
Temperature range	Ambient +5°C to 200°C
Available calibration volume	185mm x 140mm x 300mm
Capacity	Approximately 15 litres
Maximum depth of immersion	300mm
Power	1000W 108-130 or 208-240VAC, 50/60Hz
Performance summary	Please ask for the 10 page full evaluation
Communications	Supplied as standard with serial interface, PC adaptor cable and Cal NotePad, See page 46
Recommended liquids	Water to 90°C, Silicon Oil to 200°C Oil for standard resistors
Dimensions	Height 645mm Overall Width 240mm Depth 378mm
Weight	17 kg
Options	
820/01	Standard Resistor Holder
820/02	Standard Aluminium Equalising Block
820/02S	Special Drilling Equalising Block
915/07	Medium Viscosity Oil 40°C to 180°C
915/08	High Viscosity Oil 150°C to 250°C
915/09	VH Temperature Oil 50°C to 288°C
932-19-72	Standard Resistor Oil
How to Order	
	820 Large Volume Liquid Calibration Bath
	Please specify voltage required

875 Fluidized

Calibration Bath



The Isotech fluidised calibration bath out performs dangerous salt baths in all respects: wider temperature range, less hazardous and better uncertainties. The Isothermal Technology Limited patented fluidized bath is the result of 20 years research and development into flow patterns, powder technology and filtration. Recent developments have enabled the baths facilities to be extended even further, it is now eminently suitable for Liquid in glass thermometer calibration. To achieve this the filter and exhaust system were re-designed to cope with the increased level of powder needed for Liquid in glass thermometer calibration.

The result is a calibration system to national standards. The performance is only matched by heat pipe technology. The profiles are so small that the bath has been used by National Laboratories for fixed points of Indium through Aluminium, with great success. In comparison mode 2 sigma uncertainties of ±0.020°C at 300°C and ±0.035°C at 660°C can be obtained.

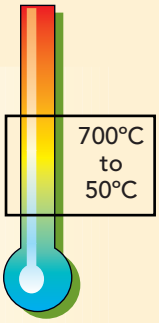
This is the only product capable of covering a very wide temperature range without a change of thermal media. Like most fluidized bed baths, the 875 bath consists of a container of aluminium oxide powder with a porous baseplate. Sufficient air is passed through the baseplate to motivate the powder into a fluid like state so that it will flow, display buoyancy effects and have good heat transfer characteristics.

A disadvantage of many fluidized-bed baths is that good temperature stability and uniformity cannot be achieved in the fluidized medium itself. They are obtained by using large metal blocks or by inhibiting the fluidising action in the powder around the workpiece - either locally, or by completely collapsing the bed at the required temperature, this is not the case with the 875. A full evaluation report is available upon request.

Wide temperature range, High Accuracy,
Absolute ±0.0005 to ±0.004°C using Freeze Point Cells.
Comparison Calibration
±0.020 to ±0.035°C at 660°C,
No powder loss into the Laboratory

Model No.	875
Temperature Range	50°C to 700°C
Accuracy	Absolute ±0.0005 to ± 0.004 using freeze point cells ±0.020°C to ±0.035°C at 660°C using comparison calibration
Working Volume	67mm diameter 475mm deep } using 875/02
Heaters	3 x 1 kW
Power	3kw, 208-240VAC, 50/60Hz
Warm Up Time	From 50°C to 700°C, 240 minutes
Supply Air Pressure	Less than 1 BAR 100 litres/minute max
Communications	Supplied as standard with serial interface, PC adaptor cable and Cal Notpad, see page 46
Safety	Safety melting fuse. Blocked filter cut-out Low flow indication. Elapsed time indication. Over pressure diaphragm
Installation	Via single phase supply
Dimensions	Height (overall) 1570mm Height (To top of body) 880mm Depth 640mm Width 580mm
Weight	Fluidising Medium 22kgs Overall Approx. 85kgs
How to Order	
Model 875	Fluidized Calibration Bath

875 Fluidized
Calibration Bath



ACCESSORIES
The following options are available:

875/01 Equalising block & calibration tubes consisting of a large mass aluminium bronze block drilled with one perpendicular and 4 angled holes to accept 500mm long stainless steel calibration tubes, each with an inside diameter of 7.6mm. The angled tubes allow for the larger diameter of the sensor heads.

875/02 Calibration Tube. As fitted as standard. This enables a calibration volume of 67mm inside diameter and 475mm deep.
This calibration tube is supplied and fitted as standard.

875/03 Compressor and connecting tube. Used to supply air to the fluidized bed where an independent air supply is not available within the laboratory.

875/04 Alumina powder specifically chosen for this application, supplied in a 25kg container.

875/06 Liquid in Glass Thermometer Support Gantry System consisting of a multi-tube probe holder with ten 10.80mm by 470mm deep pockets, four support pillars and an adjustable stainless steel gantry with holes corresponding to the probe holder, to locate up to ten thermometers simultaneously.
Thermometer collars and 'O' rings (10 off) are included with the assembly.

875/07 The multi-tube probe holder, described under 875/06 is available separately upon request.

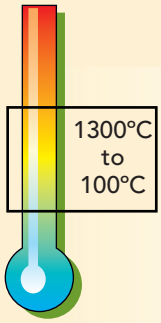
875/08 Monocular and Support. Useful for viewing and magnifying the liquid column within the thermometer being calibrated. This ancillary piece of equipment is used in conjunction with 875/06 Liquid in Glass Thermometer Support Gantry System.

Note: The bath is fully commissioned, tested and charged with the correct amount of aluminium oxide powder before despatch.

Accessories

877 Thermocouple Calibration

Facility



The Saturn comprises a number of concentric shells. The outer shell of spun metal is for containment and support. Inside this is a layer of ceramic fibre. Within the fibre is a ceramic spherical mantle containing the heater windings. In the centre of the furnace is a solid cast ceramic sphere with 8 or 16 tubes, to be used for the thermocouples requiring calibration.

Isotech's calibration furnace is revolutionary from a number of aspects:-

It is spherical, and its design ensures a central zone of constant temperature.

Thermocouples are inserted around the circumference of the furnace. When fully inserted the measuring junctions are within a few millimetres of each other at the centre of the sphere.

Up to 14 thermocouples can be calibrated simultaneously. The accuracy is between ±0.25°C and ±0.1°C at 1000°C.

Larger tube diameters will give larger gradients, as will larger numbers of tubes. The precision of this furnace has previously been achieved only by using heat pipes.

Because of the design the price is only one half to one third that of a bath with comparable accuracy and much smaller capacity of calibration.

The use of newly developed modern ceramic materials has enabled high accuracy, low mass and high stability to be obtained. The Saturn system will not contaminate your thermocouples unlike some furnaces that have metal equalising blocks.

Model No.	877
Temperature Range	100°C to 1300°C
Number of Calibration Points	8 as standard 16 to special requirements
Diameter of Sensors	4 x 6mm + 4 x 8mm
Depth of immersion	180mm
Accuracy	±0.25°C to ±0.1°C at 1000°C (using comparison techniques.)
Warm-up times*	1 hour to 700°C 3 hours to 1300°C
Stabilisation time*	1 hour to ±0.25°C
Communications	Supplied as standard with senal interface. PC adaptor cable, and Cal NotePad, see page 46
Power	3kw, 208-240VAC, 50/60Hz 3kw, 115VAC, 50/60Hz
Dimensions	425 mm Diameter
Weight	25 kgs

* These times may increase as the windings age or if the supply voltage is low.

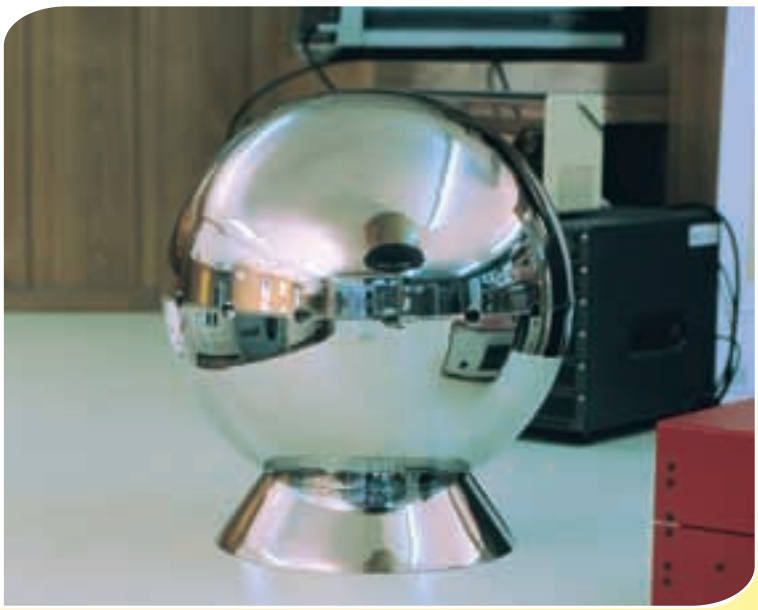
Options	
877/01	Equalising Block 4 x 8mm + 4 x 6mm i.d. (standard)
877/01S	Equalising Block 16 x 6mm (special)
877/01E	Equalising Block – Other configurations (consult Isotech)
877/02	Platinum Foil Temperature Barrier

How to Order	
	877 Thermocouple Calibration Facility including Standard Equalising Block
	Please specify voltage required

Controller Note:
The controller includes features custom designed for Isotech by a world leader in temperature control technology. Power feedback is used to stabilise against supply voltage changes, leading to greater stability. A digital filter circuit ensures high integrity of measurement correcting for drift, rejecting 50/60HZ pick-up and filtering out other sources of input noise.

Hint:
Please advise supply voltage with order so we can ensure 3kW is realised with your supply. 208V, 220V, 240V operation is recommended to keep the current requirement manageable, 115V available to special order.

Fast calibration of up to 14 thermocouples, Central zone of zero heat flux. Inserted radially thermocouple heads do not interfere. Accuracy ±0.25°C at 1000°C



877 Thermocouple Calibration Facility

Each thermocouple is completely isolated in a gas tight closed end tube to prevent any contamination problems during calibration.

Normally the windings will require replacing after a few years of operating (dependent on work cycle) and so the furnace has been designed with ease of maintenance in mind. A spare set of windings is provided free with each furnace, as is a comprehensive handbook.

OPTIONS

To special order, the following options are available, please contact Isotech for details.

1. 16 Thermocouple Inserts. Because of the extra thermal mass involved in offering this option, an extra 30 minutes should be allowed for full stabilisation.
2. Larger Thermocouple Inserts. Inserts of up to 10mm (0.4 inches) diameter can be accommodated in the furnace. Please consult Isotech.
3. Platinum wrap can be fitted. Isotech wrap the insert of the Saturn in Platinum foil. Reducing the gradient at 1000°C to an unmeasurable value (less than 1µV difference from 2 type R Thermocouples).
4. Blackbody Option. Please refer to databook 4.

Hint:

Spherical furnaces are normally supplied 240 Volts, 50 Hz, 3 Kw with 8 sensor insertion points, one of which is used to house the control thermocouple. Eight tubes with a nominal internal diameter of 6 mm have been found to give a very good and stable performance. It is the configuration around which the specification has been written.

Blackbody Option

Thermocouple Calibration

Points on the Temperature Scale (P.O.T.T.S.)

Unit	Temperature Range	Cells	Internal Timer	Sensor Included
Europa-6	***-45°C to +140°C**	**Hg, H_2O, Ga**	**No**	**935-14-82**
Oceanus-6	***-25°C to +110°C**	**H_2O, Ga**	**Yes**	**935-14-85**
Medusa	**+30°C to +550°C**	**Ga, In, Sn, Pb, Zn**	**Yes**	**935-14-95**
Oberon	**+450°C to +1100°C**	**Al, Ag, Cu**	**No**	**None**

***In an ambient of 20°C**

P.O.T.T.S are primarily designed for the maintenance of slim cells. The unit is automatically switched on some 2 to 3 hours before the working day starts and gets the cell onto its melt plateau. The indicator tells the user on their arrival in the morning that the melt has begun and calibration can commence.

