GEMINI R
MODEL 976

This manual is issued under the authority of
Mr. J.P. Tavener, Managing Director

**ISOTHERMAL TECHNOLOGY LIMITED
PINE GROVE, SOUTHPORT
MERSEYSIDE PR9 9AG
ENGLAND**

**Tel: +44 (0) 1704 543830
Fax: +44 (0) 1704 544799**

http://www.isotech.co.uk

E-mail info@isotech.co.uk

The company is always willing to give technical advice and assistance where appropriate. Equally, because of the programme 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.

CONTENTS

GUARANTEE

This instrument has been manufactured to exacting standards and is guaranteed for twelve months against electrical break-down or mechanical failure caused through defective material or workmanship, provided the failure is not the result of misuse. In the event of failure covered by this guarantee, the instrument must be returned, carriage paid, to the supplier for examination, and will be replaced or repaired at our option.

FRAGILE CERAMIC AND/OR GLASS PARTS ARE NOT COVERED BY THIS GUARANTEE

INTERFERENCE WITH, OR FAILURE TO PROPERLY MAINTAIN THIS INSTRUMENT MAY INVALIDATE THIS GUARANTEE

RECOMMENDATION

The life of your ISOTECH Instrument will be prolonged if regular maintenance and cleaning to remove general dust and debris is carried out.

We recommend this instrument to be re-calibrated annually.

Serial No:...

Date:..

ISOTHERMAL TECHNOLOGY LTD
PINE GROVE,
SOUTHPORT, MERSEYSIDE
PR9 9AG
ENGLAND

TELEPHONE: +44 (0) 1704 543830/544611
FAX: +44 (0) 1704) 544799

EMC INFORMATION

This product meets the requirements of the European Directive on Electromagnetic Compatibility (EMC) 89/336/EEC as amended by EC Directive 92/31/EEC and the European Low Voltage Directive 73/25/EEC, amended by 93/68/EEC. To ensure emission compliance please ensure that any serial communications connecting leads are fully screened.

The product meets the susceptibility requirements of EN 50082-1, criterion B.

Symbol Identification	Publication	Description
ISO3864	Caution (Refer to Handbook)	
	IEC 417	Caution, Hot Surface

ELECTRICAL SAFETY

This equipment must be correctly earthed.

This equipment is a Class 1 Appliance. A protective earth is used to ensure the conductive parts can not become live in the event of a failure of the insulation.

The protective conductor of the flexible mains cable which is coloured green/yellow MUST be connected to a suitable earth.

The blue conductor should be connected to Neutral and the Brown conductor to Live (Line).

Warning: Internal mains voltage hazard. Do not remove the panels.

There are no user serviceable parts inside. Contact your nearest Isotech agent for repair.

Voltage transients on the supply must not exceed 2.5kV.

Conductive pollution, eg. Carbon dust, must be excluded from the apparatus. EN61010 pollution degree 2.

The apparatus has an input connectors for temperature sensors, see page 22. These inputs are only suitable for either a thermocouple or resistance thermometer. No other sensor or signal may be connected.

ENVIRONMENTAL RATINGS

Operating Temperature   0-50°C

Relative Humidity   5-95%, non condensing

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HEALTH AND SAFETY INSTRUCTIONS

1.   Read all of this handbook before use.

2.   Wear appropriate protective clothing.

3.   Operators of this equipment should be adequately trained in the handling of hot and cold items and liquids.

4.   Do not use the apparatus for jobs other than those for which it was designed, ie. the calibration of thermometers.

5.   Do not handle the apparatus when it has hot (or cold), unless wearing the appropriate protective clothing and having the necessary training.

6.   Do not drill, modify or otherwise change the shape of the apparatus.

7.   Do not dismantle the apparatus.

8.   Do not use the apparatus outside its recommended temperature range.

9.   If cased, do not return the apparatus to its carrying case until the unit has cooled.

10.   There are no user serviceable parts inside. Contact your nearest Isotech agent for repair.

11.   Ensure materials, especially flammable materials are kept away from hot parts of the apparatus, to prevent fire risk.

CAUTIONARY NOTE

ISOTECH PRODUCTS ARE INTENDED FOR USE BY TECHNICALLY TRAINED AND COMPETENT PERSONNEL FAMILIAR WITH GOOD MEASUREMENT PRACTICES.

