

GEMINI R 550/700 MODEL 976

User Maintenance Manual/Handbook

Isothermal Technology Limited, Pine Grove, Southport, PR9 9AG, England
Tel: +44 (0)1704 543830 Fax: +44 (0)1704 544799 Internet: 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.

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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 that this instrument to be re-calibrated annually.



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

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

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CE 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 I Appliance. A protective earth is used to ensure the conductive parts cannot 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, e.g. Carbon dust, must be excluded from the apparatus. EN61010 pollution degree 2.

ENVIRONMENTAL RATINGS

Operating Temperature 0-50°C

Relative Humidity 5-95%, non condensing

HEALTH AND SAFETY INSTRUCTIONS

1. Read this entire 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, i.e. 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:

<u>COLOUR</u>	<u>FUNCTION</u>
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 Models provide a variable temperature, portable black body radiation source designed for use at temperatures up to 700°C.

The sources are black bodies for the highest precision calibration of radiation thermometers over the range 35°C to 700°C. 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 Reference Thermometer.

When used in conjunction with the Reference 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 $\pm 5K$.
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	:	Gemini R 550: 1 kW
	:	Gemini R 700: 1 kW
Supply Frequency	:	50/60Hz
Maximum Operating Temperature	:	Gemini R 550: 550°C
	:	Gemini R 700: 700°C
Minimum Operating Temperature	:	30°C (Ambient = 20°C)
Stability (Absolute over 30 minutes)	:	<0.2°C
Radiation Cavity	:	Gemini R 550: Coated Aluminium
	:	Gemini R 700: Coated Aluminium Bronze
Emissivity	:	>0.995
Dimensions (not including handle)	:	Height 185mm
	:	Width 260mm
	:	Depth 315mm
Reference Probe	:	Gemini R 550: PRT 935-14-72
	:	Gemini R 700: Type N T/C 935-14-94
Weight	:	Gemini R 550: 11kg approx
	:	Gemini R 700: 16kg approx

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 23.

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 $\pm 2^{\circ}\text{C}$ of the controller.

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

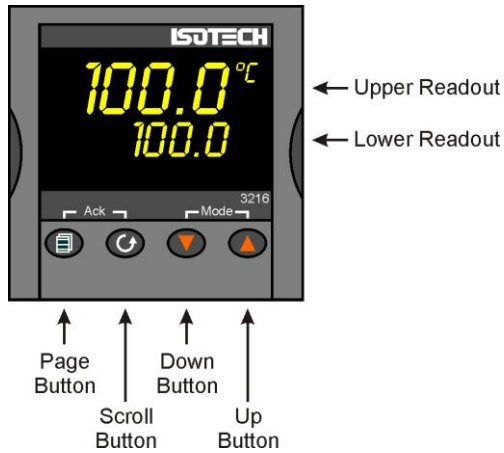
If any problems or faults arise during these tests please contact us or our agents for help and advice.

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,

SP.RAT

The upper display will show the current value, and is adjustable from OFF to 999.9. The units are °C/min and are adjustable via the UP/DOWN keys.

When the SP.RAT is active 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

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 lower display indicates,

ADDR

The upper 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,

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

For models fitted with cooling, the lower display will alternate between the setpoint and the message, cooling to temperature. It will automatically switch off when the temperature is within 5°C of the setpoint.

Units

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

THE TEMPERATURE INDICATOR

The site models include an electronic temperature indicator. The indicator can be configured for the desired sensor type, and for custom calibration data. The customer calibration data can be set ON or OFF.

Setting the Input Type

A 100 Ohm resistance thermometer can be connected to the PRT Connector or a thermocouple may be connected to the miniature TC Connector.

Ensure that only a PRT or a TC is connected at any one time. If a PRT and TC are connected simultaneously the indicator will read in error.

Check that any sensor placed into the equipment is suitable for the temperature range. Sensors can be damaged if taken outside their normal operating limits.

