

CON THERM

INSTRUCTION MANUAL

CAT 6900

ENVIRONMENTAL CHAMBER

CON THERM SCIENTIFIC LIMITED

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WARRANTY STATEMENT

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CONTHERM Scientific Company will guarantee CONTHERM equipment for a period of twelve months from the date of installation against faulty workmanship and fabricated materials. This guarantee covers the replacement of component parts found to be defective and authorised labour charges during this period.

Should a malfunction occur or condition develop beyond reasonable acceptance the company will accept responsibility for returning the unit to its factory specification at no cost to the Purchaser providing that the operating instructions have been observed and the defect is due solely to faulty design, material and workmanship. That the defective part be returned, freight paid to the nearest sales service office, the Company shall service the affected component and despatch, freight prepaid, within ten working days of receipt. Units outside the warranty period will be accepted and repairs will be covered under an extension of the above for 90 days.

In remote installations where it is not possible for the company's or agents' engineers to attend, authority may be given to allow the Purchaser to arrange such service.

The Purchaser is required to remit the purchase price of the unit to the supplier within the terms of that supplier's condition of sale. CONTHERM Scientific Company will accept no liability or shall its agents for consequent damage of any kind due to a malfunction or component failure.

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CONTENTS

SECTION 1	Definition of Terms
SECTION 2	Introduction and Specifications
SECTION 3	Installation
SECTION 4	Operating Instructions
SECTION 5	Calibration
SECTION 6	Theory of Operation
SECTION 7	Diagnostics
SECTION 8	Customer Troubleshooting and Maintenance
SECTION 9	Spare Parts Lists
SECTION 10	Fault / Alarm Codes

IMPORTANT

All electrical servicing **must** be carried out by suitably qualified personnel only.

SECTION 1 DEFINITION OF TERMS

For the purpose of our standard specifications the following definitions shall apply:

a) WORKING SPACE

That portion of the internal space which is above the lowest shelf and not less than 5cm from any wall (including roof).

b) CHAMBER TEMPERATURE

That temperature at the centre of the working space.

c) SPATIAL VARIATION

The difference between the midrange of all measured temperatures obtained at one site and that at another site for those sites which give the greatest difference.

d) TEMPORAL VARIATION

The maximum value of the temperature range obtained for the standard site with the greatest range throughout the test interval.

e) TEMPERATURE DRIFT

Any long term changes in chamber temperature during continuous operation of the closed chamber.

f) TEMPERATURE OVERSHOOT

Any excess of actual over desired chamber temperature during a heating up period.

g) TEMPERATURE REPRODUCIBILITY

Temperature regained without alteration to controls.

h) TEST INTERVAL

Interval of time to which the steady state characteristics apply (Max 1 hour).

NB: All the above apply with an **empty** chamber.

For definitions and test methods refer: **AS2853 : 1986** (and Appendices)

SECTION 2 INTRODUCTION AND SPECIFICATIONS

The CONTHERM CAT6900 Biosyn Environmental Chamber has been expressly designed to give the widest choice of operating conditions consistent with high reliability and low cost, the addition of microprocessor control gives additional versatility and resolution while improving the degree of temperature control.

All specifications are quoted for a chamber temperature of 20°C with an ambient temperature of 20°C with any lighting off.

- **Construction** - Combination of High quality stainless steel and zinc plated mild steel; epoxy coated exterior, full fibreglass insulation, High quality stainless steel interior with two access doors and magnetic door catches. Lighting is supplied via specially ventilated light shelves.
- **Safety** - Fitted with an independent factory set Hi-Limit and user adjustable Hi-Limit completely separate from normal controls.
- **Convection** - All units come with mechanical convection fan systems.
- **Electrical** - Designed to NZS6200 / AS3100:1994 240V AC M.E.N
- **EMC** - Complies with AS/NZS 2064: 1997
- All performances quoted at 20°C - PLCS5 Precision Control System.

PERFORMANCE:

a) Temperature:	
Nominal Range (LIGHTS OFF)	0°C - 50.0°C
(LIGHTS ON)	5°C - 50.0°C
Temporal Variation	± 0.5°C
Spatial Variation	± 1.2°C
Initial Overshoot	+2.0°C
Reproducibility	±0.5°C
Dial resolution	0.1°C
Operating Ambient	10°C - 35°C
Mains Voltage Range	210-250 AC 50Hz

NB: The lowest temperature performance is only achievable in a maximum ambient of +20°C

- b) Lighting:**
Maximum Light Intensity 150 μ E
(Measured 300mm from glass)

Day-night Lighting:

Automatic control (ON/OFF) with manual switch selection of lamps to be controlled.

- c) Relative Humidity:**
Display Resolution: 1% RH
Display Range: 0 - 100%RH
Control Range: (Typical) 40 - 90%RH
Accuracy: (typical @ 20°C, 50 - 90%RH) \pm 5%RH

- d) Timer:**
Timing Range: 1 minute - 99hours 59 minutes
Timing Resolution: 1 minute

Manual or Timed operation:

NB: The symbol '[:]' means run continuously.

- e) Refrigeration:**
Automatic control, Hot and Cold cycle.
Used for Dry temperature control and Dehumidification (RHS Models) with automatic Hot Gas Defrost. Defrost may be programmed to occur automatically or manually.

- f) Programmable:**
Up to nine user programs may be set and run in conjunction with a 999 or continuous cycle counter.

- g) Computer:**
An RS232c computer connection is provided. Contherm PLCS5 Communications program sold separately.

SECTION 3 INSTALLATION

The CAT6900RHS Environmental Chamber is designed to be installed into a suitable well ventilated room with a preferred minimum clear space of at least 1000mm on all sides to allow access for servicing.

The chamber requires a 240Volt 50HZ 15Amp Single phase EARTHED electricity supply.

Total electrical load is upto 3.3Kw.

The approximate heat load (Lighting OFF) is 2.8Kw, Lighting ON is 3.1Kw

The chamber should be thoroughly inspected for any signs of mechanical damage that may have occurred in transit before any attempt is made to apply power to the unit.

WARNING: To prevent FIRE or SHOCK hazard, DO NOT expose this product to rain or any type of moisture.

FOR YOUR SAFETY

To ensure safe operation this cabinet must be connected to a 15A three-pin power outlet which is effectively earthed through the normal building wiring.

Extension cords are NOT recommended.

The fact that the equipment operates satisfactorily does NOT imply that the power outlet is earthed and that the installation is completely safe. For your safety, if in any doubt about the effective earthing of the power outlet, consult a qualified electrician.

This appliance should be regularly tested (at intervals not exceeding 12 months or after any service work on the appliance) according to the procedures prescribed in **AS/NZS 3760**. The basic safety checks and tests on electrical appliances required by **AS/NZS 3760** are:

- a) A visual check to ensure that there is no mechanical damage, that controls etc. are in good working order and that no parts are missing.
- b) An earth continuity test. (Maximum allowed resistance is 1 Ω)
An insulation resistance test. (Minimum insulation resistance is 1 M Ω)

SECTION 4 OPERATING INSTRUCTIONS

To set up unit for operation after unpacking and checking for damage proceed as follows:

- 1) Follow any installation procedures (See SECTION 3).
- 2) If lightshelves are not already installed install them using the following procedure (NB: the shelf with the longest connecting lead must be placed at the TOP of the chamber).
REMOVE the center mullion by first carefully opening both outer doors and the four inner glass doors then remove the two top knurled mullion retaining nuts. Remove the glass door drip trays (two more special machined knurled nuts, and finally the two lower knurled mullion retaining nuts. The mullion should now be able to be carefully removed from the cabinet.
Install the top lightshelf first, this fits into the very top shelf guides, the connecting wire must be carefully placed down the rear of the LHS of the chamber and exit through the rear LHS cable port.
Place the other two lightshelf guides (identifiable by the small retaining clips at one end) at suitable intervals (250-300mm is recommended) and install the other two light shelves in a similar manner.
- 3) Now install the standard shelf guides (NB: the edge that the shelf sits on is UP not down) usually the shelf position is on the nearest slot above the lightshelf, choose carefully as the mullion may have to be removed to change to a different position in the future, slide the wire shelf into the desired position on the shelf guide.
- 4) Reinstall the center mullion using the reverse procedure to removal, ensure that the knurled nuts used to hold the glass door drip trays in position are the special machined ones to prevent the glass door from hitting them when the doors are closed.
- 5) Plug the light shelf connecting cables into the special sockets on the cabinet outer LHS usually in the order top to bottom shelf goes from left to right sockets.

OPERATING CONTROLLER:

- 1) Fill HUMIDITY water tank. If humidity operation is attempted without filling tank a LOW WATER ALARM (06) will sound.
To fill tank: Open RHS lower hinged door, lift lid off stainless tank at top and carefully fill to within 50mm of tank top (deionised water preferred). Replace lid and close door.
- 2) Apply power at wall main switch.
- 3) Turn on RCD 'MAIN ISOLATOR' switch at panel on RHS of chamber - The 'MAINS INDICATOR' neon should now be on and the green LED displays on the control panel should be illuminated.
- 4) When power is FIRST applied to the chamber the display will most likely show an '03' (Preset) Alarm. This is due to the fact that power has been removed from the chamber for more than 48 hours. Use the method described on page 10 of this manual to cancel the special '03' Alarm.
- 5) Set program(s) to desired operating parameters.
- 6) Ensure USER HI-LIMIT (located on panel accessed by opening RHS wing) setting is suitable for operation at your desired maximum temperature. This should be set fully CLOCKWISE until the cabinet has stabilised at the highest temperature used by your program, then turned slowly ANTICLOCKWISE until the OVERTEMPERATURE neon lights on the panel, the control should then be turned slightly CLOCKWISE until the neon goes off, this sets the HI-LIMIT just above the normal maximum operating temperature. When the 'OVERTEMPERATURE' neon is ON power is removed from the cabinet heating elements.
- 7) Confirm factory calibration by monitoring the temperature, Humidity etc with your own calibrated instruments and make adjustments as per the CALIBRATION section if necessary.

