

Precision Thermometers

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

Precision Thermometers

Isotech have a range of precision thermometers, from a two channel handheld thermometer, the TTI-10 to a bench mounting thermometer with performance to 1mK (0.001°C) at a ground breaking new price.

True Surface Temperature Measuring System

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

Semi Standard Resistance Thermometers and Thermocouples

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

Fixed Resistors

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



In addition to Precision Thermometers a range of Thermometry Bridges are available. The microK range have accuracies of $< \pm 0.1\text{ppm}$ to suit Primary and Secondary Laboratories.

Details are in Catalogue 1: Solutions for Primary and Secondary Laboratories.

Thermometer Selection Guide

Model	SPRTs	PRTs	Thermistors	Thermocouples	Accuracy at 0°C	Features
TTI-10		■			0.01°C	Handheld, two channel
TTI-22	■	■			0.001°C	Sets new Standard for Price to Performance Ratio
milliK	■	■	■	■	0.003°C	SPRTs, PRTs, Thermistors and Thermocouples
Model 954						8 Channel PRT Switch for TTI-22 and TTI-7 PLUS
Model 958						8 Channel Thermocouple Switch for TTI-22 and TTI-7 PLUS



True Surface

Temperature Measuring System

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



Semi Standard

Resistance Thermometers and Thermocouples

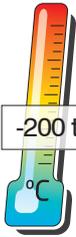
- Ideal for Industrial Applications
- Can be supplied with UKAS
- Choice of temperature ranges and sizes



Fixed

Resistors

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



-200 to 850°C

Handheld Thermometer TTI-10

- High Accuracy Handheld Thermometer
- High Resolution, to 0.001°C
- Perfect Standard for use with Isocal-6, Fast-Cal & Dry Blocks

The TTI-10 is a high accuracy handheld temperature indicator with two platinum resistance thermometer inputs. The high precision makes the instrument particularly suitable as a portable reference thermometer to use alongside Isotech temperature calibrators such as the Fast-Cal, Isocal-6 and Dry Block ranges. It is also suited for high accuracy measurements in industrial and scientific applications.

TTI-10 brings laboratory level performance of up to 10mK (0.01°C) and resolution up to 0.001°C in a portable handheld instrument. Battery life is typically 20 hours from a 9V PP3 battery and a protective rubber boot offers protection in field use.

The instrument can capture the minimum, maximum and average values over up to 4000 measurements with a logging rate selectable in the range of 1 second to 30 minutes.

The TTI-10 has an easy to use “learning calibration mode” that allows the TTI-10 to be system calibrated with a Platinum Resistance Thermometer simply by comparing it to a calibrated standard thermometer, no need to calculate coefficients or data, simply enter the reference probe temperature or temperatures and the TTI-10 does the work for you.

The USB interface allows connection to Isotech Cal Notepad software with its charting and logging features.

TTI-10 supports Isotech Semi Standard Platinum Resistance probes with system uncertainties (probe and instrument) as low as 20mK. We recommend the 935-14-61 and 935-14-16 probes detailed below and have special calibration deals available. Other probes and ranges are available, refer to Semi Standards – Platinum Resistance Thermometers in catalogue.



Input Connectors
Highest quality latching metal 'Lemo' connectors.



Rubber Sleeve
The TTI-10 Handheld Thermometer is supplied with a protective rubber boot.

Specifications

Input Channels	Two: 100 Ohm PRT, EN 60751 (Pt100), Four Wire
Range	-200°C to +850°C
Units	°C, °F and Ohms
Resolution	0.001°C from -199.999°C to +199.999°C remaining range 0.01°C
Accuracy: Instrument Only	±0.012°C from -80°C to 199.999°C ±0.02°C ±0.0015% RDG from 200°C to 660°C
Logging	Record Average, Min and Max over 4000 measurements
Measuring interval	Adjustable: 1 second to 30 minutes
PC Interface	USB - Cable Included

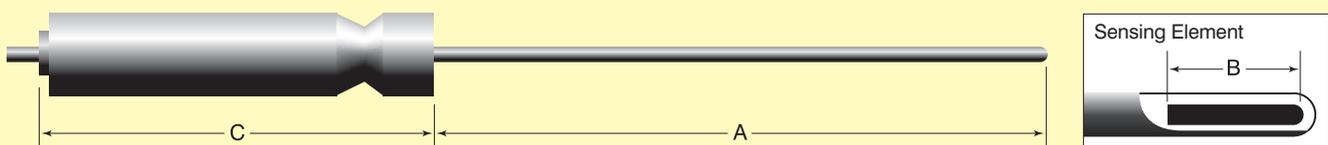
Connectors	High Quality Latching Metal: Lemo:
Working temperature	0°C to +40°C
Display	2-line LCD Display Single Channel or Dual Channels Simultaneously
Housing	Plastic (ABS) supplied with protective rubber boot
Weight	300g
Power Supply	9V battery PP3 (or via USB Cable)
Battery Life	Typically 20 Hours
Dimensions	200 x 85 x 40 mm (LxWxH)

Options

Semi Standard PRT 935-14-112-TTI	Isotech Semi Standard Platinum Resistance Thermometer: Fast Response, 2m Cable Length, four wire with Lemo plug fitted
UKAS System Calibration TTI-10-14-112-SYST	Recommended: -50°C to 199.999°C Four Point System Calibration, Uncertainty across range 0.025°C (25mK)
Semi Standard PRT 935-14-61-TTI	Isotech Semi Standard Platinum Resistance Thermometer: Fast Response, 2m Cable Length, four wire with Lemo plug fitted
UKAS System Calibration TTI-10-14-61-SYST	Recommended: -50°C to 199.999°C Four Point System Calibration, Uncertainty across range 0.02°C (20mK)

