

NEPTUNE MODEL 915 PARALLEL TUBE LIQUID BATH



Isotech North America
154 Brentwood Drive, Unit 3
Colchester, VT 05446

Phone: (802)-863-8050
Fax: (802)-863-8125

www.isotechna.com
sales@isotechna.com

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.

Serial No:.....

Date:.....



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EMC INFORMATION

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

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

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



ELECTRICAL SAFETY

This equipment must be correctly earthed.

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

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

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

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

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

Voltage transients on the supply must not exceed 2.5kV.

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

ENVIRONMENTAL RATINGS

Operating Temperature 5-50°C

Relative Humidity 5-95%, non condensing



HEALTH AND SAFETY

INSTRUCTIONS

1. Wear appropriate protective clothing.
2. Operators of this equipment should be adequately trained in the handling of hot and cold items and liquids.
3. Do not use the apparatus for jobs other than those for which it was designed, ie. the calibration of thermometers.
4. Do not handle the apparatus when it is hot (or cold), unless wearing the appropriate protective clothing and having the necessary training.
5. Do not drill, modify or otherwise change the shape of the apparatus.
6. Do not dismantle the apparatus without disconnecting it from the supply and leaving time for it to reach ambient temperatures.
7. Do not use the apparatus outside its recommended temperature range.
8. The apparatus is protected by an over temperature circuit, ensure correct settings at all times.



ON ARRIVAL

Check List.

You should have the following parts,

1. Main Bath Assembly
2. One overflow and one drain pipe
3. This handbook
4. Mains Lead

Optional accessories are available and will only be present if specified on your order, see page 24.

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 unit's supply voltage requirement is specified on a plate on the instrument along with the Serial number.

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 that the old plug is disposed of 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)



IMPORTANT. READ THIS NOW!

CHILLERS

If supplied these devices should be left to settle for 24 hours before use with the flexible hose in an upright position. This will allow the internal oil to return to its correct position if it has been disturbed during transit.

SETTING UP

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



Connect the drain pipe to the drain tap and the overflow pipe to the side 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.

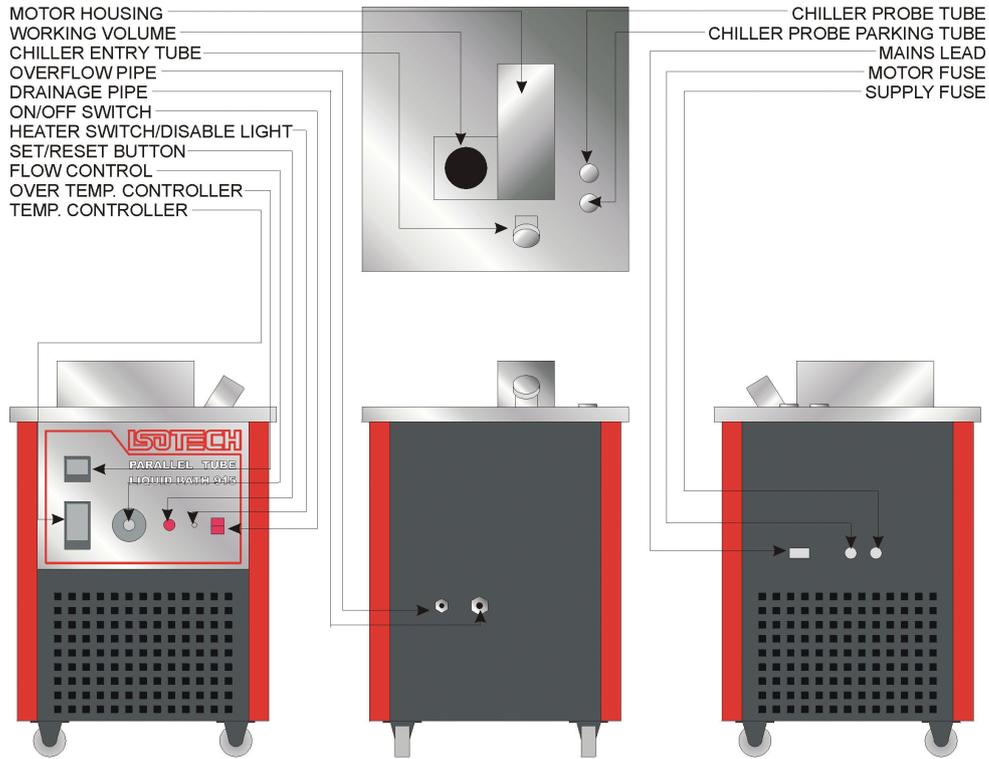
Fill the bath with a suitable liquid, water is probably best for initial testing. Fill the bath until the level is 10mm below the top of the round central calibration tube

ALWAYS ISOLATE THE BATH FROM THE SUPPLY WHEN CHANGING LIQUIDS

Turn the flow control to the mid position.