IT IS EXPECTED THAT PERSONNEL USING THIS EQUIPMENT WILL BE COMPETENT WITH THE MANAGEMENT OF APPARATUS WHICH MAY BE POWERED OR UNDER EXTREMES OF TEMPERATURE, AND ARE ABLE TO APPRECIATE THE HAZARDS WHICH MAY BE ASSOCIATED WITH, AND THE PRECAUTIONS TO BE TAKEN WITH, SUCH EQUIPMENT.

UNPACKING AND INITIAL INSPECTION

Our Packing Department uses custom designed packaging to send out your unit, but as accidents can still happen in transit, you are advised, after unpacking the unit to inspect it for any sign of shipping damage. Confirm that your delivery is in accordance with the packing note. If you find any damage or that part of the delivery is missing notify us or our agent, and the carrier immediately. Keep the packing, if damaged, for possible inspection by an insurance assessor.

ELECTRICITY SUPPLY

Before connecting to the electricity supply please familiarise yourself with the parts of the handbook relevant to your model.

Your unit's supply voltage requirement is specified on a plate on the instrument along with the serial number. All Gemini R instruments will work on an electricity supply frequency of 50Hz or 60Hz.
The apparatus is provided with an approved power cord. If the plug is not suitable for your location then the plug should be removed and replaced with an appropriate plug.

Take care to ensure the old plug is disposed safely.

The cable is colour coded as follows:

COLOUR	FUNCTION
Green/yellow	Earth (Ground)
Brown	Live (line)
Blue	Neutral

Please ensure that your unit is correctly connected to the electricity supply.

THE APPARATUS MUST BE CORRECTLY EARTHED (GROUNDED)

The units on/off switch is located on the power inlet. Take care NOT to switch the unit off when it is hot - allow to cool first.

INTRODUCTION

The Gemini R Model 976 is a variable temperature, portable black body radiation source designed for use at temperatures up to 550°C.

The source is a primary standard black body for the highest precision calibration of radiation thermometers over the range 35°C to 550°C (120°F to 1020°F). When the set point temperature is reached, the output from the thermometer under test is compared with the temperature of the source as measured by a Platinum Resistance Thermometer and Electronic Temperature Indicator.

When used in conjunction with the Platinum Resistance Thermometer, which is supplied complete with a UKAS Calibration Certificate, the highest precision is obtained, alternatively the source can be used.

1.   The temperature of the source can be measured by using a radiation thermometer of traceable calibration. This method of calibration can be described as calibration by comparison with a standard radiation thermometer.

2.   If traceability to National Standards is not required, the source can be used without any certification. From previous work, the temperature, as shown on the controller indication, has been found to agree with the radiance temperature to within ±5K.

3.   If traceability to National Standards is required to a larger uncertainty, a UKAS Certificate of Calibration for the source can be supplied. The relationship between the indicated temperature of the controller and the radiance temperature, as measured by a secondary standard radiation thermometer, is reported.

The source provides a wide angle target which makes it ideal for use with both fixed installation and portable, hand held thermometers.

The difference between the corrected probe and the cavity was found to be less than 2°C when a model of identical construction was tested.

Orifice plates are available, they allow the cavity to be restricted in diameter from 65mm diameter to sizes of 50, 40, 30, 20 or 10mm diameter.

For absolute calibration, metal freeze point cells are available which fit into the cavity - instruction for use is supplied with the cells.

SPECIFICATION

Voltage	:	230VAC (or 115VAC) see ratings plate
Power	:	1 kW
Supply Frequency	:	50/60Hz
Maximum Operating Temperature	:	550°C
Minimum Operating Temperature	:	30°C (Ambient = 20°C)
Stability (Absolute over 30 minutes)	:	<0.2°C
Radiation Cavity	:	Coated Aluminium
Emissivity	:	>0.995
Dimensions (not including handle)	:	Height 185mm Width 260mm Depth 315mm
Weight	:	11kg

INITIAL TESTING

This unit was fully tested before despatch to you but please check its operation as outlined below.