The desired sensor type is easily set, press the Scroll key until the lower display indicates,

In.Type

The upper display will show the current set sensor type,

J.tc	J thermocouple
K.tc	K thermocouple
L.tc	L thermocouple
r.tc	R thermocouple (Pt/Pt13%Rh)
b.tc	B thermocouple (Pt30%Rh/Pt6%Rh)
n.tc	N thermocouple
t.tc	T thermocouple
S.tc	S thermocouple (Pt/Pt10%Rh)
PL.2	PL 2 thermocouple
rtd	100 Ohm platinum resistance thermometer.
T012	E thermocouple

Again the value can be modified with the UP and DOWN keys.

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. Isotech will configure and set user calibration when the Dry Block is ordered with a temperature sensor.

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

UCAL

The upper display will indicate either,

ON for user calibration

Or

OFF for factory calibration of the indicator

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

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 lower display indicates,

ADDR

The upper 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 of 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,

Hold the PAGE key down until the display indicates,

CONF
GOTO

then

0
CODE

Set the Code to 2 with the UP key

The display reads,

CONF

Press the Page Key until the controller shows

CAL

Now use the Scroll key to examine the data pairs. The values Pnt 1 - Pnt 5 and Ofs 1 to Ofs 5 can be modified with the UP and DOWN keys.

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

CONF
GOTO

And then set the upper display to Lev 1. While in this mode take care not to modify other parameters.

CALIBRATION DATA EXAMPLE

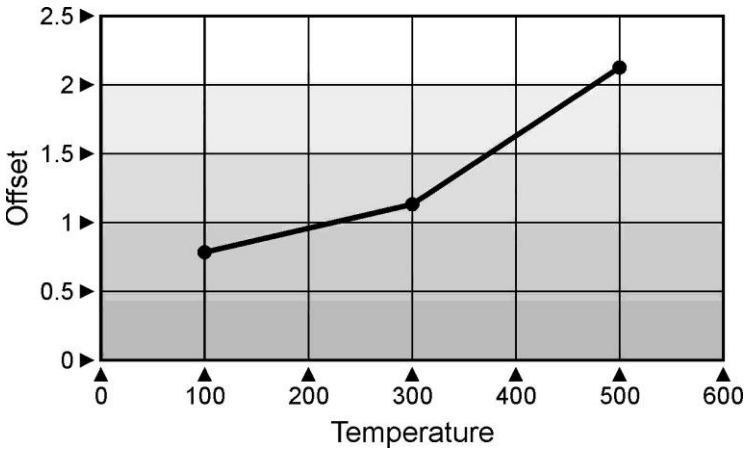
A maximum of five points may be entered, shown as Pnt 1 to Pnt 5 for the temperature point and Ofs 1 to Ofs 5 for the offset values.

The Pnt values must be entered in ascending order.

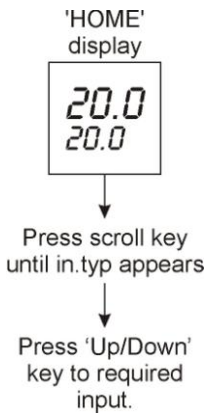
Set a Pnt to a value lower than the previous point to disable it.

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



SELECTING INPUT TYPE



CONNECTING A CURRENT TRANSMITTER (UP TO 20mA)

The transmitter should be powered externally, a 2.49Ω current sense resistor is fitted internally and this allows the indicator to read mA.

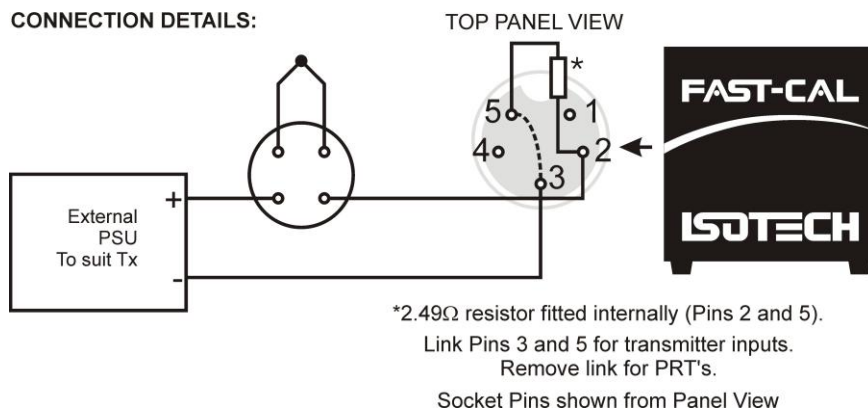
To scale the Linear input:

