A Guide to
Dry Block Calibration

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

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

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

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

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

Dry Block pre-purchase check list ✔

1 Does the supplier have an accredited laboratory?
UKAS accreditation, "the means by which, in the public interest, the integrity and competence of independent evaluators is confirmed and declared". Isotech can issue a UKAS certificate with the performance expressed in the manner that you will need, not to some confusingly expressed specification that is made with no confirmation of integrity and competence.

2 Experience
Does the producer have experience? Do they understand the difference between accuracy and uncertainty? Can they tell you how to calculate the uncertainty of a probe being calibrated in the block? Isotech can.

3 Expandable
Can the Dry Block be used with other sensors? Are there accessories available for future expansion? With Isotech products they are.

4 PC Support
Can it be connected to a computer? Is there software available, can it be automated? Isotech Dry Block Calibrators have a range of software options.

5 Documented
Is the bath fully documented? Can you download a full evaluation report from the Web Site? Does it come with a comprehensive handbook and tutorial? Is training available? Isotech provide all of these free of charge.

6 Practical
Isotech Dry Blocks are practically designed with a strong metal case, and are a compact portable size. If you are going to carry it around don't forget to check the size and weights. It is surprising how large some other blocks are, even though they take the same number of probes. Beware if the specification does not include the weight.

7 Value
*Check the prices, all the above come at an amazingly competitive price when you choose **Isotech.***

Isotech Dry Block Features

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

■ Plug-in Controllers

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

■ Inbuilt Indicator

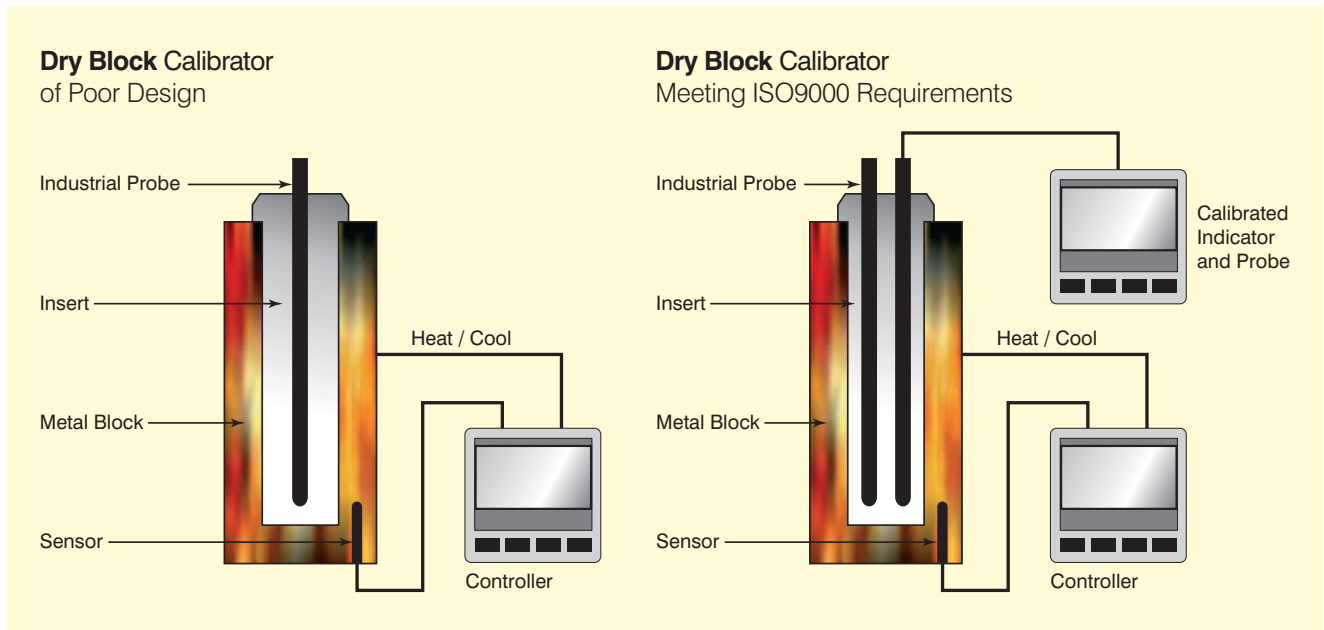The SITE(S) models include an electronic temperature indicator that can be used with a 100Ω Resistance Thermometer, Thermocouples, (K, N, R, S, L, B, PL2, T, J and E) and DC process inputs including 4-20mA current transmitters. A reference thermometer can be connected or for complete flexibility the in-built indicator can be used to show the value from a sensor being calibrated.
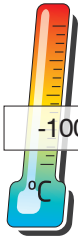
■ Using Isotech's Dry Blocks Traceable Calibration