Semi Standard PRT 935-14-116-TTI	Isotech Semi Standard Platinum Resistance Thermometer: General Purpose, 2m Cable Length, four wire with Lemo plug fitted
UKAS System Calibration TTI-10-14-116-SYST	Recommended: 0°C to 420°C Four Point System Calibration, Uncertainty across range 0.04°C (40mK)

Carrying Case
931-22-101



■ Recommended Probes (Fit TTI-10 Carry Case)

Model	Maximum Range	Diameter	Length (A)	Sensing Length (B)	Handle (C)	Cable	Application
935-14-112/TTI	-50°C to 250°C	3mm	225mm	6mm	No Handle	2m PTFE	Fast Response, Low Stem Conduction
935-14-61/TTI	-50°C to 250°C	4mm	300mm	6mm	19 x 120mm	2m PTFE	Fast Response, Low Stem Conduction
935-14-116/TTI	-100°C to 450°C	6mm	350mm	25mm	19 x 120mm	2m PTFE	General Purpose



Precision Thermometer milliK

- Wide Range of Sensors, SPRTs, PRTs, Thermistors, Thermocouple and 4 - 20mA
- High Accuracy, < ± 5 ppm for PRTs, $\pm 2\mu\text{V}$ for Thermocouples and $\pm 1\mu\text{A}$ Transmitters
- Logs - Controls Isotech Temperature Sources
Massive logging capacity – controls Dry Blocks and Liquid Baths

The milliK Precision Thermometer from Isotech sets a new standard for the high accuracy measurement and calibration of Platinum Resistance Thermometers, Thermistors, Thermocouple and Process Instrumentation (4-20mA) over the range -270°C to 1820°C.

In addition to low uncertainty measurements from Reference Standards and Industrial sensor measurement the milliK can control Isotech temperature sources, sequencing through a programmable list of temperature set points and log data to internal memory or a USB drive.

The milliK forms the hub of a measurement system, reading SPRTs, RTDs, Thermistors, Thermocouples and 4 - 20mA current inputs with the option to control calibration baths and log readings accurately.

Benefiting You

The milliK sets a new standard for value, versatility and accuracy - < ± 5 ppm over range for PRTs, $\pm 2\mu\text{V}$ for Thermocouples and $\pm 1\mu\text{A}$ for current transmitters, see table.

Supporting a wide range of sensors and functions it replaces individual devices making a cost effective calibration solution.

A robust design and operation from AC or DC power allows the milliK to be used in the laboratory, test room or out in the field.

The milliK can display in °C, °F, K, Ohms, mV and mA with numeric and graphical display modes. The large back lit display makes configuring the instrument and setting the scrolling strip charts intuitive. The USB port allows for the use of a mouse, keyboard or USB Drive.

Built on World Leading Technology

In 2006 Isotech launched the microK range of thermometry bridges which quickly established themselves as the instrument of choice for National Metrology Institutes and Primary Laboratories with innovative features, accuracy and versatility.

In response to industry demands for greater accuracy, the milliK now brings the same design philosophy of the microK to those outside the Primary Laboratory. Users calibrating industrial sensors in the laboratory, pharmaceutical plants, food and beverage plants, aerospace, power industries and service companies will welcome the milliK as a solution to increase measurement confidence, ensure high accuracy traceable calibration, improve quality as well as ensure safety and lower energy consumption.



*The Isotech milliK
High Accuracy Measurement
Controls Calibration Baths
Logs Data*

No Compromise Design

The design team have considered industrial users and applications in order to avoid measurement errors and problems encountered in some instruments from other manufacturers:

- **Eliminates Thermal EMF Errors in PRTS**
Fast current reversal technology and solid state switching eliminate thermal EMF effects avoiding the errors that occur with fixed DC instruments.
- **Lead Wire Correction**
PRT lead wire errors are eliminated for up to 30m of four core screened cable.
- **Galvanic Isolation**
Not only are the two sensor channels galvanically isolated, the 4 - 20mA input is also separately isolated. The benefits of the advance design are no ground loops, improved safety and noise immunity.

High Resolution

The display resolution is 0.0001°C (0.1mK) made possible by using a powerful Sigma Delta Analogue to Digital converter to achieve a true measuring resolution of just 28 $\mu\Omega$ equivalent to 0.00007°C (0.07mK) for PRT inputs.

Automation

The milliK is compatible with I-cal EASY and the Isotech range of PRT and Thermocouple Selector Switches, enabling users to build fully automatic calibration systems for up to 32 temperature sensors with the ability to calculate coefficients and print tables and certificates.

Reliable

Like the award winning microK range, the milliK is all solid state. There are no mechanical relays, switches or potentiometers which would reduce reliability.

Input Connectors

No compromise design ruled out lower cost problematic connectors and the SPRT / PRT inputs are via the highest quality gold plated push / pull self latching circular connectors overcoming the problems seen elsewhere where thermometers have been designed to a budget.

Outstanding CJC Performance and Flexibility

Again, the no compromise design philosophy led to a specially developed rugged thermocouple connector made from alumina and incorporating the same type of platinum sensor as used in Isotech precision probes ensuring optimal cold junction accuracy.

Three CJC modes allow thermocouple operation with internal automatic compensations, external 0°C reference

systems or the milliK can measure the junction with a probe on an unused channel, useful for automated systems.

21st Century Design

Utilising a powerful internal operating system and fast 32 Bit processor the milliK has the power and capacity to overcome the memory limitations of older instruments.

Store Probe Data

There is sufficient memory for an almost unlimited number of standard probes, allowing the storing of calibration data for both resistance thermometers and thermocouples. The digital matching of probe data allows the instrument to show the true temperature. The instrument will warn if a probes calibration time has expired.

