



INSTRUCTION MANUAL

MITRE 4000 SERIES

Standard/Tropicool/Cooled Models

CO₂ CELL CULTURE INCUBATORS

**CONTHERM SCIENTIFIC LIMITED
P O BOX 30-605 LOWER HUTT 5040**

TEL: (0064-4) 568 8034

FAX: (0064-4) 568 8095

EMAIL: contherm@xtra.co.nz



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. 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.

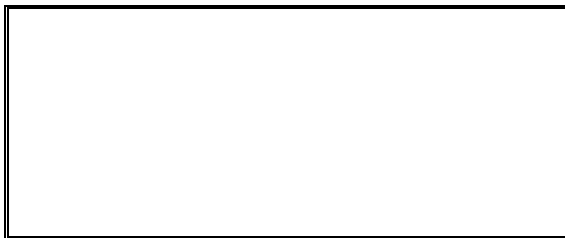
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STATEMENT of CONFORMITY

This **CONTHERM** cabinet conforms to the following standards:

- **Electrical Safety:** Designed to NZS6200 / AS3100:1994
- **EMC:** Complies with AS/NZS 2064: 1997



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	Customer Troubleshooting and Maintenance
SECTION 8	Spare Parts Lists
SECTION 9	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 OVERSHOOT**
Any excess of actual over desired chamber temperature during a heating up period.
 - f) **TEMPERATURE REPRODUCIBILITY**
Temperature regained without alteration to controls.
 - g) **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 CAT4000 Mitre Series of Co₂ Culture Incubators 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 an enclosure temperature of +37°C with an ambient Temperature of +20°C for Standard and Tropicool cabinets and for an enclosure temperature of +20°C for cooled cabinets.

- **Construction** - Combination of High quality stainless steel and zinc plated mild steel; epoxy coated exterior, full fibreglass insulation, High quality stainless steel interior with full access door and magnetic door catch
- **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, ZP22 Microprocessor control System.

PERFORMANCE:

a) Temperature:	
Nominal Range: Standard	(Ambient +5°C) to +50°C
Tropicool	(Ambient -5°C) to +50°C
*Cooled	+15°C to +50°C
Temporal Variation	± 0.2°C
(Cooled)	± 0.3°C
Spatial Variation	± 0.3°C
(Cooled)	± 0.6°C
Initial Overshoot	+2.0°C
Reproducibility	±0.5°C
Dial resolution	0.1°C
Operating Ambient	10°C - 35°C
Mains Voltage Range	230-250 AC 50Hz

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

NB: If fitted with a HEPA filter, the spatial specification is downgraded to ± 0.8°C

b) Relative Humidity -

With the standard tray of water inside a standard cabinet the humidity will typically rise to 80% RH or more at a temperature of 37.0°C. The maximum achievable humidity will be less in a Tropicool or Cooled cabinet.

***NB:** Can only be operated on 60Hz when cooled units fitted with a special refrigeration compressor.

On COOLED units the supplied stainless steel water tray should be placed on the cabinet floor and pushed so that the sloping side firmly touches the rear wall.

c) Carbon Dioxide:

Range:	0.5 - 20 % CO ₂
Fluctuation (@35Kpa / 5PSI)	±0.2% CO ₂
Accuracy: (@37oC, 85% RH)	±0.5% CO ₂

SECTION 3 INSTALLATION

The CAT 4000 Mitre Series Incubators are designed to be installed into a suitable well ventilated room with a preferred minimum clear space of at least 150mm on all sides to allow access for servicing. Mount the enclosure in its final place ensuring that adequate space is allowed for the door to open. The enclosure may be placed on the floor or a bench.

NB: On **Tropicool** and **Cooled** units ensure a space of at least 150mm is allowed at the rear of the cabinet for air circulation – On **Tropicool** units ensure that the unit can not be pushed too close to a rear wall. Locate the two stainless perforated “butterfly wings” at the rear sides of the **Tropicool** unit and gently bend to an angle of 90°.

The chamber requires a 240Volt 50HZ 10Amp Single phase EARTHED electricity supply.

Total electrical load is upto 0.75Kw (4400C).

Maximum shelf loading is 30Kg/shelf, maximum total for cabinet is 100Kg.

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.

- 1) Connect a bottle of **DRY FOOD GRADE CO₂** fitted with a two stage Pressure Regulator set at **35kpa (5psi)** to the **Hosetail No 1** at the rear of the enclosure.
- 2) If the enclosure is fitted with the automatic **CO₂ CHANGEOVER** option fit the second gas bottle to **Hosetail No 2**. This bottle will automatically be selected when bottle **No 1** is empty.
- 3) Install the shelf guides in the desired positions. Slide the shelves into guides.
- 4) On cooled / Tropicool units a large stainless steel or plastic tray is used to both provide and collect water from the refrigeration system evaporator. Ensure this tray is pushed firmly against the rear wall of the cabinet. If elevated humidity conditions are desired partially fill the tray with distilled or deionised water.

NOTE: The hosetail is a nominal ¼” brass barb. Typically use 6.0mm ID PVC beverage tubing or similar to connect to the gas bottle regulator output. The tubing should be secured to the hosetail using S/S hose clips.

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 the three-pin plug supplied must be inserted **ONLY** into a standard 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 (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

This appliance is NOT intended for use by young children or infirm persons without supervision.

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

- 1) Follow any installation procedures (See SECTION 3).

OPERATING CONTROLLER:

This example will demonstrate how to set the cabinet for the following conditions:

Temperature = 37.0°C Carbon Dioxide = 5.0%

TO SET TEMPERATURE

Press and hold the **TEMP** button. The display will **blank** for 2 seconds, release the button. The **SET** LED above the temperature display will turn on indicating that this parameter is now in the temperature set mode and the current set point will be displayed. Use the **UP** and **DOWN** buttons to adjust the Set Point to **37.0°C**.

When the adjustment is complete the controller will return to normal operation if the buttons are not pressed. This is indicated by the **TEMP SET** LED going off.

TO SET THE CO₂ CONCENTRATION

Press and hold the **CO₂** button. The display will **blank** for 2 seconds, release the button. The **SET** LED above the CO₂ display will turn on indicating that this parameter is now in the set mode and the current set point will be displayed. Use the **UP** and **DOWN** buttons to adjust the set point to **5.0%**.