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

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

Dry Block Calibrator
of Poor Design

Industrial Probe
Insert
Heat / Cool
Metal Block
Sensor
Controller

Dry Block Calibrator
Meeting ISO9000 Requirements

Industrial Probe
Insert
Calibrated Indicator and Probe
Heat / Cool
Metal Block
Sensor
Controller

-100°C Dry Block
Isis

-100 to 40°C

°C

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

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

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

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

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

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

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

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

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

http://www.isotech.co.uk

METAL BLOCK INSERTS

Standard Insert A

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

ALTERNATIVE INSERTS

Standard Insert B

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

Standard Insert C

8mm and
6 x 6.5mm
All 157 deep

Validation Insert

6.5mm and
20 x 3.5mm
All 157 deep

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

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

35 to 650°C

°C

Dry Block Calibrator
Jupiter

■ 35 x 148mm Calibration Volume

■ 35°C to 650°C

■ Fast - Wide Operating Range

■ PC Interface and Software

The Jupiter^PLUS650 Dry Block range offers industry-leading performance in an easy to use portable package - ideal for the calibration of thermocouples and platinum resistance thermometers. It has been designed for fast heating and cooling for convenient field use. For flexibility surface sensor and infrared thermometer accessories can be added.

The standard insert can hold up to six thermometers. For larger blocks see the Gemini and Medusa models. The Jupiter^PLUS650 is available in two models, the BASIC (B) and the SITE (S). The B model includes a sophisticated temperature controller with a dual display for Set Temperature and Dry Block Temperature.

The S model includes a built in digital indicator to which an external standard thermometer can be connected giving greater accuracy eliminating temperature gradient and loading errors. For Surface Sensor and Blackbody use an external thermometer should always be used. For lab accuracy the Jupiter^PLUS650 can be used with a high-end temperature indicator such as one of the Isotech True Temperature Indicators (TTI).
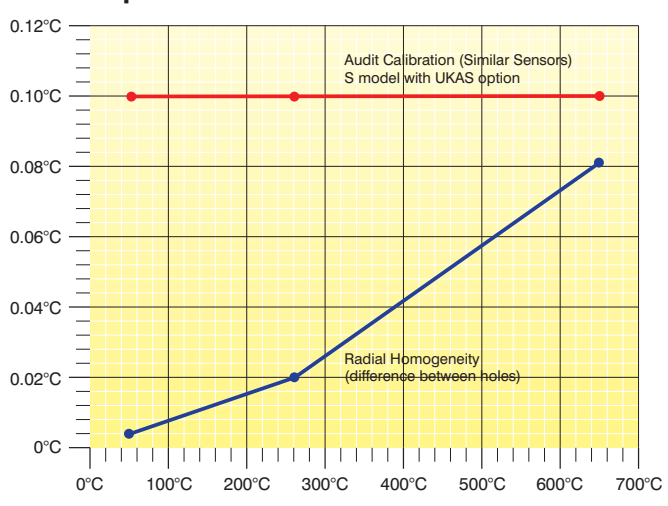
http://www.isotech.co.uk/industrial/
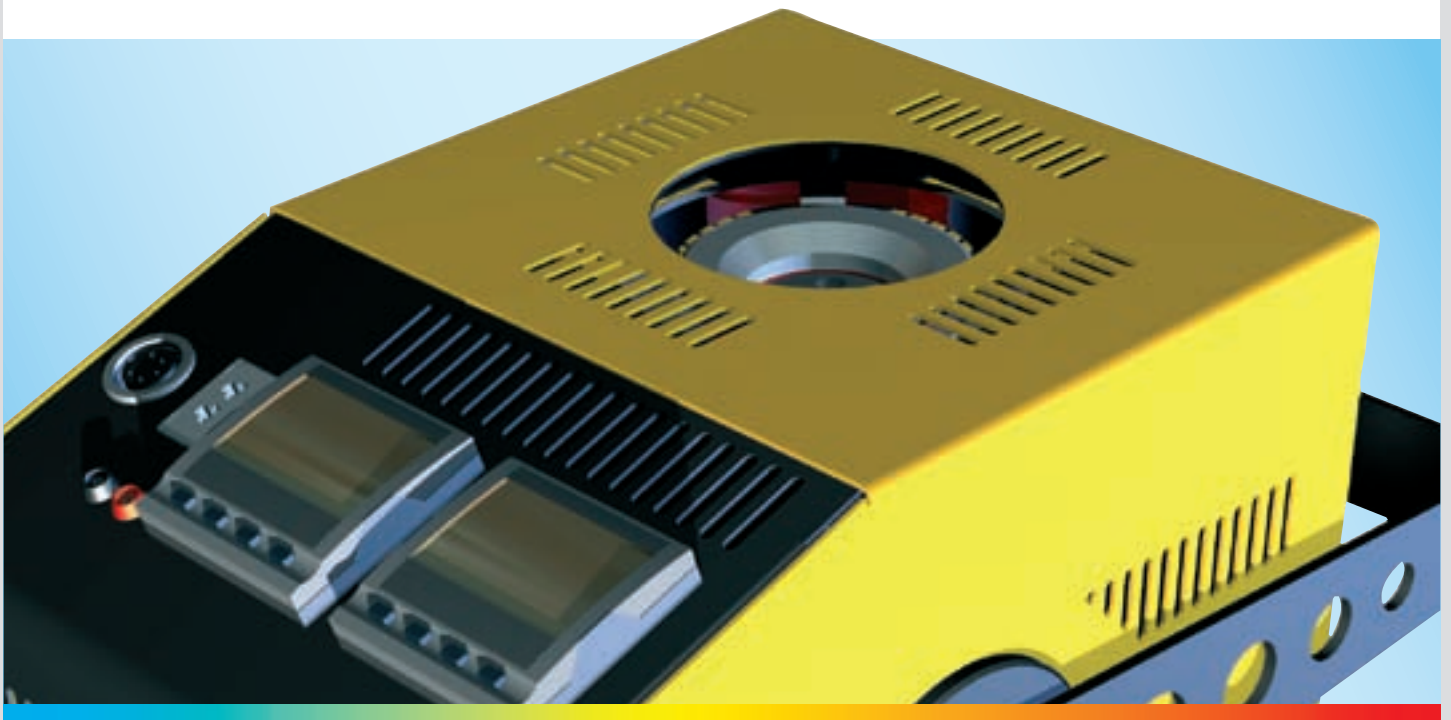
Model	Jupiter^{PLUS} 650
Temperature Range	35°C to 650°C
Absolute stability over 30 minutes	At 50°C ±0.02°C At 250°C ±0.02°C At 650°C ±0.03°C
Blackbody Source	±0.3°C
Surface Sensor Calibrator	±0.5°C
Computer Interface	Included with Software
Cools from 650°C to 150°C	in 60 minutes
Heats from 30°C to 650°C	in 20 minutes
Best Performance	See Graph
Calibration volume	35mm diameter by 148mm deep
Standard Insert	6 pockets, 2 x 4.5mm, 2 x 6.4mm, 1 x 8.0mm, 1 x 9.5mm diameter, all 140mm deep
Display Resolution	0.01 to 99.99 0.1 100.0 to 650.0 PC can display 0.01 across whole range with the software included
Indicator units	°C, °F, K
Power	100 to 120V (50 / 60 Hz) or 200 to 240V (50 / 60 Hz) 1000 Watts
Dimensions	Height 302mm Width 176mm Depth 262mm
Weight	8.5kg