ALARMS

There are TWO main types of alarm used in the PLCS5 control system.

a) **STANDARD ALARMS:** 01,02,04,05,06,07,08,10,11,12

These alarm numbers indicate a problem with chamber control, IE over-temperature, low water, faulty sensor etc.

To **CANCEL** these alarms press the DIAGNOSTIC select button THREE times. (Some of these alarms can also be cancelled by pressing ANY button). ENSURE that note is taken of the alarm indication and that any indicated problem is attended to,

b) **03 & 09 ALARMS:** 03,09

These alarms are SPECIAL and can **ONLY** be cancelled by using the SPECIAL procedure outlined below. These alarms indicate EITHER that the chamber MAY have lost some of its settings ('03') most likely due to being disconnected from the power for more than 48 hours, or that INTERFERENCE ('09') to the chambers internal operating system has occurred, due to external electrical interference or electronic system malfunction.

To ensure that the required settings and CALIBRATION factors are checked it is necessary to EXAMINE **ALL** the program settings and TEMPERATURE and HUMIDITY calibration factors. If there was more than one program running the settings for the additional programs should also be checked but this is NOT essential in order to cancel the alarm.

The following procedure is recommended:

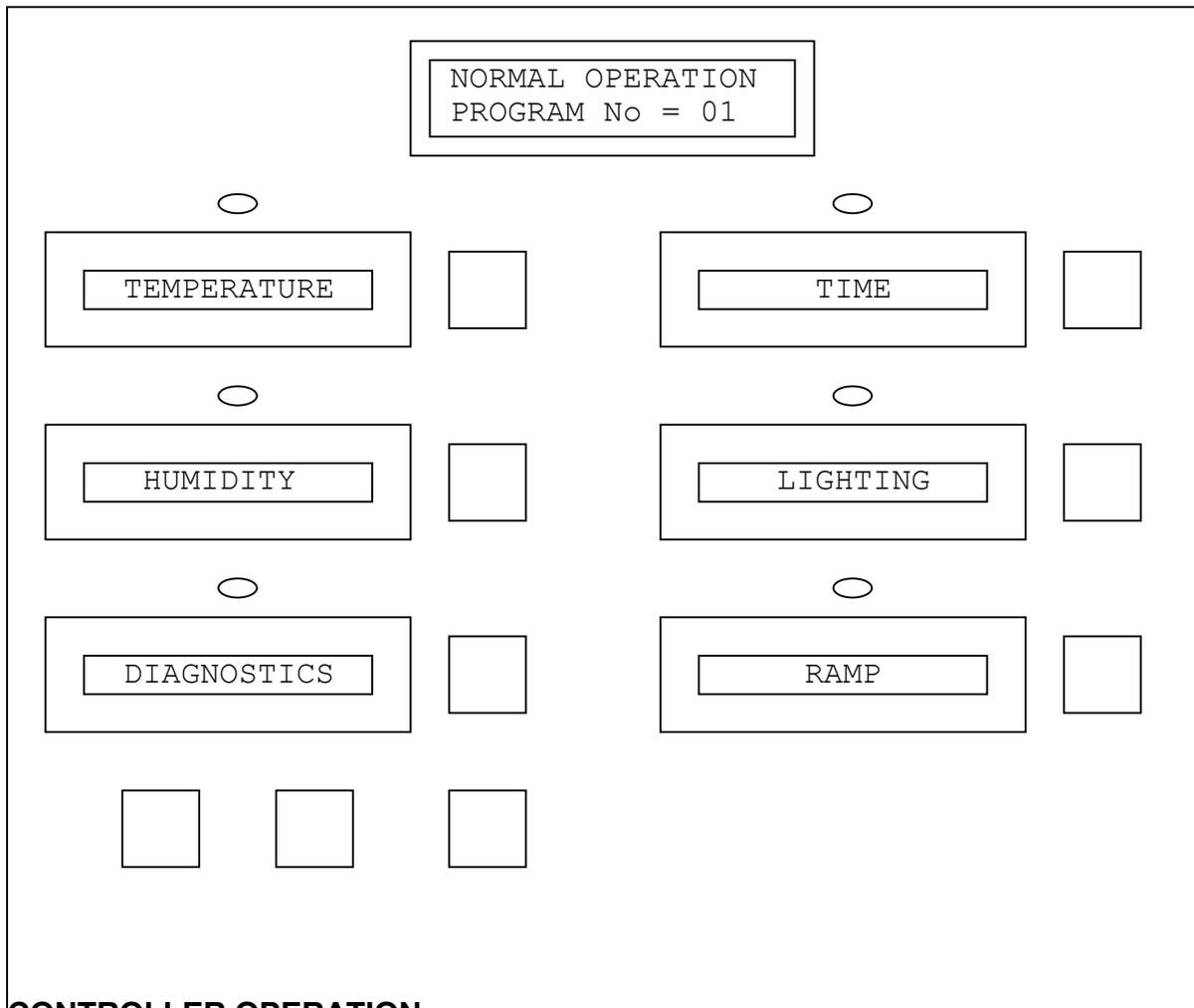
1) Press the 'SELECT' button adjacent to the green temperature display and confirm the SET POINT is correct, if not then adjust it using the 'UP' and 'DOWN' buttons. Press 'SELECT' again if the 'SET' LED above the display is ON so that it goes OFF. - REPEAT for all the other Green display parameters (TIME, HUMIDITY, LIGHT etc).

2) Press the 'SELECT' button adjacent to the red 'DIAGNOSTICS/ALARMS' display and using the 'UP' button obtain diagnostic No20 (Calibrate Temp), check that the current value is correct. (Check against the Factory Cal Factor - on front cover of manual, or other known Cal Factor), if NOT correct press 'SELECT' again and adjust Cal Factor using the 'UP' and 'DOWN' buttons. Press the 'SELECT' button a third time to exit the DIAGNOSTIC routines.

- 3) Press the 'SELECT' button adjacent to the red 'DIAGNOSTICS/ALARMS' display and using the 'UP' button obtain diagnostic No21 (Calibrate RH), check that the current value is correct. (Check against the Factory Cal Factor - on front cover of manual, or other known Cal Factor), if NOT correct press 'SELECT' again and adjust Cal Factor using the 'UP' and 'DOWN' buttons. Press the 'SELECT' button a third time to exit the DIAGNOSTIC routines.
- 4) Press the 'PROG' button adjacent to the 'UP' button and step through the three program settings (Select program, Set cycle counter and Set max prog number).
- 5) Having carried out all of the above pressing any parameter button will now cancel the alarm. (IE, press the 'TEMPERATURE' select button. If the red LED above the 'TEMPERATURE' parameter display is ON press the 'SELECT' button again.

SPECIAL NOTES

- 1) To ensure correct refrigeration operation and longest life, the fridge condenser **MUST** be kept free of dust by regular cleaning, at least once every 3 months (use a nylon brush). When operating in adverse conditions (IE, very dusty environment, corridors etc) it may be necessary to clean the condenser more often (IE, monthly). If the condenser is **NOT** kept clean the refrigeration compressor may fail and your **WARRANTY** on the refrigeration system may be **VOID**.
- 2) Unless changed by the customer an automatic defrost cycle will be started every four hours when running at low temperatures. This defrost is necessary to keep the refrigeration evaporator free of ice buildup which would otherwise impair the ability of the chamber to maintain its operating temperatures. The defrost sequence is designed to minimise any changes to the chamber temperature during the defrost period but some change in conditions cannot be avoided. When the chamber is being used
- 3) CAT 6900R models do **NOT** have a humidity control system fitted. It is essential that the humidity set point is adjusted to 0.0% to avoid **LOW WATER** alarms and any problems with temperature control.



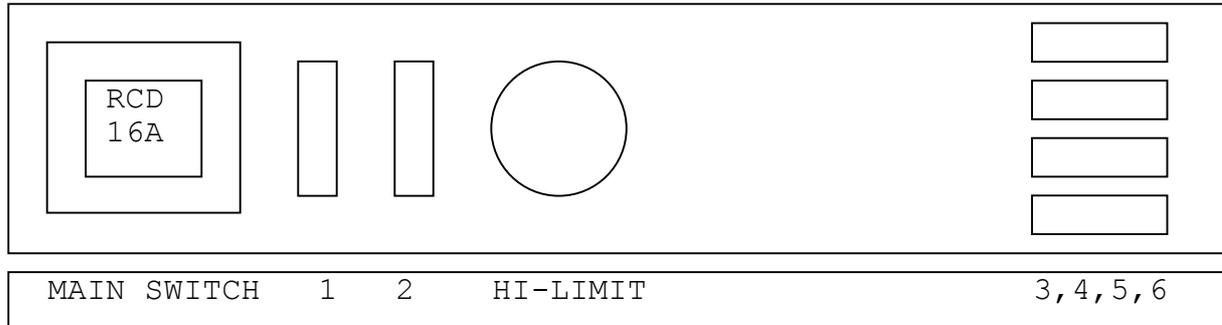
CONTROLLER OPERATION:

The PLCS5 Control System is Contherm's latest offering in a series of Microprocessor based Control Systems. The front control panel is fitted with a two line by 16 character LCD display to allow the controller to be easily setup for all operations. An additional Control/Monitor Panel is fitted at the top of the RHS lighting wing of the chamber.

