

# **RESISTOR MAINTENANCE**



## **BATH MODEL 455**

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.

We recommend that this instrument to be re-calibrated annually.

**ISOTECH**

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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 manual)
	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.

## HEALTH AND SAFETY INSTRUCTIONS

1. Read this entire manual 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.
12. Ensure adequate ventilation when using oils at high temperatures.

## SYSTEM DESCRIPTION

The standard resistor oil bath is designed to provide an environment in which up to six standard fixed resistors can be maintained at a steady temperature.

When filled, the bath contains a quantity of approximately 34 litres of oil which is stirred by a large propeller driven by an electric motor and monitored by an immersed control sensor (PRT).

An advanced temperature controller is used to control the bath temperature by varying the power and heat flow direction of four thermoelectric heat pumps.

The bath is thus able to heat or cool the liquid and, therefore, can maintain a temperature either below or above ambient.

## SPECIFICATIONS

Setpoint Resolution:	0.01°C
Indicator Temperature Resolution:	0.01°C
Stability	±0.005°C
Size:	910mm high, 635mm wide, 710mm deep
Weight:	Approximately 66kg dry
<b>Acceptable Ambient Conditions:</b>	
Operating:	15 to 26°C, 10 to 80% relative humidity
Storage:	-30 to 55°C, less than 85% relative humidity
<b>Power Requirements:</b>	115/230 VAC, 50/60 Hz, 150 VA max.
Bath Fluid:	Castrol Whitmore WOM 14 oil
Bath Temperature:	10 to 30°C

## OPERATING INSTRUCTIONS

### LOCATION

The typical industrial standards laboratory provides an environment suitable for the bath, which is designed to operate at any ambient temperature between 15 and 26°C, in air that is relatively free of particulate material (particularly soluble salts) and soluble or corrosive gases such as ammonia or sulphur dioxide. The external clearance necessary for cooling air to circulate through the back of the cabinet is provided by the extended frame around the air filter. This frame may be placed directly against a wall provided that the lower opening is not restricted. The cabinet is equipped with castors so that it may be moved easily; however, care must be taken to avoid splashing oil from the bath. Power requirements need no special consideration: since maximum power consumption is 150VA, thermal inertia is high and the temperature coefficients of the "fixed" resistors are extremely low, interruptions of a few minutes will not affect the efficacy of the bath.

### INDICATORS AND CONTROLS

- (i) Fitted near the upper right-hand corner of the cabinet front is the panel containing the power/system switch.
- (ii) The temperature controller is fitted at the front of the cabinet at a level below that of the bottom of the tank. It controls the power to the heat pump system in accordance with the temperature differential between control sensor and set-point.

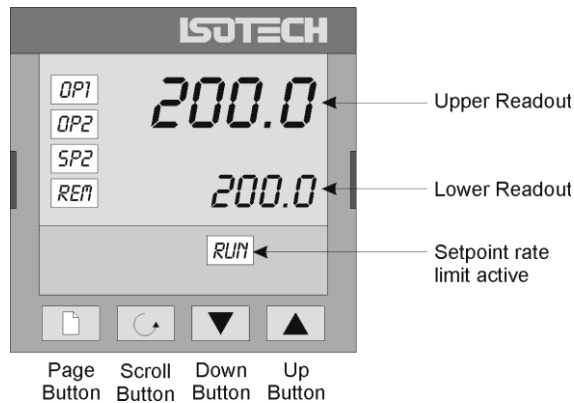
### START-UP

1. Visually inspect the system to ensure that it has not been damaged in transit.
2. Remove the spare filters and instruction manuals from the tank. (The resistor holder assembly is designed to stay in the tank.)
3. Fill the tank to the top of the resistor frame with a suitable oil, preferably Castrol Whitmore WOM 14.
4. Connect the mains cable to a suitable outlet, turn the power switch on and set the controller to the desired temperature.
5. Observe the bath temperature.