After connecting the Gemini R to the electricity supply, the temperature controller display will show the temperature of the block and the last set-point value. The S controller and indicator both go through a self-test sequence first. The fan on the front panel should be heard running.

Connect a sensor to the Gemini R - see page 22.

When using a Platinum Resistance Thermometer handle carefully. The internal components are fragile. Lower the sensor into the pocket - do not drop it into the hole.

It is good practise to allow PRT's to cool slowly to a temperature less than 450°C before withdrawing the probe.

Change the set-point to 100°C and observe that the block temperature rises and settles to this value. Place a thermometer in an insert in the block and connect it to the suitably configured indicator. Confirm that the indicator agrees within ±2°C of the controller.

Your unit's should have performed as described above and can now be used for calibration.

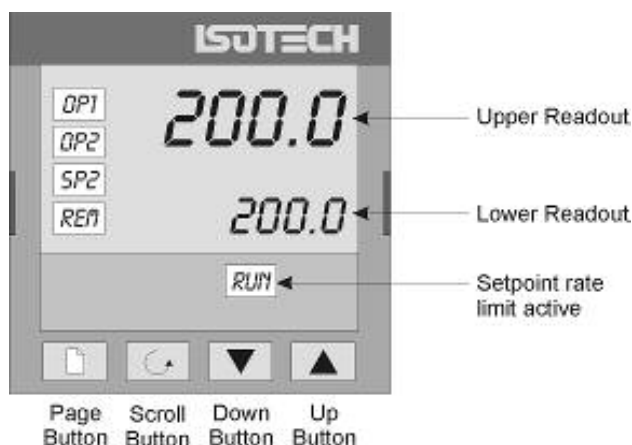If any problems or faults arise during these tests please contact us or our agents for help and advise.

IMPORTANT NOTICE

The controller's function settings are preset and will not require adjustment.

OPERATING THE CONTROLLER

FRONT PANEL LAYOUT

The Temperature Controller

The controller has a dual display, the upper display indicates the nominal block temperature, and the lower display indicates the desired temperature or setpoint.

Altering the Setpoint

To change the setpoint of the controller simply use the UP and DOWN keys to raise and lower the setpoint to the required value. The lower display changes to indicate the new setpoint.

Advanced Controller Features

Setpoint Ramp Rate

By default the Dry Blocks are configured to heat (and cool) as quickly as possible. There may be some calibration applications where it is advantageous to limit the heating (or cooling rate).

An example might be when testing bimetallic thermostats, by forcing the Dry Block to heat at a controlled rate it is easier to determine the temperature at which the thermostat changes state.

The Dry Block can have its heating rate limited with the Setpoint Ramp Rate feature. This feature is accessed from the Scroll key. Depress the key until the display shows,

SPrr

On the Upper Display, the lower display will show the current value from OFF (default) to 999.9. The desired rate is set here with the UP and DOWN keys, the units are °C/min.

When the SPrr is active the controller display will show "RUN", the lower setpoint display will now automatically update with the current value, known as the working setpoint. The setpoint can be seen by pressing either the UP and DOWN key.

The Setpoint ramp rate operates when the bath is heating and cooling.

Instrument Address (Comms Models only)

The controller has a configurable "address" which is used for PC communications. Each instrument has an address, this allows several instruments to be connected in parallel on the same communications bus. The default value is 1. This address would only need to be changed if more than one Dry Block is connected to the same PC port.

To check the Address value press the scroll key until the top display indicates,

Addr

The lower display will show the current value that can be modified with the UP and DOWN keys.

Monitoring the Controller Status

A row of beacons indicate the controllers status as follows,

OP1   Heat Output
OP2   Cool Output   (Only for models which operate below 0°C)
REM   This beacon indicates activity on the PC interface

Units

Momentary pressing the Scroll key will show the controller units °C or °F.

The Temperature Indicator

The indicator can be configured for custom calibration data. The customer calibration data can be set ON or OFF.

Enabling / Disabling Custom Calibration

Custom calibration allows the indicator to be programmed to suit a particular temperature sensor. This allows the indicator to automatically show the true temperature, without having to manually apply a correction.