When the adjustment is complete the controller will return to normal operation if the buttons are not pressed. This is indicated by the **CO₂ SET** LED going out.

HEPA FILTER (If Fitted): To change the HEPA Filter, undo the two knurled nuts holding the filter to the inside top tray and withdraw the filter.

RELATIVE HUMIDITY

There is no electronic control of humidity in these enclosures, the humidity is maintained either by placing a small plastic tray of water in the tray support and attaching this to a vacant shelf ladder near the bottom of the cabinet or by partially filling the large stainless tray on cooled units. The humidity level will usually equilibrate to a relative humidity of above 80%. (typically 60% - 70% on **Tropicool** and **Cooled** units.

To display the Relative Humidity (Non INFRA-RED Models ONLY): Press the **CO₂** button momentarily and the CO₂ display will indicate the %RH. After a few seconds the display will return to displaying the CO₂ reading.

CONDENSATION:

It is normal for a small amount of condensation to appear on the side walls and glass door(s) and floor when operating with humidities above 85% RH. Any water accumulating on the floor of the cabinet should be removed at regular intervals.

CONFIRMATION OF OPERATING PARAMETERS

Contherm check the Temperature, and CO₂ calibration in the factory in the final testing stages. For your confidence it is advisable to obtain your own calibration so as to ensure the enclosure is operating to your satisfaction. This must be carried out in the enclosures final operating environment. A full procedure for calibrating the enclosure is given in the **CALIBRATION** Chapter.

TROPICOOOL UNITS:

This type of cabinet is fitted with Contherm's 'Tropicool' peltier cooling option. The Tropicool unit uses a peltier cooling device to obtain lower temperatures, typically allowing operation to 5°C below ambient. The 'Tropicool' unit runs continuously.

COOLED UNITS:

This type of cabinet is fitted with a special refrigeration unit, the lowest temperature of which is factory set via a 'evaporator pressure regulator' to minimise the dehumidifying effect of the cooling coils. The minimum attainable temperature will be about +15°C. The refrigeration unit runs continuously.

ALARMS

There are TWO types of alarm used in the Contherm Mitre series enclosures. **Standard Alarms** and **Special Alarms**

STANDARD ALARMS

[1-.-] [2-.-] [4-.-] [5-.-] [6-.-] [7-.-] [8-.-] [11-.-] [12-.-]

These alarm numbers indicate a problem with cabinet control, ie. over-temperature, faulty sensor ,etc.

To **CANCEL** all the alarms except [2-.-] Press and Hold the **TEMP** button until the temperature display **blanks**. To cancel the [2-.-] alarm, press and hold the **CO₂** button until the CO₂ display blanks. To assist any service enquiries later please note the number of the alarm and what was done to eliminate the cause.

The HI/LO temperature alarm ([1-.-]) is triggered 5 minutes after the temperature moves more than $\pm 2.0^{\circ}\text{C}$ from the set point. The 5 minute delay is re-established when the temperature attains within $\pm 0.3^{\circ}\text{C}$ of the set point.

The LOW CO₂ Alarm ([2-.-]) is set to trigger when the CO₂ level has not reached the SET POINT level for at least 32minutes. PROVIDING THAT:

- a) The Cabinet temperature is within $\pm 2.0^{\circ}\text{C}$ of the set point.
- b) The cabinet outer door is NOT open.
- c) The CO₂ baseline 'AUTO-CAL' has completed (I.E the CO₂ display is NOT flashing) – applies to thermal conductivity sensor units ONLY.

SPECIAL ALARMS

[3-.-] [9-.-]

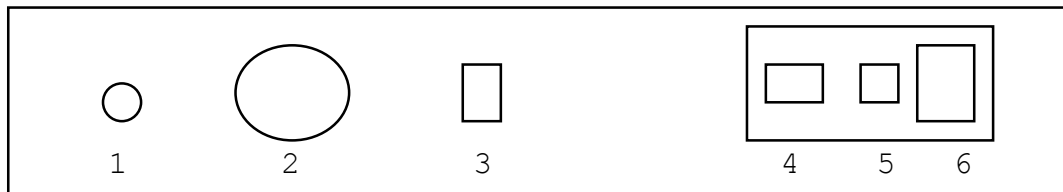
These alarms can ONLY be cancelled by using the procedure outline below. These alarms indicate that the cabinet may have lost some of its settings [3-.-], **OR** that Electrical Interference [9-.-] has corrupted the cabinets internal operating system.

To cancel the [3-.-] or [9-.-] alarms it is necessary to go into **SET MODE** and check both Temperature and CO₂ set points. Once the set points of the CO₂ and Temperature and the Temperature calibration has been checked the alarms will cancel.

POWER CONTROL AND HI-LIMIT PANEL (RIGHT HAND SIDE)

The Power Control and Hi-Limit Panel is fitted at the top right hand side of the enclosure.