Jupiter^{PLUS} 650

Graph: Audit Calibration (Similar Sensors) S model with UKAS option. Radial Homogeneity (difference between holes)

Calibration and Uncertainty

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

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

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

Accessories - Jupiter

Metal Block Insert 852-07-11
Standard Insert included

Alternative Inserts

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

852-07-07C Custom Insert. Isotech can provide custom drilled pockets, minimum of 3mm separation between holes. *Contact with your requirements.*
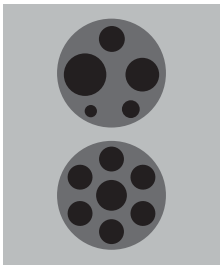
852-09-03 Standard Insert type B 13mm, 10mm, 8mm, 5mm and 3.5mm diameter holes, all 140mm deep

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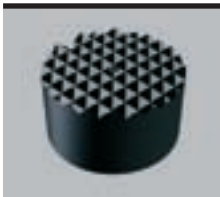
Blackbody Kit

852-09-05 Includes a Blackbody target and Sensor.

Surface Sensor Kit

852-07-15 Includes angled thermocouple.

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

Air Cooling

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

Standard Probe

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

Carrying Case

931-22-64 Purpose designed carrying case. Ideal for storing the calibrator and accessories
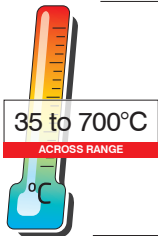
Transit Case

931-22-105 Resin case with inline wheels and pull out handle. Ideal for transporting the calibrator