FRONT PANEL CONTROLS (See figure 1.)

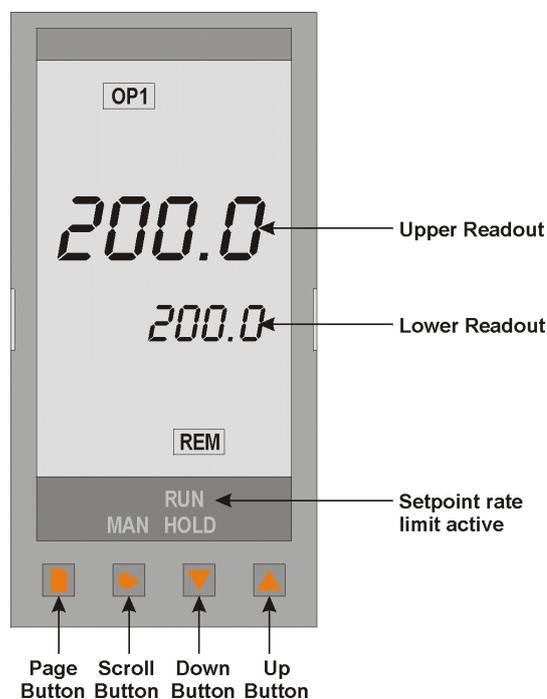
FIGURE 1



COMPONENT ASSEMBLY OF 915 CABINET

A. USING 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 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,

SPrr

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

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

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

Instrument Address

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
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

B. OVER TEMPERATURE CONTROLLER

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 over temperature controller is used in conjunction with the Set / Reset Button.

C. SET / RESET BUTTON

When the bath is first switched on the heater is disabled. When this button is pressed the heater will become enabled and the light next to the button will become illuminated. If the bath temperature exceeds the value set in the over temperature controller the heater will no longer be enabled and the light will turn off.

D. HEATER ENABLED / DISABLED LIGHT

As mentioned above the light will be lit when the heater is enabled and will be off when the heater is disabled.

E. 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.

F. ON / OFF SWITCH

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.

DO NOT PRESS THE SET BUTTON YET!

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. Adjust the flow if necessary.
4. Only if a chiller has been supplied.

For temperatures above ambient ensure any chiller (cooler) probe is not in the liquid and that the chiller is turned off.

5. Press the Set / Reset Button. The bath should now reach and control at the target set point.

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

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 spoiled 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 Ayries 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 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 an 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 EXTERNAL CHILLERS

Refer to the Chiller operating instructions before using the chiller.

The cooling probe should be fully immersed into the chiller probe tube. Push the hose firmly into position until the end of the chiller probe locates at the bottom of the tube.

This chiller has a maximum operating temperature.

Remove the chiller probe from the bath when operating above ambient temperature.

The chiller probe should not be allowed to reach temperatures higher than 30°C.

TROUBLE SHOOTING

PROBLEM

SOLUTION

No Power

Check Fuse

Motor does not turn

Check Fuse and flow control setting

Drive belt slipping or broken

To replace the drive belt with the spare belt supplied, remove the four screws securing the motor cover. Loosen the motor bolts and remove the worn belt. Replace with the new one and readjust the motor via the four bolts. Replace the motor cover.

Temperature does not rise

Check over temperature controller setting and press Set button

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

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



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

Connections

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

RS422 Connections

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

Using the Interface

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

CAL NOTEPAD

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

Minimum System Requirements

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

Development

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

License

Use of the Cal NotePad software program "CNP" is as granted in this license agreement. In using the CNP

software the user "licensee" is agreeing to the terms of the license. You must read and understand the terms of this license before using CNP.