- 1 From the input type menu select “mV”.
- 2 The scaling can be configured in the CAL menu, accessed as described above..
- 3 Access the Input sub-menu by pressing the Page button
- 4 Set the input type to mV
- 5 Press again to enter the mv.hi value
- 6 Press again to enter the mv.lo value
- 7 Press again to enter the rng.hi value
- 8 Press again to enter the rng.lo value
- 9 To exit press Page and Scroll buttons together and select level I using the up/down buttons

EXAMPLE: From the input menu iP set the mv.hi, mv.lo, rng.hi and rng.lo parameters to suit see table below:

Linear Input Scaling - The next 4 parameters only appear if a linear input is chosen			
e.g. 4 to 20mA = 0 to 100°C			
	mv.lo	Input value low	i.e. 4mA set 9.96
	mv.hi	Input value high	i.e. 20mA set 49.8
	rng.lo	Displayed reading low	0°C
	rng.hi	Displayed reading high	100°C
E.g. 4-20mA = 0 to 100°C			
mv.lo	=	9.96 (mV)	(4mA x 2.49Ω)
mv.hi	=	49.8 (mV)	(20mA x 2.49Ω)
rng.lo	=	0 (°C)	
rng.hi	=	100 (°C)	

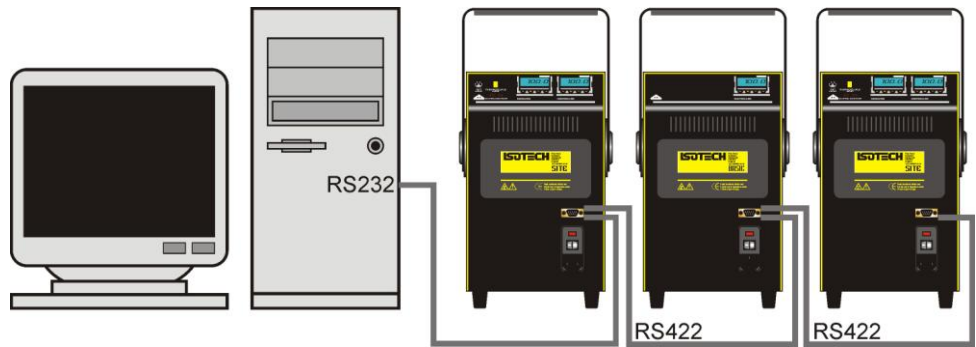
CONNECTION DETAILS:



USING THE PC INTERFACE

The PLUS models include an RS422 PC interface and a special converter cable that allows use with 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, XP. 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

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 9X, XP, 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 backup 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 Isotech Support CD into the CD drive.
2. Allow CD browser to open and install version of Cal NotePad required.
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.