If left unused the melt continues for 6 to 12 hours and during the night the timer switches the apparatus off to re-freeze the cell, the cycle is repeated each day, giving the user the fixed point all day, every day without attention.

The P.O.T.T.S works by having a controller which is set about 1°C above the fixed point which is inside the apparatus. If it is fitted with a timer the unit can be set to switch on and off automatically.

Note: The exceptions are the Europa-6 and Oberon which do not have a built-in timer. An external timer can be fitted to the Europa-6 or Oberon. Please contact Isotech for further details.

The P.O.T.T.S. range of baths will meet all your temperature calibration needs from a metal block bath to an ITS-90 fixed point apparatus.

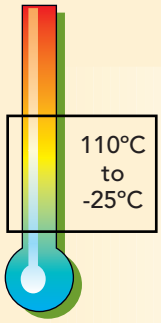
The P.O.T.T.S. range are all available with optional kits allowing the bath to be used in a variety of applications, making these the most flexible calibration baths available.

1. A Metal Block Bath
2. A Stirred Liquid Bath
3. A Stirred Ice / Water Bath
4. A Black Body Source
5. A Surface Sensor Calibrator
6. An ITS-90 Fixed Point Apparatus

580 Oceanus-6

P.O.T.T.S.

POINTS ON THE TEMPERATURE SCALE



The multi-functions of the OCEANUS-6 is a unique concept from Isotech, so unique that it is currently the subject of a patent application.

The OCEANUS-6 is a complete calibration laboratory working over the temperature range 45°C below ambient temperature to +110°C. It permits the calibration of temperature sensors absolutely (at fixed points of the ITS-90 scale) or by comparison to a reference standard.

It will calibrate both contact and non-contact thermometers such as optical pyrometers, surface sensors, liquid in glass thermometers as well as thermistors, thermocouples and resistance thermometers, whether they are short, long or odd shaped. Further it permits maintenance of reference standards by confirming the Ice or Water triple point at regular intervals.

The OCEANUS-6 has a calibration volume of 52mm diameter and 300mm deep and is supplied with the very latest technology digital indicator, timer and controller making the OCEANUS-6 a complete self-contained calibration laboratory.

The OCEANUS-6 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).

Model No.	580
Temperature Range	45°C below ambient to +110°C
Absolute minimum temperature	-45°C
Absolute stabilities over	30 minutes:
Metal Block Bath	±0.03°C
Stirred Liquid Bath	±0.025°C
Ice/Water Bath	±0.001°C
Black Body Source	±0.3°C
Surface Sensor Calibrator	±0.5°C
ITS-90 Fixed Point Apparatus	±0.0002°C
Heating / Cooling	See Graph
Stabilisation Times	10 minutes
Calibration Volume	52 dia x 300mm deep
Uniformity	±0.018°C
Controller Resolution	0.1 to 0.01 (4 digit display)
Indicator Resolution	0.1 to 0.01 (4 digit display)
Indicator Units	°C, °F, K
Communications	Supplied as standard with serial interface, PC adaptor cable and Cal Notepad. Refer to page 46
Power	300W, 108-130 or 208-240 VAC, 50/60Hz
Overall dimensions	Height 430mm Width 310mm Depth 300mm
Weight	17kg
How to order	
	580 Oceanus-6 P.O.T.T.S.
	Please specify voltage required

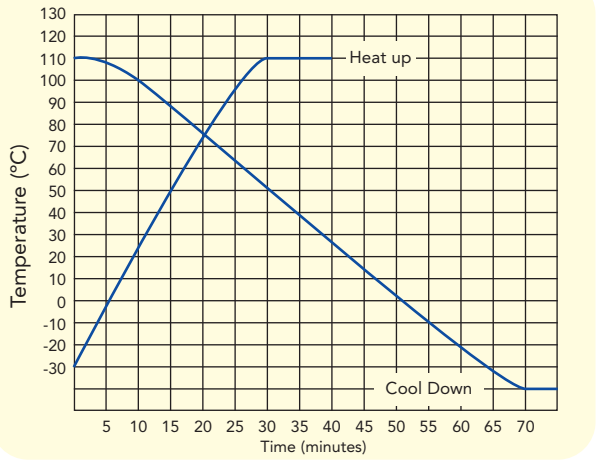
Automated Calibration using Fixed Point Cells. Temperature range 45°C below ambient to +110°C. Calibrate absolutely at the fixed points of ITS-90 or by comparison

POINTS ON THE TEMPERATURE SCALE

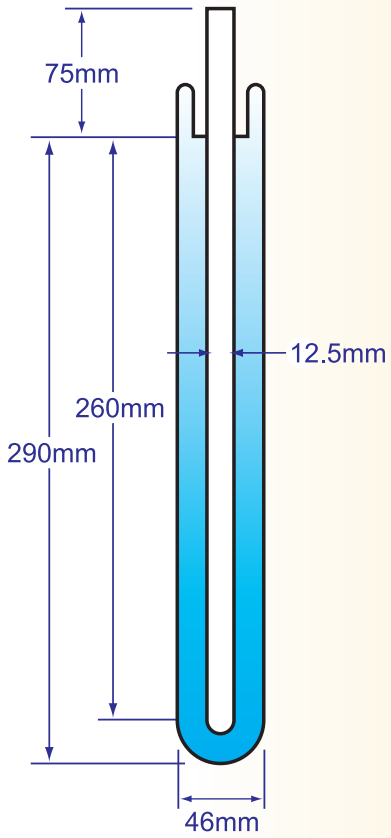
580 Oceanus-6

P.O.T.T.S.

Oceanus-6 Heat Up / Cool Down Graph



Type B-12
Water Triple Point Cell

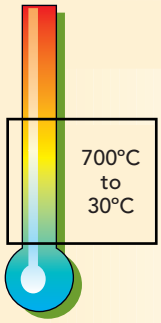


Metal Clad Cell

Options	
Metal Block Bath	Standard Insert 6 x 8mm holes x 250mm deep. Adjustable Equalising Block Non-standard Insert - please consult Isotech
Stirred Liquid Bath	Stirred Liquid Container (For alcohols, water & oils) C20 Oil (ambient to +150°C) 1L required Liquid in Glass Thermometer Support kit
Stirred Ice/Water Bath	Stirred Liquid Container (For alcohols, water & oils) Liquid in Glass Thermometer Support kit
Blackbody Source	Blackbody Target
Surface Sensor Calibrator	Surface Sensor Calibrator Kit
ITS-90 Fixed Point	Large B12 Water Triple Point Cell
	Large ITL M 17401 Gallium Melting Point Cell
Additional accessories	
	935-14-85 Semi-Standard Probe
	931-22-58 Carrying Case
	UKAS 5 Point Comparison Calibration

510 Medusa & 511 Medusa 3

Dry Block Calibrator



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 then the earlier Dry Blocks in this databook but have higher capacities and retain outstanding temperature uniformity, this uniformity is so good that these larger products are also featured in DataBook 2 as apparatus for Secondary Laboratories to realize the Fixed Points of ITS-90.

Medusa 510 has a maximum operating temperature of 550°C. The Medusa 3 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.

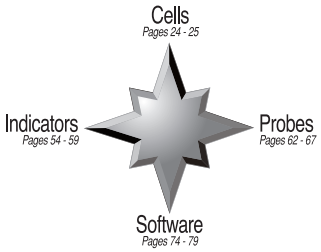
For Comparison Calibration the MedusaPLUS should be used with an insert, the standard insert has six 8mm pockets 250mm deep. Also available is an insert 44mm diameter x 170mm deep which is suspended from the top of the block so that the height is user adjustable. For flexibility the MedusaPLUS can also be used with accessories for infrared thermometers and surface sensors. The MedusaPLUS 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 MedusaPLUS 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.

New in the S model is 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.

New ! The Site model can now be used with the supplied Cal NotePad software to test thermostats.



Fixed Point Cells Available

Material	*Temperature*	*Uncertainty*
Gallium	29.7646°C	±0.001°C
Indium	156.5985°C	±0.001°C
Tin	231.928°C	±0.002°C
Lead	327.462°C	±0.010°C
Zinc	419.527°C	±0.005°C
Aluminium	660.323°C	±0.010°C

Key Features

- **High Capacity Deep Block**
  45mm diameter x 285mm Deep.
- **Use for Comparison and Fixed Point Calibration.**
- **Use with very long thermometers.**

510 Medusa & 511 Medusa 3

Dry Block Calibrator

Options

510 Metal Block Insert 	510-06-01	Standard Insert *Included*
	510-06-02	Blank Insert *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 *Insert without pockets for local machining*
	511-06-03	Special Insert *Contact Isotech with your requirements*
	511-06-04	Adjustable Equalising Block

510 Blackbody Kit	510-06-05	Includes a Blackbody target and Sensor
511 Blackbody Kit	511-06-05	Includes a Blackbody target and Sensor

510 Surface Sensor Kit	510-06-06	Includes an insert and angled thermocouple
511 Surface Sensor Kit	511-06-06	Includes an insert and angled thermocouple

ITS-90 Fixed Points	ITL17401M	Gallium Slim Cell (510 only)
	ITL17668M	Indium Slim Cell
	ITL17669M	Tin Slim Cell
	ITL17670M	Lead Slim Cell
	ITL17671M	Zinc Slim Cell
	ITL17672M	Slim Aluminium Cell (511 only)
		Slim Cell Holder

UKAS Calibration	UKAS Calibration available to Order

Standard Probe	935-14-95	Platinum Resistance Thermometer for use up to 650°C

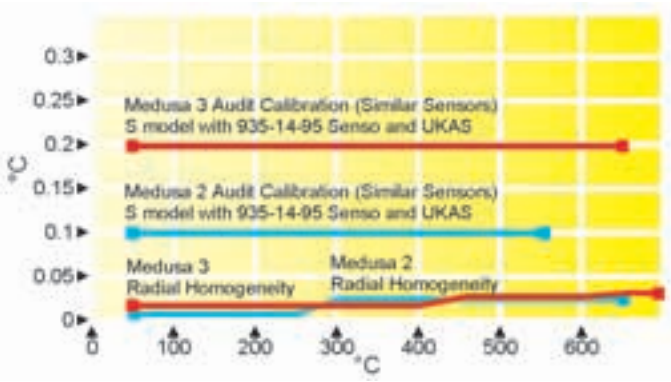
Carrying Case	931-22-58	Sturdy case accommodates the unit with room for accessories

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."

510 Medusa^{PLUS} Performance



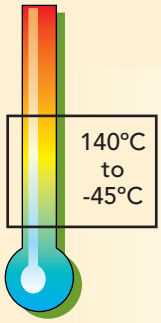
For Evaluation Reports, Uncertainty Budgets and Calculations with regard to EA 10-13 UKAS etc, please contact Isotech - also http://www.isotech.co.uk/refer.html

Model No.	510 MEDUSA^{PLUS}	511 MEDUSA 3
Temperature Range	30°C to 550°C	50°C to 700°C
Absolute stability over 30 minutes	Metal Block Bath ±0.03°C Blackbody Source ±0.1°C Surface Sensor Calibrator ±0.5°C ITS-90 Fixed Point ±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	°C, °F, K
Power	100 to 120V (50 / 60 Hz) or 200 to 240V (50 / 60 Hz) 1000 Watts	108 to 130V (50 / 60Hz) or 208 to 240V (50 / 60Hz) 1800 Watts
Overall dimensions	Height 430mm Width 310mm Depth 300mm	Height 430mm Width 310mm Depth 300mm
Weight	17kg	25kg
How to Order	510 Medusa^{PLUS} or 511 Medusa 3 Please specify model type required Please specify voltage required Please specify options required	

520 Europa-6

P.O.T.T.S.

