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Models: 3980 and 3986

Reach-In Incubator
29 cu. ft. capacity

Manual No. 7033980

Rev. 7

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 rear cover of this manual



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MANUAL NO. 7033980				
REV	ECN	DATE	DESCRIPTION	BY
7	19187/IN-2816	7/24/00	Added line cord standard	ccs
6	18153/IN2816 19207/IN-2827	6/28/00	Updated electrical specs and schematics (ratings)	ccs
5	18972/IN-2791 18948/IN-2787	3/6/00	Updated humidity configs, clarified dehumidify indicator operation Updated 3980-72 & 3986-71 drawings	ccs
4	17861/IN-2439	8/4/99	Updated electrical schematics for CSA	ccp
3	18192	4/20/99	Updated Figure 5-1 wiring per G. Smith	ccp

Do You Need Information or Assistance on Forma Scientific Products?

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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 Forma warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, Forma's professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 7:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

Forma Scientific, Inc.
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Marietta, OH 45750

International customers please contact your local Forma Scientific distributor.

General Safety Notes used in this Manual

	<p>Important operating and/or maintenance instructions. Read the accompanying text carefully.</p> <p>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.</p> <p>Wichtige Betriebs- und/oder Wartungshinweise. Lesen Sie den nachfolgenden Text sorgfältig.</p>
	<p>Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.</p> <p>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.</p> <p>Gefahr von Stromschlägen. Nur qualifizierte Personen sollten die Tätigkeiten ausführen, die mit diesem Symbol bezeichnet sind.</p>
	<p>Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.</p> <p>Risques potentiels liés à l'énergie. L'équipement en entretien ou en maintenance doit être éteint et mis sous clé pour éviter des blessures possibles.</p> <p>Geräte, an denen Wartungs- oder Servicearbeiten durchgeführt werden, müssen abgeschaltet und abgeschlossen werden, um Verletzungen zu vermeiden.</p>



Hot surface(s) present which may cause burns to unprotected skin or to materials which may be damaged by elevated temperatures

Présence de surface(s) chaude(s) pouvant causer des brûlures sur la peau non protégée, ou sur des matières pouvant être endommagées par des températures élevées.

Heiße Oberfläche(n) können ungeschützter Haut Verbrennungen zufügen oder Schäden an Materialien verursachen, die nicht hitzebeständig sind.

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

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Section 1 - Receiving

1.1 Preliminary Inspection

This item was thoroughly inspected and carefully packed prior to shipment and all necessary precautions were taken to ensure safe arrival of the merchandise at its destination. Immediately upon receipt, before the unit is moved from the receiving area, carefully examine the shipment for loss or damage. Unpack the shipment and inspect both interior and exterior for any in-transit damage.

1.2 Visible Loss or Damage

If any loss or damage is discovered, note any discrepancies on the delivery receipt. Failure to adequately describe such evidence of loss or damage may result in the carrier refusing to honor a damage claim. Immediately call the delivering carrier and request that their representative perform an inspection. Do not discard any of the packing material and under no circumstances move the shipment from the receiving area.

1.3 Responsibility for Shipping Damage

For products shipped F.O.B. Marietta, Ohio, the responsibility of Forma Scientific, Inc. ends when the merchandise is loaded onto the carrier's vehicle.

On F.O.B. Destination shipments, Forma Scientific's and the carrier's responsibility ends when your Receiving Department personnel sign a free and clear delivery receipt.

Whenever possible, Forma Scientific, Inc. will assist in settling claims for loss or in-transit damage.

Section 2 - Installation and Start-Up

2.1 Location

Locate the unit on a firm, level surface in an area of minimum ambient temperature fluctuation. A minimum of 12 inches clearance is required at the top of the incubator and a minimum of three inches clearance is required at the rear of the incubator to facilitate adequate air flow around the refrigeration system.

2.2 Connecting the Water (Humidity) System



Do not attempt to operate the humidity system without filling it with water. The humidification heater will overheat, and the overtemp safety thermostat will shut the humidification system down.

The humidity reservoir will require approximately one quart (.946 liter) of water on the initial filling. To ensure continuous satisfactory operation of the incubator, only distilled water should be used in the humidity system. Purity of the distilled water used in the incubator humidifier reservoir must be within the 50K Ohm to 1 M Ohm range to protect and prolong the life of the stainless steel unit.

Important:

Use of tap water, or distilled water outside the specified range, will decrease the operating life of the unit and will void warranty.

The water inlet is the 1/8" NPT connection located on the rear top left corner of the incubator. Water inlet pressure at the unit should be from 15 to 40 PSI. A manual shut-off valve should be installed between the main water supply and the incubator.



To prevent mineral buildup on heater coils and humidity generator walls, it may be necessary to clean the humidity generator and immersion heaters with a non-metallic abrasive pad and flush thoroughly every two or three months. Refer to Section 5.8, Cleaning and Adjusting the Humidity Steam Generator.

2.3 Attaching the Drain Lines

Note: For location of drain line connection, refer to Figure 2-2 on the following page.

The Condensate Drain is located at the rear of the cabinet on the lower left side (labeled DRAIN). A 3/8" MPT connection is required. The Door Condensate Drain (flexible tubing connected to the door condensate eliminator) should be fed into the hole in the rear of the chamber floor panel to return the condensate to the humidification reservoir.

The Chamber Drain (overflow from the humidification reservoir) is located on the rear of the cabinet in the lower center area. This drain must be trapped to prevent CO₂ drainage from the chamber. A copper p-trap (Figure 2-1 and Item A of Figure 2-2) is provided with the Model 3980 and must be installed. Attach vinyl tubing to the p-trap and route it to an open drain.

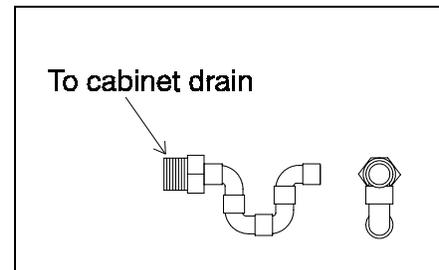


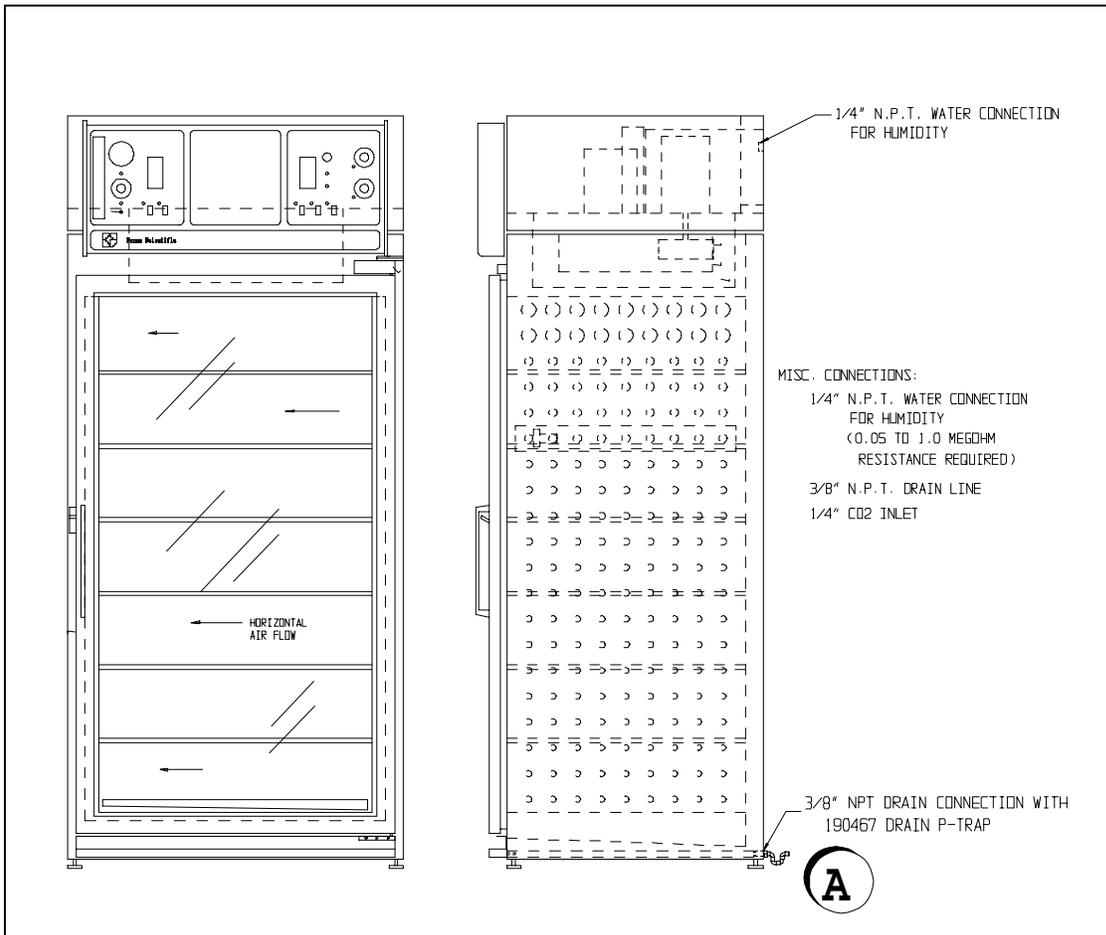
Figure 2-1
Cabinet Drain P-trap

2.4 Connecting the CO₂ Source

For the most economical use, the liquid CO₂ should be supplied from tanks without siphon tubes, so that only CO₂ gas enters the incubator injection system. Two tanks may be joined together with a manifold to ensure a continuous supply of CO₂.

A two-stage pressure regulator, with indicating gauges, should be installed at the supply cylinder outlet. The high-pressure gauge should have an indicating range of 0 to 2000 PSIG to monitor tank pressure. The low-pressure gauge should have an indicating range of 0 to 30 PSIG to monitor input pressure to the incubator injection system. A suitable two-stage pressure regulator is available from Forma Scientific, Inc.

The CO₂ source must be regulated at a pressure level between 5 and 10 PSIG. Higher pressure levels may damage the CO₂ control system. The user should determine the most economical pressure level, between 5 and 10 PSIG appropriate for the desired CO₂ percentage in the chamber. Forma Scientific, Inc. recommends only sufficient pressure to maintain recovery time after door openings.

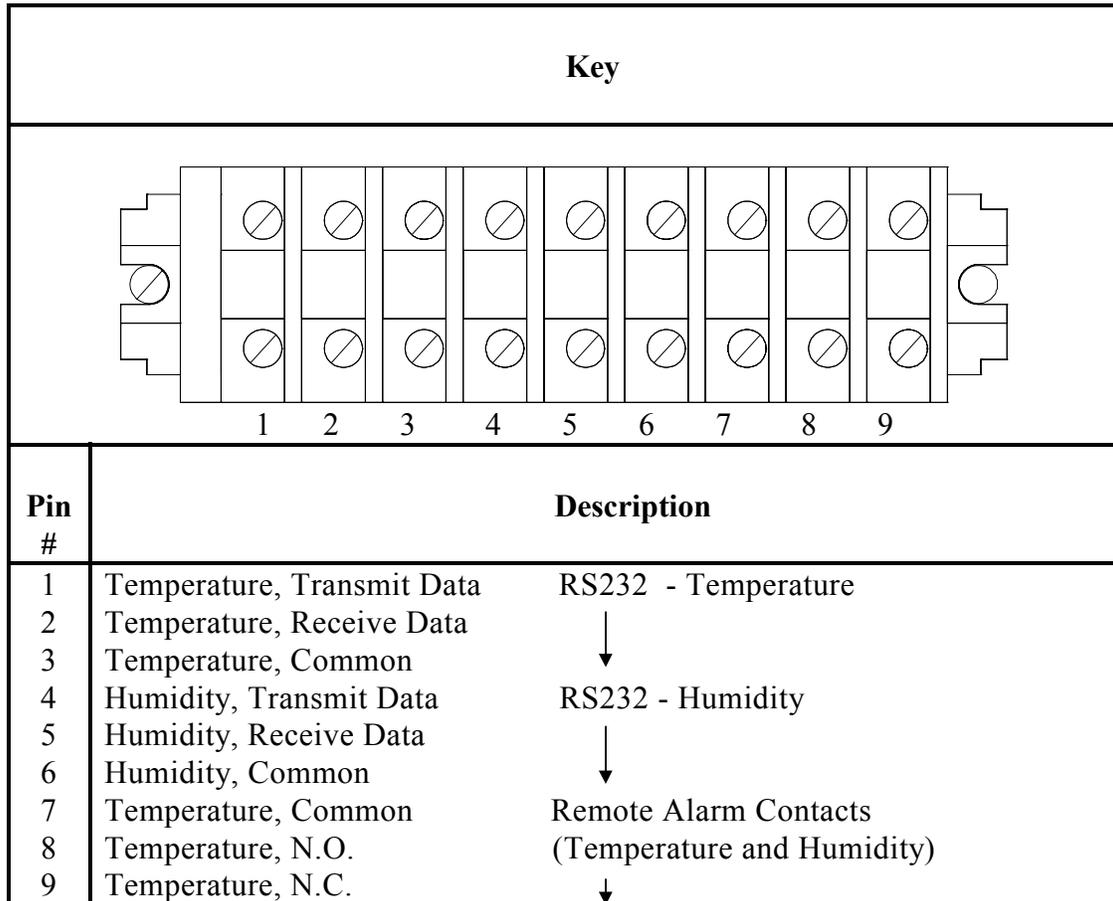


To connect the CO₂ supply:

- Insert the copper tubing provided with the unit as far as it will go into the nut of the CO₂ connection.
- Turn the nut until it is finger tight.
- For reference, scribe the nut at the 6:00 position.
- While holding the fitting body steady with a wrench, tighten the nut 1-1/4 turn until the mark is at the 9:00 position.
- Securely attach the CO₂ line to the open end of the copper tubing.
- Check the tubing connection for leaks.

2.5 RS-232 Interface and Remote Alarm Connector

The Model 3980/3986 is equipped with an RS-232 Serial Communication Interface for the remote transmission of temperature and humidity data. Remote alarm connections are also included on the terminal strip.



Terminal Pin Descriptions, RS-232 (1-6) and Remote Alarm Connections (7-9)
Figure 2-2

IMPORTANT USER INFORMATION

Caution! Stored product should be protected by an activated alarm system capable of initiating a timely response 24 hours/day. Forma Alarms provide interconnect for centralized monitoring.

2.6 Power Connection

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.



CAUTION! 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.

For Model 3980, plug the provided 10 ft. power cord with the NEMA 14-20 plug into the power outlet connection on the back of the cabinet, then into the grounded, dedicated electrical circuit.

For Model 3986, the electrical junction box is located on the rear top section of the incubator. With the junction box switch in the "OFF" position, connect the incubator to an adequate power source.

2.7 Start-Up

When the humidification system is operational, the incubator may be placed into service. Set the controls:

Overtemp Safety Thermostat.....(Fully Clockwise)
 Undertemp Safety Thermostat.....(Fully Clockwise)
 Main Power Switch.....ON
 Humidity Controller.....Desired Setpoint
 Temperature Controller.....Desired Setpoint
 CO₂ Flowmeter.....OFF
 CO₂ Purge ControlOFF
 Door Heater40% (factory set)

For best overall performance, the refrigeration switch should be turned on. When running Low/No humidity and high temperatures, the refrigeration switch may be turned off.



The defrost switch must be turned on when the temperature setpoint is 10°C, or below.

2.8 Setting the Overtemp Safety Thermostat

Permit the chamber temperature and humidity to stabilize, then set the overtemp safety thermostat as follows:

1. Turn the overtemp control knob slowly counterclockwise until the audible alarm sounds and the overtemp indicator lights.
2. Turn the overtemp control knob clockwise approximately two units on the scale. The alarm should be silenced and the overtemp indicator light should go out.

The overtemp safety thermostat is now set a few degrees above the control temperature setpoint. When the chamber temperature rises to the overtemp control point, the alarm system will activate, power to the heaters will shut off, and the chamber temperature will be maintained at the overtemp control point.

When an overtemp condition occurs, the cause must be determined and corrected before normal operation under the main temperature controller can be resumed.

Note: When the chamber temperature control setpoint is changed, the overtemp safety thermostat must be reset to accommodate the change.

