

STIRRED LIQUID BATH MODEL HYDRA 798

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

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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

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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 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 degrees 2

Environmental Ratings

Operating Temperature 5-50°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 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 without disconnecting it from the supply and leaving time for it to reach ambient temperatures.
8. Do not use the apparatus outside its recommended temperature range.
9. The apparatus is protected by an over temperature circuit, ensure correct settings at all time.

ON ARRIVAL

You should have the following parts,

1. Main Bath Assembly
2. One overflow and one drain pipe
3. Lid
4. This handbook
5. PC Interface Lead (yellow)

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

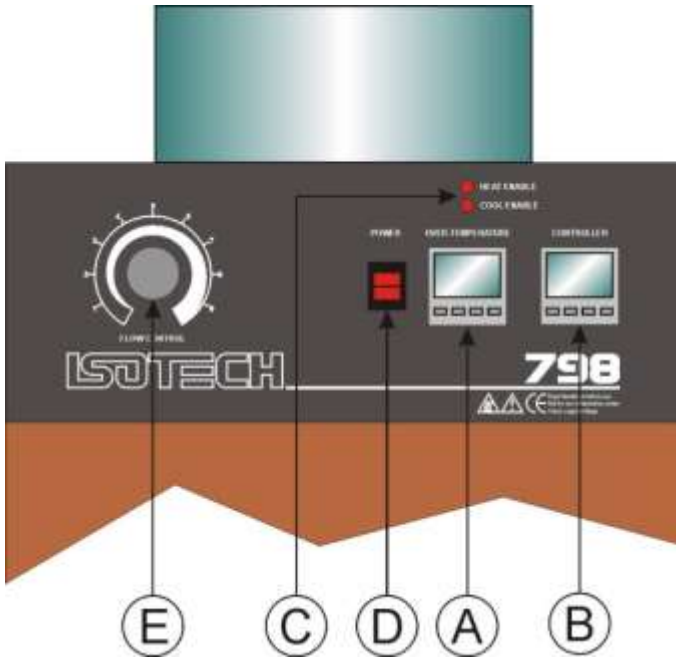
In the unlikely event of any items arriving damaged please retain the packing materials (which may need to be inspected later) and then contact your supplier.

SPECIFICATION

798H	Ambient to 300°C**
798EHT	Ambient to 300°C
798M	-40 to 125°C
798L	-80 to 125°C
Volume	150mm diameter, 300mm deep (5 litres)
Dimensions	400mm Wide 615mm Deep 800mm Height
Absolute Stability	±0.01°C
Best Comparison Accuracy	±0.002°C
Communications	RS422
Uniformity 125°C (oil)	Vertical 0.002°C Horizontal 0.001 to 0.0025°C
Uniformity 200°C (oil)	Vertical 0.005°C Horizontal 0.001 to 0.0035°C
Safety	Compliant to CE Regulations
Power	<u>798EHT</u> 800W 110V 50/60Hz 230V 50/60Hz <u>798H</u> 800W 110V 50/60Hz 230V 50/60Hz <u>798M</u> 1.5 KW 110V 50/60Hz 230V 50/60Hz <u>798L</u> 2.5 KW 110V 50/60Hz 230V 50/60Hz

