Thermo
ELECTRON CORPORATION

# Model 310 Series*

## Forma Direct Heat $CO^2$ Incubator

**Operating and Maintenance Manual**
**Manual No: 7000310 Rev. 13**

***Refer to listing of all models on Page i.***


Fisher Scientific
Part of Thermo Fisher Scientific

| | | | | | |
|---|---|---|---|---|---|
| **Belgique / België** | tél 056 260 260 | fax 056 260 270 | be.fisher@thermofisher.com | www.be.fishersci.com |
| **España** | tfno 91 515 92 34 | fax 91 515 92 35 | es.fisher@thermofisher.com | www.es.fishersci.com |
| **France** | tél 03 88 67 53 20 | fax 03 88 67 11 68 | fr.commande@thermofisher.com | www.fr.fishersci.com |
| **Italia** | tel 02 953 28 258 | fax 02 953 27 374 | it.fisher@thermofisher.com | www.it.fishersci.com |
| **Netherlands** | tel 020 487 70 00 | fax 020 487 70 70 | nl.info@thermofisher.com | www.fishersci.nl |
| **Portugal** | tel 21 425 33 50 | fax 21 425 33 51 | pt.fisher@thermofisher.com | www.pt.fishersci.com |
| **Suisse / Switzerland** | tél 056 618 41 11 | fax 056 618 41 41 | info.ch@thermofisher.com | www.ch.fishersci.com |

**Read This Instruction Manual.**

Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance.

***CAUTION! All internal adjustments and maintenance must be performed by qualified service personnel.***

**Refer to the serial tag on the back of this manual.**

| Model | $CO_2$ Sensor* | Voltage** |
|---|---|---|
| 310 | T/C | 115 |
| 311 | T/C | 230 |
| 320 | IR | 115 |
| 321 | IR | 230 |
| 350† | T/C | 115 |
| 351† | T/C | 230 |
| 360† | IR | 115 |
| 361† | IR | 230 |

*T/C is a thermal conductivity sensor. IR is an infrared sensor.

**All units are 50/60 Hz.

†Copper interior



***If the incubator is not used in the manner specified in this operating manual, the protection provided by the equipment design may be impaired.***


**MANUAL NUMBER 7000310**

| REV | ECR/ECN | DATE | DESCRIPTION | By |
|---|---|---|---|---|
| 13 | 21980/IN-3156 | 11/7/03 | Added min/max load and max external cable length for analog output boards | ccs |
| 12 | 21273/IN-3147 | 10/13/03 | Factory default of gas guard to ON from OFF. | ccs |
| 11 | 21574/IN-3124 | 8/12/03 | Temp sensor updated from 290137 to 290184 (glass encapsulated) | ccs |
| -- | 20959/IN-3048 | 10/1/02 | Added spacers to power supply mounting | ccs |
| 10 | 20750/SI-8485 | 6/14/02 | Updated IR sensor cable restraining strap on sensor assembly mount | ccs |
| 9 | 20221/IN-2959 | 3/1/02 | Updated 203 drawing for use with Models 5060 and 5050 Series (display bd) | ccs |
| -- | 20599/IN-3019 | 2/19/02 | Updated 203 drawing - hardware from mounting bracket to control panel | ccs |
| 8 | 20374/IN-2994 | 11/7/01 | Updated 203 drawing - Kaizen, board hardware | ccs |
| -- | 20214/IN-2958 | 8/14/01 | Updated 310-202 drawing, new one-piece injection molded blower scroll | ccs |
| -- | 20050/IN-2944 | 5/16/01 | Added artwork to show location of temp probe when installed, step to verify | ccs |
| -- | -- | 3/26/01 | Added instructions to remove door before stacking per R. Wager | ccs |
| 7 | 19769 | 01/05/01 | Max temp on overtemp setpoint is 55°C, not 60°C (Section 1.6b) | ccs |

***Important operating and/or maintenance instructions. Read the accompanying text carefully.***

***Ce symbole attire l'attention de l'utilisateur sur des instructions importantes de fonctionnement et/ou d'entretien. Il peut être utilisé seul ou avec d'autres symboles de sécurité. Lire attentivement le texte d'accompagnement.***

***Wichtige Betriebs- und/oder Wartungshinweise. Lesen Sie den nachfolgenden Text sorgfältig.***

***Importante instruccions de operacion y/o mantenimiento. Lea el texto acompanante cuidadosamente.***

***Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.***

***Ce symbole attire l'attention de l'utilisateur sur des risques électriques potentiels. Seules des personnes qualifiées doivent appliquer les instructions et les procédures associées à ce symbole.***

***Gefahr von Stromschlägen. Nur qualifizierte Personen sollten die Tätigkeiten ausführen, die mit diesem Symbol bezeichnet sind.***

***Potencial de riesgos electricos. Solo personas das capacitadadas deben ejecutar los procedimientos asociadas con este simbulo.***

- √ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- √ Always dissapate extreme cold or heat and waer protective clothing.
- √ Always follow good hygiene practices.
- √ Each individual is responsible for his or her own safety.

## Do You Need Information or Assistance on Thermo Electron Corporation Products?

If you do, please contact us 8:00 a.m. to 6:00 p.m. (Eastern Time) at:

| | |
|---|---|
| 1-740-373-4763 | Direct |
| 1-888-213-1790 | Toll Free, U.S. and Canada |
| 1-740-373-4189 | FAX |
| http://www.thermo.com/forma | Internet Worldwide Web Home Page |
| service@thermoforma.com | Service E-Mail Address |

Our **Sales Support** staff can provide information on pricing and give you quotations. We can take your order and provide delivery information on major equipment items or make arrangements to have your local sales representative contact you. Our products are listed on the Internet and we can be contacted through our Internet home page.

Our **Service Support** staff can supply technical information about proper setup, operation or troubleshooting of your equipment. We can fill your needs for spare or replacement parts or provide you with on-site service. We can also provide you with a quotation on our Extended Warranty for your Thermo products.

Whatever Thermo products you need or use, we will be happy to discuss your applications. If you are experiencing technical problems, working together, we will help you locate the problem and, chances are, correct it yourself...over the telephone without a service call.

When more extensive service is necessary, we will assist you with direct factory trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

Thermo Electron Corporation
Controlled Environment Equipment
Millcreek Road, PO Box 649
Marietta, OH 45750

International customers, please contact your local Thermo Electron distributor.

## Table of Contents

# Section 1 - Installation and Start-up

## 1.1 Incubator Components

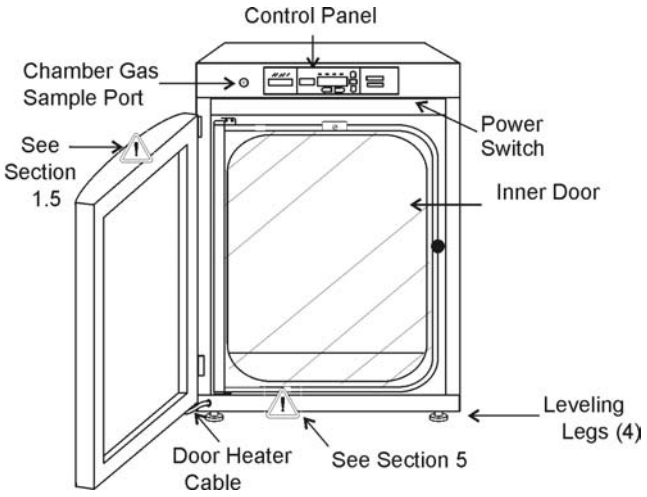



**Figure 1-1**
**Model 310 Series Direct Heat Incubator**

- Outer Door - Reversible to opposite swing, see Section 5.5
- Inner Door - Reversible to opposite swing, see Section 5.5
- Chamber Gas Sample Port - Used for sampling chamber $CO_2$ content using a FYRITE or similar instrument.
- Main Power Switch
- Control Panel - Keypad, Displays and indicators (See Figure 1-2)
- Leveling Legs - Used to level the unit

**Note:** The incubators are stackable. See Section 1.5.b.

## 1.2 Control Panel Keys, Displays and Indicators (See Figure 1-2)

1. **Silence** - Silences the audible alarm.
2. Alarm Indicator - Light pulses on/off during an alarm condition in the cabinet.
3. **Mode** Select Switch - Used to select Run, Setpoints, Calibration and System Configuration Modes.
4. Message Center - Displays system status.
5. **Mode** Select Indicators -

   **Run:** Run Menu

   **Set:** Set Points Menu

   **Cal:** Calibrate Menu

   **Config:** Configuration Menu
6. Up and Down Arrows - Increases or decreases the number values, toggles between choices.
7. **Enter** - Stores the value into computer memory.
8. **Heat** Indicator - Lights when power is applied to the heaters.
9. **Temp** Display - Program to display temperature continuously, RH continuously (with RH option), or toggle between temperature and humidity (with RH option). See Section 3.1, Configuration.
10. **Scroll for Parameters** Arrows - Moves the operator through the choices of the selected mode.
11. $CO_2$ **Inject** Indicator - Lights when $CO_2$ is being injected into the incubator.
12. **% CO2** Display - Displays $CO_2$ percentage continuously.

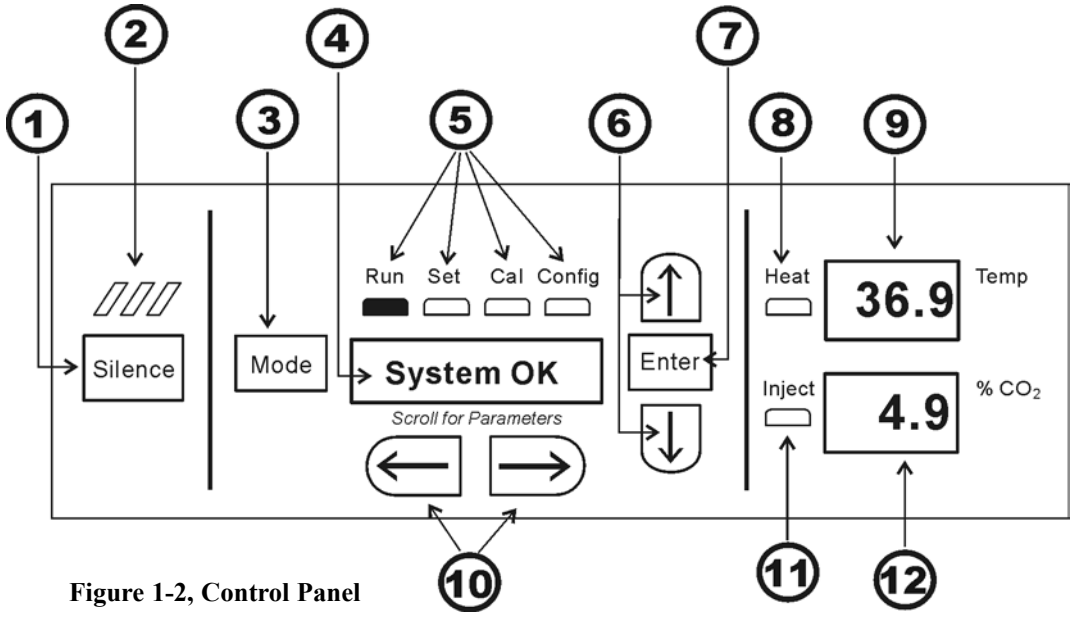
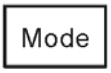



**Figure 1-2, Control Panel**

## 1.3 Operation of the Keypad




The Model 310 Series direct heat incubator has four basic modes which allow incubator setup: Run, Setpoints, Calibration and System Configuration.

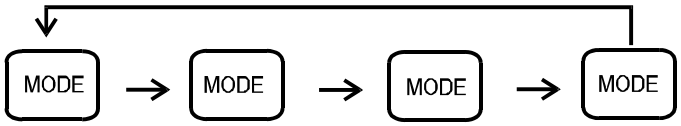
**Run** is the default mode which the incubator will normally be in during operation.

**Set** is used to enter system setpoints for incubator operation.

**Calibration** is used to calibrate various system parameters.

**Configuration** allows for custom setup of various options.

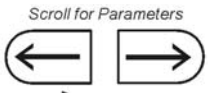
The chart below shows the selections under each of the modes.




| RUN | SETPOINT | CALIBRATION | CONFIGURATION |
|---|---|---|---|
| **Default Mode** | **Temperature** | **Temp Offset** | **Audible** |
| | **Overtemp** | **$CO_2$ Cal**[1] | **Access Code** |
| | **$CO_2$** | **IR Cal**[2] | **Temp Lo Alarm** |
| | | *RH Cal* | **Temp Relay** |
| | | | **$CO_2$ Lo Alarm** |
| | | | **$CO_2$ Hi Alarm** |
| | | | **$CO_2$ Relay** |
| | | | **$CO_2$ Z & S #'s *** |
| | | | *RH Lo Alarm* |
| | | | *RH Relay* |
| | | | *Display Temp* |
| | | | *Display Rh* |
| | | | *Tank Select* |
| | | | *Gas Guard* |
| | | | **RS485 Address** |

[1] T/C units only
[2] IR units only

Base Unit Displays
Option Displays
*T/C units only




**Scroll for Parameters Arrows:** Steps the operator through the parameters of SET, CAL and CONFIG Modes. The right arrow goes to the next parameter, the left arrow returns to the previous parameter.

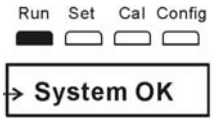

**Up Arrow:** Increases or toggles the parameter value that has been selected in the SET, CAL, and CONFIG Modes.

**Enter:** Must press Enter key to save to memory all changed values.

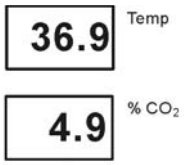
**Down Arrow:** Decreases or toggles the parameter values that have been selected in the SET, CAL and CONFIG Modes.


**Silence Key:** Press to silence the audible alarm. See Section 4 for alarm ringback times.

## 1.4 Displays




**Message Center:** Displays the system status (Mode) at all times. Displays SYSTEM OK during normal operation, or alarm messages if the system detects an alarm condition. See Section 4.1, Alarms.




**Upper and Lower Displays:** These 7 segment displays vary depending upon the options present and the configuration chosen. The upper display can display temp or RH, or toggle between them. The bottom display shows $CO_2$ continuously.

## 1.5 Installing the Incubator

### a. Choosing the Location

***Single and stacked units must be installed against a wall or similar structure. Maintain a three-inch clearance behind the incubator for electrical and gas hook-ups.***

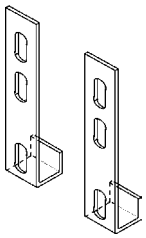
1. Locate the unit on a firm level surface capable of supporting the unit's weight of 205 lbs.
2. Locate the unit away from doors and windows and heating and air conditioning ducts.
3. Lift the unit only by the sides of the cabinet base . Do not attempt to lift it by the front and back . This places stress on the outer door hinges.

### b. Stacking the Incubators

***When stacking incubators, the direct heat incubator must be the top unit. Never stack a water-jacketed incubator on top of a 310 Series unit.***

***With incubators in a stacked configuration, do not leave both exterior doors open at the same time.***

***If the units have been in operation, shut them both off and pull the plugs before beginning any service work.***



**Note:** Two stacking brackets (shown at left) are included in the parts bag shipped with each incubator.

**Figure 1-3**

1. Unscrew the slotted head screws on the top of the bottom incubator about an inch. Refer to Figure 1-4.

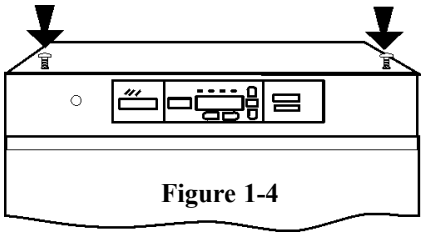


**Figure 1-4**

2. Remove the kickplate from below the door on the top incubator (Figure 1-5). Two Phillips screws secure the plate. Note that the bottom of the incubator frame is notched.
3. Disconnect the door cable from the connector behind the plate. Lift the door off the hinge pins and set it aside. The hinge pins are not attached to the brackets and may fall out when the door is lifted off.
4. Unscrew and remove the leveling feet from the top unit and lift it onto the bottom unit, offsetting the base of the top unit approximately 2-3 inches behind the screws identified by the arrows in Figure 1-4.

***This incubator weighs 205 lbs. Have sufficient personnel when lifting. Lift the unit only by the sides of the cabinet base. Do not attempt to lift it by the front and back as this places stress on the outer door hinge.***

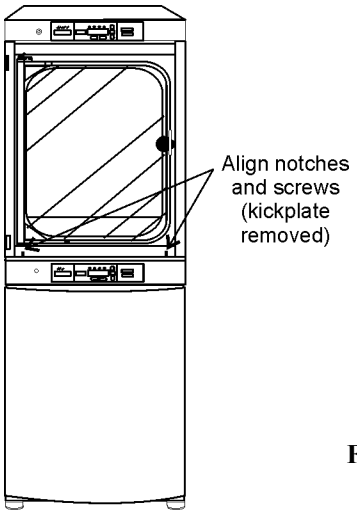



**Figure 1-5**

5. Align the sides of the top unit with the bottom unit and slide the top unit forward until the notches in the base of the top unit align with the (2) slotted screws in the top of the bottom unit.
6. Remove the four nylon plugs on the lower portion of the back of the upper incubator.
7. Insert the stacking brackets into the slots on the back of the control panel of the bottom unit as shown in Figure 1-6. Align the slots in the brackets with the mounting holes on the back of the top incubator. Secure the brackets with the screws provided in the stacking kit.

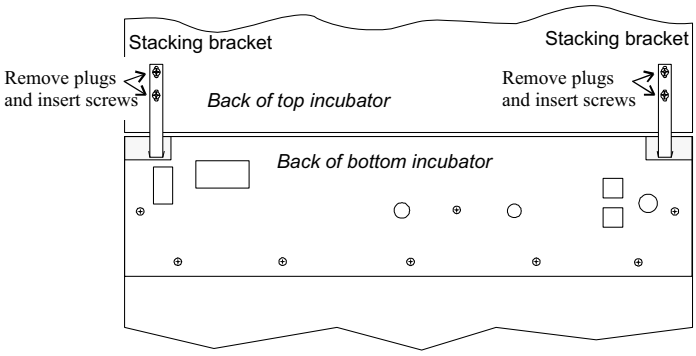



**Figure 1-6**

8. Make sure the hinge pins are in the hinge brackets. Slide the door onto the hinge pins.
9. Install the door heater cable to the connector below the door and replace the kick plate on the top unit, taking care not to crimp the cable.
10. The stacked incubators are ready for service.

### c. Preliminary Cleaning and Disinfecting

Using a suitable laboratory disinfectant, disinfect all interior surfaces including shelves and shelf supports, door gaskets, blower wheel and $CO_2$ sensor. Refer to Section 5.1.

### d. Installing the Shelves

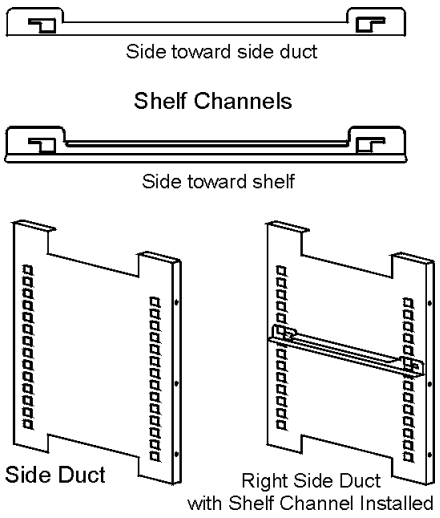



**Figure 1-7**

1. Install the large sheet metal shelf supports with the tabs facing into the center of the chamber with their slots up. There are no right side or left side supports, simply turn one of them to fit the opposite side. Tilt the shelf supports as they are placed in the chamber so the tops fit into the top air duct, then guide them into the vertical position. Figure 1-7 shows the support as it would be oriented for the right side of the chamber.
2. Referring to Figure 1-7, note that there is no difference in the left side and right side shelf channels.
3. Install the shelf channels by placing the channel's rear slot over the appropriate rear tab on the shelf support. Pull the shelf channel forward and engage the channel's front slot into the shelf support's appropriate forward tab. Refer to Figure 1-8.

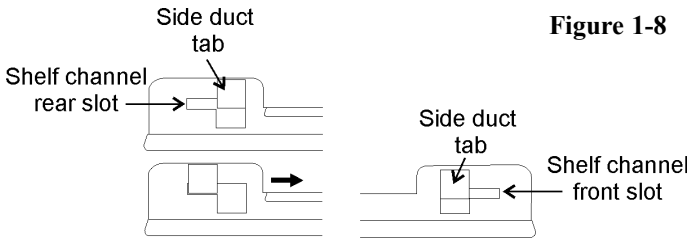



**Figure 1-8**

### e. Installing the Access Port Filter

Locate the opening in the top left corner on the inside of the chamber. Remove the tape covering the opening on the outside of the unit. Locate the stopper with filter in the hardware bag. Install the assembly in the opening inside the chamber. See Figure 1-9.

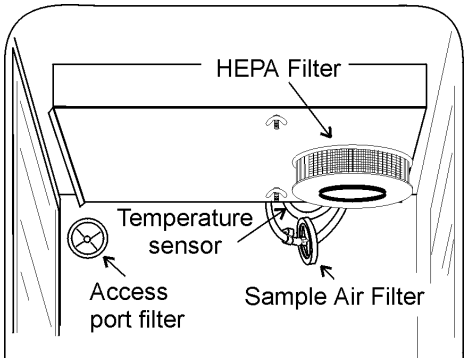



**Figure 1-9**

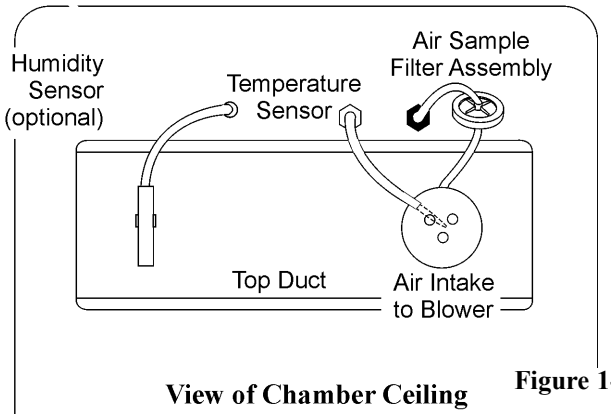
### f. Installing the (optional) HEPA Filter

***Use caution when handling the filter. The media can be damaged if it is mishandled.***
***To avoid damage to the incubator, do not operate the unit without the HEPA filter in place.***

1. Remove the filter from the shipping box.
2. Remove the plastic coating from the filter, using caution not to touch the filter media.
3. Install the filter as shown in Figure 1-9. Refer to Section 5.6 for HEPA filter maintenance.

