Thermo
SCIENTIFIC

Model 3920
Forma Environmental Chamber

Operating and Maintenance Manual
Manual No: 7043920 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.

The material in this manual is for information purposes only. The contents and the product it describes are subject to change without notice. Thermo Fisher Scientific makes no representations or warranties with respect to this manual. In no event shall Thermo be held liable for any damages, direct or incidental, arising out of or related to the use of this manual.

MANUAL NUMBER 7043920

REV	ECR/ECN	DATE	DESCRIPTION	By
7	--	6/25/07	Removed light warning on page 2-2 per R. Lada (Job #1000570)	ccs
6	23879/SI-9748	1/15/07	Removed COMM from 982 configuration sheets (temp, humidity)	ccs
5	--	8/1/06	Typo in parts list	ccs
4	23451/IN-3294	6/29/06	Added ±5 psig to incoming CO2 pressure range, updated P/L per R. Lada	ccs
3	22678/IN-3229	1/17/05	Removed 270129 from terminals 15 and 16 temp. control	aks
2	22454/IN-3208	9/14/04	Watlow SD 4-20mA standard; new schematics, configuration sheet	ccs
--	22452/IN-3208	9/14/04	Added noise reducing filters to Watlow 982 controllers, new schematics	ccs
--	--	6/30/04	Clarified unit clearance requirements	ccs
1	22070/22129	1/29/04	Pre-programmed controller/changed thermal fuse	aks
	20843	10/28/03	Release 9	aks

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

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

Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.

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

Marking of electrical and electronic equipment, which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005.
This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the WEEE symbol. Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State European Country, and this product should be disposed of or recycled through them. Further information on Thermo's compliance with this directive, the recyclers in your country and information on Thermo products will be available at www.thermofisher.com.

- √ 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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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 Scientific
Controlled Environment Equipment
401 Millcreek Road, Box 649
Marietta, OH 45750

International customers, please contact your local Thermo Scientific distributor.

Warranty Notes

Information You Should Know Before Requesting Warranty Service

- **Locate the model and serial numbers.** A serial tag is located on the unit itself.
- For equipment service or maintenance, or with technical or special application inquiries, contact Technical Services at 1-888-213-1790 or 1-740-373-4763 (USA and Canada). Outside the USA, contact your local distributor.

Repairs NOT Covered Under Warranty

- **Calibration of control parameters.** Nominal calibrations are performed at the factory; typically ±1°C for temperature, ±1% for gases, and ±5% for humidity. Our service personnel can provide precise calibrations as a billable service at your location. Calibration after a warranty repair is covered under the warranty.
- **Damage resulting from use of improper quality water, chemicals or cleaning agents detrimental to equipment materials.**
- **Service calls for improper installation or operating instructions.** Corrections to any of the following are billable services:
  1) electrical service connection
  2) tubing connections
  3) gas regulators
  4) gas tanks
  5) unit leveling
  6) room ventilation
  7) adverse ambient temperature fluctuations
  8) any repair external to the unit
- **Damage resulting from accident, alteration, misuse, abuse, fire, flood, acts of God, or improper installation.**
- **Repairs to parts or systems resulting from unauthorized unit modifications.**
- **Any labor costs other than that specified during the parts and labor warranty period, which may include additional warranty on CO_2 sensors, blower motors, water jackets, etc.**

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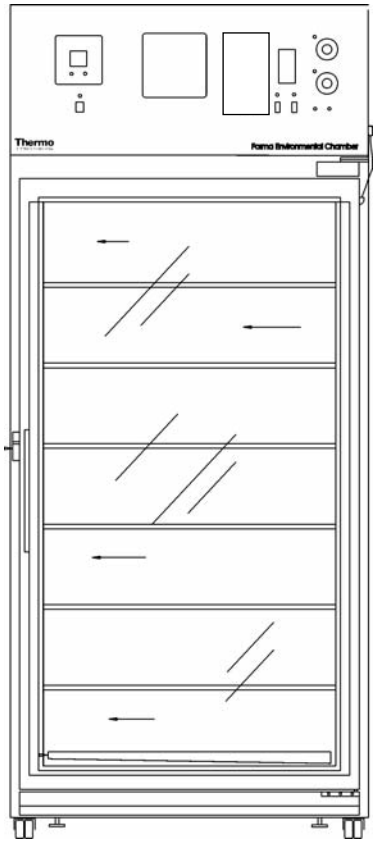
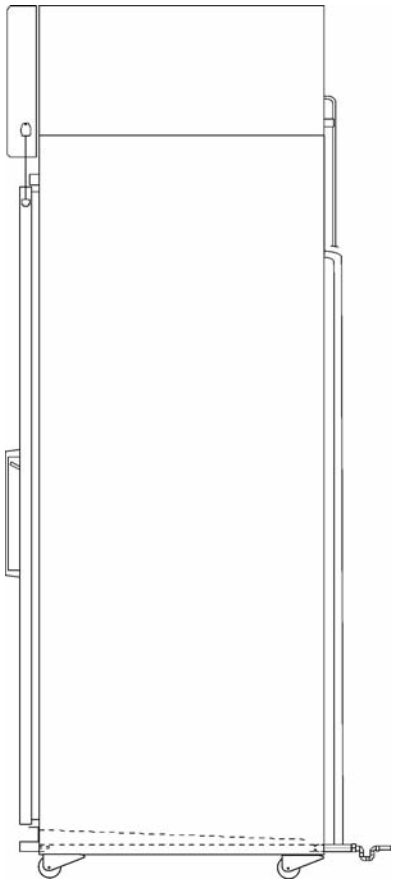
Warranty Information
Supplement

Section 1 - Receiving



Front View



Side View

1.1 Preliminary Inspection

This incubator was thoroughly inspected and carefully packed prior to shipment and all necessary precautions were taken to ensure its safe arrival. Immediately upon receipt, before the incubator is moved from the receiving area, carefully examine the shipment for loss or damage. Unpack the incubator and inspect its 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 Thermo Scientific ends when the merchandise is loaded onto the carrier's vehicle.

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

Whenever possible, Thermo will assist in settling claims for loss or in-transit damage.

Section 2 - Installation and Set-Up

2.1 Location

a. Choosing the Location

Locate the unit on a firm, level surface in an area of minimum ambient temperature fluctuation. A minimum of three (3) inches clearance is required at the top and back of the incubator. This space is necessary to allow adequate air flow around the refrigeration system. At least eight (8) inches of clearance is required at the top of the incubator for service access.

b. Preliminary Cleaning and Disinfecting

Disinfect all interior surfaces with a general-use laboratory disinfectant. Rinse thoroughly with sterile distilled water, then 70% ethanol. Dry with a sterile cloth as needed.

Disinfect the shelf channels and shelves, then rinse with distilled water before installing.

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

Accidental spills of hazardous materials on or inside this unit are the responsibility of the user.

c. Installing the Shelves

The shelves may be installed at any level in the incubator. Install a shelf channel on each side. With the tabs pointing up, attach the channel by locating the rivet into a slotted hole, far end first. Pull the channel toward the front and slide the front rivet on the channel into the slotted hole and press down. Make sure that the channels are opposite each other so that the installed shelf will be level.

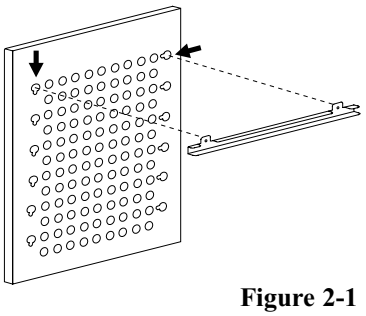


Figure 2-1

d. Leveling the Unit

Place a bubble-type level on a shelf inside the incubator. Adjust the feet as needed; counterclockwise to lengthen or clockwise to shorten. Level the unit front-to-back and left-to-right.

2.2 Attaching the Drain Connections

The cabinet's 3/8" MPT drain line connection is located on the rear (lower left side) of the cabinet. A P-trap (Figure 2-2) is included with the unit and must be installed on the connection.

To install the drain connection, push a piece of 3/8" ID tubing onto the trap and direct the tubing to a convenient drain. Install a hose clamp on the tubing, if desired.

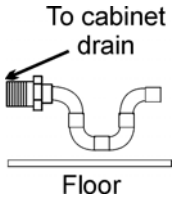


Figure 2-2

2.3 Remote Data Output

a. 4-20 Milliamp Output

The environmental chamber is equipped with 4-20mA output for the remote transmission of temperature or CO_2 data. A terminal strip is located on the back of the incubator for convenience. Refer to Figure 2-3 for terminal pin identification.

b. Remote Alarm Contacts

Remote alarm connections are also included on the terminal strip (Figure 2-3) providing Normally Open (N.O.) and Normally Closed (N.C.) contacts. C is the Common terminal. The remote alarm will activate when either the incubator's temperature or CO_2 go out of the set alarm limits.

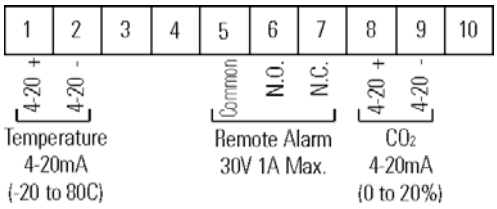


Figure 2-3 Terminal Strip Connection

IMPORTANT USER INFORMATION

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

2.4 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.

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 10 ft. power cord with the NEMA 14-20 plug into the grounded dedicated electrical circuit.

2.5 Start-Up

Preset the controls as follows:

Overtemp Safety Thermostat . . . . . Fully Clockwise
Undertemp Safety Thermostat . . . . . Fully Counterclockwise
Main Power Switch . . . . . .ON
Temperature Controller . . . . . .Desired Setpoint
Door Heater . . . . . .40% (factory set)

Turn the Main Power switch on. The Power indicator and Heat indicator will light. Turn the Refrigeration switch on and the indicator will light.

2.6 Setting the Overtemp Safety Thermostat

Allow 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 at least 2 degrees. 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.

Note: The overtemp control is not directly calibrated. The numbers on the dial are for reference only.

2.7 Setting the Undertemp Safety Thermostat

Allow the chamber temperature and humidity to stabilize, then 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 at least 2 degrees 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.

Note: The undertemp control is not directly calibrated. The numbers on the dial are for reference only.

2.8 Preparing the (Optional) CoBex Recorder

a. Installing the 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 (Figure 2-4). If the unit is operating, the green LED lights steady. If the unit is not turned on, the LED blinks.

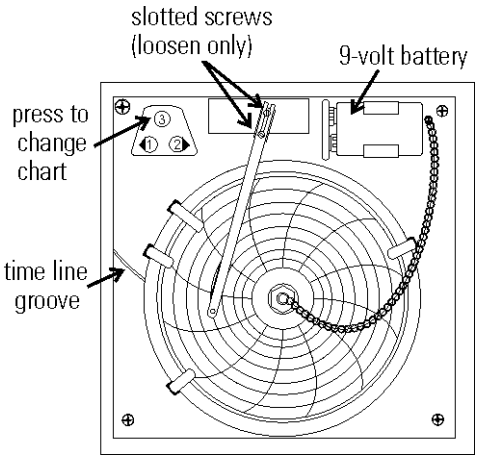


Figure 2-4

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. Dispose of the old battery following established environmental practices.

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 2-4.
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.
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.

2.9 Honeywell Recorder (optional)

The Honeywell, DR 4500 Recorder is a one to four-channel microprocessor-based, circular chart recorder.

The recorder is capable of recording both temperature and humidity and printing alphanumeric chart data on blank heat-sensitive chart. Refer to the Honeywell Configuration Record at the end of Section 5 and the supplemental Honeywell Recorder manual.

2.10 IR CO_2 Option

This section applies to units with the IR CO_2 option only.

a. Connecting the CO_2 Source (Figure 2-5)

For the most economical use, the liquid CO_2 supply tanks should be without siphon tubes, so that only CO_2 gas enters the incubator injection system. Two tanks may be joined together with a manifold to ensure a continuous CO_2 supply.