Data Logging

Older instruments are limited to a maximum number of logged data points, the milliK is limited only by storage space. The internal memory can store more than six months of data, and with a low cost USB Memory stick the milliK can log continuously for a lifetime

Data Management

Probe data and logged measurements can be exported to a USB Memory drive at the push of a button. Additionally the instrument is future proof with future software updates applied from a USB drive.

Connectivity and Communications

With USB host, two serial interfaces and Ethernet it is easy to communicate with the milliK whether it is on the bench next to a PC or remote by using a LAN or WAN connection. These interfaces are fitted as standard.

The milliK includes a PC lead and Cal Notepad software.

Open Calibration

The milliK is readily calibrated against resistance and voltage standards. There are no internal adjustments and the calibration commands are simply sent via RS232 or from the front panel (password protected). The procedure is open and fully documented unlike some other instruments where there is no choice but to return to the manufacturer.



1 The milliK can connect to Isotech temperature sources

Dry Blocks, Liquid Baths and Furnaces Can cycle the bath through a series of temperatures logging the data - all without a PC.



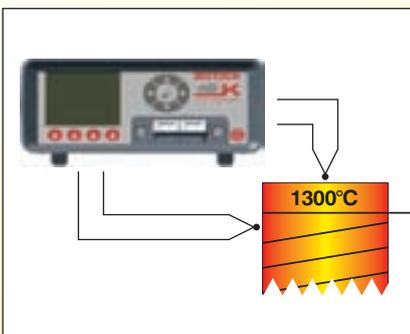
2 Wide range of sensors

The milliK can use Standard Reference probes and read from industrial sensors being calibrated, including 4 - 20mA transmitters - all to high accuracy.



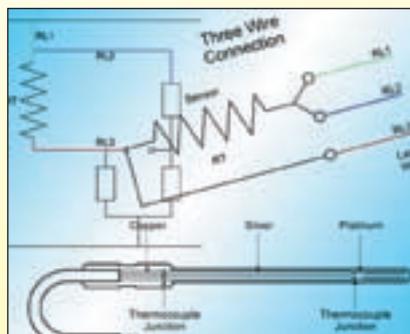
3 Logs

The milliK can record time stamped data to internal memory or a USB Memory Drive.



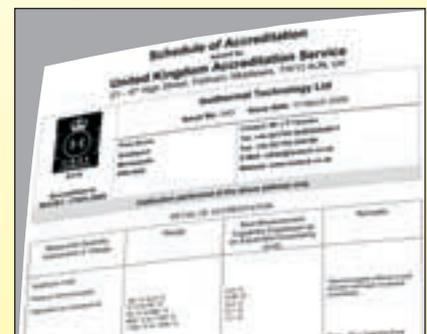
4 Safety

The milliK inputs are galvanically isolated, with the 4 - 20mA input separately isolated avoiding problems with high voltage pick up common when using thermocouples in high temperature furnaces.



5 Designed to eliminate and protect against real world problems

The milliK eliminates thermal EMF errors, compensates for lead wire resistance and warns if a probe is out of calibration.



6 High accuracy

For demanding industrial and laboratory applications, the milliK features probe matching for all sensor types, self heating test, exceptional CJC performance and high stability internal standards.

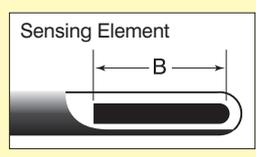
Specifications

Input Channels	3	
Channels 1+2	SPRTs, PRTs, Thermistor and Thermocouples	
Channel 3	Process Inputs 4 - 20mA Isolated 24VDC Power Supply Included	
Ranges	SPRTs:	0-115Ω
	PRTs:	0-460Ω
	Thermistors:	0-32kΩ, 0-130kΩ, 0-490kΩ
	Thermocouples:	±115mV
	4-20mA:	0-30mA
Units	°C, °F, K, Ω, mV, mA	
Accuracy	Initial	Over 1 year
SPRTs/PRTs:	5ppm	7ppm
Thermistors:	50ppm	150ppm
Thermocouples:	2μV	4μV
4-20mA:		0.002mA
Temperature Accuracy	Initial	Over 1 year
SPRTs/PRTs (at 0°C):	3mK	4mK
(over full range):	5mK	7mK
Thermistors:	50ppm	150ppm
Thermocouples:		
Type B:	±0.23°C	±0.46°C
Type E:	±0.03°C	±0.06°C
Type J:	±0.04°C	±0.07°C
Type K:	±0.05°C	±0.10°C
Type L:	±0.04°C	±0.07°C
Type N:	±0.06°C	±0.12°C
Type R:	±0.17°C	±0.34°C
Type S:	±0.19°C	±0.38°C
Type T:	±0.05°C	±0.09°C
Au-Pt:	±0.12°C	±0.23°C
Resolution	Resistance (PRTs):	0.00001Ω
	(Thermistors):	0.001Ω
	Voltage:	0.00001mV
	Current:	0.001mA
	Temperature:	0.0001°
Temperature Conversions	PRTs:	IEC60751 (2008), Callendar-van Dusen, ITS90
	Thermocouples:	IEC584-1 1995 (B,E,J,K,N,R,S,T), L, Au-Pt
	Thermistors:	Steinhart-Hart, polynomial
Sensor Currents	SPRTs/PRTs:	1mA and 1.428mA ±0.4% (reversing)
	Thermistors:	5μA (reversing)
Keep-Warm Current	SPRTs/PRTs:	1mA and 1.428mA

