






**PARALLEL TUBE LIQUID  
BATH MODEL  
LIBRA 785**  
User Maintenance Manual/Handbook

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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.

ISOTHERMAL TECHNOLOGY LTD.  
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**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.

## 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 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, e.g. Carbon dust, must be excluded from the apparatus. EN61010 pollution degrees 2.

## 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 is 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.

 **ON ARRIVAL**

Check List:

You should have the following parts;

1. Main Bath Assembly.
2. One overflow and one drain pipe.
3. This User Maintenance Manual/Handbook.
4. PC Comms Lead.

Optional accessories are available and will on be present if specified on your order.

In the unlikely event of any items arriving damaged please retain the packing materials (which may need to be inspected later) and then contact your supplier.

## ELECTRICITY SUPPLY

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

Your bath is supplied with a fixed main cable. Due to the complexity of world power supplies and installation connectors, your bath has no connector fitted. Please fit a suitable connector for you local supplier's outlet.



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)**



**⚠ IMPORTANT - READ THIS NOW!**

**REFRIGERATION**

The M and L models include an internal mechanical refrigeration unit. During transit the internal oil can be displaced. On arrival the equipment should be left for 24 hours in an upright position to allow any displaced oil to settle.

**Chiller function**

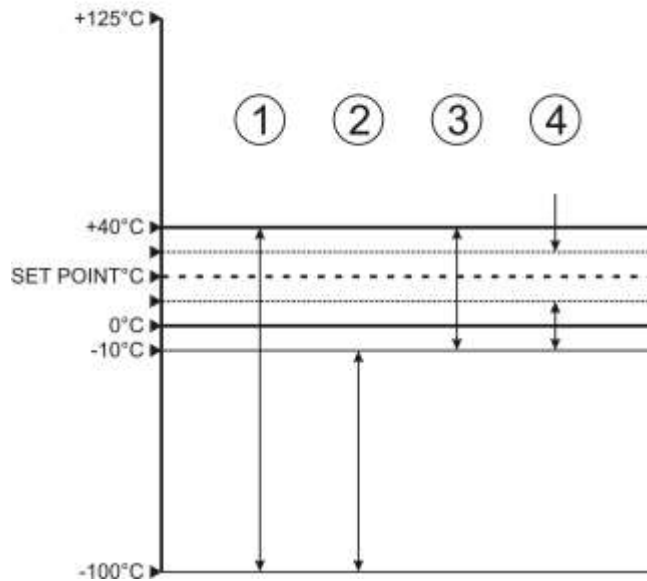
The chiller is designed to automatically enable at any temperature below 40°C. The chiller will run all the time and the temperature control is balanced by the heater. The chiller will have unwanted cooling power at the higher temperatures, such as temperatures above -10°C; it can cause unwanted instability in the liquid temperature. To prevent this, the Libra has an automatic cooling reduction facility built in. For the M version, this is in the form of an internal by-pass valve that will reduce the running pressure of the refrigeration system.

The by-pass valve will automatically enable at temperatures above -10°C until the chiller is automatically switched off at 40°C. Because of the time taken to cool down from higher temperatures with the by-pass enabled and reduced cooling, the by-pass valve only actually opens when the actual temperature is within ±3 °C of the set point. This allows the full cooling at all other times.

For the L version, this cooling power reduction is in the form of an expansion reservoir that will accept excess refrigerant at the higher temperatures, above -40°C, to allow lower cooling power. When fast cooling or ultra low temperature work is required, the refrigerant is returned to the system; this is automatic and requires no user intervention.