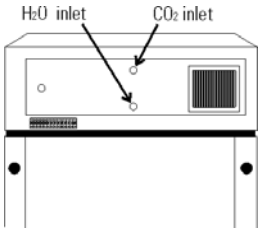


Figure 2-5

Install a two-stage pressure regulator, with indicating gauges, 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.

The CO_2 source must be regulated at a pressure level of 15 psig, ±5. Higher pressure levels may damage the CO_2 control system. The user should determine the most economical pressure level, between 10 and 20 psig appropriate for the desired CO_2 percentage in the chamber. Use only sufficient pressure to maintain recovery time after door openings.

To connect the CO_2 supply:

1. Insert the copper tubing provided with the unit as far as it will go into the nut of the CO_2 connection.
2. Turn the nut until it is finger tight.
3. For reference, scribe the nut at the 6:00 position.
4. While holding the fitting body steady with a wrench, tighten the nut 1-1/4 turns until the mark is at the 9:00 position.
5. Securely attach the CO_2 line to the open end of the copper tubing.
6. Check the tubing connection for leaks.

b. Setting the CO_2 Content

The Watlow SD CO_2 controller's upper display shows the actual CO_2 content inside the chamber. The lower display shows the CO_2 setpoint.

Before setting the CO_2 Content, allow the chamber temperature and humidity to stabilize. Do not open door during the stabilization period.

To set the CO_2 content, press the Up or Down Arrow keys on the Watlow SD Controller.

c. CO_2 Control and Indicators

- **Sample Port (Figure 2-6)**

The sample port is used for checking CO_2 percentage in the incubator chamber by an independent test instrument (such as with a Fyrite, or similar CO_2 test instrument).

To prevent CO_2 loss, the sample port must be capped when it is not in use.

- **CO_2 Alarm (Figure 2-6)**

The CO_2 alarm is factory set to activate when the chamber CO_2 content deviates from configured alarm set points (see configuration record). When a CO_2 alarm occurs, the CO_2 Alarm indicator on the control panel lights and the audible alarm sounds.

The CO_2 alarm high and low setpoints are established through the Watlow SD CO_2 controller (ALO, and AHI). Refer to the Configuration Record included at the end of Section 5.

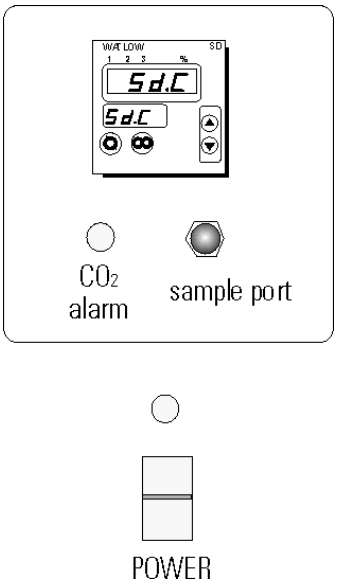


Figure 2-6

Section 3 - Start Up and Operation

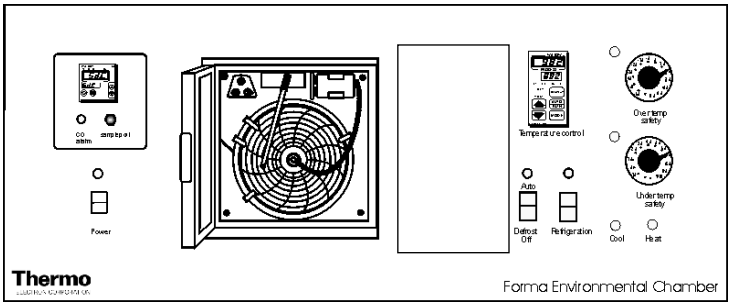


Figure 3-1, Environmental Chamber Control Panel shown with optional CoBex Recorder and optional CO_2 control

3.1 The Control Panel

A **Main Power Switch and Indicator Light (Figure 3-2)**

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

B **Refrigeration Switch and Indicator Light (Figure 3-3)**

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.

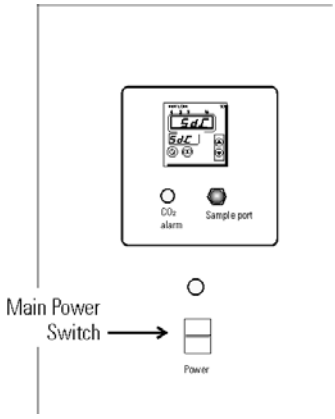


Figure 3-2

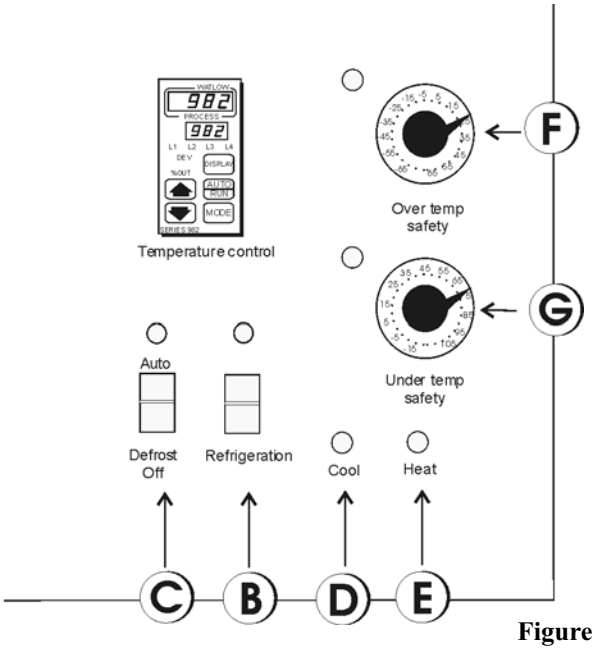


Figure 3-3

C **Defrost Switch and Indicator Light (Figure 3-3)**

The defrost switch controls power to the defrost system. Setting the defrost switch to Auto will provide two 15-minute defrost cycles during a twenty-four hour period. The defrost indicator lights when the defrost switch is on and the incubator is in a defrost cycle.

The defrost switch must be set to Auto when the temperature setpoint is 10°C, or below.

D **Cool Indicator (Figure 3-4)**

The Cool Indicator is illuminated when the refrigeration system is activated.

E **Heat Indicator (Figure 3-4)**

The Heat Indicator is illuminated when the heater is activated.

F **Overtemp Safety Control, Indicator Light, and Audible Alarm (Figure 3-3)**

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:

- Activate the audible alarm and the overtemp indicator light.
- Interrupt power to the heaters and maintain the incubator's cabinet temperature at the overtemp safety control point.

Note: The overtemp control is not directly calibrated. The numbers on the dial are for reference only.

If an overtemp condition occurs, the alarm can only be silenced by raising the overtemp safety thermostat setting. However, the cause of the problem must be determined and corrected before normal operation under the main temperature controller is resumed.

G **Undertemp Safety Control, Indicator Light and Audible Alarm (Figure 3-3)**

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:

- Activate the audible alarm and the undertemp indicator light.
- Interrupt power to the refrigeration system and maintain the incubator's cabinet temperature at the undertemp safety control point.

Note: The undertemp control is not directly calibrated. The numbers on the dial are for reference only.

If an undertemp condition occurs, the alarm can only be silenced by lowering the undertemp safety thermostat setting. However, the cause of the problem must be determined and corrected before normal operation under the main temperature controller is resumed.

3.2 Setting the Operating Temperature (Figure 3-4)

H **I** The Watlow temperature controller's upper numerical display shows the actual temperature inside the incubator chamber. The lower display shows the temperature setpoint.

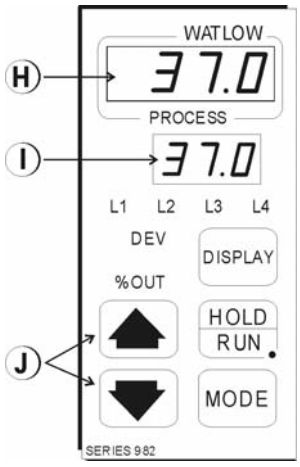


Figure 3-4

J **Changing the Setpoint**

To raise or lower the setpoint, press the Up or Down Arrow. Temperatures are set in .1°C increments.

3.3 Air Exchange Ventilator Caps

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.

For optimum performance of the unit, the vent caps should be closed at all times.

3.4 Heatless Dryer P/N 1900139 (optional)

The optional heatless dryer provides dehumidification for the incubator chamber. The dehumidify switch must be turned on for the dryer to operate. The dryer is controlled with the humidity controller and should operate at 90 psi.

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 this unit 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 with a solution of ammonia and water.

PREVENTIVE MAINTENANCE
Environmental Chambers

Your 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 that 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.

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.

Preventive Maintenance for Environmental Chambers

Refer to Manual Section	Action	Daily	Weekly	Yearly
--	Inspect door latch, hinges and door gasket seal			☑
3.3	Check air exchange ventilator caps for adjustment; open or close as required			☑
4.1	Perform a complete decontamination procedure. Wipe down interior, shelves, side panels with disinfectant. Rinse everything well with sterile distilled water.		Between experiments *More frequent decontamination may be required, depending on use and environmental conditions.*	
5.4, 5.7	Verify and document all calibrations, at the minimum.			☑
--	Clean drip pan and drain lines			☑
--	Clean refrigeration system condenser			☑
--	Verify defrost cycle for below 10°C operation			☑
--	Change filters (under normal conditions)			☑

* Regular monitoring routines of the various levels in your unit is encouraged.

Section 5 - Service

Servicing must be performed by qualified service personnel only!

De-energize all potential sources of energy to this unit and lockout/tagout their controls.

5.1 Accessing the Electrical Components

To gain access to the electrical components, remove the two screws located on the left side of the control panel with a Phillips screwdriver. The control panel is hinged and will swing open.

5.2 Replacing Over/Undertemp Probe and Thermostat

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 two plastic clips that hold the probe in place.
5. Open the control panel by removing the two screws located on the left side of 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 from the panel, and remove the unit.
12. Replace the thermostat and probe.

Note: Reseal probe access hole with Permagum and tie-wrap overtemp cable to existing wires after replacing probe.

5.3 Replacing the Temperature Sensor

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 Programming the Temperature Controller

The Watlow temperature controller has been set at the factory to operate the incubator within the specifications listed in Section 6 of this manual. Reference copies of the Watlow configuration records are included at the end of this section.

To prevent tampering, mechanical and software lockouts are employed in the system. These lockouts must only be removed by persons skilled in configuring controller software.

Re-programming either the temperature or humidity controllers alters the factory defaults and will seriously alter the performance of the incubator. This may also void the warranty. Do not reconfigure the controllers without first consulting the Technical Services Department, (888) 213-1790.

a. Removing the Mechanical Lockout

Make sure the unit is turned off.

Wearing a grounding wrist strap or maintaining constant contact with the metal cabinet, press in the four locking tabs on the frame of the Temperature controller. There are two tabs on either side as shown in the front and side views in Figure 5-1. When all tabs are unlocked, pull the controller module out of its frame.

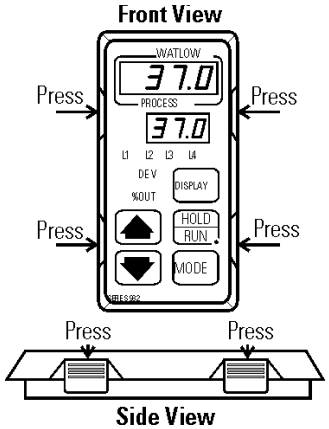
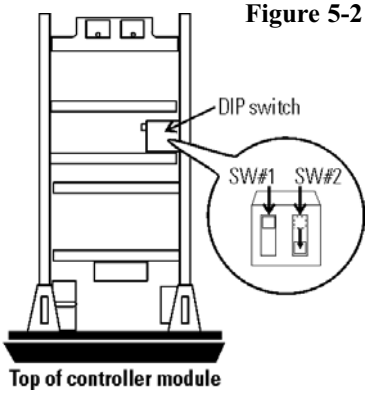


Figure 5-1

Looking at the top of the module, locate the red DIP switch indicated in Figure 5-2. With a fingernail or small screwdriver, turn off SW #2 by moving the white toggle down or towards the front of the module. (SW#2 is the top switch when looking at the module from the right side.)