2.9 Setting the Undertemp Safety Thermostat

After the chamber temperature and humidity have stabilized, set the undertemp safety thermostat as follows:

1. Turn the undertemp control knob slowly clockwise until the audible alarm sounds and the undertemp indicator lights.
2. Turn the undertemp control knob counterclockwise approximately two units on the scale. The alarm should be silenced and the undertemp indicator light should go out.

The undertemp safety thermostat is now set a few degrees below the control temperature setpoint. When the chamber temperature drops to the undertemp control point, the alarm system will activate, power to the compressor will shut off and the chamber temperature will be maintained at the undertemp control point.

When an undertemp condition occurs, the cause must be determined and corrected before normal operation under the main temperature controller can be resumed.

Note: When the chamber temperature control setpoint is changed, the undertemp safety thermostat must be reset to accommodate the change.

2.10 Preparing the (optional) CoBex Recorder

a. Installing the Chart Recorder Battery

The seven-day circular chart recorder is located on the front of the incubator cabinet and is protected by a glass door.

To prepare the recorder for operation, open the glass door and snap the connector onto the 9-volt battery as shown in Figure 2-3. If the unit is operating, the green LED lights steady. If the unit is not turned on, the LED blinks.

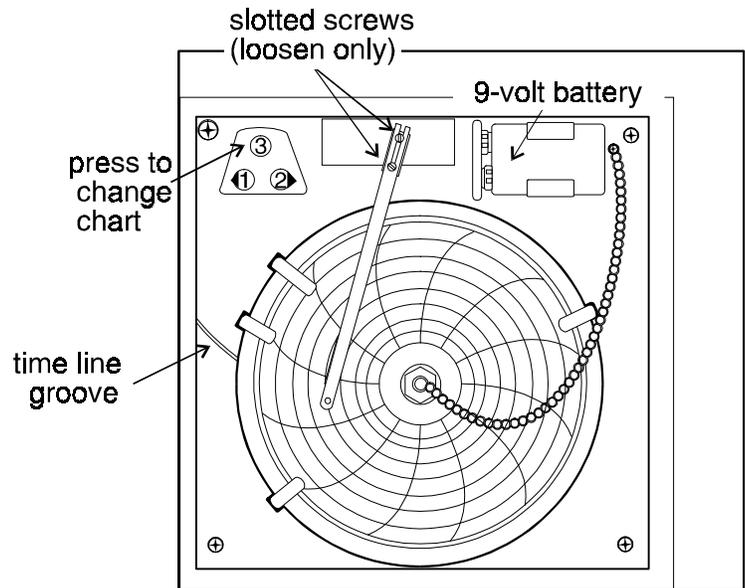


Figure 2-3

If the battery is weak or not connected, the green LED will flash. If power is lost to the cabinet, the LED will also flash. When replacing the 9-volt battery, use only an alkaline-style battery.

b. Changing the Chart Paper

1. Press the Change Chart button (#3) and hold it for 1 second until the pen begins to move to the left of the chart. See Figure 2-3.
2. Remove the existing chart by unscrewing the center knob securing it.
3. Install the new chart, positioning it so that the correct time line coincides with the time line groove on the chart plate.
4. Replace the center knob and screw it tightly against the chart.

c. Changing the Pen

1. Using a small flat blade screwdriver, loosen the 2 screws holding the pen arm and remove the pen and arm as an assembly.
2. Unsnap the plastic hinge securing the pen. Remove and discard the old pen.
3. Install the new pen by snapping the hinge securely around the pen arm.

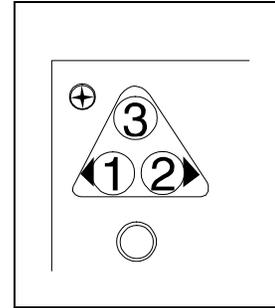


Figure 2-4

4. Re-install the pen assembly by sliding the pen arm under the screws, positioning the pen tip in the time line groove. Tighten the screws.
5. Push the Chart Change button and hold it for 1 second until the pen begins to move back onto the chart.

Note: Make sure that the pen is marking on the chart. It may be necessary to gently lift the pen onto the chart paper.

d. Calibrating the Chart Recorder

1. Place an accurate thermometer(s) in the chamber next to the recorder's probe(s). After about three minutes, compare the thermometer with the chart recorder. For 2 pen operations, also compare the second thermometer.

Note: For 2 pen operations, first select the pen you wish to calibrate. Hold down the #1 arrow for the red (#1) pen or the #2 arrow for the blue (#2) pen, until the light goes out. Then adjust as necessary.

If an adjustment is necessary, press either the #1 or #2 button to move the pen left or right. The button must be held about five seconds before the pen begins to move. Release the button when the pen matches the thermometer.

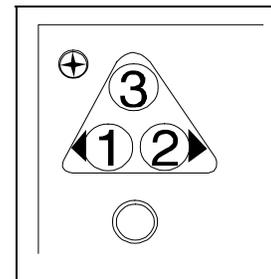


Figure 2-5

2.11 Offset Calibration

It may be necessary to calibrate the temperature or humidity controllers to match an independent temperature or humidity sensor. To do so, follow the next steps. *Wear a grounding wrist strap to avoid damaging any of the electrical components.*

1. Suspend an independent, calibrated sensor(s) in the center of the interior chamber. Allow approximately 30 minutes for the incubator to stabilize.
2. Turn OFF the main power switch.
3. Remove the 982 controller module(s) by pressing in the four retaining tabs, two on the right side, two on the left side. (Refer to Figure 2-6) Pull the controller module out by gently rocking it from side to side.
4. Looking at the top and left side of the controller module, locate the red DIP switches indicated in Figure 2-7. Use your fingernail or a small screwdriver, to turn *off* SW 2 by moving the white toggle towards the front of the module as shown in the illustration.
5. Return the controller into its frame and firmly press on the top and bottom of the bezel until all four locking tabs “click” into place.
6. Turn ON the main power switch.
7. Press the Up and Down Arrow keys simultaneously for 3 seconds. The word “InPt” will appear in the upper display, and “set” will appear in the lower display.
8. Press the Down Arrow once, then continue to press the Mode key until “LOC” appears in the lower display. The upper display will show 2. Press the Down Arrow until 0 appears.
9. Press the Mode key once, then the Up Arrow once. “InPt” will appear in the upper display, and “set” will be in the lower display. Press the Mode key until “CAL 1” appears in the lower display. Press the Up or Down Arrow key to either add or subtract an offset value. This would be the difference between the actual value shown on the controller and the reference sensor value.
10. Press the Display key once, then the up and down keys simultaneously for 3 seconds. The word “InPt” will appear in the upper display, and “set” will appear in the lower display.
11. Press the down arrow once and continue to press the mode key until “LOC” appears in the lower display. The upper display will show 0. Press the up arrow until 2 appears.

12. Press the display key once
13. Turn OFF the main power switch.
14. Remove the 982 controller module(s) by pressing in the four retaining tabs, two on the right side, two on the left side. (Refer to Figure 2-6) Pull the controller module out by gently rocking it from side to side.
15. Looking at the top and left side of the controller module, locate the red DIP switches indicated in Figure 2-7. Use your fingernail or a small screwdriver, to turn **on** SW 2 by moving the white toggle towards the rear of the module as shown.
16. Return the controller into its frame and firmly press on the top and bottom of the bezel until all four locking tabs “click” into place.

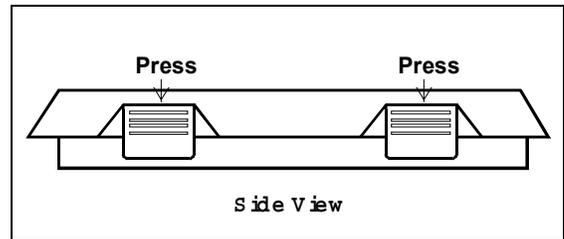


Figure 2-6

17. Turn ON the main power switch.
18. Looking at the top and left side of each controller module, locate the red DIP switches indicated in Figure 2-6.
19. With a fingernail or small screwdriver, turn off SW 2 by moving the white toggle towards the front of the module as shown. SW 2 is the top switch when looking at the module from the side.
20. Looking at the back of the module, set all three of the DIP switches at the bottom of the chassis to the ON position (up as shown in Figure 2-8).
21. Install the modules into their locations on the front panel and press on the top and bottom of the bezel until all four locking tabs “click” into place.
22. Restore electrical power to the unit.

23. To enter Setup (SET on the controller display), press the up and down keys simultaneously for 3 seconds. The word “InPt” will appear in the upper display, and “set” will appear in the lower display. If numbers appear in the bottom display and begin to scroll up or down, the keys have not been pressed simultaneously. Try again.
24. There are four menus under the “set” prompt: InPt (input menu), OtPt (output menu), gLbL (global menu), and COM (communications menu). Use the Up or Down keys to select a menu, and the Mode key to advance through the menus.

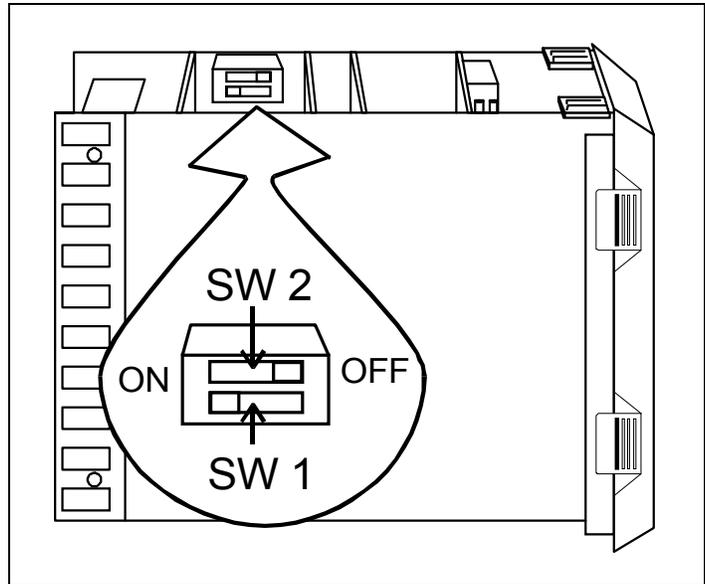


Figure 2-7

25. Follow the configurations on the back two pages of this instruction sheet. The function (Temperature or Humidity) is identified in the header section of the sheets under “control type.”

Note: Prompts on the configuration sheet marked NA indicated that they will not appear in the menus and therefore will not appear on the display.

26. Install the configurations in the order listed on the sheets: InPt, OtPt, gLbL, and COM. COM is required only if the RS-232 data communications port is to be used.
27. When all of the setup menus are completed, press the Display key to revert back to the actual/setpoint display. Then press the Mode key. The Operations Menu (OPER) should be showing in the lower display, (SyS) should be showing in the upper display.
28. Install the Operation menu consisting of SyS and PID according to the configuration sheets.
29. To enter the Setup (SET) prompt, press the Up and Down Arrow keys simultaneously for 3 seconds. The word “InPt” will appear on the upper display, and “set” will appear on the lower display. If numbers are displayed which begin to scroll up or down, the keys have not been pressed simultaneously. Try again.

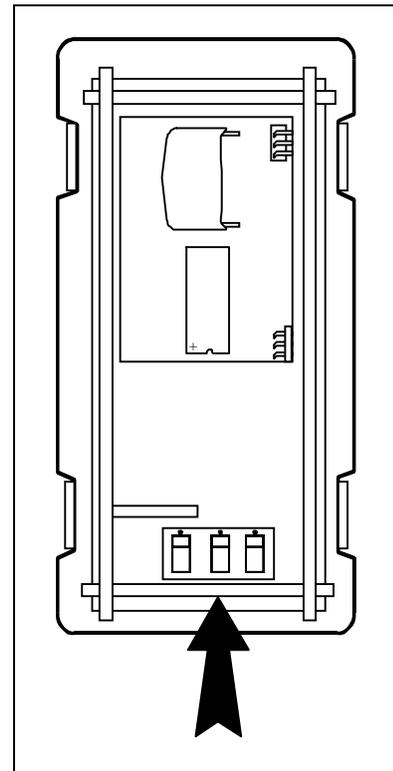


Figure 2-8

2.12 Controller Configuration

The controllers have been pre-configured at the factory. Reference copies of the Watlow Configuration records are included on the following pages.



Do not re-configure the controllers without first consulting Forma Scientific, Inc., Service Department at 1-888-213-1790.

Section 3 - Control Panel Operation

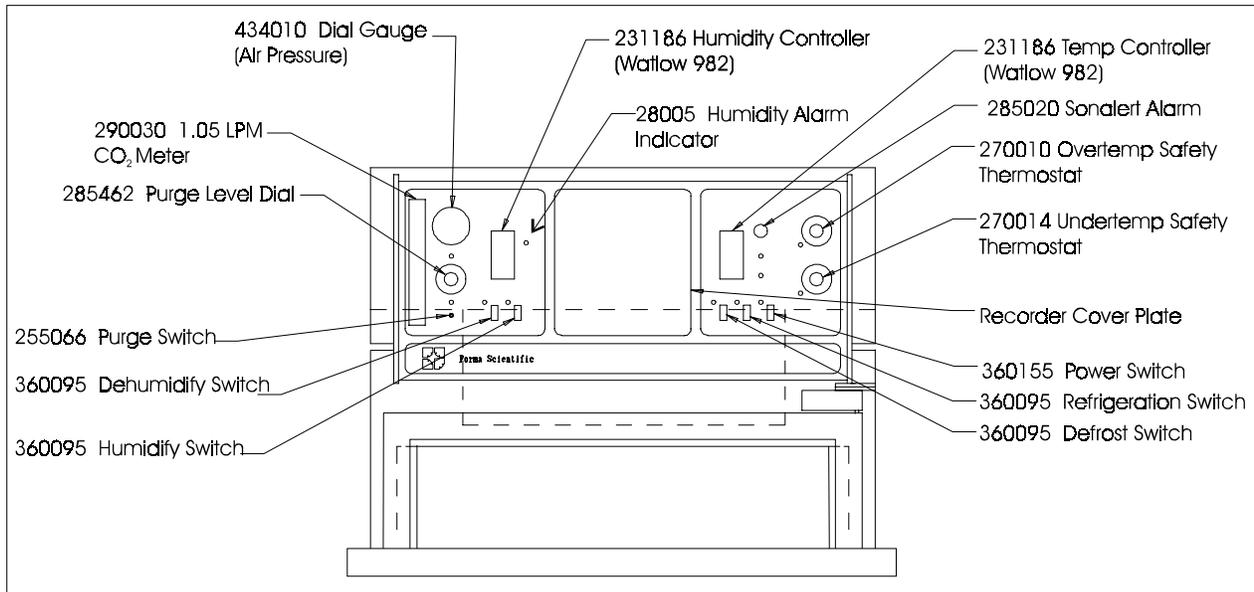


Figure 3-1
Control Panel of the Model 3980 Incubator

3.1 Main Power Switch and Indicator Light

The main power switch controls power to the incubator control systems. The main power indicator lights when the power switch is on and the unit is receiving power.

3.2 Refrigeration Switch and Indicator Light

The refrigeration switch controls power to the refrigeration system. The refrigeration indicator lights when the refrigeration switch is on and the compressor is receiving power.

3.3 Defrost Switch and Indicator Light

The defrost switch controls power to the defrost system. The defrost timer is factory-set to provide two 15-minute defrost cycles during a 24-hour period.



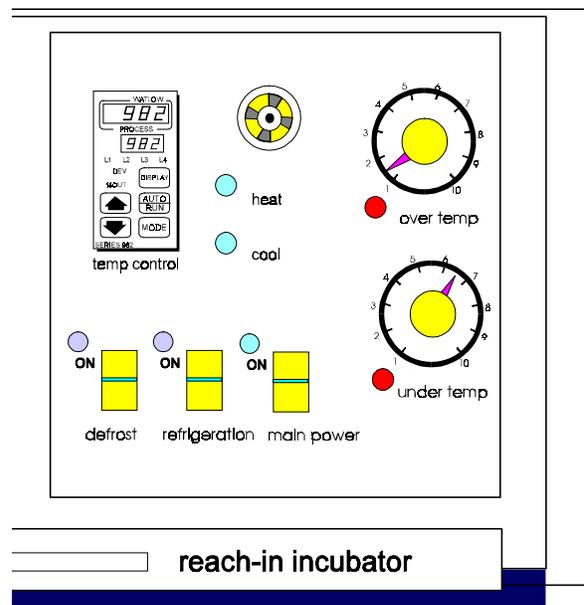
The defrost switch must be turned on when the temperature setpoint is 10°C, or below.