1, This license permits licensee to use CNP software on a single computer. The user may make copies for back up and archival purposes freely as long as the software is only ever in use on a single computer at any one time. Please enquire about multi-user licenses.

2, CNP is protected by international copyright laws and treaties. CNP must not be distributed to third parties.

3, CNP must not be reversed engineered, disassembled or de-compiled. Licensee may transfer the software to a third party provided that no copies or upgrades of CNP are retained.

4, It is the responsibility of the user to ensure the validity of all stored results and printed certificates. Isothermal Technology Ltd accept no responsibility for any errors caused by inappropriate use, incorrect set up or any other cause; including defects in the software.

5, Limited Warranty. Isothermal Technology warrants that CNP will perform substantially as described in this manual for a period of 90 days from receipt. Any distribution media will under normal used be guaranteed for a period of 90 days.

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

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

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

Installing Cal NotePad

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

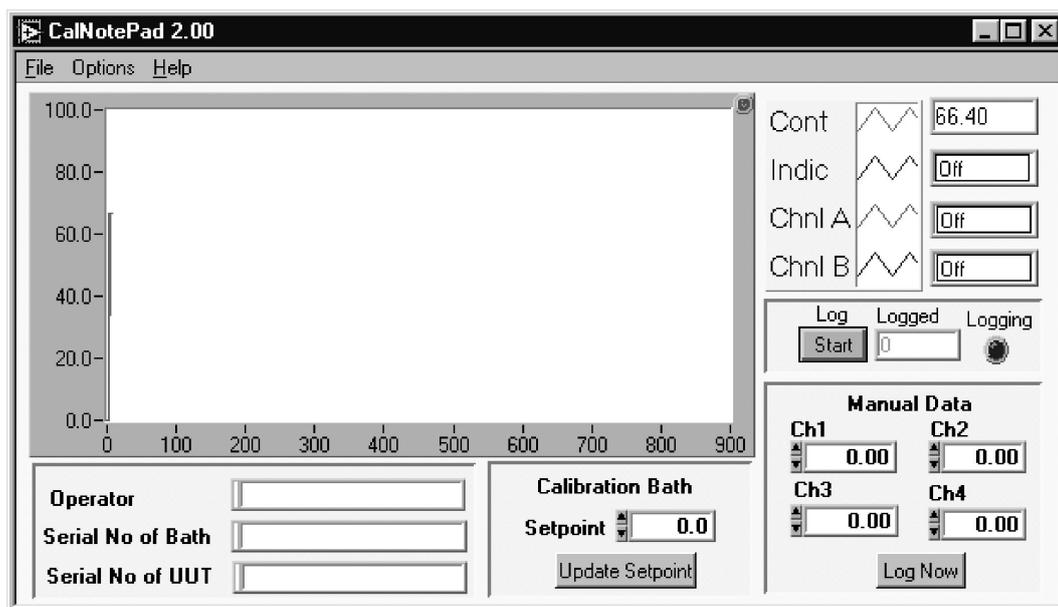
Starting Cal NotePad

From a Standard Installation:

Click the START button

Highlight PROGRAMS

Select Isotech - Select Calpad

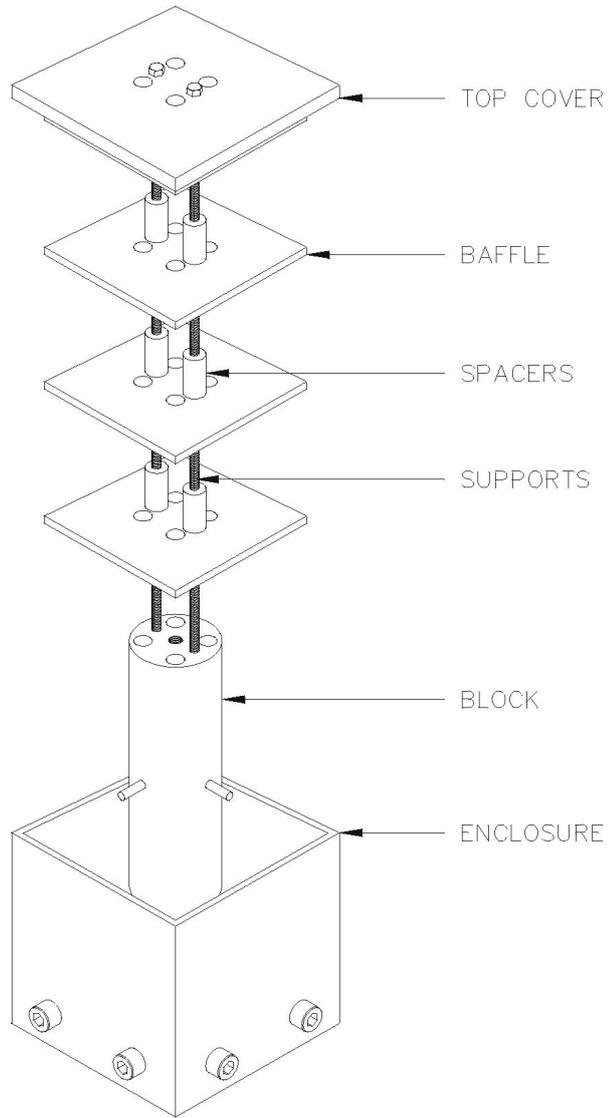


Protocol

The instruments use the "Eurotherm EI BiSynch Protocol"

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

EXPLODED VIEW OF CALIBRATION TUBE COVER (915/05)



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
- 915/05 Calibration Tube Cover.**
The cover consists of a square enclosure containing baffles and fits over the calibration tube area insulating the circulating liquid from ambient air. Access for temperature probes remains at the top of the enclosure. An equalising block may also be supported from this assembly. Maximum operating temperature 180°C.
- 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.

APPENDIX 1

USING THE ISOTECH HIGH STABILITY TEMPERATURE CONTROLLER

i, Isotech High Stability Controller

OPERATING INSTRUCTIONS

The ISOTECH HIGH STABILITY CONTROLLER has been designed to provide superior stability with ease of use.

CHANGING SET POINT

The set point is modified utilising the three front panel keys.

To modify the set point first press "ALTER" once, the top left digit will flash which indicates that the digit may be modified by pressing the "SET" key. The digit will step with each press of the "SET" key. The first digit may be -, 0, 1 or 2 whilst the following digits may be in the range 0 - 9 which allows an entry range of -99.99 to 299.99°C.

When the required value has been set or to move to the next digit then press the "ENTER" key.

After the fifth digit has been set then pressing "ENTER" will now cause all five digits to flash showing the new set point or target temperature. To accept this new value press "ENTER" again the display will now stop flashing. It is only when the display has stopped flashing that the new set point is activated.

Or if you are unhappy with the new set point value instead of pressing "ENTER" as the display flashes press "ALTER" which allows the set point to be changed again.

In use there may be a small offset (less than 1 °C) between the set point and the measured value this is quite normal. The measured value is to a large extent a measurement system independent of the control loop. If you are aiming for a particular temperature, for example 50 °C and with a set point of 50.00 the actual temperature is found to be 50.06 then the set point may be offset by 0.06, 49.94 in this case. Remember this is a comparison calibration bath.

RS 232 OPERATION WITH THE ISOTECH HIGH STABILITY CONTROLLER

The controller has an RS232 serial communication interface which allows the set point to be read and modified and also the measured value may be examined. The controller operates at 9600 baud, 8 data bits, No parity and 1 stop bit (9600,8,N,1).

To read the set point send the controller the command (as an ascii character) S.

To read the Measured value send the controller the command R.

To modify the set point send Cabc.de, where a is either 0, -, 1 or 2 and b to e are in the range 0 to 9. All zero digits must be sent. The complete string should be sent in one go, if the controller receives the entire string in more than 80mS then it is ignored as are out of range values.

Examples, the following strings are allowed,

1,	C123.45	Set point will become 123.45
2,	C-00.15	Set point will become 0.15

The following strings are not allowed and would be ignored,

1,	C300.45	Out of range
2,	C-0.15	A zero is "missing"
3,	C100.0	A zero is "missing"

RS 232 Connections.

The standard 9 pin D connector is wired as follows,

Pin 2	Rxd Receive Data
Pin 3	Txd Transmit Data
Pin 5	Common

Other pins no connection.

RS232 operation with a Eurotherm Controller, see separate Eurotherm Manual.