### g. Installing the Air Sample Filter

1. Remove the filter from the shipping bag.
2. Install the air sample filter assembly to the black hose barb behind the top duct.
3. Insert the other end of the filter assembly into the larger hole in the air intake to the blower. Refer to Figure 1-10.
4. Verify that the temperature sensor is installed into the smaller hole in the intake, as in Figure 1-10.




View of Chamber Ceiling

**Figure 1-10**

### h. Leveling the Unit

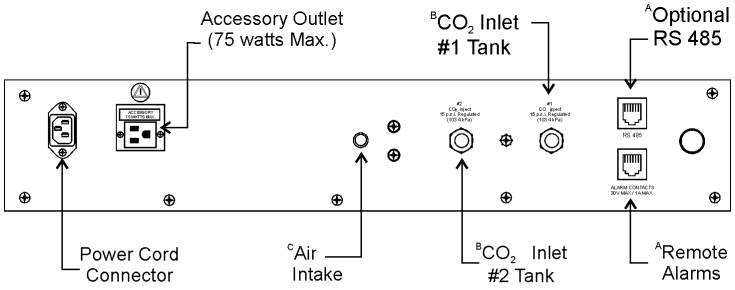
Check for level by placing a bubble style level on one of the shelves. Turn the hex nut on the leveler counterclockwise to lengthen the leg or clockwise to shorten it. Level the unit front-to-back and left-to-right.

### i. Connecting the Unit to Electrical Power

See the serial tag on the side of the unit for electrical specifications or refer to the electrical schematics at the end of this manual.

***Connect the incubator to a grounded, dedicated circuit.***
***The power cord connector is the mains disconnect device for the incubator. Position the incubator so the unit can be easily disconnected.***

Plug the provided power cord into the power inlet connector on the back of the cabinet (See Figure 1-11), then into the grounded, dedicated, electrical circuit.




[a] *RJ-II telephone style connectors*
[b] *Used with the optional Gas Guard System*
[c] *IR $CO_2$ Units only*

**Figure 1-11**

### j. Filling the Humidity Pan

Fill the humidity pan with sterile distilled water to within 1/2" of the top. Place the pan directly in the center of the incubator floor to ensure best humidity and temperature response.

For applications requiring abnormally high humidity, the pan should be placed against the left side wall of the incubator. The ductwork has been modified to allow the pan to be placed against the wall of the incubator. In some ambient conditions, this may cause condensation to form in the chamber.

For best operation of the incubator, sterilized distilled, demineralized or de-ionized water should be used in the humidity pan. Water purity should be in the resistance range of 50K Ohm/cm to 1M Ohm/cm, or a conductivity range of 20.0 uS/cm to 1.0 uS/cm. Refer to ASTM Standard D5391-93 or D4195-88 for measuring water purity.

Distillation systems, as well as some types of reverse osmosis water purity systems, can produce water in the quality range specified. Tap water is not recommended as it may contain chlorine, which can deteriorate the stainless steel. Tap water may also have a high mineral content, which would produce a build-up of scale in the reservoir. High purity, ultra pure or milli-q water is not recommended as it is an extremely aggressive solvent and will deteriorate the stainless steel. High purity water has a resistance of above 1M Ohm to 18M Ohm. Even high purity water can contain bacteria and organic contaminants. Water should always be sterilized or treated with a decontaminant, safe for use with stainless steel as well as safe for the product, prior to being introduced into the humidity pan.

Check the level and change the water frequently to avoid contamination. Do not allow the water level to fluctuate significantly. "Dry-outs" will have an adverse effect on the humidity level and $CO_2$ calibration of the T/C units.

***Distilled or de-ionized water used in the humidity pan must be within a water quality resistance range of 50K Ohm/cm to 1M Ohm/cm to protect and prolong the life of the stainless steel. Use of water outside the specified range will decrease the operating life of the unit and may void the warranty.***

### k. Connecting the $CO_2$ Gas Supply

***High concentrations of $CO_2$ gas can cause asphyxiation! OSHA Standards specify that employee exposure to carbon dioxide in any eight-hour shift of a 40-hour work week shall not exceed the eight-hour time weighted average of 5000 PPM (0.5% $CO_2$). The short term exposure limit for 15 minutes or less is 30,000 ppm (3% $CO_2$). Carbon dioxide monitors are recommended for confined areas where concentrations of carbon dioxide gas can accumulate.***

***This incubator is designed to be operated with $CO_2$ gas only. Connecting a flammable or toxic gas can result in a hazardous condition.***
***Gases other than $CO_2$ should not be connected to this equipment. $CO_2$ gas cylinders have a UN1013 label on the cylinder and are equipped with a CGA 320 outlet valve. Check the gas cylinder for the proper identification labels. The $CO_2$ gas supply being connected to the incubator should be industrial grade, 99.5% pure. Do not use $CO_2$ gas cylinders equipped with siphon tubes. A siphon tube is used to extract liquid $CO_2$ from the cylinder which can damage the pressure regulator. Consult with your gas supplier to ensure that the $CO_2$ cylinder does not contain a siphon tube. Gas cylinders should also be secured to a wall or other stationary object to prevent them from tipping.***
***A two-stage $CO_2$ pressure regulator is required to be installed on the outlet valve of the gas cylinder. Input pressure to the incubator must be maintained at 15 psig (103.4 kPa) for proper performance of the $CO_2$ control system. A single stage $CO_2$ pressure regulator will not maintain 15 psig (103.4 kPa) to the incubator as the pressure in the CO2 cylinder decreases; therefore, a two stage regulator is recommended.***
***If higher purity $CO_2$ is desired inside the incubator (greater than 99.5% pure), the pressure regulator should be constructed with a stainless steel diaphragm, along with specifying the purity of the $CO_2$ from the gas supplier. Follow the manufacturer's instructions to ensure proper and safe installation of the pressure regulator on the gas cylinder.***
***Consult your facility safety officer to ensure that the equipment is installed in accordance with the codes and regulations that are applicable in your area.***

The $CO_2$ gas supply being connected should be industrial grade 99.5% pure and should not contain siphon tubes. Install a two-stage pressure regulator at the cylinder outlet. The high pressure gauge at the tank should have 0-2000 psig range. The low pressure gauge, at the incubator inlet, should have a 0-30 psig range. Input pressure to the incubator must be maintained at 15 psig (103.4 kPa).

The incubator has serrated fittings on the back of the cabinet to connect the gas supply. Refer to Figure 1-12. The fitting is labeled $CO_2$ Inlet #1 Tank. Make sure that the connections are secured with clamps. Check all fittings for leaks.

For units having the $CO_2$ Gas Guard option, refer to Section 6.2.

## 1.6 Incubator Start-Up

With the incubator properly installed and connected to power, the humidity pan filled, and the unit connected to gas supplies, system setpoints can be entered. The following setpoints can be entered in Set mode: Temperature, Overtemperature and $CO_2$. To enter Set mode, press the Mode key until the Set indicator lights. Press the right and/or left arrow keys until the proper parameter appears in the message center. See Chart 1-1 for more detail.

### a. Setting the Operating Temperature

All 310 Series incubators have an operating temperature range of 10°C to 50°C, depending on ambient temperature. The incubator is shipped from the factory with a temperature setpoint of 10°C. At this setting, all heaters are turned off. To change the operating temperature setpoint:

1. Press the Mode key until the Set indicator lights.
2. Press the right arrow until "Temp XX.X" is displayed in the message center.
3. Press the up/down arrow key until the desired temperature setpoint is displayed.
4. Press Enter to save the setpoint.
5. Press the Mode key until the Run indicator lights for Run mode or press the right/left arrow keys to go to next/previous parameter.

### b. Setting the Overtemp Setpoint

***The independent overtemp system is designed as a safety to protect the incubator only. It is not intended to protect or limit the maximum temperature of the cell cultures or customer's equipment inside the incubator if an overtemp condition occurs.***

Model 310 Series incubators are equipped with a secondary temperature monitoring system to monitor the air temperature inside the cabinet. This system is designed as a safety device to turn off all heaters in the event of a temperature control failure. Temperature control in the incubator will be ± 1° of the overtemp setpoint.

The factory overtemperature setpoint (default) is 40°C. However, the overtemp can be set up to 55°C in 0.5° increments.

If the incubator's operating temperature setpoint is set above the overtemp setpoint, the overtemp setpoint will automatically update to 1°C above the temperature setpoint. It is recommended that the overtemp setpoint be maintained at 1°C over the operating temperature setpoint.

To set the Overtemp setpoint:

1. Press the Mode key until the Set indicator lights
2. Press the right arrow until Otemp XX.X is displayed in the message center
3. Press the up or down arrow key until the desired Overtemp setpoint is displayed
4. Press Enter to save the setting
5. Press the Mode key until the Run indicator lights or press the right or left arrow to go to the next or previous parameter.

### c. Setting the $CO_2$ Setpoint

All T/C $CO_2$ cells are calibrated at the factory at 37°C, high humidity, and 10% $CO_2$. Therefore, if a temperature setpoint of 37° C has been entered, the humidity pan has been filled and the $CO_2$ control is to run between 0-10% with a T/C $CO_2$ sensor, the $CO_2$ setpoint may be entered immediately. Otherwise, it is important to allow the unit 12 hours to stabilize at the temperature setpoint before entering the $CO_2$ setpoint.

All models of the incubator have a $CO_2$ setpoint range of 0.0% to 20.0%. The incubator is shipped from the factory with a $CO_2$ setpoint of 0.0%. At this setting, all $CO_2$ control and alarms are turned off. To change the $CO_2$ setpoint:

1. Press the Mode key until the Set indicator lights.
2. Press the right arrow until “CO2 XX.X” is displayed in the message center.
3. Press the up/down arrows until the desired $CO_2$ setpoint is displayed.
4. Press Enter to save the setpoint.
5. Press the Mode key until the Run indicator lights to go to Run mode or press the right/left arrow keys to go to next/previous parameter.

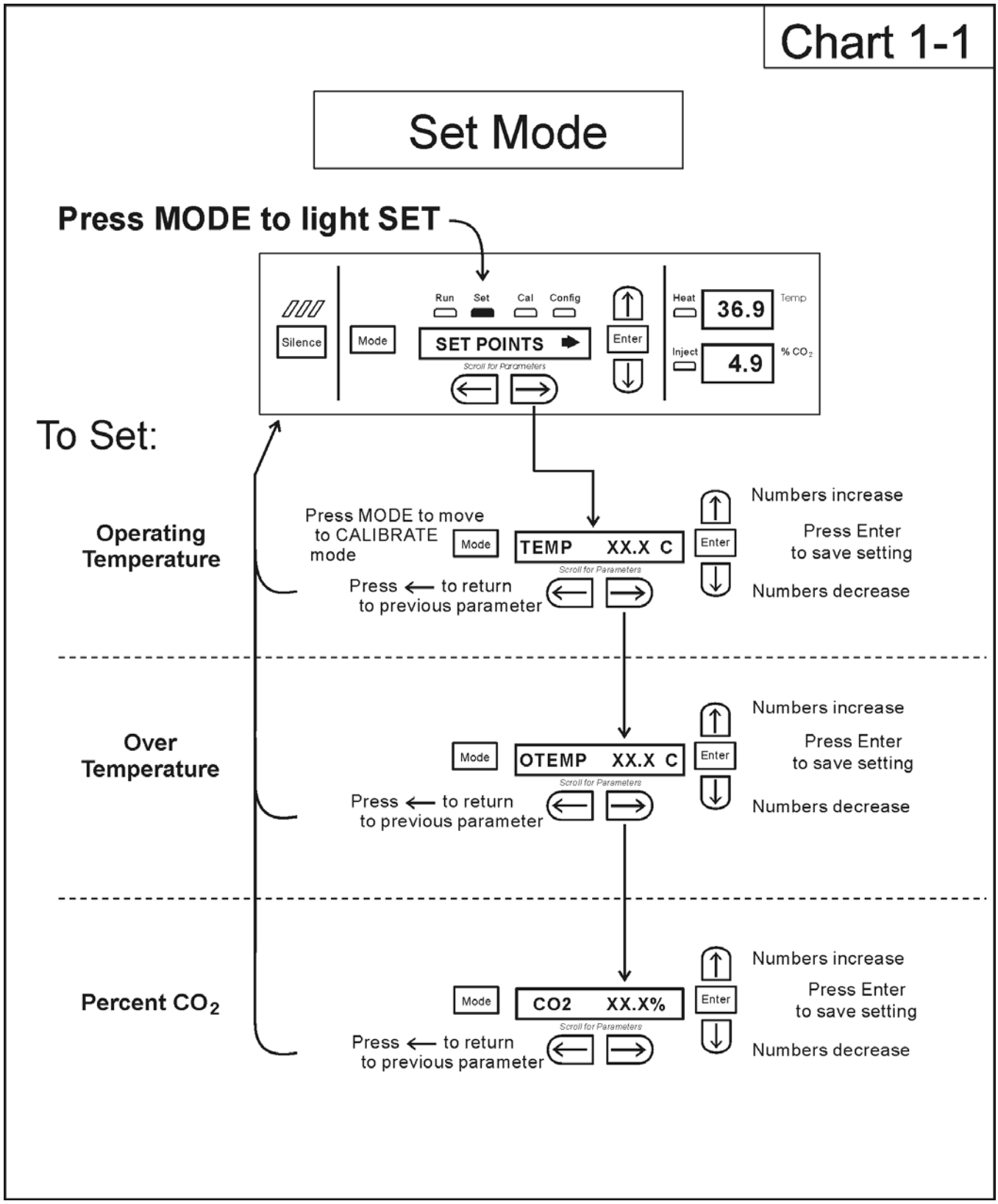


Chart 1-1
Set Mode
Press MODE to light SET
Silence
Mode
Run
Set
Cal
Config
SET POINTS
Scroll for Parameters
Enter
Heat
36.9
Temp
Inject
4.9
% CO2
To Set:
Operating Temperature
Press MODE to move to CALIBRATE mode
Mode
TEMP XX.X C
Scroll for Parameters
Press ← to return to previous parameter
Enter
Numbers increase
Press Enter to save setting
Numbers decrease
Over Temperature
Mode
OTEMP XX.X C
Scroll for Parameters
Press ← to return to previous parameter
Enter
Numbers increase
Press Enter to save setting
Numbers decrease
Percent CO2
Mode
CO2 XX.X%
Scroll for Parameters
Press ← to return to previous parameter
Enter
Numbers increase
Press Enter to save setting
Numbers decrease

# Section 2 - Calibration

## 2.1 Calibration Mode

After the unit has stabilized, several different systems can be calibrated. In the calibration mode, the air temperature, CO2 and RH levels can be calibrated to reference instruments. To access the calibration mode, press the Mode key until the Cal indicator lights. Press the right and/or left arrow until the proper parameter appears in the message center. See Chart 2-1 at the end of this section for more detail.

Calibration frequency is dependent on use, ambient conditions and accuracy required. A good laboratory practice would require at least an annual calibration check. On new installations, all parameters should be checked after the stabilization period.

Prior to calibration, the user should be aware of the following system functions. While the unit is in the calibration mode, all system control functions are stopped so the unit remains stable. Readout of the system being calibrated will appear on the message center. If no keys are pressed for approximately five minutes while in calibration mode, the system will reset to Run mode so control functions are reactivated.

***Before making any calibration or adjustments to the unit, it is imperative that all reference instruments be properly calibrated.***

### a. Calibrating the Temperature

Before calibration, allow the cabinet temperature to stabilize. Place the calibrated instrument in the center of the chamber. The instrument should be in the air flow, not against the shelf.

#### Temperature Stabilization Periods

**Startup** - Allow 12 hours for the temperature in the cabinet to stabilize before proceeding.

**Already Operating** - Allow at least 2 hours after the display reaches setpoint for temperature to stabilize before proceeding.

1. Press the Mode key until Cal indicator lights.
2. Press the right arrow until “TEMPCAL XX.X” appears in the message center.
3. Press up/down arrow to match display to calibrated instrument.
4. Press Enter to store calibration.
5. Press the Mode key to return to Run or the right/left arrow to go to next/previous parameter.

### b. Calibrating Thermal Conductivity $CO_2$ System

Models 310, 311, 350 and 351 have a thermal conductivity (T/C) $CO_2$ sensor. Thermal conductivity of the incubator atmosphere is not only effected by the quantity of $CO_2$ present but also by the air temperature and water vapor present in the incubator atmosphere. In monitoring the effects of $CO_2$, air temperature and absolute humidity must be held constant so any change in thermal conductivity is caused by a change in CO2 concentration.

Changing temperature or changing from elevated humidity to room ambient humidity levels will necessitate a re-calibration of the $CO_2$ control.

#### T/C $CO_2$ Sensor Stabilization Periods

**Start -Up** - The $CO_2$ sensor has been calibrated at the factory for 37°C and elevated humidity. Allow the temperature, humidity, and $CO_2$ levels in the chamber to stabilize at least 12 hours before checking the $CO_2$ concentration with an independent instrument.

**Presently Operating** - Make sure the chamber doors are closed. Allow at least 2 hours after the temperature and $CO_2$ displays reach their setpoints for chamber atmosphere stabilization.

1. Make sure the stabilization periods outlined above are followed.
2. Sample the chamber atmosphere through the sample port with an independent instrument. Sample the atmosphere at least 3 times to ensure accuracy of the instrument.
3. Press the Mode key until the Cal indicator lights.
4. Press the right arrow until “CO2 CAL XX.X” is displayed in the message center.
5. Press the up /down arrows to change the display to match the independent instrument.
6. Press Enter to store the calibration.
7. Press the Mode key to return to Run or the right or left arrows to go to the next/ previous parameter.

### c. Calibrating the Infrared $CO_2$ System

Models 320, 321, 360 and 361 have an infrared CO2 sensor. Infrared CO2 sensors are not effected by chamber atmosphere temperature or humidity. However, the light detector in the sensor is effected by wide temperature changes. Therefore, changing temperature setpoints could necessitate a recalibration of the CO2. Chamber temperature should be allowed to stabilize before checking $CO_2$ concentrations with an independent instrument, especially on start-up.

All models equipped with an IR/$CO_2$ sensor have an automatic calibration which occurs every 24 hours and lasts for 5 to 6 minutes. During automatic calibration, the $CO_2$ display is blanked out and HEPA filtered room air is pumped through the $CO_2$ sensor. A new $CO_2$ calibration value is stored in memory for use as the 0.0% $CO_2$ reference point. The keypad/ control panel is locked during calibration, with the message center reading “CO2 AUTO CAL”.

### IR $CO_2$ Sensor Stabilization Times

**Start-Up**- Allow the temperature and the $CO_2$ of the cabinet to stabilize at least 12 hours before proceeding.

**Presently Operating** - Allow $CO_2$ to stabilize at least 2 hours at setpoint before proceeding.

1. Measure the $CO_2$ concentration in the chamber through the gas sample port with a FYRITE or other independent instrument. Several readings should be taken to ensure accuracy.
2. Press the Mode key until the Cal indicator lights.
3. Press the right arrow until “IR CAL XX.X” appears in the message center.
4. Press the up/down arrow to adjust the display to match the independent instrument reading.
5. Press Enter to store the calibration.
6. After Enter is pressed, the unit will go into a calibration cycle that will last 5 to 6 minutes. The control panel is locked during this cycle.
7. Press the Mode key to return to Run mode.

## d. Calibrating Relative Humidity

All 310 Series incubators can be equipped with an optional direct read out relative humidity sensor. This is a readout only of the chamber relative humidity level. It does not provide any control of the relative humidity in the cabinet.

### Relative Humidity Stabilization Times

**Start-Up** - Allow 12 hours for the relative humidity and temperature in the chamber to stabilize before proceeding.

**Already Operating** - Allow at least 2 hours after temperature display reaches setpoint for relative humidity to stabilize before proceeding.

1. Place an accurate independent instrument in the center of the chamber. Allow at least 30 minutes for RH to stabilize.
2. Press the Mode key until the Cal indicator lights.
3. Press the right arrow key until “RH CAL XX” appears in the message center.
4. Press the up/down arrow to match the display to the independent instrument.
5. Press Enter to store the calibration.
6. Press the Mode key to return to Run mode.

If a reliable RH measuring device is not available, you may calibrate the display to a typical level;

1. Follow the RH stabilization periods outlined above.
2. With a full humidity pan and stable temperature, the relative humidity in the chamber will be 95%.
3. Using Step 3-5 of the relative humidity sensor adjustment, adjust the display to 95%.

This calibration method should be accurate to within 5%.