Input Connectors	SPRTs/PRTs:	LemoEPG.1B.306. HLN 6-pin gold plated contacts
	Thermocouples:	Miniature Thermocouple socket (ASTM E 1684-05)
	4-20mA:	4mm sockets
Interfaces	10/100MBit Ethernet (RJ45 socket) USB (2.0) host 2 x RS232 (9-pin D-type plug, 9600 Baud)	
Display	89mm / 3.5" QVGA (320 x 240) colour TFT LCD with LED backlight	
Operating Conditions	Operating:	0-45°C / 32-113°F, 0-99% humidity
	Full Specification:	15-30°C / 50-85 °F, 10-90% humidity
Display Units	°C, °F, K, Ohms, mV and mA	
Statistics	In Addition to Instantaneous Display user can select mean of 2 - 100 measurements with Standard Deviation	
Measurement Time	950mS	
Cable Length	Limited to 10Ω per core or 10nF shunt capacitance (equivalent to 100m of typical 4-core screened PTFE cable)	
Logging	Capacity to store > 180 Days of time stamped measurements to internal memory	
Recommended Probes	Isotech Semi Standard PRTs Isotech Model 909 SPRT	
Power	88-264V (RMS), 47-63Hz (universal), 6W maximum or 4 x AA cells	
Dimensions	255mm x 255mm x 114mm / 10" x 10" x 4.5" (W x D x H)	
Weight	2.25kg / 5lb	
Optional Carrying Case	931-22-102	



NOTE: Due to our program of continual development and improvement, we reserve the right to amend or alter characteristics and design without prior notice.



■ Recommended Probes (Fit milliK Case)

Model	Maximum Range	Diameter	Length (A)	Sensing Length (B)	Handle (C)	Cable	Application
935-14-61/TTI	-50°C to 250°C	4mm	300mm	6mm	19 x 120mm	2m PTFE	Fast Response, Low Stem Conduction
935-14-116/TTI	-100°C to 450°C	6mm	350mm	25mm	19 x 120mm	2m PTFE	General Purpose

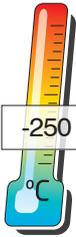
For further options and details, see Reference Probes - Semi Standards, pages 68-73.

For laboratory standard thermometers we recommend for SPRTs the Isotech Model 909Q and for thermocouples the Model 1600 Type R, see Catalogue 1: Solutions from Primary & Secondary Laboratories.



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





-250 to 962°C

True Temperature Indicator

TTI - 22

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

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

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

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

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

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

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

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



Simple to use
High Accuracy
High Resolution

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

The TTI-22 continually compares the connected sensor to a highly stable precision internal reference resistor. For a Pt100 at 0°C the annual stability for absolute measurement is typically $\pm 1.3\text{mK}$ ($5\text{ppm} \times 100\Omega = 0.5\text{m}\Omega / 1.3\text{mK}$).

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

The instrument can be configured to measure ratio of the measured

resistance of the two input channels, a technique familiar to users of older style thermometry bridges.

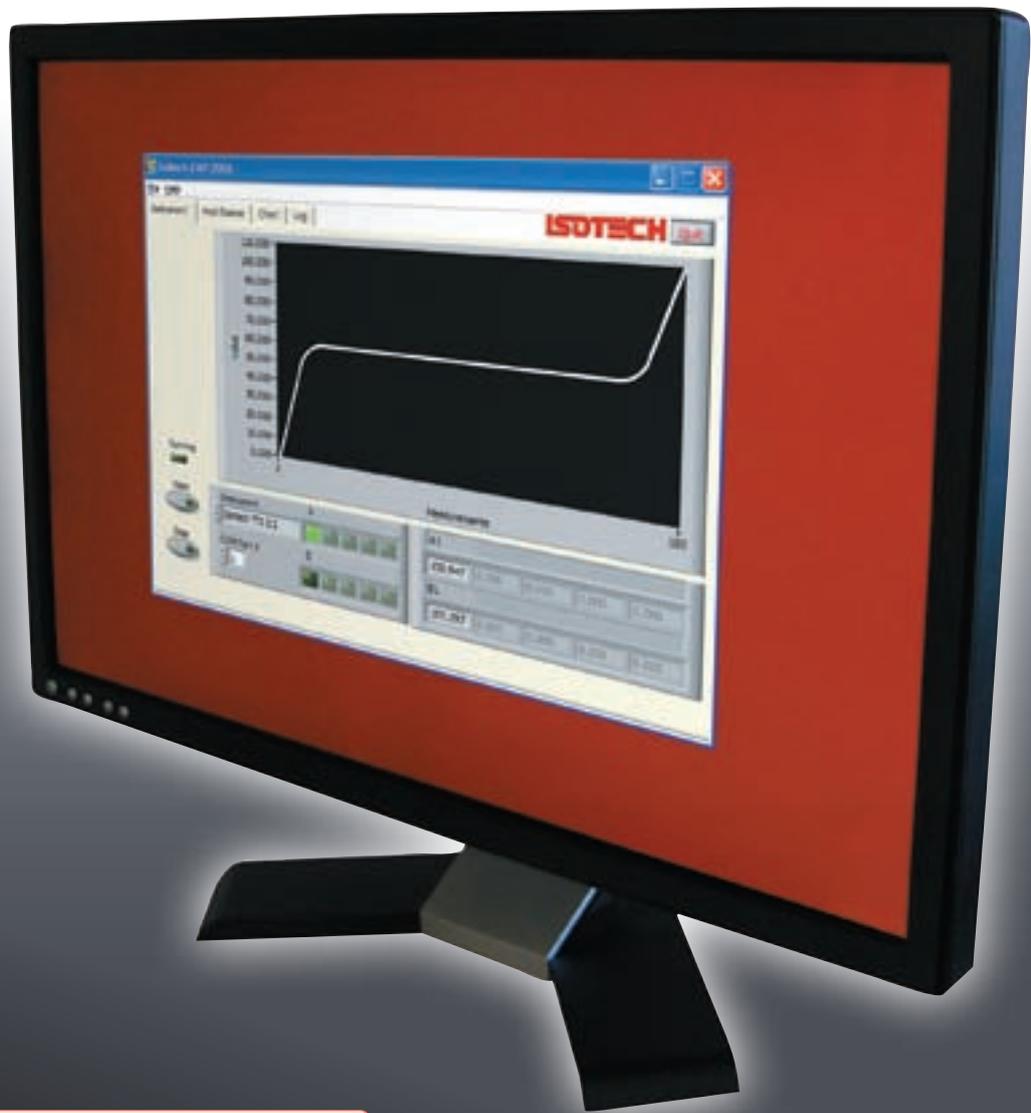
The overall uncertainty of the instrument and probe together will be determined by the model of probe and the temperature range. For the majority of applications the contribution of the instrument uncertainty will be negligible compared to the uncertainty of the calibrated probe.

