

Model 3940 Series

Forma Environmental Chamber

Operating and Maintenance Manual

7043940 Rev. 10



Table 1. Models Covered in This Manual

Model	Capacity (cu. ft.)	Voltage
3911	11	208-220
3913	11	220-240
3940	29	208-220
3949	29	220-240

MANUAL NUMBER 7043940					
REV	ECR/ECN	DATE	DESCRIPTION	By	
10	24405/IN-3830	5/5/08	Updated electrical schematics for alarm wiring update to failsafe operation	ccs	
9	23879/SI-9748	1/15/07	Removed COMM from 982 configuration sheets (temp, humidity)	ccs	
8	23411/IN-3303	7/11/06	Updated electrical schematic for 3913 & 3949, new MOV	ccs	
7	23451/IN-3294	4/6/06	Changed to 15, ± 5 PSIG and specified range in required CO ₂ pressure regulation	ccs	
6	22678/IN-3229	1/17/05	Remove 270129 from terminals 15 and 16 of temperature control	aks	
--	22672/IN-3227	1/17/05	Revised steam generator wiring	aks	
5	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	
4	22453/IN-3208	9/7/04	Updated FLA specs on drawings and specification page	ccs	
--	--	8/18/04	Added Puregas dryer preventive maintenance	ccs	
3	--	6/28/04	Reinstalled reference to Hold/Run key for silence on Watlow, corrected	ccs	
2	22337	5/11/04	Removed reference to Hold/Run key for silence on Watlow, chg pending	ccs	
1	22070/22129	1/29/04	Pre-programmed controller/changed thermal fuse	aks	
--	--	1/26/04	Updated section 3.1.E dehumidification	aks	
--	20843	11/20/03	Release 9	aks	



Important 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. ▲

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



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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:

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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 1-800-438-4851 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 $\pm 1^{\circ}\text{C}$ for temperature, $\pm 1\%$ for gases, and $\pm 5\%$ 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 CO₂ sensors, blower motors, water jackets, etc.**

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Section 1 Installation and Set-Up

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

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.

Caution 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. ▲

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

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.

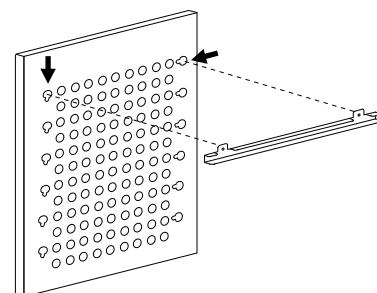


Figure 1-1. Install Shelf Channel

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.

Connect Water Inlet for Humidity System

The humidity reservoir will require approximately three cups (0.710 liter) of water on the initial filling. For best operation of the incubator, sterilized distilled, demineralized or de-ionized water should be used in the humidity reservoir. Water purity should be in the resistance range of 50K to 1M Ohm/cm, or a conductivity range of 20.0 to 1.0 uS/cm. Refer to ASTM Standard D5391-93 or D4195-88 for measuring water purity.

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

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

The water inlet is the 1/8" FPT connection located on the rear top center of the incubator. A 1/4" hose fitting is provided for a hose connection, if desired. Water inlet pressure must not exceed 40 PSI. A manual shut-off valve should be installed between the main water supply and the incubator.

Caution To prevent mineral buildup on humidity generator walls, it may be necessary to clean the humidity generator with a non-metallic abrasive pad and flush thoroughly every two to three months. Refer to Section 4, Cleaning the Humidity Steam Generator. ▲

Alternate Water Supply for Humidity System

If an in-house water supply of the required purity range (50K to 1M Ohm) is not available, an alternate water supply method can be used. A large vented carboy (5 gal. minimum) of water in the required purity range can be placed on top of the unit. Connect it to the 1/8" FPT water inlet fitting, located on the rear top center of the incubator.

Note The maximum water consumption of this incubator could be as high as 2 gallons per day. When using an alternate water supply method, it is recommended that the supply be checked periodically based on source volume. ▲

Connect Drain Line

The cabinet's 3/8" MPT drain line connection is located on the rear (lower left side) of the cabinet. A P-trap (Figure 1-2) is included with the unit and must be installed on the connection.

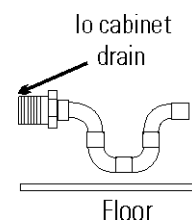


Figure 1-2. P-Trap

To install the drain connection:

1. Using Teflon pipe thread tape, tape the threads on the cabinet drain connection.
2. Using an open end adjustable wrench, install the P-trap onto the connection. Make sure the trap section is positioned down.
3. 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. A condensate evaporator (P/N 1900031) or condensate pump (P/N 184062) may also be used.