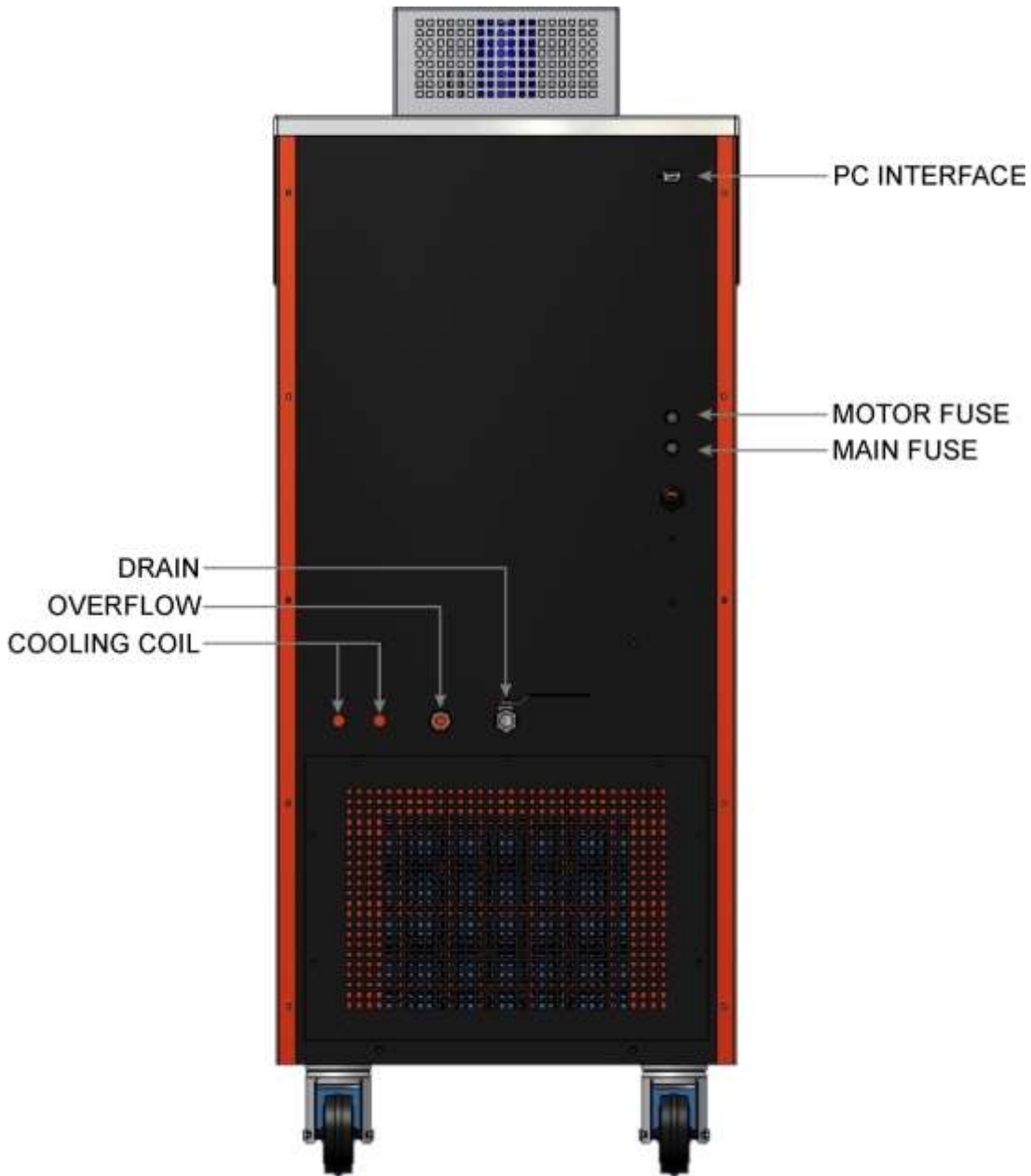
** The temperature range of the Hydra 798H was increased from 200°C to 300°C from 2016.

FRONT PANEL CONTROLS



- A OVER/UNDER-TEMPERATURE CONTROLLER (SAFETY)
- B TEMPERATURE CONTROLLER
- C HEATER ENABLED
- D ON / OFF SWITCH
- E FLOW CONTROL

REAR PANEL



⚠ IMPORTANT READ THIS NOW!