The defrost indicator lights when the defrost switch is on and the incubator is in a defrost cycle.

3.4 Overtemp Safety Control, Indicator Light and Audible Alarm (Refer to Figure 3-2)

The overtemp safety thermostat should be set slightly above the operating temperature of the incubator. In the event of an overtemp condition, the overtemp safety thermostat will:

1. Activate the audible alarm and the overtemp indicator light.



**Figure 3-2
Temperature Controls Detail**

2. Interrupt power to the heaters and maintain the temperature at the overtemp control point.

The overtemp control is not directly calibrated. The numbers (0 to 10) on the dial are *for reference only* and do not correspond to any specific temperature. If an overtemp condition occurs, the cause of the problem must be determined and corrected before normal operation under the main temperature controller can be resumed.

3.5 Undertemp Safety Control, Indicator Light and Audible Alarm

The undertemp safety thermostat should be set slightly lower than the operating temperature of the incubator. In the event of an undertemp condition, the undertemp safety thermostat will:

1. Activate the audible alarm and the undertemp indicator light.
2. Shut off power to the refrigeration system and maintain the temperature at the undertemp control point.

The undertemp control is not directly calibrated. The numbers (0 to 10) on the dial are *for reference only* and do not correspond to any specific temperature. When an undertemp condition occurs, the cause of the problem must be determined and corrected before normal operation under the main temperature controller can be resumed.

3.6 Temperature/Humidity Controllers

The Watlow Series 982 microprocessor based controllers control the temperature and humidity functions of the incubator. Refer to Figure 3-3. Refer to the Watlow manual included with this manual and the Watlow configuration records at the end of Section 2.

Upper Display (PROCESS)

The four digit, LED upper display indicates either actual process value, the operating prompt values, or error codes. When powering up, the display will be blank for 3 seconds.

Lower Display

The four digit, LED lower display indicates the setpoint, deviation, percent power temperature unit, menu prompts or alarm codes.

L1, L2, L3, L4

When lit, these LEDs indicate when Output #1, #2, #3, or #4 are respectively active. Outputs can be configured as:

- OT1 Control**
- OT2 Control or Alarm**
- OT3 Alarm, Event or Re Transmit**
- OT4 Alarm, Event or Communications**
Flashes on transmit and receive.

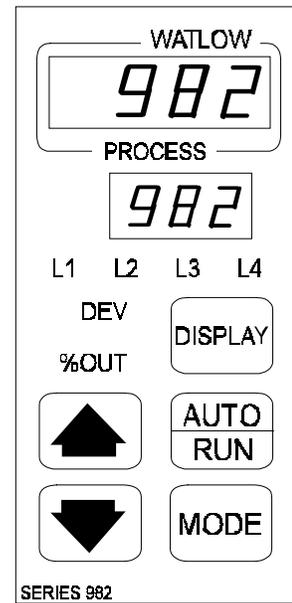


Figure 3-3
Controller Keys and Displays

Dev LED

When lit, shows the deviation from the current setpoint in the lower display.

% Out LED

When lit, shows the current percent output in the lower display.

Display Key

Press the display key to enter the Display loop. Refer to Pages 21 and 22 of the Watlow manual.

Up Key

Press the Up Key to increase the value of the displayed prompt.

Down Key

Press the Down Key to decrease the value of the displayed prompt.

Up/Down Key (simultaneously)

Press the Up/Down keys simultaneously for three seconds, the Setup (SET) prompt appears. Press and hold the keys for six seconds and the Factory (FCTY) prompt appears.

Hold/Run Key

Press once to clear a latched alarm without altering the Hold/Run status. To run or halt a program refer to Chapter 7 of the Watlow manual.

Hold/Run LED

When lit, the control is RUNning. When blinking, press the Hold/Run key again to begin RUN.

Mode Key

Steps the control through the menus. Enter new data after pressing the Mode key.

Mode/Up Key

First press the Mode Key then press the Up Key to scroll backwards to the top of the menu. Scrolling is disabled when the keys are released.

3.7 Audible Humidity Alarm and Indicator

The humidity alarm is a function of the humidity controller. When the cabinet humidity goes outside the set parameters of the controller, L3 indicator on the controller lights, the audible alarm sounds and the humidity alarm indicator on the control panel lights.

Pressing the Mode key on the controller silences the audible alarm and extinguishes the humidity alarm indicator. The L3 indicator on the controller remains on until the cabinet humidity returns to the parameter setpoint.

3.8 Dehumidify Switch and Indicator Light

The dehumidify switch will enable the refrigeration system if the refrigeration switch is currently off. When controlling humidity, the dehumidification switch should be in the ON position for most applications. The dehumidification light will cycle on and off as the humidity controller toggles between humidify and dehumidify. The dehumidify light will be de-energized when the system is in Defrost mode.

Humidity is removed from the cabinet by the refrigeration evaporator coil. Moisture accumulates on the coil and is collected into the evaporator pan. The accumulated moisture is then plumbed to the back of the cabinet, which can be emptied to a floor drain, or an evaporative device.

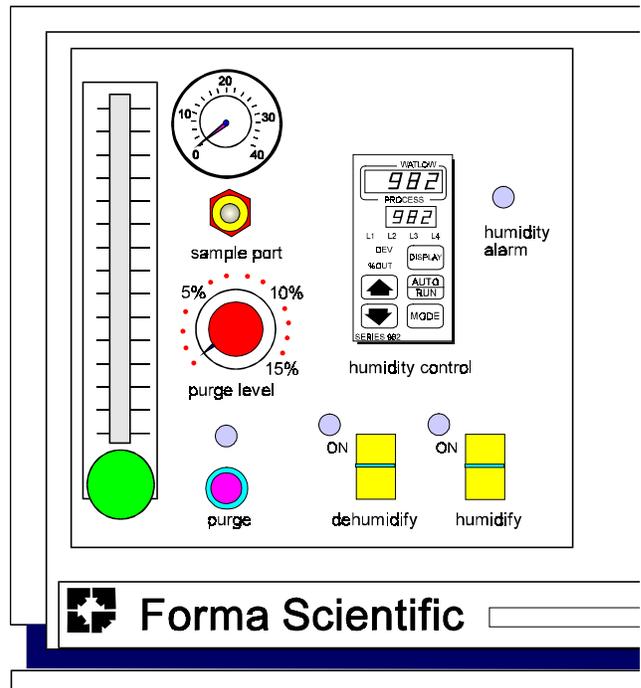


Figure 3-4
Humidity/CO₂ Detail

3.9 Humidify Switch and Indicator Light

The humidify switch controls the power to the humidification system circuit. The humidity indicator light will cycle as the controller toggles between humidify and dehumidify.

3.10 Setting the CO₂ Flowmeter

The CO₂ flowmeter controls the flow of CO₂ into the incubator chamber. A float ball indicates the CO₂ flow rate against the 0 to 100 arbitrary scale. To provide approximately 5% of CO₂ content in the chamber, set the scale to 40.

CO₂ content should be checked with an independent test instrument to insure the desired percentage.

3.11 CO₂ Sample Port

A serrated gas sample port, located on lower left front corner of control panel has been provided for checking the CO₂ percentage by an independent measuring device.



To prevent CO₂ loss, the sample port must be capped when it is not in use.

3.12 Purge Level Dial

The purge level dial is used to set the duration of the CO₂ purges. For example, when the dial is set at 5%, the incubator will be purged with CO₂ for about one minute and 45 seconds. This is enough to replace approximately 5% of the air in the chamber with CO₂.

The reference markings on the dial are 5%, 10% and 15%.

3.13 Purge Button and Indicating Light

The purge button permits manual injection of CO₂ into the chamber, to replace CO₂ loss due to door openings, etc. The purge duration is dependent upon the purge level dial setting. The purge indicating light is energized when CO₂ is being purged in the incubator chamber.



Press the CO₂ purge button after each opening of the incubator door to regain the correct CO₂ percent in the chamber.

3.14 Air Pressure Gauge

The CO₂ is propelled inside the chamber by air pumps. The air pressure gauge indicates the approximate air pump pressure in a range from 0 to 5 PSIG.

A minimum air pressure of 3/4 PSI is needed to maintain a 5% CO₂ content in the chamber.

3.15 Recorder (Optional)

The optional recorder provides a tracing of the chamber temperature and, on some recorder models, both temperature and humidity. Refer to the recorder supplement included with the manual.

3.17 Air Exchange Ventilator Caps



When using CO₂ in the chamber, the ventilator caps must be completely closed to minimize CO₂ loss.

Air exchange for the incubator is regulated through the manually adjustable intake and exhaust ventilator caps located on the top of the cabinet.

When viewed from the front of the incubator, the intake cap is on the left and the exhaust cap is on the right. The ventilator caps may be opened by turning counterclockwise and closed by turning clockwise.

Section 4 - Routine Maintenance

4.1 Cleaning the Incubator



De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

The continued cleanliness of the stainless steel used in Forma products has a direct effect on the appearance and operation of the unit. Use the mildest cleaning procedure that will do the job effectively. Clean the outside of the incubator with soap and water or with any non-abrasive commercial spray cleaner. Clean the inside of the chamber with alcohol and/or soap and water. Disinfect the interior panels with a general use laboratory disinfectant, diluted according to the manufacturer's instructions. Rinse the surface thoroughly after each cleaning and wipe the surfaces dry. Always rub in the direction of the finish polish lines.



Do not use chlorinated solvents on stainless steel as they can cause rusting and pitting.



Do not use volatile or aromatic solvents for cleaning inside the cabinet as their residue can contaminate the cabinet environment.

The Thermopane glass door may be cleaned with commercial glass cleaner or a solution of ammonia and water.

Section 5 - Service



Servicing must be performed by qualified service personnel only!

5.1 Access to the Electrical Components



De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

To gain access to the electrical components, open the control panel and grasp the left side of the control panel housing. Pull it firmly up and out.

5.2 Replacing the Overtemp/Undertemp Probe and Thermostat



De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

1. Remove the incubator ceiling by removing the screws holding it in place.
2. Remove the top three screws from the top of the right duct cover.
3. Lean the duct sheet out and remove the Permagum seal from around the probe access hole.

4. Remove the 15" copper capillary overtemp probe by extracting the two plastic clips that hold the probe in place.
5. Open the control panel.
6. Pull the overtemp probe up through the access hole and into the control panel.
7. Follow the wires from the probe to the thermostat mounted on the control panel. Clip the plastic ties holding the overtemp cable to the existing wiring.
8. Pull the overtemp knob on the control panel off.
9. Remove the two screws that hold the overtemp assembly to the control panel.
10. Disconnect the two wires from the back of the thermostat assembly.
11. Pull the entire assembly out of the panel, and remove the unit.
12. Replace the thermostat and probe.

Note: Reseal the probe access hole with Permagum and retie the overtemp cable to the existing wires after replacing the probe.

5.3 Replacing the Humidity/Temperature Sensor



De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

1. Locate the probe mounting plate in the center of the right side of the incubator interior.
2. Open the mounting plate by removing the screws that hold it in place.
3. Locate the humidity sensor mounted on the inside of the panel in a black housing. Note the angle of the probe.
4. Grasp and unplug the probe from the probe cable.
5. When replacing the humidity sensor, be sure to mount the probe at the same angle as it was originally mounted.

5.4 Replacing the Optional Recorder and Probe(s)



De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

1. Open the incubator door and locate the probe mounting plate attached to the center of the right interior wall. Remove the mounting plate.
2. Single pen recorders have only one long stainless steel probe, attached to the lower end of the back of the mounting plate. Remove the probe by carefully sliding it out of the housing.
3. Remove the screws securing the ceiling of the incubator and remove the ceiling.
4. Remove the top three screws on both edges of the right duct sheet.
5. Lean the duct sheet out in order to remove the Permagum seal from around the probe access hole.
6. Open the control panel door, and remove any Permagum from around the access hole.
7. Pull the probe(s) carefully up through the hole.
8. Follow the probe cable(s) to the back of the recorder and carefully clip any plastic ties holding the cable(s) to other wiring.
9. Remove the three screws securing the recorder and pull it carefully out from the front of the control panel.
10. Replace the recorder with the correct Forma part.

Note: When replacing the recorder and probe(s), retie the probe cable(s) to the existing wires.

Avoid making sharp bends in the probe capillary tubes.

5.5 Removing the Top Section



De-energize all potential sources of energy to this unit and lockout/tagout their controls. (O.S.H.A. Regulation, Section 1910-147.)

If it becomes necessary to remove the top of the incubator when moving it through low doorways, use the following procedure:

- Read the instructions completely before starting the removal process.
- Provide adequate space and sufficient lighting to perform the work.
- Disconnect the inlet water supply and the drain.
- Before lifting the top section from the incubator, provide sawhorses or another suitable support arrangement so that the underside of the top is suspended.

Procedure:

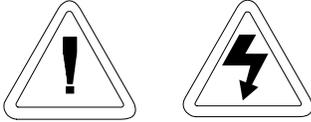
1. Remove all test material from the incubator chamber.
2. All temperature and/or humidity sensing probes are mounted on a probe mounting bracket on the right side of the incubator chamber. Remove the nuts securing the bracket and then remove the probes from the bracket. Note the location and configuration of the probes.
3. The sensing bulb capillaries are routed behind the duct sheet up to the access port at the top of the unit behind the control panel. Route all of the probes between the duct sheet and the outside wall of the chamber so that when the top is raised, the probes will move freely up and out. Do not kink or bend the capillaries.
4. The humidification system drain line (3/8" clear Tygon) is routed down through the access port and is secured to the condensate drain tube on the center left side of the incubator, as viewed from the rear. Free the drain line, by pulling it away from the float tank (behind the control panel) and routing it down through the access port.
5. Open the control panel (up to 90°) by grasping the left side and pulling out until the catch releases.

6. Loosen the top gasket around each of the air exhaust vents by turning the screw.
7. Remove the eight screws from the top cover of the incubator.
8. Remove the four screws from each of the vent caps on the top cover of the incubator. The top cover can now be removed.
9. Remove the nine 5/16" x 4" hex head bolts, lock washers, and two flat washers which secure the top assembly to the cabinet. Note the washer arrangement on the bolts.
10. Remove the black trim gasket located at the junction of the top assembly and the main incubator section. The ends of the gasket have been joined together at the rear of the incubator.

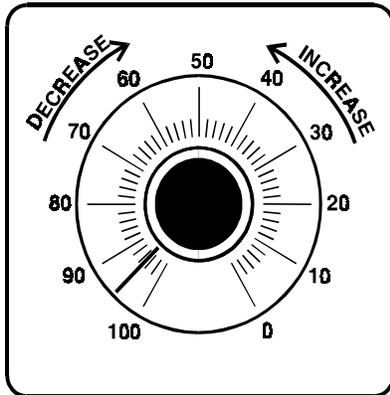
Note: When raising the top section, notice the gasket seal at the top opening of the incubator chamber. The gasket must be correctly positioned when reinstalling the top on the chamber.

11. *Slowly* lift the entire top assembly up and off the lower chamber section while *carefully* guiding the capillaries and sensing bulbs out of the chamber area. Place the top assembly onto the carpenter's horses or other support arrangement.
12. Reinstall the top assembly by reversing the above procedure. Exercise care particularly when:
 - Placing and aligning the sealer gasket on the 1/2" flange on top of the chamber when lowering the top in place.
 - Routing the temperature and/or humidity sensors and capillaries to prevent severe bending.
 - Mounting the temperature and/or humidity sensor bulbs on the mounting brackets.
 - Tightening the top mounting bolts alternately, to ensure a balance pressure on the gasket.

5.6 Setting the Door Heater Control



Warning:
*High voltage is present behind the control panel.
Servicing must be performed only by qualified
electrical service personnel.*



The infinite heater control is located in the right side of the incubator top compartment behind the control panel door. The heater varies the amount of door heat from no heat (zero) to full heat (100) as indicated by the control dial face. If the knob is turned past zero, a “click” will indicate that all power to the door is shut off. If turned past 100, a similar “click” will indicate that the heat is set at the maximum.