Figure 5-2



Very carefully, replace the module into its frame and press firmly on the top and bottom of the bezel until all four locking tabs "click" into place.

b. Removing the Software Lockout

Press the Up and Down Arrows at the same time and hold them for about three seconds. The words "inpt" (input) and "set" will appear in the top and bottom displays. (Figure 5-3) If numbers in the bottom display begin to scroll up or down, the keys have not been pressed simultaneously. Try again.

Press the Up Arrow until "gLbL" (global) appears in the upper display. The word "set" will remain in the lower display (Figure 5-4).

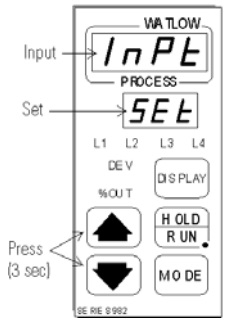


Figure 5-3

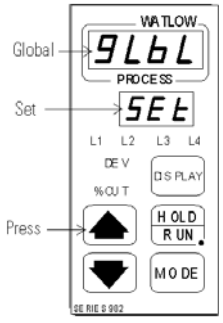


Figure 5-4

Press the Mode key to scroll through the menus until the upper and lower displays show "2 Loc" (Figure 5-5). Press the Down arrow key until the "2" becomes "0" (zero) as shown in Figure 5-6.

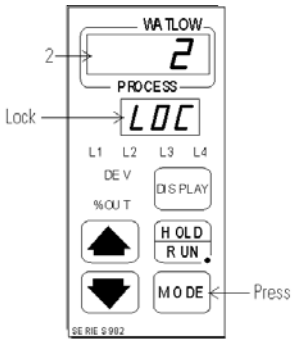


Figure 5-5

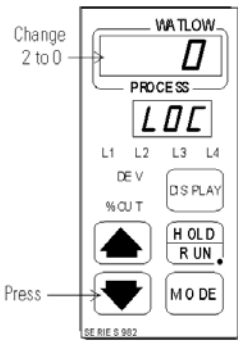


Figure 5-6

c. Controller Configuration

The Watlow 982 Temperature Controller has been configured at the factory. Copies of the Watlow Configuration records are included at the end of this section.

Do not reconfigure the controller without first consulting the Technical Services department at (888) 213-1790.

Refer to Section 3 of this manual for Watlow 982 controller operating instructions. The Watlow factory manuals are included with this manual.

d. Offset Calibration (Temperature)

It may be necessary to calibrate the temperature controller to match an independent temperature sensor. To do so, follow the next few steps.

1. Suspend an independent, calibrated sensor(s) in the center of the interior chamber.
2. Allow approximately 30 minutes for the incubator to stabilize.
3. Turn off the main power switch.
4. Wear a grounding wrist strap to avoid damaging any of the electrical components.

5. 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 5-7. Pull the controller module out by gently rocking it from side to side.

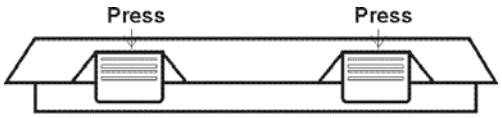


Figure 5-7

6. Looking at the top and right side of the controller module, locate the red DIP switches indicated (Figure 5-8). Use your fingernail or a small screwdriver, to turn off SW 2 by moving the white toggle towards the front of the module as in the illustration.

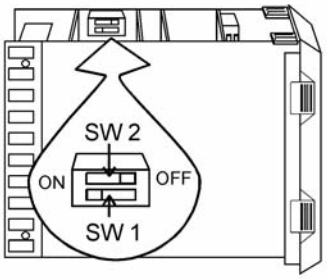


Figure 5-8

7. Return the controller to its frame and firmly press the top and bottom of the bezel until all four locking tabs "click" into place.
8. Turn on the main power switch.
9. 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.
10. 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.
11. 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 value is the difference between the actual value shown on the controller, and the reference sensor value.
12. Press the Display key once.

To turn the hardware lockout back on:

1. 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.
2. Press the Down Arrow once, then 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.
3. Press the Display key once.
4. Turn off the main power switch.
5. Wear a grounding wrist strap to avoid damaging any of the electrical components.
6. Remove the 982 controller module(s) by pressing in the four retaining tabs, two on the right side, two on the left side. Pull the controller module out by gently rocking it from side to side.
7. Looking at the top and right side of the controller module, locate the red DIP switches. Use your fingernail or a small screwdriver, to turn on SW 2 by moving the white toggle towards the back of the module.
8. Return the controller into its frame and press firmly on the top and bottom of the bezel until all four locking tabs "click" into place.
9. Turn on the main power switch.

5.5 Replacing the Optional Recorder and Probe(s)

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. The recorder probe is 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. Remove the two screws located on the left side of the control panel and open the control panel door. 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 part.

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

a. Calibrating the Recorder

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. Refer to Figure 5-9. 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.

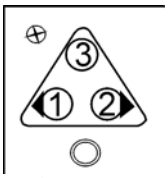


Figure 5-9

5.6 Setting the Door Heater Control

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

The infinite heater control is located in the left side of the incubator top compartment behind the control panel door. The control varies the amount of door heat from no heat (zero) to full heat (100) as indicated by the 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.

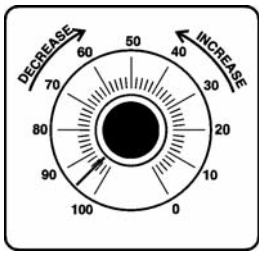


Figure 5-10

Initially, the units leave the factory with the dial set at 40. If desired, the amount of heat can later 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 CO_2 Controller Calibration

If it should become necessary to calibrate the CO_2 controller, perform the following procedure.

Start from the standard operating display (setpoint in bottom display, actual CO_2 reading in the upper display).

1. Press the Advance key until "CAL" appears in the lower display.
2. Use the up and down arrows to make offset adjustment.
3. Press the Infinity key to exit the calibration menu.

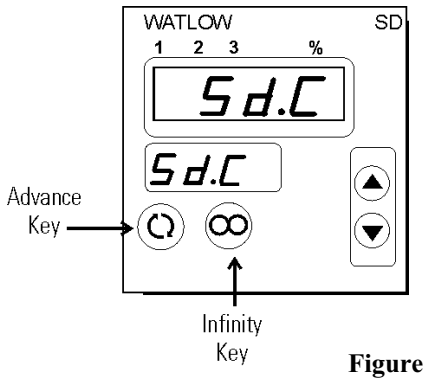


Figure 5-11

WATLOW 982 CONFIGURATION RECORD

CUSTOMER: 3920 & 3940 (Release 9)
JOB NUMBER:
SERIAL NUMBER:
CONTROL TYPE: TEMPERATURE (RTD)
PREPARED BY: GLS DATE: 12/12/2006
COMPLETED BY: DATE:

Switch Configuration:

(1)*** Main Boards

SW1	ON
SW2	ON

Input 1 Board

SW1	OFF
SW2	OFF
SW3	ON

Software Configuration:

Setup Menus

(2)****	gLbL:	C_F	C	Anun	OFF	PtyP	ti	PStr	StPt
		Err	nLA	LoP	-100	gSd	0.0	LOC	2*
		Ei1	NO	HiP	100	Pout	Cont		
		Ei2	NA	AtSP	90	IdSP	NA		

*LOC should be set at 0 until factory testing and calibration is complete

(3)****	InPt:	In1	RT.D***	CAL1	**	rL2	NA	CAL2	NA
		dEC1	NA	rtd1	DIN	rH2	NA	Hunt	NA
		rL1	-20.0	Ftr1	2	LrnL	NA		
		rH1	80.0	In2	NA	LrnH	NA		

**This is a calibration factor and will vary from unit to unit.

(4)****	OtPt:	Ot1	Ht	AL2	NA	LAt3	NA	SIL4	OFF
		PrC1	NA	LAt2	NA	SIL3	NA	Aout	Prc1
		HyS1	0.1	SIL2	NA	Ot4	AL4n	PrC3	4-20
		Ot2	CL	Ot3	NA	AL4	Pr1	ArL	-20.0
		PrC2	NA	AL3	NA	HyS4	0.1	ArH	80.0
		HyS2	0.1	HyS3	NA	LAt4	nLA	ACAL	**

**This is a calibration factor and will vary from unit to unit.

Operation Menus

(6)****	SYS:	Ei1S	NA	Ent4	NA	A3LO	NA	A4Hi	34.0
		Ei2S	NA	A2LO	NA	A3LHi	NA	Aut	OFF
		Ent3	NA	A2Hi	NA	A4LO	-73.3		

(7)****	PID:	Pb1	2.0	dE1	NA	It2	NA	dB	0.0
		rE1	0.50	Ct1	5.0	rA2	0.25		
		It1	NA	Pb2	1.0	dE2	NA		
		rA1	0.19	rE2	0.25	Ct2	30.0		

PROG: See Programming Sheets if required.
***SET THESE PARAMETERS FIRST
****CONFIGURE CONTROL IN IDENTIFIED ORDER.

WATLOW SD CONFIGURATION RECORD

CUSTOMER: 1900226 & 1900227 KITS
JOB NUMBER:
UNT SERIAL NUMBER:
CONTROL TYPE: CO2
PREPARED BY: GLS **DATE:** 12/12/2006

SETUP PAGE:Press UP and DOWN arrow for thee seconds.

SEn	MA	SP.hı	20.0	Ot 2	Pr.AL	hYS 2	0.3	rP	OFF
P.dec	0.0	Ftr.E	both	Ot 3	rMt	L9c2	ALO	LOC	0[1]
Sc.LO	4.00	FLtr	2.0	AO3.U	MA	LAt2	nLAt		
Sc.hı	20.00	Ot 1	hEAT	O3.Lo	4.00	SIL 2	On		
PI.LE	-1.00	Ftb1	20.0	O3.Hi	20.00	dSP 2	On		
PI.HE	21.00	PL 1	100.0	r3.50	Proc	Unıt	US		
r9.LO	0.0	PSL 1	0.0	r3.Hi	20.0	1.Err	nLAt		
r9.hı	20.0	PSh 1	100.0	r3.Lo	0.0	FAıL	OFF		
SP.LO	0.0	nLF 1	OFF	r3.Co	0.0	dSP	nor		

OPERATION PAGE:Press ADVANCE key from home page. LOC = 0 to view and change.

POht	0[2]	CAL	0.0[3]	rE.ht	0.15	A2Lo	0.0[4]
A-M	Auto	htM	Pıd	rA.ht	0.10		
Aut	OFF	Pbht	1.0	A2hı	20.0[4]		

FACTORY PAGE:Press UP and DOWN arrow for six seconds.

dSPL = Display Intensity 5 to 99%
rESt = Restore Factory Calibration (Select YES to restore)
Usrr = Restore User Settings (Select YES to restore user configuration)
USrS = Save User Settings (Select YES to save user configuration)
dFLt = Default Parameters (Select YES to reset to default configuration)

NOTE: Not all available parameters are listed on this page. See Watlow manual for more information.

NOTES:

[1] - Lock out setting range 1 to 4. (Factory set at 3)
[2] - %power output display. Not configurable.
[3] - User settable calibration offset.
[4] - User selectable alarm points.

Section 6 – Specifications

Temperature

Control	±0.3°C @ +25°C to +37°C
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*

Shelves

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)

Construction

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.

Weights

Net	700 lbs.

Shipping

Motor	850 lbs.