POINTS ON THE TEMPERATURE SCALE



The multi-functions of the EUROPA-6 is a unique concept from Isotech, so unique that it is currently the subject of a patent application.

The EUROPA-6 is a complete calibration laboratory working over the temperature range 65°C below ambient temperature to +140°C. It permits the calibration of temperature sensors absolutely (at fixed points of the ITS-90 scale) or by comparison to a reference standard.

It will calibrate both contact and non-contact thermometers such as optical pyrometers, surface sensors, as well as thermistors, thermocouples and resistance thermometers, whether they are short, long or odd shaped. Further it permits maintenance of reference standards by confirming the Water triple point at regular intervals.

The EUROPA-6 has a calibration volume of 35mm diameter by 160mm deep and is supplied with the very latest technology digital indicator and controller making the EUROPA-6 a complete self-contained calibration laboratory.

The EUROPA-6 offers unprecedented accuracies of 0.001°C (2 Sigma) at the Water triple point and the Gallium melt temperature of 29.7646°C and the Mercury Triple Point of -38.8344°C.

Model No.	520
Temperature Range	65°C below ambient to +140°C
Absolute minimum temperature	-45°C
Absolute stabilities Metal Block Bath Stirred Liquid Bath Ice/Water Bath Black Body Source Surface Sensor Calibrator ITS-90 Fixed Point	over 30 minutes: ±0.03°C ±0.025°C ±0.001°C ±0.3°C ±0.5°C ±0.001°C
Heating / Cooling	See Graph
Stabilisation Times	10 minutes
Calibration volume	35mm diameter x 160mm deep
Uniformity	±0.018°C
Controller Resolution	0.1 to 0.01 (4 digit display)
Indicator Resolution	0.1 to 0.01 (4 digit display)
Indicator Units	°C, °F, K
Communications	Supplied as standard with serial interface, PC adaptor cable and Cal Notepad. Refer to page 46
Power	300W, 108-130 or 208-240VAC, 50/60Hz
Overall dimensions	Height 322mm Width 176mm Depth 262mm
Weight	14kg
How to order	
	520 Europa-6 P.O.T.T.S.
	Please specify voltage required

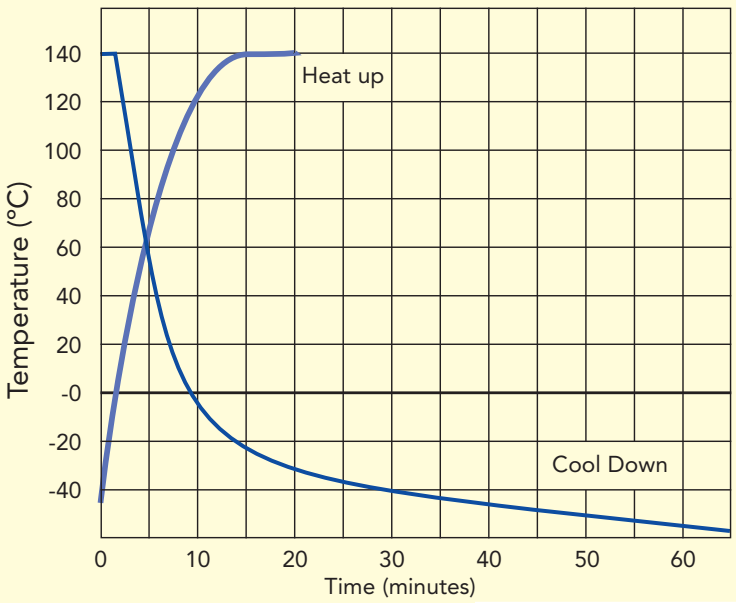
P.O.T.T.S. 520 Europa-6

POINTS ON THE TEMPERATURE SCALE

520 Europa-6

P.O.T.T.S.

EUROPA-6 Heat Up / Cool Down GRAPH with insert fitted



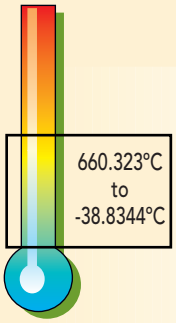
Metal Clad Slim Cell

Options	
Metal Block Bath	Standard Insert 2 x 4.5 mm, 2 x 6.4 mm, 1 x 8 mm and 1 x 9.5 mm holes x 155 mm deep. Non-standard Insert - please consult Isotech
Stirred Liquid Bath	Stirred Liquid Container (For alcohols, water & oil) C20 Oil (ambient to +150°C) 0.1 litre required Liquid in Glass Thermometer Support kit
Stirred Ice/Water Bath	Stirred Liquid Container (For alcohols, water & oil) Liquid in Glass Thermometer Support kit
Blackbody Source	Blackbody Target
Surface Sensor Calibrator	Surface Sensor Calibrator Kit
ITS-90 Fixed Point	ITL M 17724M Slim Triple Point of Mercury Cell ITL M 17401M Slim Gallium Melting Point Cell B8 Slim Triple Point of Water Cell
Additional accessories	
	935-14-82 Semi-Standard Probe
	931-22-27 Carrying Case
	UKAS 5 Point Comparison Calibration

Metal Clad

Fixed Point Cells

POINTS ON THE TEMPERATURE SCALE



In the practical world of industrial temperature measurement, a large number of laboratories who normally make comparison calibrations need 1 or 2 fixed points to monitor their Standard Platinum Resistance Thermometers, or would like to calibrate shorter thermometers than the larger cells and apparatus can accept. For this group of users Isothermal Technology Limited have introduced Metal Clad Fixed Point Cells.

The special requirements of immersion depth, plateau duration, etc. required for the calibration of SPRT's may not be necessary in laboratories charged with calibrating industrial resistance thermometers, thermocouples and thermistors, but mobility and cost may be more important. Metal Clad Cells is a name given to another category of cell, being somewhat slimmer, slightly shorter and lower in price than the standard varieties. Metal Clad Cells are built using the same materials, techniques and purity of metal as the larger cells, but the uncertainties associated with them are somewhat larger, not because of the cells but precisely because their properties cannot be measured with SPRTs and transfer thermometers must be employed in qualifying them.

In consequence of their smaller size, small, lighter-weight apparatus (bench-top or cart-mounted furnaces) may be used to melt and freeze the metal in these cells. Sealed cells and associated apparatus, such as the Model 510 - Medusa and Model 580 - Oceanus-6, are available from Isotech.

Metal Clad Fixed Point Cells are available with a UKAS Certificate at an additional cost, see databook 5.

Features

- Fixed Point Cells and Apparatus for Special Applications
- Shorter for the Calibration of Industrial Sensors
- Economic
- More compact

Options	
510-05-00	Inconel Basket including insulators for use With Medusa 510
426-04-00	Inconel Basket including insulators for use With Oberon 426

How to Order	
	ITL M 17724M Mercury Metal Clad Slim Cell
	ITL M 17401M Gallium Metal Clad Slim Cell
	ITL M 17668M Indium Metal Clad Slim Cell
	ITL M 17669M Tin Metal Clad Slim Cell
	ITL M 17671M Zinc Metal Clad Slim Cell
	ITL M 17672M Aluminium Metal Clad Slim Cell

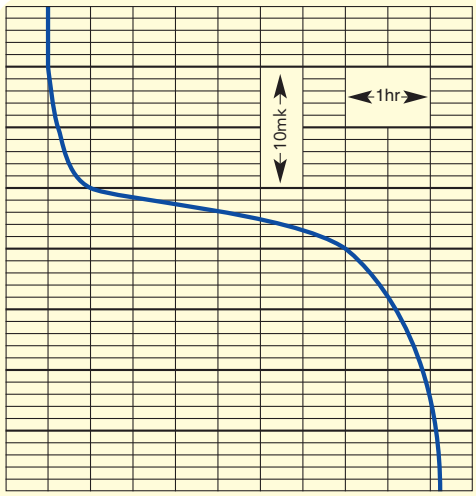
Metal Clad Fixed Point Cell shown with an Isotech Semi-Standard Platinum Resistance Thermometer

Metal Clad Cells

Cell	Type	Diameter OD/ ID	Length (mm) Overall / Main Body / Immersed (±10mm)	Temperature °C	Uncertainty °C	P.O.T.T.S. Apparatus
Mercury	TP	35/10	375/140/130	-38.8344	±0.001	Europa-6
Gallium	MP	31/10	200/155/140	29.7646	±0.001	Oceanus-6
Indium	MP	42/7.5-8	220/190/140	156.5985	±0.001	Medusa
Tin	MP	42/7.5-8	220/190/140	231.928	±0.002	Medusa
Zinc	MP	42/7.5-8	220/190/140	419.527	±0.005	Medusa
Aluminium	MP	42/7.5-8	220/190/140	660.323	±0.020	Oberon

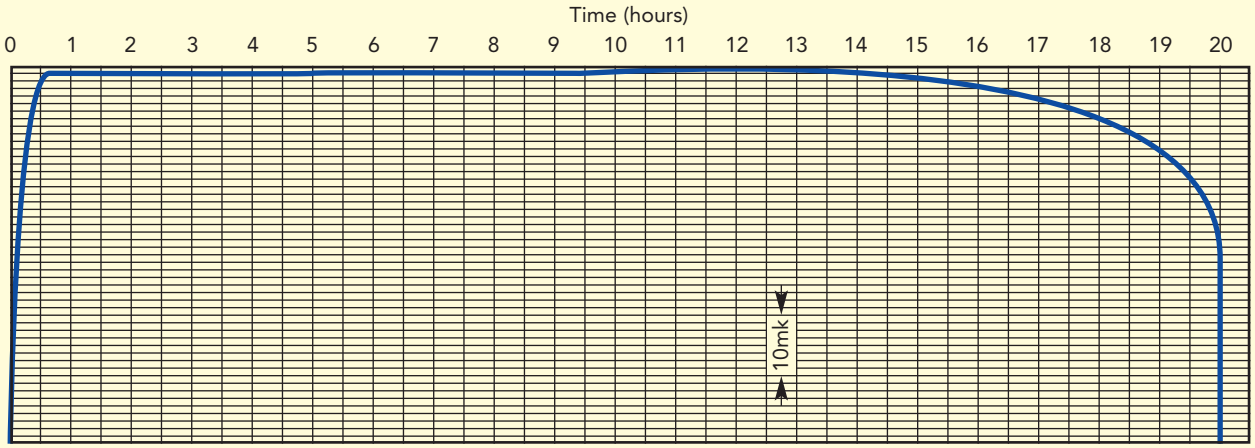
Metal Clad Cells

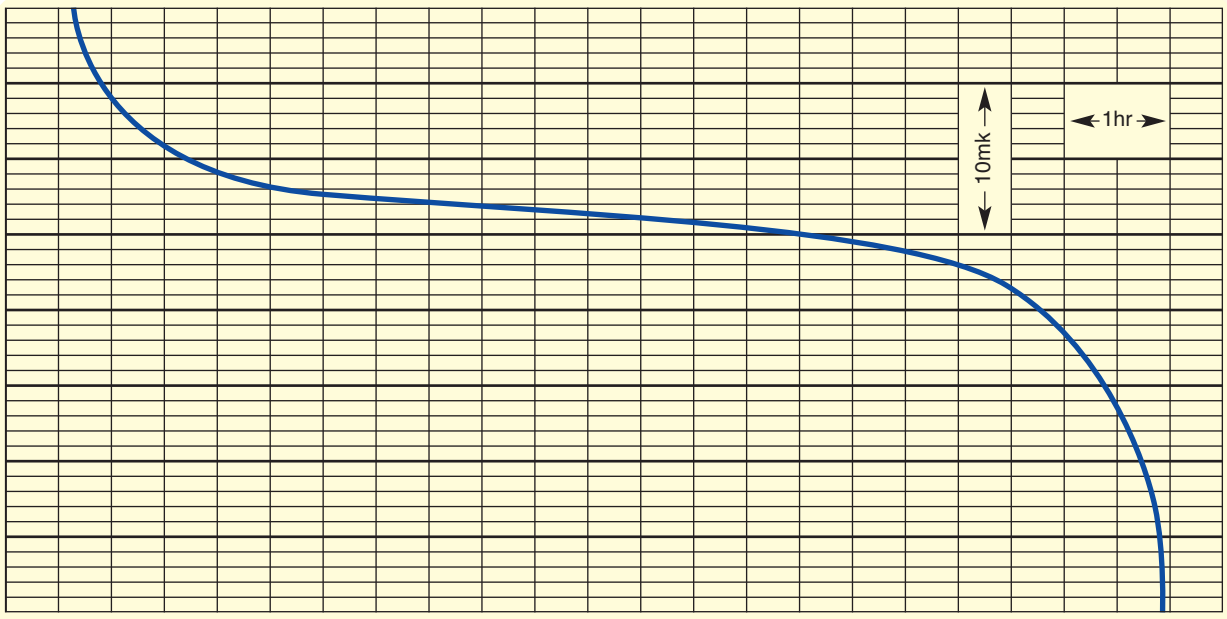
Reference Graphs



Melt of Al94 - ISOTECH's Glass Covered Cell

Zinc Metal Clad Cell Freeze





Melt of Metal Clad Al Cell Al91 after more than 1 year continuous use

Slim Fixed Point Cells

6N Quality

Isotech's 6N Quality Quartz Clad Slim Cells have been in constant use for more than ten years and have a proven record of successful use in many laboratories World-wide.