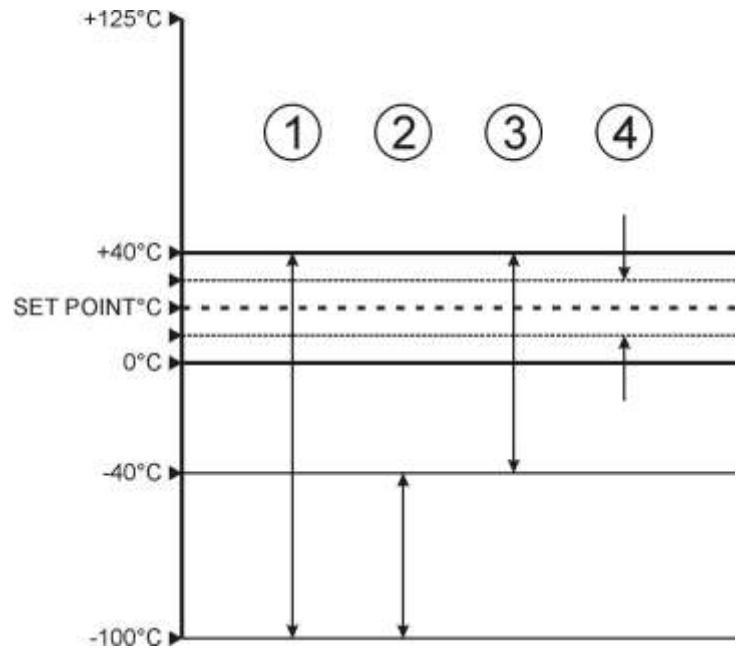
The diagram below gives a graphical account of the Libra medium chiller function

- (1) Chiller enabled.
- (2) Full cooling, by-pass valve off
- (3) By-pass valve enabled
- (4) Band of temperature where by-pass valve is active.



The diagram below gives a graphical account of the Libra Low chiller function

- (1) Chiller enabled.
- (2) Full cooling, all refrigerant in system
- (3) Expansion reservoir flooded, reduced cooling power
- (4) Band of temperature where cooling reduction is active.



## SETTING UP

The whole manual should be carefully read before using the bath, and then set the bath up as follows.

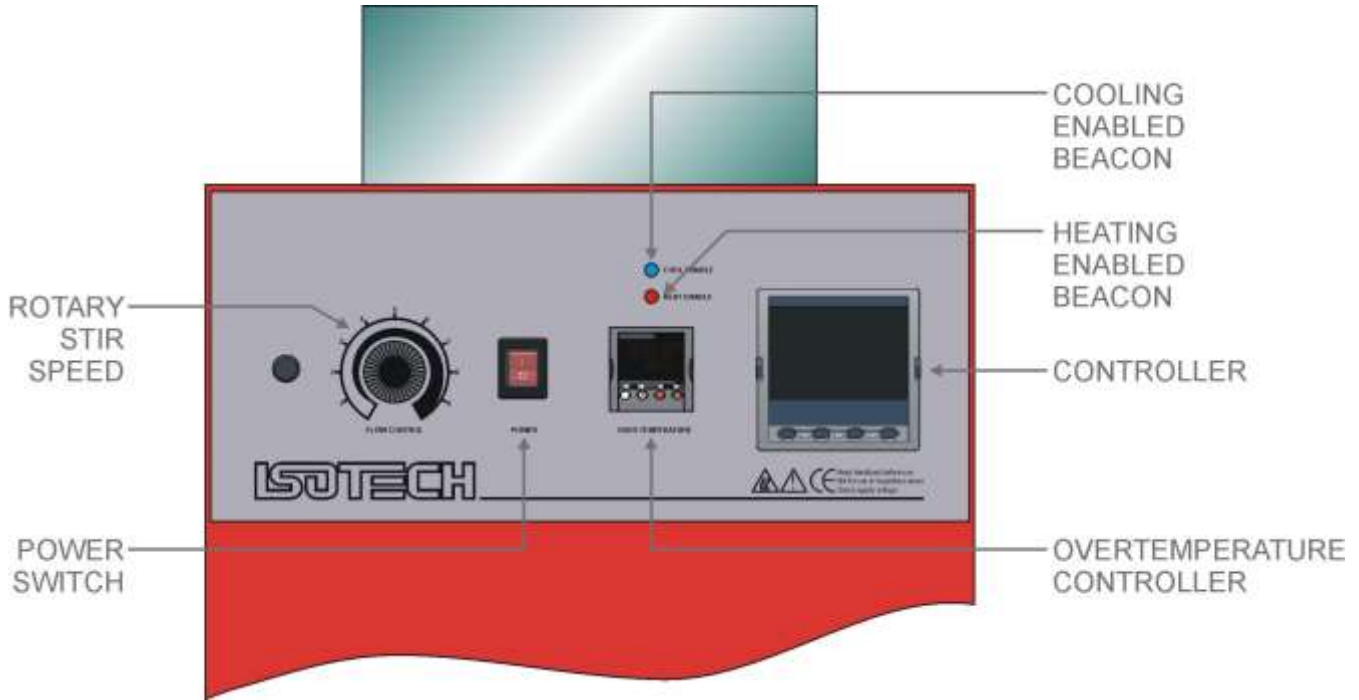


Connect the drain pipe to the drain tap and the overflow pipe to the rear overflow pipe. Place a suitable container under the overflow pipe. Ensure the tap is shut, i.e. lever at 90° to the tap body. If the equalising block is to be used it should be placed in position now.