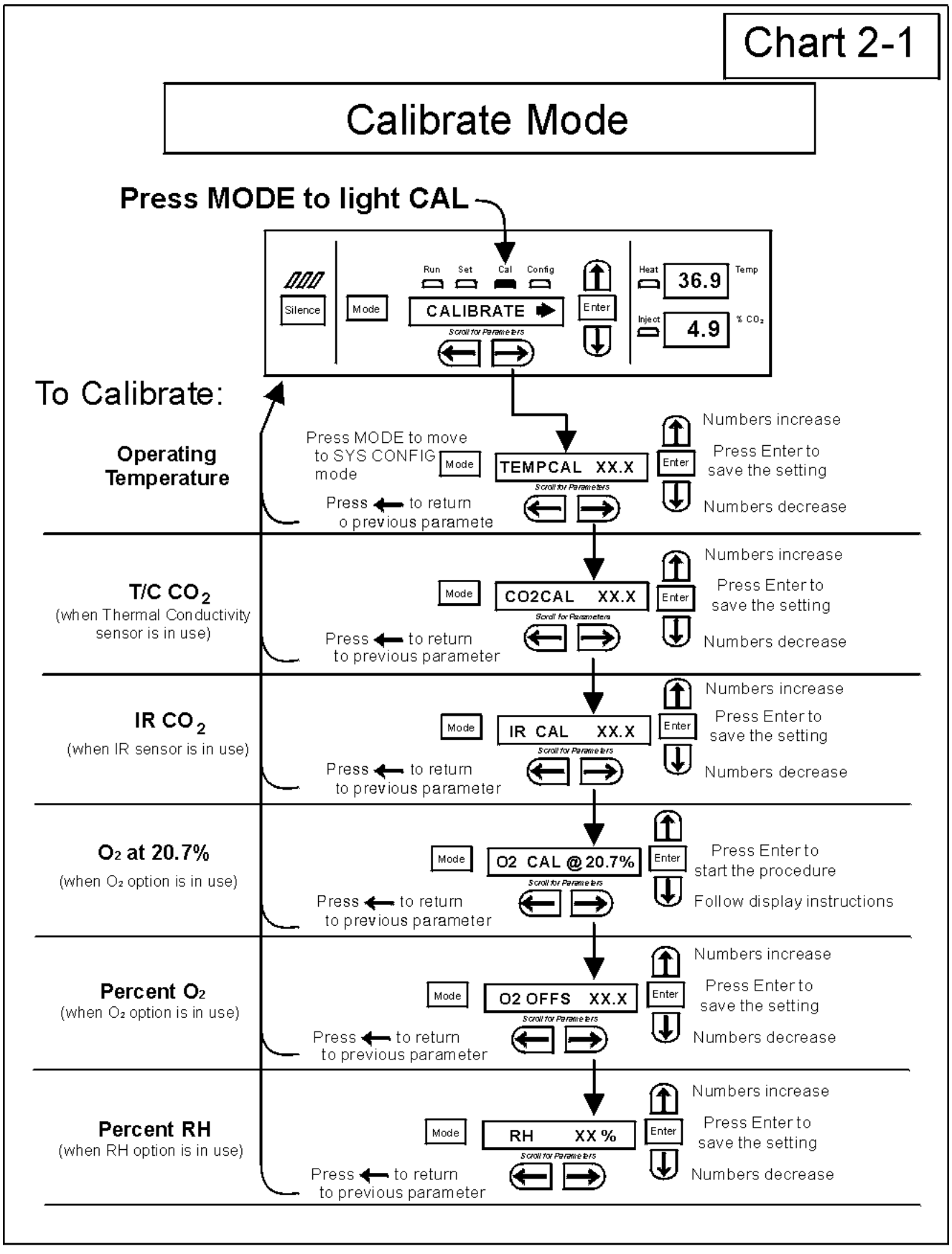


Chart 2-1
Calibrate Mode
Press MODE to light CAL
Silence
Mode
Run
Set
Cal
Config
CALIBRATE
Scroll for Parameters
Enter
Heat
36.9
Temp
Inject
4.9
% CO2
To Calibrate:
Operating Temperature
Press MODE to move to SYS CONFIG mode
TEMPCAL XX.X
Press ← to return o previous paramete
Numbers increase
Press Enter to save the setting
Numbers decrease
T/C CO2
(when Thermal Conductivity sensor is in use)
CO2CAL XX.X
Press ← to return to previous parameter
IR CO2
(when IR sensor is in use)
IR CAL XX.X
O2 at 20.7%
(when O2 option is in use)
O2 CAL @ 20.7%
Press Enter to start the procedure
Follow display instructions
Percent O2
(when O2 option is in use)
O2 OFFS XX.X
Percent RH
(when RH option is in use)
RH XX %
Chart2-1.cdr

# Section 3 - Configuration

## 3.1 Configuration Mode

Several features available in the Configuration Mode allow custom setup of the incubator. These features are listed and described below. All features may not be necessary in all applications, but are available if needed. To enter Configuration mode, press the Mode key until the Config indicator lights. Press the right and/or left arrow until the appropriate parameter appears in the message center. See Chart 3-1 for more detail.

### a. Turning the Audible Alarm ON/OFF

The audible alarm can be turned on or off. The factory setting is ON.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until Audible XXX is displayed in the message center.
3. Press up/down arrow to toggle Audible ON/OFF.
4. Press Enter to save the setting.
5. Press the Mode key to return to run mode or right/left to go to next/previous parameter.

### b. Setting an Access Code

A 3-digit Access Code can be entered to avoid unauthorized personnel from changing the setpoints, calibration, or configuration. A setting of 000 will bypass the access code. The factory setting is 000.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until Acc Code XXX is displayed in the message center.
3. Press up/down arrow to change the access code.
4. Press Enter to save the access code.
5. Press the Mode key to return to the Run mode or right/left to go to next/previous parameter.

### c. Setting a Low Temp Alarm Limit (tracking alarm)

The low temp alarm limit is the deviation from the temperature setpoint which will cause a low temp alarm. The low temp alarm is variable from 0.5° below setpoint to 5° below setpoint. The factory setting is 1° below setpoint. A minus sign (-) in the display indicates that the alarm setting is below the setpoint.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until Temp Lo -X.X is displayed in the message center.
3. Press up/down arrow to change the low temp alarm limit.
4. Press Enter to save the low temp alarm limit.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### d. Enabling the Low Temperature Alarm to Trip Contacts

The low temperature alarm can be programmed to trip the remote alarm contacts. A setting of ON will cause this, a setting of OFF will not allow temp alarm to trip the contacts. The factory setting is ON.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until TMP RLY XXX is displayed.
3. Press the up/down key to toggle the setting ON/OFF.
4. Press Enter to save the setting
5. Press the Mode key to return to Run or the right/left arrow key to go to next/previous parameter.

### e. Setting a Low $CO_2$ Alarm Limit (tracking alarm)

The low $CO_2$ alarm limit is the deviation from the $CO_2$ setpoint which will cause a low $CO_2$ alarm. The setpoint is variable from 0.5% $CO_2$ below setpoint to 5.0% $CO_2$ below setpoint. The factory setting is 1.0% $CO_2$ below setpoint. A minus sign (-) in the display indicates that the alarm setting is below the setpoint.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until CO2 Lo -X.X is displayed in the message center.
3. Press up/down arrow to change the low $CO_2$ alarm limit.
4. Press Enter to save the low $CO_2$ alarm limit.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### f. Setting a High $CO_2$ Alarm Limit (tracking alarm)

The high $CO_2$ alarm limit is the deviation from the $CO_2$ setpoint which will cause a high $CO_2$ alarm. The setpoint is variable from 0.5% $CO_2$ above setpoint to 5.0% $CO_2$ above setpoint. The factory setting is 1.0% $CO_2$ above setpoint.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until CO2 Hi X.X is displayed in the message center.
3. Press up/down arrow to change the high CO2 alarm limit.
4. Press Enter to save the high CO2 alarm limit.
5. Press the Mode key to return to run mode or right/left to go to next/previous parameter.

### g. Enabling $CO_2$ Alarms to Trip Contacts

High and Low $CO_2$ alarms can be programmed to trip the remote alarm contacts. A setting of ON will cause this, a setting of OFF will not allow $CO_2$ alarms to trip the contacts. The factory setting is ON.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until CO2 Rly XXX is displayed in the message center.
3. Press up/down arrow to toggle the setting ON/OFF.
4. Press Enter to save the setting.
5. Press the Mode key to return to Run Mode or right/left to go to next/previous parameter.

### h. Setting a New Zero Number for T/C $CO_2$ Sensors

If a new T/C $CO_2$ sensor is being installed, the two numbers on the factory installed sticker on the T/C cell must be entered to calibrate the $CO_2$ in the unit.

**Note:** For the technician's convenience, a label containing the two numbers on the T/C cell is affixed inside the electronics drawer.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until T/CZ# XXXX is displayed in the message center.
3. Press up/down arrow to change the zero number to match the sticker.
4. Press Enter to save the setting.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### i. Setting New Span Number for T/C $CO_2$ Sensors

If a new T/C $CO_2$ sensor is being installed, the two numbers on the factory installed sticker on the T/C cell must be entered to calibrate the $CO_2$ in the unit.

**Note:** For the technician's convenience, a label containing the two numbers on the T/C cell is affixed inside the electronics drawer.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until T/CS# XXXX is displayed in the message center.
3. Press up/down arrow to change the span number to match the sticker.
4. Press Enter to save the setting.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### j. Setting a Low RH Alarm Limit

On units that have the RH option installed, a low RH alarm limit may be entered. The low RH alarm limit is the %RH in the cabinet which will cause a low RH alarm. The setpoint is variable from setpoint 0 to 90% RH The factory setting is 0% RH which will disable the alarm.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until RH Lo XX is displayed in the message center.
3. Press up/down arrow to change the RH low alarm limit.
4. Press Enter to save the RH low alarm limit.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### k. Enabling RH Alarms to Trip Contacts

The low RH alarm can be programmed to trip the remote alarm contacts. A setting of ON will cause this, a setting of OFF will not allow the RH alarm to trip the contacts. The factory setting is ON.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until RH Rly XXX is displayed in the message center.
3. Press up/down arrow to toggle the setting ON/OFF.
4. Press Enter to save the setting.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### l. Enabling Temp/RH to be Displayed

On units that are equipped with the RH option, the upper seven segment display on the control panel can be configured to display Temp continuously, RH continuously, or toggle between Temp and RH. If the units does not have RH the upper display will always display temperature. If temperature is set to ON, and the RH is set OFF temperature will be displayed continuously. If temperature is set to OFF and RH is set to ON, RH will be displayed continuously. If both are turned ON the display will toggle between the two. The factory setting will default to toggle mode if the RH option is present.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until Disp Tmp XXX or Disp RH XXX is displayed in the message center.
3. Press up/down arrow to toggle the setting ON/OFF.
4. Press Enter to save the setting.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### m. Selecting a Primary Tank w/ Gas Guard Option

On units equipped with the Gas Guard option, a primary tank can be selected. The primary tank will be either Tank 1 or 2. The factory setting is Tank1 .

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until Tnk Sel X is displayed in the message center.
3. Press up/down arrow to toggle the setting between 1 and 2 .
4. Press Enter to save the setting.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### n. Disabling the Gas Guard System

On units equipped with the Gas Guard option, the Gas Guard system may be turned ON, or OFF if it is not in use. The factory setting is ON.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until Gas Grd XX is displayed in the message center.
3. Press up/down arrow to toggle the setting ON/OFF.
4. Press Enter to save the setting.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

### o. Setting a RS485 Communications Address (1535 compatible only)

On units that have the RS485 option, direct communication with the Model 1535 alarm system can be established. Each piece of equipment connected to the 1535 must have a unique address. An address of 0-24 can be entered for the incubator. A setting of 0 is an invalid address that the 1535 will ignore. The factory setting for the RS485 address is 0.

1. Press the Mode key until the Config indicator lights.
2. Press the right arrow until RS485 XX is displayed in the message center.
3. Press up/down arrow to move the RS485 address.
4. Press Enter to save the RS485 address.
5. Press the Mode key to return to Run mode or right/left to go to next/previous parameter.

# Chart 3-1

## Configure Mode

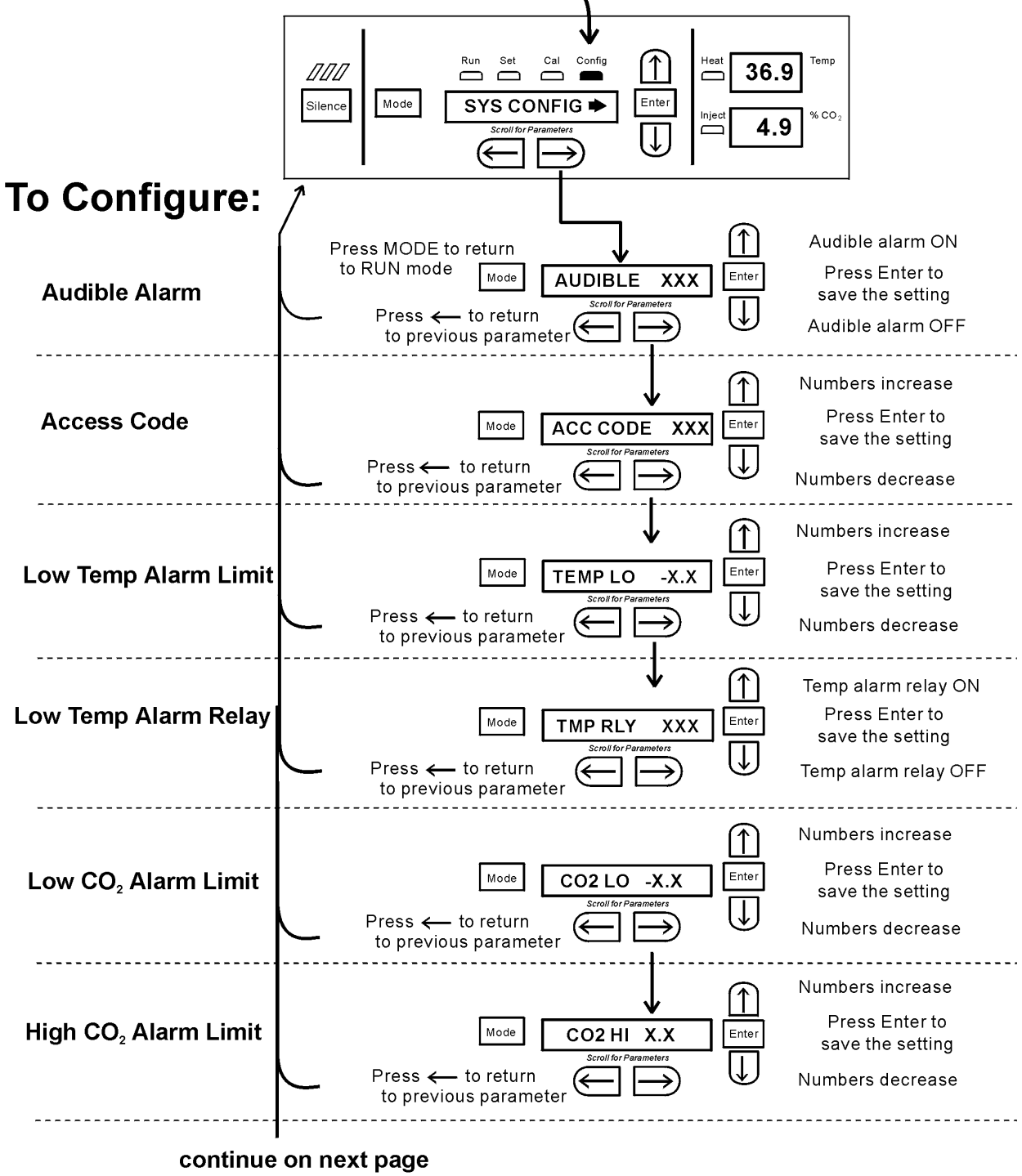



Chart3-1_1.cdr

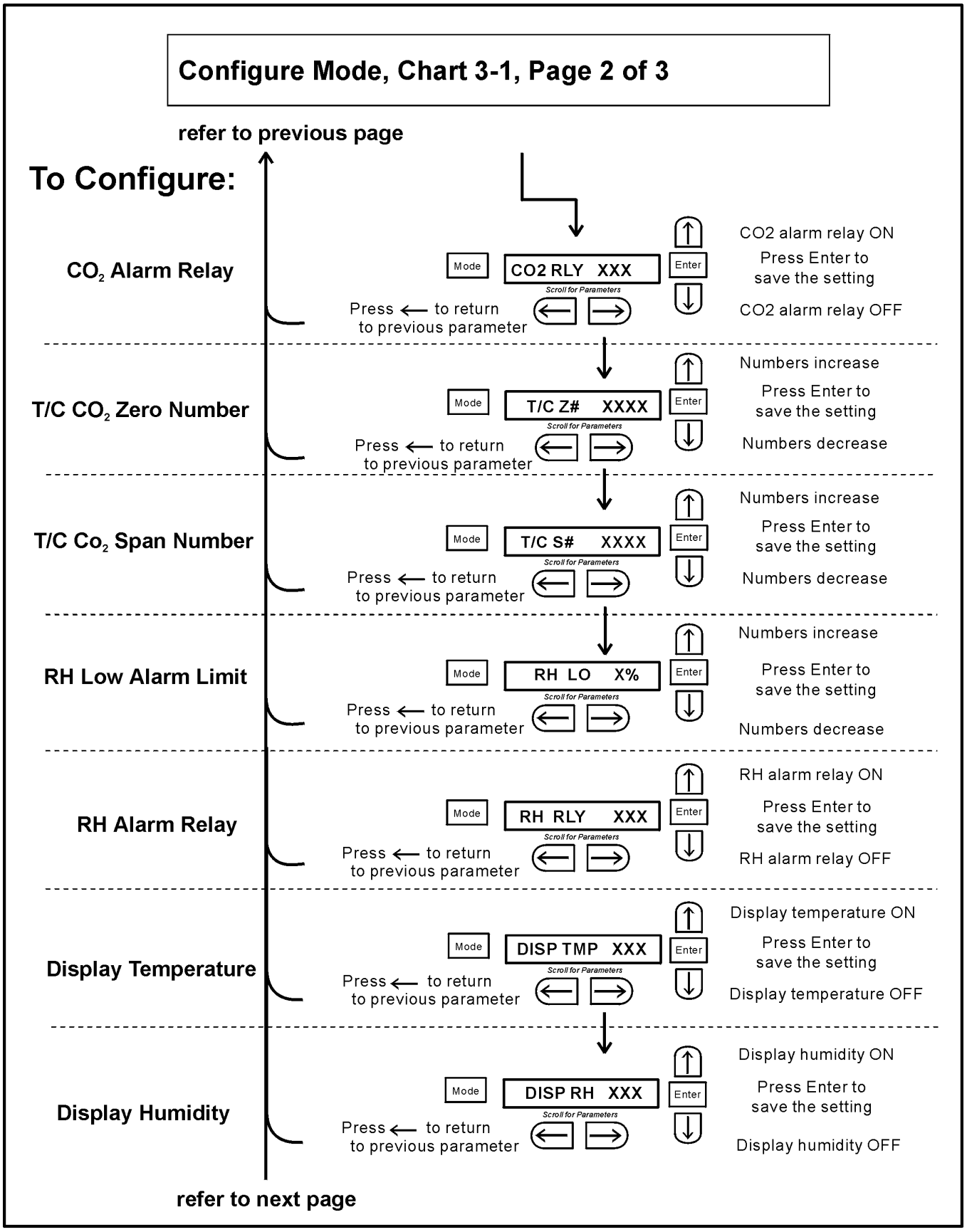
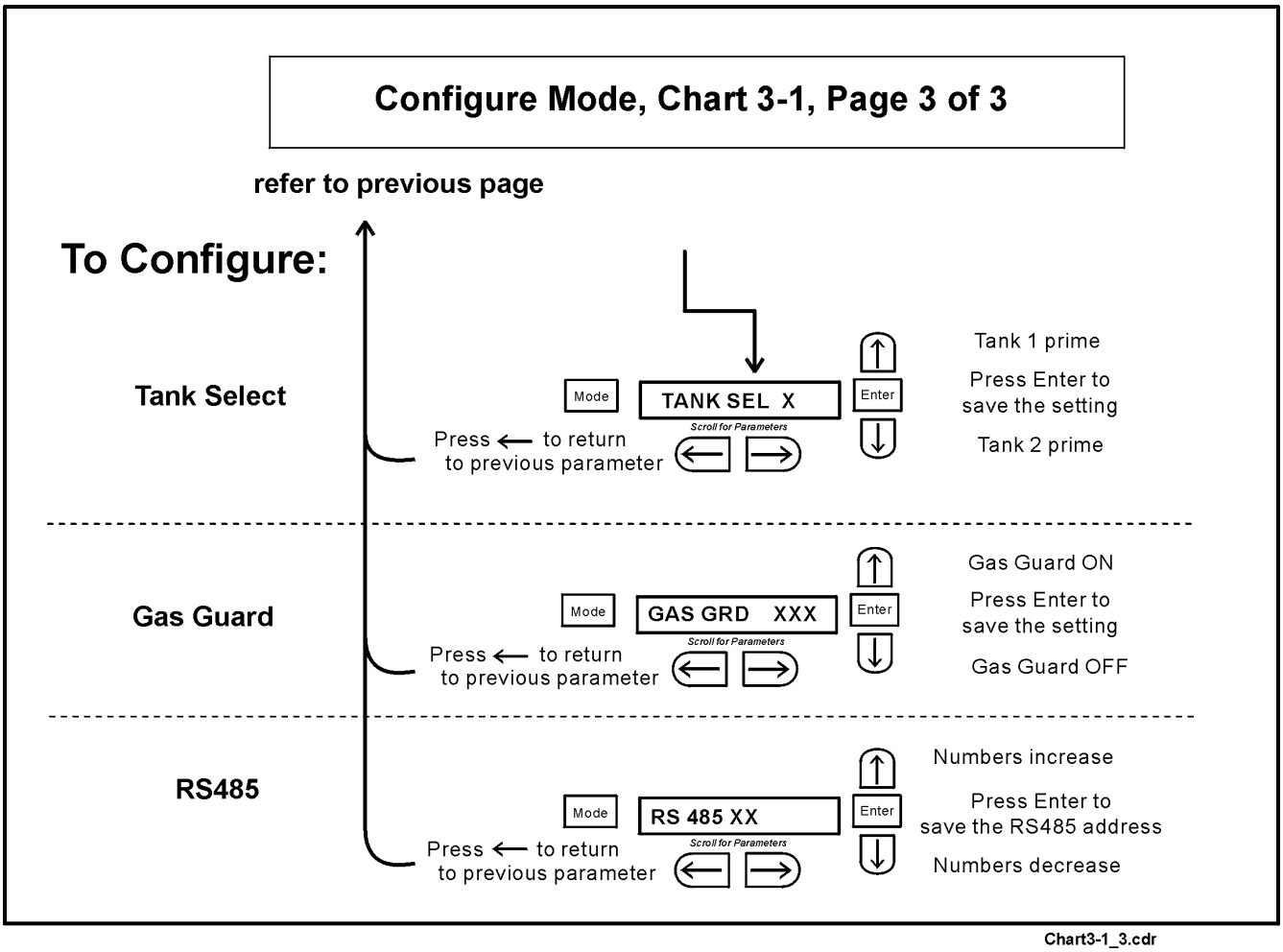



Chart3-1_2.cdr


Configure Mode, Chart 3-1, Page 3 of 3
refer to previous page
To Configure:
Tank Select
Mode
TANK SEL X
Enter
Scroll for Parameters
Press ← to return
to previous parameter
Tank 1 prime
Press Enter to
save the setting
Tank 2 prime
Gas Guard
Mode
GAS GRD XXX
Enter
Scroll for Parameters
Press ← to return
to previous parameter
Gas Guard ON
Press Enter to
save the setting
Gas Guard OFF
RS485
Mode
RS 485 XX
Enter
Scroll for Parameters
Press ← to return
to previous parameter
Numbers increase
Press Enter to
save the RS485 address
Numbers decrease
Chart3-1_3.cdr

# Section 4 - Alarms

## 4.1 Alarms

The Model 310 Series incubator alarm system is shown in the table below. When an alarm is active, the message appears in the LED message center. Pressing Silence disables the audible alarm for the ringback period. However, the visual alarm continues until the incubator returns to a normal condition. The alarms are momentary alarms only. When an alarm condition occurs and then returns to normal, the incubator automatically clears the alarm condition and the message center.

| Description | Message | Delay | Ringback | Relay |
|---|---|---|---|---|
| No alarm condition exists | SYSTEM OK | ----- | ----- | ----- |
| $CO_2$ System Auto Calibrating | CO2 AUTO CAL | ----- | ----- | ----- |
| Temp > Otemp Set point | SYS IN OTEMP | 0 min. | 15 min. | Yes |
| Air Temp Sensor Fault (See Section 4.3) | TMP SNSR ERR | 0 min. | 15 min. | No |
| Temperature Controller Failure (See Sect. 4.2) | TMP CTRL ERR | 0 min. | 15 min. | YES |
| $CO_2$ Sensor Fault (See Section 4.4) | CO2 SNSR ERR | 0 min. | 15 min. | No |
| $CO_2$ Auto Zero Fault (IR option only, See Sect 4.5) | IR AUTOZ ERR | 0 min. | 15 min. | No |
| $CO_2$ Sensor Cannot be Calibrated (IR option only, See Sect. 4.3) | REPL IR SNSR | 0 min. | 15 min. | No |
| Inner Door is Open | DOOR OPEN | 15 min. | 15 min. | No |
| $CO_2$ is higher than $CO_2$ High Tracking Alarm | CO2 IS HIGH | 15 min. | 15 min. | Programmable |
| $CO_2$ is lower than $CO_2$ Low Tracking Alarm | CO2 IS LOW | 15 min. | 15 min. | Programmable |
| TEMP is lower TEMP Low Tracking Alarm | TEMP IS LOW | 15 min. | 15 min. | Programmable |
| RH is lower than RH Low Limit Alarm (RH option) | RH IS LOW | 30 min. | 30 min. | Programmable |
| Tank 1 is low, switch to Tank 2 (Gas Guard only) | TANK1 LOW | 0 min. | ---- | No |
| Tank 2 is low, switch to Tank 1 (Gas Guard only) | TANK2 LOW | 0 min. | ---- | No |
| Both tanks are low (Gas Guard only) | TANK 1 and 2 LOW | 0 min. | 15 min. | No |

**- All alarm delays and ringback times are ±30 seconds -**

When multiple alarm conditions occur, active messages are displayed in the message center one at a time, updating at 5 second intervals. Pressing Silence during multiple alarms causes all active alarms to be silenced and to ring back in 15 minutes.