For the Millennium we have automated most of the Slim Fixed Point Cells apparatus so that untrained personnel can have the ITS-90 values available all day, each and every day. An article from Isotech explains this philosophy in detail, please ask for a copy.

The Cells themselves are made from the highest quality graphite and quartz glass and are sealed with 1 atmosphere of 6N (99.9999%) pure argon at the freeze temperature. The metals are also 6N purity to ensure the most accurate realisation of ITS-90.

The Cells can be expected to realise the ITS-90 according to the depressions listed overleaf (CCT/96-8 Page 6).

However to obtain these uncertainties expensive apparatus such as that described in databook 1 is required.

Isotech's Slim Fixed Point Cells can be used to calibrate temperature sensors, either as the metal within them melts, or as it freezes.

Typically, says CCT/96-8, a 6N pure cell will melt over 80% of its plateau within ±1mK. Exceptionally Isotech's Gallium Cell will melt over ±0.2mK.

The purpose of Slim Cells is to calibrate shorter sensors, and so large apparatus is inappropriate. A Secondary Laboratory needs easy-to-use, economically priced apparatus which needs to be smaller and bench mounted.

By using our beautiful Slim Cells on their melting curve the time spent in melting the cell in order to create the freeze plateaux is avoided.

Since 1991 Isotech has produced simple-to-use apparatus for Slim Cells, Gallium, Indium, Tin, Zinc, Aluminium, Silver and Copper.

Our apparatus is now automated so that each Cell is available on its melt curve for the complete working day and during the night the apparatus re-freezes the Cell ready to re-melt it the next day. The operator just has to check, using the in-built indicator, that the Cell is on the plateau before using the Cell to calibrate sensors. The more sensors calibrated, the longer the melting curve will last, as each sensor re-freezes a little of the melting cell.

Allowance must be made for the sensor being calibrated, sensors with short sensing lengths will add no additional errors to the above but other types with longer sensing lengths will add additional uncertainties. A free article is available from Isotech detailing stem conduction errors, please ask for your free copy.

Two examples showing the cell / apparatus / sensor performance are illustrated on the facing page.

Quartz Clad Slim Fixed Point Cells are available with a UKAS Certificate at an additional cost, see databook 5.

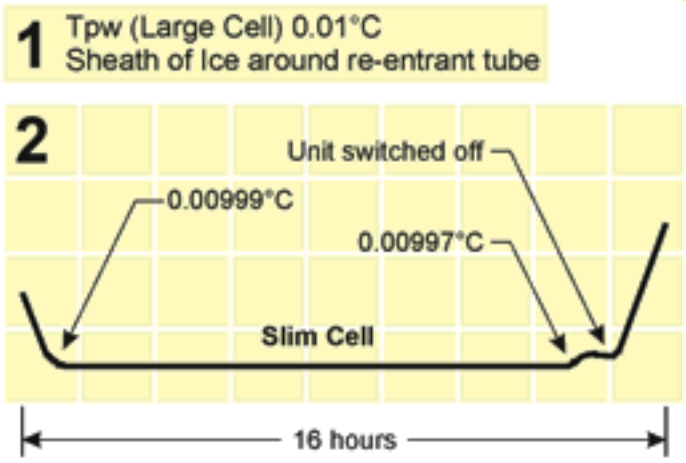
Options	
510-05-00	Inconel Basket including insulators for use with Medusa 510
426-04-00	Inconel Basket including insulators for use with Oberon 426

How to Order
ITL M 17401 Gallium Metal Clad Slim Cell
ITL M 17668 Indium Quartz Clad Slim Cell
ITL M 17669 Tin Quartz Clad Slim Cell
ITL M 17671 Zinc Quartz Clad Slim Cell
ITL M 17672 Aluminium Quartz Clad Slim Cell
ITL M 17673 Silver Quartz Clad Slim Cell
ITL M 17674 Copper Quartz Clad Slim Cell
ITL M 17675 Gold Quartz Clad Slim Cell

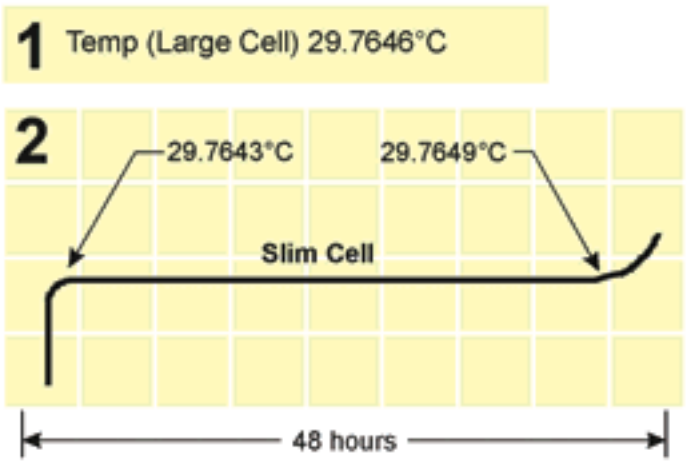
A Slim Fixed Point Cell

Slim Fixed Point Cells

Proven Quality



The graph shows a Standard Platinum Resistance Thermometer's temperature firstly as measured in a 2 week old large Water Triple Point Cell and then as measured in a Slim Cell placed in an Isotech metal block bath such as Europa-6 or Venus 2140. After 16 hours the apparatus was switched off (we wanted to go home).



The graph shows a Standard Platinum Resistance Thermometer's temperature firstly as measured in a large 7N pure Gallium Cell and then as recorded in a Slim Gallium Cell placed in an Isotech metal block bath such as Europa-6 or Venus 2140.

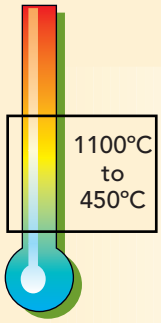
Cell	*Temperature ITS-90 Value (°C)*	*Length Immersed (mm) (1) (2)*	*Uncertainty*	*Type*	*Apparatus*	*Model Number*
Mercury	-38.8344°C	130	±0.001°C	Metal Clad	Europa-6	17724 Slim
Water	0.01°C	130	±0.001°C	Glass	Europa-6 Venus 2140	B8-30-130 B12-40-210 B12-46-210
Water	0.01°C	210	±0.001°C	Glass	Oceanus-6	B12/46
Gallium	29.7646°C	250	±0.001°C	Metal Clad	Oceanus-6	17401
Gallium	29.7646°C	140	±0.001°C	Metal Clad	Europa-6 Venus 2140 Calisto 2250	17401 Slim
Indium	156.5985°C	140	±0.001°C	Metal Clad	Medusa	17668M Slim
Tin	231.928°C	140	±0.002°C	Metal Clad	Medusa	17669M Slim
Lead	327.462°C	140	±0.010°C	Metal Clad	Medusa	17670M
Zinc	419.527°C	140	±0.005°C	Metal Clad	Medusa	17671M Slim
Aluminium	660.323°C	140	±0.010°C	Metal Clad	Oberon / Medusa 3	17672M Slim
Silver	961.78°C	140	(3)	Quartz Clad	Oberon	17673 Slim
Gold	1064.78°C	140	(3)	Quartz Clad	See Databook 2 Model 469	17675 Slim
Copper	1084.62°C	140	(3)	Quartz Clad	See Databook 2 Model 469	17674 Slim

(1) Depth from metal surface to the bottom of the re-entrant quartz tube
(2) Immersion errors depend on total depth of immersion in the apparatus which for Oceanus, Medusa and Oberon is 300mm, for Europa is 160mm.
Please ask for a free article titled 'Depth of Immersion Errors' for more details.
(3) Please consult Isotech.

How to Order Slim Cells
Please state Type and Model Number

426 Oberon

High Temperature Furnace



Model 426 is for Aluminium, Silver, Gold 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.

Connections are provided for a water supply of 0.5 to 1 litre per minute. Water supply and waste connections are provided. Use without cooling is not recommended above 700°C.

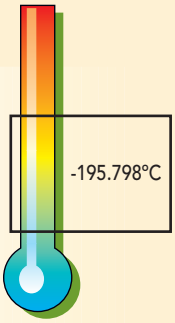
The Oberon can be used with Blackbody Fixed Point Cells. See databook 4.

Model No.	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 Notpad, see page 46
Power	110 VAC, 1.5kw, 50/60Hz (230 VAC Transformer available)
Dimensions	Height 410mm Width 415mm Depth 280mm
Weight	30.5kgs
Options	
Metal Block Bath	Standard Insert 6 x 8mm holes x 250mm deep Non-standard Insert - please consult Isotech
ITS-90 Fixed Point	ITL M 17672 Aluminium Quartz Clad Slim Cell
Apparatus	ITL M 17673 Silver Quartz Clad Slim Cell
	ITL M 17675 Gold Quartz Clad Slim Cell
	ITL M 17674 Copper Quartz Clad Slim Cell
Additional accessories	
426-04-00	Inconel Basket including insulators
935-19-43	230/110V Transformer
How to order	
	426 Oberon High Temperature Furnace
	Please specify voltage required

Oberon for Aluminium, Silver, Gold or Copper Slim Fixed Point Cells

Simple Liquid N_2 Apparatus

Model 461



In databook 1 we describe a sealed - apparatus for the boiling point of Nitrogen or Argon.

It is possible for most uses to construct a simple apparatus open to the atmosphere comprising a stainless steel dewar flask filled with liquid Nitrogen, an insulating layer which houses a metallic equalising block and thermometer holder. Lastly a split insulated lid reduces evaporation and permits easy addition of liquid Nitrogen.

From time to time extra liquid Nitrogen must be added, approximately every 30 minutes, to keep the dewar flask full.

The dewar flask is 100mm inside diameter and 280mm deep. The standard equalising block houses four SPRT's or industrial thermometers up to 8mm in diameter, giving ±0.002°C temperature uniformity.

Method of Operation

A standard calibrated SPRT is placed in the equalising block together with the sensors to be calibrated. The whole is allowed equilibriate.

The level is checked and Nitrogen added as necessary and readings taken 10 minutes afterwards.