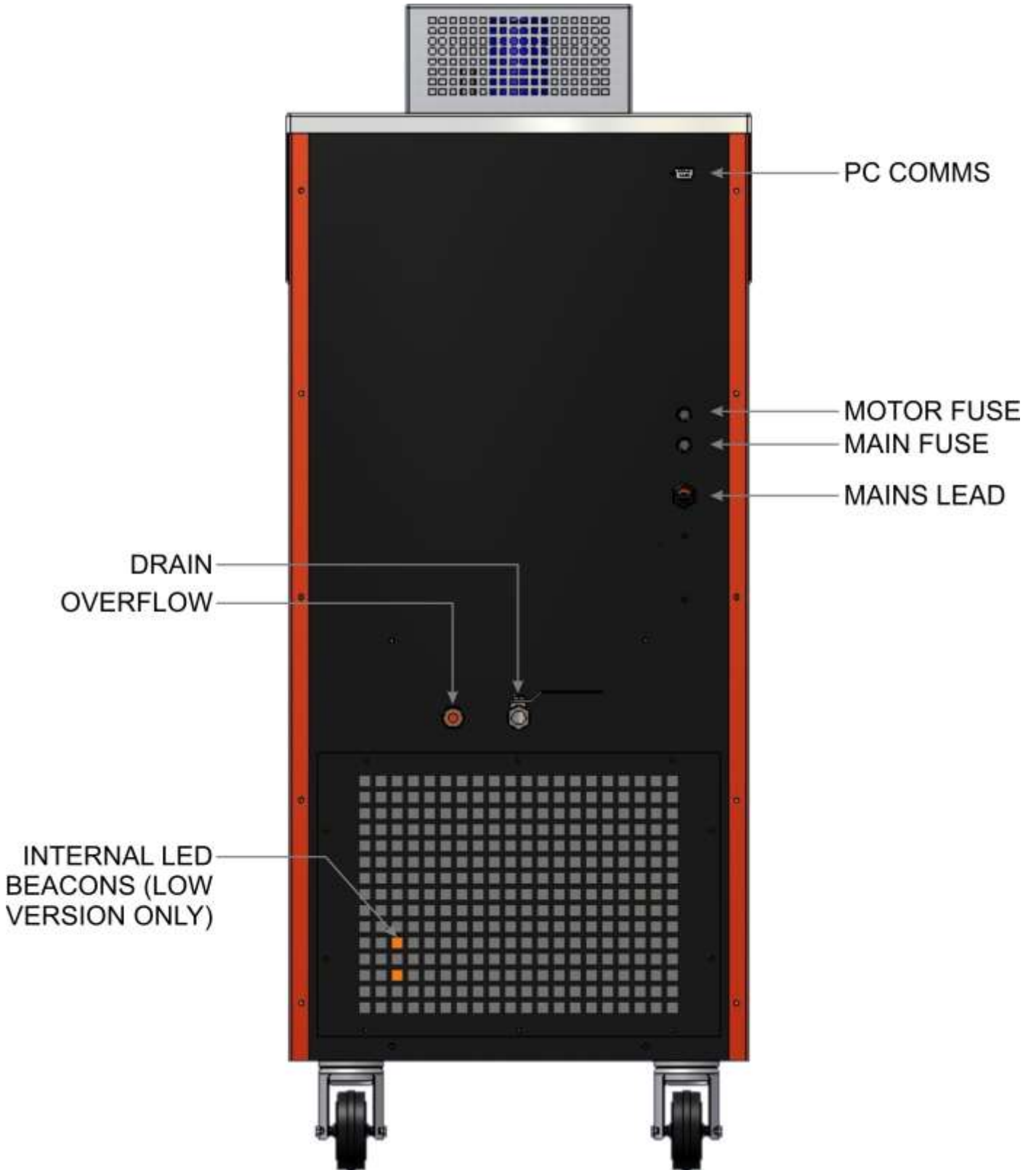
Fill the bath with suitable liquid, water is probably best for initial testing. Fill the bath until the level is 10mm below the top of the round central calibration tube