The temperature alarms are disabled when the Temp set point is 10°C. The $CO_2$ alarms are disabled when the $CO_2$ set point is 0.0%.

## 4.2 Temperature Controller Failure TMP CNTR ERR (alarm)

In addition to other safety features designed into Model 310 Series incubators, a thermostat is also provided to monitor the cabinet's temperature. In the unlikely event of a temperature control failure, the thermostat will turn off all heaters at a cabinet temperature of 65°C, +/-10%. This is intended to be a safety feature to protect the incubator, and is not intended to protect the cell cultures or the equipment inside the chamber should a temperature control failure occur.

## 4.3 Sensor Fault Alarms

The microprocessor in Model 310 Series incubators continually scans all available sensors to ensure that they are operating properly. Should an error be detected, the incubator will sound an alarm and display the appropriate message. If such an alarm occurs, contact your local distributor or the Technical Services department at 740-373-4763 or 1-888-213-1790 (USA and Canada) or fax 740-373-4189.

## 4.4 CO2 SNSR ERR

If the cables or connectors between the main microprocessor board and the $CO_2$ sensor or between the $CO_2$ board and the sensor head on the I/R $CO_2$ units become loose or disconnected, the CO2 SENS ERR alarm will occur.

**I/R Units** -

On I/R incubators, the red light on the I/R module (Refer to Figure 5-8 for the location of the module circuit board) will be lit continuously if communication is lost between the $CO_2$ board and the sensor head. The $CO_2$ display will also be locked at 00.0 without injection. Turning the incubator off and on will not clear the alarm. Only proper connections of all the components will correct the alarm.

## 4.5 IR AUTOZ ERR

On incubators equipped with I/R $CO_2$ control, calibration is done automatically using an auto zero system. Auto zero occurs once every 24 hours. If, during the auto zero cycle, a CO2 correction of more than .45% is detected, the IR AUTOZ ERR alarm will occur.

Possible problems which will cause this alarm are:

- Auto Zero pump, orifice, filter or tubing will not let air to the sensor.

  Possibilities are:
  - Defective or electrically disconnected air pump
  - Kinked auto zero vinyl tubing
  - Disconnected tubing between the air pump and the sensor
  - Plugged filter or orifice on the auto zero assembly
  - Defective auto zero circuit
- Cabinet temperature has been increased significantly from a previous setpoint. (For example, the unit was calibrated and operating at 30°C and the setpoint is increased to 50°C) Here, calibrating the $CO_2$ will correct the alarm.
- High background $CO_2$ in the laboratory. This could be from leaks in the tank, regulator or vinyl $CO_2$ tubing.
- High $CO_2$ sensor calibration drift. This will require replacement of the sensor.
- Calibration of the $CO_2$ system to less than 3% actual $CO_2$. If this has occurred, contact the Technical Services Department.

# PREVENTIVE MAINTENANCE

## Incubators

Your Forma equipment has been thoroughly tested and calibrated before shipment. Regular preventive maintenance is important to keep your unit functioning properly. The operator should perform routine cleaning and maintenance on a regular basis. For maximum performance and efficiency, it is recommended the unit be checked and calibrated periodically by a qualified service technician.

The following is a condensed list of preventive maintenance requirements. See the specified section of the instruction manual for further details.

We have qualified service technicians, using NIST traceable instruments, available in many areas. For more information on Preventive Maintenance or Extended Warranties, please contact us at the number listed below.

Cleaning and calibration adjustment intervals are dependent upon use, environmental conditions and accuracy required.

**Tips for all incubators:**

- Do NOT use bleach or any disinfectant that has high chloros
- Use sterile, distilled or demineralized water.
- Avoid spraying cleaner on the $CO_2$ sensor.
- Do not use powdered gloves for tissue cultures.

Millcreek Road, Box 649 • Marietta, Ohio 45750 USA • 740-373-4763
USA and Canada 888-213-1790 • Telefax: 740-373-4189 • http://www.service@thermoforma.com

# Preventive Maintenance for Direct Heat Incubators

| Refer to Manual Section | Action | Daily | Weekly | Monthly | 3 to 6 Months | Yearly |
|---|---|---|---|---|---|---|
| -- | Check $CO_2$ tank levels. | ✓ | | | | |
| -- | Inspect door latch, hinges and door gasket seal. | | | | | ✓ |
| 1.5i | Check water level in the humidity pan, ½" from top | | ✓ | | | |
| 2.1 | * Verify and document $CO_2$, $O_2$, humidity and temperature calibration, as applicable | | | | | ✓ |
| 5.1<br>5.4 | Perform a complete decontamination procedure. Wipe down interior, shelves and shelf supports with disinfectant. Change or clean blower wheel and scroll. Clean top duct. Clean humidity pan. Rinse everything well with sterile distilled water. | Between experiments<br>*More frequent decontamination may be required, depending on use and environmental conditions* | | | | |
| 1.5f | Change HEPA and gas filters, if applicable (*or as needed)* | | | | | ✓ |

***** Qualified service technicians only

## Section 5: Routine Maintenance

***If the unit has been in service, turn it off and disconnect the power cord connector before proceeding with any maintenance.***

### 5.1 Disinfecting the Incubator Interior

***Before using any cleaning or decontamination method except those recommended by the manufacturer, users must check with the manufacturer that the proposed method will not damage the equipment.***

Use an appropriate disinfectant. All articles and surfaces to be disinfected must be thoroughly cleaned, rinsed with sterile water, and rough dried.

***Alcohol, even a 70% solution, is volatile and flammable. Use it only in a well ventilated area that is free from open flame. If any component is cleaned with alcohol, do not expose the component to open flame or other possible hazard.***
***Do not spray the T/C sensor with flammable solutions. The internal temperature of the $CO_2$ sensor is approximately 150°C when the unit is in operation. Allow sufficient time for the sensor to cool before cleaning.***

***Do not use strong alkaline or caustic agents. Stainless steel is corrosion resistant, not corrosion-proof.***
***Do not use solutions of sodium hypochlorite (bleach) as they may also cause pitting and rusting.***

1. Remove the shelves, HEPA filter (a factory installed option), access port filter, sample air filter, left and right duct sheets and the top duct. The top duct requires the two wing nuts to be removed.
2. Set the HEPA filter aside. Wash the shelves, ducts, wing nuts and stopper with disinfectant. Optional: The shelves, ducts and wing nuts may be autoclaved.
3. Remove the blower scroll held on by four screws. Remove the blower wheel and the access port filter. If a new blower wheel and scroll are going to be used, discard the old ones. If the old ones are being reused, wash and rinse all parts with disinfectant.
4. The $CO_2$ sensor may be lowered by unscrewing the retaining ring around the sensor. This will allow the sensor gasket to be removed, cleaned and replaced. WIPE the $CO_2$ sensor, do not spray or soak.
5. Wash the inner door gasket with disinfectant. The inner door gasket may be removed and/or replaced.
6. Wash the cabinet interior with disinfectant, starting at the top and working down. Refer to the disinfectant directions for length of time needed before rinsing. Wash the inner door both inside and out. The cabinet and door must be rinsed with sterile water until the disinfectant has been removed. After the cabinet has been rinsed, spray with 70% alcohol.
7. If the $CO_2$ sensor gasket was removed, spray it with 70% alcohol and install it. Install the sample filter.
8. Install the top duct, left and right ducts, inner door gasket, and access port stopper spraying each with 70% alcohol.
9. Install new HEPA Filter.
10. Install the shelves and spray with 70% alcohol.

### 5.2 Cleaning the Cabinet Exterior

Clean the incubator exterior with a damp sponge or soft, well-wrung cloth and mild detergent dissolved in water. Dry with a soft cloth.

### 5.3 Cleaning the Glass Doors

The chamber glass door and the optional independent inner glass doors may be cleaned using the same disinfectant as used on the incubator interior. It is imperative that they be rinsed with sterile distilled water to remove the disinfectant residue. The doors should then be dried with a soft cloth.

**Some precautions in the cleaning and care of the incubator glass doors:**

Moisture leaches alkaline materials (sodium, Na) from the surface of the glass. Evaporation of the moisture concentrates the alkaline and may produce a white staining or clouding of the glass surface. Cleaning chemicals with a pH above 9 and heat (autoclaving) accelerate the corrosion process. Therefore, it is very important to rinse and dry the glass doors after cleaning. Autoclaving the glass doors should be avoided.

There is no simple method for repairing corroded glass. In most cases, the glass must be replaced.

### 5.4 Cleaning the Humidity Pan

Clean the humidity pan with soap and water and a general use laboratory disinfectant. Rinse with sterile water and spray with 70% alcohol. The humidity pan may be autoclaved.

### 5.5 Reversing the Door Swing

For side-by-side operation or changing lab layouts, the inner and outer doors are field reversible. The procedure is written from the prospective of changing the door swing from a left-hand to a right-hand swing. All screw holes are pre-drilled for reversing the door. The tools required are a Phillips screwdriver, a 1/8" Allen wrench and a flatblade screwdriver.

The door reversing procedure takes about 30 minutes.

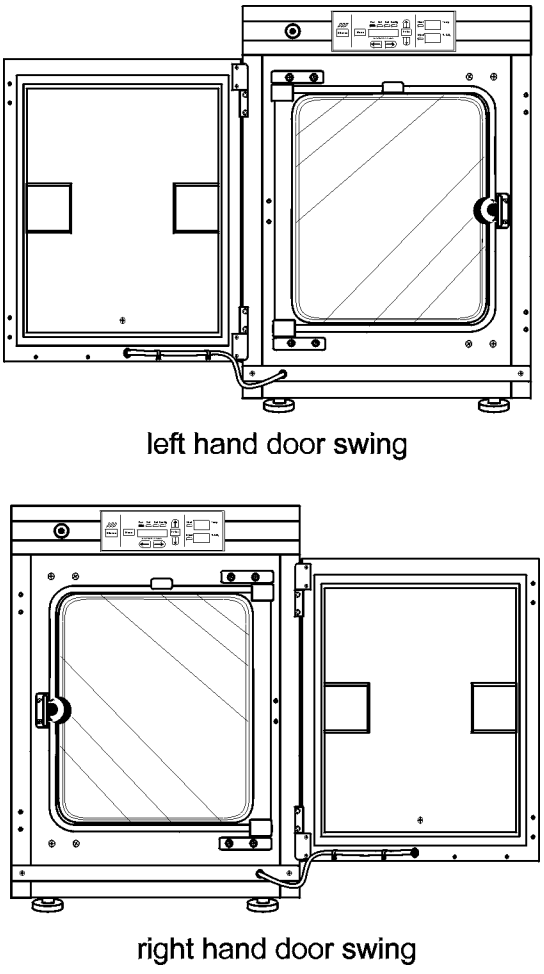



**Figure 5-1**

1. Remove the kick plate at the bottom of the cabinet by removing the two Phillips screws indicated by the black arrows in the illustration. Disconnect the cable inside the cabinet.

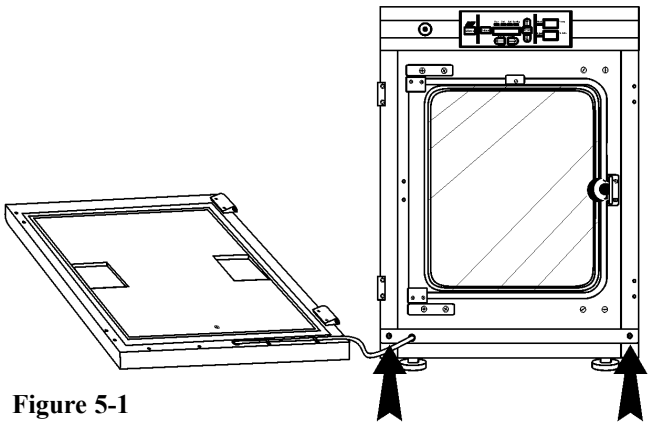


**Figure 5-1**

2. Open the outer door and remove it by lifting it off its hinge pins. Place the door on a padded surface to prevent scratches. (Figure 5-1)

Note: The hinge pins are not connected to the brackets and may fall out when the door is lifted off.

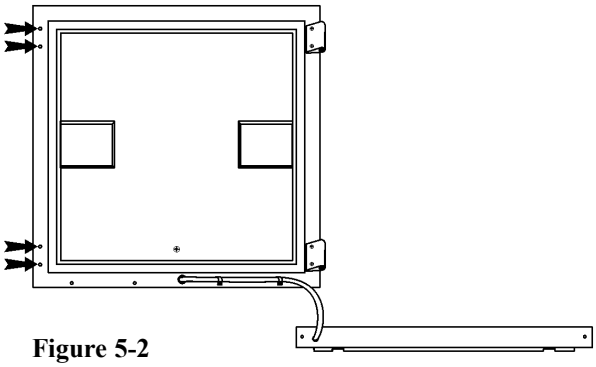


**Figure 5-2**

3. Refer to the illustration of the outer door in Figure 5-2. With a Phillips screwdriver, remove and save the four nylon screws from the door hinge mounting holes. The black arrows identify the screw locations.
4. Remove the door hinges, rotate them 180° and secure them on the left side of the door. Install the nylon screws into the newly exposed holes.
5. Remove the two plastic clips securing the door heater cable. (These clips will be rotated 180° when installed on the left lower edge of the door frame.)

6. Rotate the kick plate and attach the door heater cable with the clips as shown in Figure 5-3. The insert in the illustration shows the proper positioning of the clips.

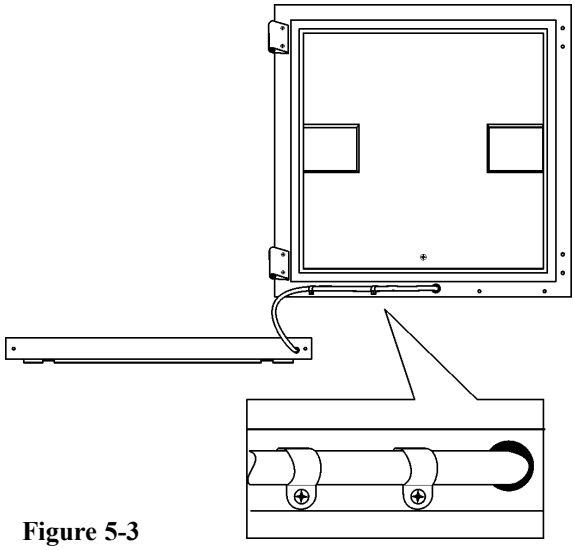


**Figure 5-3**

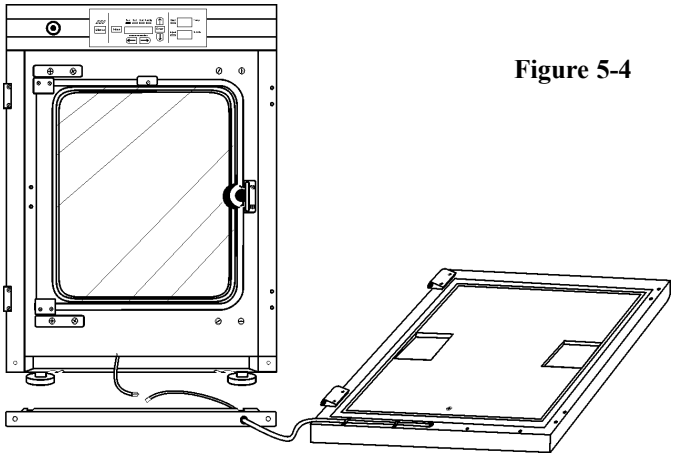


**Figure 5-4**

7. The incubator and door should look similar to Figure 5-4.
8. Remove the nylon screws along the right side of the cabinet. Remove the outer door hinges (Items 1 in Figure 5-5). Rotate them 180° and install them on the right side of the cabinet (Locations 2). Install the nylon screws in the holes vacated by the hinges.
9. With a 1/8" Allen wrench, remove the door open switch target plate on the top of the inner door (Item 3).
10. Remove the door latch striker plate (Item 4).
11. Hold the door securely and remove the upper hinge bracket on the cabinet (Item 5). This hinge bracket will be rotated 180° and be placed in the lower right corner of the cabinet at Location 8.
12. Lift the glass door from the lower hinge and set it aside. Then remove the lower hinge from the cabinet (Item 6). This hinge bracket will be rotated 180° and be placed in the upper right corner of the cabinet at Location 9.

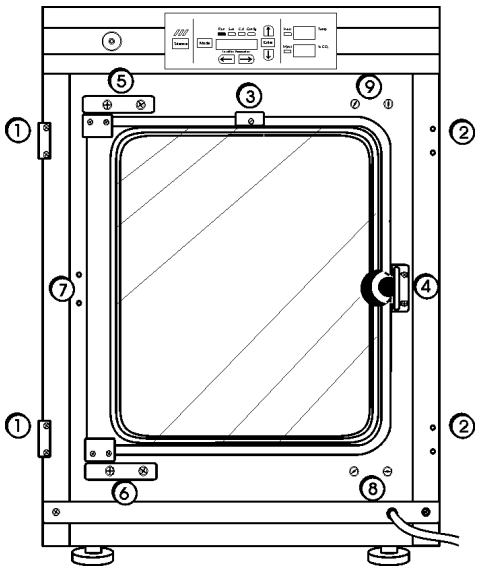



**Figure 5-5**

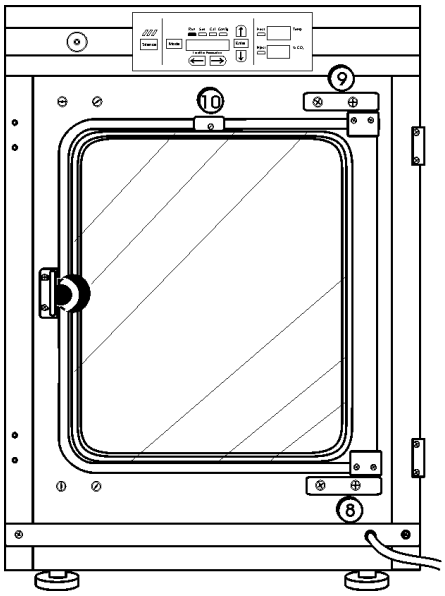



**Figure 5-6**

13. Remove the screws and washers from the new striker plate location (Item 7). These screws and washers can be threaded into the holes vacated by the striker plate at Location 4.
14. Rotate the striker plate 180° from its original position and attach it to the cabinet at Location 7.
15. Using a flatblade screwdriver, remove the threaded nylon plugs from the new hinge bracket locations (Locations 8 and 9). Install the lower hinge bracket, (Item 5 removed earlier) at Location 8.
16. Rotate the door 180° and place it in the lower hinge bracket. Install the upper hinge bracket (Item 6 removed earlier) at Location 9.

17. Screw the threaded plugs into the holes vacated by the door hinge brackets at Locations 5 and 6 identified in Figure 5-5.
18. Install the door open switch target plate, Item 10. Refer to Figure 5-7. The plate must be positioned exactly 12.5 inches from the outside edge of the cabinet to the leading edge of the plate. Do not overtighten.