- 1) The LCD display shows information on the current status of the chamber (NORMAL OPERATION, DEFROSTING, STOPPED, FAULT etc) and also displays prompts when setting parameters, changing programs etc.
- 2) In NORMAL operation the values displayed in the boxes for the installed parameters represent the current value measured by the Controller.
- 3) The 'UP' and 'DOWN' buttons below the DIAGNOSTIC/ALARM display are used to make any adjustments to the Controller set points.
- 4) The 'SET' led's will illuminate if the selected parameter has been selected for adjustment.
- 5) The 'SELECT' buttons are used to 'select' a parameter for adjustment.

CONTROL / MONITOR PANEL

Additional Neon indicators and switches are fitted to the top RHS main control panel to provide overall control of various functions and to give a visual indication of cabinet operation.



- A) **MAIN SWITCH & RCD** allows power to flow to the cabinet. The RED neon (1) will be illuminated when this switch is ON and the cabinet is connected to the Main power supply. Inside the main panel is an RCD (Residual Current Device) which should be tested once per month or at least when the cabinet is about to be setup for the next experimental run. Test the RCD device by pressing the 'TEST' button - the RCD circuit breaker should switch to the OFF position. **NB:** The whole cabinet will be switched OFF. (It is best to conduct this test with the lighting OFF).
To RESET the circuit breaker push the lever to the 'ON' position. If the lever will not stay in the 'ON' position an electrical fault is present.
If the RCD trips with the small white 'flag' showing this means that the tripping was due to excessive 'earth leakage'. The cause **MUST** be investigated **DO NOT** attempt to BYPASS the RCD device.
- B) **HI-LIMIT & MONITOR NEON.** This RED neon (2) will illuminate when the user HI-LIMIT has tripped. When this neon is on NO POWER will be applied to the HEATING ELEMENT (This acts as an additional safety to prevent cabinet overheating). The HI-LIMIT should be set to trip JUST above the maximum allowable temperature of any samples.

- C) **HOT GAS NEON.** Neon 3 is illuminated when the refrigeration HOT-GAS (HOT CYCLE) solenoid is energised. When this solenoid is energised the refrigeration is trying to HEAT the cabinet, in normal operation this solenoid may be energised on a regular cycle. The solenoid may be tested via the DIAGNOSTIC system by selection number 4 (TEST HOT SOLN).
- D) **COLD LIQUID NEON.** Neon 4 is illuminated when the refrigeration LIQUID solenoid (COLD CYCLE) is energised. When this solenoid is energised the refrigeration system is trying to COOL the cabinet. The solenoid may be tested via the DIAGNOSTIC system by selection number 5 (TEST COLD SOLN). When the refrigeration system is operating it MAY cycle the **HOT GAS** solenoid (Red Neon 3 will come on) OR the **COLD LIQUID** solenoid (Green neon 4 will come on) to achieve the desired temperature and humidity.
- E) **HEATER NEON.** This neon will be illuminated whenever power is being applied to the HEATING ELEMENTS. When the cabinet has stabilised at Temperature this neon is usually pulsing at a steady rate.
- F) **HUMIDITY NEON** .(If HUMIDITY CONTROL FITTED). The GREEN neon will be illuminated whenever power is applied to the humidity delivery system. The delivery system will inject a very fine mist of water/steam into the internal fans circulating air which will then be rapidly dispersed into the chamber in order to RAISE the Relative Humidity level. The HUMIDITY delivery system may be tested via the DIAGNOSTIC system by selection number 3 (TEST RH INJECT).
- G) **LIGHTING** switches.
These switches allow the cabinet LIGHTS to function . If all switches are OFF the LIGHTING will NOT function.
- H) **RS232** PORT.
This is a simplified RS232 Communications interface - suitable for connecting to a standard IBM compatible PC.
Software for use with this port is available from CONTHERM at extra cost.

SELECT LIGHTING.

The switches adjacent to the light shelf sockets allow the chamber LIGHTS to function, the neon in the switch will illuminate whenever the controller has selected any lighting to come on if the switch is in the 'ON' position. If ALL these switches are 'OFF' NO LIGHTING will function.

The lights are selected in PAIRS. The switches either switch the inside or outside pair of lamps on/off in each lightshelf..

RS232 PORT.

At the REAR of the chamber top panel there is a simplified RS232 Communications interface - suitable for connecting to a standard IBM compatible PC.

Software for use with this port is available from CONTHERM at extra cost.

SETTING UP

The following example shows how to set the chamber for the shown conditions:

Program No 1

Temperature = 20.0°C
Humidity = 70.0%
Time = 6:00 (SIX HOURS)
Lights = OFF

Program No 2

Temperature = 15.0°C
Humidity = 70.0%
Time = 6:00 (SIX HOURS)
Lights = ON

No of Cycles = 10

1) Press the button marked 'PROG' (adjacent to the UP & DOWN buttons), the LCD display will say 'SELECT PROGRAM', use the UP & DOWN buttons to adjust the Program Number to '01'. Press the 'PROG' button AGAIN, the LCD display will then say 'SET CYCLE COUNT', use the UP & DOWN buttons to set the cycle counter to '00'. (This ensures that the chamber will stay OFF until we are ready to run it!). Press the 'PROG' button a third time, the LCD display will say 'SET MAX PROG No'. Since we are going to have TWO Programs, use the UP & DOWN buttons to set the MAX PROG No to '02'. This will allow only Programs 1 & 2 to be considered when running the chamber. Press the 'PROG' button once more (or just wait for 20 seconds) to return the Controller to its 'NORMAL OPERATION' mode.

NB: The number of cycles is the number of times the Controller will swap from Program No 1 to Program No 2. After each Program swap the number of cycles is decremented. When the Cycle Counter reaches 00 the Controller will switch the chamber OFF.

When the Program advances from one Program to the next it continues to select the next highest Program number until it EXCEEDS the MAXIMUM SET PROGRAM number at which time it DECREMENTS the Cycle Counter and selects Program number 1 again.

All of the selected parameters change SIMULTANEOUSLY when the Program changes from one to the next, and the TIME setting for each Program starts to DECREMENT IMMEDIATELY.

SET UP PROGRAM NUMBER 1:

a) Set TEMPERATURE

Press the 'SELECT' button adjacent to the TEMPERATURE display - The display will blank for 2 seconds, the 'SET' led above the display will turn on (indicating that this parameter is now in the set mode) and the Current Set Point will be displayed. The LCD display at the top of the panel will be showing 'SET TEMPERATURE'.

Use the 'UP' and 'DOWN' buttons (below the Diagnostic/Alarm display) to adjust the Set Point to 20.0oC. When the adjustment is complete you can exit the Temperature Set mode by pressing the 'SELECT' button again OR just wait (20 seconds) without pressing any buttons and the Controller will automatically return to normal operation.

b) Set TIME

The TIME display shows how long the chamber will run this Program before it changes to the second Program.

Press the 'SELECT' button adjacent to the TIME display - The display will blank for 2 seconds, the 'SET' led above the display will turn on (indicating that this parameter is now in the set mode) and the Current Set Point will be displayed. The LCD display at the top of the panel will be showing 'SET TIMER'. Use the 'UP' and 'DOWN' buttons (below the Diagnostic/Alarm display) to adjust the set point to 6:00. When the adjustment is complete you can exit the Timer Set mode by pressing the 'SELECT' button again OR just wait (20 seconds) without pressing any buttons and the Controller will automatically return to normal operation.

NB: The ':' symbol means 'run continuously' and if this symbol is selected the Timer will stay at this setting INDEFINITELY.

c) Set HUMIDITY. (If HUMIDITY CONTROL option fitted).

Press the 'SELECT' button adjacent to the HUMIDITY display - The display will blank for 2 seconds, the 'SET' led above the display will turn on (indicating that this parameter is now in the set mode) and the Current Set Point will be displayed. The LCD display at the top of the panel will be showing 'SET HUMIDITY'. Use the 'UP' and 'DOWN' buttons (below the Diagnostic/Alarm display) to adjust the set point to 70.0.

When the adjustment is complete you can exit the humidity set mode by pressing the 'SELECT' button again OR just wait (20 seconds) without pressing any buttons and the Controller will automatically return to normal operation.

NB: To set the HUMIDITY to OFF (ie NO Humidity Control attempted) set the RH set point = 0.0, this will also disable the LOW WATER alarm from sounding again even if the water level is LOW. This MUST be done on CAT 6900R Models.

d) Set LIGHTING.

Press the `SELECT' button adjacent to the LIGHTING display. The display will blank for 2 seconds, the `SET' led above the display will turn on (indicating that this parameter is now in the set mode) and the Current Set Point will be displayed. The LCD display at the top of the panel will be showing `SET LIGHTING'. Use the `UP' and `DOWN' buttons (below the Diagnostic/Alarm display) to adjust the set point to 'OFF'. When the adjustment is complete you can exit the Lighting Set mode by pressing the `SELECT' button again OR just wait (20 seconds) without pressing any buttons and the Controller will automatically return to normal operation.

CAUTION: If your chamber has been fitted with a SPECIAL lighting arrangement as requested by you please observe any extra specified precautions, especially note that **ULTRA-VIOLET** and **HI-INTENSITY** lights are **HARMFUL** to the eyes and **MUST NOT** be viewed directly or for extended periods.