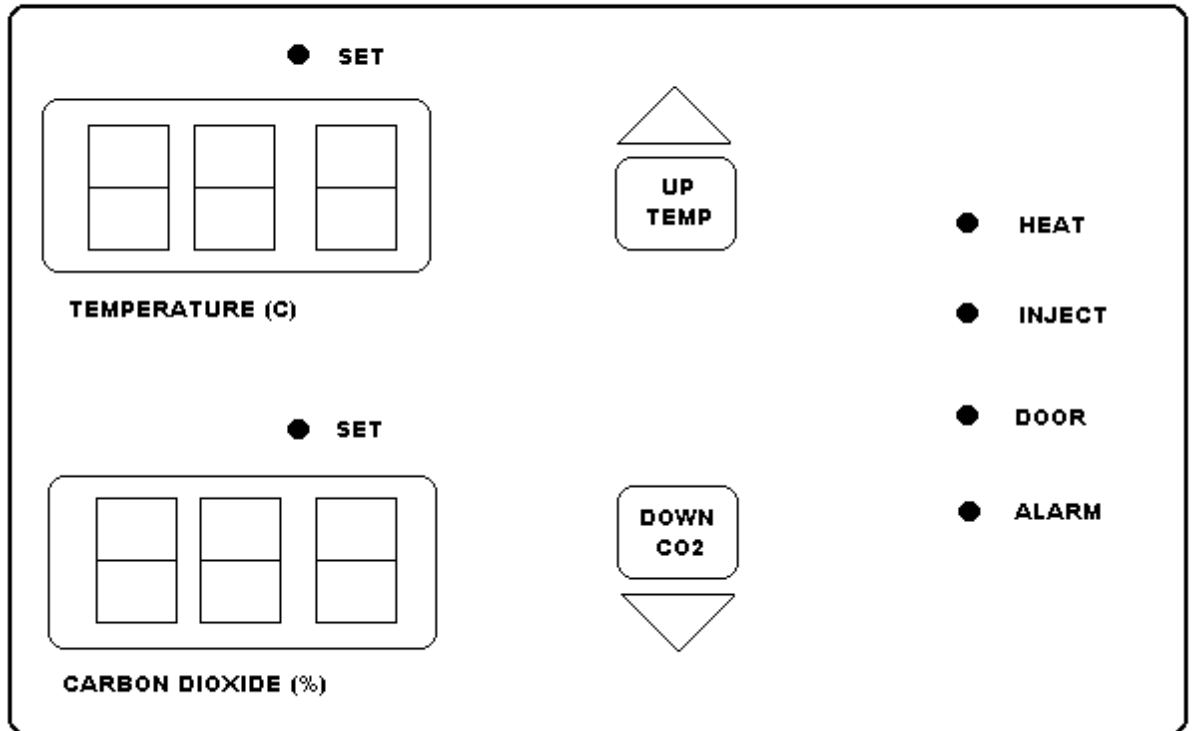
This panel contains the **ON/OFF** Switch, **FUSE** and user adjustable Temperature **HI-LIMIT** thermostat.



- 1 CO₂ SAMPLE PORT**
This fitting allows the user to SAMPLE the atmosphere inside the cabinet. The fitting cover **MUST** be fitted after sampling to minimise CO₂ loss.
Note: A sample should NOT be taken within 5 seconds of the **CO₂ INJECT** LED coming on.
- 2 TEMPERATURE HI-LIMIT THERMOSTAT**
This is a mechanical thermostat which directly monitors the temperature of the enclosure. If the temperature exceeds this setting the power to the element will be switched **off** and the associated **Hi-Limit (3)** neon will illuminate when the controller applies power to the element. This can be observed by watching the **HEAT** LED on the front panel. This thermostat should be set to operate **just above** the set point temperature. See **Setting Hi-Limit Thermostat** below.
- 3 HI-LIMIT NEON**
This RED neon lights whenever the Hi-Limit Thermostat is activated. Whenever the neon is illuminated no power is being supplied to the enclosure heating elements (this is an additional safety against inadvertent enclosure overheating).
- 4 ON/OFF SWITCH**
This turns the power on or off. The fitting also contains an electrical noise filter.
- 5 FUSE :** The fitting contains a **5AMP** fuse.
- 6 POWER LEAD SOCKET:** The power lead plugs into this socket.

OPERATING CONTROL PANEL

The Control Panel on the outer door is used to access the operating conditions for the enclosure



UP/TEMP

This button is used to increase the parameter value, to display the enclosure Temperature and the Temperature set point. This will sometimes be referred to as the **TEMP** or the **UP** button.

DOWN/CO₂

This button is used to decrease the parameter value, to display the CO₂ set point and the Relative Humidity (Non INFRA-RED Models ONLY). This will sometimes be referred to as the **CO₂** or the **DOWN** button.

SET

These LED's indicate if the Temperature or CO₂ displays are in **SET MODE**.

HEAT

Indicates when power is being supplied to the heating element. This will remain steady when large changes in conditions are occurring eg warming up or if the door has been opened. When the enclosure is at the temperature set point, the LED will pulse.

INJECT

Indicates when CO₂ is being injected. This will usually be accompanied by an audible click of the CO₂ inject solenoid.

DOOR

Indicates that the outer door is open. If the door is opened a door switch is activated, the internal fan, heater and CO₂ solenoid are disabled until the door is closed. Leaving the outer door ajar for prolonged periods will affect the internal control of the cabinet atmosphere.

ALARM

Indicates when an ALARM condition has been triggered. The alarm will be accompanied by a beep and will display the **Alarm Code** in the **Temperature Display**.

SECTION 5 CALIBRATION

It is important to note that the calibration of this enclosure is valid only when it is calibrated in its final operating environment. Contherm calibrates the enclosure **to our internal standards** in the final testing stages of manufacture. This means that when the enclosure arrives at the customer site, the calibration carried out in the factory may no longer be valid. **Contherm wishes to make it clear that calibration is a CUSTOMER responsibility.** Contherm has ensured that a complete acceptable calibration procedure is available for the customer to follow.

Calibration of the enclosures is achieved by checking the enclosure temperature display against a **customer supplied calibrated thermometer and CO₂ monitoring device**. It is important that the calibration is carried out at the temperature of interest.

The temperature sensor that is used by the electronic thermal control system is also used to indicate the control temperature. This sensor is in the duct of the air circulation system and is not directly in the work space, therefore it is necessary to adjust any offset between the work space and the indicated temperature. Calibration entails adjusting the CALIBRATION FACTOR so that the work space temperature matches the indicated temperature. The CALIBRATION FACTORS are stored in an **Electrically Erasable Read Only Memory (EEROM)**. EEROM retains its stored memory even with the power off.

TEMPERATURE CALIBRATION

- 1 Place a calibrated reference thermometer that has been checked to the customers satisfaction into the enclosure. The usual place for this is in the centre of the work space. Place it so that it is able to be read **without** opening the glass inner door.
- 2 Ensure the enclosure has stabilised at the temperature of interest for at least 6 hours.
- 3 Press and hold the **TEMP** button until the display momentarily **blanks**, this will access the **SET POINT** mode and the **SET** LED above the temperature display will be on.
- 4 Press both **TEMP** and **CO₂** buttons at the same time. The temperature display will show **[Cal]** for 2-3 seconds and then show the current temperature.
- 5 Adjust the value displayed to read the **same** as your reference thermometer.