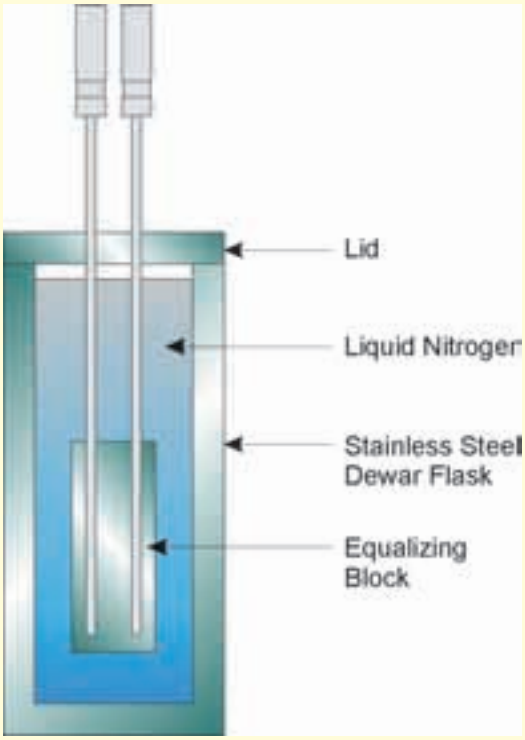
The Isotech Simple Liquid Nitrogen Apparatus is safe to use, having no glass dewar flask internally to explode.

A comprehensive handbook accompanies the apparatus which includes an article by Henry E. Sostmann on the corrections required to convert the calibration to the ITS-90 value of the Argon Triple Point.

Technical Note:

The Simple Liquid Nitrogen Apparatus, because there is air access will slowly condense oxygen from the atmosphere increasing the temperature of the Boiling Point.

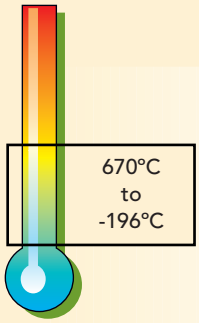
This is of small importance provided a calibrated SPRT is being used as the reference and simultaneous ratios of SPRT and unknown thermometers are being recorded, as in our TTI-2 or the F700.



Model No.	461 Simple Liquid Nitrogen Apparatus
Temperature Range	Nominal -195.798°C depending on the pressure and liquid Nitrogen purity
Thermometer Wells	Four 8mm Inside Diameter wells as standard, others available to special order
Dewar flask inside dimensions	100mm inside diameter 280mm deep
Temperature Uniformity	Typically ±0.002°C
Volume	3 litres Note: Liquid Nitrogen is not included with the apparatus
How to order	
	461 Simple Liquid N_2 Apparatus

Model 909 25.5 & 100Ω

Working S.P.R.T.s



This economically-priced standard platinum resistance thermometer, Model 909, is the workhorse of calibration laboratories all over the world. Model 909/25.5 has a range of -196°C to 670°C and model 909/100 has a range of -196°C to 550°C. The wide range of Model 909 means that the associated uncertainties are slightly larger than those of the new models developed from it.

MODEL 909/25.5 & 909/100

The resistance element is of pure platinum, coiled and mounted in a strain free construction. The former is of pure alumina material and all parts have been pre-aged to eliminate contamination and strain.

All joints are welded to minimise resistance changes. The leads are brought to a handle assembly where they are connected to a low loss cable, 2 metres long and screened.

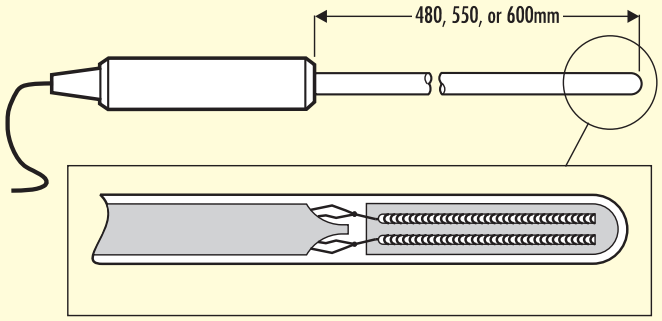
The thermometer sheath is of quartz material which is filled with dry air during construction. Three lengths are available, standard length 480mm, extra length 550mm or maximum length 600mm.

The model 909 is supplied with a calibration certificate giving R_{TPW} and Wga. Alternatively we can provide a complete calibration certification in accordance with our UKAS schedule (see databook 5).

For transportation and storage the Model 909 is supplied in its own attractive carrying case.

A 909F having faster settling time is now available, contact Isotech for details.

Model No.	909/25.5	909/100
Measuring Range	-196°C to 670°C	-196°C to 550°C
Nominal Resistance	25.5Ω at 0°C	100Ω
Recommended Maximum Current mA	1	0.5
Nominal Sensitivity Ω/°C	0.1	0.4
Resistance Ratio	Wga > 1.11807 as required by ITS-90	
Self-heating	1mK/25 microwatts	
Sealed-in gas	Dry air	
Stability	Depends upon the temperature range of use. Typical annual stability, see table on page 35	
Internal Leads	4 wire-platinum	
External Leads	Silver-plated multistrand wires in a low-loss insulation cable terminating in gold-plated terminals.	
Length	480mm standard 550mm to order (E) 600mm to order (L)	
Nominal diameter	7.5mm	
Options		
	909E/25.5 or 100 ohm	
	909L/25.5 or 100 ohm	
	909F/25.5 or 100 ohm	
How to Order		
Model 909/25.5 or 100 ohm	Please specify length required State with UKAS Calibration or without UKAS Calibration.	

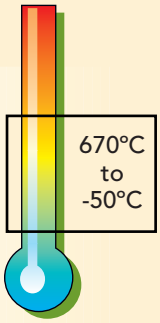


STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) 909

3 Lengths. Wide Range. Proven Design

Model 935-14-77 25.5Ω

Working S.P.R.T.s



This economically priced standard platinum resistance thermometer, Model 935-14-77, is the metallic sheathed version of the Model 909, the workhorse of calibration laboratories all over the world. Model 77 has a range of -50°C to 670°C.

The resistance element is of pure platinum, coiled and mounted in a strain free construction. The former is of pure alumina material and all parts have been pre-aged to eliminate contamination and strain.

All joints are welded to minimise resistance changes. The leads are brought to a handle assembly where they are connected to a low loss cable, 2 metres long and screened.

The thermometer sheath is of metallic material which is filled with dry air during construction. It is available in a standard length of 450mm.

The model 77 is supplied with a calibration certificate giving R_{TPW} and Wga, plus a comprehensive handbook.

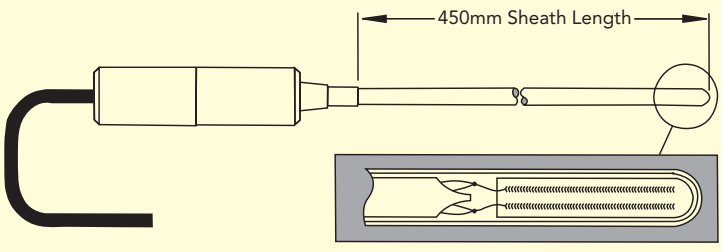
For transportation and storage the Model 77 is supplied in its own attractive carrying case.

Please Note:

The incanol sheath ensures that the 77 will not break. However, internally it has the same construction as a standard platinum resistance thermometer and must be handled accordingly.

		Uncertainty (±)				
Temperature	(°C)	Range 1	Range 2	Range 3	Range 4	Range 5
BP Nitrogen	-196		10 mK	10 mK	10 mK	
TP Mercury	-38.8344	2 mK	2 mK	2 mK	5 mK	
TP Water	0.01	1 mK	1 mK	2 mK	5 mK	10 mK
MP Gallium	29.7646	2 mK				
FP Indium	156.5985		3 mK			
FP Tin	231.928		3.5 mK	3.5 mK	5 mK	10 mK
FP Zinc	419.527			3.5 mK	5 mK	10 mK
FP Aluminium	660.323				10 mK	25 mK
FP Silver	961.78					40 mK

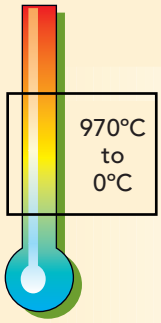
Note: TP = Triple Point FP = Freezing Point MP = Melting Point BP = Boiling Point



Sensing length 70mm

Model No.	935-14-77 / 25.5
Measuring Range	-50°C to 670°C (for a -196°C model please contact Isotech)
Nominal Resistance	25.5Ω at 0°C
Recommended Maximum Current mA	1
Nominal Sensitivity Ω/°C	0.1
Resistance Ratio	Wga ≥ 1.11807 as required by ITS-90
Self-heating	1mK/25 microwatts
Sealed-in gas	Dry air
Stability	Depends upon the temperature range of use. Typical annual stability, see table above
Internal leads	4 wire-platinum
External Leads	Silver-plated multistrand wires in a low-loss insulation cable terminating in gold-plated terminals.
Length	450mm
Nominal Diameter	6mm
Options	
	35mm sensing length is also available
How to Order	
Model 935-14-77	State with UKAS Calibration or without UKAS Calibration.

962/0.25Ω High Temperature Thermometer



The extension, in ITS 90, of the platinum range to the freezing point of silver (961.78°C) has required the development of a new platinum resistance thermometer; acronym HTSPRT.

The first problem of extending the range is insulation. Mica can not tolerate the higher temperatures.

For example, for a 25.5Ω thermometer, suppose that the shunt resistance were 20MΩ. Then the network resistance is 25.499967Ω. But we require measurement assurance of better than 1 part per million, so this will not do, even if the shunt were a constant (calibratible) value, which it is not. For a 0.25Ω thermometer, a 20MΩ shunt gives a network resistance of 0.24999997Ω, which is tolerable. The cost, and there is a cost, is increased difficulty on the electrical measurement side, particularly in the presence of noise, at high temperatures.

This new design of HTSPRT offers solutions to the problems identified by previous researchers.

1. Allowing the sensor winding to expand and contract without friction.
2. Keeping the leads close to the sheath.
3. Preventing the lead wires from expanding toward the sensor winding.
4. Allowing expansion chambers for the platinum leads.
5. Keeping a high degree of electrical isolation between leads.
6. Preventing heat piping up the sheath or lead assemblies.
7. A patented technique is used to prevent unwanted gases penetrating the quartz sheath at high temperatures and is included with each thermometer.

PERFORMANCE

We have seen various ways of specifying the reproducibility and short and long term stability of the SPRT. A user of thermometers will know that this varies with temperature excursion and roughness of use. We have decided that our best way to describe our standards is to explain that they will meet the expected criteria of calibration, as shown in the specifications issued by N.P.L.

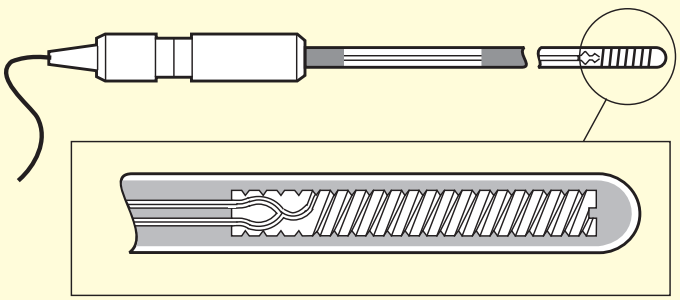
The fact that over 200 of these thermometers are in use world-wide testifies to the popularity of this version of high temperature thermometer.

Its particular features are reliability and simplicity.

The model 962 is supplied with a calibration certificate giving R_{TPW} and Wga. Alternatively we can provide a complete calibration certificate with our UKAS schedule.

0.25Ω High Temperature Platinum Resistance Thermometers

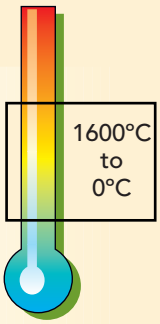
Model No.	962 / 0.25
RTPW	0.2-0.25 ohms
Wga	above 1.11807
Sensor Length	40mm
Sheath Length	680mm
Sheath Diameter	less than 7.5mm
Sheath Material	Quartz
Energising Current	10mA
Case Dimensions	Height 60mm Width 860mm Depth 150mm
How to Order	
Model 962/0.25ohm	State whether UKAS calibration required
	Refer to Databook 5 for temperature ranges



HIGH TEMPERATURE STANDARD PLATINUM RESISTANCE THERMOMETER 962 (HTSPRT)

Standard Thermocouple

Model 1600 NCJ



The Isothermal range of Thermocouple Standards are the result of 5 years development. The type R and S standards will cover the range for 0°C to 1600°C.