Temperature Alarm

Sensor	Thermostat
Controller	Thermostat
Setpoint	Analog reference dial
Alarm	Audible/visual

Fittings

Drain Port	3/8” OD Copper

Unit Heat Load

115V	5500 BTUH (1600W)
220V	6000 BTUH (1750W)

Refrigeration

Compressor	1/4 Horsepower, air-cooled R-134A

Electrical

	120V, 1 PH, 2W, 60Hz, 16 FLA
Power Switch	1 Pole
Line Cord	None (lockable disconnect provided)

Dimensions

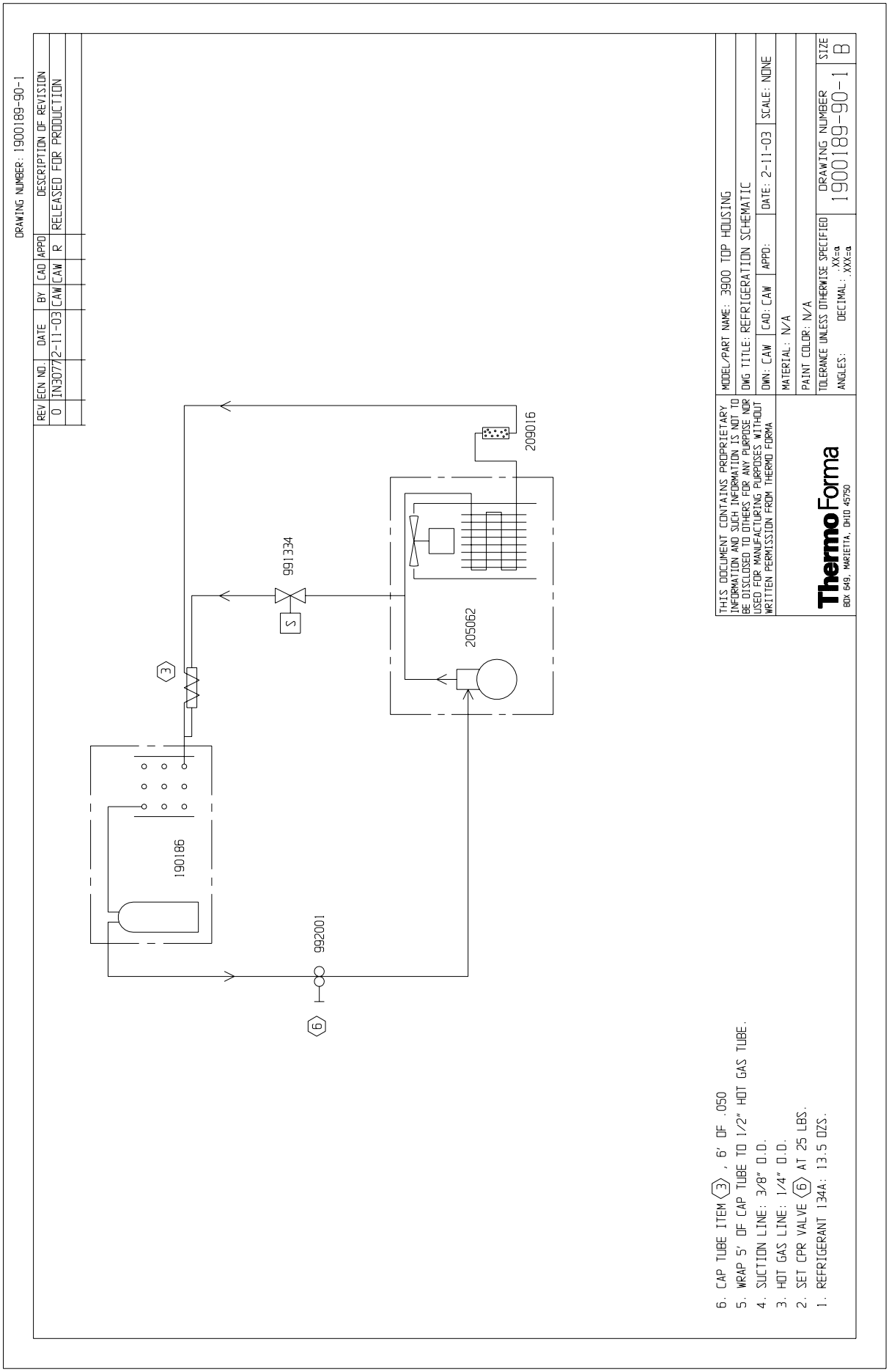
Exterior	38.0”W x 87.5”H x 32.0”F-B (96.5cm x 222.3cm x 81.3cm)
Interior	31.0”W x 60.0”H x 27.0”F-B (78.7cm x 152.4cm x 68.6cm)

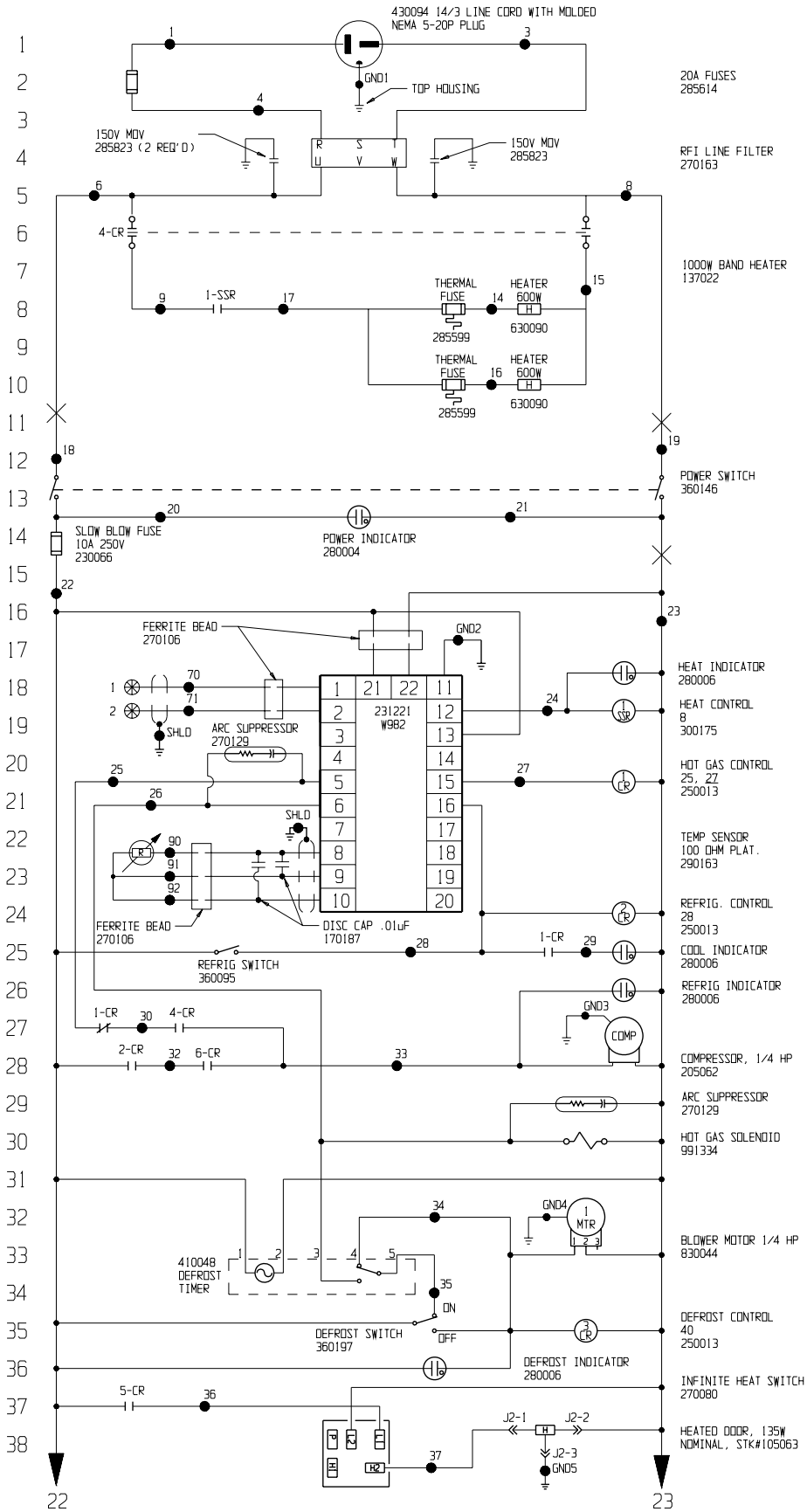
Continuing research and improvements may result in specification changes at any time. Performance plus or minus the least significant digit unless otherwise specified.

** Better than ±0.5°C uniformity at all other temperature parameters.*

Section 7 - Spare Parts

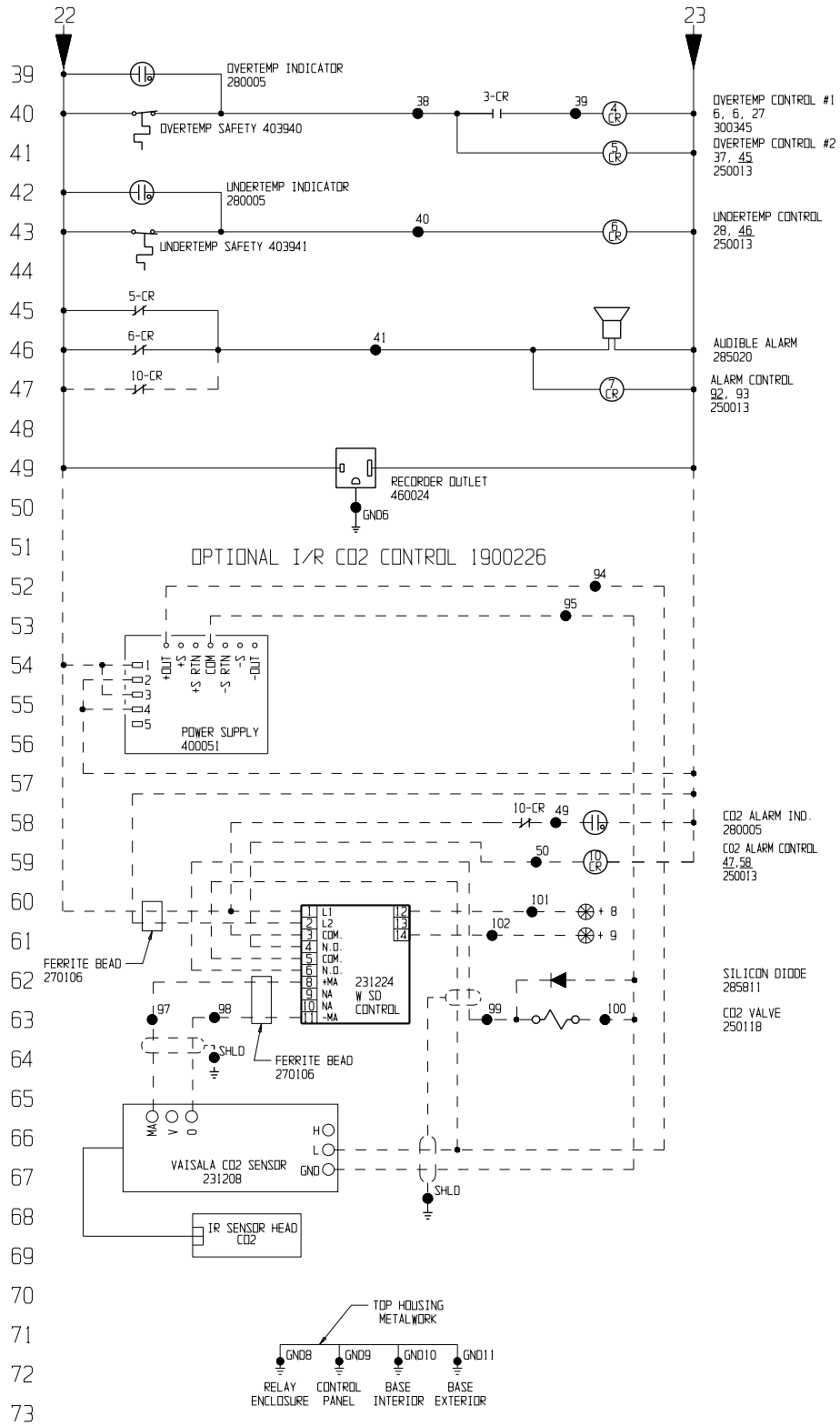
Part No.	Description	Qty
290163	RTD Temperature Sensor	1
230066*	Fuse, Ceramic 10A 350V	1
400051	Power Supply (CO_2 option)	1
231221	Watlow 982 Controller	1
231224	Watlow SD Controller (CO_2 option)	1
285614	20A Fuse	2
403940	Over Temp Thermostat	1
403941	Under Temp Thermostat	1
410048	Defrost Timer	1
630090	Heater (wirewound)	1
205062	Condensing Unit, 1/4 HP 115V R-134A	1
285599	Thermal Fuse	2
830044	Blower Motor, 1/4 HP, 115V	1