When the Custom or User Calibration is active the indicator will show the REM beacon lit continuously. The use of User calibration can make a significant difference to the accuracy of the instrument, and this REM beacon provides a clear and continuous indication of the calibration status. This is pre configured at Isotech and will only need adjustment when the instrument is re-calibrated.

To alter the calibration status press the Scroll key until the upper display shows,

CAL
The lower display will indicate either,
USEr   for user calibration

Or
FACt   for factory calibration of the indicator, i.e. User Cal OFF

Use the UP and DOWN keys to toggle between the two values.

When calibrating an unknown sensor against a calibrated probe it may be necessary to switch the calibration off for the unknown, and on for the calibrated probe.

Instrument Address (Comms Models only)

Like the controller, the indicator has a configurable "address" which is used for PC communications. Each instrument has an address; this allows several instruments to be connected in parallel on the same communications bus. The default value is 2 (The controller defaults to 1). This address would only need to be changed if more than one Dry Block is connected to the same PC port.

To check the Address value press the scroll key until the top display indicates,

Addr

The lower display will show the current value that can be modified with the UP and DOWN keys.

Monitoring the Indicator Status

For the indicator the REM beacon is lit continuously when the user calibration is active, the REM beacon flashes when the PC communications port is active.

Units

Momentary pressing the Scroll key will show the controller units °C or °F.

Advanced Indicator Operation

The indicator can be configured with up to five custom calibration points; the points contain "data pairs". First the temperature (point) and secondly the Error (offset) at this temperature point. Isotech Dry Block calibration certificates will show the values to suit a particular sensor.

These values can be inspected, and modified with the following procedure,

Press the PAGE key until the display indicates,

ACCS
LiSt

Press the SCROLL key until the display shows,

Goto
OPEr

Press the UP key until the display shows

Goto
conF

Press the Scroll Key twice, when the display will show,

inSt
Conf

Press the Page Key until the controller shows

CAL
Conf

Now use the Scroll key to examine the data pairs. The values can be modified with the UP and DOWN keys.

To exit this mode press the Page key until the top display shows,

Exit

And then set the lower display to YES. While in this mode take care not to modify other parameters - a full list of all the parameters can be found in appendix 1.

CALIBRATION DATA EXAMPLE

A maximum of five points may be entered, shown as Pnt 1 to Pnt 5 for the temperature point and Ofs 1 to Ofs 5 for the offset values.

The Pnt values must be entered in ascending order.

Set a Pnt to a value lower than the previous point to disable it.

The indicator would be programmed with the following data:

```
Pnt 1  100      Ofs 1  0.8
Pnt 2  300      Ofs 2  1.1
Pnt 3  500      Ofs 3  2.1
Pnt 4 -999      Ofs 4  0
Pnt 5 -999      Ofs 5  0
```
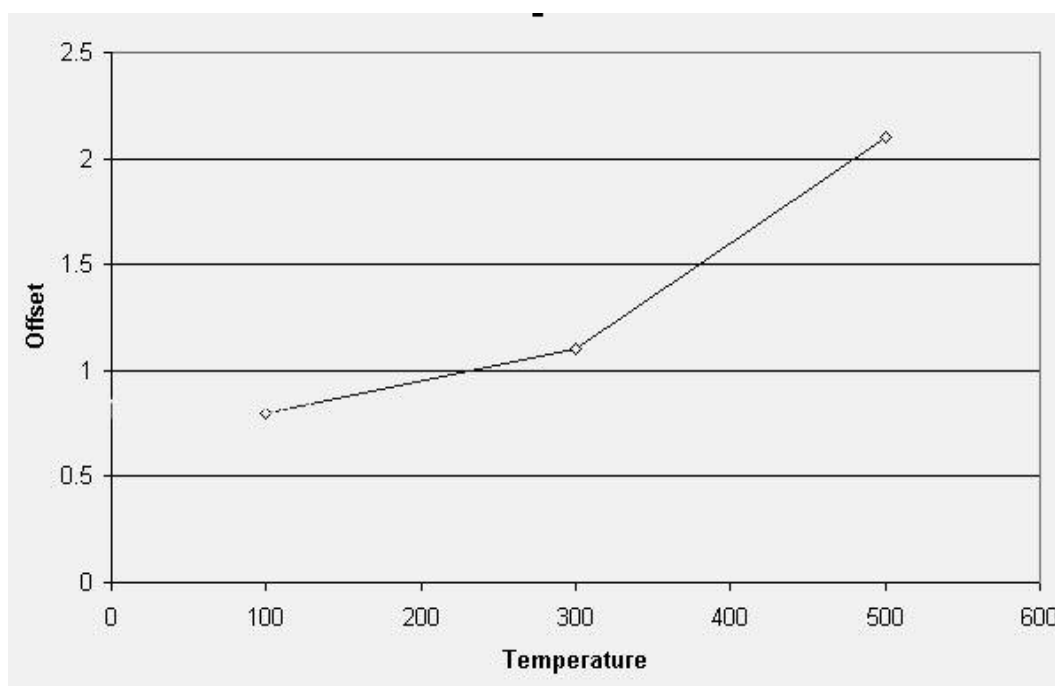
Using the PC Interface (Optional)