- 6 Release all buttons. After about 3 seconds the temperature display will show [---] then a HEXIDECIMAL number for about 2 seconds (This number may be noted as a reference to the current calibration) then another [---] and beep. The enclosure will now begin to adjust itself so that the reference thermometer temperature matches the SET POINT temperature. The indicated temperature will show a temperature offset from the SET POINT Temperature immediately after the calibration. This is normal as the controller is now endeavoring to match the SET POINT to the work space reference thermometer.

The procedure **may** need to be repeated to obtain the best final calibration.

CO₂ CALIBRATION – THERMAL CONDUCTIVITY SENSOR

There are two modes of calibration for the THERMAL CONDUCTIVITY CO₂ system. An AUTO-CALIBRATION (**AUTO-CAL**) and MANUAL CALIBRATION (**MAN-CAL**). Both types perform the same operation. **AUTO-CAL** enables the enclosure to perform the calibration at 'quiet' times of operation, whereas **MAN-CAL** is used when the cabinet has been empty of CO₂ for a long period. Both require the enclosure to be stabilised at the desired set Temperature.

AUTO-CAL

The normal method of calibrating the CO₂ concentration is by using the AUTO-CAL facility. To force the controller to carry out an AUTO-CAL the following procedure is recommended.

- 1 Change the Temperature Set Point by 0.1°C (eg. if your normal operating Temperature Set Point is 37.0°C change it to 36.9°C).
- 2 The CO₂ display should now be **flashing**, this indicates that the CO₂ is now out of calibration. Note that the operation of the CO₂ gas inlet solenoid(s) will be inhibited while the CO₂ display is flashing.
- 3 **OPEN** both the outer and inner incubator doors, and **leave** them open for **at least 30 seconds**. (This is to flush the enclosure of CO₂ gas).
- 4 **CLOSE** both doors.
- 5 **CHANGE** the Temperature Set Point back to your normal setting, ie. 37°C
- 6 **LEAVE** the enclosure (preferably without opening the doors) until the CO₂ display stops flashing. This indicates that normal CO₂ control has returned.

MAN-CAL

- 1 Flush the enclosure of CO₂ by opening the doors for at least 30 seconds.
- 2 Press and Hold the **CO₂** button until the CO₂ display momentarily *blanks*.
- 3 Press both the **TEMP** and **CO₂** buttons together until the display shows **[Cal]**.
- 4 Release all buttons and wait. The display will show **[--]** and beep. The CO₂ display will automatically reset itself to **[0.3%]** when the current temperature next reaches the Temperature Set Point.

NOTE AUTO-CAL and MAN-CAL will assume that there is no CO₂ in the enclosure when the calibration sequence begins.

CO₂ SPAN CALIBRATION

As there is no facility to adjust the span of the CO₂ display, it is necessary to check the CO₂ concentration by independent means and if necessary REPEAT the AUTO-CAL procedure until satisfactory calibration is achieved. CONTHERM recommends a FYRITE is used to check the CO₂ concentration. Any other means that is satisfactory to the customer may be substituted.

- 1 Let the enclosure stabilise at its operating conditions for at least 6 hours.
- 2 Monitor the CO₂ level via the **CO₂ SAMPLE PORT** with the independent CO₂ monitor ensuring that the CO₂ injection solenoid does not operate during the sampling time. Note the reading of the independent monitor.
- 3 If the **MONITOR** value is within $\pm 0.5\%$ of the **DISPLAYED CO₂** reading no further action is necessary.
- 4 **Repeat** the **AUTO-CAL** calibration procedure until a satisfactory result is achieved.

Notes on Calibration Procedures for THERMAL CONDUCTIVITY Sensors

- The CO₂ SET POINT can be left as it is for the duration of the AUTO-CAL and MAN-CAL calibration sequences. Once the CO₂ display has stopped flashing the controller will adjust the workspace CO₂ level to the SET POINT.
- AUTO-CAL is best done last thing at night as the calibration usually takes from 1 to 4 hours to complete.
- CONTHERM recommends that AUTO-CAL is carried out at least every two months OR if a Temperature Calibration has taken place.

- The temperature should be recorded on a daily basis by placing a thermometer in the work space so that it can be read without opening the inner glass doors and the long term temperature performance can then be plotted to give an assurance of correct temperature performance. Similarly, the CO₂ should be checked and monitored regularly using the independent monitor. Record these for long term assurance.

CO₂ CALIBRATION – INFRA-RED CO₂ SENSOR (IR)

There are two modes of calibration for the infra-red CO₂ system.

1. Zero Offset Calibration (This should never require adjustment)
2. Span calibration. (This may require a slight adjustment if the CO₂ calibration is incorrect)

NB: These adjustments do not calibrate the accuracy of the CO₂ concentration measurement, but only adjust the output to match the measuring device. Before carrying out these procedures insure that the cabinet has been allowed to stabilise for at least 6 hours.

CO₂ ZERO OFFSET CALIBRATION

To adjust the ZERO of the CO₂ display, it is necessary to proceed as follows:

- 1 Connect a voltmeter to the CO₂ sensor board output terminals.
- 2 With JP5 OPEN, connect the shorting jumper onto pins of JP4, use the 'UP' or 'DOWN' buttons on the CO₂ PCB to adjust the voltmeter to read 0.005 volts DC. (The cabinet display will read about 0.2% CO₂)
- 3 REMOVE the shorting jumper from pins of JP4.

CO₂ SPAN CALIBRATION

To adjust the SPAN of the CO₂ display, it is necessary to proceed as follows:

- 1 Connect a voltmeter to the CO₂ sensor board output terminals (V0 & COM).
- 2 With JP5 CLOSED, connect the shorting jumper onto pins of JP4, use the 'UP' or 'DOWN' buttons on the DCS-300 INFRA-RED CO₂ PCB to adjust the voltmeter to read 0.650 volts DC. (The cabinet display will read about 16.5% CO₂). This value may be raised or lowered to achieve the exact CO₂ calibration result. ('Normal' range is from 0.550 – 0.750). If the cabinet display is reading too high when the CO₂ concentration is compared with a test instrument ('Fyrite' etc) then the reference voltage should be adjusted slightly DOWN.
Just press either the 'UP' or 'DOWN' button VERY briefly and then WAIT for the meter reading to change as the reading will lag the button press by several seconds.
- 3 REMOVE any shorting jumpers from pins of JP4 & JP5. Recheck calibration if necessary.