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

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



931-22-106 Optional Carrying Case



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





PRT and Thermocouple Thermometer

TTI - 7 PLUS

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

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

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

Data Logging and Statistical Analysis

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

Usability

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

Why the TTI-7 PLUS ?

The TTI-7 PLUS has the features you need for high accuracy temperature measurement. With resistance thermometers used at high temperatures unwanted thermal EMFs are generated, the TTI-7 PLUS can take two measurements switching the polarity then computing the average to eliminate this error source. Many other instruments lack the ability to eliminate thermal EMFs. The thermal EMF error can be greater than the quoted



accuracy of an instrument, if you need small measurement uncertainty for high temperature PRT work you need this feature. Add the internal scanner to expand the instrument to have up to 10 channels - any or all can be scanned and lodged with the internal data logger.

High Accuracy

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

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

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

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

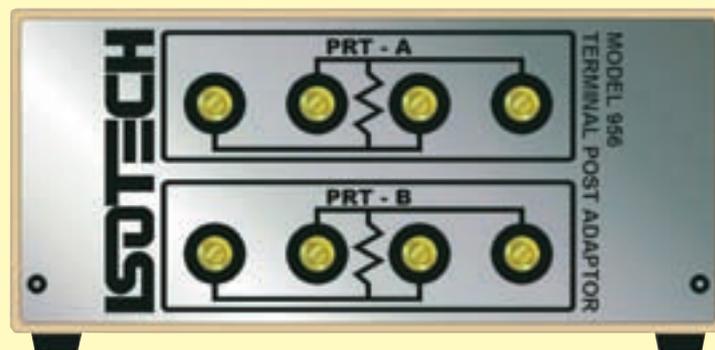
Model	TTI-7 PLUS	Working Temperature	0°C to 40°C rel. humidity 80% max non condensing
Temperature	Depending on Sensor	Storage Temp.	-20°C to +50°C.
Range	-200 to 2315°C	Main Supply	100/120/220/240 Volts +10% -13% 47 to 63Hz max. 40VA
Indicator units	°C, °F, K	Dimensions	Height 110mm Width 219mm Depth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

Terminal Adaptor Model 956

- Accepts Bare Wire, Spades or Banana Plugs
- Gold Plated Connectors
- Suits a wide range of Isotech instruments

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

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



Specifications

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

Weight 0.660kg

How to Order

956 Terminal Adaptor suits milliK, TTI-6, TTI-7 or TTI-10
 956/TTI-22 Terminal Adaptor for TTI-22

Miniature Fixed Resistor Model 836

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

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

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

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

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

Resistance Values

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

UKAS Calibration

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

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

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



Please Note:
We offer other Resistor Ranges including the models 456, the SRA and the SRB ranges.
For more information please contact Isotech, or visit our website www.isotech.co.uk



Model	836 Miniature Fixed Resistor
Power Rating	0.5 watt
Nominal Temperature Coefficient of Resistance	+0.6ppm/ $^{\circ}$ C (0 $^{\circ}$ C to +25 $^{\circ}$ C) -0.6ppm/ $^{\circ}$ C (+25 $^{\circ}$ C to +60 $^{\circ}$ C)
Resistance Tolerance	(Initial Resistance Accuracy) $\pm 0.005\%$
Resistance Range	5 ohms to 3.3 megaohms
Current Noise	<0.010 μ V (RMS) / Volt of applied voltage
Thermal EMF	0.1 μ V/ $^{\circ}$ C maximum 0.05 μ V/ $^{\circ}$ C typical
Connections	Screw Terminal Posts
Stability	Typically 1ppm per year at 1mA
Dimensions	Height 30mm Width 89mm Depth 58mm (including terminals)
Weight	90g
How to Order	836 Miniature Fixed Resistor Please state Ohms Value Required Please state if UKAS Certification is required