DRAWING NUMBER: 1900189-90-1
REV | ECN NO. | DATE | BY | CAD | APPD | DESCRIPTION OF REVISION
0 | IN3077 | 2-11-03 | CAW | CAW | R | RELEASED FOR PRODUCTION
190186
992001
991334
205062
209016
3
6
S
6. CAP TUBE ITEM 3 , 6' OF .050
5. WRAP 5' OF CAP TUBE TO 1/2" HOT GAS TUBE.
4. SUCTION LINE: 3/8" O.D.
3. HOT GAS LINE: 1/4" O.D.
2. SET CPR VALVE 6 AT 25 LBS.
1. REFRIGERANT 134A: 13.5 OZS.
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 FORMA
ThermoForma
BOX 649, MARIETTA, OHIO 45750
MODEL/PART NAME: 3900 TOP HOUSING
DWG TITLE: REFRIGERATION SCHEMATIC
DWN: CAW | CAD: CAW | APPD: | DATE: 2-11-03 | SCALE: NONE
MATERIAL: N/A
PAINT COLOR: N/A
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES: DECIMAL: .XX=±
.XXX=±
DRAWING NUMBER
1900189-90-1
SIZE
B



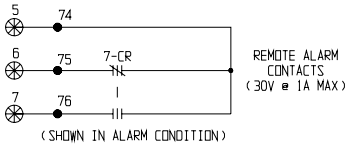
Electrical Schematic
Model:
3920
Environmental
Chamber

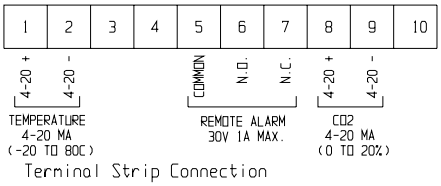
3920-70-0-D Rev. 12
Page 1 of 3



Electrical Schematic
Model:
3920
Environmental
Chamber

3920-70-0-D Rev. 12
Page 2 of 3





Terminal Strip Connection

WIRE REFERENCE CHART

NO.	AWG	COLOR	NO.	AWG	COLOR	NO.	AWG	COLOR
1	12	BLK	31	NA	NA	79	N/A	N/A
2	NA	NA	32	16	BRN	---	---	---
3	12	WHT	33	16	BLU	90	22	BLK
4	12	BLK	34	16	YEL	91	22	RED
5	NA	NA	35	16	BRN	92	22	WHT
6	12	BLK	36	20	RED	93	NA	NA
7	12	WHT	37	20	BLK	94	22	GRN
8	12	WHT	38	20	RED	95	22	BLK
9	16	BLK	39	20	RED	96	NA	NA
10	NA	NA	40	20	BLU	97	22	RED
11	NA	NA	41	20	YEL	98	22	BLK
12	NA	NA	42	NA	NA	99	22	RED
13	NA	NA	43	NA	NA	100	22	WHT
14	16	BLK	44	NA	NA	101	22	BLK
15	16	WHT	45	NA	NA	102	22	WHT
16	16	BLK	46	NA	NA	---	---	---
17	16	PUR	47	NA	NA	---	---	---
18	14	BLK	48	NA	NA	GND1	12	GRN
19	14	WHT	49	20	YEL	GND2	16	GRN
20	14	BLK	50	20	RED	GND3	16	GRN
21	14	WHT	---	---	---	GND4	16	GRN
22	16	BLK	70	22	RED	GND5	20	GRN
23	16	WHT	71	22	BLK	GND6	16	GRN
24	20	RED	72	NA	NA	GND7	NA	NA
25	20	PUR	73	NA	NA	GND8	14	GRN
26	20	ORG	74	22	RED	GND9	BRAID	N/A
27	20	YEL	75	22	BLK	GND10	16	GRN
28	20	BLU	76	22	WHT	GND11	16	GRN
29	20	BLU	77	N/A	N/A	---	---	---
30	20	ORG	78	N/A	N/A	---	---	---

REV	ECN NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
12	IN-3229	12/21/04	GLS	GLS	AKS	REMOVED 270129 FROM TERM 15 & 16 TEMP. CONT.
11	IN-3208	07/29/04	GLS	GLS	AAL	ADD CO2 4-20MA RETRANSMIT & 270129 TO CONTROL
10	IN-3077	01-26-04	GLS	pdk	AAL	CHANGED TEMPERATURE CONTROLLER
9	IN-3077	09-16-03	GLS	GLS	LDN	PRODUCT UP-DATES
8	IN-3057	11-13-02	NDW	KDG	LDN	GROUND SHIELD ON TEMP PROBE

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MODEL/PART NAME: 3920 REACH-IN INCUBATOR

DWG TITLE: ELECTRICAL SCHEMATIC

DWN: JAS | CAD: PDK | APPD: LDN | DATE: 06-28-99 | SCALE: NONE

MATERIAL:

PAINT COLOR:

TOLERANCE UNLESS OTHERWISE SPECIFIED ANGLES: DECIMAL: .XX=± .XXX=±

DRAWING NUMBER 3920-70-0 | SIZE D

Thermo
ELECTRON CORPORATION
Controlled Environment Equipment
Box 649, Marietta, Oh 45750

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

Electrical Schematic
Model:
3920
Environmental
Chamber

3920-70-0-D Rev. 12
Page 3 of 3

THERMO FISHER SCIENTIFIC STANDARD PRODUCT WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for 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, labor included. Installation and calibration are 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 Electron Corporation 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.

Rev. 3 2/07

ISO 9001 REGISTERED

THERMO FISHER SCIENTIFIC INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for 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. Dealers who stock our equipment are allowed an additional six months for delivery and installation, provided the warranty card is completed and returned to the Technical Services Department.

During the first year, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor excluded. Installation and calibration are 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, reagents, tubing, 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.

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Rev. 3 2/07

ISO 9001 REGISTERED

INSTALLATION, OPERATION AND SERVICE INSTRUCTIONS

FOR CIRCULAR CHART RECORDERS

COBEX RECORDERS, INC.

CAUTION: IT IS IMPORTANT THAT THESE INSTRUCTIONS BE READ BEFORE INSTALLING THE INSTRUMENT. KEEP THESE INSTRUCTIONS ON FILE FOR FUTURE REFERENCE.

RECEIVING INSPECTION

As soon as the recorder is received, visually inspect the shipping container for signs of damage. If there is evidence of rough handling, inspect the recorder immediately to make certain that it is intact and has not been damaged in shipment.

TRANSIT LOSS

All COBEX instruments are insured against transit loss by breakage. To make this insurance effective, all claims must be filed with the carrier at the destination within one week of receipt of merchandise. No claims, regardless of the nature of same, will be accepted beyond this period.

UNPACKING

Each recorder is shipped with the standard accessory items listed below. When unpacking the recorder make certain that all of the items are accounted for.

1. Charts: One box (where applicable).
2. Battery (for optional battery backed-up units).
3. Installation manual.

COBEX RECORDERS, INC.
6601 LYONS ROAD, F-7
COCONUT CREEK, FL 33073
TEL. (954) 425-0003
FAX. (954) 425-0509
www.cobexrecorders.com

RECORDER CASE LOCATION

Upon unpacking, find a suitable location to mount the unit before plugging it in. After the recorder has been connected to the main AC power supply, connect the battery to the battery strap and place the battery in its holder (if your unit is equipped with an optional battery back-up).

Select a location that is well lighted, free from dust, dirt and corrosive fumes. The instrument should not be located near any sources of heat or be subjected to sudden or extreme temperature changes. It should be mounted on a rigid support that is not subject to vibration. Refer to Figures 7 and 8 for recorder case dimensions.

POWER SUPPLY

The recorder uses AC power when the unit is operating normally. If the AC power were to fail and the battery back-up option is installed, then the green LED light will begin "flashing" to indicate that there is an interruption in the main power. Otherwise, the green LED light glows continuously.

The recorder will have either an AC power cord or a wall mounted transformer for connection to the main AC power supply. If a permanent connection to the main AC power supply is to be accomplished in the field, then refer to Figures 6A, 6B, 6C and 6D for diagrams showing the connection to a 115VAC 50-60Hz or a 230VAC 50-60Hz main power supply.

CONNECTING A PROBE

Most of the temperature recording units will already have a temperature indicating probe installed. If the recorder has a Temperature/Humidity type probe, make sure to remove the protective cap when the recorder is in use and replace the cap whenever the environmental chamber is to be rinsed.

If you will be supplying your own probe input device, then this next section will contain some important information concerning the connection of the probe to the recorder.

This recording unit is capable of accepting input from either a CURRENT source (such as 4-20mA), a VOLTAGE source (such as 0-1 Volt, 0-5 Volts, 1-5 Volts or 0-10 Volts) or a 100 ohm RTD probe. **Note:** The recorder is programmed (at the factory) to accept a specific probe input range. Connecting a probe that supplies the recorder with a current or voltage that is not within the specified range will give unpredictable results and may damage the recorder. If you are not sure of the probe type or input range for your recorder, please contact COBEX Recorders before continuing.

In order to connect the probe input device to the recorder, you must first gain access to the main microprocessor PC board that is mounted to the back of the chart plate.

CAUTION! DO NOT TOUCH the terminals of the transformer while the unit is connected to the main AC power supply. To avoid the risk of possible electric shock, unplug or disconnect the recording unit from the main power supply before attempting to open the recorder. If the recorder is installed with the battery back-up option, disconnect the 9 Volt battery to avoid damaging the recorder and draining the battery.

On 6" inch recording units mounted in a metal enclosure, the chart plate on the recorder case is held by four (4) screws. Unscrew and gently remove the chart plate to expose the main microprocessor PC board of the recording unit. Otherwise, your recording unit will have a hinged chart plate held in place by two (2) screws located in the upper and lower right hand corners of the chart plate. Remove these two screws and open the hinged chart plate. On 8" enclosures, there is a single screw along the right hand edge that secures the chart plate inside of the enclosure. Loosen this screw and open the hinged chart plate.

If you are not sure how to access the back of the chart plate, please contact COBEX Recorders before continuing.

Next, you will need to determine the *type* of microprocessor controller PC board that is installed in your recorder. Refer to Figures 1A, 1B and 1C and compare these figures to the microprocessor controller PC board that is installed in your recorder.

TYPE "A" CONTROLLER PC BOARD

If your recorder has a **Type A** microprocessor controller PC board installed, then locate screw terminal blocks J6 and JP5. Screw terminal block J6 is normally used when connecting an RTD temperature probe and JP5 is normally used to supply a signal input to the recorder from a VOLTAGE or CURRENT type probe. JP5 may also be used when connecting a second RTD temperature probe (on a two pen recorder). Refer to Figure 1A for the location of J6 and JP5 on the microprocessor PC board.