4-20 Milliamp Output

The environmental chamber is equipped with 4-20mA output for the remote transmission of temperature, humidity and CO₂ data. A terminal strip is located on the back of the incubator for convenience. Refer to Figure 1-3 for terminal pin identification.

1	2	3	4	5	6	7	8	9	10
+	-	+	-	Common	N.O.	N.C.	+	-	
4-20	4-20	4-20	4-20				4-20	4-20	
Temperature		Humidity		Remote Alarm			CO ₂		
4-20mA		4-20mA		30V 1A max.			4-20mA		
(-20 to 80C)		(0 to 100%)					(0 to 20%)		

Figure 1-3. Terminal Pin Identification

Remote Alarm Contacts

Remote alarm connections are also included on the terminal strip (Figure 1-3) 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, humidity, or CO₂ go out of the set alarm limits.

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. For Models 3911 and 3940, the power cord connector is the mains disconnect device. Models 3913 and 3949 have a fusible disconnect located on the back of the unit. Position the incubator so the unit can be easily disconnected. ▲

For Models 3911 and 3940, plug the provided 10 ft. power cord with the NEMA 14-20 plug into the grounded dedicated electrical circuit.

Start-Up

When the humidification system is operational, the incubator may be started. Preset the controls as follows:

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

For best overall performance of the incubator, the refrigeration switch should be turned On for most applications. When running Low or No humidity at high temperatures, the refrigeration switch may be turned Off.

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

Set 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°. 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. ▲

Set 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° on the scale. The alarm will silence and the undertemp indicator light 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 activates, power to the compressor shuts off, and the chamber temperature is 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.

Set Undertemp Safety Thermostat (cont'd)

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. ▲

Cobex Recorder (Optional)

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 9V battery (Figure 1-4). If the unit is operating, the green LED lights steady. If the unit is not turned on, the LED blinks.

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 9V battery, use only an alkaline style battery. Dispose of the old battery following established environmental practices.

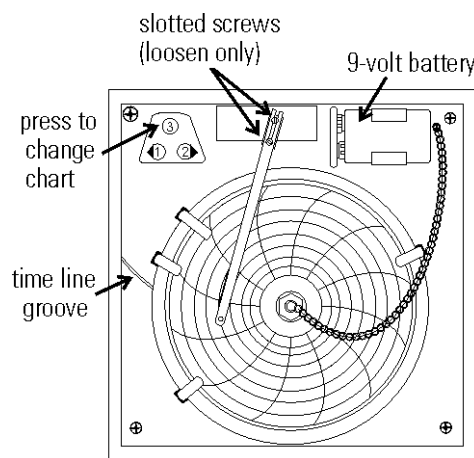


Figure 1-4. Install Battery In Recorder

Change 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 1-4.
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.

Change 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. ▲

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 4 and the supplemental Honeywell Recorder manual.

IR CO₂ Option

This section applies to units with the IR CO₂ option only.

Connect the CO₂ Source

For the most economical use, the liquid CO₂ supply tanks should be 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 CO₂ supply.

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.

Connect the CO₂ Source (continued)

The CO₂ source must be regulated at a pressure level of 15, ±5 psig. Higher pressure levels may damage the CO₂ control system. The user should determine the most economical pressure level, between 10 and 20 psig appropriate for the desired CO₂ percentage in the chamber. Use only sufficient pressure to maintain recovery time after door openings.

To connect the CO₂ supply (Figure 1-5):

1. Connect the CO₂ tubing to the 1/4" hose fitting installed in the CO₂ inlet.
2. Check the tubing connection for leaks.

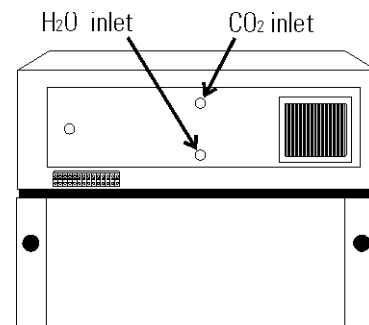


Figure 1-5. Inlet Connections

Set the CO₂ Content

The Watlow SD CO₂ controller's upper display shows the actual CO₂ content inside the chamber. The lower display shows the CO₂ setpoint.

Before setting the CO₂ content, allow the chamber temperature and humidity to stabilize. Do not open door during the stabilization period.

To set the CO₂ content (0% to 20%), press the Up or Down Arrow keys on the Watlow SD Controller.