VERIFYING CABINET PERFORMANCE

There are two basic tests that may be carried out to verify cabinet performance.

NB: These tests MUST be carried out with the cabinet EMPTY and at the specified ambient of +20°C.

TEMPORAL PERFORMANCE:

The cabinet should be set to operate at the Contherm specified calibration conditions.

Temporal performance is tested by placing a suitable (calibrated) test probe in the centre of the workspace and recording the readings for up to 1 hour AFTER the cabinet has FULLY STABILISED.

The cabinet has fully stabilised when the average temperature is no longer increasing or decreasing over time.

The result should be within the quoted specification.

This result is a function of the cabinet control system, sensor and airflow.

SPATIAL PERFORMANCE:

The cabinet should be set to operate at the Contherm specified calibration conditions.

Check Spatial Variation @ 37°C

(Refer manual for specification, 8 points as per diagram)

[6R] [4C] [3R] TOP

[8C] [1C] [] CEN

[2F] [7C] [6F] BOT

(Where F=Front, C=Center, R=rear)

Spatial performance is tested by placing suitable (calibrated) test probes (usually thermocouples) in the eight specified positions and recording the readings for up to 1 hour AFTER the cabinet has FULLY STABILISED.

The cabinet has fully stabilised when the average temperature is no longer increasing or decreasing over time.

The sensors must be no closer than 30mm to any wall or roof and must be above the lowest shelf position by at least 30mm.

The result should be within the quoted specification.

This result is a function of the cabinet design and air distribution.

The spatial test must be performed with all doors, vents etc CLOSED and the measuring sensors must be very closely matched at the specified temperature.

SECTION 6 THEORY OF OPERATION

Power to the enclosure is supplied through a proprietary combination fused, filtered, and switched input module.

The controller board incorporates an onboard step-down transformer that supplies the necessary low voltages for the board. A further transformer is utilised to provide 12v AC for the door heater. CO₂ inject solenoids, enclosure heater, door heater and fan motor make up the other controlled devices within the enclosure.

The versatility of the enclosure is based on the Contherm ZP22 microprocessor control system. Multiplexed analog inputs that sense the Temperature, and CO₂ are used to interface the sensor circuitry to the controller .

All off board controlled devices are interfaced via optically isolated triac modules. A proximity switch is incorporated in the front panel to sense the status of the outer door. The motor and heater are deactivated whenever the door is open.

The temperature in the enclosure is sensed by a solid state temperature sensor. The microprocessor supplies PID controlled heater outputs that control the temperature conditions of the enclosure. Carbon dioxide sensing is by EITHER Thermal Conductivity OR by an INFRA-RED sensor.

After first turning on power to the unit a RESET operation is performed, this operation tests the condition of retained data in the EEROM which contains any set points or correction factors and then by computing a CHECKSUM determines if the data has been corrupted.

If the data is found to have been corrupted, all the control points are set to factory preset values and all calibration factors are reset to their defaults.

Every 10 milliseconds after initial turn on a timer interrupt occurs, this signal is derived from the internal clock and is used for timekeeping functions.

Relative Humidity is sensed by a capacitive sensor probe. The humidity is not controlled in the enclosure but the value of the current enclosure RH can be accessed via the CO₂ button. The RH is used to correct the CO₂ algorithm for humidity interferences.

NB: A relative humidity sensor is **NOT FITTED** on INFRA-RED Models as these do not require any correction for humidity.

SECTION 7 TROUBLESHOOTING AND MAINTENANCE

All fault alarms are displayed on the **TEMPERATURE** LED display. The appropriate fault alarm can be identified in the **Alarm Code** list.

NO DISPLAY WHEN MAINS SWITCH TURNED ON.

- | | |
|------------------------------------|----------------------|
| - Cabinet not plugged in | Plug in. |
| - Input Fuse blown (5AMP) | Replace. |
| - Check power at electrical outlet | Turn on wall socket. |
| - ZP22 PWR PCB fuse blown (2AMP) | Replace. |
| - None of the above is at fault | Call Service |

NB: Unplug cabinet from wall socket before checking or replacing any fuses.

DISPLAY ON BUT FAN MOTOR STOPPED

- | | |
|-------------------|---|
| - Outer Door Open | Check DOOR LED. Close door.
Call Service |
|-------------------|---|

HI-LIMIT NEON COMING ON AND CABINET NOT UP TO TEMPERATURE.

- | | |
|--------------------------------|-----------------|
| - Hi-Limit thermostat tripping | Reset Hi-Limit. |
|--------------------------------|-----------------|

ENCLOSURE WILL NOT HEAT/COOL TO TEMPERATURE

- | | |
|--------------------------|-----------------------------|
| - Door open | Check DOOR LED. Close door. |
| - Faulty heater element | Call Service |
| - Already at temperature | Wrong set point entered. |

TEMPERATURE CONTROL NOT TIGHT ENOUGH

- | | |
|---------------------------|-------------------------|
| - Circulation Fan stopped | Check/change fan motor. |
| - Sensor faulty. | Call Service |

INACCURATE READINGS ON ANY PARAMETER

- | | |
|----------------------------|--------------|
| - Not correctly calibrated | Calibrate. |
| - Faulty sensor | Call Service |
| - Component failure | Call Service |

NO CO₂ COMING INTO CABINET - No Alarm.

- | | |
|--|---------------------------------|
| - Outer door open | Check DOOR LED. Close door. |
| - CO ₂ set point set too low (possibly 0.0) | Reset CO ₂ setpoint. |

DISPLAY PRESENT- BUT CONTROLLER WILL NOT OPERATE CORRECTLY

- | | |
|---------------------|----------------------------------|
| - Data corrupted | Switch off for ten seconds |
| | Check set points and calibration |
| - Component failure | Call Service |

DISPLAY ON BUT SHOWING RUBBISH!

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

- | | |
|----------------|--|
| - Faulty Reset | Turn Mains power <u>off</u> for 10 seconds |
| | Call Service |

CO₂ is too HIGH (IE Set for 5% but showing > 10% and not controlling).