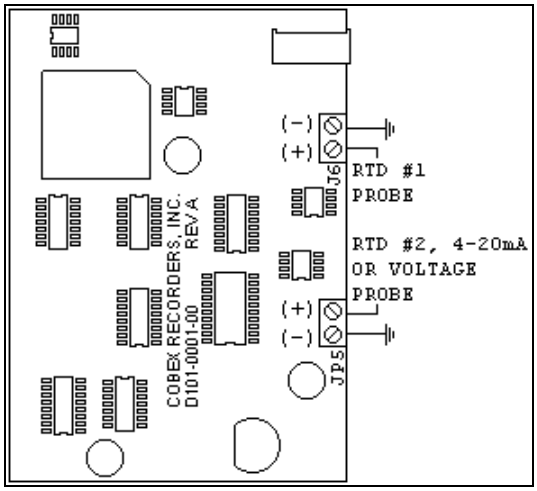

Figure 1A: Microprocessor PC Board (Type "A").

TYPE "B" CONTROLLER PC BOARD

If your recorder has a **Type B** microprocessor controller PC board installed, then locate screw terminal blocks J3 and J4 on the microprocessor PC board. These screw terminal blocks are used to provide signal input to the recorder for up to two pens. Refer to Figure 1B for the location of J3 and J4 on the micro-controller PC board. VIN (located on screw terminal block J4) is used to provide a signal input to the recorder from a VOLTAGE type probe, +5V can be used to power an external probe.

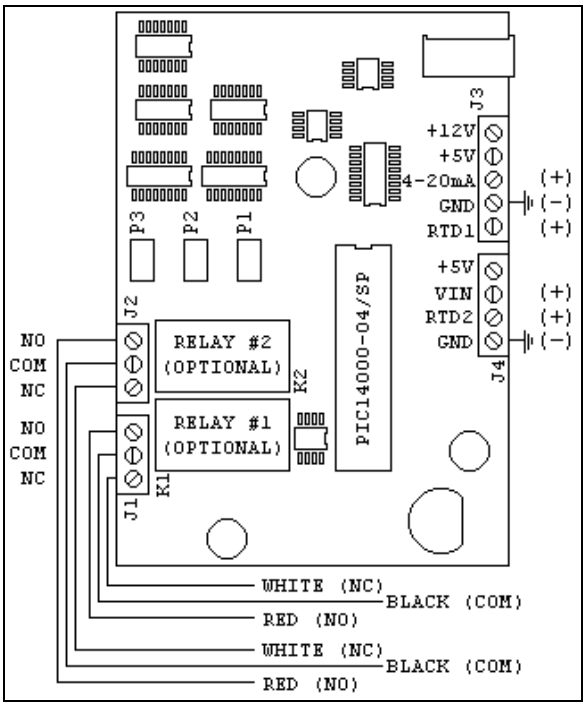

Figure 1B: Micro-Controller PC Board (Type B).

TYPE "C" CONTROLLER PC BOARD

If your recorder has a **Type C** microprocessor controller PC board installed, then locate screw terminal block J3 on the microprocessor PC board. This screw terminal block is used to provide a signal input to the recorder for one pen. Refer to Figure 1C for the location of J3 on the micro-controller PC board.

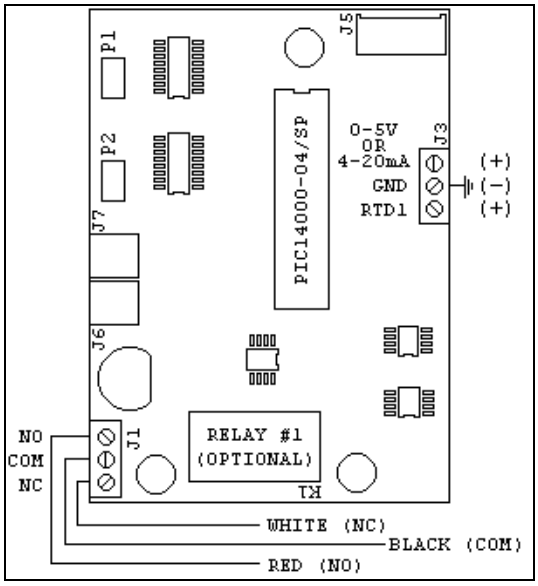

Figure 1C: Micro-Controller PC Board (Type C).

CHANGING THE CHART PAPER

Press and hold the "change chart" button (#3) for approximately one (1) second until the pen begins to move to the left of the chart and then release the button. Wait until the pen has moved completely off of the chart. To remove the chart paper, unscrew (counter-clockwise) the chart "hub" knob at the center of the chart. Remove the old chart paper and position the new one so that the correct time line coincides with the time line groove on the chart plate. Refer to Figure 5 for the location of the time line groove.

Re-attach the chart "hub" knob and screw securely (by hand) against the chart. Press and hold the "change chart" button (#3) again for approximately one (1) second until the pen begins to move back onto the chart and then release the button. Check to make sure that the pen is marking on the chart paper. If it is not, then carefully adjust the pen arm to establish contact with the paper.

MARKING SYSTEMS:
MARK-A-MATIC II INKING SYSTEM

This type of pen consists of a self contained ink reservoir with a porous plastic stylus which is snapped around the outer edge of the metal pen arm.

A pen cap is provided to extend the life of the ink pen during shipping or when the recording unit is not in service. To remove the pen cap, gently lift the pen arm away from the chart paper. Remove the black plastic pen cap to expose the fiber tip of the ink pen and gently place the pen back onto the chart paper. Do not let the pen arm "snap" back onto the chart paper. This will flatten the fiber tip of the pen and will no longer give you a fine line marking on the chart paper. Place the pen cap in a safe place for future use.

If the stylus does not touch the chart, adjustment can be made by slightly bending the metal pen arm in the center towards the chart paper. Do not use more pressure than is necessary to create a fine line marking on the chart paper. **Note:** As the pen ink supply runs out, the pen color will become lighter. This indicates that the pen should be replaced.

REPLACEMENT OF PEN

Note: In non-inking units, (that is, when using pressure sensitive recording chart paper) replacement of the pen is not necessary.

Recorders that are equipped with fiber tipped cartridge pens will have a cartridge that is color coded "red" to designate pen number one (1) and an optional cartridge that is color coded "blue" to designate pen number two (2). The pen cartridge is securely fastened to the metal pen arm using a special "U" clip tab.

For ease of replacement, it is suggested that the two (2) screws that hold the pen arm be loosened and the pen cartridge and metal pen arm be removed as an assembly. Refer to Figure 5 for the location of the pen arm screws. Unsnap the plastic "U" clip tab of the pen cartridge from the metal pen arm, remove and discard the old pen cartridge. Replace the new cartridge by opening the hinge and snapping it securely around the metal pen arm. Refer to the following figure.

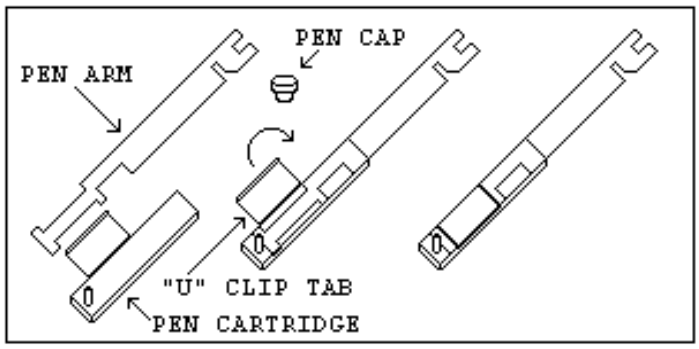

Figure 2: Pen Arm Assembly.

PEN ARM CALIBRATION

To check and/or adjust the recording pen(s) calibration to the outer most temperature graduation of the chart, press and hold the "change chart" button (#3) until the pen begins to move off of the chart. Once the pen(s) has moved off of the chart, again press and hold the "change chart" button (#3) until the pen begins to move back onto the chart. The pen

should briefly stop at the outer most temperature graduation of the chart before continuing onto the chart to begin recording. If the pen does not stop exactly at this location on the chart, it can be adjusted or "calibrated" by using the left (#1) or right (#2) arrow buttons (refer to Figure 3).

When the pen moves back onto the chart and briefly stops, you will have approximately five (5) seconds in which to adjust the pen's position using the left and right arrow buttons of Figure 3.

On multiple pen recorders, each pen will move (one-at-a-time) onto the chart briefly stopping at the outer most temperature graduation of the chart at which time the pen's position can be adjusted by using the left (#1) or right (#2) arrow buttons. When the time to adjust the position of the first pen has expired, the second pen will move onto the chart briefly stopping at the outer most temperature graduation of the chart at which time the second pen's position may be adjusted.

Each time the chart paper or fiber tip pen cartridge is changed, you should make sure that each pen stops at the outer most temperature graduation of the chart paper. Otherwise, this pen *offset* will cause the unit to record an incorrect temperature on the chart.

TEMPERATURE RECORDER CALIBRATION CHECK

This recorder has been accurately calibrated at the factory. Before making any adjustments, this instrument should be in service for 24 hours. Thereafter, if any adjustment is required, perform the following procedure. **Important: DO NOT immerse a Temperature/Humidity probe in any solution.**

1. Place a Certified Test Thermometer(s) in a solution bottle(s) alongside the recorder's sensor probe(s).

2. Once the temperature has leveled out, compare the position of the pen on the recorder to the test thermometer's reading.

2a. For two (2) pen recorders, also compare the second thermometer's reading to the second pen of the recorder.

3. If an adjustment is required, use the left (#1) and right (#2) arrow push buttons on the recorder to calibrate (or move) the pen's position on the chart to correspond to the temperature of the solution. The arrow buttons must be held for approximately five (5) seconds before the pen will begin to move.

3a. For two (2) pen recorders, you must first select the pen that you wish to calibrate. This is done by pressing the left (#1) arrow button to select the red pen or the right (#2) arrow button to select the blue pen. The arrow button must be held down until the green LED light goes out. After the green LED light goes out, follow the instructions in step #3 above. (Refer to the following figure for a diagram of the push buttons).

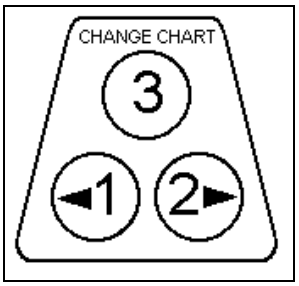

Figure 3: Push buttons.

OPTIONAL FEATURES

BATTERY BACK-UP

The green LED light remains a constant green color indicating that both the battery and the main power to the unit are good. Refer to Figure 5 for the location of the green LED indicating light. If the AC power were to fail or the battery becomes weak, then the green LED light will begin "flashing" indicating that either you have lost the main power to the unit or it is time to replace the battery. Having a 9 volt DC battery back-up in place, will allow the recorder to continue to function normally for approximately 24 hours in the event of a power failure.

BATTERY LOCATION AND REPLACEMENT

4", 6" AND 10" RECORDERS

To replace the battery, first open the recorder door. The battery will be located in the upper right hand corner of the unit. Refer to Figure 5 for the location of the battery. **Note:** Use only NEW 9 volt alkaline replacement batteries.

8" RECORDERS

CAUTION! DO NOT TOUCH the terminals of the transformer while the unit is connected to the main AC power supply. To avoid the risk of possible electric shock, unplug or disconnect the recording unit from the main power supply before changing the battery.

To replace the battery on an 8" recorder, first open the recorder case door. Next, loosen the single screw located on the right hand side of the chart plate and open the hinged chart plate. The battery strap and battery holder are located on the back of the chart plate. **Note:** Use only NEW 9 volt alkaline replacement batteries.

OPTIONAL ALARM/CONTROL RELAY CONNECTION TO THE RELAY

CAUTION! DO NOT TOUCH the terminals of the transformer while the unit is connected to the main AC power supply. To avoid the risk of possible electric shock, unplug or disconnect the recording unit from the main power supply before attempting to access the terminals of the relay. If the recorder is installed with the battery back-up option, disconnect the 9 Volt battery to avoid damaging the recorder and draining the battery.