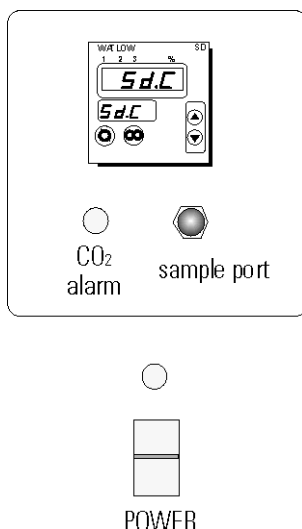


Figure 1-6. Watlow SD Control

CO₂ Control and Indicators

Sample Port

The sample port is used for checking CO₂ percentage in the incubator chamber by an independent test instrument (such as with a Fyrite, or similar CO₂ test instrument).

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

CO₂ Alarm

The CO₂ alarm is factory set to activate when the chamber CO₂ content deviates from configured alarm set points (see configuration record). When a CO₂ alarm occurs, the CO₂ Alarm indicator on the control panel lights and the audible alarm sounds.

The CO₂ alarm high and low setpoints are established through the Watlow SD CO₂ controller (ALO, and AHI). Refer to the Configuration Record included at the end of Section 4.

Section 2 Start-Up and Operation

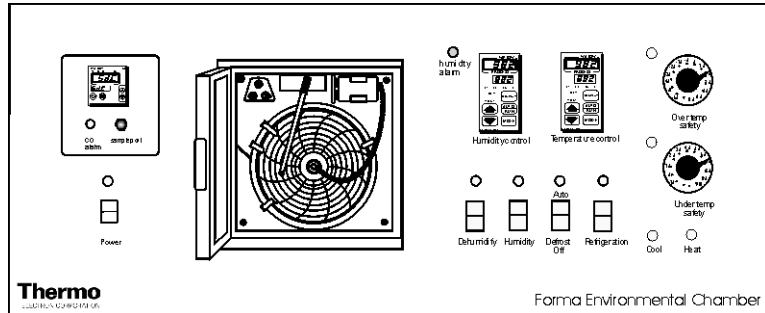


Figure 2-1. Environmental Chamber Control Panel, Shown with Optional CoBex Recorder and Optional CO₂ Control

Control Panel

Main Power Switch and Indicator Light (Figure 2-2)

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.

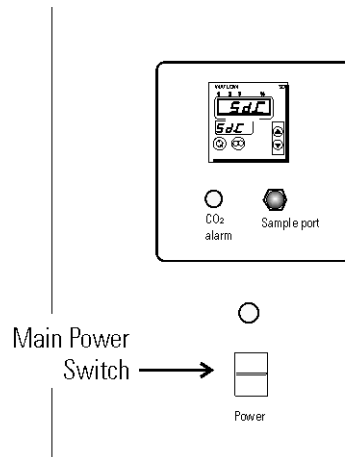


Figure 2-2. Main Power

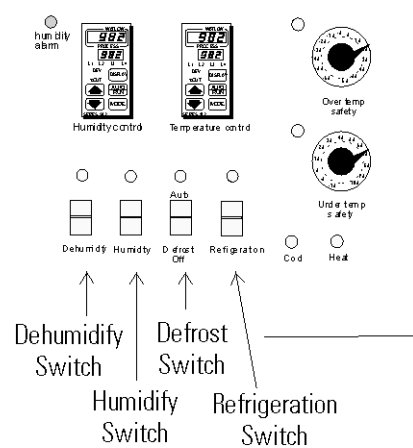


Figure 2-3. Switches

Refrigeration Switch and Indicator Light (Figure 2-3)

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.

Control Panel (continued)

Defrost Switch and Indicator Light (Figure 2-3)

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.

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

Humidity Switch and Indicator (Figure 2-3)

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

Dehumidify Switch and Indicator (Figure 2-3)

The dehumidify switch is used with the optional heatless dryer P/N 1900139 to provide dehumidification. The heatless dryer injects dry air into the incubator chamber as needed, to maintain humidity levels. 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.

Heat Indicator (Figure 2-4)

The Heat Indicator illuminates when the heater activates.

Cool Indicator (Figure 2-4)

The Cool Indicator illuminates when the refrigeration system activates.

Overtemp Safety Control, Indicator Light, and Audible Alarm (Figure 2-4)

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:

- Activates the audible alarm and the overtemp indicator light.
- Interrupts 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.