Initially the units leave the factory with the dial set at 40. If desired, the amount of heat can be reduced until moisture appears on the door, then the heat advanced. However, in fluctuating ambient conditions, it is recommended that a minimum of 40% door heat be used.

5.7 Replacing the Air Pump(s)



**De-energize all potential sources of energy to this unit and lockout/tagout their controls.
(O.S.H.A. Regulation, Section 1910-147.)**

1. Access to the air pump(s) is obtained by opening the front of the control panel. Grasp the left side of the control panel housing and pull it gently but firmly, up and out.
2. The air pump(s) are located midway back toward the right side of the component area.
3. Remove the screws securing the air pump bracket(s). Remove bracket(s) and set aside.
4. Remove the clear outlet tubing from defective air pump(s).
5. Electrically disconnect air pump(s) from main wiring harness.

5.8 Cleaning and Adjusting the Humidity Steam Generator, P/N 505087

Materials Required: 6-foot stepladder Flat and Phillips screwdrivers
Clamp-on style Ammeter Laboratory disinfectant
Siphon, sponge, and cleaning materials

1. Remove all contents from the incubator, shut it off and disconnect the power.

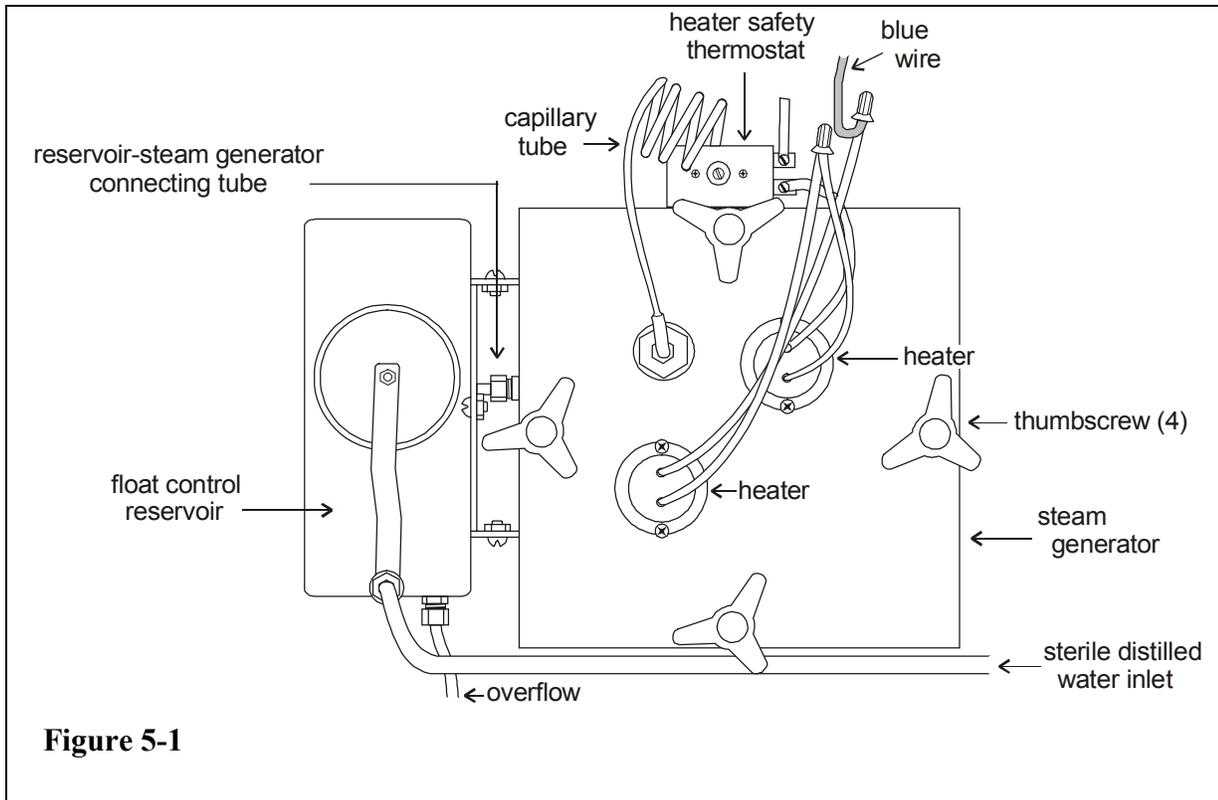
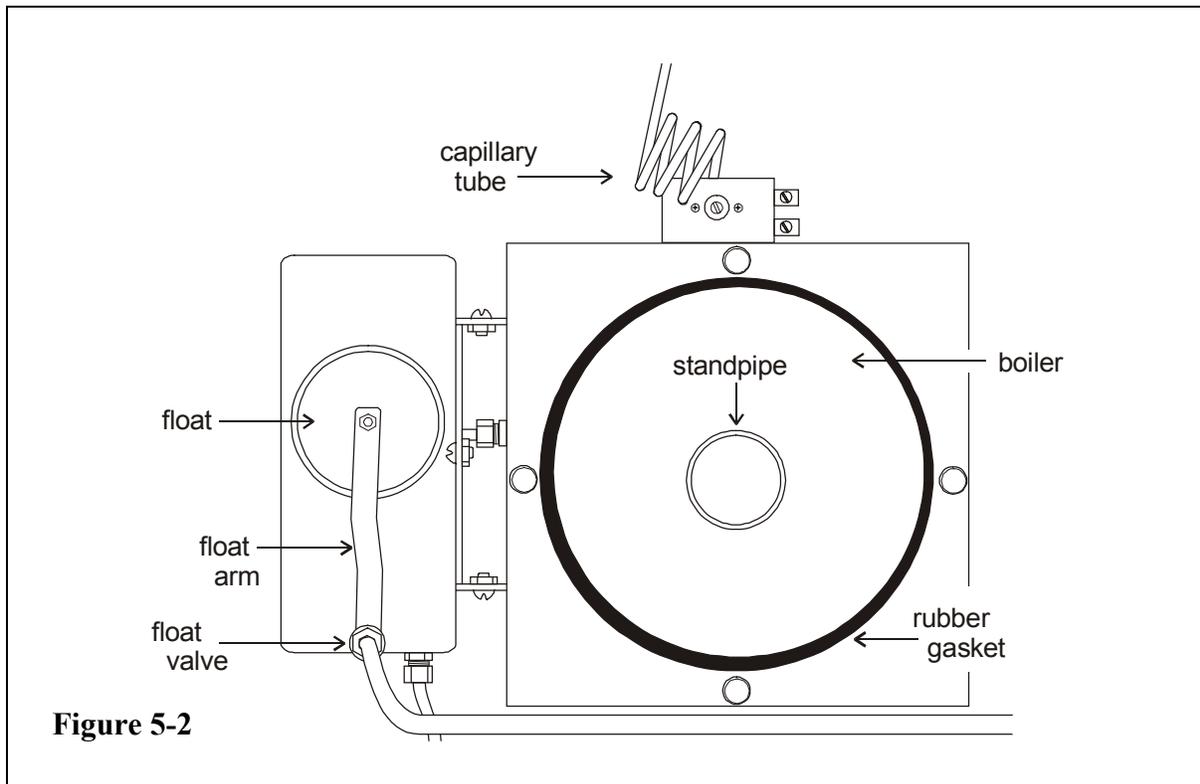


Figure 5-1

2. Turn off the valve supplying the sterile distilled water.
3. From the stepladder, remove the eight Phillips screws securing the top of the incubator cabinet.
4. When the steam generator has cooled, remove the four thumbscrews.



The internal temperature of the steam generator is hot enough to boil water. Make certain sufficient time is given to allow the unit to completely cool before removing the top.



5. Lift the top off the steam generator and lay it aside, taking care not to crimp the copper capillary tube.
6. Siphon all of the water out of the steam generator and clean it with a good quality laboratory detergent and disinfectant. **Do not use any type of chloride cleaner.** A bristle brush may be needed for stubborn rust and scale. Also clean the inside of the standpipe using a test tube brush. Siphon and sponge the wash water out of the steam generator. Repeat cleaning with soap and water as necessary.
7. Carefully pry off the brass top of the float control reservoir. Clean and disinfect it and the connecting tube between the reservoir and the steam generator, being careful not to damage the float assembly.
8. Also clean the two heater elements and the part of the copper capillary tube attached to them.
9. When all surfaces are clean, rinse with sterile distilled water until all soap and disinfectant are removed.

10. Open the distilled water valve and allow the reservoir to fill. Measure the water level. Limits are three inches, plus or minus one-quarter of an inch. The water level is raised and lowered by carefully bending the float arm. When set, replace the cover.
11. Replace the top of the steam generator and alternately tighten the four thumbscrews to evenly compress the rubber gasket.

Calibration Check for Steam Generator Safety Thermostat

1. Turn the slotted rheostat shaft of the temperature control on the back of the steam generator fully clockwise.
2. Remove all tools and cleaning materials from the top of the incubator. Reconnect power to the unit and turn it on.
3. Set the RH level to 100% and open the incubator door. This will cause the heaters in the steam generator to be continuously energized.



The next step requires working in the top section of the incubator where high voltages are present. This should only be done by qualified persons.

4. Using a clamp-on ammeter, verify that there is current flow in the blue wire going to the heater connectors. Refer to the illustration in Figure 1.
5. Proper current is about 3.6 amps. If there is no current flow and the humidity indicator is on, rotate the small slotted screw in the shaft of the safety thermostat counterclockwise, using a jeweler's screwdriver, until the current flows to the heaters.
6. Allow the steam generator to operate for about 30 minutes continuously. If the heaters cycle off due to the safety thermostat, rotate the small slotted screw further counterclockwise to maintain the heater's operation.
7. After 30 minutes, turn the small slotted screw clockwise *very slowly* until the heaters shut off.
8. Turn the slotted screwdriver 1-1/2 turns counterclockwise. The thermostat is now properly adjusted.
9. Replace the cabinet top and return the incubator to service.

Section 6 - Specifications

<p>Temperature</p> <table style="width: 100%; border: none;"> <tr><td>Control</td><td>±0.1°C @ +37°C (98.6°F)</td></tr> <tr><td>Range</td><td>0°C (32°F) to +60°C (140°F)</td></tr> <tr><td>Sensor</td><td>RTD</td></tr> <tr><td>Controller</td><td>Digital electronic proportional</td></tr> <tr><td>Setpoint</td><td>Digital</td></tr> <tr><td>Display</td><td>Digital LED</td></tr> <tr><td>Readability</td><td>0.1°C</td></tr> <tr><td>Setability</td><td>0.1°C</td></tr> <tr><td>Uniformity</td><td>±0.3°C at 25°C to 37°C with six shelves installed*</td></tr> </table> <p>CO₂</p> <table style="width: 100%; border: none;"> <tr><td>CO₂ Gas Control</td><td>Flowmeter</td></tr> <tr><td>Range</td><td>0-20%</td></tr> <tr><td>Inlet Pressure</td><td>10 PSIG</td></tr> <tr><td>Controller</td><td>Flow ratio</td></tr> <tr><td>Setpoint</td><td>Single flowmeter 0 to 1.05 LPM</td></tr> <tr><td>Air Supply</td><td>Built-in air pump</td></tr> </table> <p>Shelves</p> <table style="width: 100%; border: none;"> <tr><td>Standard</td><td>6</td></tr> <tr><td>Maximum</td><td>19</td></tr> <tr><td>Dimensions</td><td>30.62"W x 25.81"F-B (77.78 cm x 65.56 cm)</td></tr> <tr><td>Construction</td><td>Solid stainless steel reinforced</td></tr> <tr><td>Surface Area</td><td>5.4 sq. ft. (.51 sq. m) per shelf</td></tr> <tr><td>Max. Per Chamber</td><td>104.3 sq. ft. (9.69 sq. m)</td></tr> <tr><td>Clearance</td><td>Adjustable on 3" (7.62 cm) centers</td></tr> <tr><td>Loading</td><td>35 lbs. (16 Kg) (slide in and out) 50 lbs. (23 Kg) (stationary)</td></tr> </table> <p>Construction</p> <table style="width: 100%; border: none;"> <tr><td>Volume</td><td>29 cu. ft. (823 liters)</td></tr> <tr><td>Interior</td><td>304 2B stainless steel</td></tr> <tr><td>Exterior</td><td>Cold rolled steel</td></tr> <tr><td>Insulation</td><td>2" (5.1cm) Foamed urethane</td></tr> <tr><td>Outer Door Gasket</td><td>Four sided vinyl compression</td></tr> <tr><td>Finish</td><td>Powder coated. Salt spray tests exceed 1000 hrs. per ASTM Standard B117-85.</td></tr> </table> <p>Weights</p> <table style="width: 100%; border: none;"> <tr><td>Net</td><td>800 lbs. (363 Kg)</td></tr> </table> <p>Shipping</p> <table style="width: 100%; border: none;"> <tr><td>Motor</td><td>860 lbs. (390 Kg)</td></tr> <tr><td>Air</td><td>940 lbs. (476 Kg)</td></tr> <tr><td>Ocean</td><td>985 lbs. (447 Kg)</td></tr> </table>	Control	±0.1°C @ +37°C (98.6°F)	Range	0°C (32°F) to +60°C (140°F)	Sensor	RTD	Controller	Digital electronic proportional	Setpoint	Digital	Display	Digital LED	Readability	0.1°C	Setability	0.1°C	Uniformity	±0.3°C at 25°C to 37°C with six shelves installed*	CO ₂ Gas Control	Flowmeter	Range	0-20%	Inlet Pressure	10 PSIG	Controller	Flow ratio	Setpoint	Single flowmeter 0 to 1.05 LPM	Air Supply	Built-in air pump	Standard	6	Maximum	19	Dimensions	30.62"W x 25.81"F-B (77.78 cm x 65.56 cm)	Construction	Solid stainless steel reinforced	Surface Area	5.4 sq. ft. (.51 sq. m) per shelf	Max. Per Chamber	104.3 sq. ft. (9.69 sq. m)	Clearance	Adjustable on 3" (7.62 cm) centers	Loading	35 lbs. (16 Kg) (slide in and out) 50 lbs. (23 Kg) (stationary)	Volume	29 cu. ft. 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(447 Kg)	<p>Temperature Alarm</p> <table style="width: 100%; border: none;"> <tr><td>Sensor</td><td>Thermostat</td></tr> <tr><td>Controller</td><td>Thermostat</td></tr> <tr><td>Setpoint</td><td>Analog reference dial</td></tr> <tr><td>Alarm</td><td>Audible/visual</td></tr> </table> <p>Humidity</p> <table style="width: 100%; border: none;"> <tr><td>Humidity Control</td><td>±5.0% RH</td></tr> <tr><td>Range</td><td>Above ambient to 95%</td></tr> <tr><td>Sensor</td><td>Bulk polymer</td></tr> <tr><td>Controller</td><td>Electronic, direct set in % R.H.</td></tr> <tr><td>Setpoint</td><td>Digital</td></tr> <tr><td>Display</td><td>Digital LED</td></tr> <tr><td>Readability</td><td>1.0%</td></tr> <tr><td>Setability</td><td>1.0%</td></tr> <tr><td>Steam Generator</td><td>Initial fill 1 qt. (.946 liter)</td></tr> </table> <p>Fittings</p> <table style="width: 100%; border: none;"> <tr><td>Fill Port</td><td>1/4" compression</td></tr> <tr><td>Drain Port</td><td>3/8" O.D. copper</td></tr> <tr><td>CO₂ Inlet</td><td>1/4" compression 3980 (3986)</td></tr> </table> <p>Unit Heat Load</p> <table style="width: 100%; border: none;"> <tr><td>115V</td><td>5500 BTUH (1600W)</td></tr> <tr><td>220V</td><td>6000 BTUH (1750W)</td></tr> </table> <p>Refrigeration</p> <table style="width: 100%; border: none;"> <tr><td>Compressor</td><td>1/4 Horsepower, air-cooled</td></tr> <tr><td>Refrigerant</td><td>R-134A Non-CFC</td></tr> </table> <p>Electrical</p> <table style="width: 100%; border: none;"> <tr><td>3980</td><td>208-220VAC, 60Hz, 1PH, 3P, 4W, 14.0 FLA</td></tr> <tr><td>3986</td><td>220-240VAC, 50/60Hz, 1PH, 2P, 3W, 14.0 FLA</td></tr> <tr><td>Line Cord -</td><td></td></tr> <tr><td>3980</td><td>NEMA 14-20 plug</td></tr> <tr><td>3986</td><td>None (lockable disconnect provided)</td></tr> </table> <p>Dimensions</p> <table style="width: 100%; border: none;"> <tr><td>Exterior</td><td>38.00"W x 87.50"H x 32.00"F-B (96.52 cm x 222.25 cm x 81.28 cm)</td></tr> <tr><td>Interior</td><td>31.00"W x 60.00"H x 27.00"F-B (78.74 cm x 152.40 cm x 68.58 cm)</td></tr> </table> <p style="text-align: center;"><i>Continuing research and improvements may result in specification changes at any time. Performance plus or minus the least significant digit unless otherwise specified.</i></p> <p>* Better than ±0.5°C uniformity at all other temperature parameters.</p>	Sensor	Thermostat	Controller	Thermostat	Setpoint	Analog reference dial	Alarm	Audible/visual	Humidity Control	±5.0% RH	Range	Above ambient to 95%	Sensor	Bulk polymer	Controller	Electronic, direct set in % R.H.	Setpoint	Digital	Display	Digital LED	Readability	1.0%	Setability	1.0%	Steam Generator	Initial fill 1 qt. (.946 liter)	Fill Port	1/4" compression	Drain Port	3/8" O.D. copper	CO ₂ Inlet	1/4" compression 3980 (3986)	115V	5500 BTUH (1600W)	220V	6000 BTUH (1750W)	Compressor	1/4 Horsepower, air-cooled	Refrigerant	R-134A Non-CFC	3980	208-220VAC, 60Hz, 1PH, 3P, 4W, 14.0 FLA	3986	220-240VAC, 50/60Hz, 1PH, 2P, 3W, 14.0 FLA	Line Cord -		3980	NEMA 14-20 plug	3986	None (lockable disconnect provided)	Exterior	38.00"W x 87.50"H x 32.00"F-B (96.52 cm x 222.25 cm x 81.28 cm)	Interior	31.00"W x 60.00"H x 27.00"F-B (78.74 cm x 152.40 cm x 68.58 cm)
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Construction	Solid stainless steel reinforced																																																																																																																								
Surface Area	5.4 sq. ft. (.51 sq. m) per shelf																																																																																																																								
Max. Per Chamber	104.3 sq. ft. (9.69 sq. m)																																																																																																																								
Clearance	Adjustable on 3" (7.62 cm) centers																																																																																																																								
Loading	35 lbs. (16 Kg) (slide in and out) 50 lbs. (23 Kg) (stationary)																																																																																																																								
Volume	29 cu. ft. (823 liters)																																																																																																																								
Interior	304 2B stainless steel																																																																																																																								
Exterior	Cold rolled steel																																																																																																																								
Insulation	2" (5.1cm) Foamed urethane																																																																																																																								
Outer Door Gasket	Four sided vinyl compression																																																																																																																								
Finish	Powder coated. Salt spray tests exceed 1000 hrs. per ASTM Standard B117-85.																																																																																																																								
Net	800 lbs. (363 Kg)																																																																																																																								
Motor	860 lbs. (390 Kg)																																																																																																																								
Air	940 lbs. (476 Kg)																																																																																																																								
Ocean	985 lbs. (447 Kg)																																																																																																																								
Sensor	Thermostat																																																																																																																								
Controller	Thermostat																																																																																																																								
Setpoint	Analog reference dial																																																																																																																								
Alarm	Audible/visual																																																																																																																								
Humidity Control	±5.0% RH																																																																																																																								
Range	Above ambient to 95%																																																																																																																								
Sensor	Bulk polymer																																																																																																																								
Controller	Electronic, direct set in % R.H.																																																																																																																								
Setpoint	Digital																																																																																																																								
Display	Digital LED																																																																																																																								
Readability	1.0%																																																																																																																								
Setability	1.0%																																																																																																																								
Steam Generator	Initial fill 1 qt. (.946 liter)																																																																																																																								
Fill Port	1/4" compression																																																																																																																								
Drain Port	3/8" O.D. copper																																																																																																																								
CO ₂ Inlet	1/4" compression 3980 (3986)																																																																																																																								
115V	5500 BTUH (1600W)																																																																																																																								
220V	6000 BTUH (1750W)																																																																																																																								
Compressor	1/4 Horsepower, air-cooled																																																																																																																								
Refrigerant	R-134A Non-CFC																																																																																																																								
3980	208-220VAC, 60Hz, 1PH, 3P, 4W, 14.0 FLA																																																																																																																								
3986	220-240VAC, 50/60Hz, 1PH, 2P, 3W, 14.0 FLA																																																																																																																								
Line Cord -																																																																																																																									
3980	NEMA 14-20 plug																																																																																																																								
3986	None (lockable disconnect provided)																																																																																																																								
Exterior	38.00"W x 87.50"H x 32.00"F-B (96.52 cm x 222.25 cm x 81.28 cm)																																																																																																																								
Interior	31.00"W x 60.00"H x 27.00"F-B (78.74 cm x 152.40 cm x 68.58 cm)																																																																																																																								