An RS422 PC interface and a special converter cable that allows use with the a standard RS232 port. When using the bath with an RS232 port it is essential that this converter cable is used. Replacement cables are available from Isotech, part number ISO-232-432.   A further lead is available as an option, Part Number ISO-422-422 lead which permits up to 5 instruments to be daisy chained together.

The benefit of this approach is that a number of calibration baths may be connected together in a "daisy chain" configuration - and then linked to a single RS232, see diagram.

Note: The RS 422 standard specifies a maximum lead length of 1200M (4000ft). A true RS422 port will be required to realise such lead lengths. The Isotech conversion leads are suitable for maximum combined lead lengths of 10M that is adequate for most applications.

Connections

For RS232 use simply connect the Isotech cable, a 9 to 25 pin converter is included to suit PCs with a 25 pin serial converter.

RS422 Connections
Pin	Connection
4	Tx+ A
5	Tx- B
8	Rx+ A
9	Rx- B
1	Common

Using the Interface

The models are supplied with Cal NotePad as standard. This easy to use package is compatible with MS Windows 9x. A handbook for Cal NotePad can be found on the first installation disk in Adobe PDF format. If required a free Adobe PDF reader can be downloaded from, www.adobe.com.

CAL NOTEPAD (Only supplied with Comms Models)

Cal Notepad can be used to log and display values from the Dry Blocks and an optional temperature indicator.

Minimum System Requirements

CNP requires Windows 95 / 98, a minimum of 5Mb of free hard drive space and free serial ports for the instruments to be connected.

Development

CNP was developed by Isothermal Technology using LabVIEW from National Instruments.

License

Use of the Cal NotePad software program "CNP" is as granted in this license agreement. In using the CNP
software the user "licensee" is agreeing to the terms of the license. You must read and understand the terms of this license before using CNP.
1, This license permits licensee to use CNP software on a single computer. The user may make copies for back up and archival purposes freely as long as the software is only ever in use on a single computer at any one time. Please enquire about multi-user licenses.
2, CNP is protected by international copyright laws and treaties. CNP must not be distributed to third parties.
3, CNP must not be reversed engineered, disassembled or de-compiled. Licensee may transfer the software to a third party provided that no copies or upgrades of CNP are retained.
4, It is the responsibility of the user to ensure the validity of all stored results and printed certificates. Isothermal Technology Ltd accept no responsibility for any errors caused by inappropriate use, incorrect set up or any other cause; including defects in the software.
5, Limited Warranty. Isothermal Technology warrants that CNP will perform substantially as described in this manual for a period of 90 days from receipt. Any distribution media will under normal used be guaranteed for a period of 90 days.

NO OTHER WARRANTIES, EXCEPT AS STATED ABOVE. The software and documentation is provided "as is" without warranty of any kind and no other warranties (either expressed or implied) are made with regard to CNP. Isothermal Technology does not warrant, guarantee or make any representations regarding the use or results of the use of the software or documentation and does not warrant that the operation of CNP will be error free.

In no event will Isothermal Technology, its employees, agents or other associated people be liable for direct, indirect, incidental or consequential damages, expenses, lost profits, business interruption, lost business information or other damages arising out the use or inability to use CNP. The license fee reflects this allocation of risk.

CNP is not designed for situations where the results can threaten or cause injury to humans.