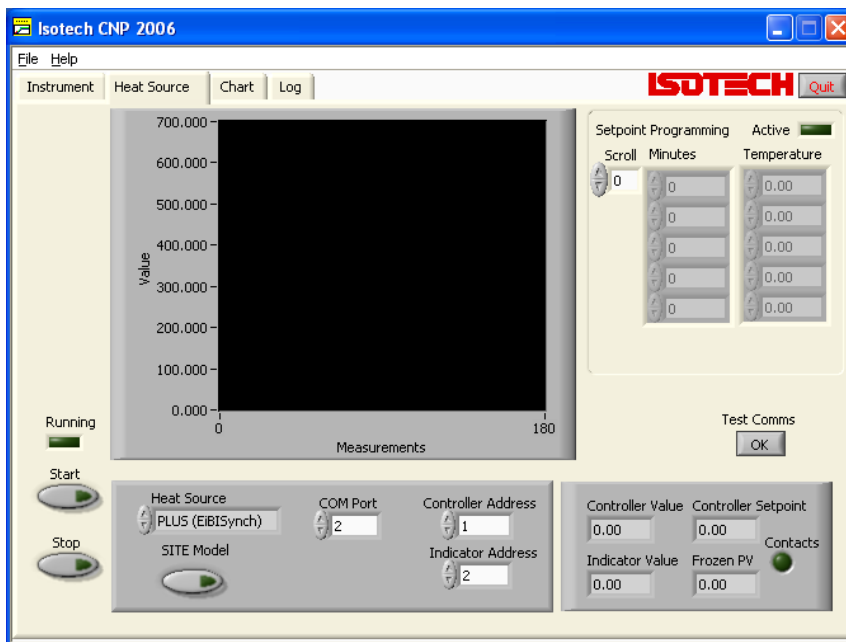
STARTING CAL NOTEPAD

From a Standard Installation:

Click the START button

Highlight PROGRAMS

Select Isotech - Select Calpad



Protocol

The instruments use the "Modbus 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

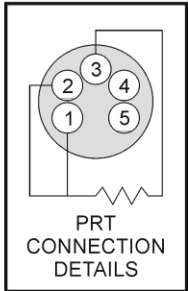
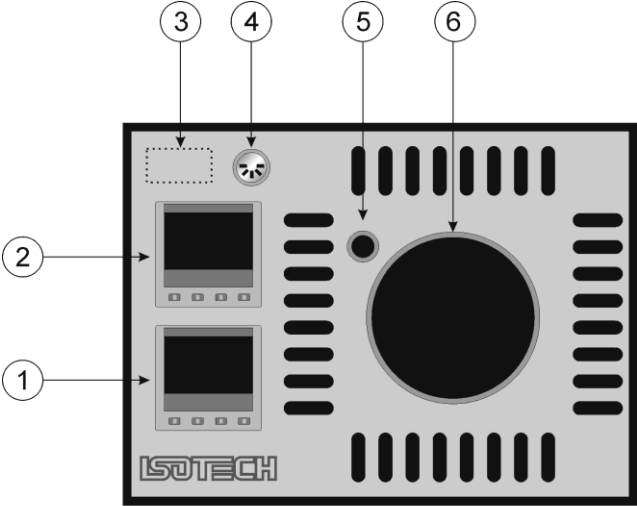
Diagnostic alarms indicate a possible fault within the controller or connected devices.

Display shows	What it means	What to do about it
E.Conf	A change made to a parameter takes a finite time to be entered. If the power to the controller is turned off before the change has been entered then this alarm will occur. Do not turn the power off to the controller while ConF is flashing	Enter configuration mode then return to the required operating mode. It may be necessary to re-enter the parameter change since it will not have been entered in the previous configuration.
E.CaL	Calibration error	Re-instate Factory calibration, refer to Isotech
E2.Er	EEPROM error	Return to Isotech for repair
EE.Er	Non-vol memory error	Note the error and contact Isotech.
E.Lin	Invalid input type. This refers to custom linearisation which may not have been applied correctly or may have been corrupted.	Go to the INPUT list in configuration level and set a valid thermocouple or input type
Emod	IO1, OP2, or OP3 has been changed	If this has been field changed by the installation of a new board, enter config level, then exit back to operator level. If the message occurs at any other time return to factory for repair.

Additional Information;

1. If the input is too high HHHHH will be displayed.
2. If the input is too low LLLLL will be displayed.

PANEL LAYOUT AND FUNCTIONS



- 1. Temperature Controller
- 2. Temperature Indicator
- 3. Optional communications socket
- 4. Connections for PRT - Gemini R Model 700 incorporates mini- thermocouple connector
- 5. Thermometer Pocket
- 6. Cavity

APPENDIX I

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	0.00

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.IA

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)