- | | |
|---|--------------|
| - Check CO ₂ Inlet Regulator Pressure is not set too high. | |
| CO ₂ Inlet Solenoid is Stuck OPEN. | Call Service |

ROUTINE MAINTENANCE

Suggested to be checked Annually:

- Check glass door gasket for damage (cuts and splits), replace if necessary.
- Check glass door seals correctly onto gasket, adjust side mounted door latch plate if required.
- Remove and clean water supply tray - refit.
- Wipe out floor of cabinet to remove any water stains.
- Check door controller overlay for damage, replace if necessary.
- Check basic cabinet control functions and that user hi-limit control is set appropriately.

DETAILED MINOR SERVICING

Replacing Main Fuse

Unplug power lead from the wall and enclosure socket. With a small screw driver gently prise the fuse holder from the fitting.

Replace with a **5 AMP fuse ONLY**

Replacing Controller Board Power Supply Fuse

- 1 Unplug the power lead from the wall and enclosure socket.
- 2 Undo the 2 allen head retainers that hold the top panel in place. These are found at the front of the panel. Lift the top off, carefully removing the earth connection at the left rear.
- 3 The Power Supply fuse is situated on the controller board under a clear perspex fuse holder.
- 4 Gently prise the fuse holder lid off and remove the fuse and replace it [**2AMP**].
- 5 Put the perspex lid back on the fuse holder, replace the top ensuring the earth strap is reattached, push down the retaining clips, plug in and switch on.

Checking the Heart-Beat LED on the Controller Board

- 1 If the controller does not appear to be operating but the display is on. It is useful to check if the **Heart-Beat** watch dog circuit is operating.
- 2 Unplug the power lead from the wall and enclosure socket.
- 3 Undo the 2 allen head retainers that hold the top panel in place. These are found at the front of the panel.
- 4 Lift the top off, carefully removing the earth connection at the left rear.
- 5 Plug the power lead back into the wall and enclosure sockets and turn on the enclosure.
- 6 The **GREEN Heart-Beat LED** is situated on the controller board next to the largest integrated circuit. It should pulse with one second intervals. If the heart-beat is operating, switch off and unplug the power lead.
- 7 Replace the top with the earth strap and switch on.
- 8 Attempt the procedure as described for cancelling ALARM [**9--**]

- 9 If controller is still not working correctly, call Service.

Motor Shaft Seal or Fan Motor Replacement

The following procedure describes how to replace the fan motor or motor shaft seal.

Unplug the power lead from the wall and enclosure socket before commencing.

Procedure in interior of the enclosure:

- 1 Undo the 2 knurled nuts that hold the element and fan cover to the inside of the enclosure. Carefully lower the cover and remove from enclosure. Note the slots at the rear of the interior that the element cover slots into. Ensure these are engaged on assembly.
- 2 Undo the 3 knurled nuts (or 3/16" S/S nuts and washers) around the fan shroud and remove fan shroud.
- 3 Remove the fan rotor - nut is ***Left Hand Thread***.

NOTE The washer goes on the shaft ***before*** the rotor. This ensures that the rotor sits square on the shaft. Carefully pry off the circlip from the motor shaft.

Now move to the exterior top of the enclosure

- 1 Undo the 2 allen head retainers that hold the top panel in place. These are found at the front of the panel.
- 2 Lift the top off, carefully removing the earth connection at the left rear. ***Remember*** to reattach this connection on assembly.
- 3 Remove wires from motor, undo 3 nuts holding motor to its mount and carefully lift motor off the threaded screws and place to one side.

Motor Shaft Seal

Use a small screwdriver to prise the **black shaft seal** from white plastic holder (Note the orientation of the seal face - smooth side to top). Replace the seal with a new one (7.00mm). The seal should be given a light coating of silicone grease.

Fan Motor replacement

Disconnect earth wire from motor, replace motor with new one and **reconnect** earth wire, then **reverse** the above disassembly procedures, ensure motor is free to turn **before** reapplying any power to cabinet.

- To reassemble follow the above procedure in reverse.
- **Ensure motor and rotor turn freely after assembly.**

REFRIGERATION SYSTEM (COOLED CO₂ units ONLY)

The refrigeration compressor is of the low starting torque type and may not start immediately if the power supply is disconnected. After approximately 3-5 minutes the internal refrigeration pressures will have equalised and the compressor will start up as normal.

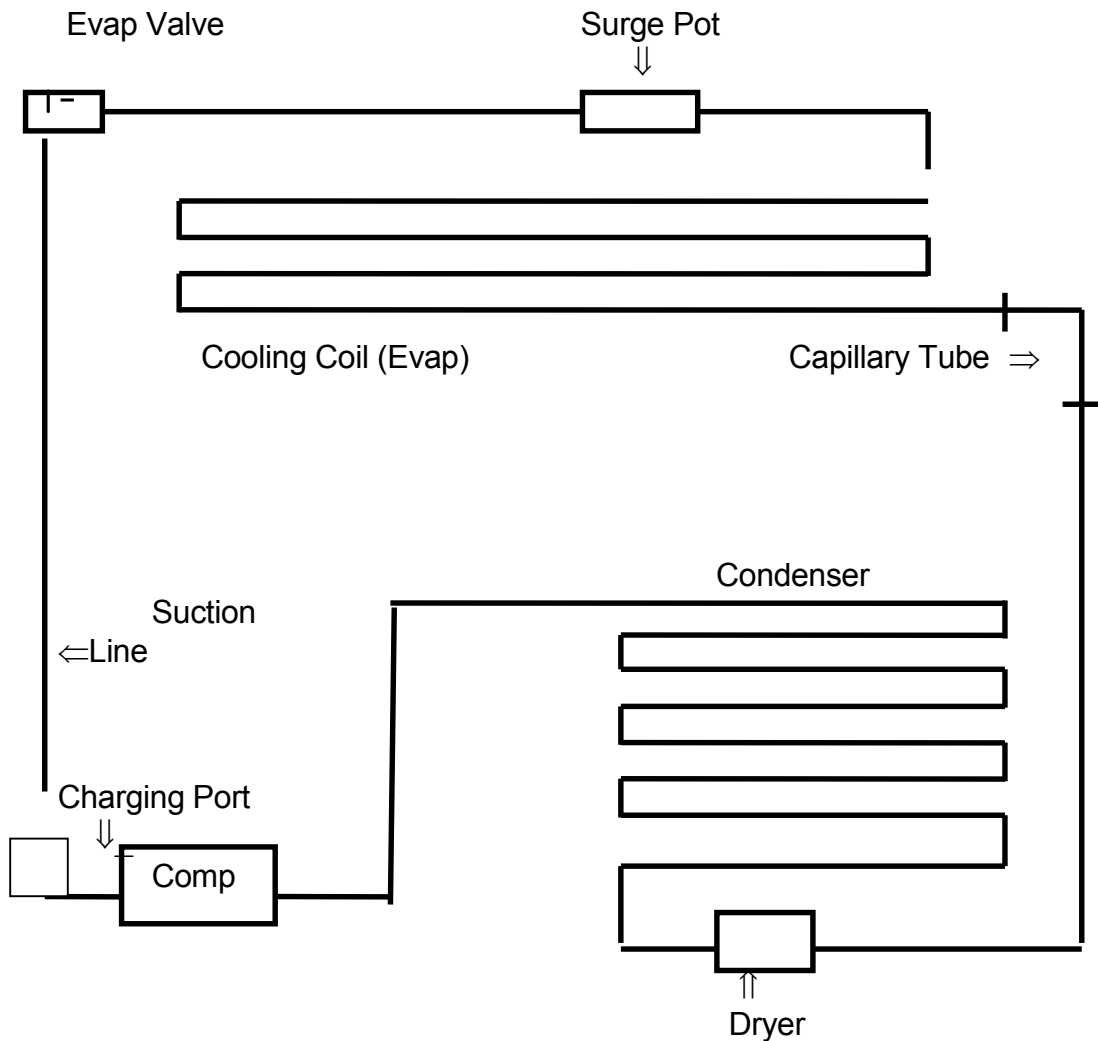
The cooling coil under normal operating conditions does not build up frost. This is due to the setting of the special evaporator pressure regulator which prevents the coil from getting too cold.