SETUP PROGRAM NUMBER 2:

Before the Set Points for the next Program can be entered the Program number must be changed to Program number 2.

SELECT PROGRAM No 2

Press the `PROG' button (at the bottom of the panel adjacent to the `UP' and `DOWN' buttons) and look at the LCD display (top of the panel), the display will show the words `SELECT PROGRAM'. Use the `UP' and `DOWN' buttons to adjust the Program number (shown on the lower line of the LCD display) until it reads `No = 02'.

Press the `PROG' button AGAIN. The top line of the LCD display will now show `SET CYCLE COUNT' and the lower line will show the number of cycles on the Cycle Counter. The number of Cycles was set earlier and so the LCD should display `No CYCLES = 00'. Press the `PROG' button TWICE to return to normal operation, you should now adjust the set points for Program Number 2 in the same way as for Program Number 1.

You must now decide which Program (1 OR 2) that you wish the chamber to START on, let us say it is Program No 1.

Press the `PROG' button and use the Up & Down buttons to select Program Number 1.

Press the `PROG' button again and set the number of cycles = `10' (using the Up & Down buttons), press the `PROG' button twice more and the chamber should start running from Program Number 1.

The chamber will run Program Number 1 for the Set Timer duration and then change to Program Number 2 and run it also for its Set Timer duration, after which the Cycle Counter will be decremented by one and the Cycle repeated until the Cycle Counter becomes = `00' when the chamber will turn OFF.

NB: When the lighting display is set for `On' this means the lights will be turned ON for the duration of this Program, a setting of `OFF' will turn the lights OFF.

Any **MANUAL** light switches must be in the appropriate position for the lights to function correctly.

If HUMIDITY CONTROL is NOT fitted or desired the HUMIDITY set point **MUST** be set to 0.0%RH to avoid any attempt by the refrigeration system to control the humidity.

SPECIAL PROGRAMMING HINTS

It is possible to use one of the Programs ABOVE the maximum program number to act as a PRECONDITIONING Program. If say, the MAX PROGRAM NUMBER is set at 02, this would mean that as the Program changes from one program to the next any Program number ABOVE 02 would NOT be selected. We could, therefore, setup Program Number 3 as a PRECONDITIONING Program and when starting the Program run, start with this Program Number. This Program would run and stabilise the chamber at its selected settings and when the timer for Program Number 3 expired the Controller would automatically select Program Number 1 to run, Program Number 3 would NOT RUN AGAIN however, because its number is ABOVE the MAX program number.

When setting up Program Set points from the Controller it is best to FIRST set the Cycle Counter to `00' to ensure the Program does NOT change as you are entering the new settings.

SECTION 5 CALIBRATION

Final calibration for the PLCS5 range of chambers is achieved by adjusting the CALIBRATION FACTORS for TEMPERATURE and HUMIDITY, these adjustments are made through the front panel DIAGNOSTIC section.

The CAL FACTORS are stored in the internal memory of the controller and are held up by a SUPERCAP which will store the factors for a maximum of 72 hours in the absence of power, if power to the controller has been interrupted for a prolonged period (more than 48 hours) the CAL FACTORS should be checked to see if they are still valid, this should ALWAYS be done if a PRESET alarm (03) has occurred.

If the CAL FACTORS are lost the controller will set them to the default value (50). This could result in a temperature error of up to $\pm 5.0^{\circ}\text{C}$ or a humidity error of up to $\pm 5\%$ RH.

The factory CAL FACTORS for the chamber are noted on the inside front cover of the instruction manual and also on the test report that comes with the chamber.

To CALIBRATE the control system use the DIAGNOSTIC controls. These services are attained by Pressing the 'SELECT' button adjacent to the 'DIAGNOSTICS/ALARMS' display and following the instructions on the LCD (top of panel) display.

When first entered the 'DIAGNOSTICS/ALARMS' display may be blank indicating that no diagnostics features have yet been selected, by using the 'UP' and 'DOWN' buttons various diagnostic tests may be carried out.

When you have made your selection - Press the 'SELECT' button again to move to the 'ADJUST VALUE' mode, and if required adjust the CAL FACTOR value, press the 'SELECT' button a THIRD time to exit the DIAGNOSTIC mode.

20 - CALIBRATE TEMPERATURE. This selection will allow the internal calibration VALUE to be changed, this in turn will change the temperature calibration for the chamber, the minimum value is `00' and the maximum value is `99' when calibrated this value should be NOTED and WRITTEN down so that it may be replaced if the controller loses the value (this will occur if power has been removed from the controller for more than 3 days!). Use the up & down buttons to adjust the calibration value.

EG: If the display was reading 2.0°C too low, then INCREASE the calibration value by 20 (20=2.0°C) to obtain the correct calibration. ALWAYS calibrate with any lighting set to OFF.

21 - CALIBRATE HUMIDITY. This selection will allow the internal humidity calibration VALUE to be changed, this in turn will change the HUMIDITY calibration for the chamber, the minimum value is `00' and the maximum value is `99' when calibrated this value should be NOTED and WRITTEN down so that it may be replaced if the controller loses the value (this will occur if power has been removed from the controller for more than 3 days!). Use the up & down buttons to adjust the calibration value.

EG: If the display was reading 2.0% too low, then INCREASE the calibration value by 20 (20=2.0%) to obtain the correct calibration. This calibration value is normally 50, and must only be used to make SMALL adjustments to the humidity calibration. If large adjustments are required they should be performed using the screwdriver adjustment on the sensor box to alter the capacitive trimmer on the ZP10a PCB. ALWAYS calibrate with any lighting set to OFF.

NB: Ensure that the Humidity Probe Temperature correction factor (See DIAG No 42) has been set. (Standard ZP10a Philips Capacitive sensor = 3, HYPAL = 0).

* **22 - CALIBRATE CARBON DIOXIDE.** (If chamber is fitted with a CO₂ sensing system) This selection will force the chamber to perform a CO₂ MANUAL-CAL. To Force a MANUAL-CAL change the VALUE from 00 to 01.

The MANUAL-CAL will take place as soon as the chamber reaches the current temperature set point. The MANUAL-CAL will assume that there is NO carbon dioxide gas in the chamber!.

The temperature should be recorded on a daily basis by placing a thermometer in the work space so that it can be read and the long term temperature performance can then be plotted to give an assurance of correct temperature performance.

SECTION 6 THEORY OF OPERATION

The key to the versatility of operation of the PLCS5 controller is based on the use of a Microprocessor Control System and multiplexed analog inputs controlled by this system.

Analog input information is amplified by conventional circuitry and filtered before being sent to an eleven channel multiplexer/AD converter.

The Microprocessor, on direction of its ROM based program, selects an input to be converted by the A/D converter to digital form. The information obtained is then acted upon to up-date the display, control heaters, solenoids, etc and the next input is then selected. This sequence of events is repeated continuously unless interrupted by a special event or by user intervention.

Time pulses for timed events are obtained from the internal crystal controlled microprocessor clock.

BASIC OPERATION

The PLCS5 is a microprocessor based control unit capable of measuring and controlling temperature, relative humidity, carbon dioxide concentration and lighting.

The temperature in the chamber is sensed by a solid state temperature sensor and controlled by a PID algorithm to a resolution of 0.1°C.

The humidity conditions are sensed by a capacitive sensor probe which will control the relative humidity in the chamber by fog-jet mist or steam injection and by varying the refrigeration evaporator temperature to obtain the desired humidity.

Carbon dioxide sensing (if fitted) is by means of an INFRA-RED detector.

After first turning on power to the unit a RESET operation is performed, this operation tests the condition of retained data in the RTC RAM (Random Access Memory) which contains any set points, correct factors, etc and by computing a CHECKSUM determines if the data has been held by the SUPERCAP or corrupted (if chamber has been turned off for more than 48 hours).

If the data is incorrect, all the control points are set to their "Preset" values and all CALIBRATION FACTORS are set to their defaults.

Every 1/100th second after initial turn on a TIMER Interrupt occurs, this signal is derived from the RTC clock and is used for timekeeping functions.

The unit is now "IDLING" and measures the correct parameters in turn about once every 0.6 seconds.

SECTION 7 DIAGNOSTICS

The PLCS5 controller has a limited number of diagnostic services inbuilt. These services are attained by Pressing the `SELECT' button adjacent to the DIAGNOSTICS/ALARMS' display and following the instructions on the LCD (top of panel) display.

When first entered the `DIAGNOSTICS/ALARMS' display will be blank indicating that no diagnostics features have yet been selected, by using the `UP' and `DOWN' buttons various diagnostic tests may be carried out.

When you have made your selection - Press the `SELECT' button again to move to the 'ADJUST VALUE' mode, and if required adjust the test value, press the 'SELECT' button a THIRD time to exit the DIAGNOSTIC mode and execute the selected test.

01 - Test CO2 INJECT. This selection will force the CO2 solenoid (if fitted) to turn on for a duration of 10 seconds to enable its operation to be confirmed.

02 - Test FAN PAUSE. This selection will stop the internal circulating fans (and the heating elements) for a period of 30 seconds.

03 - Test RH INJECT. This selection will run the HUMIDITY pump continuously for a period to enable the pump/steam system to fully prime. The length of time the pump will run for may be changed by `adjusting' the value, a value of 30 represents about 5 seconds of humidity injection time.

04 - Test HOT SOLN. This selection will cause the HOT refrigeration solenoid to be energised for a period of ten seconds, the COLD solenoid will be turned OFF during this period.