Control Panel (continued)

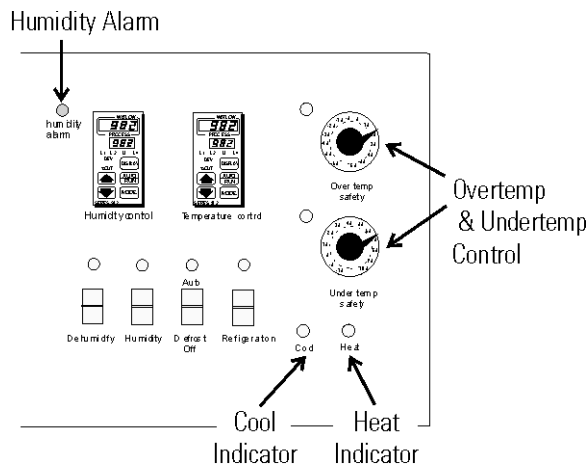


Figure 2-4. Indicators and Controls

Undertemp Safety Control, Indicator Light and Audible Alarm (Fig. 2-4)

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.

Audible Humidity Alarm and Indicator Display (Figure 2-4)

The humidity alarm is a function of the humidity controller (Figure 2-5). When the cabinet humidity goes outside the set parameters of the controller, L4 indicator on the controller lights, the audible alarm sounds, and the humidity alarm indicator on the control panel lights.

Control Panel (continued)

Hold/Run Key

Pressing the Hold/Run key on the controller silences the audible alarm and extinguishes the humidity alarm indicator and the L4 indicator on the controller. A4HI/A4LO flashes on the lower display until the cabinet humidity returns to the system setpoint.

Note The humidity controller's high and low limits are factory-set at 100% and 0%. Therefore, the system will go into the alarm state when the humidity exceeds these percentages by one percent. When operating the incubator near these high or low humidity levels, frequent alarms may occur. This will require that the controller's high or low limit be reset to three or four percent over the high limit or three or four percent under the low limit. Refer to the Watlow User's guide provided. Refer also to the factory configuration records located at the end of Section 4 of this manual. ▲

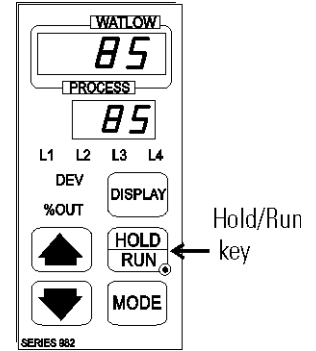


Figure 2-5. Hold/Run Key

Set the Operating Temperature

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

To raise or lower the setpoint, press the Up or Down Arrow. Temperatures are set in 0.1°C increments.

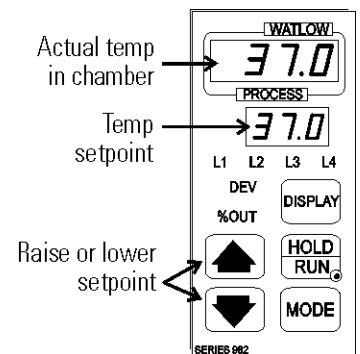


Figure 2-6. Changing Temp

Set the Operating Humidity

The Watlow humidity controller's upper numerical display shows the actual humidity inside the incubator. The lower display shows the humidity setpoint.

To raise the setpoint, press the Up or Down Arrows. Humidity is set in one percent increments.

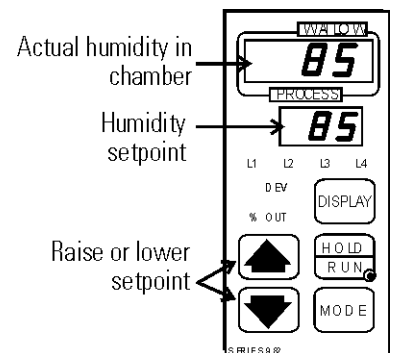


Figure 2-7. Changing Humidity

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.

Heatless Dryer (Optional)

The optional heatless dryer (P/N 1900139) 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 3 Routine Maintenance

Warning 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.

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

Caution 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.

Maintaining the Humidity Generator

Depending on the quality of water used in the humidification system, it may be necessary to clean the humidity generator every 2 to 3 months. Refer to Section 4 for cleaning instructions.

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. For more information on Preventive Maintenance or Extended Warranties, please contact us at the number below.

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

Tips for all incubators:

- Do NOT use bleach or any disinfectant that has high chloros.
- Use sterile, distilled or demineralized water.
- Avoid spraying cleaner on the CO₂ sensor.
- Do not use powdered gloves for tissue cultures.