CHILLERS

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 - Medium

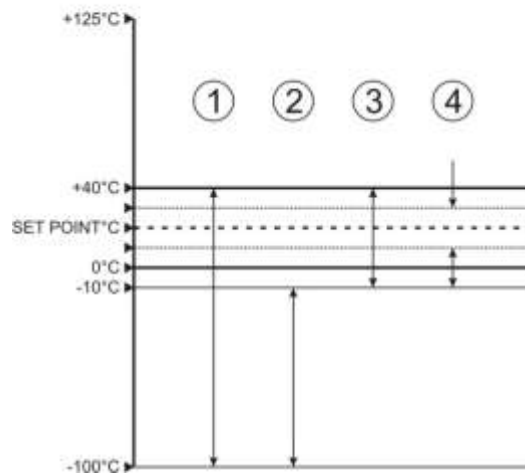
The chiller is designed to automatically enable at any temperature below 40°C. The chiller will run all the time and the temperature control is balanced by the heater. The chiller will have unwanted cooling power at the higher temperatures, such as temperatures above -10°C; it can cause unwanted instability in the liquid temperature. To prevent this, the Hydra has an automatic cooling reduction facility built in. 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.

The functions of the chiller can be identified by the display of the controller on the front panel. Refer to the controller section on page 15 for details.

The diagram below gives a graphical account of the Hydra 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.





Chiller function - Low

The Hydra Low has a cascade refrigeration system. This allows the bath to reach temperatures in excess of -80°C. The chiller is fully automated and requires no user intervention.

Because of the complex nature of this refrigeration system, it is recommended that in the event of service, you contact Isotech for advice as it is generally beyond the scope of standard refrigeration systems.

Chiller gases and quantities

Hydra Medium

Gas used R404A
Quantity \simeq 550grams

Hydra Low

Gas used
High stage R404A
Quantity \simeq 350 grams
Low stage R23
Quantity \simeq 100grams

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

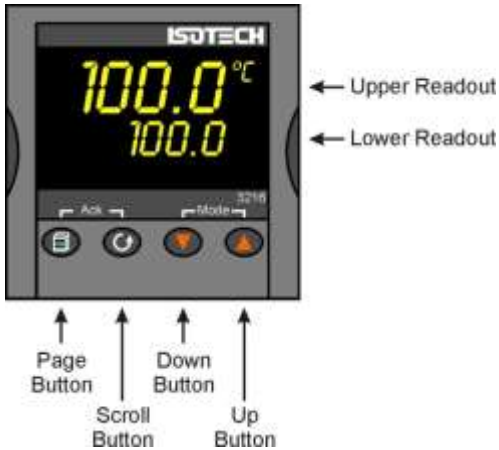
Fill the bath with suitable liquid, water is probably best for initial testing. Fill the bath until the level is 45mm below the top lid of the bath.

ALWAYS ISOLATE THE BATH FROM THE ELECTRICAL SUPPLY WHEN CHANGING LIQUIDS



USING THE CONTROLLER

FRONT PANEL LAYOUT



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.

ADVANCED CONTROLLER FEATURES

Setpoint Ramp Rate

By default the bath is 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 bath to heat at a controlled rate it is easier to determine the temperature at which the thermostat changes state.

The bath 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,

OFF
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 for the controller and 2 for the over/under temperature controller. This address would only need to be changed if more than one piece of equipment 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,

- Output 1 (**op1**) Heater – shows when the heater is active, seen to pulse to display heater output
- REM This beacon indicates activity on the PC interface
- Output 2 (**op2**) Full cooling – When illuminated shows full cooling and the by-pass valve is closed.
(M Only) When not illuminated, indicates the by-pass valve is open and reduced cooling is enabled
- Output 4 (**op4**) Indicates the chiller is enabled and working

Units

The units can be changed from °C. Press the scroll key until the lower displays shows

UNITS

Use the UP and DOWN keys to select the desired display unit. Continue to press the scroll key to access the following options

- Pb
- Ti
- Td

These controls allow the user more level of control over the bath performance and should only be adjusted if the user has a full understanding of PID control systems.

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. Whichever 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 & L MODELS)

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 Hydra 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.