05 - Test COLD SOLN. This selection will cause the COLD solenoid to be energised for a period of ten seconds, the HOT solenoid will be turned OFF during this period.

06 - Test DEFROST. This selection will set the next defrost to occur immediately, the defrost will work as an entirely standard defrost. When a defrost occurs the internal circulating fans will stop and the refrigeration system will enter a `full hot gas' cycle for 4 minutes, during this time the `HOT GAS SOLENOID' will be energised. After the 4 minutes the `COLD LIQUID' solenoid will be energised for 30 seconds to PRE-COOL the evaporator, the fans will then start and normal operation will resume. The LCD display will alternate between `NORMAL OPERATION' & `DEFROSTING NOW' during the defrost period.

07 - Test FRIDGE PULLDOWN. This selection will cause the fridge to turn the COLD solenoid on and keep the circulating fan running, all other functions (except for lighting which can be turned on or off as desired) are inhibited. The fridge will continue to pull down to its lowest possible temperature until this test is cancelled!. When the test is running the LCD display will show `FRIDGE PULLDOWN' and a warning `BEEP' will sound every minute until the test is cancelled. To run this test, CHANGE the VALUE to 01. To CANCEL the test change the value to 00. The default value is 00 and this will be set whenever the mains power is turned off.

08 - Test FRIDGE GAS CHARGE. This selection will cause the fridge to turn the COLD solenoid ON and STOP the internal circulating fan!. ALL other operations are INHIBITED!. The fridge evaporator will go as cold as possible and the gas charge can be observed after a period of 20 - 30 minutes by how far the evaporator has frosted. **NB:** The cooling coil drain tray must be removed to clearly see the evaporator. (See refrigeration charging section). When this test is running the LCD display will show `FRIDGE GAS CHARG' and a warning `beep' will sound every minute until the test is cancelled. To run this test change the VALue to 01. To CANCEL the test change the VALue to 00. The default VALue is 00 and this will be set whenever the mains power is turned off.

09 - TEST ELECTRONICS. This selection will allow various components on the PLCS5 INTERFACE and DISPLAY PCB's to be tested. The particular test performed depends on the VALue selected.

VALue	Test carried out	FAIL ALARM
00	No tests carried out	none
01	Test real time clock tick (IC 8583)	91
02	Test RTC RAM storage (IC 8583)	92
03	Test CPU RAM storage (IC 68HC705C9)	93
04	Test EEROM storage (IC 24C02 or 2814)	94
05	Test A/D Converter (IC 145051)	95
06	Test Output porta (IC 2803,OPTO's)	none
07	Test LED displays - VISUAL TEST ONLY	none
08	Test RS232 Computer port	none
09	Test AUDIBLE alarm	none
10	Perform ALL of the above tests	various
11	Test serial printer	none

If a test with a fail alarm is performed and the test fails the fail alarm code will be displayed on the DIAGNOSTIC led's.

If there is more than one failure mode (running test value 10),the intermediate fail alarms will be only displayed briefly and the last failure alarm will stay on the display.

If a test fails the operation of the IC in that area should be investigated, IE a **91** FAIL ALARM could mean that the crystal for the RTC clock chip (8583) has broken OR that the chip itself is faulty.

10 - RAW CO2 VOLTAGE. This selection will place the value of the RAW voltage coming from the CO₂ sensor (same as test point #6) onto the CO₂ display for about 1 second, **NB:** A reading of 56.1 represents a voltage of 0.561 Volts DC. The value should be between 0.400 Volts (40.0) and 1.600 Volts (160.0).

To run this test, CHANGE the VALUE to 01.

20 - CALIBRATE TEMPERATURE. This selection will allow the internal calibration VALUE to be changed, this in turn will change the temperature calibration for the chamber, the minimum value is `00' and the maximum value is `99'. When calibrated this value should be NOTED and WRITTEN down so that it may be replaced if the controller loses the value. (this will occur if power has been removed from the controller for more than 3 days!). Use the up & down buttons to adjust the calibration value.

EG: If the display was reading 2.0°C too low, then **INCREASE** the calibration value by 20 (20=2.0°C) to obtain the correct calibration.

21 - CALIBRATE HUMIDITY. This selection will allow the internal humidity calibration VALUE to be changed, this in turn will change the HUMIDITY calibration for the chamber, the minimum value is `00' and the maximum value is `99'. When calibrated this value should be NOTED and WRITTEN down so that it may be replaced if the controller loses the value (this will occur if power has been removed from the controller for more than 3 days!). Use the up & down buttons to adjust the calibration value.

EG: If the display was reading 2.0% too low, then **INCREASE** the calibration value by 20 (20=2.0%) to obtain the correct calibration. This calibration value is normally 50, and must only be used to make SMALL adjustments to the humidity calibration, if large adjustments are required they should be performed using the screwdriver adjustment on the sensor box to alter the capacitive trimmer on the ZP10a PCB.

NB: Ensure that the Humidity Probe Temperature correction factor (See DIAG No 42) has been set. (Standard ZP10a Philips Capacitive sensor = 2).

22 - CALIBRATE CARBON DIOXIDE. (If chamber is a CO₂ chamber). This selection will force the chamber to perform a CO₂ MANUAL-CAL.

To Force an MANUAL-CAL change the VALUE from 00 to 01.

The MANUAL-CAL will take place as soon as the chamber reaches the current temperature set point. The MANUAL-CAL will assume that there is **NO** carbon dioxide gas in the chamber!.

30 - AUDIBLE ALARM - This selection allows the AUDIBLE alarm to be DISABLED or ENABLED. A value of 00 = DISABLED, 01 = ENABLED.

The DEFAULT setting is ENABLED (01).

31 - DEFROST INTERVAL - This selection allows the DEFROST INTERVAL to be varied, or DISABLED altogether.

The DEFAULT value is 04, this give a defrost lasting four minutes every at 4HR intervals.

The INTERVAL may be set from 01 to 99 hours.

The defrost may be INHIBITED altogether by setting the VALUE to 00.

32 - DOOR HEATER? - This selection allows the glass DOOR HEATER(s) to be ENABLED or DISABLED. A VALue of 00 = DISABLED, 01 = ENABLED. The default setting is ENABLED (01).

33 - DOOR SWITCH? - This selection allows the DOOR AJAR SWITCH (RHS door ONLY) to be ENABLED or BYPASSED. A VALue of 00 = BYPASSED/DISABLED, 01 = ENABLED. The DEFAULT setting is ENABLED (01).

34 - PRINTING INTERVAL - This selection allows the standard interval (in minutes) between lines of recorded data being output to the serial printer (if fitted). If this interval is set for 00, all output to the printer will be inhibited.

35 - SETUP PASSCODE - This selection allows the user to prevent unauthorised access to the chamber's set points by using a PASSCODE (00 - 99). If the chamber has been removed from the mains power for more than 72 hours the current passcode will be 00 (This will allow access without entering a PASSCODE).

TO SETUP A PASSCODE: Use this selection to select your desired passcode BEFORE changing or examining a SETPOINT, once this is done that same number MUST be entered before any future access will be allowed to change any settings. The PASSCODE number will be automatically returned to 00 two minutes after any buttons have been pressed. Once a PASSCODE is in effect it will remain so until cancelled (using Diagnostic routine 36) **or** by discharging the SUPERCAP backup device (This occurs after 72 hours without power).

36 - CANCEL PASSCODE - This selection allows the user to REMOVE a passcode from use and revert back to a no passcode condition. To use this selection the original passcode (if any) must be known.

TO CANCEL A PASSCODE: Set the value = 01.

37 - SET REAL CLOCK - This selection allows the user to SETUP the internal REAL TIME CLOCK to the true time of day. Use the UP & DOWN buttons to set the value to the correct time. (MUST be done before using REAL TIME MODE).

38 - SET TIMER MODE - This selection allows the user to choose between

ELAPSED (mode 0) time and REAL (mode 1) time. REAL time settings are ONLY applicable to programmable chambers (NOT CO2). When using the REAL TIME mode the program changeovers can be synchronised to the actual time of day.

ELAPSED TIME MODE: Set the value = 00 (Default setting).

REAL TIME MODE: Set the value = 01.

39 - LIGHT RAMP RATE - This selection allows the user to SETUP the rate at which the lighting (If Fitted!) will be turned ON or OFF (in $\mu\text{E} / \text{min}$). A higher setting for this value will cause the lights to come on (or go off) at a faster rate.

A value of 00 means DO NOT turn the lights ON.

40 - SET LIGHT MODE - If set to 00 the lights will switch to the amount set in one step, if set to 01 the lights will RAMP up or down to the desired setting at the RATE set by DIAG routine No 39.

41 - USE FRIDGE? - This selection allows the user to DISABLE the refrigeration system. When the fridge is DISABLED there will be NO DEHUMIDIFICATION as this function is handled by the refrigeration system, the chamber will also take a much longer time to drop in temperature and the lowest achievable temperature will depend on the ambient room conditions. A value of 00 means DISABLE the fridge, a value of 01 means ENABLE the fridge. The default is ENABLED (01).

42 - RH PROBE CORRECT - This selection allows the user to set a TEMPERATURE CORRECTION factor for the Capacitive Humidity Probe. The factor may be set from 0 to 5. A setting of 2 means that a correction of 0.2%RH will be added to the current humidity reading for every degree above 20.0°C. The recommended setting for the standard ZP10a probe is 2.