Selector Switch 8 Way

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

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

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

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

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

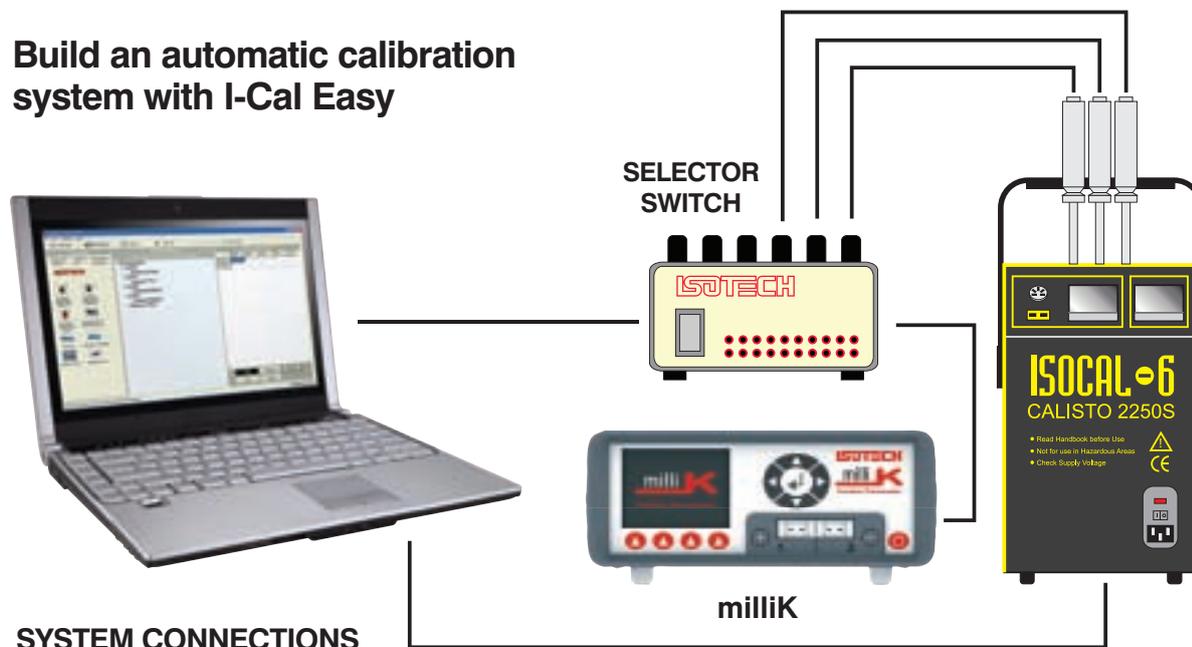
The software can automatically switch between the boxes and connect the appropriate output to the TTI. This 16 channel operation is not convenient without the software and manual operation of two boxes together is not recommended.

Advantages

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



Build an automatic calibration system with I-Cal Easy



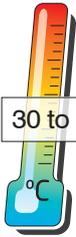
SYSTEM CONNECTIONS

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

How to Order
954 RTD Selector Switch

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

How to Order
958 TC Selector Switch



30 to 350°C

Surface Measurement Model 944

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

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

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

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

Principal of Operation

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

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

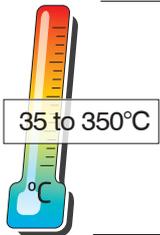
The 944 can be used with the Isotech Small Hot Plate model 983. A traceable calibration certificate is available to order.



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

How to Order

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



Surface Sensor Calibrator Small Hot Plate

- Low Cost Portable Hot Plate
- PC Interface and Software
- Stable to $\pm 0.1^\circ\text{C}$

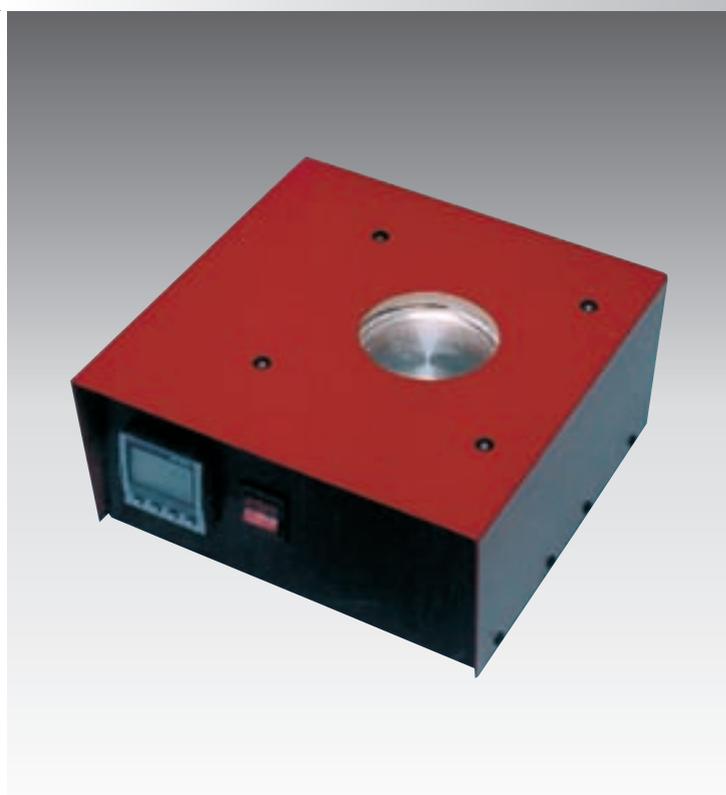
The Isotech Small Hotplate is a lightweight portable calibration system purpose designed for surface mounted sensors. The flat surface plate is made from precision-machined aluminum. The sensor to be tested is simply placed on the surface, for higher accuracy a calibrated surface sensor can be placed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

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

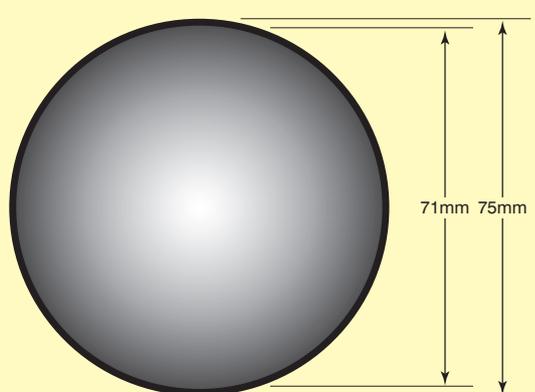
The internal control sensor is located immediately below the plate's surface.