Preventive Maintenance for Environmental Chambers

Refer to Manual Section	Action	Yearly	2 Years	5 Years	6 Years
--	Inspect door latch, hinges and door gasket seal	✓			
3	Check air exchange ventilator caps for adjustment; open or close as required	✓			
4	Perform a complete decontamination procedure. Wipe down interior, shelves, side panels with disinfectant. Rinse everything well with sterile distilled water.	Between Experiments			
					<i>More frequent decontamination may be required, depending on use and environmental conditions.</i>
5	Verify and document all calibrations, at the minimum.	✓			
5	* Inspect and clean the humidity generator, 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)	✓			
--	†Replace the filter elements on the dryer, if applicable.	✓			
--	†Rebuild the solenoid valves on the dryer, if applicable.		✓		
--	†Replace/repack the dessiccant towers on the dryer, if applicable.			✓	
--	†Replace the check valve and o-rings on the dryer, if applicable.				✓

* Qualified service personnel only

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

† Refer to Puregas Dryer manual included in shipping box.

Section 4 Service

Caution Service must be performed by qualified service personnel only! ▲

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

Access 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.

Over/Undertemp Probe and Thermostat

1. Remove the incubator top right side air dam 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 four screws located on the top and bottom of the control panel.

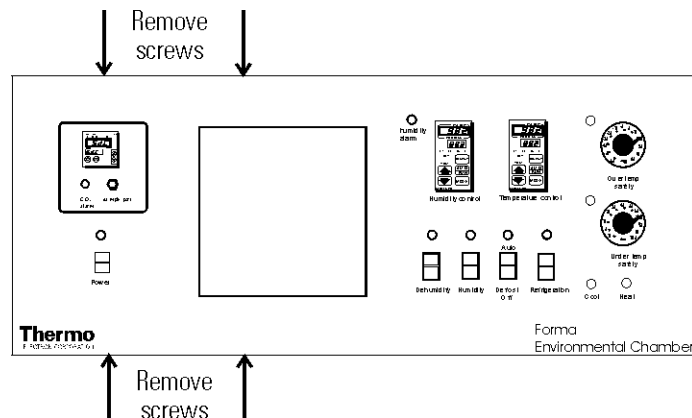


Figure 4-1. To Open Control Panel

Over/Undertemp Probe and Thermostat (cont.)

6. Pull the 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.
13. Re-assemble in reverse order.

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

Humidity/Temp Sensor

1. Follow instructions 1-6 from 'Over/Undertemp Probe and Thermostat' section to locate and remove the probe from the chamber.
2. Clip any plastic ties securing the probe wiring. Disconnect the probe.
3. Install the replacement probe in the chamber. When replacing the humidity sensor, be sure to mount the probe at the same angle as originally mounted.
4. Route the probe wire through the access hole into the control housing.
5. Connect the probe to the appropriate controller wiring.
6. Reseal the probe access hole with Permagum and tie-wrap the probe wire to existing wires.

Program Humidity/Temp Controllers

The Watlow temperature and humidity controllers have been set at the factory to operate the incubator within the specifications listed in the Specifications section 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.

Caution 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 re-configure the controllers without first consulting the Technical Services Department, (888) 213-1790. ▲

Remove Mechanical Lockout

1. Make sure the unit is turned off.
2. 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 4-2. When all tabs are unlocked, pull the controller module out of its frame.

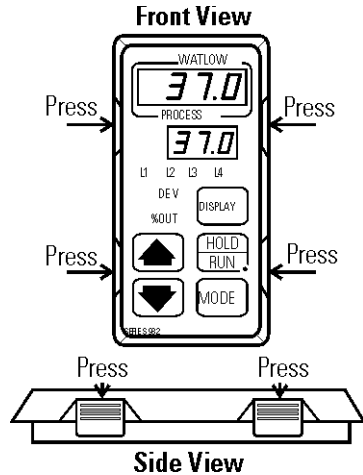


Figure 4-2. Locking Tabs

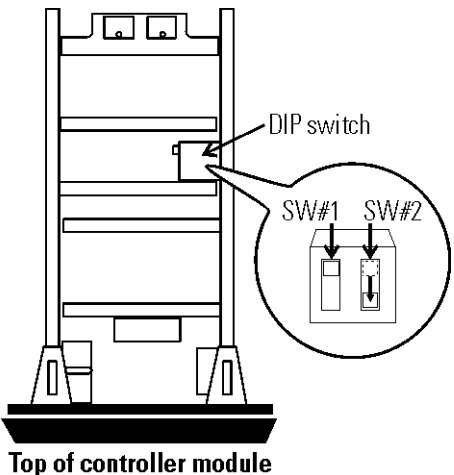


Figure 4-3. DIP Switch Location

3. Looking at the top of the module, locate the red DIP switch indicated in Figure 4-3. 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 module from right side.)
4. Very carefully, replace module into frame and press firmly on the top and bottom of the bezel until all four locking tabs “click” into place.