43 - CPU VERSION No - This selection allows the user to view the current FIRMWARE version fitted to the CPU. This is a READ ONLY value and is set into the CPU when it is programmed in the factory.

44 - HUMIDITY EFFORT – Not Used.

45 - DELAY TIMER STRT - This selection allows the user to delay the elapsed timer from running until the chamber is within $\pm 2^{\circ}\text{C}$ of the desired set point. 0=Timer starts immediately, 1= Timer is DELAYED until set point is reached.

SECTION 8 TROUBLESHOOTING AND MAINTENANCE

If a FAULT/ALARM code is displayed on the RED led display, consult the FAULT CODE section first to see if there is an easy remedy.

1) NO MAINS NEON WHEN MAINS ISOLATOR TURNED ON.

- Chamber not connected to mains
- Main ISOLATOR/RCD breaker tripped. If trip is due to excessive earth leakage ensure cause is investigated.
- No power at electrical supply.
- Call Service Engineer

2) MAINS NEON ON - No LCD/LED Display.

- Internal preset HI-LIMIT tripped (inside chamber RHS panel)
- Interface power supply failure.(look at LED's)
- Cable to display unit broken/damaged.
- Call Service Engineer

3) CONTROLLER ON - But will not operate correctly

- Check that SET POINTS are correct.
- Check for INTERNAL fan operation.
- Check that Fridge is ENABLED (DIAG No 41)
- CHECK DETAILED TROUBLESHOOTING SECTION

4) NO LIGHTS - Lights must be set for normal operation, check that the lighting switches are in the ON position and that the light intensity is set to 'ON'. Check that if the lighting mode is 01 (DIAG No 40) then a light ramp rate (DIAG 39) is set to other than 00.

NB: When the need arises to contact a Service Engineer always note the type of Chamber, ie., CAT 6900RHS, and Program Version, ie., VERS7.5, also Chamber Serial Number. (Appliance No).

(The Program Version, etc. will be indicated on the inside front cover of this manual. and also via Diagnostic No 43)

DETAILED TROUBLESHOOTING SECTION

NO DISPLAYS OR LEDS (Mains NEON on)

- NON-RESET Hi-Limit Tripped (inside RHS chamber side panel)
- Power Supply Failure on Interface PCB.

1) Check NON-RESET Hi-Limit (small RED button)

if Hi-Limit is OK then look at interface board. The heartbeat led (nearest 40pin IC) should be pulsing at about a two second rate, if not then look at the power supply leds.

Both Red power supply LEDs should be on, if not, then one of the power supplies has failed - if **NO LEDS** are on then Check the 100mA transformer fuse on the interface PCB. REMOVE ALL power from chamber BEFORE checking any fuses.

DISPLAY ON BUT NOTHING ELSE WORKING

- Check that chamber has not turned OFF (Look at LCD display). If so ensure TIMER has been set for a time (also program counter if running multiple programs).
- PLCS5 INTERFACE PCB Fuse has blown. REMOVE ALL POWER from chamber and remove RHS cover check 2Amp fuse on interface PCB.

DISPLAY ON BUT SHOWING RUBBISH!

The only power supplied to the display PCB comes from the 5 volt regulator on the interface PCB. If the LED displays are illuminated it is a good indication that the 5v power supply is present.

- Bad connection in cable from interface pcb.
- Ingress of moisture onto display PCB.

There are two separate data links to the display PCB, the SPI data link (works the led displays) and the IIC data link (works the LCD display). The SPI link uses the connections SLT, MOS, SCK, the IIC link uses SCL & SDA. Check the wiring connections for the appropriate area. The chamber should be able to operate without the display PCB connected.

- If the TOP line of the LCD is showing ALL segments and the BOTTOM line is blank, suspect either the SCL or SDA wires between the Interface PCB and the display PCB.

- Faulty Reset (turn Mains power off for 10 sec)

ALARM SOUNDING AND FAULT LED DISPLAYING '01'

- Hi/Lo limit alarm
- Measure temperature inside chamber and ensure temperature is less than 2°C above/below set point. Could be caused by faulty triac or heater element, this condition can also be caused by addition of any 'live' load addition to chamber interior. Check also that fridge evaporator has not iced up.

CHAMBER WILL NOT HEAT/COOL TO TEMPERATURE

- Door open, OUTER DOOR AJAR.
- Check for correct SET POINTS esp timer (|=manual)
- Faulty element/fridge
- Already at temperature
- Look at state of CONTROL panel neons.
- Check that element is coming on (look at 'Heat' NEON on chamber).

REFRIGERATION PROBLEMS

Ensure Fridge condenser is kept free from dust build-up.

Ensure main chamber circulation fans are running!.

- Main Fridge does not come on
(Under normal circumstances the CONDENSER fan motor will be on when the fridge is running)
- Ensure Fridge is ENABLED (See DIAG No 41)
- Chamber not in use (Timer = 0:00 OR cycle counter set to 0).
- Refrigeration evaporator has ICED UP.
- Faulty fridge solenoid
NB: At least ONE of the refrigeration solenoids **MUST** be ON in order for the refrigeration system to operate. Look at the state of the neons on the CONTROL panel.
- Faulty low pressure cutout in fridge compartment.
- Refrigeration system has lost some/all refrigerant.
- Fault on interface board.

FRIDGE IS ON BUT LITTLE/NO COOLING EFFECT

- Check that power is not being applied to main heating element. (Look at heater NEON)- if so is Temperature set point correct?
- Check that Internal fans are operating.
- Check that refrigeration evaporator is not ICED UP.
- Check that COLD solenoid is ON and HOT solenoid goes OFF.
- Check fridge condenser for dust buildup.
- Possible loss of refrigerant.
- Compressor not working (Thermal overload)

FRIDGE DOES NOT GO OFF

NB: The refrigeration SHOULD be on under most circumstances unless the refrigeration has been DISABLED via DIAGNOSTIC No41.

The fridge will NOT turn off unless BOTH refrigeration solenoids (HOT & COLD) are OFF. (Both neons should be off!).

- Allow more time for Fridge to pump down. (esp low temps)
- Faulty low pressure cutout in fridge compartment
- Faulty fridge solenoid(s) (Check using DIAGNOSTIC No4 & No5)
- Faulty interface board

CONTROL PARAMETERS NOT RETAINED AFTER MAINS FAILURE

- Supercap discharged. (After 48 hours with no power)

The SUPERCAP will keep the real time clock chip (RTC) and any set points in memory for about 48hours without external power being supplied.

TEMPERATURE CONTROL NOT TIGHT ENOUGH

- Circulation Fan stopped or airflow impaired
- Check that refrigeration evaporator has not ICED UP.
- Sensor faulty or airflow through sensor box impaired.

Sensor unit relies on good airflow for correct operation, unit must be correctly attached to front of inside refrigeration evaporator.

UNABLE TO ACHIEVE DESIRED HUMIDITY (RHS MODELS)

- Check that desired humidity is achievable (Min=40%, Max=90% and only between temperatures of 15 to 50°C lights OFF)
- Use Diagnostic No3 (Inject RH) to see if system is ACTUALLY delivering water.
- Check that VENT at rear of chamber is sealing fully (to obtain high humidities)
- Ensure sufficient time is allowed for chamber to stabilise at desired humidity.
- Humidity system spray nozzles may be blocked.

INACCURATE READINGS ON ANY PARAMETER

- Not correctly calibrated
- Out of range (% RH only between 15-50°C)
- Faulty sensor
- Component failure

NB: If the TEMPERATURE is NOT correctly calibrated see the DIAGNOSTIC tests (TEST No 20) to calibrate the chamber, the calibration should be carried out EITHER at 20.0°C OR for CRITICAL APPLICATIONS at the temperature of interest. **NB:** All lighting MUST be off.

In particular the calibration factors should be checked if power has been removed from the chamber for more than 48 hours.

The chamber may have difficulty achieving some HUMIDITY settings (especially if the ambient temperature is high and the lights are ON) if in doubt reset the chamber for more easily achieved Temperatures/Humidities.

Ensure that if any Humidity probe Temperature Correction Factor required has been entered. (See DIAG No 42)

SERVICING A LIGHT SHELF

The light shelf **MUST** be removed from the cabinet for servicing, ensure that **ALL** power to the light shelf is removed (I.E. The shelf is **UNPLUGGED** from the cabinet) **BEFORE** attempting to open or service the shelf. If **NONE** of the lights will work it is likely that the problem lies within the cabinet control system rather than the individual light shelves.

The light shelf contains up to four 16mm 28W fluorescent tubes, powered from two electronic ballasts (located inside a sealed box on the LHS of the light shelf). Normally the only servicing required will be to remove and replace the tubes, it is recommended that if the tubes are nearing the end of their service life and one or more has failed that **ALL** the tubes be replaced at the same time.

To replace a tube: Remove the two front light shelf cover retaining screws and lift the cover off by drawing forward and up. Carefully lift the failed tube clear of the 'u' shaped plastic retaining clip. Slide the protective endcap plastic boot off the tube and pull the two terminal clips off the tube endpins, repeat for the other end of the tube. Replace the tube with the same wattage size and type. Reconnect the terminals to the tube ends and refit the protective covers, ensuring these completely cover the metal ends on the tube. Carefully reinstall the tube back into the plastic retaining clips ensuring that the tube is firmly held in position, repeat for any other tubes. Replace the light shelf cover.

It is best to test the light shelf outside the cabinet (by plugging into the cabinet socket and using the cabinet controls to turn the lights on) **BEFORE** replacing the light shelf back into the cabinet.