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

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

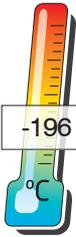


Notes:
A similar model but with a black high emissivity surface is available.
Many of the dry block calibrators featured within this book have accessories available for surface sensor calibration.



Hotplate Dimensions

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



-196 to 670°C

Reference Probes - Semi Standards Platinum Resistance Thermometers

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

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

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

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

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

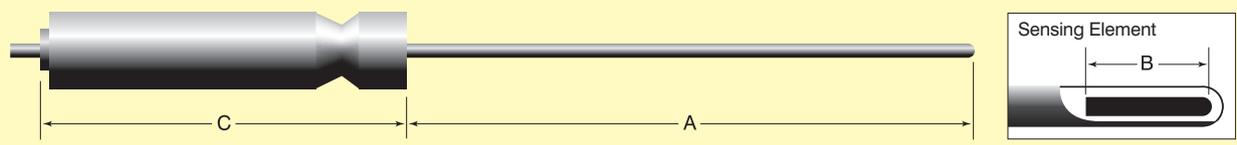
<http://www.isotech.co.uk>



Universal Specifications

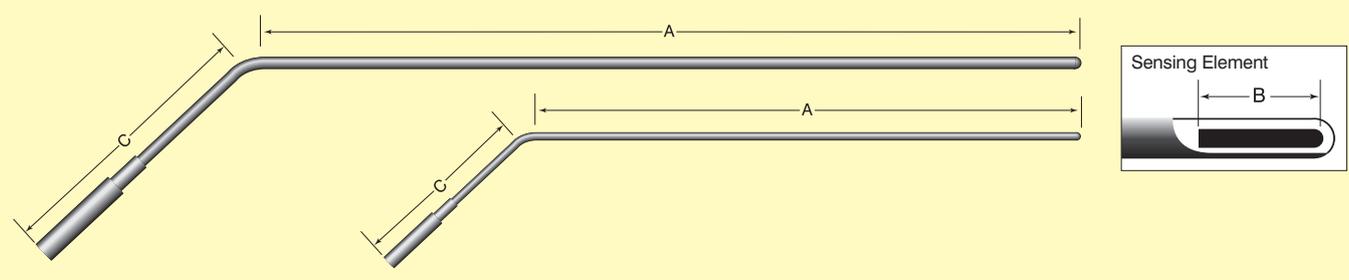
Ro	100Ω ± 0.05 Ω
Alpha	0.003850 ± 0.000005
Standard	IEC 60751
Stability	0.010 Ω/year
Recommended Current	1mA
Self Heating at 1mA	0.004°C
Calibration	Optional UKAS Calibration at extra cost. See table for typical uncertainties
Connection	Four Wire
Max. Handle Temperature	80°C

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



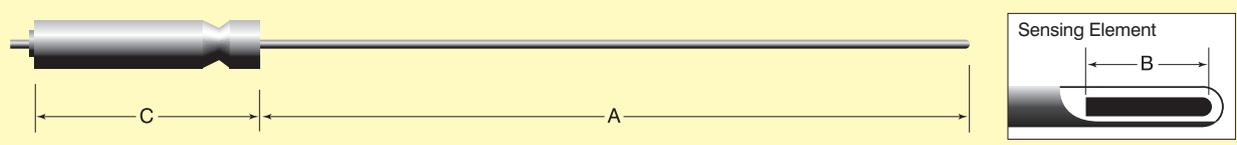
■ **General Purpose Probes**

Model	Range	Diameter	Length (A)	Sensing Length (B)	Handle (C)	Cable	Application
935-14-112	-50°C to 250°C	3mm	225mm	6mm	No Handle	2m PTFE	General Purpose/TTI-10
935-14-61	-50°C to 250°C	4mm	300mm	6mm	19 x 120mm	2m PTFE	Fast Response, Low Stem Conduction
935-14-13	-196°C to 250°C	6mm	350mm	25mm	25 x 115mm	2m PTFE	Low Temperature
935-14-113	-100°C to 250°C	6mm	350mm	25mm	19 x 120mm	2m PTFE	General Purpose
935-14-16	-100°C to 450°C	6mm	450mm	25mm	19 x 120mm	2m PTFE	General Purpose
935-14-116	-100°C to 450°C	6mm	350mm	25mm	19 x 120mm	2m PTFE	General Purpose/Fits milliK Case
935-14-72	-50°C to 670°C	6mm	375mm	25mm	No Handle	2m PTFE	Fits Jupiter / Gemini Carry Case
935-14-98	-50°C to 350°C	4mm	300mm	8mm	No Handle	2m PTFE	Low Stem Conduction



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

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



■ **Working Industrial Standards**

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

Model	Range	Diameter	Length (A)	Sensing Length (B)	Handle (C)	Cable
935-14-95L	-200°C to 165°C	6mm	480mm	25mm	25 x 115mm	2m PTFE
935-14-95H	-80°C to 670°C	6mm	480mm	25mm	19 x 120mm	2m PTFE

Termination Options

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

How to Order

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

Typical Uncertainties of PRT Semi Standards with Range

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

*Preferred Models

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

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

Here are a few documented facts:

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

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

ISOTECH

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

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

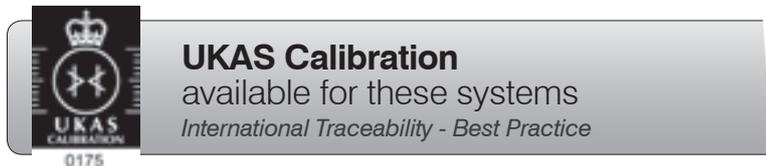
You'll see from the attached history of the calibration by our NMI that the probe has remained stable and accurate, and bearing in mind the daily variations in temperature that it has undergone, these results are testimony to the high quality of this product.