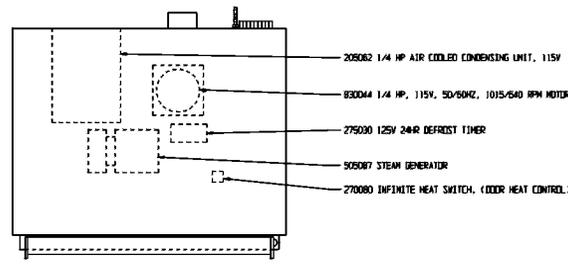
Section 7 - Parts List

Stock #	Description
290162	RH/Temp Control Signal Board
290163	RH/Temp Control Sensor
400051	Power Supply
140148	Temp Insert Panel
231186	Controller, Microprocessor
250013	Relay, DPDT, 10A, 120V
300345	Contact, 3P, 25A, 120V
230066	Ceramic Fuse, 10A, 250V
320277	Triac 25A 400V Flat Base
403941	B-20, 10 to 220F
285604	Safety Switch, 3P, 30A
285614	Fuse, Fusetron, 20A
403940	T-Stat. B10, Snap
505087	Steam Generator
620430	Heater, Steam Generator
980052	Float
270010	T-Stat. B10, (Steam Generator)
901900	Air Pump, 4.1 LPM, 115v 60Hz (model 3980)
184022	Air Pump, 4.1 LPM, 115v 50Hz (model 3986)
190467	Copper P-Trap
195080	Water Strainer 1/4 FPT
475510	Door
285020	Sonalert 110VAC, 2.9 kHz
285081	Kwik Purge Circuit Board
290030	1.05 LPM meter
434010	2-1/2" dial gauge

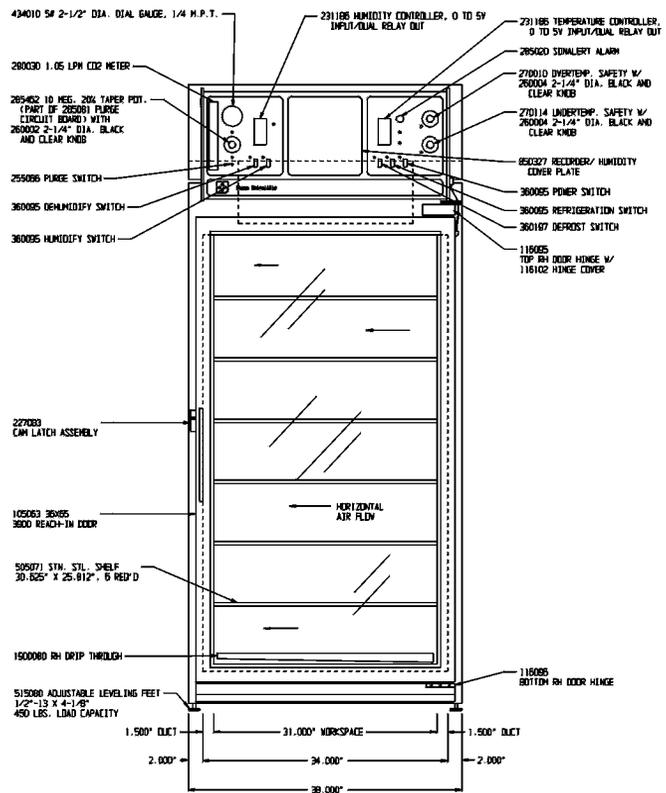
SPECIFICATIONS

MODEL: 2880 28 CU. FT. INCUBATOR
 INTERIOR MATERIAL: 20 GA. STN. STL., TYPE 304, 2-B
 EXTERIOR MATERIAL: 18 GA. E.R.S.
 PAINT: ANTI-ROST WHITE W/ SLATE BLUE TRIM, POWDER COATED
 INSULATION: 2" FOAMED-IN-PLACE URETHANE
 SHELVING: SIX SOLID STN. STL., 30.625" WIDE X 25.813" FRONT-TO-BACK,
 ADJUSTABLE ON 3" CENTERS
 TEMPERATURE RANGE: 0°C TO 80°C +/-1.0°C
 CONTROL: +/-0.1°C @ 37°C
 HUMIDITY RANGE: AERIE ARGENT TO 85% +/-5%
 CO2 GAS CONTROL: DUAL GAS CONTROL, FLOW
 RANGE: 02 TO 200
 REFRIGERATION: 1/4 HP. AIR COOLED, HIGH TEMP CONDENSING UNIT, R134A
 ELECTRICAL CONNECTIONS: 208-220V, 1PH, 3Ø, 4W, 60HZ, 14FLA

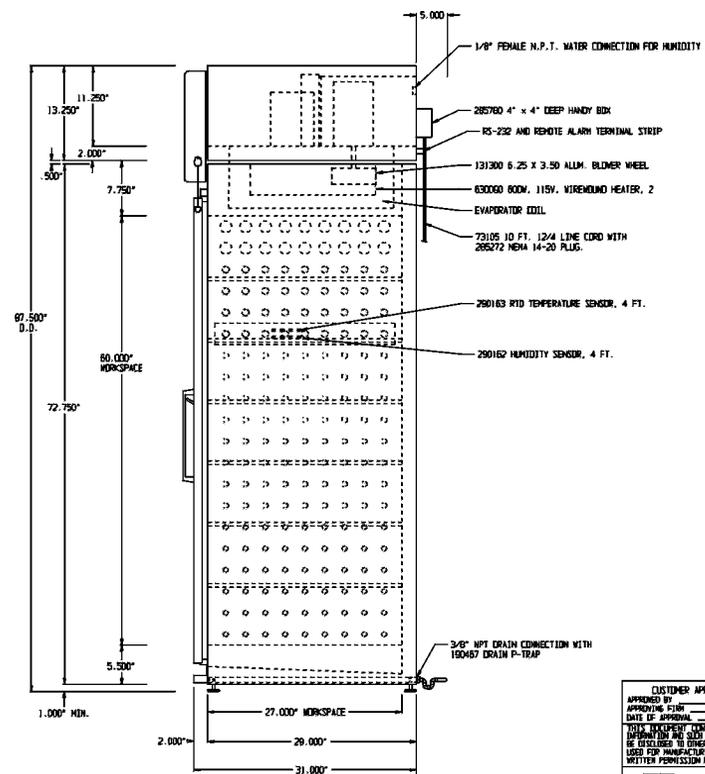
MISC. CONNECTIONS:
 1/4" N.P.T. WATER CONNECTION FOR HUMIDITY
 (0.05 TO 1.0 MEGOHM RESISTANCE REQUIRED)
 3/8" N.P.T. DRAIN LINE
 1/4" CO2 INLET



TOP VIEW



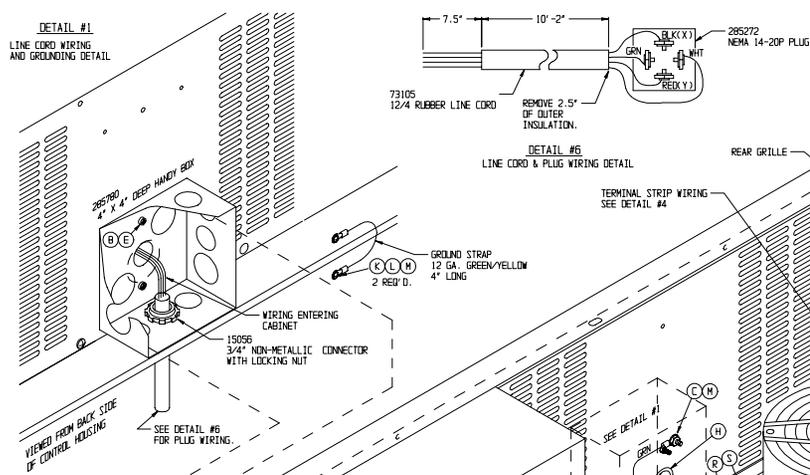
FRONT VIEW



SIDE VIEW

CUSTOMER APPROVAL/REFERENCE		15	14-2880	11-14-00	CLC	CLC	MSB	DNMEE	DOOR NUMBER
APPROVED BY	DATE OF APPROVAL	15	14-2816	07-11-00	CLC	CLC	LOW	CHG.	DISCONNECT WITH LINE CORD
DATE OF APPROVAL		14	14-2816	05-28-00	CLC	CLC	LOW	REV.	ELECTRICAL POWER CONN. INFO.
DATE OF APPROVAL		13	SI-7744	02-18-00	DMG	CLC	LOW	ADDED	1.500" 3/8" TUBE TO P-TRAP
DATE OF APPROVAL		12	14-2765	12-27-00	JAS	PKM	LOW	CSA & UL CERTIFICATION UP-DATES	
REVISION NO.	DATE	BY	CA/APPD	DESCRIPTION OF REVISION					
DATE	1-29-79	DAVE	CAO	MLS	APPO	LOW	SCALE	1/8"=1"	
CUSTOMER: Forma Scientific JOB TITLE: 2880 28CF INCUBATOR, 0°C TO 80°C DWG TITLE: ASSEMBLY LOCATION: INCUBATR JOB NUMBER: DRAWING NUMBER: 3980-00-0-0									

DETAIL #1
LINE CORD WIRING
AND GROUNDING DETAIL

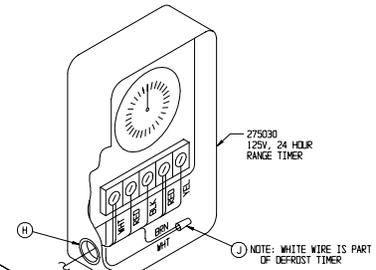


DETAIL #6
LINE CORD & PLUG WIRING DETAIL

TERMINAL STRIP WIRING
SEE DETAIL #4

REAR GRILLE

CONTROL HOUSING IS PART 190219
SEE DRAWING 3980-71-0-0 FOR
CONTROL PANEL



DETAIL #2
DEFROST TIMER WIRING DETAIL

HARDWARE CHART			
A	22115	#6-32 X 1/4" PHP SCREW	
B	22052	#6-32 X 3/8" PHP SCREW	
C	23002	#6-32 KEPS NUT	
D	22068	#6 EXTERNAL TOOTH LOCKWASHER	
E	23021	#6 FLAT WASHER	
F	22049	#6-32 X 3/8" PHP SCREW	
G	15001	YELLOW WIRE NUT	
H	30088	7/8" SNAP BUSHING	
I	30081	ADHESIVE BACK TIE WRAP ANCHOR	
J	16038	SMALL GRAY WIRE NUT	
K	15013	12-10 RING LUG (FID STYLE)	
L	22051	#6-32 X 1/4" PHP SCREW	
M	23059	#6 EXTERNAL TOOTH LOCK WASHER	
N	24032	#6-32 X 3/8" SS PHP SCREW F	
O	30015	3/4" SNAP BUSHING	
P	220529	20A FUSE LABEL	
Q			
R	285773	DOUBLE FUSE HOLDER	
S	285613	20A FUSE/IRON DUAL ELEMENT	
T	100053	3/16" X 3/4" NEUPRENE GASKET, 4" LONG	