UNITS

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

DIAGNOSTIC ALARMS

These indicate that a fault exists in either the controller or the 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	<i>Electrically Erasable Memory Error:</i> The value of an operator or configuration parameter has been corrupted	Contact Isotech
S.br	<i>Sensor Break:</i> Input sensor is unreliable or the input signal is out of range.	Contact Isotech Check rear panel to ensure connection of both control and over-temperature sensors
HW.Er	<i>Hardware error :</i> Indication that a module is of the wrong type, missing or faulty	Contact Isotech
LLLL	<i>Out of Display range, low reading</i>	Contact Isotech
HHHH	<i>Out of Display range, high reading</i>	Contact Isotech
Err1	<i>Error 1: ROM self-test fail</i>	Consult Isotech
Err2	<i>Error 2: RAM self-test fail</i>	Consult Isotech
Err3	<i>Error 3: Watchdog fail</i>	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	<i>Error 5: Input circuit failure</i>	Consult Isotech
Pwr.F	<i>Power failure.</i> The line voltage is too low	Check that the supply to the controller is within the rated limits

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 50.0°C.
3. The bath should now reach and control at the target set point.
4. Select the correct stir speed using the dial on the left side of the control panel, turning the dial clockwise will increase the stir speed and anti clockwise will reduce it.

The bath may now be used for calibration.

MOTOR NOTE

This bath has a variable speed motor control installed. This allows the user to select the optimum stir speed for the liquid and temperature choice.

The motor is a brushed DC drive motor and uses internal carbon brushes, available from Isotech.

Motor speed can be adjusted via the dial on the control panel, rotate the dial clockwise to increase the stir speed and counterclockwise to reduce the stir speed.

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, refer to Volume 1 and 2 of the Solutions Catalogues.

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 are hygroscopic. 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 ingress 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. 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 Ethanol and water or pure Ethanol. 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 user's 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 approximately 25mm from the top of the calibration tube.

Ensure at all time that the liquid level is kept at the correct level and that the liquid is circulating around the bath. If the level falls excessively the flow will stop with a consequence of large temperature gradients. If a liquid is being used close to its flash point a hazard could then occur.

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,

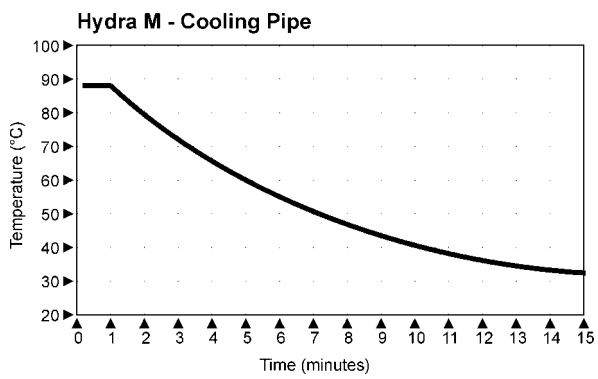
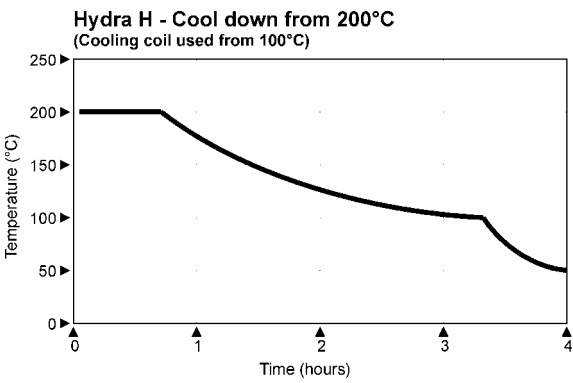
1. Disconnect from the supply.
2. Ensure the liquid is at a safe handling temperature. Then open the drain tap.
3. Drain the liquid into clean containers of adequate capacity, properly labelled for future use.
4. Clean the bath. Detergent and absorbent paper will assist. If the bath has been used with 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.

USING THE COOLING COIL

The EHT and HT models have an internal cooling coil fitted. Access for the cooling coil is via two bulkhead fittings on the rear panel.