In the unlikely event that a ballast should fail a similar procedure to the above is used except that the sealed box housing the two ballasts must be opened, carefully note (or number) any wires before removing them from the faulty ballast. Only replace the ballast with the same or equivalent type.

When operating the light shelf **ONLY** operate via the cabinet sockets.

BALLAST: TridonicAtco PC2/14/21/28/35 T5 PRO

TUBE: OSRAM FH 28W/840 16mm Lumilux cool white

MAINTENANCE SCHEDULE No1

This schedule should be carried out at intervals of about **2000** running **hours**, in adverse conditions the cleaning procedures should be carried out more frequently. After 2000 hours of running a maintenance alarm (No13 or 14) may occur. Cancel the alarm and then carry out the following procedures.

- Turn the chamber **OFF** using the '**TEST**' button on the **RCD** circuit breaker, this checks operation of the **RCD** device.
- Remove the chamber power cable from the wall socket.
- Open the front lower door and using a brush or vacuum cleaner, clean any dust buildup from the refrigeration condenser fins (the water tank may have to be removed to gain clear access to the condenser).
- Drain any water from the water reservoir system and clean and inspect the tank and hoses for leaks and deterioration, replace / clean as necessary.
- Remove pump main inlet filter, inspect and clean then replace.
- Lower top internal element cover tray, (mullion must be removed first so that top lightshelf can be moved out of the way) remove spray nozzles, remove and clean nozzle filters.
- Restore power to the system.
- With nozzle(s) removed use DIAGNOSTIC No3 to FLUSH the humidity system with clean water (the water tank and hoses must be restored first). If Ultrasonic system lift unit CAREFULLY from floor tank inside cabinet and clean tank then replace.
- If pump system then replace spray nozzle and filter, use DIAGNOSTIC No3 to test spray delivery system. A fine conical mist of spray should be seen from the nozzle.

MAINTENANCE SCHEDULE No2

At intervals of about 8000 running hours the following procedures should be carried out in **ADDITION** to the procedures listed above.

- If a pump type delivery system is fitted the pump should be **OVERHAULED** (brushes, diaphragms etc) to ensure ongoing reliability.
- All plastic hoses should be **REPLACED**.

REFRIGERATION SYSTEM

The Refrigeration System is designed to operate continuously.

The System is started when either the HOT or COLD solenoid valves are opened by the PLCS5 control system. Opening either of these valves will allow refrigeration Pressure into the Cooling Coil and Low Pressure Switch which will close and allow the Refrigeration Compressor and Condenser Fan Motor to start up.

After the initial start up period (approx one 20 seconds) depending on whether a cooler or warmer temperature is required the Hot Gas Solenoid Valve will open and close to help in achieving the required Chamber Temperature.

The Hot Gas solenoid operates on a 16 second cycle, ie., if the Hot gas solenoid is on for 10 seconds it will be off for 6 seconds. When the Hot gas solenoid is on for 16 seconds it will stay on ALL the time (Off time = 0 seconds), this is FULL HOT GAS.

If the fridge is DISABLED via DIAGNOSTIC No41 then both Solenoid Valves will close and the Refrigeration Compressor will automatically pump down and turn off on the Low Pressure Switch. This could take up to 5 minutes.

It is also possible should the Pressure inside the Cooling Coil rise during a Hot Chamber temperature period for the Refrigeration System to turn on automatically and pump itself out and stop again on the Low Pressure Switch (neither Solenoid Valve will open).

IMPORTANT

As the Refrigeration Unit located under the Chamber is Air cooled it is essential that an unimpeded Air Flow over the unit is maintained.

Allow **AT LEAST** 100mm of clear space **ON ALL SIDES** of the chamber.

Air is drawn through front grille of the chamber over the Condenser Fins, through the Fan, over the Compressor and exhausted through the rear of the chamber.

Dust and dirt will collect on the Air Entry side of the Condenser Fins so it is essential that once every three months the Lower front door is opened and the Condenser Fins brushed downwards with a small hearth brush.

If the chamber is located in a dusty position this procedure should be carried out more regularly. **FAILURE** to keep the **CONDENSER CLEAN** will result in the overheating of the Refrigeration Unit and may **VOID YOUR WARRANTY**.

REFRIGERANT CHARGE

The refrigeration system is charged with **R134a** refrigerant and polyester oil. **NO other substitutes should be used.** The refrigeration charge must be checked by a suitably qualified refrigeration engineer.

HI/LOW SAFETY PRESSURE CONTROL

This control is wired in Series with the Refrigeration Compressor and condenser fan motor, and as such is only used as a pump- out control when the PLCS Controller is set outside the refrigeration limits. Its function is not to cycle the Refrigeration Compressor to maintain chamber temperature.

Temperature control is achieved by the PLCS Controller pulsing the Hot Gas Valve.

Pressure Control Settings should be -

Cut In	30 psi
Cut out	5"Vac

NOTE:1: Cut Out is Cut In - Differential

NOTE:2: To evacuate the system either the liquid or the Hot Gas Solenoid **must** be energised to allow the complete system to be exposed to the vacuum pump.

REFRIGERATION COMPONENTS

UNIT:	1/2HP AIR COOLED SEALED HOT GAS
COMPRESSOR:	L'UNITE CAE4456Y
FAN MOTOR:	EBM 16 WATT
REFRIGERANT:	R134a
REFRIGERANT CONTROL:	CAPILLARY TUBE 10/051
DRYER:	SWEAT TYPE X256/HX9
CONDENSER:	AIR COOLED X5504
LIQUID SOLENOID VALVE:	SPORLAN E3S120
HOT GAS SOLENOID VALVE:	SPORLAN XUP RAPID ACTION
LP CONTROL:	RANCO 016/8713

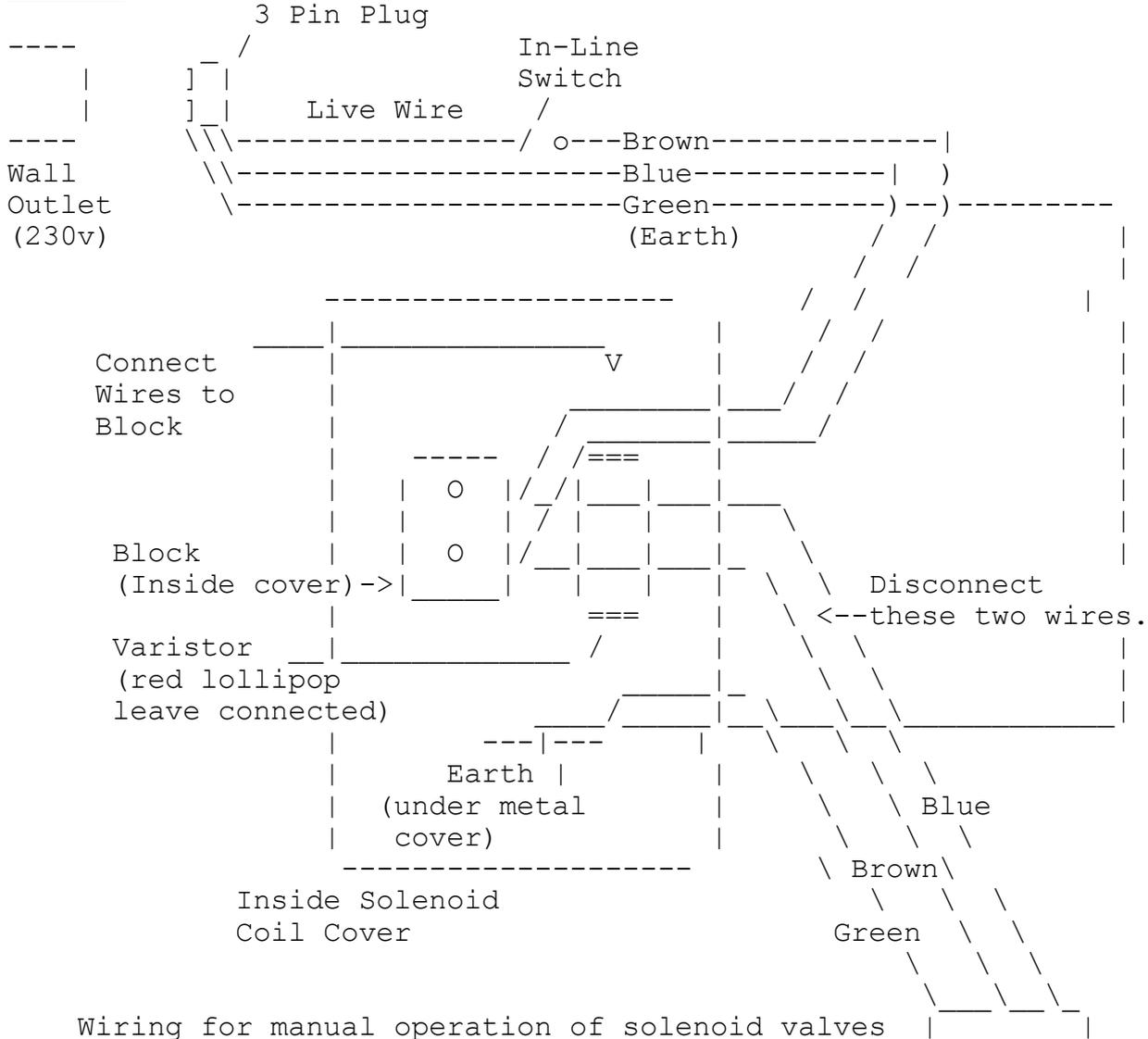
EVACUATION OF REFRIGERATION SYSTEM

To evacuate the system EITHER the liquid OR the hot gas solenoid must be energised to allow the complete system to be exposed to the vacuum pump.