The condensate water from the cooling coil drains back into the water tray on the internal floor of the cabinet so that any condensed water is recirculated. The supplied stainless steel water tray should be placed on the cabinet floor and pushed so that the sloping side firmly touches the rear wall.

The refrigeration system condenser located on the External rear of the cabinet is cooled by natural convection, therefore, it is important to ensure no obstructions are placed to prevent normal circulation around the cabinet. The condenser will slowly collect a layer of dust, therefore, it is recommended that once a year it is brushed clean with a small broom.

This refrigeration unit is optimised to provide best result when the cabinet is operated at or near +20°C. The minimum attainable temperature in a +20°C ambient will be approximately +15°C. Operating the cabinet at higher temperatures (I.E 30 – 37°C) will result in lower relative humidities inside the cabinet and therefore, greater drying effect on samples.

REFRIGERATION SCHEMATIC DIAGRAM



COMPONENT LOCATION

Inside Cabinet Behind False Back: Cooling Coil, Surge Pot

External Back of Cabinet : Compressor, Compressor cooling fan, Condenser, Dryer, Evap Valve.

REFRIGERATION UNIT DATA (Cooled Units ONLY):

Model:	4150C	4200C	4400C
Compressor:	Electrolux GL45AA	Electrolux GL45AA	Electrolux GL45AA
Compressor*:	L'Unite THB1340Y	L'Unite THB1340Y	L'Unite THB1340Y
Condensor:	S12/21	S12/21	S20/21
Cooling Coil:	G6/15	G6/21	G10/21
Evap Valve:	Danfoss KVP12	Danfoss KVP12	Danfoss KVP12
Refrigerant:	R134a	R134a	R134a
Refrigerant Control:	Capillary Type 5/044	Capillary Type 5/044	Capillary Type 6/044
Dryer	Sweat Type 256/XH9	Sweat Type 256/XH9	Sweat Type 256/XH9
Comp Cooling Fan:	(ALL Models)	SUNON	38/2/23HTB

* For operation with a 60hz supply.

SECTION 8 PARTS LISTS

<u>4400</u>	<u>4150</u>	<u>4200</u>
Shelf - Stainless Steel M1056	M1156	M1056
Shelf Guides (State Model)	M1164	
Glass Door (State Model) M1165	M1166	M1165
Glass Door Hinge	M1006	
Glass Door Catch	M1008	
Motor Shaft Seal	M1198	
Knurled knob		
Main Cabinet Glass door seal (S520) M1193	M1193	M1193
Twin Glass Door Seal (S541) M1111		
Humidifying Tray (Short/Long/Long)		
Fan Motor (S.E.L)	M1010	
Element 200W/400W/400W M1078	M1077	M1078
Door Switch	M1171	
Hi-Limit Thermostat	M1021	
CO ₂ Solenoid(s) Type SMC	M1302	
Glass Door Heater Transformer (s)		
Controller Board ZP22INT	M1101	
Display Board ZP22DSP	M1102	
**RH Sensor (HYCAL)	M1207	
CO ₂ Detector Thermal Conductivity	M1104	
*CO ₂ Detector DCS300 INFRA-RED	M1301	
Temperature Sensor (LM35DZ)	M1105	
Internal HEPA Filter (If Fitted)	M1200	
Escutcheon Heater (If Fitted) 10W	M1177	
Sample Port HEPA Filter		
Switched/Fused/Inlet IEC		
TROPICOOOL peltier cooling unit (Tropicool Models ONLY)		

* If INFRA-RED sensor fitted.

** Not fitted on INFRA-RED Models.

SECTION 9 FAULT/ALARM CODES

These codes will be shown on the temperature display, the **ALARM** LED will come on and an intermittent beep will sound.

[1-.-] **Under/Over Temperature**

The enclosure is operating more than $\pm 2^{\circ}\text{C}$ from the set point. The alarm will stop when the temperature is back within $\pm 2^{\circ}\text{C}$ of the set point. Cancelled by pressing **TEMP** button.

[2-.-] **Low CO₂ in enclosure**

The CO₂ concentration is too low for too long. Not enough CO₂ to maintain CO₂ set point. Check there is CO₂ in the bottle, turned on and sufficient pressure (35kpa). Slightly higher pressures (upto 50kpa) may be required at very high CO₂ settings. Check hose connections. Check INJECT LED is coming on. Faulty solenoid. Cancelled by pressing **CO₂** button.