Remove Software Lockout

1. 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 4-4) If numbers in the bottom display begin to scroll up or down, the keys have not been pressed simultaneously. Try again.
2. Press the Up Arrow until “gLbL” (global) appears in the upper display. The word “set” will remain in the lower display (Figure 4-5).

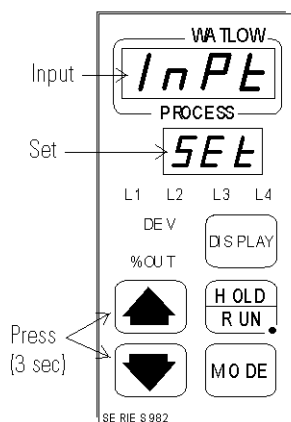


Figure 4-4. Input and Set Appear

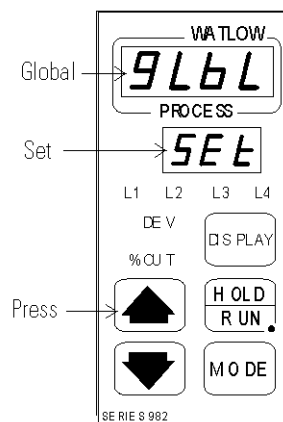


Figure 4-5. Global and Set Appear

3. Press the Mode key to scroll through the menus until the lower displays show “Loc” (Figure 4-6). Press the Down arrow key until the “2” becomes “0” (zero) as shown in Figure 4-7.

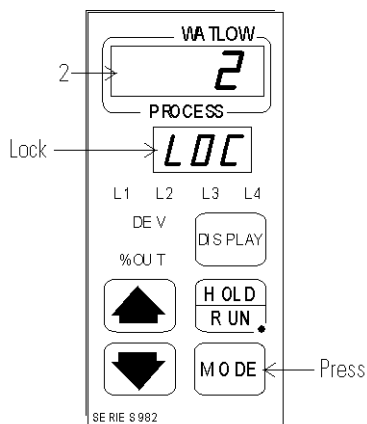


Figure 4-6. 2 and Lock Appear

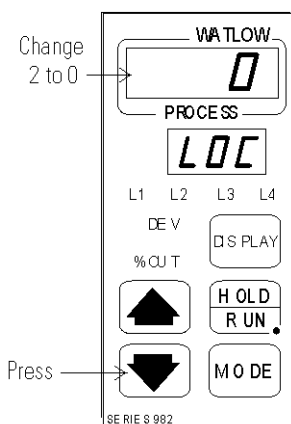


Figure 4-7. Change 2 to 0

Controller Configuration

The Watlow 982 Temperature and Humidity Controllers have been configured at the factory. Copies of the Watlow Configuration records are included at the end of this section.

Caution Do not re-configure the controller without first consulting the Technical Services department at (888) 213-1790. ▲

Offset Calibration (Temp/Humidity)

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 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 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 4-8. Pull the controller module out by gently rocking it from side to side.

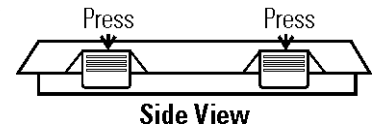


Figure 4-8. Retaining Tabs

6. Looking at the top and right side of the controller module, locate the red DIP switches indicated (Figure 4-9). Use your fingernail, or a small screwdriver, to turn Off SW2 by moving the white toggle towards the front of the module as in the illustration.

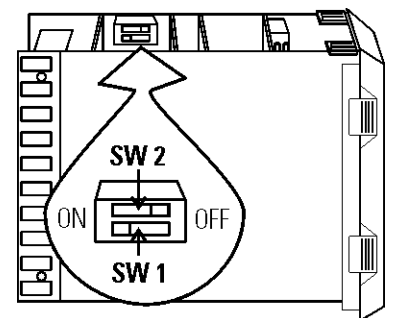


Figure 4-9. Red DIP Switches

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.