Installing Cal NotePad

1.   Insert CNP DISK 1 into the disk drive
2.   Click on the START button on the task bar, select RUN, type A:\SETUP (Where A: is your drive letter) then click OK
3.   Follow the prompts which will install the application and necessary LabVIEW run time support files.
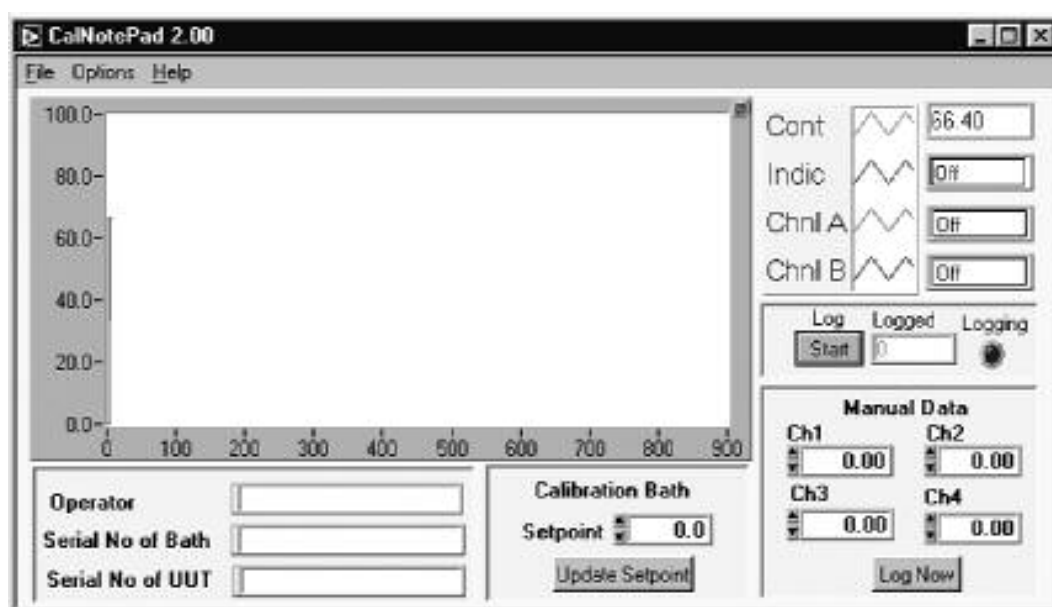4   Should you ever need to uninstall the software then use the Add/Remove Programs option from the Control Panel.

Starting Cal NotePad

From a Standard Installation:

Click the START button

Highlight PROGRAMS

Select Isotech - Select Calpad

Protocol

The instruments use the "Eurotherm EI BiSynch Protocol"

If required, e.g. for writing custom software the technical details are available from our website at, www.isotech.co.uk/refer.html

Diagnostic alarms

These indicate that a fault exists in either the controller, indicator or the connected sensor.

Controller Error Messages

The instruments include powerful diagnostics and in the unlikely event of an internal failure, or a sensor error, one of the following error messages may be displayed.

Display shows	What it means	What to do about it
EE.Er	*Electrically Erasable Memory Error:* The value of an operator or configuration parameter has been corrupted	For Controller: Contact Isotech For Indicator: Check Config Against Data in Appendix
S.br	*Sensor Break:* Input sensor is unreliable or the input signal is out of range.	For Controller: Contact Isotech For Indicator: Check a sensor is connected. Check that only a PRT or a TC is Connected (Not both)
HW.Er	*Hardware error :* Indication that a module is of the wrong type, missing or faulty	Contact Isotech
LLLL	*Out of Display range, low reading*	For Controller: Contact Isotech For Indicator: Check Sensor and Connections
HHHH	*Out of Display range, high reading*	For Controller: Contact Isotech For Indicator: Check Sensor and Connections
Err1	*Error 1: ROM self-test fail*	Consult Isotech
Err2	*Error 2: RAM self-test fail*	Consult Isotech
Err3	*Error 3: Watchdog fail*	Consult Isotech
Err4	Error 4: Keyboard failure Stuck button, or a button was pressed during power up.	Switch the power off and then on without touching any of the controller buttons.
Err5	*Error 5: Input circuit failure*	Consult Isotech
Pwr.F	*Power failure.* The line voltage is too low	Check that the supply to the controller is within the rated limits