The thermocouples are as follows:

The measuring assembly comprises a 7mm x 300mm or 600mm gas tight 99.7% recrystallised alumina sheath inside which is a 2.5mm diameter twin bore tube holding the thermocouple.

The inner 2.5mm assembly can be removable since some calibration laboratories will only accept fine bore tubed thermocouples and some applications require fine bore tubing.

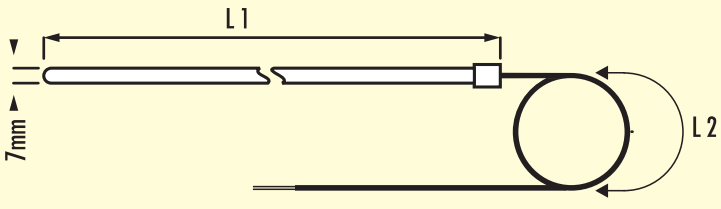
Insulated noble metal thermocouple wire connects the measuring sheath.

If cold junctions are required please refer to databook 1.

Isotech offer a 4-point UKAS calibration for temperatures up to 1100°C (supplied as standard), or an optional 6-point UKAS up to 1300°C. Both have a table of millivolts to degrees celsius. Alternatively we can arrange for a NPL calibration for temperatures up to 1600°C. Please contact Isotech to obtain current prices for calibration.

Hint:
Use Model 700 Zeref and Model 740 Thermocouple Selector see databook 4

Types R & S Standard Thermocouple without Cold Junction
Model 1600 NCJ, Premium grade wire,
Gas tight assembly



TYPE R & S NCJ STANDARD THERMOCOUPLE	CODE	L 1	L 2
	/600	600	1400mm
	/300	300	1700mm

Model No.	1600 NCJ
Hot Sheath Temperature Range	0°C to 1600°C (R or S)
Emf Vs Temperature	According to relevant document
Response Time	5 minutes
Hot Junction Dimensions	See diagram
Immersion	100mm min
Case Dimensions	Height 65mm Width 710mm Depth 165mm
Gross Weight	900g
Feature	Removable inner assembly
	The standard thermocouple described can be supplied in the following noble metal combinations
TYPE R: Platinum vs Platinum 13% Rhodium	
TYPE S: Platinum vs Platinum 10% Rhodium	
How to Order	
	Model 1600 NCJ R/300
	Model 1600 NCJ R/600
	Model 1600 NCJ S/300
	Model 1600 NCJ S/600
	Specify either Type R or S.
	UKAS calibration is included see databook 5

microK

Precision Thermometer

We are proud to introduce a new type of precision thermometer, which sets new world standards for accuracy and stability. Designed for a wide range of highly accurate industrial and scientific calibration applications, the instrument uses a completely new measurement technique to achieve accuracies better than 0.4 parts per million (ppm) - equivalent to 0.0004°C - when used with a standard platinum resistance thermometer (SPRT).

A key to achieving such high accuracies and stability is the use of a specially designed analogue to digital converter (ADC) within the instrument's measurement circuits. In conjunction with a digital signal processor (DSP), this uses a unique adaptation of existing advanced sigma-deltaADC techniques to achieve linearity better than 0.4 ppm.

A further major benefit of this ADC technique is its low noise performance, noise is reduced by a factor of 32 over conventional sigma-deltaADC circuits.

Another break with convention is that the instrument uses no mechanical switches, relays or potentiometers whatsoever (other than the main power on/off switch), relying on solid state switching to route voltage and current signals internally. Comparative instruments in this class have used high quality mechanical relays for this purpose, a technique which inherently introduces inaccuracies arising from thermal EMFs, and degrades reliability. By using the latest semiconductor technology, performance has been enhanced, component counts have been reduced and reliability considerably improved.

When measuring the voltage from a thermocouple, it is common practice to reverse the input terminations and repeat the measurement in order to detect and/or compensate for any thermal EMFs. The microK automatically reverses the input connections immediately behind the input terminals with solid state switching. This does not suffer from the limitations (extra thermal EMFs) associated with doing this using mechanical relays. The user can, of course, still reverse the connections manually to gain confidence in the instrument, but it is no longer necessary in order to achieve low measurement uncertainty.

The microK is intended for low uncertainty precision thermocouple measurements and should be used with an external 0°C reference unit such as the Isotech TRU Model 938. Internal cold junction referencing is not provided but the microK can be used to measure an external junction with a resistance thermometer on a different input channel.

The microK range consists of two instruments, offering a choice of measurement accuracy:

The **microK 400** is accurate to 0.4 ppm and the **microK 800** is accurate to 0.8 ppm. For SPRT's with Ro ≥ 2.5Ω this is equivalent to 0.4mK (0.0004°C) and 0.8mK (0.0008°C) over the whole temperature range. With thermocouple sensors the voltage uncertainty is 0.25µV, equivalent to 0.01 °C for Gold / Platinum thermocouples.

The two instruments in the microK range offer performance characteristics and features which are simply not available elsewhere. Comparable instruments available internationally do not achieve the same accuracy or stability (zero drift characteristics with SPRT measurements are not obtainable in any other instrument), do not support the same variety of sensors, and offer considerably less operational features. As a result, the 'Cost of Ownership', a key feature of growing international importance, has been considerably reduced.

Key Features...

- Accuracy ±0.4ppm
- Zero drift for PRTs
- PRT, thermocouple and thermistor sensing
- <2 second measurement time
- Keep-warm currents
- 0-10mA sensor current
- Touch screen

Unequalled combination of accuracy, stability and versatility.

microK

Precision Thermometer

Accurate: The microK range of precision thermometers employ a completely new type of sigma-delta ADC to provide measurement uncertainty that is quite simply the best in its class (0.4ppm for µK-400 or 0.8ppm for µK-800).

Stable: The inherently stable 'substitution technique' used in the microK means that it achieves zero drift for resistance measurements and only 3ppm/year for voltage measurements so you can be confident in your measurements between calibrations.

Versatile: This is the only instrument of its type that works with PRTs, thermocouples and thermistors, so you only need to purchase one product for your thermometry application rather than two or more instruments.

Easy to Use: The microK includes a comprehensive range of features, including direct reading in temperature for all sensor types, data logging, easy export of data to Excel™ and graphing facilities. Despite its sophistication the microK is very easy to use. The built in 6.4" full VGA colour touch screen, powered by the Window CE operating system provides a familiar and powerful operator interface so you can get on with making measurements rather than learning how to control the instrument.

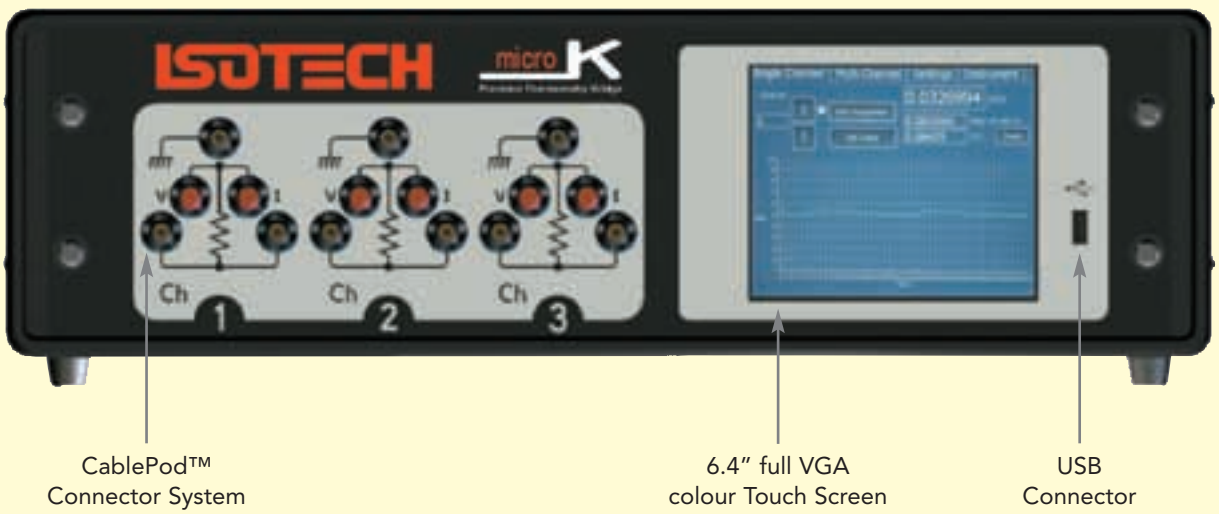
Best Practice Ready: Best practice guidelines recommend the use of two reference thermometers for calibrations. That is why we have included three channels in the microK, enabling you achieve best practice without having to buy additional and costly multiplexers.

Reliable: Until now, instruments in this class had to use relay switching. The microK breaks that mould by using the latest semiconductor devices to provide a completely solid state solution. In addition the use of high density silicon integration technology (FPGAs) reduces component count and gives you the highest possible reliability.

Cable Pod™ Connector System: The connectors accept 4mm plugs, spades or bare wires. The 3/4" separation is compatible with standard 4mm to BNC adaptors, so you can use thermometers with any normal termination type. The Cable Pod connector system uses gold- plated, tellurium-copper to give the lowest possible thermal EMF and the best measurement uncertainty. The connectors have a clamping arrangements that does not rotate as the terminal is screwed down, thereby protecting the wire from mechanical damage.

Low Noise: The new ADC, together with the low noise pre-amplifiers used in the microK, means you achieve a lower measurement uncertainty in a shorter time.

Keep-Warm Current: The microK includes keep-warm current sources to maintain the power in a PRT when it is not being measured, eliminating uncertainty resulting from power coefficients.



microK

Precision Thermometer

Specifications

Ranges	Resistance Thermometers 0W to 500kW Thermocouples ±125mV
Accuracy - PRTs	µk400: 0.4ppm maximum over whole range for SPRT with R0 ≥ 2.5W (equivalent to 0.1mK at 0°C, or 0.4mK over full range) 1ppm maximum over whole range for SPRT with R0=0.25Ω mk800: 0.8ppm maximum over whole range for SPRT with R0 ≥ 2.5Ω (equivalent to 0.2mK at 0°C, or 0.8mK over full range) 2ppm maximum over whole range for SPRT with R0=0.25Ω
Accuracy - Thermocouples	Voltage uncertainty: 250nV at 20mV (equivalent to 0.01°C for Gold-Platinum thermocouples at 1000°C)
Resolution	Resistance: 0.01ppm of range Stability: 10nV (125mV range)
Stability	Resistance (excluding resistance standard): 0[1] Voltage: 3ppm / year
Measurement Time	< 2 seconds
Temperature Conversions	PRTs: ITS-90, Callendar-van Dusen Thermocouples: IEC584-1 1995 (B, E, J, N, R, S, T), L and gold-platinum Thermistors: Steinhart-Hart
Sensor Current	0-10mA in 3 ranges: 0.1mA ±0.4% of value, ±70nA, resolution 28nA 1mA ±0.4% of value, 0.7mA, resolution 280nA 10mA ±0.4% of value, ±7mA, resolution 2.8mA
Keep Warm Current	0-10mA ±0.4% of value, ±7mA, resolution 2.8mA

Cable Length	Limited to 10Ω per core or 10nF shunt capacitance (equivalent to 100m of RG58 coaxial cable)
Internal Standard Resistors	1Ω ±0.1% TCR = ±10ppm/° typical, stability = ±25ppm / year 10Ω ±0.1% TCR = ±0.6ppm/° typical, stability = ±5ppm / year 25, 100, 400Ω ±0.1% TCR = ±0.3ppm/° typical, stability = ±5ppm / year
Input Connectors	"Cable Pod" connector accepting: 4mm plugs, spades or bare wires Contact material: gold plated tellurium copper
Interfaces	RS232 (9600 baud) USB (1.1) - host
Display	163mm / 6.4" VGA (640 x 480) Colour TFT LCD
Operating Conditions	15-30°C / 50-85°F, 10-90% RH (for full specification) 0-50°C / 32-120°F, 0-99% RH (operational)
Power	88-264V (RMS), 47-63Hz (Universal) 20W maximum, 1.5A (RMS) maximum
Size	520mm x 166mm x 300mm 20.5" x 6.6" x 11.9" (W x D x H)
Weight	12.4kg / 27lb

Specifications are subject to change without prior notice.