On 6" inch recording units mounted in a metal enclosure, the chart plate on the recorder case is held by four (4) screws. Unscrew and gently remove the chart plate to expose the relay that is mounted to the back of the chart plate. Otherwise, your recording unit will have a hinged chart plate held in place by two (2) screws located in the upper and lower right hand corners of the chart plate. Remove these two screws and open the hinged chart plate. On 8" recording units, there is a single screw along the right hand edge that secures the chart plate inside of the enclosure. Loosen this screw and open the hinged chart plate to expose the relay terminals. If you are not sure how to access the relay terminals of your recording unit, please contact COBEX Recorders before continuing.

The relays that are used in this recording unit are *latching* type relays. That is, the contacts of the relay will remain either closed or open (even when there is no power applied to the recorder) until the relay is pulsed with a signal from the recorder to change the position of the contacts.

Refer to Figures 1B, 1C and 6B for the location of the screw terminal connections for the relays. **Note:** A RED, BLACK and WHITE set of wires may already be provided as an external connection to the relay's terminal block. The terminal position NC will be *closed* when the pen is positioned to the right of the control point and will be *open* when the pen is positioned to the left of the control point.

The relays are rated for the following maximum values:

2.0 AMP at 30V DC
0.6 AMP at 125V AC
0.6 AMP at 110V DC

Warning: Damage to the recording unit may result if the ratings for the relays are exceeded.

SETTING THE CONTROL POINT FOR THE RELAY

To set the position of the pen on the chart that will determine when the relay contacts will open or close, follow these instructions:

Press and hold the "change chart" button (#3) until the pen arm begins to move off of the chart and then release the button. Wait until the pen has moved completely off of the chart. When the "change chart" button (#3) is pressed again, the pen will begin to move back onto the chart briefly stopping at the outermost graduation of the chart.

The pen arm will then move to the first control point position and the green LED light will turn off. The pen will remain at this position for a period of approximately five (5) seconds during which time the control point can be adjusted using the left arrow (#1) or the right arrow (#2) push buttons. Refer to the following figure for a diagram of the push buttons. When the time has expired for adjusting the control point, the green LED light will turn back on and the unit will begin recording.

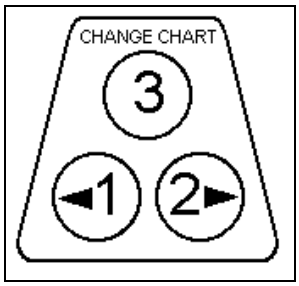

Figure 4: Push buttons.

When the pen has two control points, the pen then moves to the second control point at which time the second control point may be adjusted. Having two control points (per pen) allows you to define HIGH and LOW temperatures that will open or close the relay contacts. Approximately five (5) seconds after you have finished adjusting the control point(s), the LED light will turn solid green and the pen arm will move to indicate the probe's temperature and the unit will begin recording.

CHART "RANGE" SELECTION

If the recorder that you are using has a *range sticker* (that lists several temperature ranges) mounted on the front of the chart plate, then the following section will apply to you.

This recording unit has the option for the user to select from several temperature "ranges" that are programmed into the recorder. **Note:** The chart paper that is used on the recording unit must match the *range* that is selected for the recorder. Otherwise, the pen's position on the chart paper will not correspond to the temperature that is measured.

Also, if the pen moves to the center or outer edge of the chart and remains there while the unit is powered on, then this maybe an indication that the current range that is selected for the unit is not correct. The recorder has a built-in safety mechanism that will always move the pen to the highest temperature on the chart when the current temperature that is measured is not within the selected range.

The recording unit can have up to eight (8) user selectable ranges programmed into the unit. To select from one of the available ranges, follow these instructions:

After the recording unit has been powered-on and is operating normally (recording temperature), press and hold the "change chart" button (#3) until the pen arm begins to move off of the chart. Once the pen has moved off of the chart, press and hold the left arrow (#1) or right arrow (#2) button for approximately eight (8) seconds and then release the button. Refer to Figure 4 for a diagram of the buttons.

Note: If your recorder has a **Type A** microprocessor controller PC board installed, then the current range that the recorder is operating in will be altered when this *change range* mode is entered. For example, if the recorder is currently operating in range #1 and the left arrow (#1) button is pressed for the eight second period as described above and then released, the current range will be advanced to range #2 and the LED light will begin flashing two (2) times. Refer to Figure 1A to determine if you have a **Type A** microprocessor controller PC board installed.

The green LED light will begin flashing one (1) time if range #1 is selected or will flash two (2) times if range #2 is selected and so on. Press the left arrow button (#1) to increase the range number or press the

right arrow button (#2) to decrease the range number that is selected for the recorder. When you have finished selecting the range, press and hold the "change chart" button (#3) until the pen begins to move back onto the chart and the selected range will be saved into the recorder's permanent memory.

RECORDER SPECIFICATIONS

INPUT
Nominal Input Voltage: Single Phase 115/230VAC.
Nominal Input Current: 40mA/20mA
Nominal Input Frequency: 50-60 Hz.

BATTERY (Optional)
Battery Type: 9 Volt Alkaline
Low Battery Signaling: Flashing LED

OPERATING ENVIRONMENT
0°C-40°C (32°F-104°F); 0-95% RH, Non-condensing
Pollution Degree: 2
Installation Category: II

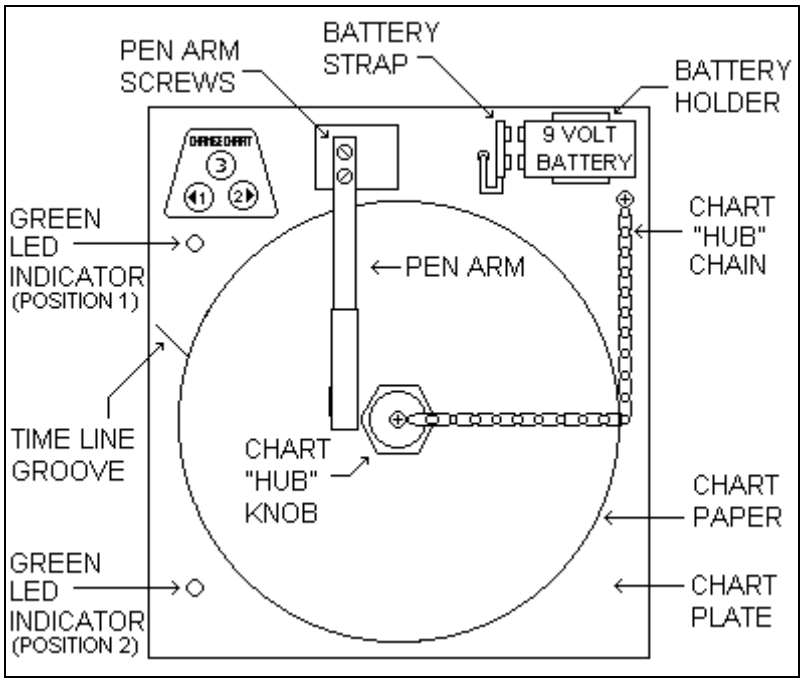

Figure 5: Recorder Assembly (Front View).

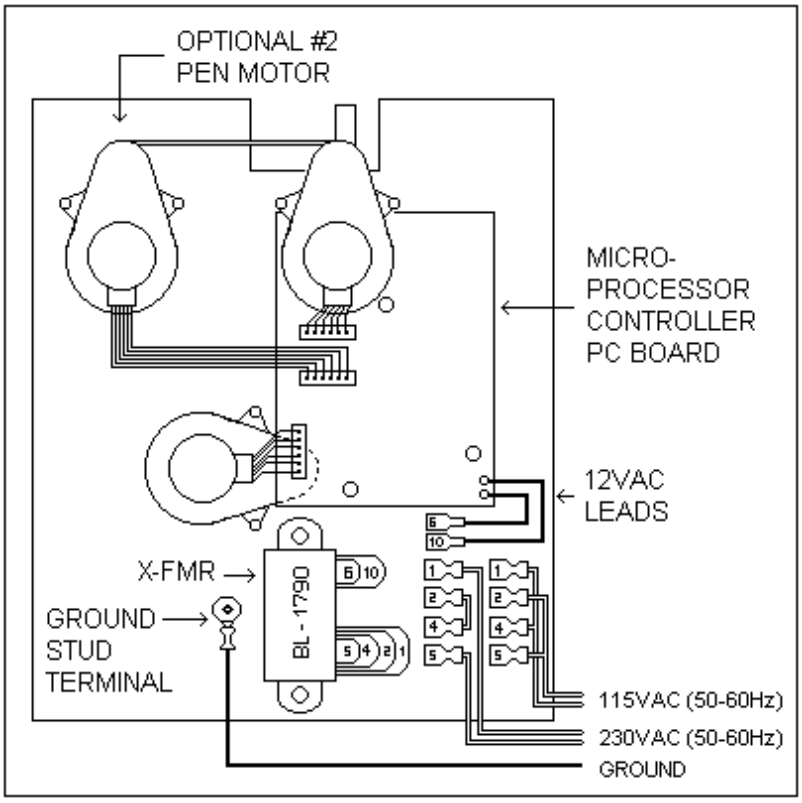

Figure 6A: Recorder Assembly "Type A" (Rear View).

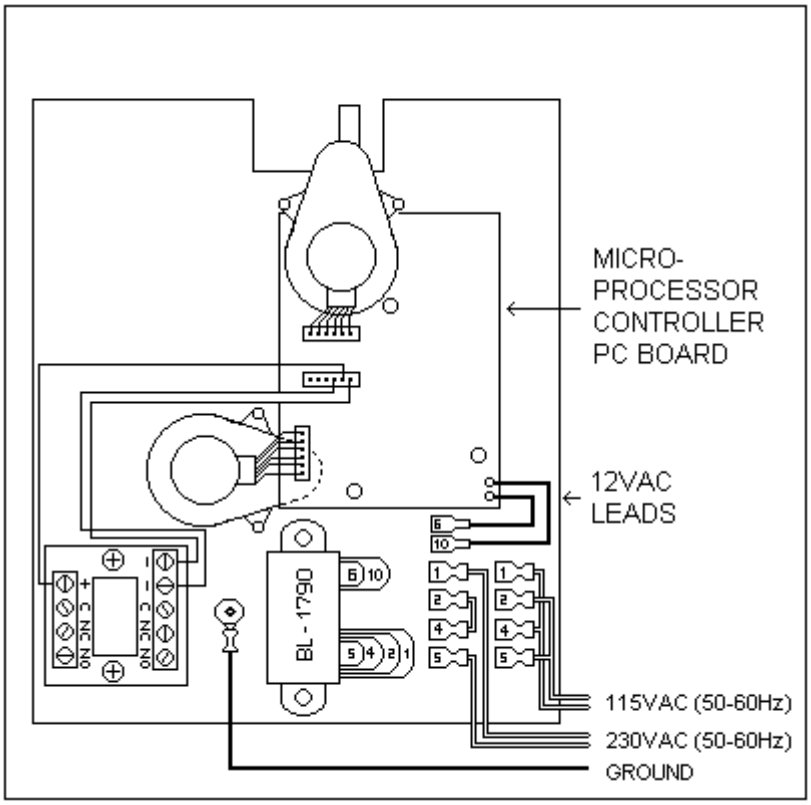

Figure 6B: Recorder Assembly "Type A" with Electric Contact Option (Rear View).