GEMINI R

PANEL LAYOUT AND FUNCTIONS
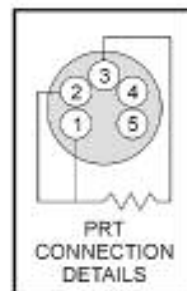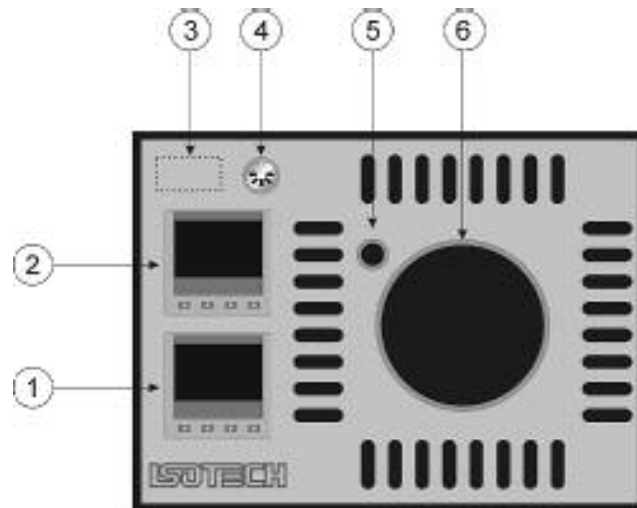
1.   Temperature Controller
2.   Temperature Indicator
3.   Optional communications socket
4.   Connections for PRT
5.   Thermometer Pocket
6.   Cavity

APPENDIX 1

INDICATOR CONFIGURATION (Reference Only)
Config.INST

Name	Description	Value
unit	Instrument Units	`C (0)
dEcP	Decimal Places in Display	NN.NN
CtrL	Control Type	PID (0)
Act	Control Action	REV (0)
COOL	Cooling Type	LIN (0)
PwrF	Power Feedback Enable	OFF (0)
Pdtr	Manual/Auto Transfer PD Control	NO (0)
FoP	Forced Output Enable	NO (0)
Sbrt	Sensor Break Type	SB.OP (0)
rnGH	Process Value High Limit	670
rnGL	Process Value Low Limit	-100

Config.IP

Name	Description	Value
inPt	Linearisation Type	RTD
CJC	CJC Type	(EXT)
imP	Sensor break impedance	AUTO (1)

Config.CAL

Name	Description	Value
UCAL	User Calibration Enable	YES (1)
Pnt1	User Cal Point 1	0
Pnt5	User Cal Point 5	-99.00
OFS1	User Cal Offset 1	0.00
Pnt2	User Cal Point 2	-99
OFS2	User Cal Offset 2	0.00
Pnt3	User Cal Point 3	-99
OFS3	User Cal Offset 3	0.00
Pnt4	User Cal Point 4	-99.00
OFS4	User Cal Offset 4	0.00
OFS5	User Cal Offset 5	-99.00

Note: User Cal values are unique to each instrument. If available set values to those from calibration certificate

Config.AL

Name	Description	Value
AL_1	Alarm 1 Type	OFF (0)
Ltch1	Alarm 1 Latching	NO (0)
AL_2	Alarm 2 Type	OFF (0)
Ltch2	Alarm 2 Latching	NO (0)
AL_3	Alarm 3 Type	OFF (0)
Ltch3	Alarm 3 Latching	NO (0)
AL_4	Alarm 4 Type	OFF (0)
Ltch4	Alarm 4 Latching	NO (0)

Config.HA

Name	Description	Value
id	Module Identity	CMS (7)
Func	Module Function	CMS (65)
bAud	Baud Rate	9600 (0)
Prty	Comms Parity	NONE (0)
rES	Comms Resolution	FUL (0)

Config.1A

Name	Description	Value
id	Module Identity	LOG (3)
Func	Module function	NONE (0)
SEnS	Sense of Output	NOR (0)

Config.2A

Name	Description	Value
id	Module Identity	LOG (3)
Func	Module function	NONE (0)
SEnS	Sense of Output	NOR (0)