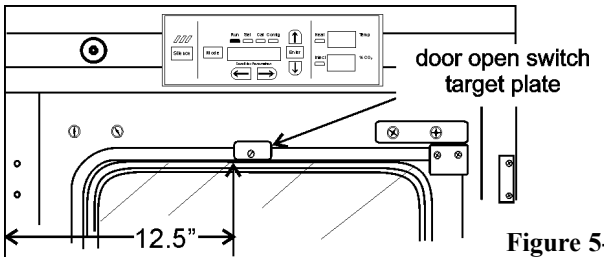



**Figure 5-7**

19. Connect the door heater cable and install the kick plate with the door heater cable on the right side.
20. Installing the outer door onto the hinge pins completes the door reversal procedure.

### 5.6 HEPA Filter Maintenance (Factory Installed Option)

Replace the HEPA filter routinely on an annual basis, or sooner if it changes color. The filter should also be changed when the chamber is cleaned. See Section 5-1.

***The electronics section contains hazardous voltages. Access to this area should only be by qualified service personnel.***

### 5.7 Replacing the Power Fuses

There are only two replaceable fuses in the incubator. To access the fuses:

1. Turn off the incubator’s power switch and unplug the power cord.
2. Open the outer door to the chamber.
3. Remove the two screws located below the control panel.
4. Lift up on the control panel, then pull it out.
5. Refer to Figure 5-8 for the location of the two fuses. (Items 21 in the illustration)
6. Slide the control panel back in, replace the screws and return the unit to service. If the fuse(s) blow after restoring power to the incubator, contact Technical Services Department at the telephone number on the cover of this instruction manual.

### 5.8 The Electronics Section

1. Turn off the incubator’s power switch and unplug the power cord.
2. Remove the two screws from the front of the cabinet top and the two screws in the uppermost corners of the back panel.
3. Slide the top about an inch to the rear and lift it off. **Note:** There are small locking tabs in the rear which will be bent if the top is lifted off without sliding it first to the rear.

### 5.9 Replacing Sample Air Filter (Figure 5-9)

1. Connect one end of the sample port filter to the ceiling port.
2. Connect the other end of the filter to the back of the blower fan inlet.

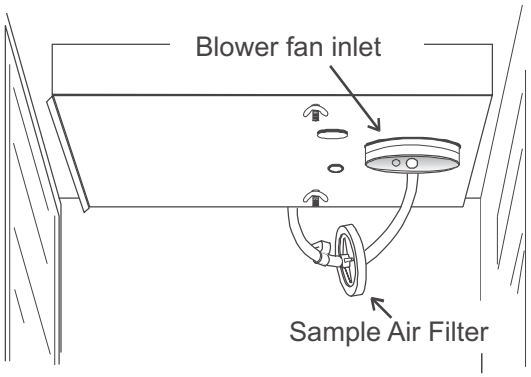



**Figure 5-9**

**Table 5-1, Fuse Replacement Chart**

| Fuse Voltage | Manufacturers Part # | Amperage Rating | Rupture Speed | IEC Letter Code |
|---|---|---|---|---|
| 115 VAC ACC | BUSS GMC - 1.0A | 1.0 Amp | Time-Lag | T |
| 230 VAC ACC | BUSS BK-GMC-500ma | 0.5 Amp | Time-Lag | T |
| 24 VAC Door Heat | Schurter 034.3124 | 5.0 Amp | Time-Lag | T |

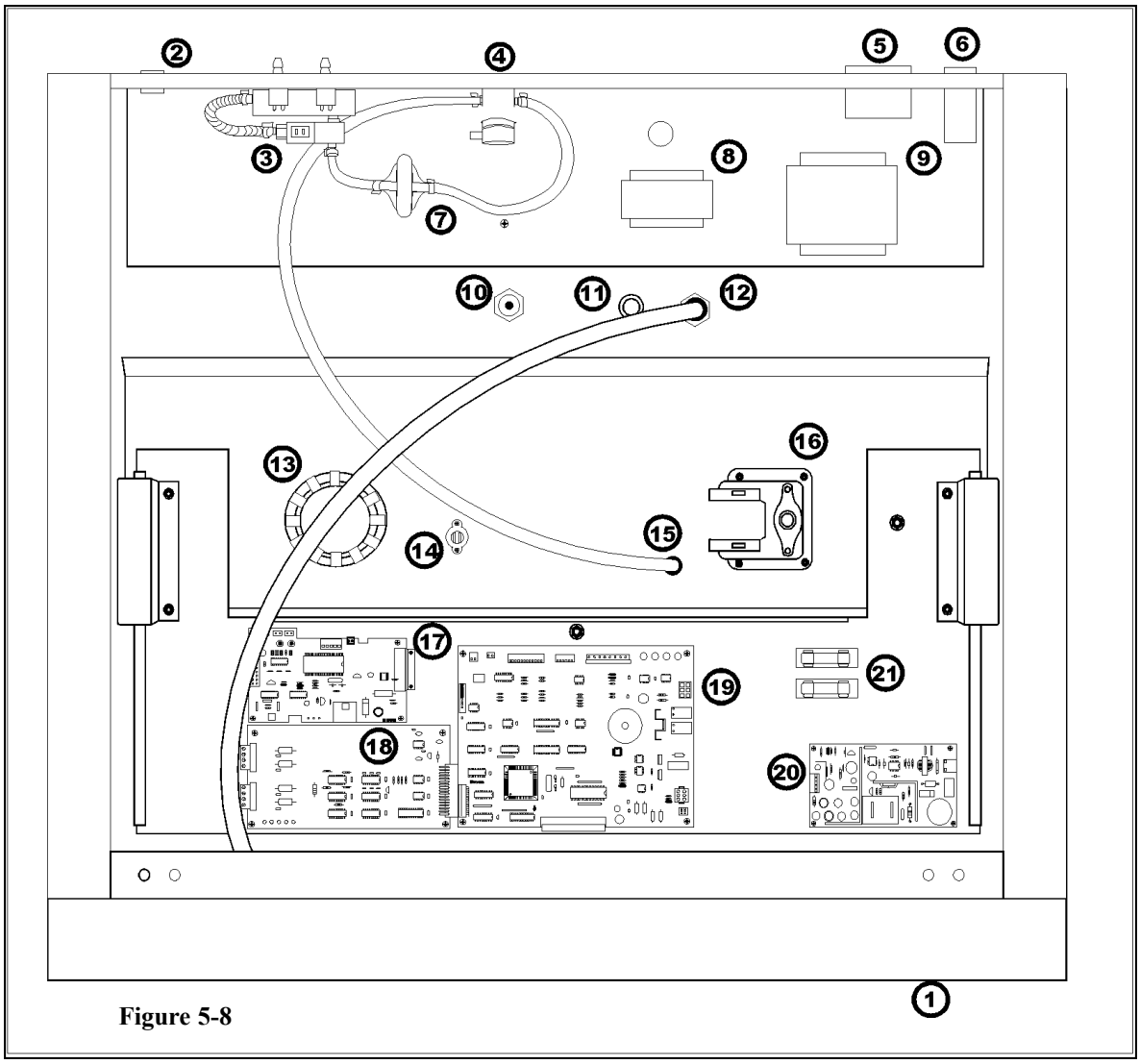



**Figure 5-8**

### a. Major Components

Refer to Figure 5-8. Some of the components shown in this illustration are factory installed options. They are identified as such in the descriptions below.

1. Power Switch - Located beneath the control panel. The outer door must be open to access the switch.
2. RS 485 and Remote Alarm Contacts -Connectors and auxiliary wire through port
3. $CO_2$ manifold and supply tank connectors -Part of the Gas Guard system, a factory installed option.
4. $CO_2$ Gas solenoid
5. Accessory outlet, 75 watts maximum
6. Filtered line cord connector
7. $CO_2$ microbiological filter
8. Power transformer, export only
9. Main power transformer
10. Humidity sensor (optional)
11. Temperature probe
12. Sample port into the chamber
13. IR/T/C $CO_2$ sensor
14. Overtemperature thermostat
15. $CO_2$ injection port
16. Blower motor
17. IR CO2 sensor board
18. Analog output board, 4-20 mA, 0-1 Volt, 0-5 Volt
19. Microprocessor board
20. Power supply board
21. Fuses

# Section 6 - Factory Options

## 6.1 Connections to External Equipment

### a. Connecting the Remote Alarm Contacts

A set of relay contacts is provided to monitor alarms through an RJ11 telephone style connector on the back of the cabinet. Refer to Figure 6-3 for the location of the alarm connector. The 12-foot telephone cord (P/N 190388) and RJ11-to-screw terminal conversion box (190392) are available through our service department.

The remote alarm provides a NO (normally open) output, an NC (normally closed) output and COM (common). Refer to Figure 6-1.

The contacts will trip on a power outage or an overtemperature condition. The contacts may also be programmed to trip or not trip on temperature alarms, $CO_2$ alarms, and RH alarms. See Section 3.1, Configuration Mode.

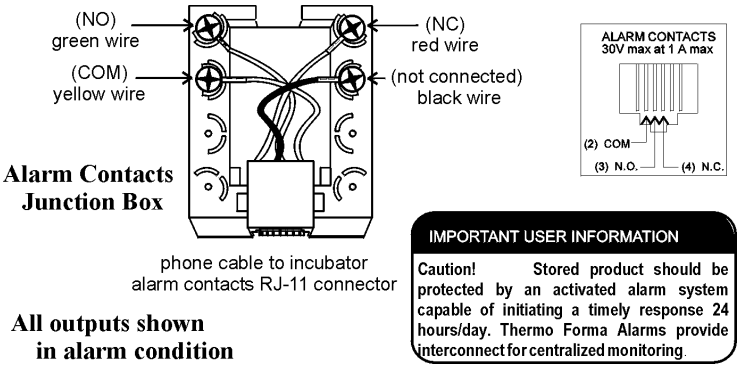



**Figure 6-1**


### b. Connecting the RS485 Interface (190523)

All incubator models can be purchased with the RS485 communications option. This option allows the incubator to be directly connected to a Model 1535 alarm system without the use of a communications module. A junction box is provided with each RS485 option. See Figure 6-2 for wiring details. Figure 6-3 shows the RS485 connector location on the back of the incubator cabinet.

To allow the incubator and the 1535 to communicate, an address must be allocated on the 1535. Refer to Section 5.8 of the 1535 operating manual. The same address number must be assigned to the incubator. Refer to Section 3.1 of this manual.

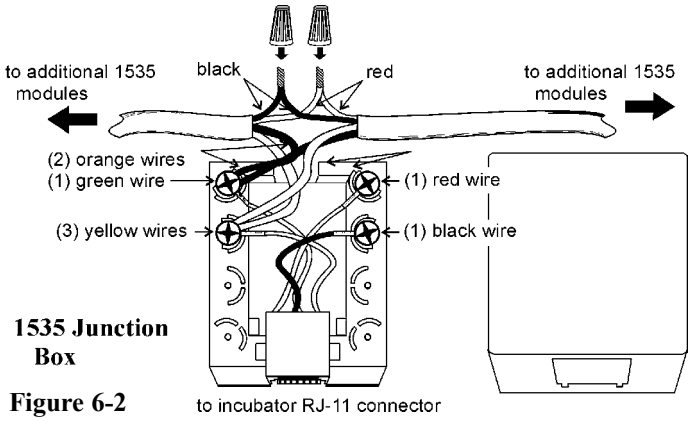



**Figure 6-2**

### c. Connecting the Analog Output Boards (190512, 190543, 190544)

***The electronics section contains hazardous voltages. Only qualified personnel should access this area.***

The analog output board is an option that allows the incubator to output analog signals representing the air temperature of the cabinet, $CO_2$ content, and relative humidity, depending upon which systems are in the incubator. There are three different analog output board options available : 0-1V, 0-5V, or 4-20mA signals. Negative display readings will output 0V. The outputs do not have isolated grounds. Refer to Table 6-1 for output specifications of the three boards.

**Table 6-1, Analog Output Board Specifications**

| | **190512 4-20 mA** Output Scaling 4-20 mA Equals | **190544 0-1V** Output Scaling 0-1 V Equals | **190543 0-5V** Output Scaling 0-5V Equals |
|---|---|---|---|
| Temperature | 0.0-100.0°C | 0.0-100.0°C | 0.0-100.0°C |
| RH | 0-100 %RH | 0-100 %RH | 0-100 %RH |
| $CO_2$ | 0.0-100.0 %$CO_2$ | 0-100.0 %$CO_2$ | 0-100.0 %$CO_2$ |

For the 0-1V and 0-5V boards, the recording device must supply a load >/= 1000ohm. For the 4-20mA board, the recording device must supply a load of </= 100 ohm.

To wire in the analog output board, a shielded 22 gauge, 3-conductor wire (P/N 73041) is recommended, with the maximum length being 50 feet (15.2m). This wire is readily available from other vendors including Alpha P/N 2403 and Deerborn P/N 972203.

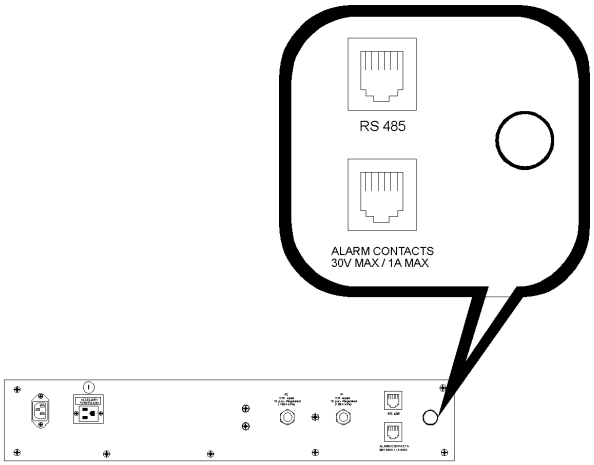



**Figure 6-3**

***Accuracy of the output at the board terminal strip to the incubator display is ±1 unit. There is no calibration from the incubator. Calibration to the incubator display must be at the instrument connected to the output board.***

To install the analog board:

1. Turn off the incubator and unplug it from the wall outlet.
2. Remove the top of the electronics section, refer to Section 5.8 of this manual.*
3. Locate the Analog Output board, Figure 6-4 and Item 18 of Figure 5-8.

* Alternate access to the electronics is to open the outer door and remove the two screws in the upper corners of the cabinet just under the display top. Lifting up the top section, the electronics drawer can be pulled out to the limit of the internal wiring.

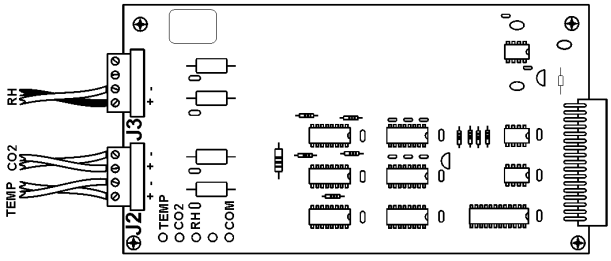



**Figure 6-4**

4. Each system monitored (Temp, CO2, RH) requires two conductors (Refer to Figure 6-4). Feed the wires through the auxiliary wire through-port on the back panel. This port is a circular fitting adjacent to the remote alarm and RS485 connectors as illustrated in Figure 6-3. The wire routing is shown by the black arrows in Figure 6-5.

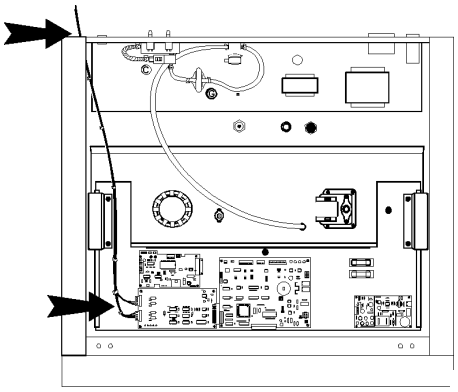


**Figure 6-5**

5. Strip the ends of each conductor and wire it to the appropriate terminals of connectors J2 and/or J3 on the analog board. (Refer to Figure 6-4)
6. When wiring is completed, slide in the electronics drawer or the replace the sheet metal cabinet top.
7. Replace the screws removed earlier and return the unit to service.

## 6.2 $CO_2$ Gas Guard (190640)

***$CO_2$ can be lethal in high concentrations. Refer to warnings in Section 1.5.j of this manual.***

The Model 310 Series incubators can be equipped with a built-in Gas Guard system that will operate with a $CO_2$ gas supply. The Gas Guard uses two pressure switches to continuously monitor the pressures of two independent $CO_2$ supplies and automatically switches from one supply to the other when the supply pressure drops below 10 psig (0.690 bar). The Gas Guard's design does not facilitate use by multiple incubators.

The $CO_2$ gas supplies must be equipped with two-stage pressure regulators with gauges. The high pressure gauge at the tank should have a 0-2000 psig range and the low pressure gauge should have a 0-30 psig range. The gas supply to the incubator must be maintained at 15 psig (1.034 bar). Gas pressures below 15 psig will cause nuisance alarms to occur on incubators equipped with the built-in Gas Guard.

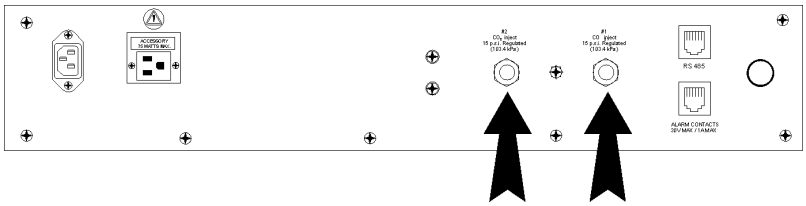



**Figure 6-6**

### a. Connecting the $CO_2$ Gas Supplies

The $CO_2$ inlets for the Gas Guard are located on the rear of the cabinet. Using 1/4" ID tubing, connect one of the $CO_2$ supply tanks to the fitting labeled $CO_2$ Inlet #1 Tank. Connect the second $CO_2$ supply tank to the fitting labeled CO2 Inlet #2 Tank. Install 3/8" hose clamps to secure the 1/4" ID tubing to the fittings on the rear of the drawer. (Refer to Figure 6-6)

### b. De-activating the Gas Guard

The built-in Gas Guard is turned ON when shipped from the factory. In addition, the Tank Sel for the Gas Guard is specified as Tank 1 when shipped. Refer to Section 3, Configure Mode, to de-activate the Gas Guard or change the Tank Sel from #1 to #2. If the Gas Guard system is not used, the incubator will function normally by supplying $CO_2$ from the supply tank connected to Inlet #1.

### c. Operation of the $CO_2$ Gas Guard

With the Gas Guard in operation, the incubator will use the gas supplied by the tank connected to Inlet #1 until the pressure drops below 10 psig (0.690 bars). At this time, the Gas Guard automatically switches to gas supplied through $CO_2$ Inlet #2.

In addition, the incubator automatically changes the Tank Sel in Configure Mode from 1 to 2 to indicate that the incubator is now using gas supplied through Inlet # 2. If the gas supply to Inlet #1 is replenished, the incubator will continue to operate using the gas supplied through

Inlet #2 unless the operator changes the Tank Sel from #2 to #1 through Configure Mode. Refer to Section 3, Configuration.

Audible and visual alarms occur on the control panel when the gas guard switches from one supply to the other. The audible alarm sounds until the operator presses the Silence key on the control panel. The visual alarm in the Message Center will read Tank 1 Low while the audible alarm is sounding, but the message will be removed when the operator presses the Silence key. However, the 'Tank Low' indicator on the control panel will stay lighted until the condition is resolved. The unit will operate normally.

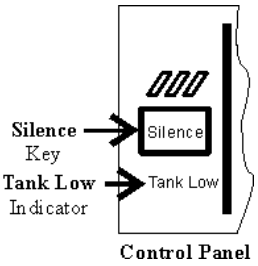



**Figure 6-7**

***Both the audible and visual alarms described above do not ring back once the Silence key is pressed.***

If the Gas Guard system does not detect an adequate gas supply at CO2 Inlet #1 or Inlet #2, a visual and audible alarm will again occur on the control panel. The visual alarm in the Message Center will read Tank 1&2 Low. The audible alarm will continue to ring until the Silence key is pressed. The audible alarm will ring back every 15 minutes after the alarm is silenced if the Gas Guard continues to detect that both gas supply pressures are below 10 psig (0.690 bars).

## 6.3 Humidity Readout (190643)

The 310 Series incubators can be equipped with a humidity sensor to monitor the relative humidity inside the chamber. The sensor is mounted to the top air duct and provides a signal that is displayed in 1% increments on the control panel. The humidity readout can be displayed continuously or toggles with the temperature readout. In addition, a low alarm limit can be set on the humidity readout, which will detect when the humidity pan runs dry. Refer to Section 3, Configuration.

### a. Factors Affecting the Humidity Level in the Chamber

- Water level in the humidity pan
- Frequency of door openings
- The humidity pan is located on the bottom of the chamber versus on a shelf.

***Incubators equipped with a Thermal Conductivity $CO_2$ sensor rely on a constant level of relative humidity in order to accurately measure and control the $CO_2$ concentration in the incubator.***

### b. Accuracy of the Humidity Readout

The sensor is capable of measuring relative humidity from 10% to 100% with an accuracy of ±5% above 90%. See Section 2, Calibration, for details on calibrating the humidity readout.

## 6.4 Connecting the Uninterruptible Power Supply (270078 and 270082)

***The Uninterruptible Power Supply is not rated for life-support applications.***

The optional Uninterruptible Power Supply (UPS) provides a back-up power source for the incubator. When the batteries are fully charged and the incubator operating at 37°C in an 18°C ambient temperature, the UPS provides approximately one hour of uninterrupted power during a power failure. A higher operating temperature decreases this back-up time, a higher ambient temperature increases it. This estimated time assumes that the incubator will be already at its operating temperature and that the incubator door will not be opened during the back-up period.

The remote alarm contacts will not trip during a power failure while connected to the UPS until battery power is exhausted. There is however, an audible and visual alarm when the unit switches to battery operation.

The UPS batteries are fully charged when the unit has been connected to utility power for a minimum of four hours. The UPS power switch does not have to be on for the batteries to charge. When battery replacement becomes necessary, refer to the UPS user's manual.

***Use only factory recommended UPS units, 270078 or 270082, which produce a pure sine wave output. Other UPS units could damage the incubator and void the warranty. Typical facility back-up systems will not effect the efficiency of the incubator.***

### a. Connecting Uninterruptible Power Supply (P/N 270078, 115V, 50/60Hz)

1. Plug the incubator line cord into one of the receptacles on the back of the UPS. Then plug the UPS line cord into a suitable wall outlet.
2. Turn the UPS power switch on.