Notes:

1. The microK uses a "substitution technique" in which the Device-Under-Test and the Reference are successively switched into the same position in the measuring circuit. This means that the stability of resistance ratio measurements is immeasurably small.

Parameter	microK 400	microK 800	Units
Accuracy (25Ω SPRT)	0.4	0.8	ppm
Accuracy (0.25Ω SPRT)	1	2	ppm
Probes Supported	PRT'S, Thermistors & Thermocouples	PRT'S, Thermistors & Thermocouples	
Channels	3	3	
Resolution	0.01	0.01	mK
Stability	0[1]	0[1]	ppm/yr
TC (resistance ratio)[2]	0[1]	0[1]	ppm/°C
Resistance Range	0 - 500	0 - 500	kΩ
Cold Junction Mode	External and Remote	External and Remote	%
Keep-Warm Current	Yes	Yes	
Internal Resistance Standards	1, 10, 25, 100, 400	1, 10, 25, 100, 400	Ω
Measurement Time	< 2	< 2	s
Units	Ratio, V, Ω, °C, °F, K	Ratio, V, Ω, °C, °F, K	
Switching Technology	Solid-state	Solid-state	

Notes:

1. The microK uses a "substitution technique" in which the Device-Under-Test and the Reference are successively switched into the same position in the measuring circuit. This means that the stability of resistance ratio measurements is immeasurably small.
2. Using external reference resistors.

Selector Switch

8 Way 4 Wire Selector Switch

The switch allows easy selection of connected sensors. It 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 switch 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 I-Cal and I-Cal Easy software supports Switchbox model 954 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 the TTI range of indicators, easily switch up to eight sensors manually or with RS232.**
- **4 wire operators eliminating errors.**
- **Use with I-Cal / I-Cal Easy Software for automatic switching and temperature calibration, add a second box to calibrate up to 16 Sensors.**
- **Switches are stand-alone allowing them to be positioned anywhere in a laboratory for most efficient operation.**

Model No.	954 RTD Selector Switch
Channels	Eight - four wire (four pole)
Control	Front panel switch And RS232 (Also compatible with Isotech VLT system)
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
Overall dimensions	Height 91mm Width 141mm Depth 165mm
Weight	1kg
How to Order	954 RTD Selector Switch

Model 456 The Millennium Range

Temperature controlled Fixed AC/DC Resistors

- Nominal Temperature Coefficient of Resistance: +0.02ppm/°C (with temperature control on)18 to 25°C
- Power Rating: 0.5 watt at +25°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 Max; 0.05µV/°C Typical
- The most precise and stable resistors available.
- Impervious to harmful environments - oil filled.

By temperature controlling an otherwise very stable resistor a performance close to the very best available World-wide can be achieved at a surprisingly low price. The resistor itself is 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 the 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 a resistance range from 5 ohms to 3.3 megaohms and long term drift of less than 5ppm, these devices are virtually secondary standards that can be kept in a laboratory as references to calibrate other devices.

The Resistor is held in a temperature controlled environment heated to 30±0.1°C other temperatures are available to special order. The heater requires 2 watts at 5V which can be supplied by a battery or an unregulated DC supply. In an ambient of 20°C the Resistor's heater will warm up in typically 30 minutes, and a LED shows when the temperature has been reached. A test pocket is provided so that the resistors' temperature can be monitored if required.

0.1 ppm/month or better stability can be expected.

We can supply the value you choose ±0.1% between a minimum of 5 ohms and a maximum of 3.3 megaohms. However we bulk buy and keep in stock the following standard values: 10Ω, 25Ω, 100Ω, 1000Ω, 10,000Ω.

For the highest quality traceability we recommend that the 456 be UKAS Certified. We can offer the 2 Sigma Uncertainties shown in the table.

Measured Quantity Instrument or Gauge	Range/ Frequency	Best measurement Capability expressed as an Expanded Uncertainty (k=2)	Remarks
DC Resistance			**Resistors suitable** for oil immersion can be measured over the range 10°C to 30°C
0.1Ω to 10Ω		±0.3ppm+0.1µΩ	
10Ω to 250Ω		±0.3ppm+2.5µΩ	
250Ω to 1000Ω		±0.4ppm+10µΩ	
1KΩ to 1MΩ		±20ppm	
1MΩ to10MΩ		±55ppm	**The uncertainties can** only be realised for resistors of suitable AC characteristics
AC Resistance			
2.5Ω to 400Ω	75Hz	±15ppm	
400Ω to 1000Ω	75Hz	±100ppm	

Model No.	456 Standard value
Dimensions	144 x 110 x 96mm (in box)
Weight	1kg (including box) 550g (excluding box)
Rating	0.5 watt
Stability	Typically lppm per year at 1mA
Traceability	A Traceable Certificate accompanies your 456 to the 2 sigma uncertainties shown above.
Induction	0.08µH typical
Capacitance	0.5pf
How to Order	
	456 Temperature Controlled Fixed AC/DC Resistor
	Please specify ohmic value
	State with UKAS Calibration or without UKAS Calibration. Refer to Databook 5.
	Other Resistor ranges including the Model 836, SRA and SRB are available. Please consult Isotech.

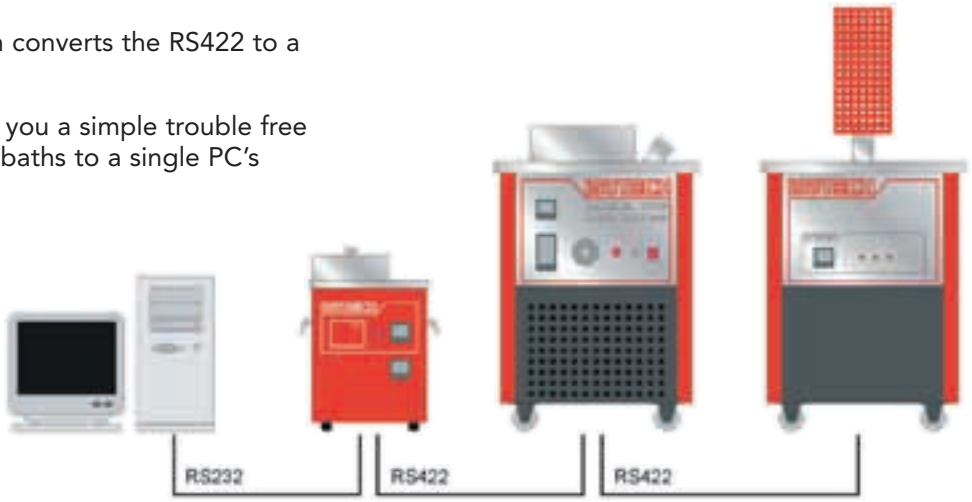
Software

For the Millennium

The calibration baths included in this databook have been enhanced to feature serial communications as standard. The baths have a serial interface (RS422) as standard, this allows a number of calibration baths to be connected together in a daisy chain.

A special lead is provided which converts the RS422 to a PC's standard RS232 port.

This innovative approach allows you a simple trouble free way of connecting a number of baths to a single PC's RS232 port.



Software
Newly developed software provides ease of use and routes to fully automatic temperature calibration.

Cal NotePad
Included as standard with the calibration baths and TTI indicators. This permits you to connect both an indicator and the calibration bath to the PC. You can view data on clear configurable chart displays, log data to file and control the calibration bath.

I-cal
A new application that can automatically calibrate up to 16 temperature sensors, it provides an expandable low cost route to automatic calibration - with I-cal Capture you can store pictures (along with time and temperature data) to enable, for example, dial thermometers to be calibrated automatically; return to a set of images of the dial captured at each calibration temperature!

Use I-cal Easy to automate the equipment in the lab, enter up to 20 calibration points and let the software set the bath wait for stability and log the data. Choose the stability criteria and how many points to record at each calibration temperature.

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 Calender Van Duesen calculators. Also included is a powerful regression calculator.

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!

Please try the demo version, we would like you to see for yourself, http://www.isotech.co.uk/software.html

Comparison Chart

	CalNotePad	I-cal	I-cal Capture	I-cal Easy
Included with communicators interface	Yes	No	No	No
Sensor Calibration With Manual Bath Operation	Yes	Yes	Yes	Yes
Automatic Sensor Calibration	No	Yes	Yes	Yes
Maximum Number of Sensors	4	16	16	32
Maximum Number of Calibration Baths for Automatic Operation	1	1	1	1
Internal Database with Certificate Printing	No	No	No	Yes
Save Results to File	Yes	Yes	Yes	Yes
Capture Images with Camera	No	No	Yes	No

Cal NotePad

Isotech Support Software

- Provides Sophisticated Real Time Chart Display
- Record Isotech Calibration Bath and Indicator Data
- Export data for Excel, Word etc.

Purpose

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 baths controller - Cal NotePad will display the temperature changes as they occur on the re-scalable chart display.

Traceable Calibration

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 can :-

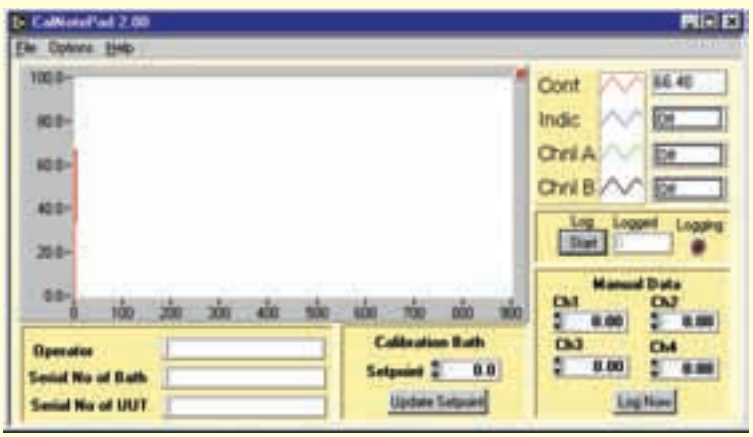
- Record a Calibration Baths Controller Temperature
- Record the Actual Baths temperature with either
  - A SITE model in-built indicator
  - A supported external indicator
  - Manual entry from the keyboard
- Identify the Unit Under test with a serial number and have its output recorded
- Export the log file to produce a complete report
- Permit real time display of temperatures
- Allow the calibration bath temperature to be changed from the PC
- Temperature Programming
- Program the bath to change temperature with time
- Ramp to Temperature
- Program the bath to ramp between limits ideal for liquid in glass thermometry
- Open new chart for individual channels
- Up to four charts in addition to the main screen

Easy to use - Windows 95/98

Interface to Isotech Block Baths & Temperature Indicators

Log Chart and Export data - Control Calibration Bath - Read Standard

Includes support for some third party indicators including ASLF150, F250. Cropico 3000 series, Labfacility Tempmaster, Labcal plus.



I-cal

Software

I-cal
Automatically Calibrate up to 16 Sensors
Simple to Use
I-cal Capture can grab video imaged from a suitable camera.

Third Generation
I-cal is Isotech's Third Generation Calibration Software. Use I-cal with Isotech calibration baths to automatically calibrate up to 16 temperature sensors.