Offset Calibration (continued)

8. Turn on the main power switch.
9. Press Up and Down Arrow keys simultaneously for 3 seconds. The word “InPt” appears in upper display, and “Set” appears in lower display.
10. Press Down Arrow once, then continue to press the Mode key until “LOC” appears in lower display. Upper display shows 2. Press Down Arrow until 0 appears.
11. Press the Mode key once, then Up Arrow once. “InPt” appears in upper display, and “Set” in lower display. Press the Mode key until “CAL 1” appears in lower display. Press 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. The hardware and software lockout is Off.

To turn the hardware and software lockout back On:

1. Press the Up and Down Arrow keys simultaneously for 3 seconds. The word “InPt” appears in upper display, and “Set” in lower display.
2. Press the Down Arrow once, then continue to press the Mode key until “LOC” appears in lower display. Upper display shows 0. Press Up Arrow until 2 appears.
3. Press Display key once.
4. Turn off main power switch.
5. Wear a grounding wrist strap to avoid damaging any 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 SW2 by moving the white toggle towards the back of the module.
8. Return the controller to 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.

Replace 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 right side air dam.
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 four screws located on the top and bottom 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 four 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. ▲

Calibrate 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 to be calibrated. Hold down the #1 arrow for the red (#1) pen or the #2 arrow for the blue (#2) pen (Figure 4-10), until the light goes out. Adjust as necessary. ▲

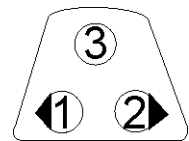


Figure 4-10. Arrows

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

Set Door Heater Control

Warning 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” indicates that all power to the door is shut off. If turned past 100, a similar “click” indicates that the heat is set at maximum.

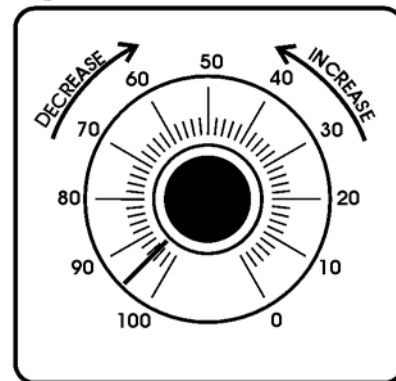


Figure 5-11. Door Heater Control

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.

Clean/Adjust Steam Generator

Depending upon the quality of water used in the humidification system, it may be necessary to clean the humidity steam generator (P/N 1900190) every 2 to 3 months.

Materials Required

- 6-foot stepladder
- Flat and Phillips screwdrivers
- 11/32 Nutdriver or wrench
- Laboratory disinfectant
- 9/16 Open end wrench
- 1/2 Open end wrench
- Sponge & cleaning materials

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

1. Remove all contents from the incubator, turn it off, and disconnect from power source.
2. Turn off the valve supplying the sterile distilled water.
3. From the stepladder, remove the eight screws securing the top of the incubator cabinet.

Clean/Adjust Steam Generator (continued)

- When the steam generator has cooled, remove the four thumbscrews and wingnuts (Figure 4-12).

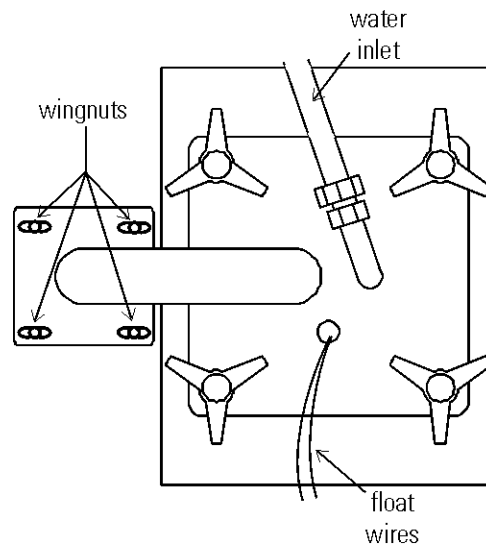


Figure 4-12. Access to Steam Generator

- Disconnect water inlet from steam generator.

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

- Lift the top off the steam generator and set it aside.
- Loosen the four nuts holding the front cover and remove it. Mark the top of heater location for future reference. Unsnap the two toggle clamps on the heater.
- Remove the can through the top of the steam generator, taking care not to spill water out of the can. Empty the water. Clean the can 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 steam tube using a test tube brush. Repeat cleaning with soap and water as necessary.
- Re-assembly in reverse order. Replace the cabinet top and return incubator to service.

CO₂ Controller Calibration

If it should become necessary to calibrate the CO₂ controller, perform the following procedure.

Start from the standard operating display (setpoint in bottom display, actual CO₂ 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.