## OPERATING THE PLUS MODEL

### 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.

### 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 bath 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.

## DIAGNOSTIC ALARMS

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

### CONTROLLER ERROR MESSAGES

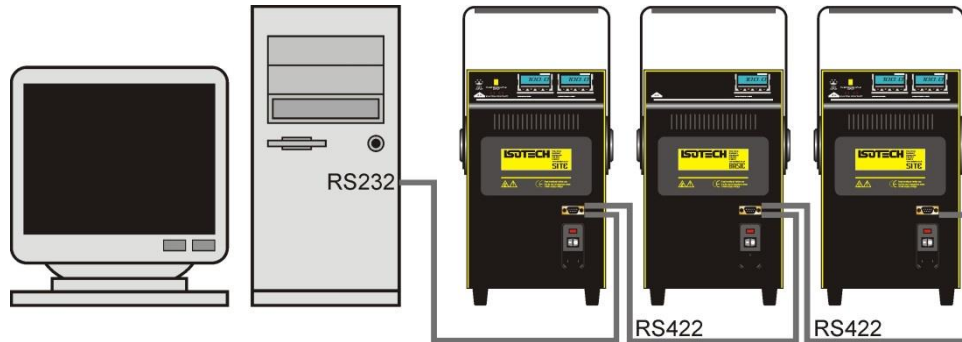
The instruments include powerful diagnostics and in the unlikely event of an internal failure, or a sensor error, one of the following error messages may be displayed.

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
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

## 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

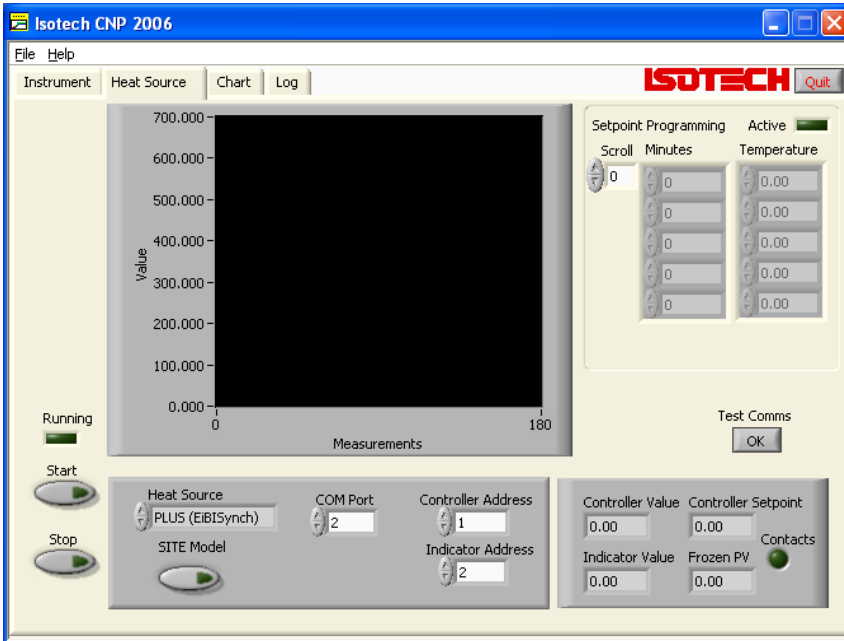
For RS232 use simply connect the Isotech cable.

### RS422 Connections

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

## 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>

## OPERATION

Openings are provided in the lid of the bath. These allow the leads from the resistors to be brought out to the measuring system.

The oil level in the bath should be maintained at the underside of the top plate of the resistor support frame. Air filtration should be maintained correctly. (See "MAINTENANCE")

## MAINTENANCE

Any change in duty cycle which does not correspond to a change in ambient conditions indicates a possible malfunction. An increase in duty cycle could be a symptom of a dirty air filter or other obstruction to air flow.

To prevent any misapprehension (and to put the above in context), it should be noted that full power is required for a few hours to bring the bath from ambient to operating temperature and the control system will also normally apply full power for several minutes if any object at a different temperature is placed into the bath.

The oil level and the air filter should be checked weekly. Replacement of the air filter (an Isotech 935-15-07 standard 8 x 16" fibreglass "furnace" filter) is indicated if it is discoloured (blackened) over more than 30% of its visible surface.