The L and M Models have a similar facility; access is via the two labeled connectors in the rear of the bath. Hydra models L and M manufactured before March 2005 do not have this cooling pipe fitted).

Water passed through the coil will substantially reduce the cooling time. To avoid any hazard from the expansion of water to steam do not use water at temperatures in excess of 100°C and ensure water is drained from the coil before setting the Hydra above 100°C.



CLEANING AND MAINTAINING THE BATH

The bath lends itself to easy cleaning and maintenance.

To clean the inside of the tank assembly simply remove the electrical supply.

Remove the motor cover via the four screws on the side.

Remove the four screws securing the motor plate to the top cover.

Lift the motor assembly clear of the calibration volume and clean the internal parts required.



USING THE PC INTERFACE

This equipment includes an RS422 PC interface and a special converter cable that allows use with the 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

Cal Notepad can be used to log and display values from the equipment 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.

Licence

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.

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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.

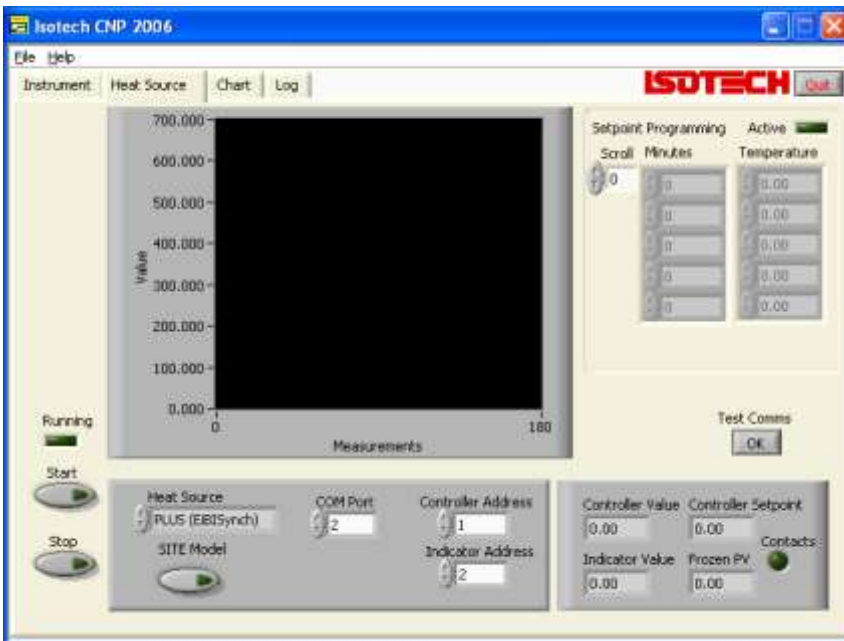
Starting Cal NotePad

From a Standard Installation:

Click the START button

Highlight PROGRAMS

Select Isotech - Select Calpad



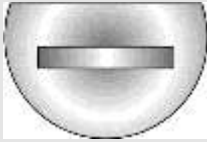
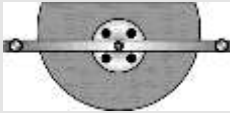

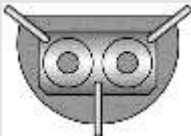
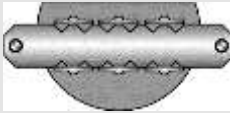





Protocol

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

ACCESSORIES

The following options are available:-

	Description	Part Number
	Liquid Volume Lid	798-05-01
	Aluminium Equalising Block, 4 pockets, 8mm x 160mm deep	798-05-02A
	Copper Equalising Block, 4 pockets, 8mm x 160mm deep	798-05-02B
	Standard Dual Cell Holder	798-05-03
	Thermometer Support Kit	798-05-04
	Mercury Triple Point Cell	17724
	Water Triple Point Cell	B12
	Gallium Melt Point Cell	17401
	Slim Gallium Melt Point Cell	17401M
	Indium Freeze Point Cell	17668M