**ALWAYS ISOLATE THE BATH FROM THE SUPPLY WHEN CHANGING LIQUIDS**

**FIGURE 1: FRONT PANEL CONTROLS**



**FIGURE 2: REAR PANEL LAYOUT**



## USING THE CONTROLLER

### FRONT PANEL LAYOUT



1. Control Process Variable
2. Controller Setpoint
3. Heating output (%)
4. Temperature bar graph
5. Page Button
6. Scroll Button
7. Up/Down buttons
8. User Level indicator
9. Heat output beacon
10. Auto/manual button

### The Temperature Controller

The controller has a dual display, the upper display indicates the nominal liquid 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.

### Instrument Address

The controller has a fixed ADDRESS set at Address 1. The Overtemperature controller is configurable, but set to 2 as factory default.

### Monitoring the Controller Status

1. This is the actual liquid temperature in the bath.
2. This is the bath setpoint in °C, configurable by using the up/down buttons.
3. This shows the heater output as a percentage, this is non adjustable and is set by the controller.
4. This graph shows the full range of the bath and the point of the current temperature.
5. Page button.
6. Scroll button.
7. Up/down buttons.
8. User level indicator. Advises which user level the controller is set to. Defaults to level one on power up.
9. Heat output beacon. Advises when the heater is on and off.
10. Auto/manual button. Allows the user to toggle between Automatic output setting, defined by the controller (default) and manual output setting. Care should be taken when using this setting.

## Additional adjustments

By pressing the Scroll button from Level one, further adjustments are available to optimise the performance of the bath.

**Autotune** – Enable using the up/down buttons. This feature will optimise the PID values for the temperature and liquid being used that that time. The temperature will cycle twice and reset the optimised values. It is recommended to always note the original values for future reference.

**Proportional Band** – Use the Up/Down buttons to adjust the proportional band of the controller.

**Integral Time** - Use the Up/Down buttons to adjust the Integral time of the controller.

**Derivative time** - Use the Up/Down buttons to adjust the Derivative Time of the controller.

*Adjustment of the above three parameters is only recommended for users experienced with PID temperature control*

**PC Address** – User definable controller address

**Units** – User definable units, °C, °F and Kelvin

## OVER TEMPERATURE CONTROLLER (H MODEL ONLY)

This device is an important safety feature. It has its own temperature sensor and will isolate the heater if the temperature exceeds the set temperature. It should be set slightly higher, perhaps 10 – 20°C higher than the working temperature or to the maximum safe temperature of the fluid in use. Which ever is the **lowest** value. IT MUST BE SET IN THIS WAY TO ENSURE SAFE USE OF THE BATH. Suitably set it will allow for protection against component failure and also operator error when setting the controller, either from the front panel or remotely from a computer.

The heat enabled beacon will be lit when the over-temperature controller is in safe mode.

Set the desired value on the lower display using the UP and DOWN keys.

## OVER AND UNDER TEMPERATURE CONTROLLER (M MODEL ONLY)

The M model has a low temperature trip in addition to a high temperature trip. The low temperature trip will turn the chiller off and can be used to safe guard water triple point cells or the liquid in the bath from freezing.

The high trip will isolate the heater if the bath temperature exceeds the set value.

Set the High Trip value to a suitable value, perhaps 10 – 20°C higher than the operating temperature but lower than the flash point of the liquid. Set this value into the A1 Hi Parameter.

Set the Low Trip value to a suitable value, perhaps the minimum safe operating temperature for the calibration into the A2 Lo Parameter.

To access these parameters press the scroll key until they appear on the lower display and modify the value shown on the top display with the up and down keys.

## **OVER TEMPERATURE CONDITION**

In the unlikely event of an over temperature or under temperature condition the Libra will go to Alarm condition. Depending which of the alarms has been triggered the unit will either disable the heater or the cooler accordingly.

The Temperature Policeman controller will identify which alarm has been triggered by the scrolling lower display. The message will read as follows:

### **OVERTEMPERATURE CONDITION – ATTENTION REQUIRED**

### **UNDERTEMPERATURE CONDITION – ATTENTION REQUIRED**

The respective illuminated beacon will also switch off.