### b. Connecting Uninterruptible Power Supply (P/N 270082, 230V, 50/60Hz)

Use the line cord supplied with the incubator to connect the UPS to a suitable wall outlet, and the UPS coupler to connect the incubator to the UPS.

***The Uninterruptible Power Supply contains potentially hazardous voltages even when not connected to line voltage.***
***Do not attempt to disassemble the UPS as it contains no user-serviceable parts. Repairs must be performed only by factory trained service personnel.***

# Section 7 - Specifications*

*Specifications are based on nominal voltages of 115V or 230V in ambients of 22°C to 25°C.

**Temperature**

| | |
|---|---|
| Control | ±0.1°C Microprocessor PID Control |
| Setpoint | Digital - Touch pad, 0.1°C |
| Range | +5°C above ambient to 50°C |
| Uniformity | ±0.2°C @ +37°C |
| Tracking alarm | User programmable (low) indicator |
| Overtemp | Tracking, user programmable, action, and indicator |
| Display | Digital, LED, 0.1°C increments |

**Temperature Safety**

| | |
|---|---|
| Type | Extreme temperature safety, action, and indicator |
| Sensor | Thermostat, independent of temperature control system |
| Indicator | Message center, audible and visual alarms |

**Relative Humidity**

| | |
|---|---|
| Control | Humidity pan - natural vaporization |
| Humidity with pan | 95% RH at 37°C |
| Display | Optional in 1% increments |
| Alarm | Low RH with optional RH monitor |

**$CO_2$**

| | |
|---|---|
| Control | ±0.1% microprocessor PID control |
| Sensor | T/C or IR |
| Readability | 0.1% |
| Range | 0 to 20% |
| Inlet pressure | 15 psig |
| Display | Digital LED, 0.1% increments |

**Shelves**

| | |
|---|---|
| Dimensions | 18.5” x 18.5” |
| Construction | Stainless Steel (belt sanded, both sides) |
| Surface area | 2.4 sq. ft. |
| Max. per chamber | 40.8 sq. ft. |
| Standard | 4 |
| Maximum | 17 |

**Construction**

| | |
|---|---|
| Interior volume | 6.5 cu. ft. |
| Interior | Type 304 stainless steel shiny finish |
| Exterior | 18 gauge cold roll steel |
| Outer door gasket | Four-sided molded, magnetic vinyl |
| Inner door gasket | Feather-edge, removable |
| Insulation | Fiberglass |

**Fittings**

| | |
|---|---|
| Access port | 1-1/4 inch removable silicone plug |
| $CO_2$ inlet | 1/4" barbed |
| Sample port | Front mounted barbed |

**Electrical**

| | |
|---|---|
| 115 Volt models | 90-125VAC, 50/60 Hz, 1PH, 2.4 FLA |
| 230 Volt models | 180-250, 50/60 Hz, 1 PH, 2.0 FLA |
| Power switch/circuit breaker | 2 Pole, 6.0 Amp |
| Accessory outlet | Voltage equal to the cabinet input. 75 Watts maximum, 0.5ma leakage current |
| Alarm contacts | Deviation of temperature, $CO_2$, power, NO and NC |

**Unit BTU Output**

| | |
|---|---|
| 115/230V | 344 BTUH (100 watt) |

**Dimensions**

| | |
|---|---|
| Exterior | 26.0" W x 38.5" H x 25.0" F-B |
| Interior | 21.4" W x 26.8" H x 20.0" F-B |

**Weight**

| | |
|---|---|
| Net Weight Stainless Steel | 205 lbs |
| Net Weight Copper | 230 lbs. |

**Options/Accessories**

| | |
|---|---|
| HEPA filter | Factory installed: Stock no. 190858 |
| Battery back-up | Free Standing: Stock no. 270078, 120VAC, 60Hz<br>Stock no. 270082, 220VAC, 50Hz |
| Humidity | Factory installed: Stock no. 190463 - provides humidity readout and low alarm |
| Inner door kit | Customer installed: Stock no. 190650 - independent eight separate glass doors |
| Built-in Gas Guard | Factory installed: Stock no. 190640 - $CO_2$ only, automatically switches supply tanks |
| Recorders | Customer installed: Standard recorders used on water-jacket incubators |
| Decontamination kits | HEPA filter, blower assembly, inner door gasket, etc.<br>Stock no. 190868 (with HEPA filter)<br>Stock no. 190869 (without HEPA filter) |

**Copper Options**

| | |
|---|---|
| Interior ductwork | Solid copper: Stock no. 190725 |
| Perforated shelf | Customer Installed: Stock no. 224166 - solid copper |
| Humidity Pan | Customer Installed: Stock no. 237015 - solid copper |
| Copper interior kit | Factory installed: Replace stainless steel duct work, shelves, and humidity pan with solid copper Stock no. 190870 |

**Optional Date Outputs**

| | |
|---|---|
| Analog | Factory installed: Stock no. 190544 - 0-1 volt |
| Analog | Factory installed: Stock no. 190543 - 0-5 volt |
| Analog | Factory installed: Stock no. 190512 - 4-20mA |
| Digital | Factory installed: Stock no. 190523 - RS-485 (Compatible with Model 1535 Alarm Monitor only) |

**Certifications**

Refer to the Declaration of Conformity at the back of this manual

**Safety Specifications**

Indoor Use Only
Altitude - 2,000 meters
Temperature - 5°C to 40°C
Humidity - 80% RH at or below 31°C, decreasing linearly to 50% RH at 40°C
Mains Supply Fluctuations - Mains supply voltage fluctuations not to exceed ±10% of the nominal voltage
Installation Category II [1]
Pollution Degree 2 [2]
Class of Equipment I

---

1 Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II which is the category used for instruments in installations supplied from a supply comparable to public mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

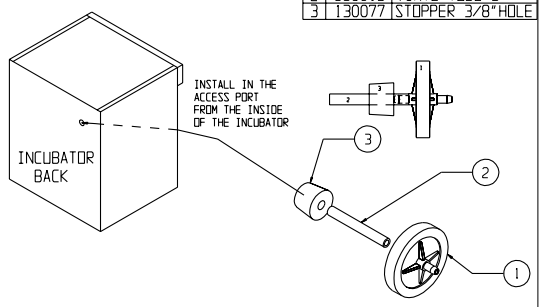
2 Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

# Section 8 - Spare Parts

| Part Number | Description |
|---|---|
| 190699 | Removable feather gasket |
| 190670 | Duct sheet and shelf channel kit |
| 190772 | Micro board, (main control) |
| 230135 | Fuse, 1A, TD, 5 x 20mm |
| 230120 | 0.5A fuse, TD, 5 x 20mm (accessory outlet) |
| 230161 | Fuse, 5A, 5 x 20mm |
| 156098 | Motor, 2-pole, 115VAC, 50/60 Hz |
| 190793 | Display board |
| 290184 | Probe, 2252 Ohm/25°C, 1/8 x2 |
| 770001 | Disposable filter, 99.97 ($CO_2$ line, air sample) |
| 760175 | HEPA filter, 5.5” diameter |
| 1900067 | Filter Replacement Kit (includes [2] 770001 and [1] 760175 |
| 224175 | Shelf |
| 190868 | Decontamination kit with HEPA filter |
| 190869 | Decontamination kit without HEPA filter |
| 130077 | Stopper with 3/8” hole |
| 290090 | Thermal conductivity type $CO_2$ sensor |
| 190885 | Infrared type $CO_2$ sensor w/ auto zero |
| 250087 | $CO_2$ valve with fittings |
| 290154 | RH sensor assembly (RH display option) |
| 190883 | Sample port filter assembly |
| 190661 | IR sensor filter |
| 190985 | Filtered air exchange assembly |
| 230153 | 6A, DPDT circuit breaker switch (power) |
| 400199 | Switcher, 40W, 12, 5, -12V |
| 420096 | 130VA transformer, int’l, 12/24V S |
| 194021 | 34 position control to display ribbon cable |
| 420097 | 43VA transformer (230VAC units only) |
| 360213 | Pressure switch (Gas Guard option) |
| 250121 | Gas valve (Gas Guard option) |
| 190512 | 4-20mA output board |
| 190543 | 0-5V output board |
| 190544 | 0-1V output board |

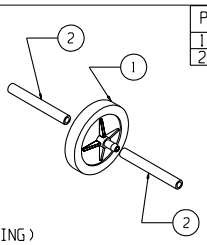
| ID# | STK # | DESCRIPTION |
|---|---|---|
| 1 | 310-201-0-D | IR/TC SENSOR ASSEMBLY |
| 2 | 310-202-0-D | MOTOR/BLOWER ASSEMBLY |
| 3 | 116022 | HINGE, 1/4" GLASS |
| 4 | 105058 | DOOR, TEMPERED GLASS |
| 5 | 180174 | FACE FRAME, PVC |
| 6 | 190611 | HINGE PIN, STN STEEL |
| 7 | 190612 | HINGE BLOCK, ALUMINUM 2.0" |
| 8 | 190643 | TEMPERATURE PROBE ASSEMBLY |
| 9 | 191534 | REMOVEABLE FEATHER GASKET |
| 10 | 113002 | ADJUSTABLE FOOT |
| 11 | 190788 | OUTER DOOR W/ HEATER |
| 12 | 190795 | MAGNET MOUNT, DOOR |
| 13 | 190833 | LATCH MOUNT, INNER DOOR |
| 14 | 180210 | KNOB, BLACK |
| 15 | XXXXX | GAS INJECT PORT |
| 16 | 360230 | SWITCH, MAGNETIC ACTUATED |
| 17 | 360231 | MAGNET, DOOR |
| 18 | 400133 | THERMOSTAT, SNAP ACTION |
| 19 | 990033 | MAGNETIC GASKET, MOLDED |
| 20 | 290184 | "OPTIONAL" RH SENSOR |
| 21 | 840020 | SAMPLE PORT BULKHEAD FITTING |
| 22 | 132054 | LEFT HEATER, 13 WATTS |
| 23 | 132050 | BACK HEATER 30 WATTS |
| 24 | 132051 | BOTTOM HEATER, 24 WATTS |
| 25 | 132055 | RIGHT HEATER, 22 WATTS |
| 26 | 132053 | COLLAR HEATER, 9 WATTS |
| 27 | NA | DOOR HEATER, 69 WATTS |
| 28 | 132056 | FACE HEATER, 27 WATTS |

| PARTS LIST - DETAIL "A" | | |
|---|---|---|
| 1 | 770001 | FILTER 50MM 1uM |
| 2 | 950013 | VINYL TUBE 3" |
| 3 | 130077 | STOPPER 3/8"HOLE |

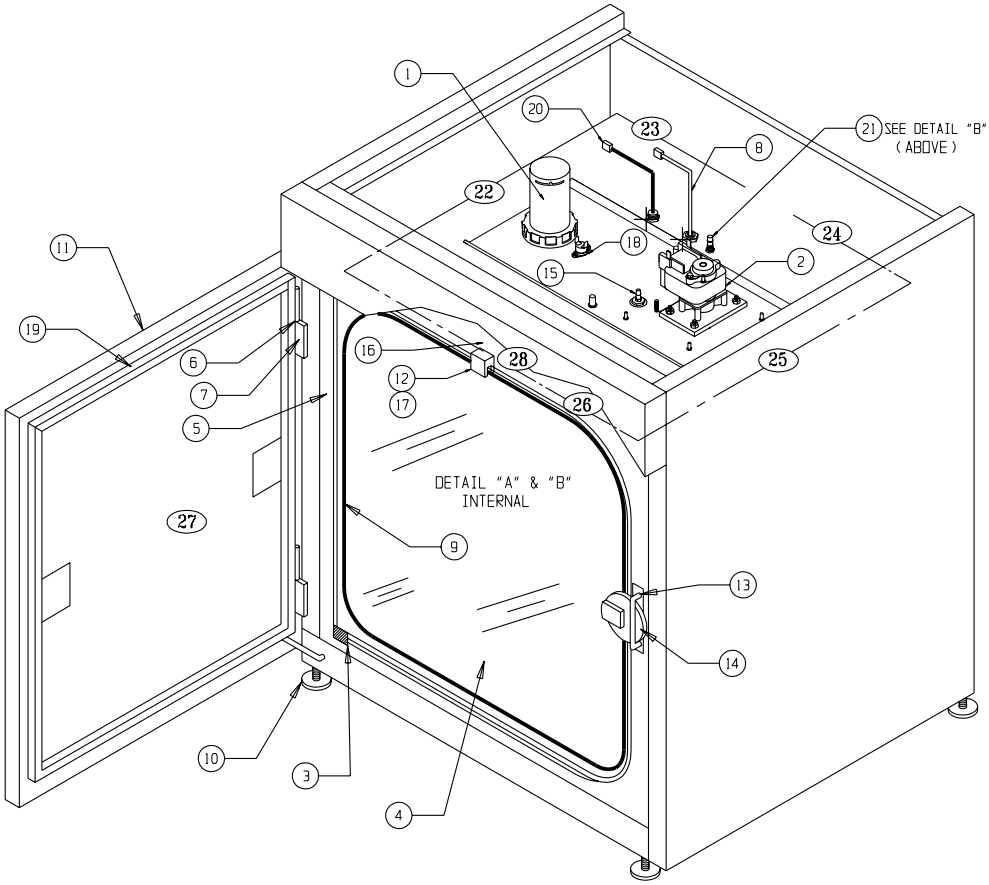



DETAIL "A"

| PARTS LIST - DETAIL "B" | | |
|---|---|---|
| 1 | 770001 | FILTER 50MM 1uM |
| 2 | 244009 | SILICONE TUBE 6" |




DETAIL "B"
( INTERNAL TUBING )




310-200-0-D

ATTENTION OBSERVE PRECAUTIONS ELECTROSTATIC SENSITIVE DEVICES

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND SUCH INFORMATION IS NOT TO BE DISCLOSED TO OTHERS FOR ANY PURPOSE NOR USED FOR MANUFACTURING PURPOSES WITHOUT WRITTEN PERMISSION FROM THERMO ELECTRON

| REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION |
|---|---|---|---|---|---|---|
| 3 | IN-3124 | 08-04-03 | JNL | KDG | CCS | CHG. 290137 PROBE TO 290184 |
| 2 | IN-2755 | 07-24-00 | G.J.G | G.J.G | LDN | REVISED PART NUMBERS |
| 1 | IN-2755 | 11-02-99 | G.J.G | KDG | DNF | CHG. 190699 GASKET TO 191534 |
| 0 | N/A | 11-8-98 | G.J.G | G.J.G | M.H. | RELEASED FOR PRODUCTION |