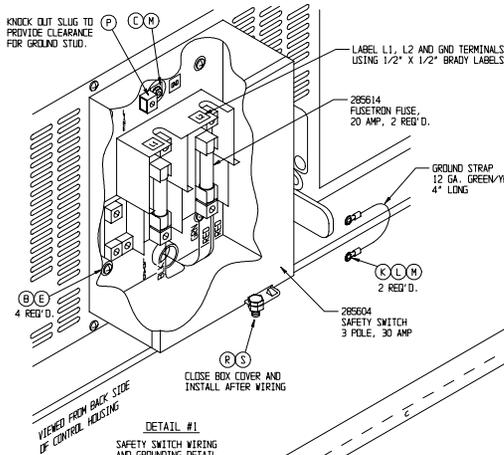
VIEWED FROM BACK SIDE
OF CONTROL HOUSING

SEE DETAIL #6
FOR PLUG WIRING

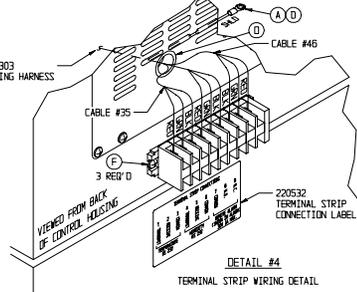
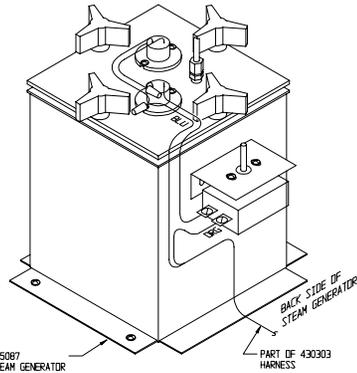
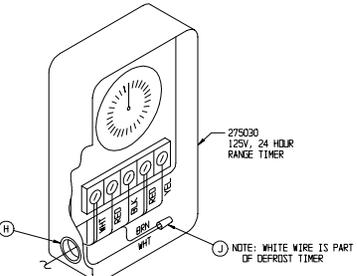
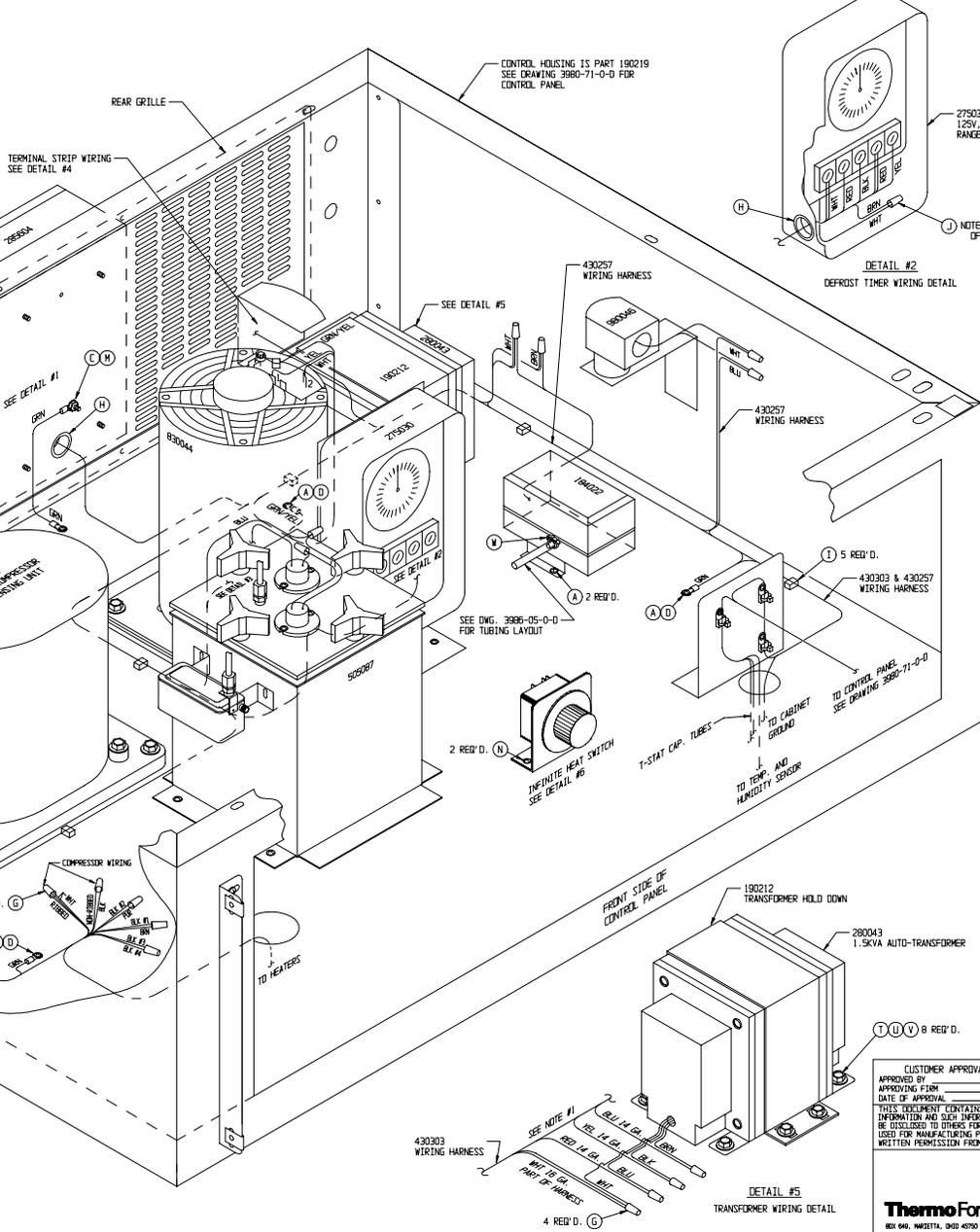
SEE DETAIL #1

285781
BLANK COVER PLATE
(MOUNTING SCREWS COME WITH
THE 285780 4' X 4' BOX)

SEE DETAIL #1



- TRANSFORMER WIRING INFORMATION:
 BLU WIRE - FROM TRANSFORMER TO POWER SWITCH
 YEL WIRE - FROM TRANSFORMER TO POWER SWITCH AREA
 (SEE DRAWING 3980-71-0-D)
 RED WIRE - FROM TRANSFORMER TO SAFETY SWITCH
 WHT WIRES - FROM TRANSFORMER TO HARNESS

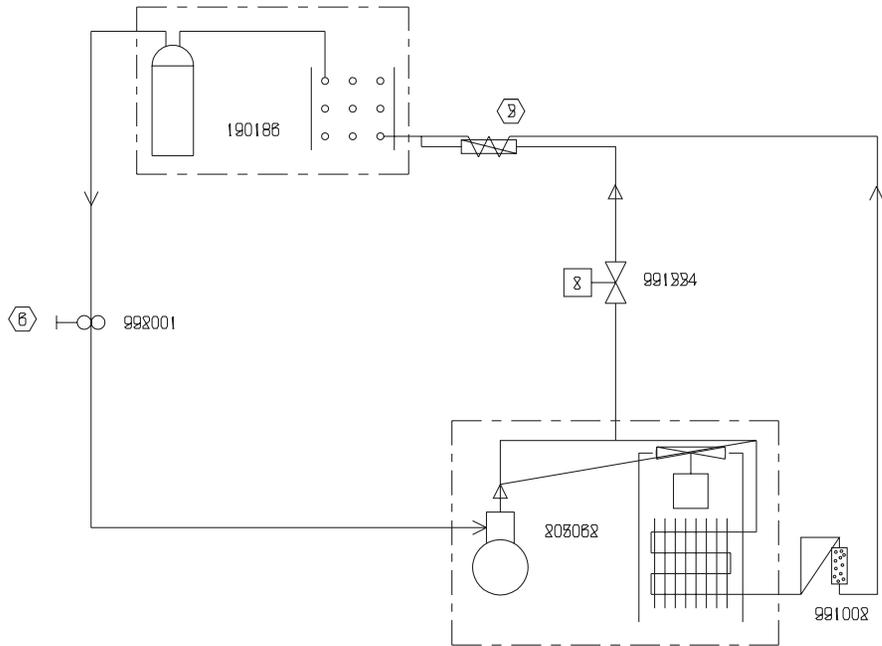


HARDWARE CHART		
A	22115	#6-32 X 1/4" PHP SCREW
B	22052	#6-32 X 3/8" PHP SCREW
C	23002	#6-32 KEPS NUT
D	22068	#6 EXTERNAL TOOTH LOCKWASHER
E	23021	#6 FLAT WASHER
F	22049	#6-32 X 3/8" PHP SCREW
G	15001	YELLOW WIRE NUT
H	30088	7/8" SNAP BUSHING
I	440002	PUSH MOUNT TIE ANCHER
J	16036	SMALL GRAY WIRE NUT
K	16013	12-10 RING LUG (1/10 SLE)
L	22051	#6-32 X 1/4" PHP SCREW
M	23059	#6 EXTERNAL TOOTH LOCK WASHER
N	24032	#6-32 X 3/8" SS PHP SCREW F
O	30015	3/4" SNAP BUSHING
P	16018	14-6 STAND-OFF CONNECTOR
Q		
R	20002	1/4-20 X 1/2" SS HEX CAP SCREW
S	23011	1/4-20 KEPS NUT
T	20003	1/4-20 X 3/4" S.S. H. BOLT
U	23023	1/4" S.S. FLAT WASHER
V	610011	1/4-20 MILD STEEL RIVNUT
W	600063	5/16" SNAPPER CLAMP

CUSTOMER APPROVAL/REFERENCE	15	IN-2858 01-30-01 WCV POK	REVISED CONTROL PANEL ATTACHMENT							
APPROVED BY	14 <td>IN-2816 07-11-00 GLS KEG LON</td> <td>CHG. 25 AMP. FUSE TO 20 AMP.</td>	IN-2816 07-11-00 GLS KEG LON	CHG. 25 AMP. FUSE TO 20 AMP.							
APPROVING FIRM	13 <td>IN-2787 02-09-00 GLS KEG LON</td> <td>CLARIFY TERMINAL STRIP WIRING</td>	IN-2787 02-09-00 GLS KEG LON	CLARIFY TERMINAL STRIP WIRING							
DATE OF APPROVAL	12 <td>SI-7638 09-25-99 JAS POK LON</td> <td>REMOVED HEAT SWITCH DIAL PLATE</td>	SI-7638 09-25-99 JAS POK LON	REMOVED HEAT SWITCH DIAL PLATE							
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REV	REC NO	DATE	BY	CAD/APPO	DESCRIPTION OF REVISION					
	DATE	11-16-93	DNV	POK	CAD	POK	APPD	LON	SCALE	1/2"=1"
CUSTOMER										
JOB TITLE 3986 REFRIGERATED REACH-IN INCUBATOR										
DWG TITLE MAIN UNIT WIRING DIAGRAM										
LOCATION INCUBATR										
JOB NUMBER										
DRAWING NUMBER 3986-71-0-D										

Thermo Forma
 REV 640, M0221A, 3986-0790

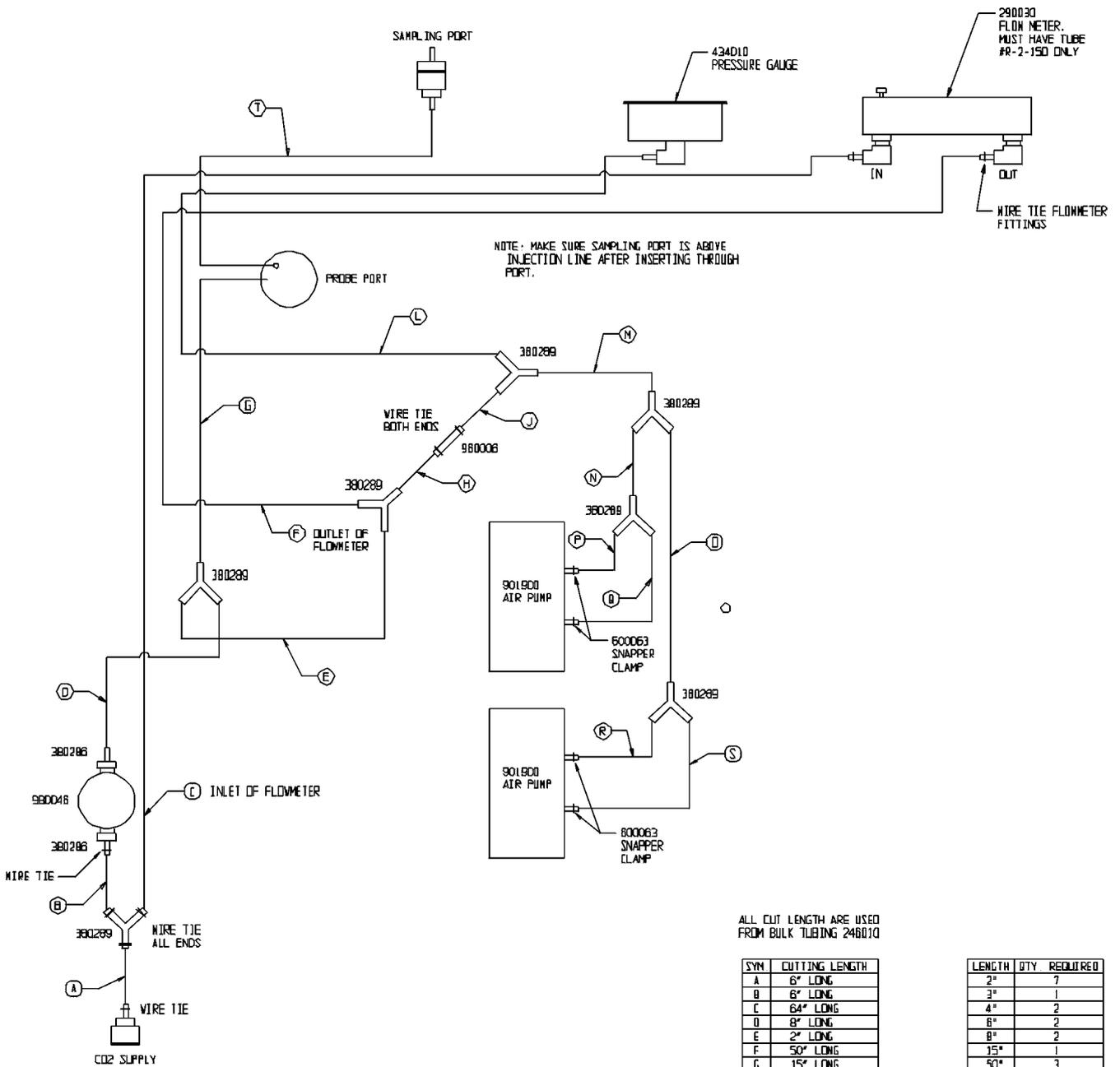
Section 8 – Schematics



- 6. GAP TOBB ITEM (8), 8" OF .030
- 8. WRAP 8" OF GAP TOBB TO 1/2" HOT GAS TOBB.
- 4. SODIUM LIME: 3/8" O.D.
- 9. HOT GAS LIME: 1/4" O.D.
- 2. SET OPR VALVE (8) AT 25 LBS.
- 1. REFRIGERANT 134A: 12.5 OZS.