[3-.-] **Enclosure running on factory Preset values**

If preset values are your working values, cancel alarm. Otherwise reset set points and check calibration. (See **CALIBRATION**) Cancelled by pressing **TEMP** button.

[4-.-] **Main Temperature Sensor broken**

Main sensor broken or damaged. Call Service. Cancelled by pressing **TEMP** button.

[5-.-] **Wet, broken or damaged Humidity Sensor (NOT on Infra-red)**

Humidity sensor wet, broken or damaged. Remove water tray from enclosure and run for at least 24 hours while opening the doors for 1 minute every hour or so to flush the humid air from the enclosure. This will dry the enclosure and sensor. If still not operating correctly, call Service. Cancelled by pressing **TEMP** button.

[6-.-] **Low Humidity - Water tray out of water. (NOT on Infra-red)**

Check tray water level and refill as necessary.

[7-.-] **CO₂ Sensor damaged, broken or out of calibration**

CO₂ damaged or broken or out of calibration. Recalibrate. If still not operating correctly, call Service. Cancelled by pressing **TEMP** button.

[8-.-] Moderate Electrical Noise on mains power supply

Interference has affected the microprocessor. This should occur only rarely. If persistent, check mains for Electrical Noise.

Cancelled by pressing **TEMP** button.

[9-.-] Severe Electrical Noise on Mains

As above for [8-.-] but more serious, check mains wiring and earthing. Look for outside interference. Turn off, turn on, Check Set points and recalibrate.

Cancelled by pressing **TEMP** button.

CO₂ CHANGEOVER

If the **CO₂ CHANGEOVER** option has been purchased it will allow the cabinet to automatically change from the current bottle (when empty) to the next bottle in the sequence No1-No2-No1-No2-No1 etc. The detection of a bottle being empty is determined from the recovery time to reach the CO₂ set point.

There is one alarm associated with the CO₂ control. **[2-.-]**.

Alarm **[2-.-]** is associated with the controller being unable to detect a rise in the CO₂ level in the cabinet even though it is attempting to inject CO₂. It will usually be due to the CO₂ bottle being empty.

CONTHERM SCIENTIFIC LTD
CERTIFICATE OF CONFORMANCE



This certifies that the CONTHERM equipment specified below has passed quality and performance tests according to our standard methods and procedures and has been approved for despatch to our customers. Contherm calibration equipment is traceable to a YSI Model 60 gallium melting point temperature standard.

CAT.No: 4150/4200/4400 [T]/[C] **App No:** **Date:/...../.....**
 (CO₂ Incubator)

SENSOR TYPE: INFRA-RED [] THERMAL CONDUCTIVITY []

FACTORS	TEST RESULTS	CALIBRATION
Test Temperature:		Temperature []
Probe Position:		IR CO ₂ []
Date of Test:		
Actual Recorded Temperature		
Temporal Variation		Passed []
CO ₂ tested @ 37.0°C 5.0%		Passed []

ELECTRICAL TESTS

Earthing: [] Ω Insulation: [] MΩ
 Flash: [N/A] Leakage: [] Ma

The electrical tests are satisfactory: []

Signature of Test Personnel

CONTHERM SCIENTIFIC LIMITED
NEW ZEALAND

PACKING INSTRUCTIONS

Installation Quality Check List (IQ)
(Leave with Cabinet & Retained by Customer)



CAT.No: 4150/4200/4400 [T]/[C]
(CO₂ Incubator)

App No:

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

<u>Accessories Supplied</u>	<u>Qty</u>	<u>(IQ)Checked</u>
Operating Manual	[]	[]
Shelf Runners (pairs)	[]	[]
Shelves	[]	[]
IEC Mains Lead	[]	[]
Water Tray	[]	[]
Other.....	[]	[]
Cabinet Undamaged when Packed <i>(No dents, scratches or obvious damage)</i>	[]	When Received []
Certificate of Conformance Completed <i>(Factory test sheet attached)</i>	[]	[]
Ensure cabinet has been fully tested and approved for packing .	[]	[]
Ensure data plates are fitted.	[]	[]
Interior and exterior clean.	[]	[]
Cabinet Installed as per installation Instructions: (See SECTION 3 of the operating manual)		[]

Installation Verification (IQ) Satisfactory: [Y][N]

PACKED BY

(IQ)CHECKED BY

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

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

OPERATION VERIFICATION INSTRUCTIONS

Operational Quality Check List (OQ)
(Retained by Customer)



CAT.No: 4150/4200/4400 [T]/[C]
(CO₂ Incubator)

App No:

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

<u>Operation.....</u>	<u>(OQChecked)</u>	<u>Comments</u>
LED Display working <i>(Manual SECTION 4)</i>	[]	
Able to adjust SET POINTS <i>(Manual SECTION 4 – set for 37.0°C)</i>	[]	
Check door switch operation <i>(Open outer door – ‘DOOR’ LED comes ON & Motor stops)</i>	[]	
Temperature within $\pm 0.5^{\circ}\text{C}$ @ 37°C <i>(Allow cabinet to stabilise at temperature for 1 hour)</i>	[]	
Check HI-LIMIT Control <i>(Manual SECTION 4 – set as per described method)</i>	[]	
Check Alarm Operation <i>(Bypass door switch, Open door for 30mins after cabinet stabilised)</i>	[]	
Check Alarm Cancellation <i>(Manual SECTION 4 – Press ‘temp’ button until ‘set’ led on)</i>	[]	
Calibrate at temperature at 37°C <i>(Manual SECTION 5 – Calibration @ 37 or temperature of interest)</i>	[]	

Operational Performance (OQ) Satisfactory: [Y][N]

(OQ)CHECKED BY

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

PERFORMANCE VERIFICATION INSTRUCTIONS

Performance Quality Check List (PQ)
(Retained by Customer)



CAT.No: 4150/4200/4400 [T]/[C]
(CO₂ Incubator)

App No:

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

Operation.....

(PQChecked)

Comments

Check Temporal Variation @ 37°C

[]

(Refer manual for specification, cabinet empty, center only, see verifying cabinet performance in the manual)

Performance Verification (PQ) Satisfactory: [Y][N]

(PQ)CHECKED BY

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

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 4150/4200/4400 [T]/[C]**

Appliance No:

Date Installed:

Company:

.....

.....

COUNTRY:

Contact Name:

PHONE: **Email:**