DATE 11-8-98 | DWN GJG | CAD G.J.G | APPD M.H. | SCALE NONE

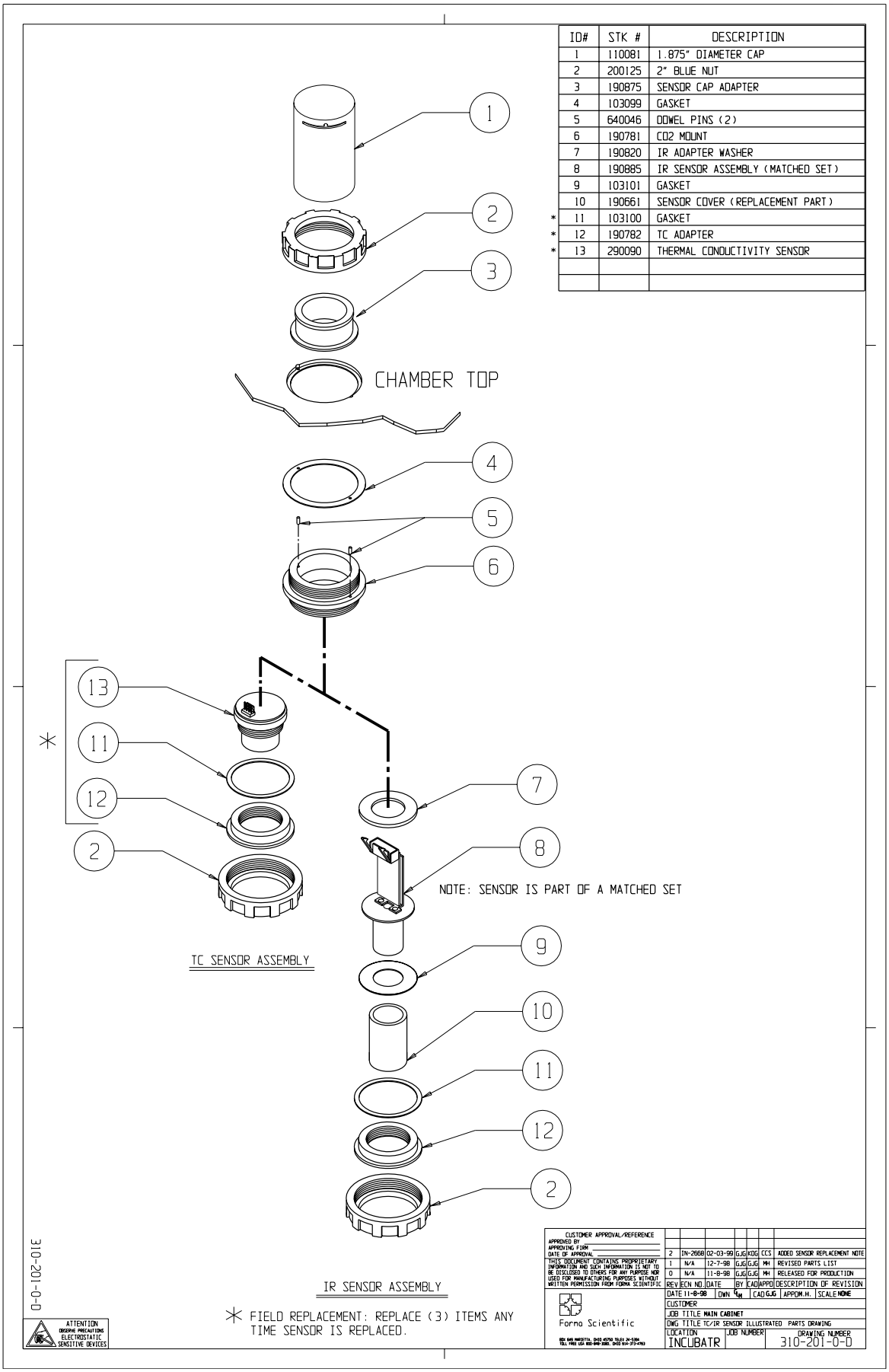
CUSTOMER

JOB TITLE MAIN CABINET

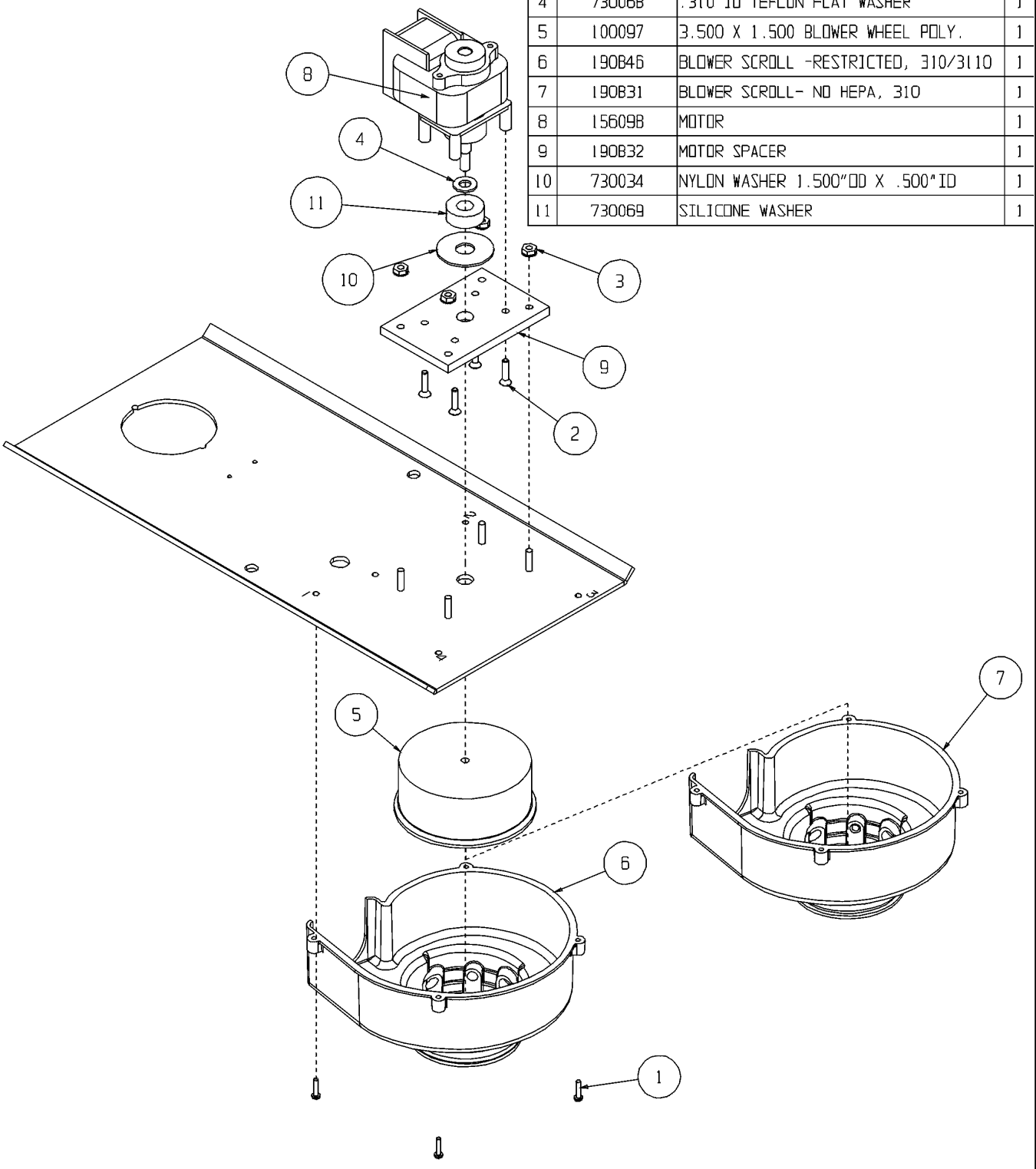
DWG TITLE ILLUSTRATED PARTS DRAWING

LOCATION INCUBATR | JOB NUMBER | DRAWING NUMBER 310-200-0-D

Thermo ELECTRON CORPORATION



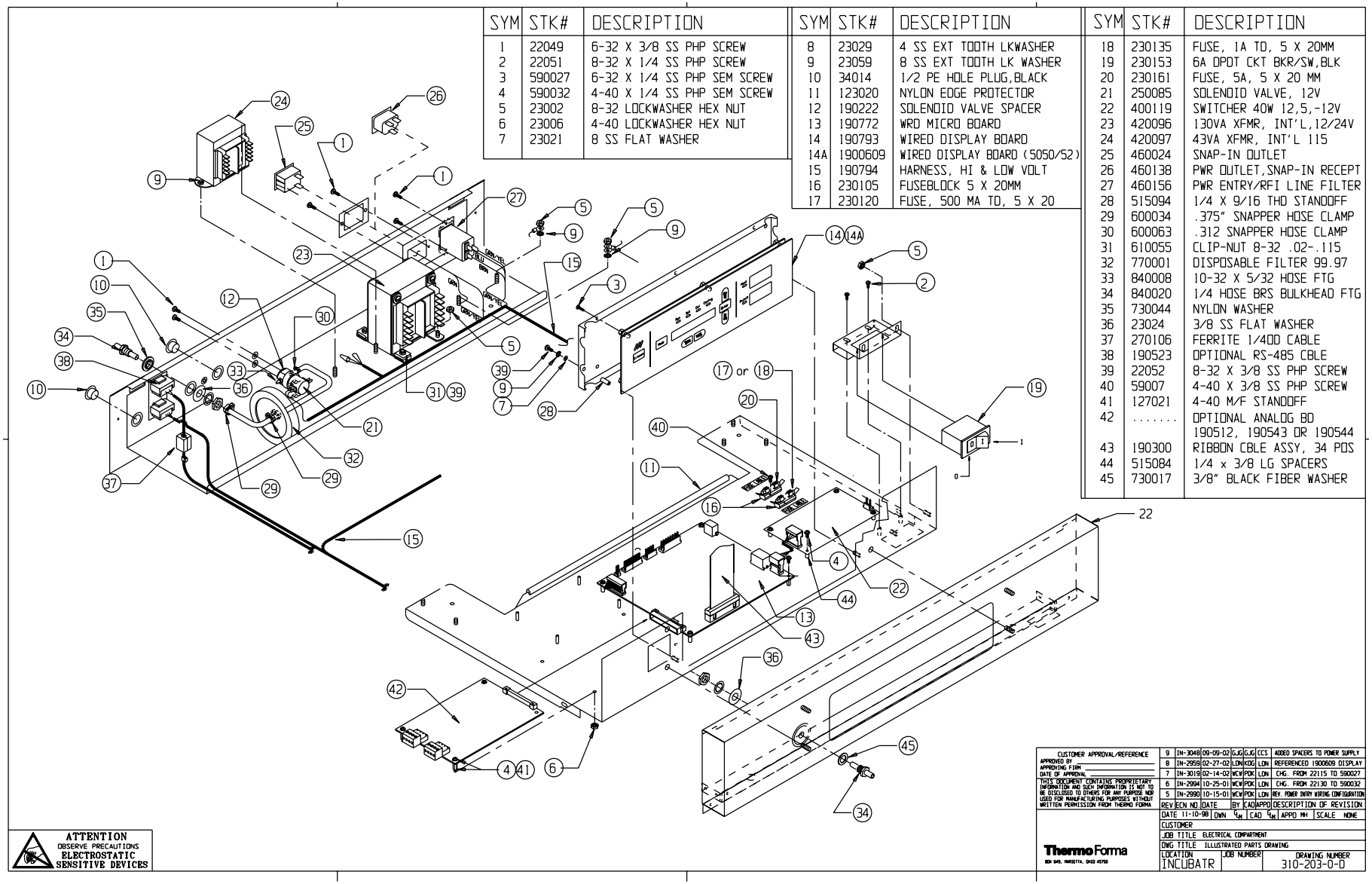

| ID# | STK # | DESCRIPTION |
|---|---|---|
| 1 | 110081 | 1.875" DIAMETER CAP |
| 2 | 200125 | 2" BLUE NUT |
| 3 | 190875 | SENSOR CAP ADAPTER |
| 4 | 103099 | GASKET |
| 5 | 640046 | DOWEL PINS (2) |
| 6 | 190781 | CO2 MOUNT |
| 7 | 190820 | IR ADAPTER WASHER |
| 8 | 190885 | IR SENSOR ASSEMBLY (MATCHED SET) |
| 9 | 103101 | GASKET |
| 10 | 190661 | SENSOR COVER (REPLACEMENT PART) |
| * 11 | 103100 | GASKET |
| * 12 | 190782 | TC ADAPTER |
| * 13 | 290090 | THERMAL CONDUCTIVITY SENSOR |




BILL OF MATERIALS

| ITEM | PART NO. | PART DESCRIPTION | QTY |
|---|---|---|---|
| 1 | 22002 | #4-40 X 1/2 SS PHP SCREW | 4 |
| 2 | 22142 | #8-32 x 3/4 FHP SCREW | 4 |
| 3 | 23002 | #8-32 ZP LKWASH HEX NUT | 4 |
| 4 | 730068 | .310 ID TEFLON FLAT WASHER | 1 |
| 5 | 100097 | 3.500 X 1.500 BLOWER WHEEL POLY. | 1 |
| 6 | 190B46 | BLOWER SCROLL -RESTRICTED, 310/3110 | 1 |
| 7 | 190B31 | BLOWER SCROLL- NO HEPA, 310 | 1 |
| 8 | 156098 | MOTOR | 1 |
| 9 | 190B32 | MOTOR SPACER | 1 |
| 10 | 730034 | NYLON WASHER 1.500"OD X .500"ID | 1 |
| 11 | 730069 | SILICONE WASHER | 1 |

310-202-1-0-D Rev. 4



| SYM | STK# | DESCRIPTION |
|---|---|---|
| 1 | 22049 | 6-32 X 3/8 SS PHP SCREW |
| 2 | 22051 | 8-32 X 1/4 SS PHP SCREW |
| 3 | 590027 | 6-32 X 1/4 SS PHP SEM SCREW |
| 4 | 590032 | 4-40 X 1/4 SS PHP SEM SCREW |
| 5 | 23002 | 8-32 LOCKWASHER HEX NUT |
| 6 | 23006 | 4-40 LOCKWASHER HEX NUT |
| 7 | 23021 | 8 SS FLAT WASHER |
| 8 | 23029 | 4 SS EXT TOOTH LKWASHER |
| 9 | 23059 | 8 SS EXT TOOTH LK WASHER |
| 10 | 34014 | 1/2 PE HOLE PLUG,BLACK |
| 11 | 123020 | NYLON EDGE PROTECTOR |
| 12 | 190222 | SOLENOID VALVE SPACER |
| 13 | 190772 | WRD MICRO BOARD |
| 14 | 190793 | WIRED DISPLAY BOARD |
| 14A | 1900609 | WIRED DISPLAY BOARD (5050/52) |
| 15 | 190794 | HARNESS, HI & LOW VOLT |
| 16 | 230105 | FUSEBLOCK 5 X 20MM |
| 17 | 230120 | FUSE, 500 MA TD, 5 X 20 |
| 18 | 230135 | FUSE, 1A TD, 5 X 20MM |
| 19 | 230153 | 6A DPDT CKT BKR/SW,BLK |
| 20 | 230161 | FUSE, 5A, 5 X 20 MM |
| 21 | 250085 | SOLENOID VALVE, 12V |
| 22 | 400119 | SWITCHER 40W 12,5,-12V |
| 23 | 420096 | 130VA XFMR, INT'L,12/24V |
| 24 | 420097 | 43VA XFMR, INT'L 115 |
| 25 | 460024 | SNAP-IN OUTLET |
| 26 | 460138 | PWR OUTLET,SNAP-IN RECEPT |
| 27 | 460156 | PWR ENTRY/RFI LINE FILTER |
| 28 | 515094 | 1/4 X 9/16 THD STANDOFF |
| 29 | 600034 | .375" SNAPPER HOSE CLAMP |
| 30 | 600063 | .312 SNAPPER HOSE CLAMP |
| 31 | 610055 | CLIP-NUT 8-32 .02-.115 |
| 32 | 770001 | DISPOSABLE FILTER 99.97 |
| 33 | 840008 | 10-32 X 5/32 HOSE FTG |
| 34 | 840020 | 1/4 HOSE BRS BULKHEAD FTG |
| 35 | 730044 | NYLON WASHER |
| 36 | 23024 | 3/8 SS FLAT WASHER |
| 37 | 270106 | FERRITE 1/4OD CABLE |
| 38 | 190523 | OPTIONAL RS-485 CBLE |
| 39 | 22052 | 8-32 X 3/8 SS PHP SCREW |
| 40 | 59007 | 4-40 X 3/8 SS PHP SCREW |
| 41 | 127021 | 4-40 M/F STANDOFF |
| 42 | ..... | OPTIONAL ANALOG BD 190512, 190543 OR 190544 |
| 43 | 190300 | RIBBON CBLE ASSY, 34 POS |
| 44 | 515084 | 1/4 x 3/8 LG SPACERS |
| 45 | 730017 | 3/8" BLACK FIBER WASHER |

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

CUSTOMER APPROVAL/REFERENCE
APPROVED BY
APPROVING FIRM
DATE OF APPROVAL



| REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION |
|---|---|---|---|---|---|---|
| 9 | IN-3048 | 09-09-02 | GJG | GJG | CCS | ADDED SPACERS TO POWER SUPPLY |
| 8 | IN-2959 | 02-27-02 | LDN | KDG | LDN | REFERENCED 1900609 DISPLAY |
| 7 | IN-3019 | 02-14-02 | WCW | PDK | LDN | CHG. FROM 22115 TO 590027 |
| 6 | IN-2994 | 10-25-01 | WCW | PDK | LDN | CHG. FROM 22130 TO 590032 |
| 5 | IN-2990 | 10-15-01 | WCW | PDK | LDN | REV. POWER ENTRY WIRING CONFIGURATION |

DATE 11-10-98 | DWN LDN | CAD LDN | APPD MH | SCALE NONE

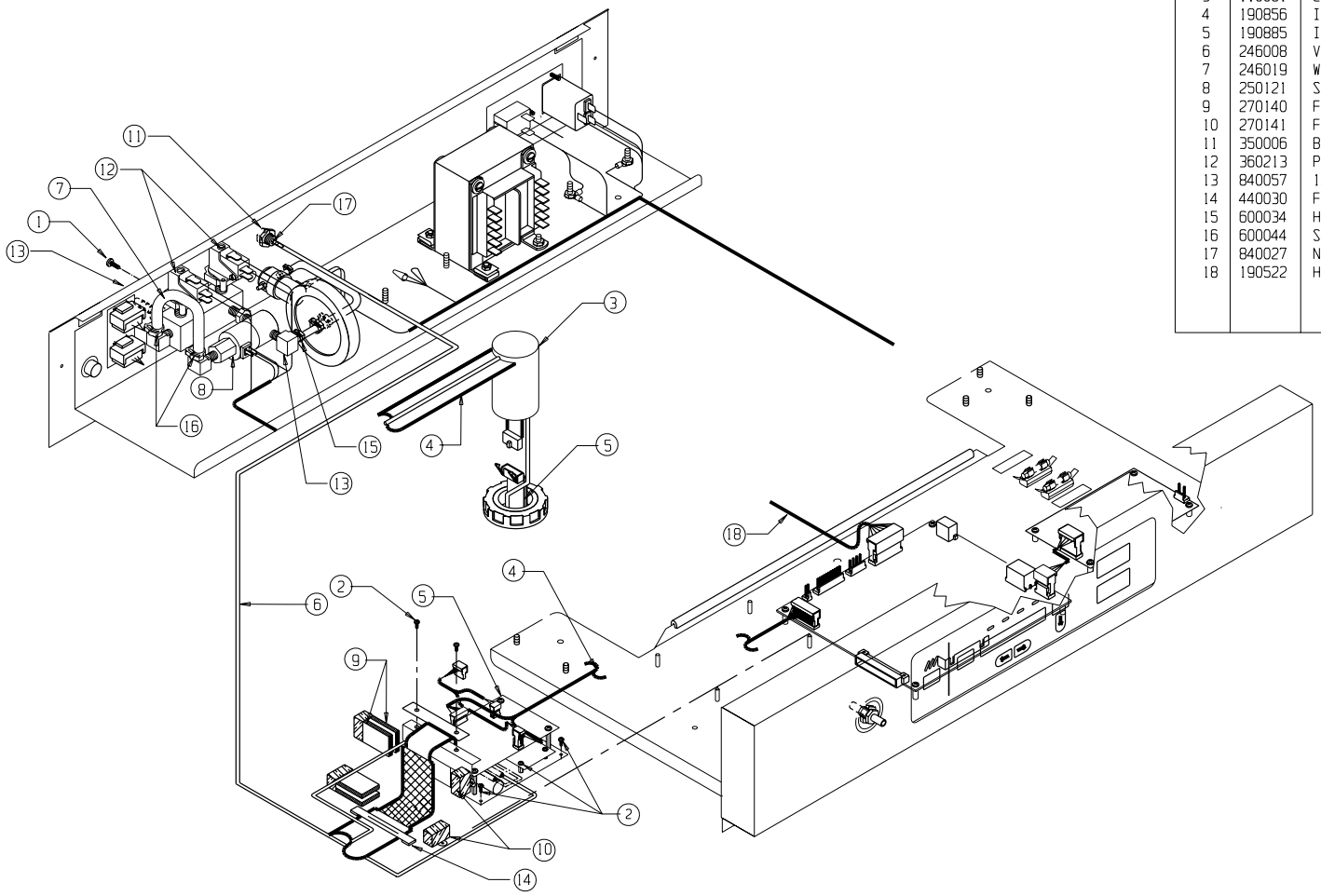
CUSTOMER

JOB TITLE ELECTRICAL COMPARTMENT

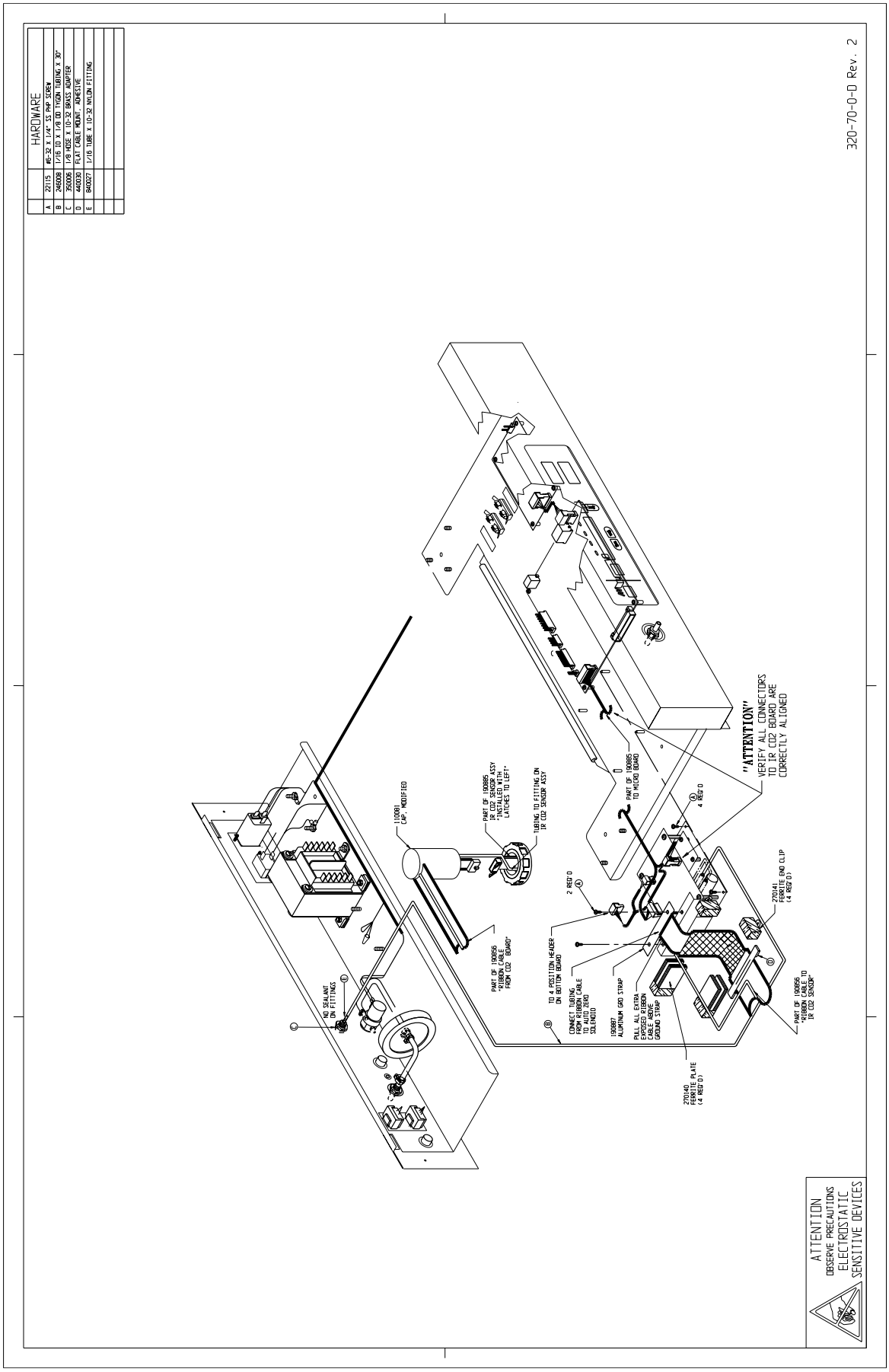
DWG TITLE ILLUSTRATED PARTS DRAWING

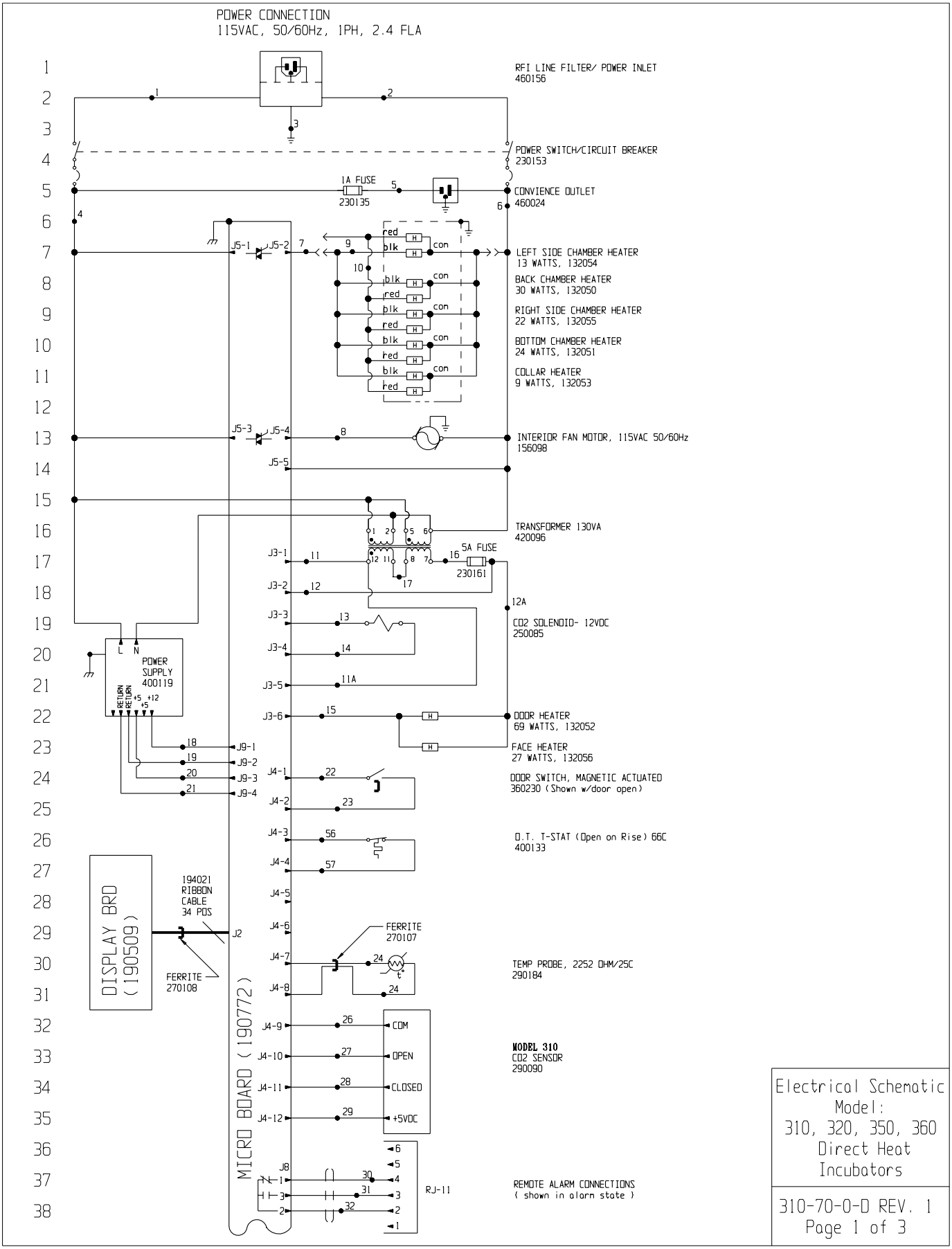
| LOCATION | JOB NUMBER | DRAWING NUMBER |
|---|---|---|
| INCUBATR | | 310-203-0-D |