CUSTOMER APPROVAL/REFERENCE							
APPROVED BY _____							
APPROVING FIRM _____							
DATE OF APPROVAL _____							
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1	1X-1718	03-08-94	JHV	PKI	NDW	134A REFRIGERANT MCM-OPR REVISION	
REV	CDM NO.	DATE	BY	QAD	APPD	DESCRIPTION OF REVISION	
	DATE	01-28-93	DWM	NDW	QAD	NDW	80AAS MCM
CUSTOMER							
JOB TITLE		190819 REFRIG. TOP HOOSING					
DWG TITLE		REFRIGERATION SCHEMATIC					
LOCATION		JOB NUMBER		DRAWING NUMBER			
STKMO801				190819-90-0-B			


Forma Scientific
 BOX 649 MARLBOROUGH, OHIO 43070 TEL: 614-241-5364
 TOLL FREE: 800-648-3080, OHIO: 614-273-4763



ALL CUT LENGTH ARE USED FROM BULK TUBING 246010

SYM	CUTTING LENGTH
A	6" LONG
B	6" LONG
C	64" LONG
D	8" LONG
E	2" LONG
F	50" LONG
G	15" LONG
H	2" LONG
J	2" LONG
K	-----
L	50" LONG
M	3" LONG
N	2" LONG
O	8" LONG
P	2" LONG
Q	4" LONG
R	2" LONG
S	4" LONG
T	50" LONG

LENGTH	QTY	REQUIRED
2"	7	
3"	1	
4"	2	
6"	2	
8"	2	
15"	1	
50"	3	
64"	1	

CUSTOMER APPROVAL/REFERENCE												
APPROVED BY												
DATE OF APPROVAL												
3	IN-2768	11-29-98	WCM/PCK NSB REV. HOSE CLAMP AT PUMPS \ REDRAWN ON CAD									
2	IN-1906	02-13-96	KDG/N/A LON ADDED TUBING QUANTITY LIST									
1	IN-1829	09-09-94	PCK/N/A LON ADDED STOCK NUMBERS									
REV	ECN	NO	DATE	BY	CAD/APPRO	DESCRIPTION OF REVISION						
			DATE	04-29-74	DWN	MARK	CAD	N/A	APPO	LON	SCALE	N 1 S

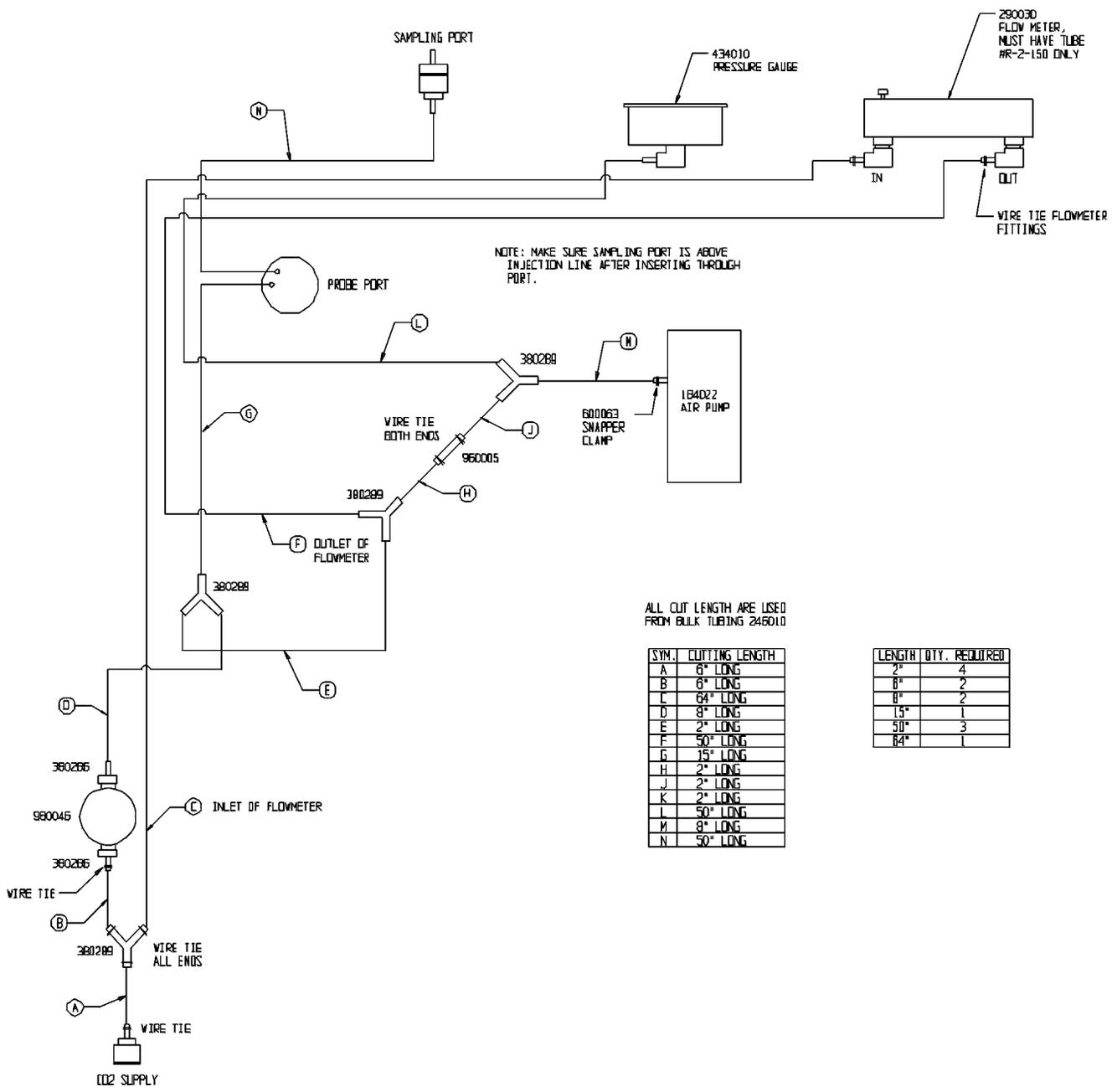


Forma Scientific
 221 4th STREET N, OAK RIDGE
 TELL FIVE FOR 822-566-2220, 800 742-222-4743

CUSTOMER	
JOB TITLE 3980 REACH-IN INCUBATOR	
DWG TITLE CO2 PIPING SCHEMATIC & R.H. PORT DETAIL	
LOCATION	JOB NUMBER
INCUBATR	3980-05-0-D
DRAWING NUMBER	
3980-05-0-D	

CO2 Piping Schematic
 Forma Model:
 3980
 Reach-In Incubator

3980-05-0-D REV. 3
 Page 1 of 1

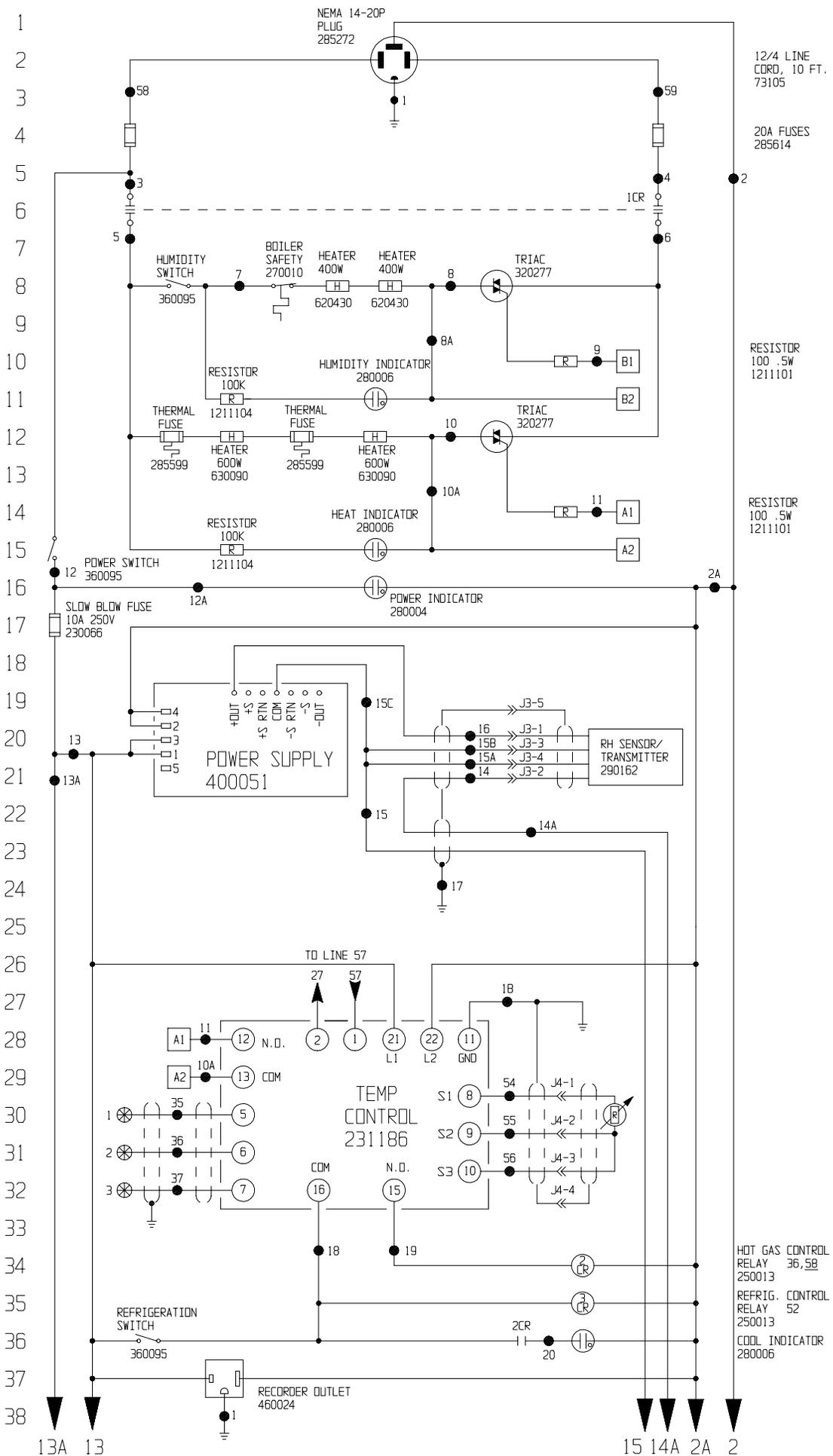


CUSTOMER APPROVAL/REFERENCE							
APPROVED BY _____							
APPROVING FIRM _____							
DATE OF APPROVAL _____							
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		REV	ECN NO.	DATE	BY	CAD	APPD
		DATE	02-19-98	OWN	POK	CAD	POK
		APPD		SCALE	N.T.S.		
CUSTOMER		3986 REACH-IN INCUBATOR					
JOB TITLE		CO2 PIPING SCHEMATIC					
LOCATION		INCUBATR		JOB NUMBER		DRAWING NUMBER	
						3986-05-0-0	

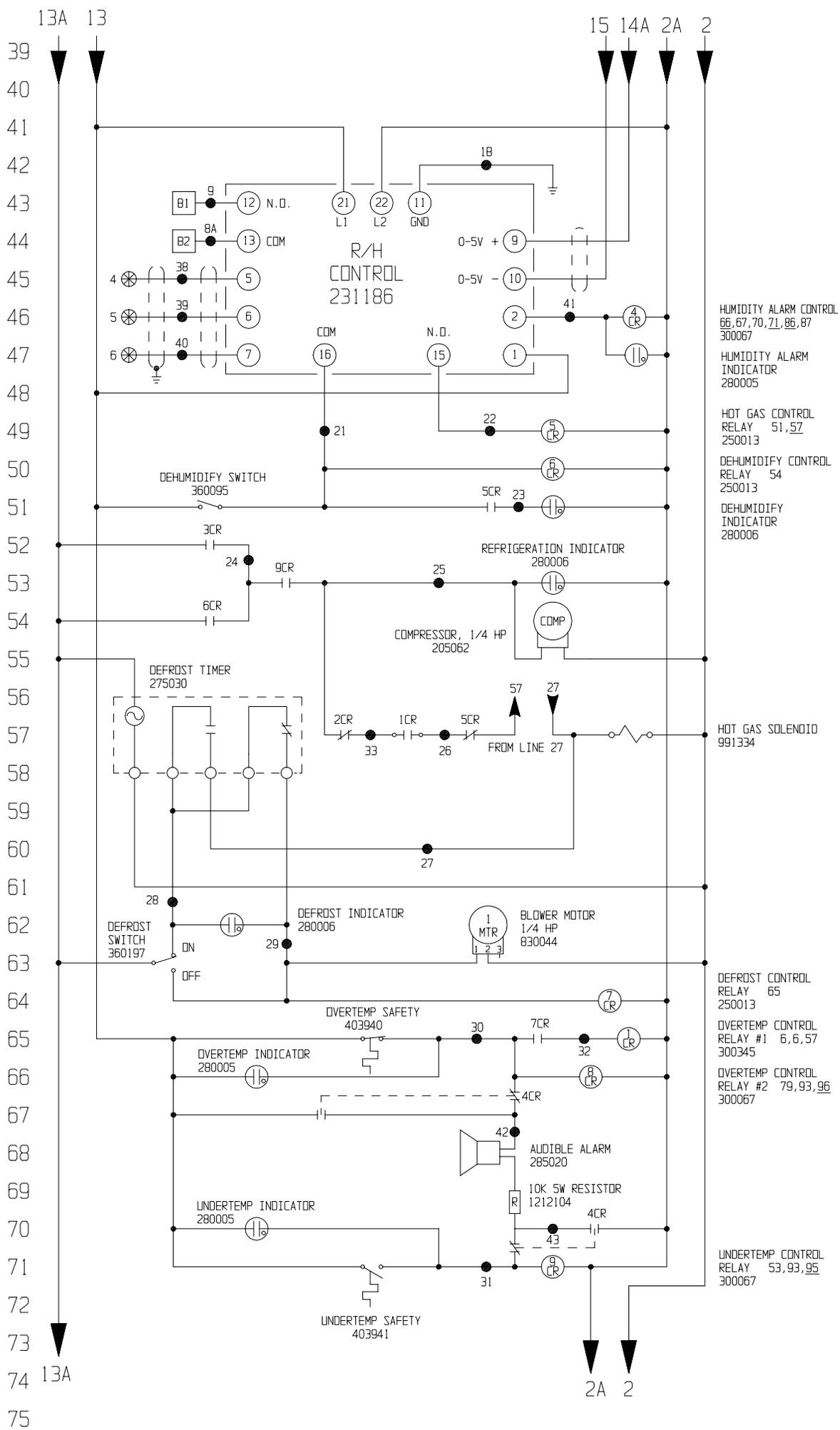
CO2 Piping Schematic
 Forma Model:
 3986
 Reach-In Incubator

3986-05-0-0 REV. 0
 Page 1 of 1

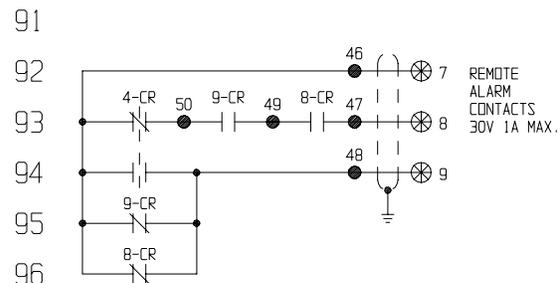
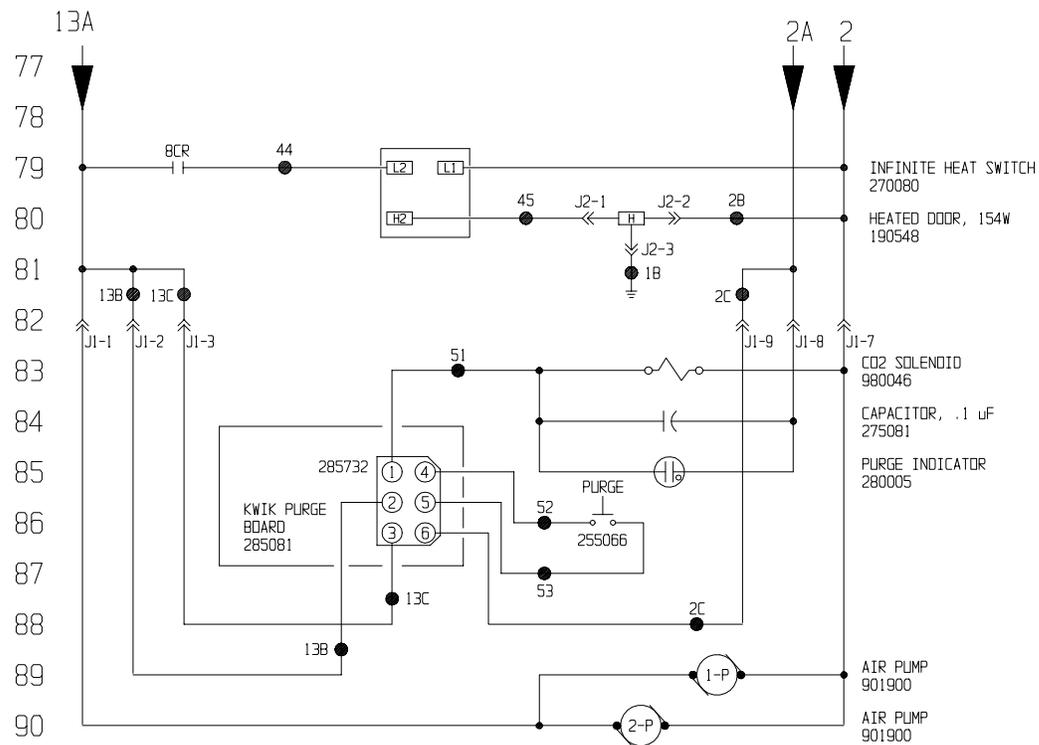




Electrical Schematic
 Forma Model:
 3980
 Reach-In Incubator
 3980-70-0-D REV.16
 Page 1 of 3



Electrical Schematic
 Forma Model:
 3980
 Reach-In Incubator



1	2	3	4	5	6	7	8	9
24 GA. RED	24 GA. GRN	24 GA. BLK	24 GA. RED	24 GA. GRN	24 GA. BLK	24 GA. BLK	24 GA. GRN	24 GA. RED
TRANSMIT	RECEIVE	COMMON	TRANSMIT	RECEIVE	COMMON	COMMON	N.D.	N.C.
TEMPERATURE RS 232			HUMIDITY RS 232			REMOTE ALARM (SHOWN IN ALARM) 30V 1A MAX.		