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

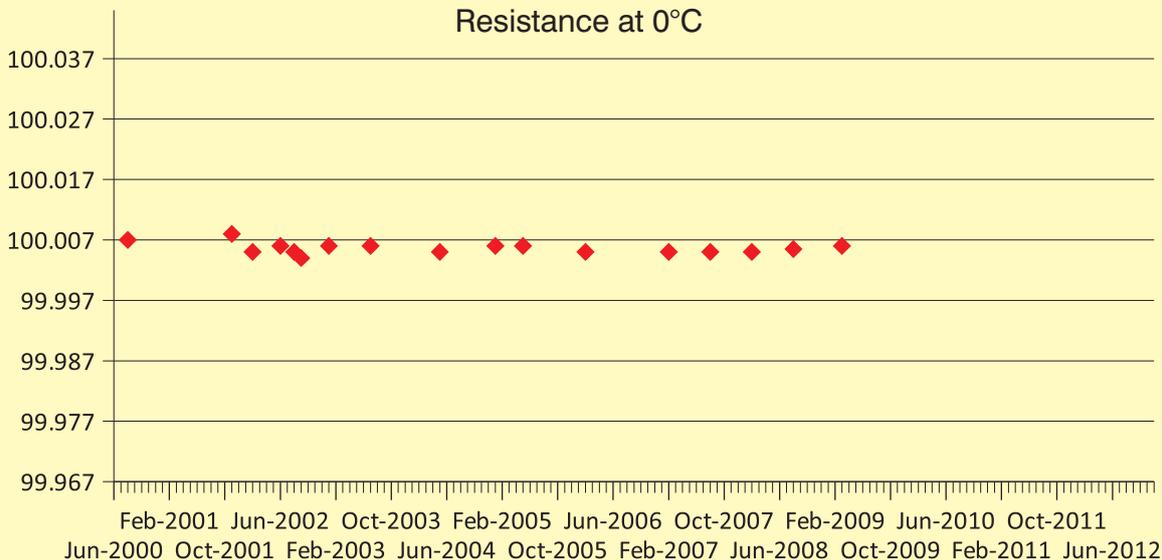
Kind regards,

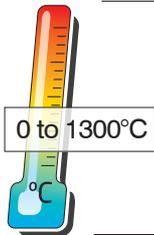
Guy Snelling

Temperature Metrologist
 InterCal (South Africa)



Resistance at 0°C





Reference Probes - Semi Standards Thermocouples

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

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

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

The 935-14-91 is constructed from Platinum and Platinum Rhodium alloys and can be used to 1300°C.

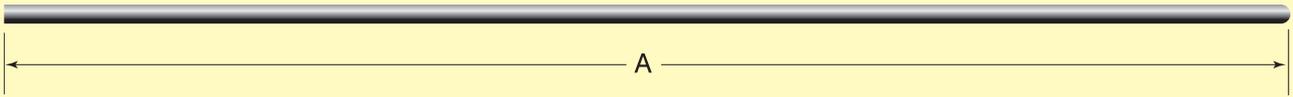
Recommended for the Pegasus 1200 and general purpose applications. It has 1M of compensating cable terminated with a miniature thermocouple plug. The 935-14-88 is similar to the 14-91 but is made entirely from precious metals, with platinum wires all the way to the miniature plug.

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

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



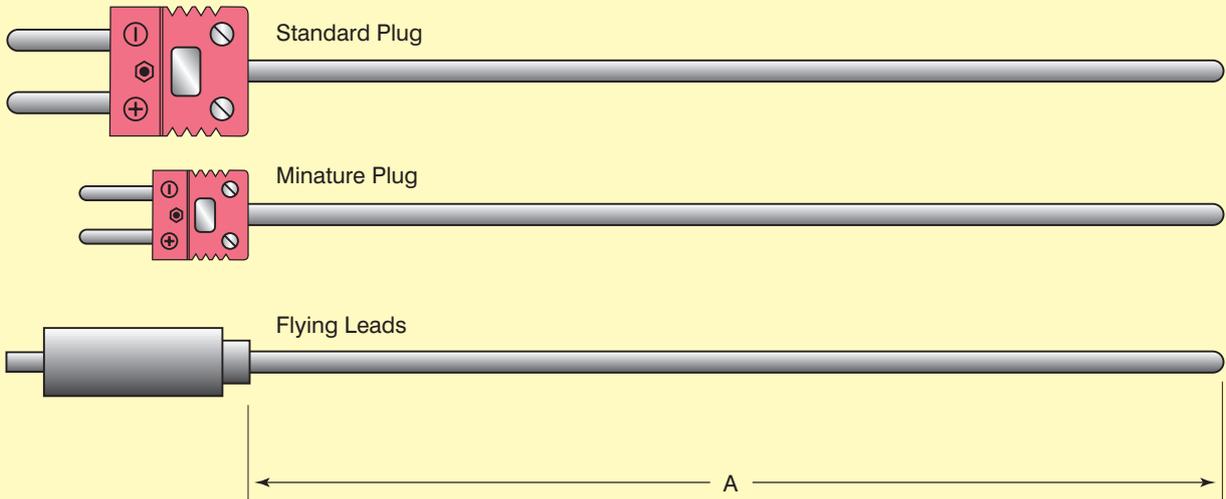
<http://www.isotech.co.uk>



■ **Noble Metal Thermocouples**

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

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



■ **Type N Thermocouples**

Recommended base metal thermocouple, low cost metal sheathed.

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

Isotech UKAS Calibration Uncertainties ($k=2$)

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



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



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



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

How to Order

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