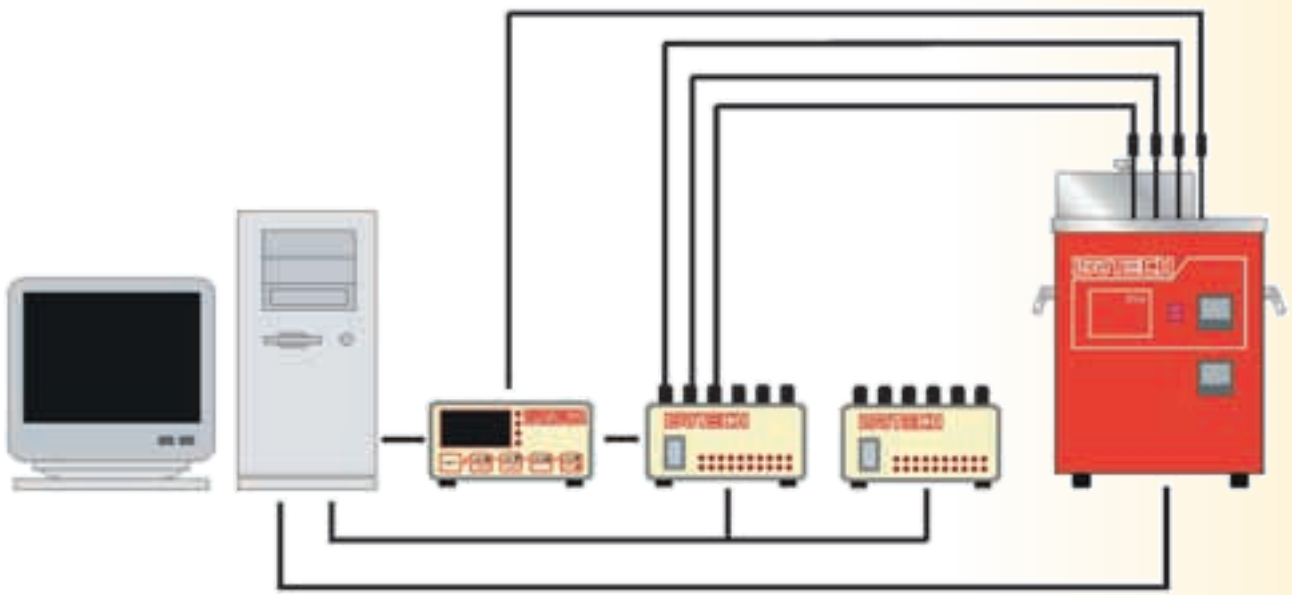
Modular
Use I-cal with a comparison bath and TTI indicator to calibrate a Thermometer under test on Channel B to a Standard on Channel A; add Selector Switches for Multi channel operation.
See databook 3 for more details.

Traceable Comparison Calibration
Choosing a TTI-7 allows for high accuracy automatic traceable temperature calibration. With one Selector Switch you can calibrate either 8 PRTs or thermocouples, add a second switch for up to 16 sensors by choosing a PRT Selector Switch and a TC Selector Switch you can calibrate a mixture of PRTs and thermocouples together up to eight of each type! Or use a TTI 6 for PRT calibration. See databook 3 for details.

What it Does
I-cal will set the Calibration Bath through a series of calibration temperatures, after the bath has been set to the desired temperature I-cal monitors the calibration bath. When it reaches temperature the standard is monitored when that is stable I-cal logs data to a spreadsheet file and moves on to the next temperature.

I-cal Capture
With Capture you can add a compatible video/camera or video frame grabber and capture images for the automatic calibration of dial thermometers, handheld digital thermometers and other devices that can not be connected to the PC.

For more data and a demo version contact us or see,
http://www.isotech.co.uk/i-cal.html



I-Cal Easy

Software

Use I-cal Easy to automate the equipment in the lab, enter up to 20 calibration points and let the software set the bath wait for stability and log the data. Choose the stability criteria and how many points to record at each calibration temperature.

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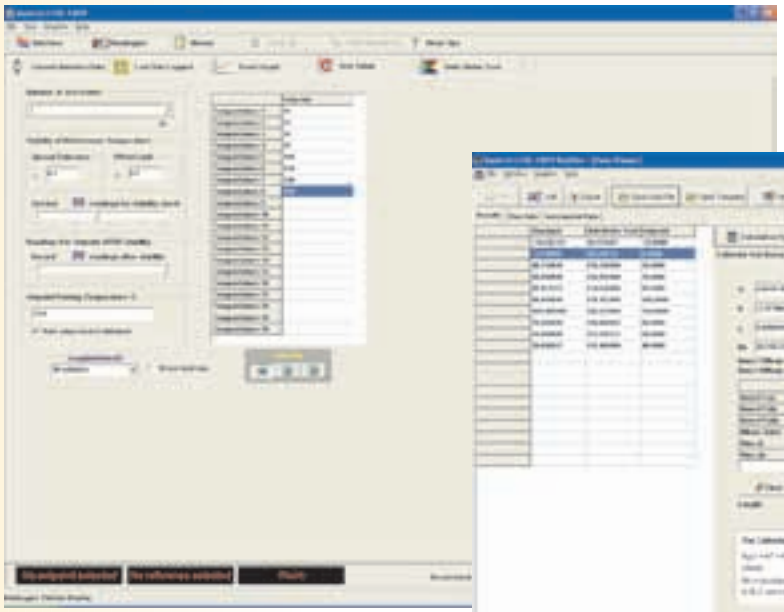
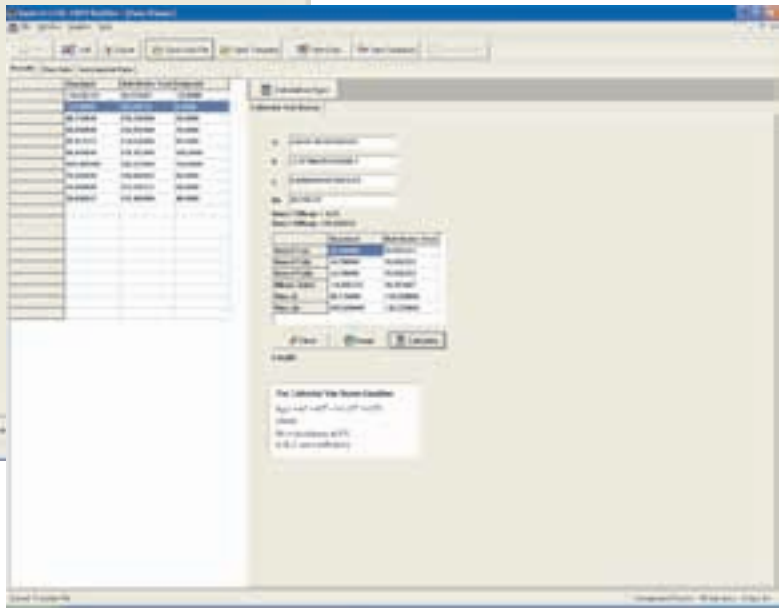
Other systems have limited the user with a built-in template and the need to pay extra for any changes, with I-cal Easy just build in your own certificate in minutes!

Please try the demo version, we would like you to see for yourself, http://www.isotech.co.uk/software.html





New

Key Features

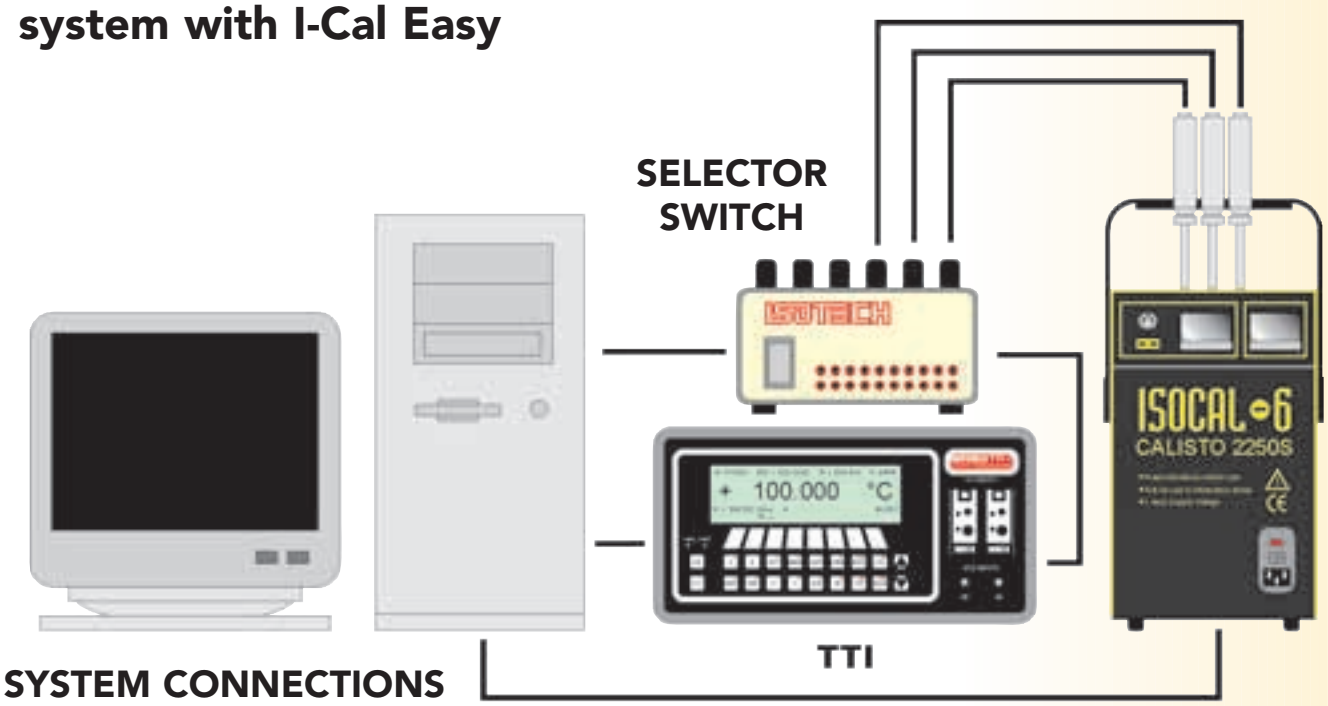
- **Fully Automatic Calibration**
- **Design and Print Certificates**
- **Calculate Coefficients**
- **More channels**
- **Supports more equipment**
- **Try the full version free for 30 days**

How to Order I-Cal Easy

I-Cal Easy

Software

Build an automatic calibration system with I-Cal Easy



I-cal Easy supports the TTI-7 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.

Minimum System Requirements

- Desktop or Notepad PC
- 800 X 600 / 16 bit display (1024 X 768 recommended)

OS	Windows 98/2000/XP
I-Cal - Supported Camera	Check with ISOTECH for supported models
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 operated from a single port)

databookone
Realising ITS-90




Includes:

- Fixed Point Cells
- Primary Apparatus
- Thermometers
- Instruments & Software

databooktwo
Secondary Laboratory Equipment




Includes:

- Slim Cells
- Secondary Apparatus
- Thermometers
- Instruments & Software

databookthree
Industrial Laboratory Equipment




Includes:

- Metal Block Baths
- Furnaces
- Thermometers
- Instruments & Software

databookfour
Blackbody & Thermocouple Referencing

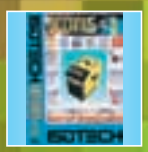



Includes:

- Blackbody Cells
- Blackbody Cavities
- Blackbody Furnaces
- Thermocouple Referencing

databookfive
Calibration Services & Information

UKAS CALIBRATION


Includes:

- U.K.A.S. Calibration
- Journal of Thermometry
- Video Courses
- Training Courses

Please send me the following databooks:

databookone ☐
databooktwo ☐
databookthree ☐
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Fax Back Form
Fax: +44 (0) 1704 544799

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