## COOLING/HEATING SOURCE

The cooling/heating function is provided by four thermoelectric modules. These modules are sandwich structures of ceramic, copper and semiconductor material. They use the Peltier effect of the semiconductor material (bismuth telluride) to produce a current-dependent heat pumping action. Each thermoelectric module is mounted between a heat sink and an aluminium block. Two of these assemblies are mounted to an aluminium plate attached to the lower part of each side of the stainless steel tank. The cooled/heated area of each side is about 230 by 280mm (9" x 11"). The tank is embedded in moulded foam insulation which has been formed to provide air channels over the heat sinks and across the bottom to the cooling fans located on the horizontal shelf that supports the tank assembly. The heat-pump circuit has two thermal fuses in series with the four modules to protect the system in case of fan failure. These fuses are mounted on one heat sink on each side of the tank assembly. Current through the thermoelectric modules is regulated by the controller circuitry to produce cooling or heating, as demanded.



## REPAIR PROCEDURES

Troubleshooting and repair procedures are generally straightforward for an experienced technician. Isotech personnel are available to answer any questions which might arise. The following information might, however, prove useful.

### CONTROLLER REMOVAL

The control assembly houses the system power supply and the controller. The controller can be removed from the cabinet as follows:

- 1) Make sure that the power supply is disconnected.
- 2) Make sure that the cables at the right-hand end of the controller rear panel are labelled to match the panel labels. Remove these cables.
- 3) Disconnect the fan cables by removing their plugs from sockets located on the side and rear of the controller chassis.
- 4) Remove the four screws holding the control front panel to the cabinet.
- 5) From the rear of the cabinet, lift the rear of the controller slightly upwards and displace the controller chassis forwards until its fascia projects from the cabinet.
- 6) Remove the controller from the front of the cabinet.

### REMOVAL OF TANK ASSEMBLY

The only individually-replaceable parts of the tank assembly (excluding support frame, stirrer and sensor) are the thermal fuses. The tank assembly may be removed as follows in order to provide access.

- 1) Make sure that the power is disconnected.
- 2) Remove the lid (**CAUTION: SPRING LOADED HINGES**). With the lid in the closed position, remove the three screws holding the lower section of each hinge to the cabinet.
- 3) Remove all oil from the tank (siphon or peristaltic pump).
- 4) Remove the four screws holding the switch panel to the upper right-hand corner of the cabinet front. Pull the panel forward and let it hang outside the cabinet by its cable. This will prevent the possibility of impact when the tank is removed.
- 5) Remove the access panel (held by two screws) directly above the lower opening at the rear of the cabinet.
- 6) Disconnect the cables from the rear panel of the controller and ensure that they are not tangled or snagged.
- 7) Remove first the cushioning strips and then the 16 brass wood screws holding the top panel of the tank assembly to the cabinet.

- 8) Secure the cabinet so that it cannot move and push the tank assembly to one side until the opposite edge of the top panel can be grasped. Lift the tank assembly vertically upwards by the side edges of the top panel.

**NOTE:** Do not lift by the corners of the panel, as the bond between the panel and the insulation might be damaged.

## THERMAL FUSE REPLACEMENT

Thermal fuses are attached to one heat sink on each side of the tank assembly.

- 1) Remove the tank assembly from the cabinet as described above.
- 2) Test each thermal fuse with an ohmmeter. The normal resistance is only a few milliohms.
- 3) Unsolder the connections at each end of the defective thermal fuse.
- 4) Carefully cut the silicone rubber that holds the thermal fuse to the heat sink. Be careful to avoid damage to the insulation behind the thermal fuse.
- 5) Ensure that the replacement 70°C thermal fuse is wrapped with a layer of thin Kapton or Mylar tape to insulate it electrically from the heat sink.
- 6) Place two solid copper alligator clips on each lead of the thermal fuse, one adjacent to the body and the other about 6mm (1/4") away (these serve as heat sinks during soldering).
- 7) Quickly solder the connections to the new fuse.

**NOTE:** Slow soldering or the absence of heat sinks can cause the fuse to melt.

- 8) Bend the leads of the fuse so that it is positioned against the top edge of the heat sink, and cement it in place with non-corrosive, single part, silicone rubber (Dow Corning RTV 3145 or equivalent).
- 9) Check the cooler circuit with an ohmmeter (resistance should be about 8 ohms) before re-assembling the bath.

## FAN REPLACEMENT

- 1) To gain access to either of the two fans, remove the controller from the cabinet as described above.
- 2) Extract the four thumb-screws holding the fan-support to the top panel of the controller compartment and remove the support with fan attached.
- 3) Detach the fan from the support (4 screws).
- 4) Mount the new fan to the support and re-attach the assembly to the top panel of the controller compartment.