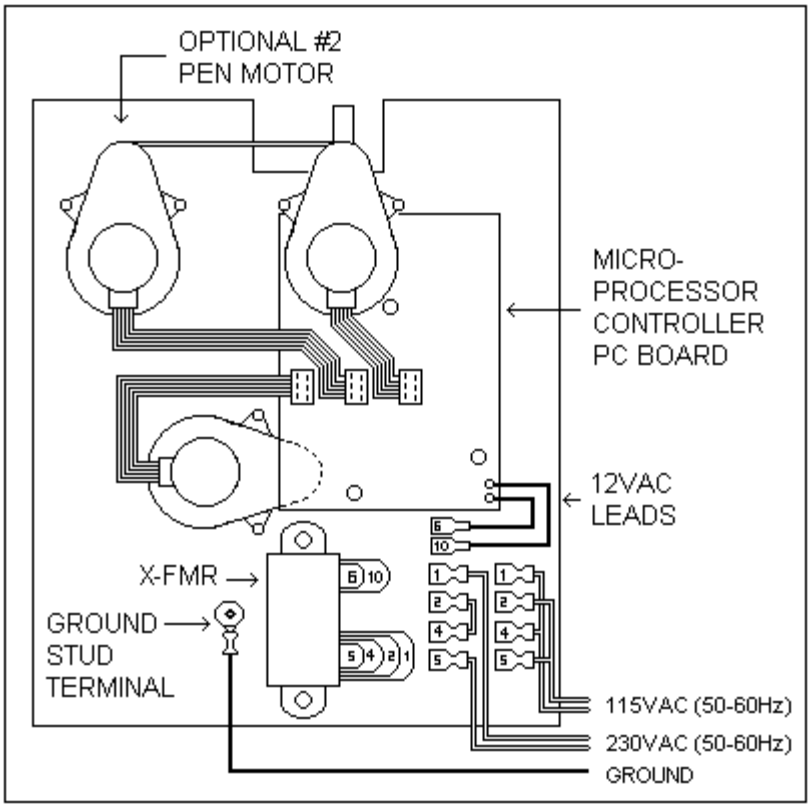

Figure 6C: Recorder Assembly Type "B" (Rear View).

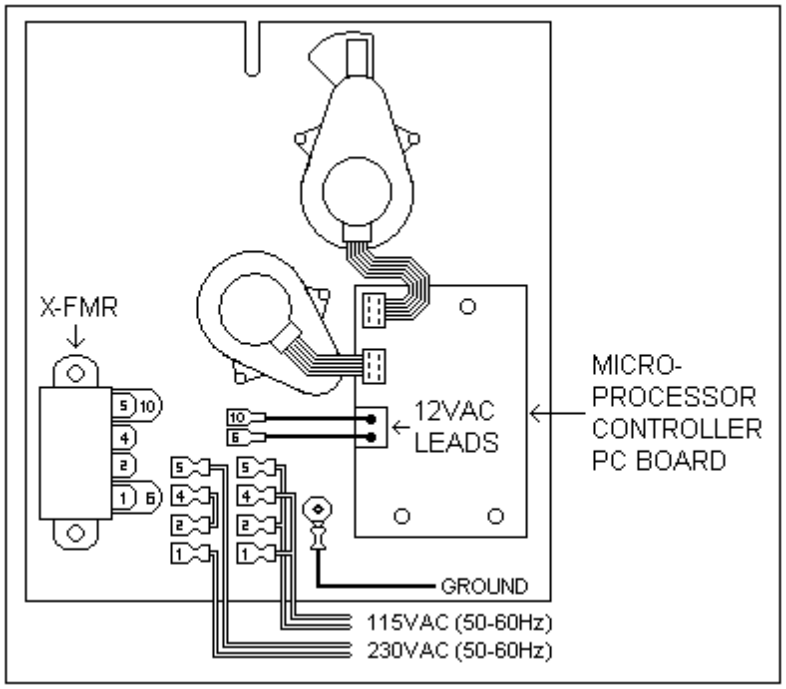

Figure 6D: Recorder Assembly Type "C" (Rear View).

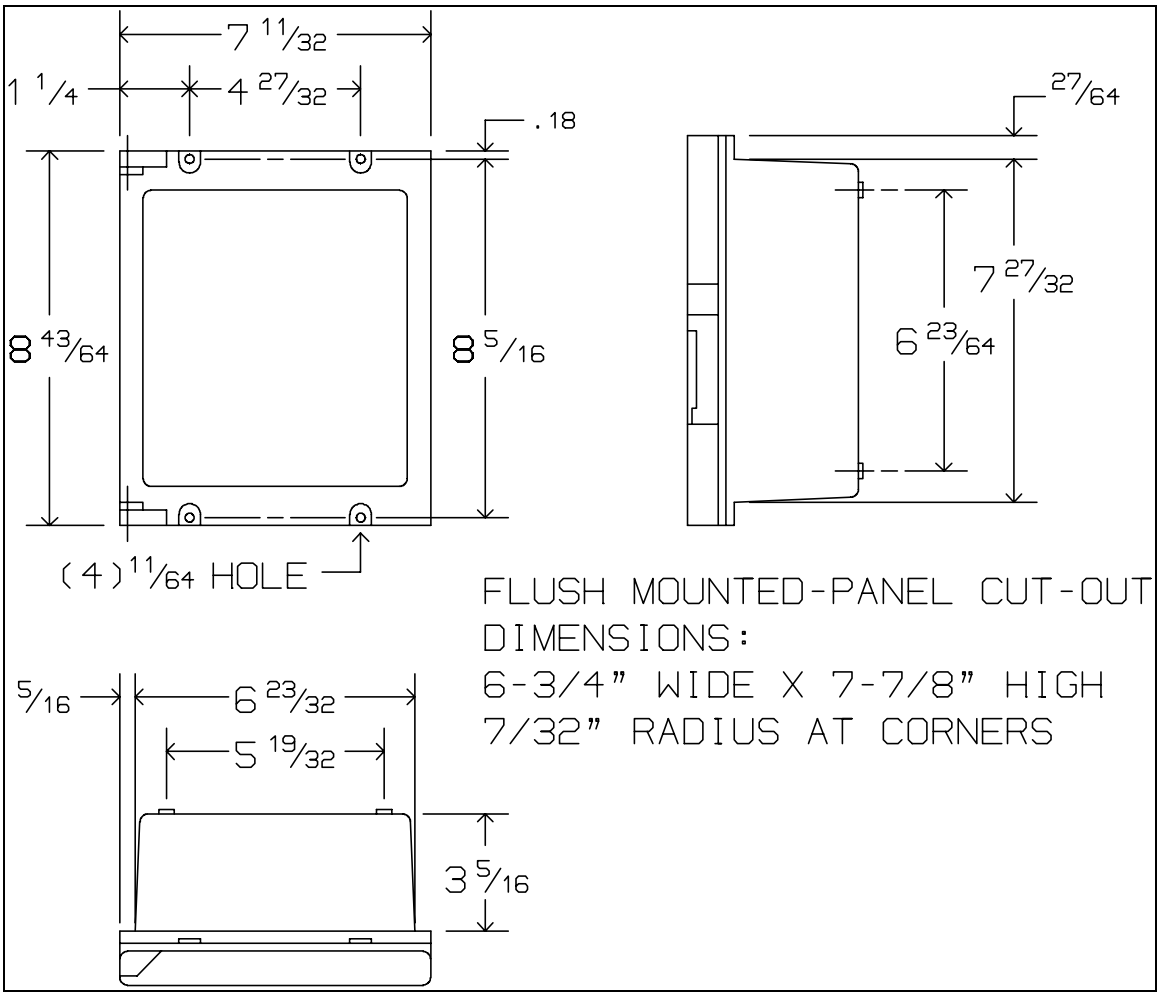

Figure 7: 6" Recorder Case Dimensions.

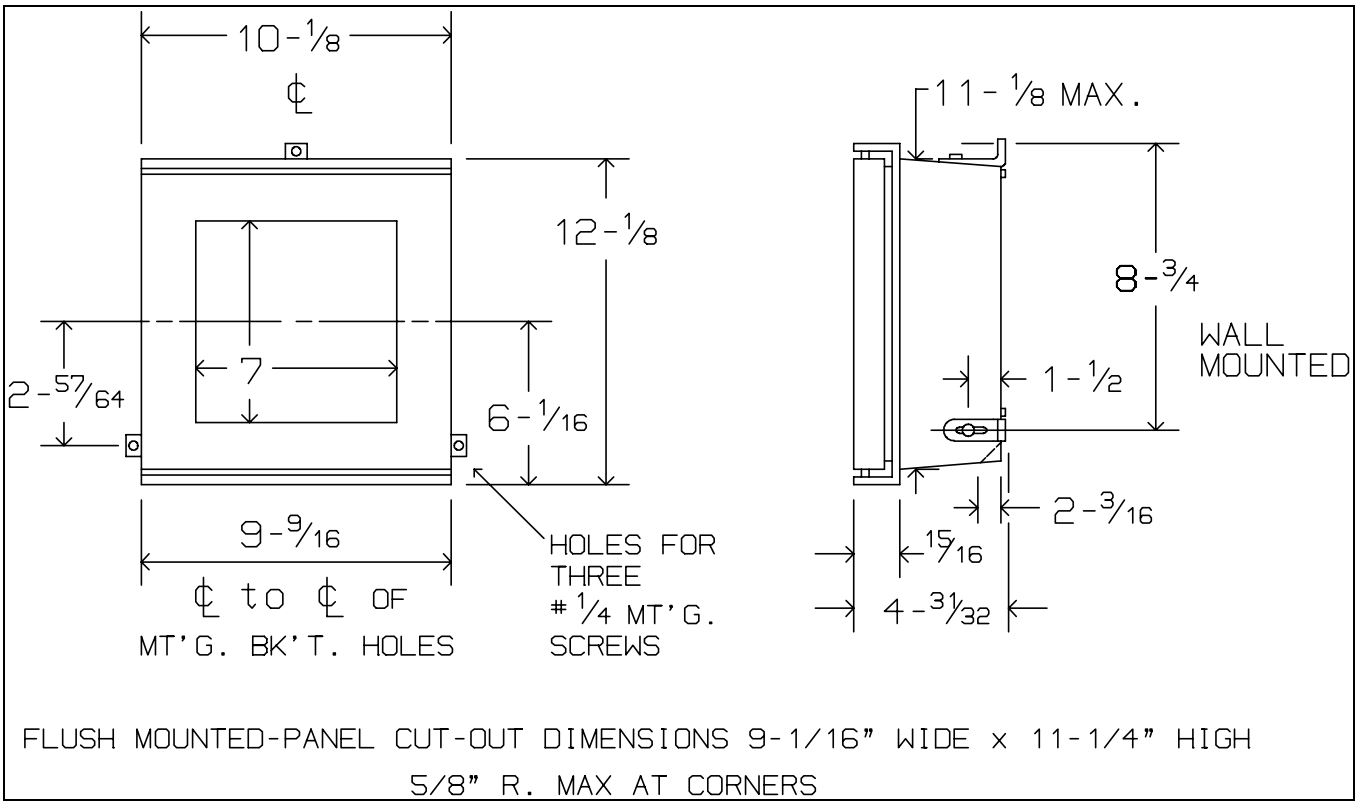

Figure 8: 8" Recorder Case Dimensions.

For all physical dimensions and panel cut-out dimensions for *skeleton* and *skeleton with door* recorders, please contact COBEX Recorders, Inc.

GUARANTEE: COBEX products are warranted to be of good workmanship and quality and free from defects under normal use and service. This warranty is limited to repairing such defects, provided return is made prepaid to COBEX Recorders, Inc., Coconut Creek, Florida within one (1) year after delivery to the original purchaser. COBEX shall not be liable for consequential damages. This warranty is in lieu of all other warranties, guarantees, liabilities or obligations, statutory, expressed or implied to the original purchaser or to any other person. No agent is authorized to assume for COBEX Recorders, Inc., any liability, except as set forth above.

Orders submitted on customer's own purchase order forms, which forms may contain statements, clauses, or conditions modifying, adding to, repugnant to or inconsistent with the terms and provisions of the Seller herein contained will be accepted by the Seller only upon condition and with the express understanding that notwithstanding any such statements, clauses, or conditions contained in any order forms of the customer the liabilities of the Seller shall be determined solely by its own terms and conditions of sale, and in accepting and consummating any such order the Seller shall be deemed not to have in anyway changed, enlarged or modified its liabilities or obligations as fixed by such terms and conditions of sale as stated by the Seller herein.

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