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

Dry Block Calibrators
Gemini

35 to 700°C
ACROSS RANGE
°C

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

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

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

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

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

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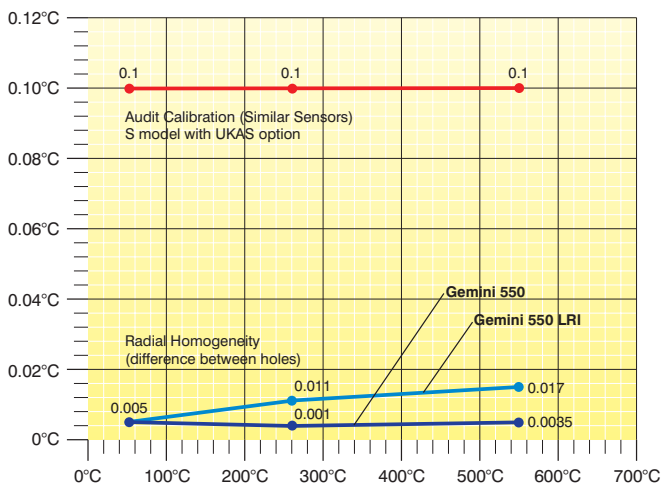
http://www.isotech.co.uk/industrial/

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

Gemini

Calibration and Uncertainty

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

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

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

Accessories - Gemini

Metal Block Sleeves

Gemini^PLUS 550

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

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

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

Gemini^PLUS 700

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

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

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

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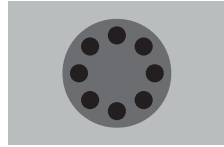
Removable Inserts

Gemini^PLUS 550 LRI

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

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

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

Gemini^PLUS 700 LRI

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

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

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

UKAS Calibration

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

Standard Probe

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

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

Carrying Case

931-22-64 Purpose designed carrying case. Ideal for storing the calibrator and accessories
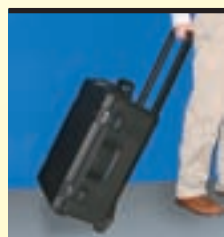
Transit Case

931-22-105 Resin case with inline wheels and pull out handle. Ideal for transporting the calibrator

UKAS Calibration

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

Standard Probe

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

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

Carrying Case

931-22-65 Purpose designed carrying case. Ideal for storing the calibrator and accessories

Transit Case

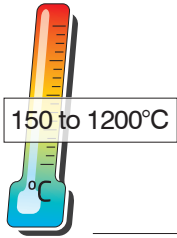**931-22-105** Resin case with inline wheels and pull out handle. Ideal for transporting the calibrator

How To Order

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

Portable Calibration Furnace
Pegasus

150 to 1200°C

°C

■ 33.5 x 130mm Calibration Volume

■ 150 to 1200°C

■ High Temperature Portable Calibration Furnace

■ PC Interface and Software included

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

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

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

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

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

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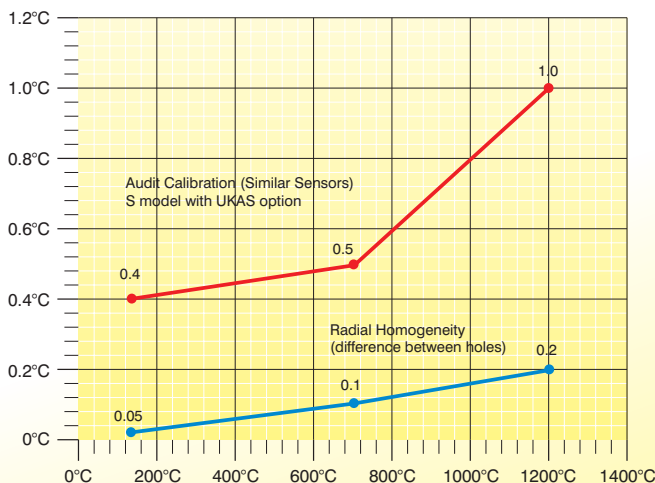
Calibration and Uncertainty

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

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

Pegasus[PLUS] **1200**

Audit Calibration (Similar Sensors)
S model with UKAS option

Radial Homogeneity
(difference between holes)

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

Accessories - Pegasus

Metal Block Insert

853-06-01 Standard Insert Included Four 8mm pockets. Pocket depth 80mm + 50mm insulator. Effective depth 130mm.

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

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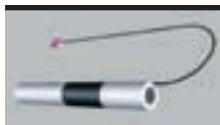
Blackbody Kit

853-06-03 Includes a Blackbody target and Sensor

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

UKAS Calibration (S models only)

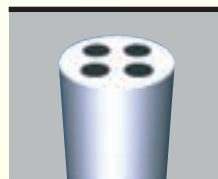UKAS Calibration available to order, legally traceable in more than 70 countries.

Standard Probe

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

Air Cooling

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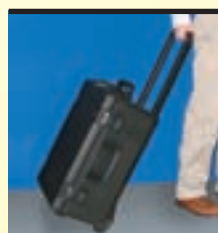
Ceramic Insulators

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

Carrying Case

931-22-64 Purpose designed carrying case. Ideal for storing the calibrator and accessories

Transit Case

931-22-105 Resin case with inline wheels and pull out handle. Ideal for transporting the calibrator

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