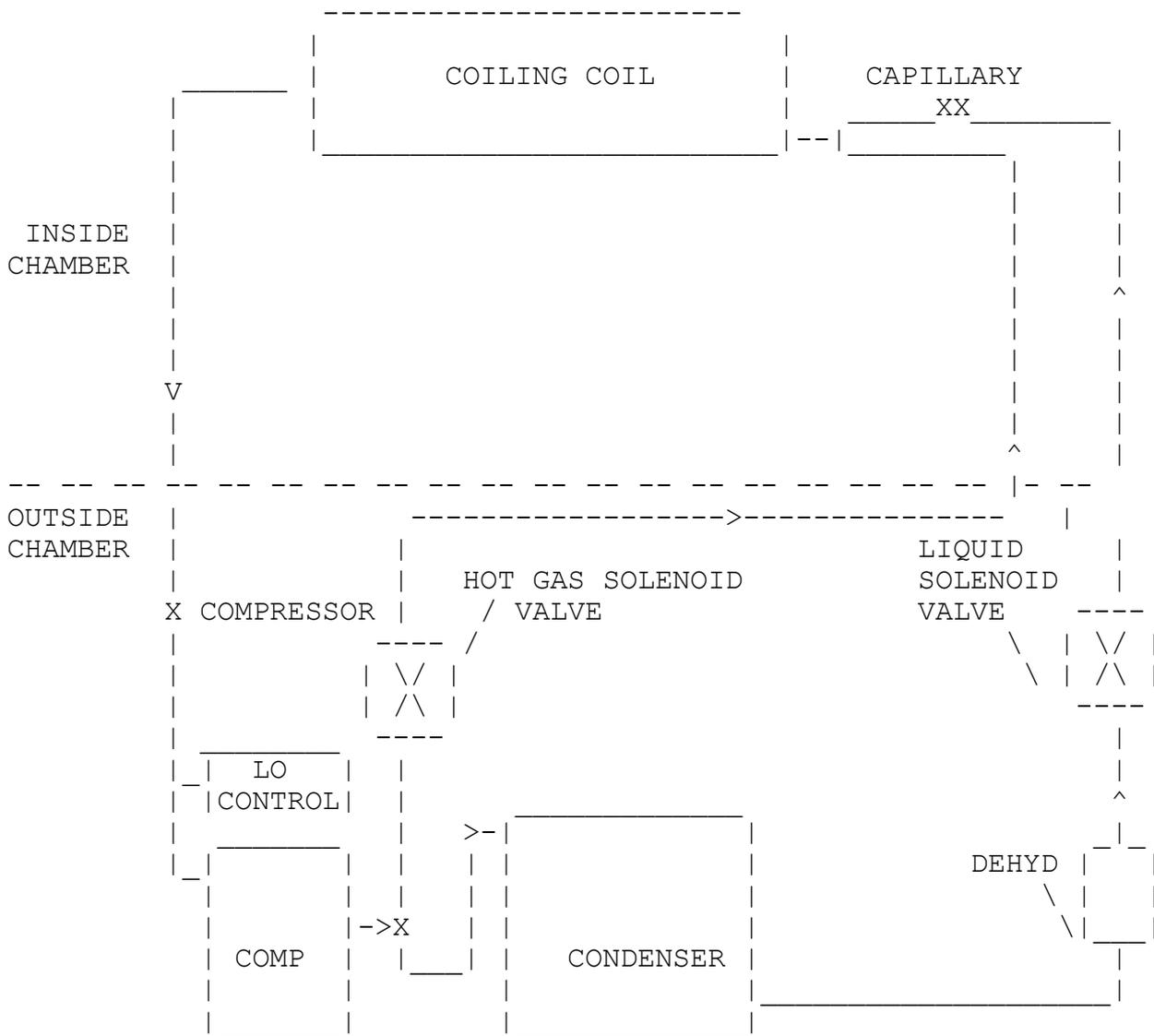
TO ENERGISE either solenoid valve to facilitate evacuation of the system:

- 1) Turn unit OFF at Mains and remove Mains Plug.
- 2) Remove cover from either solenoid coil and disconnect 2 (brown and blue) wires from connector block inside cover.
- 3) Wire plug from Mains (230v) with an In-line switch to connector strip inside solenoid cover, connect earth to metal of solenoid
- 4) To energise solenoid - plug wire into outlet and switch on!
- 5) System can now be evacuated with either solenoid open.

CAUTION: ONLY TO BE CARRIED OUT BY QUALIFIED SERVICEMEN.



REFRIGERATION SCHEMATIC DIAGRAM



SECTION 9 PARTS LISTS

<u>DESC</u>	<u>CONTHERM</u>
<u>REF</u>	
Micro Parts PLCS5 SET	CPU - 6900
RELAY 'OPTO 22' 240A10	240A10
Shelves: Chrome wire x3	
Fan Motors: x2	P.007
Elements: 2x 800W	P013
Humidity Pump - Flojet 2100-131 – 12Volt	P1188
Pump Pressure switch - 02095-101	P1183
Spray Nozzles - 2x SF2TIP	P1184
Hi-Limit Switch (non-Reset)	P132
Hi-Limit Switch (Resetable)	P021
Fuse 2Amp Fast Blow (Controller)	
Fuse 2Amp Delay (PLCSLITE Module)	
RCD Circuit Breaker 16A (10mA Leakage trip)	CIRCUIT BRK1

SECTION 10 FAULT/ALARM CODES

These codes will be shown on the Controller ALARM Display, the RED DISPLAY will come on and the buzzer will sound. Read the information to see if further action is required. To cancel the alarm, Press the 'DIAGNOSTIC/ALARM' button.

Code Problem	Remedy
01 Over/Under Temp fault - temperature in chamber more than 2°C above/Below the set point.	Alarm will stop when fault is removed.
02 Low CO ₂ in Chamber - Not enough CO ₂ to maintain CO ₂ set point.	Check bottle, hoses, for blockage or faulty solenoid.
03 Chamber now running on <u>Preset</u> Values. (Most likely due to power being removed for more than 48 Hours).	If Preset values are your working values, cancel the alarm else update the set points. CHECK CAL FACTORS.(See CAL SECTION)
04 Main temperature sensor (in sensor box) broken or damaged.	Call Service Engineer. Check sensor with meter. Could also be electronic fault in controller, or broken sensor wire, etc.
05 Humidity sensor (in sensor box), broken or damaged.	Call Service Engineer. Check sensor with meter. Could also be electronic fault in controller or broken sensor wire, etc.
06 Low water level in Humidity Reservoir.	Top up level in Humidity Reservoir, open bottom door to top up.
07 CO ₂ Sensor. Damaged or broken, or out of calibration range (20-170%) raw CO ₂ .	Call Service Engineer. Check thermistor sensors and wiring to sensor box.

08 Moderate Noise

Check wiring of Mains.
If only very occasional
alarm will not cause any
problems.

09 Severe Noise on Mains
check mains wiring and
outside interference.

As above but serious,
earthing. Look for
CHECK CAL FACTORS.

13 Maintenance Service
No1 Due (Occurs every
2000 running hours).

Carry out Standard
Maintenance Schedule
And cancel alarm.

14 Maintenance Service
No2 Due (Occurs every
8000 running hours).

Carry out Comprehensive
Maintenance Schedule
And cancel alarm.

CONTHERM SCIENTIFIC LTD
CERTIFICATE OF CONFORMANCE

This certifies that the CONTHERM equipment specified below has been tested according to our standard methods and procedures and has been approved for despatch.

CAT. No:6900 [R] [RHS]

APPLIANCE No:

DATE:.....

TEST RESULTS

Test Temperature:

Probe Position:

Date of Test:

Actual Recorded Temperature

Temporal Variation

ELECTRICAL TESTS

Earthing: [] Ω

Insulation: [] $M\Omega$

Flash: []

Leakage: [] **Ma**

The electrical tests are satisfactory: []

Signature of Test Personnel

CONTHERM SCIENTIFIC LIMITED
NEW ZEALAND

CONTHERM SCIENTIFIC
CUSTOMER INSTALLATION REPORT

Please fill in and return to:

CONTHERM SCIENTIFIC LIMITED
DEVELOPMENT SECTION
P.O. BOX 30605
LOWER HUTT
NEW ZEALAND

1) Did your chamber arrive in good condition? **YES / NO**

2) Any difficulties experienced in setting up? **YES / NO**
Comments:

3) Is this your first CONTHERM purchase? **YES / NO**

4) Any previous problems of a specific nature
with CONTHERM products? **YES / NO**
Comments:

5) Any suggestions for improvements or special
features you would like to see -
Comments:

6) **Chamber Details** **Catalogue No:** **CAT 6900 [R]/[RHS]**

Appliance No:

Date Installed:

Company:

.....

.....

COUNTRY:

Contact Name:

PHONE: **FAX:**

PACKING INSTRUCTIONS
(Leave with Chamber)

CAT.No. 6900 [R]/[RHS]
(Growth Chamber)

Date:/...../.....

- 1) Ensure chamber has been fully tested and approved for packing . []
- 2) Ensure rear data plate is fitted. []
- 3) Clean interior and exterior. []
- 4) Parts to be packed with chamber:
 - a) Manual []
 - b) Shelf runners []
 - c) Light Shelves []
 - d) Shelves []

PACKED BY