To reset the heater or cooler, the condition must be removed, that is the temperature must be restored to the correct value by either waiting for the temperature to normalise, or by resetting the controller to a more suitable value.

The controller will need to be reset manually, even if the controller is switched off, it will still power up again in the alarm condition until reset.

To reset the controller, ensure the temperature for both over and under temperature is safe then press both the PAGE button and the SCROLL button simultaneously. The scrolling warning display will disappear and the illuminated beacon light up.

## FLOW CONTROL

This controls the flow rate of the liquid. It allows for a wide range of liquid viscosities and provides easy adjustment. It should initially be set to the mid position and then adjusted whilst the flow is observed.

The optimum position for a particular liquid at a specific temperature may need to be determined experimentally. As a general guide the flow should be increased until it becomes turbulent and then backed off slightly. Generally the stability will be optimum when the flow is high but stable.



## OPERATION AND INITIAL TESTING

Set the bath up as described in the earlier "Setting Up Section". For convenience it is suggested that a newly received bath should be tested at 50°C with water as the operating liquid.

Connect the bath to the supply and switch on.

1. Set the over temperature controller to a suitable value, see earlier.
2. Set the set point of the temperature controller to the desired value.
3. Adjust the flow if necessary.
4. The bath should now reach and control at the target set point.

The bath may now be used for calibration, see tutorial.

For temperatures above 40°C the refrigeration, if fitted, will automatically disable and enable as the temperature drops below 40°C.

## LIQUIDS

### CHOICE OF LIQUIDS

The choice of liquid is important. If it is too viscous at the operating temperature then the bath may not perform correctly. Other criteria also need to be met, such as safety, operating range and fume emission for example. Isotech is able to supply a number of fluids for various temperature ranges, see catalogue.

Unfortunately, there is not one fluid which can be used over the whole operating range of the bath. Beware of oils that are claimed to work from below ambient to over 100°C. Whilst we do not supply or recommend such liquids, others do. It is our experience that such oils absorb moisture from the air when used below the dew point. Then at temperatures around 100°C this moisture boils and can lead to the oil spilling from the top of the bath. Even without the boiling risk the oil is soon spoilt by the ingressions of moisture and the oil has to be replaced regularly, which can be an expensive task. It will be seen that when changing fluids from say water to oil that it is important that ALL the water has been removed before adding the oil.

As oils approach their upper operating limit fumes become significant and fume extraction becomes essential. It is for this reason that the upper limit of the bath is 300°C. Isothermal Technology manufactures a fluidised alumina bath, the 875 Bath which overcomes the limitations of oils and may be used to 700°C without fuming problems.

Below ambient we use a mixture of methanol and water. Methanol is poisonous and has a low flash point. It needs to be used very carefully by those suitably trained and aware of the dangers if handled inappropriately. As local safety requirements vary not only from country to country but also from organisation to organisation the safety aspects of these fluids should be determined with the users safety officer.

### LIQUID LEVEL

All liquids expand as they are heated and contract when they cool.

The bath has been designed to allow for varying liquid volumes and also features an overflow system which prevents the liquid from spilling from the top of the bath.

The optimum liquid level with the motor off **at the operating temperature** is for the liquid to be level with the top of the calibration tube.

When working below ambient it can be useful to pre chill and store in a thermos flask a quantity of the operating fluid. This prevents large thermal shocks when the bath is "topped" up and helps reduce cooling time.

### CHANGING LIQUIDS

If possible it is best to plan so that liquids do not need to be frequently changed. This may be achieved by liquid choice, determining convenient calibration points or having more than one bath - each with a different liquid to cover the routine calibration range.

To change the liquid,

1. Disconnect from the supply.
2. Ensure the liquid is at a safe handling temperature. Neither too hot nor too cool then open the drain tap.

3. Drain the liquid into a clean container of adequate capacity, properly labelled for future use.
4. Clean the bath. Detergent and absorbent paper will assist. If the bath has been used with oil it can be helpful to re fill with water and detergent and to allow the mixture to circulate before draining again.
5. Close the tap.

## TROUBLE SHOOTING

Problem	Solution
No Power	Check Fuse
Motor does not turn	Check Fuse and flow control setting
Temperature does not rise	Check over temperature controller setting and enable
Liquids flows unevenly	Check Flow Setting. If no improvement the liquid may not be suitable for us at this temperature
Bath Overflows	Check Overflow is not blocked and liquid level. Remember oil expands as it heats!