WIRE CHART

Terminal Strip Connection

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

NOTES:

⊗ Denotes Terminal Strip Connection	Parts List Reference Number
9CR Last Relay Number	○ Assembly
9 Last Terminal Number	⬠ Panel
59 Last Wire Number	⊖ Refrigeration
	□ Wiring

CUSTOMER APPROVAL/REFERENCE

APPROVED BY _____

APPROVING FIRM _____

DATE OF APPROVAL _____

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Forma Scientific

BOX 649 MARITTA, OHIO 45750
TOLL FREE USA 800-646-3880, OHIO 740-373-4763

16	IN-2816	06-27-00	GLS	KDG		MADE LINE CORD STANDARD
15	IN-2827	06-06-00	GLS	GLS	LDN	CHG 250200 CONTACTOR TO 300345
14	IN-2816	05-26-00	GLS	KDG	LDN	REV. ELECTRICAL POWER CONN. INFO.
13	IN-2421	08-11-99	WLG	PKD	LDN	REV'D FOR HOT GAS BY-PASS
12	IN-2439	06-28-99	JAS	PKD	LDN	REVISED ELECTRICAL RATING
REV ECN NO.	DATE	BY	CAD	APPD		DESCRIPTION OF REVISION
DATE	5-18-92	DWN	ED	CAD	JD	APPD LDN SCALE NONE
CUSTOMER						
JOB TITLE 3980 REACH-IN INCUBATOR						
DWG TITLE ELECTRICAL SCHEMATIC						
LOCATION			JOB NUMBER		DRAWING NUMBER	
INCUBATR					3980-70-0-D	

Electrical Schematic

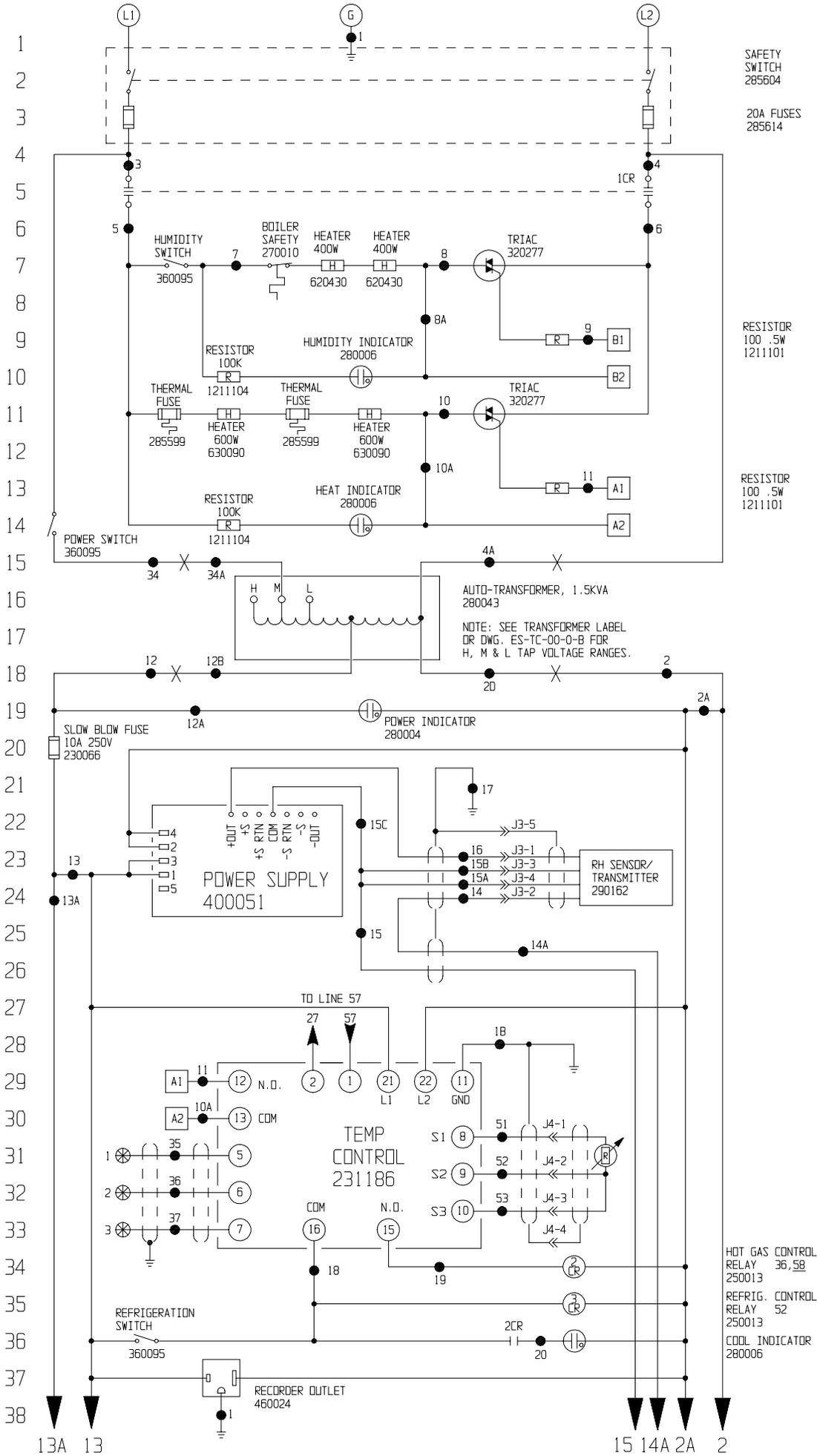
Forma Model:
3980

Reach-In Incubator

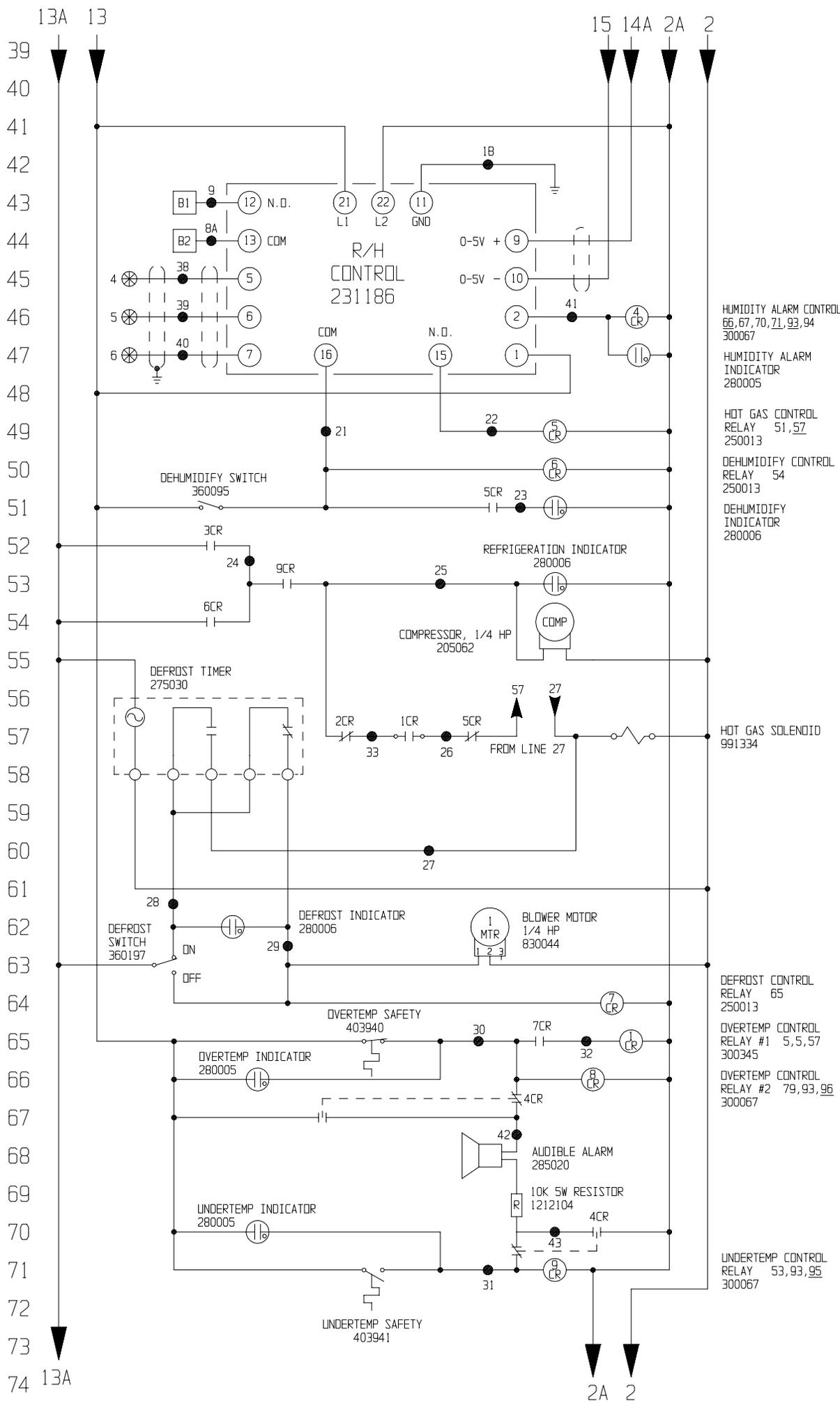
3980-70-0-D REV.16

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POWER CONNECTION
220-240V, 1PH, 2P, 3W, 50/60HZ, 14FLA



Electrical Schematic
Forma Model:
3986
Reach-In Incubator



HUMIDITY ALARM CONTROL
66, 67, 70, 71, 93, 94
300067

HUMIDITY ALARM INDICATOR
280005

HOT GAS CONTROL RELAY
51, 57
250013

DEHUMIDIFY CONTROL RELAY #4
54
250013

DEHUMIDIFY INDICATOR
280006

REFRIGERATION INDICATOR
280006

COMPRESSOR, 1/4 HP
205062

HOT GAS SOLENOID
991334

DEFROST TIMER
275030

BLOWER MOTOR
1/4 HP
830044

DEFROST CONTROL RELAY #5
65
250013

OVERTEMP CONTROL RELAY #1
5, 5, 57
300345

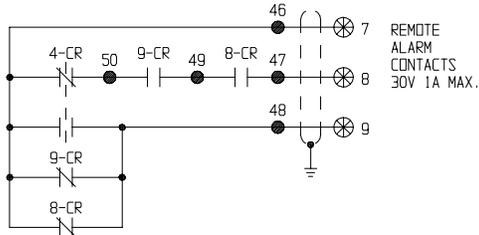
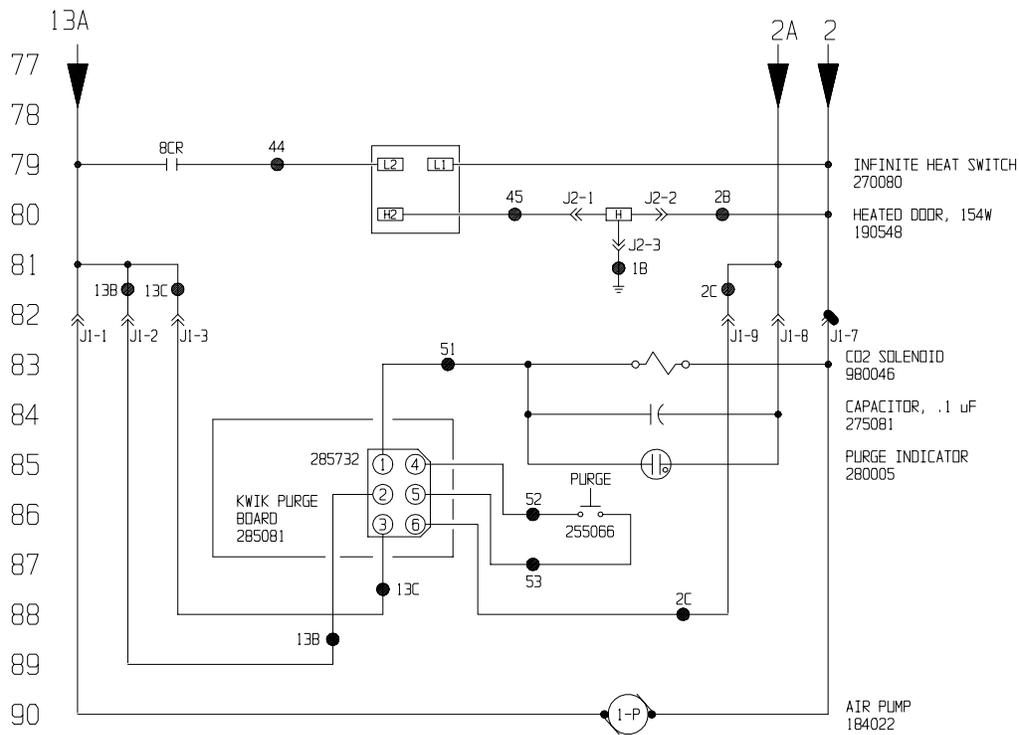
OVERTEMP CONTROL RELAY #2
79, 93, 96
300067

ALUIDIBLE ALARM
285020

UNDERTEMP INDICATOR
280005

UNDERTEMP CONTROL RELAY
53, 93, 95
300067

Electrical Schematic
Forma Model:
3986
Reach-In Incubator



1	2	3	4	5	6	7	8	9
24 GA. RED	24 GA. GRN	24 GA. BLK	24 GA. RED	24 GA. GRN	24 GA. BLK	24 GA. BLK	24 GA. GRN	24 GA. RED
TRANSMIT	RECEIVE	COMMON	TRANSMIT	RECEIVE	COMMON	COMMON	N.O.	N.C.
TEMPERATURE RS 232			HUMIDITY RS 232			REMOTE ALARM (SHOWN IN ALARM) 30A 1A MAX.		

WIRE CHART

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

Terminal Strip Connection

NOTES:	CUSTOMER APPROVAL/REFERENCE
⊗ Denotes Terminal Strip Connection	APPROVED BY _____
9CR Last Relay Number	APPROVING FIRM _____
9 Last Terminal Number	DATE OF APPROVAL _____
56 Last Wire Number	
○ Assembly	
⊕ Panel	
⊖ Refrigeration	
□ Wiring	

19	IN-2816	06-27-00	GLS	KDG		CHANGE 285615 FUSE TO 285614	
18	IN-2827	06-06-00	GLS	GLS	LON	CHG 250200 CONTACTOR TO 300345	
17	IN-2816	05-26-00	GLS	KDG	LON	REV. ELECTRICAL POWER CONN. INFO	
16	IN-2421	08-11-99	WLG	PKD	LON	REV'D FOR HOT GAS BY-PASS	
15	IN-2439	06-28-99	JAS	PKD	LON	REVISED ELECTRICAL RATING	
REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION	
	DATE 5-18-92	DWN	ED	CAD	JD	APPD LON	SCALE NONE



Forma Scientific

BOX 649 MARIETTA, OHIO 45750
TOLL FREE USA 800-948-3060, OHIO 740-373-4763

CUSTOMER						
JOB TITLE 3986 REACH-IN INCUBATOR						
DWG TITLE ELECTRICAL SCHEMATIC						
LOCATION			JOB NUMBER		DRAWING NUMBER	
INCUBATR					3986-70-0-D	

Electrical Schematic
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3986
Reach-In Incubator

3986-70-0-D REV.19
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