Thermo Forma
BOX 649, MARIETTA, OHIO 45750



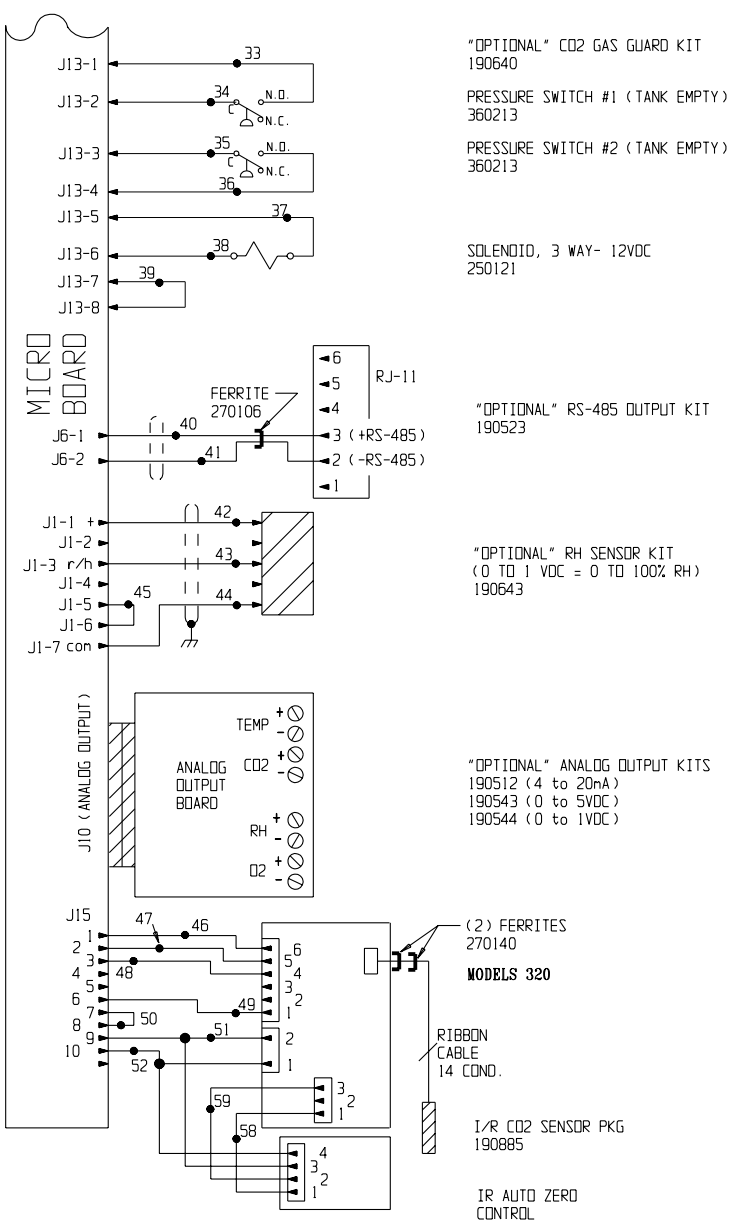

| SYM | STK# | DESCRIPTION |
|---|---|---|
| 1 | 22052 | 8-32 X 3/8" SS PHP SCREW |
| 2 | 22115 | 6-32 X 1/4" SS PHP SCREW |
| 3 | 110081 | CAP, MODIFIED |
| 4 | 190856 | IR SENSOR HARNESS (2PC) |
| 5 | 190885 | IR CO2 SYSTEM (SENOR & BOARD) |
| 6 | 246008 | VINYL TUBING 1/16ID X 1/8 OD X 30" |
| 7 | 246019 | WIRE RNF TUBING 1/4"OD X 3-3/4" |
| 8 | 250121 | SOLENOID VALVE, 3 WAY 12VDC |
| 9 | 270140 | FERRITE PLATE |
| 10 | 270141 | FERRITE END CLIP |
| 11 | 350006 | BRASS ADAPTER, 1/8 HOSE X 10-32 |
| 12 | 360213 | PRESSURE SWITCH |
| 13 | 840057 | 1/4" HOSE TO 1/8" NPT BRASS 90° |
| 14 | 440030 | FLAT CABLE MOUNT, ADHESIVE |
| 15 | 600034 | HOSE CLAMP .375" |
| 16 | 600044 | SNAPPER HOSE CLAMP 1/2" |
| 17 | 840027 | NYLON FITTING 1/16 TUBE X 10-32 |
| 18 | 190522 | HARNESS, GAS GUARD |


HARDWARE
A 22115 #6-32 X 1/4" SS PHP SCREW
B 248008 1/16 ID X 1/8 OD TYGON TUBING X 30"
C 350006 1/8 HOSE X 10-32 BRASS ADAPTER
D 440030 FLAT CABLE MOUNT. ADHESIVE
E 840027 1/16 TUBE X 10-32 NYLON FITTING
320-70-0-D Rev. 2
"ATTENTION"
VERIFY ALL CONNECTORS
TO IR CO2 BOARD ARE
CORRECTLY ALIGNED
110081
CAP, MODIFIED
PART OF 190885
IR CO2 SENSOR ASSY
INSTALLED WITH
LATCHES TO LEFT
TUBING TO FITTING ON
IR CO2 SENSOR ASSY
PART OF 190885
TO MICRO BOARD
4 REQ'D
2 REQ'D
270141
FERRITE END CLIP
(4 REQ'D)
PART OF 190856
"RIBBON CABLE
FROM CO2 BOARD"
TO 4 POSITION HEADER
ON MOTION BOARD
CONNECT TUBING
FROM RIBBON CABLE
TO MOTION BOARD
SOLENOID
190887
ALUMINUM GND STRAP
PULL ALL EXTRA
EXPOSED RIBBON
CABLE AND
GROUND STRAP
PART OF 190856
"RIBBON CABLE TO
IR CO2 SENSOR"
270140
FERRITE PLATE
(4 REQ'D)
NO SEALANT
ON FITTINGS
ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES




Electrical Schematic
Model:
310, 320, 350, 360
Direct Heat
Incubators

310-70-0-D REV. 1
Page 1 of 3




| Electrical Schematic Model: 310, 320, 350, 360 Direct Heat Incubators |
|---|
| 310-70-0-D REV. 1 Page 2 of 3 |

77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107

WIRE REFERENCE CHART

| NO. | GA. | COLOR | NO. | GA. | COLOR | NO. | GA. | COLOR |
|---|---|---|---|---|---|---|---|---|
| 1 | 16 | BROWN | 22 | 22 | BLUE | 47 | 22 | ORANGE |
| 2 | 16 | BLUE | 23 | 22 | BLUE | 48 | 22 | YELLOW |
| 3 | 16 | GRN/YEL | 24 | 22 | RED | 49 | 22 | BROWN |
| 3B | 16 | GREEN | 25 | 22 | RED | 50 | 22 | RED |
| 4 | 18 | BLACK | 26 | 22 | GREEN | 51 | 22 | GREEN |
| 4A | 18 | BLACK | 27 | 22 | GRAY | 52 | 22 | BLACK |
| 5 | 18 | BLACK | 28 | 22 | PURPLE | 53 | 18 | RED |
| 6 | 18 | WHITE | 29 | 22 | ORANGE | | | |
| 7 | 18 | ORANGE | 30 | 22/3 | BLACK | | | |
| 8 | 18 | BLUE | 31 | 22/3 | RED | 56 | 22 | BROWN |
| 9 | 18 | BLACK | 32 | 22/3 | WHITE | 57 | 22 | BROWN |
| 10 | 18 | RED | 33 | 20 | RED | 58 | 22 | BROWN |
| 11 | 18 | BROWN | 34 | 20 | RED | 59 | 22 | WHITE |
| 11A | 18 | BROWN | 35 | 20 | BLUE | | | |
| 12 | 18 | RED | 36 | 20 | BLUE | | | |
| 12A | 18 | RED | 37 | 20 | ORANGE | | | |
| 13 | 18 | YELLOW | 38 | 20 | ORANGE | | | |
| 14 | 18 | YELLOW | 39 | 20 | BLACK | | | |
| 15 | 18 | BLUE | 40 | 22/2 | RED | | | |
| 16 | 18 | RED | 41 | 22/2 | BLACK | | | |
| 17 | 18 | ORANGE | 42 | 22/3 | BLACK | | | |
| 18 | 18 | RED | 43 | 22/3 | RED | | | |
| 19 | 18 | GREEN | 44 | 22/3 | GREEN | | | |
| 20 | 18 | ORANGE | 45 | 22 | BLACK | | | |
| 21 | 22 | GREEN | 46 | 22 | BLUE | | | |

SENSOR REFERENCE VALUES

| | |
|---|---|
| CO2 (290090) | DIFFERENCE VOLTAGE OF 3-6MV/%CO2<br>J4-9 & J4-10 TO J4-9 & J4-11 |
| RH (190643) | J1-7 & J1-1 = 12VDC<br>J1-7 & J1-3 = 10MV/%RH |

NOTES:

| | | | |
|---|---|---|---|
| ⊛ | Denotes Terminal Strip Connection | Parts List Reference Number | |
| | Last Relay Number | ○ | Assembly |
| | Last Terminal Number | ⬠ | Panel |
| | Last Wire Number | ⬡ | Refrigeration |
| | | □ | Wiring |

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____



Thermo ELECTRON CORPORATION

| REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION |
|---|---|---|---|---|---|---|
| 1 | IN-3124 | 08-04-03 | JNL | KDG | CCS | CHG. 290137 TEMP. PROBE TO 290184 |
| 0 | N/A | 6/03/98 | GLM | GLM | MAH | RELEASED FOR PRODUCTION |

DATE 3-18-98 | DWN GLM | CAD GLM | APPDM.H. | SCALE

CUSTOMER **MODELS 310, 320**

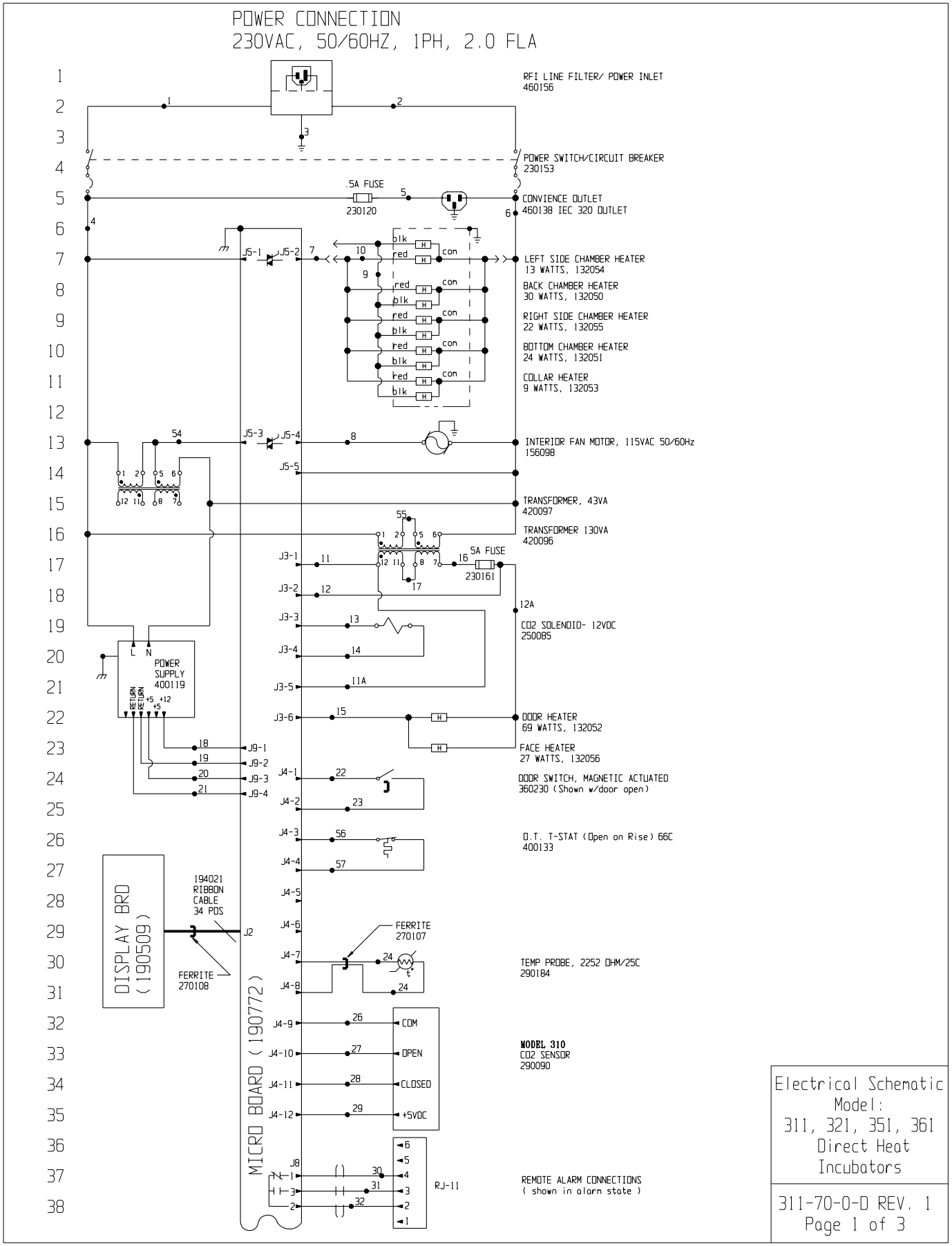
JOB TITLE **AIR JACKET INCUBATOR** 115 VOLT (DOM.)

DWG TITLE **ELECTRICAL SCHEMATIC**

| LOCATION | JOB NUMBER | DRAWING NUMBER |
|---|---|---|
| INCUBATR | | 310-70-0-D |

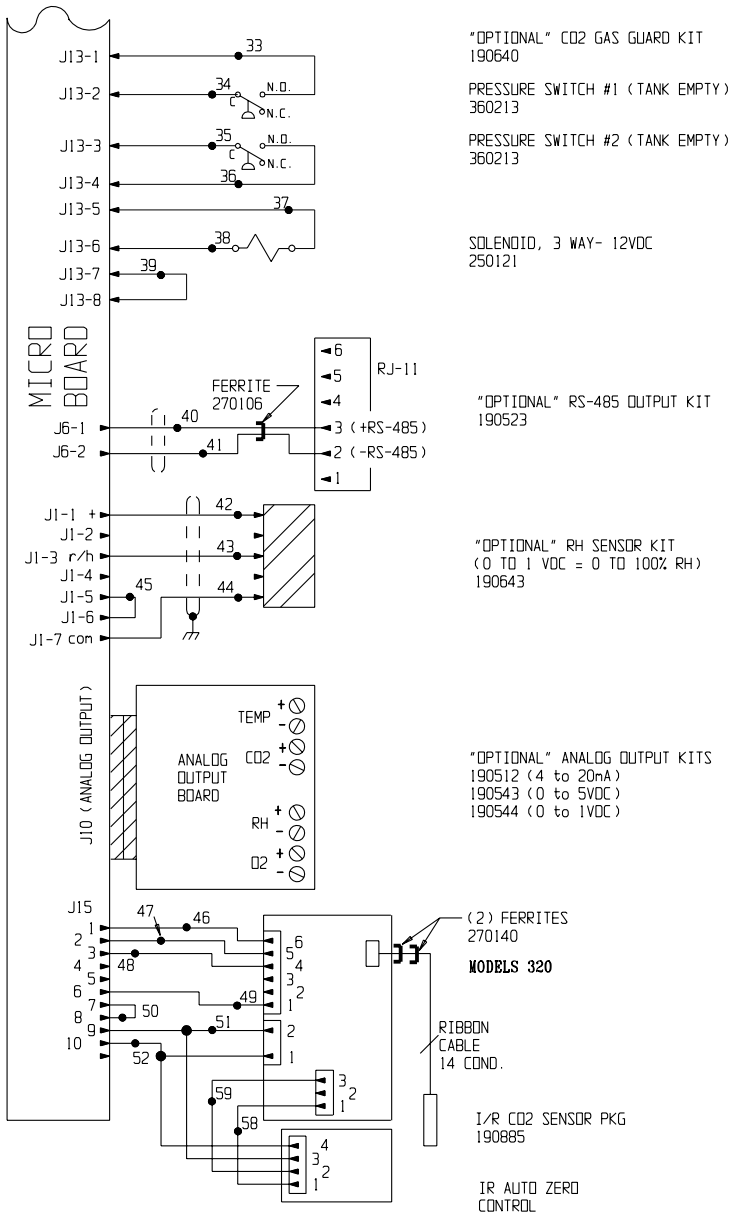
Electrical Schematic
Model:
310, 320, 350, 360
Direct Heat
Incubators

310-70-0-D REV. 1
Page 3 of 3




Electrical Schematic
Model:
311, 321, 351, 361
Direct Heat
Incubators

311-70-0-D REV. 1
Page 1 of 3




| Electrical Schematic Model: 311, 321, 351, 361 Direct Heat Incubators |
|---|
| 311-70-0-D REV. 1 Page 2 of 3 |

77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107

WIRE REFERENCE CHART

| NO. | GA. | COLOR | NO. | GA. | COLOR | NO. | GA. | COLOR |
|---|---|---|---|---|---|---|---|---|
| 1 | 16 | BROWN | 22 | 22 | BLUE | 47 | 22 | ORANGE |
| 2 | 16 | BLUE | 23 | 22 | BLUE | 48 | 22 | YELLOW |
| 3 | 16 | GRN/YEL | 24 | 22 | RED | 49 | 22 | BROWN |
| 3B | 16 | GREEN | 25 | 22 | RED | 50 | 22 | RED |
| 4 | 18 | BLACK | 26 | 22 | GREEN | 51 | 22 | GREEN |
| 4A | 18 | BLACK | 27 | 22 | GRAY | 52 | 22 | BLACK |
| 5 | 18 | BLACK | 28 | 22 | PURPLE | 53 | 18 | RED |
| 6 | 18 | WHITE | 29 | 22 | ORANGE | 54 | 18 | YELLOW |
| 7 | 18 | ORANGE | 30 | 22/3 | BLACK | 55 | 18 | YELLOW |
| 8 | 18 | BLUE | 31 | 22/3 | RED | 56 | 22 | BROWN |
| 9 | 18 | BLACK | 32 | 22/3 | WHITE | 57 | 22 | BROWN |
| 10 | 18 | RED | 33 | 20 | RED | 58 | 22 | BROWN |
| 11 | 18 | BROWN | 34 | 20 | RED | 59 | 22 | WHITE |
| 11A | 18 | BROWN | 35 | 20 | BLUE | | | |
| 12 | 18 | RED | 36 | 20 | BLUE | | | |
| 12A | 18 | RED | 37 | 20 | ORANGE | | | |
| 13 | 18 | YELLOW | 38 | 20 | ORANGE | | | |
| 14 | 18 | YELLOW | 39 | 20 | BLACK | | | |
| 15 | 18 | BLUE | 40 | 22/2 | RED | | | |
| 16 | 18 | RED | 41 | 22/2 | BLACK | | | |
| 17 | 18 | ORANGE | 42 | 22/3 | BLACK | | | |
| 18 | 18 | RED | 43 | 22/3 | RED | | | |
| 19 | 18 | GREEN | 44 | 22/3 | GREEN | | | |
| 20 | 18 | ORANGE | 45 | 22 | BLACK | | | |
| 21 | 22 | GREEN | 46 | 22 | BLUE | | | |

SENSOR REFERENCE VALUES

| | |
|---|---|
| CO2 (290090) | DIFFERENCE VOLTAGE OF 3-6MV/%CO2<br>J4-9 & J4-10 TO J4-9 & J4-11 |
| RH (190643) | J1-7 & J1-1 = 12VDC<br>J1-7 & J1-3 = 10MV/%RH |

NOTES:

| | | |
|---|---|---|
| ⊛ | Denotes Terminal Strip Connection | Parts List Reference Number |
| | Last Relay Number | ○ Assembly |
| | Last Terminal Number | ⬠ Panel |
| | Last Wire Number | ⬡ Refrigeration |
| | | □ Wiring |

CUSTOMER APPROVAL/REFERENCE
APPROVED BY _____
APPROVING FIRM _____
DATE OF APPROVAL _____



Thermo ELECTRON CORPORATION

| REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION |
|---|---|---|---|---|---|---|
| 1 | IN-3124 | 08-04-03 | JNL | KDG | CCS | CHG. 290137 TEMP. PROBE TO 290184 |
| 0 | N/A | 6/03/98 | GL | GL | MAH | RELEASED FOR PRODUCTION |

DATE 3-18-98 | DWN GL | CAD GL | APPDM.H. | SCALE

CUSTOMER **MODELS 311, 321**

JOB TITLE **AIR JACKET INCUBATOR** 230 VOLT (EXP.)

DWG TITLE **ELECTRICAL SCHEMATIC**

| LOCATION | JOB NUMBER | DRAWING NUMBER |
|---|---|---|
| INCUBATR | | 311-70-0-D |

Electrical Schematic
Model:
311, 321, 351, 361
Direct Heat
Incubators

311-70-0-D REV. 1
Page 3 of 3

# THERMO ELECTRON CORPORATION DIRECT HEAT INCUBATOR WARRANTY USA*

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period.

During the first year, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, including labor. In addition, after the initial warranty period of one year the $CO_2$ sensor (IR) will be warranted for a second year, parts only. The $CO_2$ sensor (T/C) will be warranted for four additional years for a total of five years, parts only. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment. At Thermo's option, all non-conforming parts must be returned to Thermo postage paid and replacement parts are shipped FOB destination.

**THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.** Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventative maintenance.

If equipment service is required, please call your Technical Service Department at l-888-213-1790 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special applications. Outside the USA, contact your local distributor for warranty information.

* Models covered under this warranty: **310 311 320 321 350 351 360 361**

ISO 9001 REGISTERED

Rev. 2 4/03

# THERMO ELECTRON CORPORATION INTERNATIONAL DIRECT HEAT INCUBATOR WARRANTY*

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period.

During the first year component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, excepting labor. In addition, after the initial warranty period of one year the $CO_2$ sensor (IR) will be warranted for a second year, parts only. The $CO_2$ sensor (T/C) will be warranted for four additional years for a total of five years, parts only. Installation and calibration is not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment. At Thermo's option, all non-conforming parts must be returned to Thermo postage paid and replacement parts are shipped FOB destination.

**THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.** Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

If equipment service is required, please call your Technical Services Department at 1-888-213-1790 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special application. Outside the USA, contact your local distributor for warranty information.

*Models Covered by this Warranty: **310 311 320 321 350 351 360 361**

Rev. 2 4/03

ISO 9001 REGISTERED

**Thermo Electron Corporation**
**Controlled Environment Equipment**
**Millcreek Road, P.O. Box 649**
**Marietta, Ohio 45750**
**U.S.A.**

Telephone (740) 373-4763
Telefax (740) 373-4189