**N.B.** If the oil suddenly expands and overflows at 100°C it may have been contaminated with water and the oil should be replaced after this has been cleaned.

## USING THE PC INTERFACE

The bath includes 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

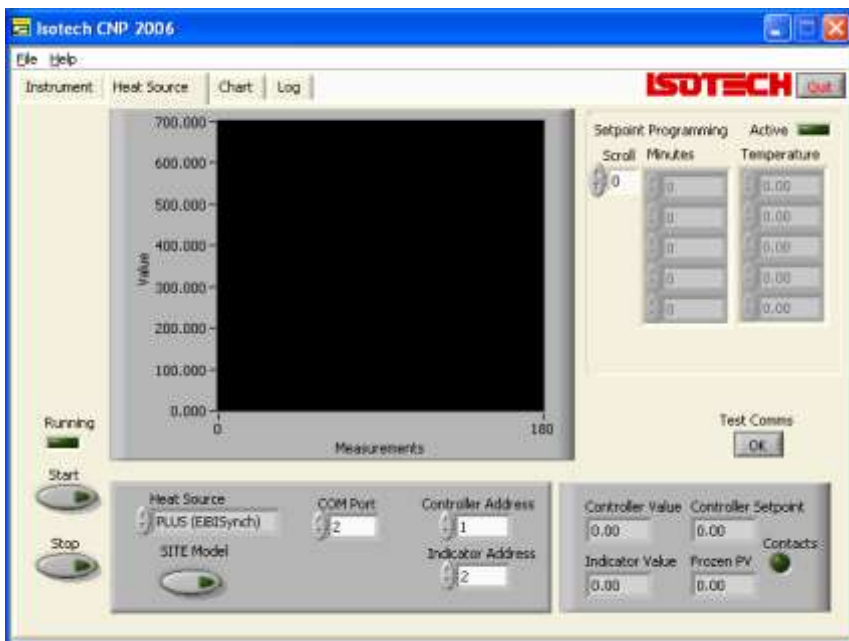
Pin	Connection
4	Tx+ A
5	Tx- B
8	Rx+ A
9	Rx- B
1	Common

## 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](http://www.adobe.com).

## CAL NOTEPAD

Cal Notepad can be used to log and display values from the Dry Blocks and an optional temperature indicator such as the milliK or TTI-10. The software requires Windows 9X, XP, a minimum of 5Mb of free hard drive space and free serial ports for the instruments to be connected.



## DEVELOPMENT

Cal NotePad was developed by Isothermal Technology using LabVIEW from National Instruments. The license details are shown on the download page and in the Cal Notepad manual.

## HOW TO INSTALL CAL NOTEPAD

1. Download the ZIP from <http://www.isotech.co.uk/downloads> (7.6Mb)
2. Extract the files to a temporary folder
3. Run setup.exe



4. Follow the prompts which will install the application, a user manual with setup information and the necessary LabVIEW run time support files.
5. Should you ever need to uninstall the software then use the Add/Remove Programs option from the Control Panel.

## PROTOCOL

The instruments use the "Modbus Protocol"

If required, e.g. for writing custom software the technical details are available from our Document Library at <http://www.isotech.co.uk>

## ACCESSORIES

The following options are available:-

**915/01a Aluminium Equalising Block.**

Containing four drilled pockets 8mmdiameter by 120mm deep in which temperature sensors can be placed and is suitable for use with silicon oils. The equalising block is suspended centrally within the calibration tube and is easily removed.

**915/01b Copper Equalising Block.**

Dimensionally the same as 915/01a. This block is more suitable for use in water and other liquids.

**915/02 Liquid in Glass Thermometer Support Kit.**

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

**915/03 Monocular and Support.**

Useful for viewing and magnifying the liquid column within the thermometer being calibrated. This ancillary piece of equipment is used in conjunction with

**915/07 Medium Temperature Silicon Oil.**

Temperature Range 40°C to 180°C.  
Supplied in 9 litre containers. Flash Point 300°C.

**915/08 High Temperature Silicon Oil.**

Temperature Range 150°C to 250°C.  
Supplied in 9 litre containers. Flash Point 315°C.

**915/09 Very High Temperature Silicon Oil.**

Temperature Range 40°C to 288°C.  
Supplied in 2 x 5 litre containers. Flash Point 288°C.