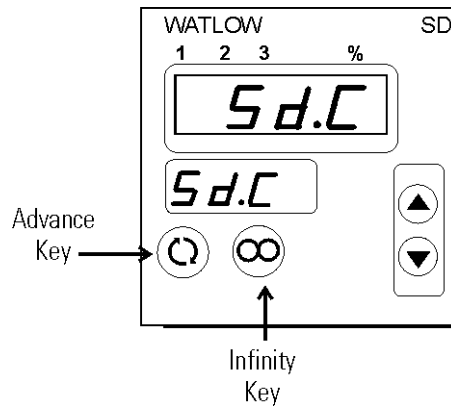


Figure 4-13. Key Locations

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		Input 1 Board	
SW1	<u>ON</u>	SW1	<u>OFF</u>
SW2	<u>ON</u>	SW2	<u>OFF</u>
		SW3	<u>ON</u>

Software Configuration:

Setup Menus

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

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

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

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

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

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

Operation Menus

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

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

PROG: See Programming Sheets if required.

***SET THESE PARAMETERS FIRST

****CONFIGURE CONTROL IN IDENTIFIED ORDER.

WATLOW 982 CONFIGURATION RECORD

CUSTOMER: 3940 (Release 9)
 JOB NUMBER: _____
 SERIAL NUMBER: _____
 CONTROL TYPE: HUMIDITY (0 - 100%)
 PREPARED BY: GLS DATE: 12/12/2006
 COMPLETED BY: _____ DATE: _____

Switch Configuration:

(1)*** Main Boards Input 1 Board

SW1	<u>ON</u>	SW1	<u>ON</u>
SW2	<u>ON</u>	SW2	<u>ON</u>
		SW3	<u>ON</u>

Software Configuration:

Setup Menus

(2)**** gLbL: C_F NA Anun ON PtyP ti PStr StPt
 Err nLA LoP -100 gSd 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 0-5*** CAL1 ** rL2 NA CAL2 NA
 dEC1 0 rtd1 NA rH2 NA Hunt NA
 rL1 0 Ftr1 2 LrnL NA
 rH1 100 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 ON
 PrC1 NA LAT2 NA SIL3 NA Aout Prc1
 HyS1 1 SIL2 NA Ot4 AL4n PrC3 4-20
 Ot2 CL Ot3 NA AL4 Pr1 ArL 0
 PrC2 NA AL3 NA HyS4 1 ArH 100
 HyS2 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 100*
 Ei2S NA A2LO NA A3LHi NA Aut OFF
 Ent3 NA A2Hi NA A4LO 0*

* These values are customer settable to there alarm points.

(7)**** PID: Pb1 8 dE1 NA lt2 NA dB 0
 rE1 0.05 Ct1 5.0 rA2 0.35
 lt1 NA Pb2 7 dE2 NA
 rA1 0.35 rE2 0.03 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 three seconds.

SEn	<u>MA</u>	SP.hi	<u>20.0</u>	Ot 2	<u>Pr.AL</u>	hYS 2	<u>0.3</u>	rP	<u>OFF</u>
P.dec	<u>0.0</u>	Ftr.E	<u>both</u>	Ot 3	<u>rMt</u>	L9c2	<u>ALO</u>	LOC	<u>0¹</u>
Sc.LO	<u>4.00</u>	FLtr	<u>2.0</u>	AO3.U	<u>MA</u>	LA2	<u>nLAt</u>		
Sc.hi	<u>20.00</u>	Ot 1	<u>hEAT</u>	O3.Lo	<u>4.00</u>	SIL 2	<u>On</u>		
PI.LE	<u>-1.00</u>	Ftb1	<u>20.0</u>	O3.Hi	<u>20.00</u>	dSP 2	<u>On</u>		
PI.HE	<u>21.00</u>	PL 1	<u>100.0</u>	r3.50	<u>Proc</u>	Unit	<u>US</u>		
r9.LO	<u>0.0</u>	PSL 1	<u>0.0</u>	r3.Hi	<u>20.0</u>	1.Err	<u>nLAt</u>		
r9.hi	<u>20.0</u>	PSH 1	<u>100.0</u>	r3.Lo	<u>0.0</u>	FAiL	<u>OFF</u>		
SP.LO	<u>0.0</u>	nLF 1	<u>OFF</u>	r3.Co	<u>0.0</u>	dSP	<u>nor</u>		

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

POht	<u>0²</u>	CAL	<u>0.0³</u>	rE.ht	<u>0.15</u>	A2Lo	<u>0.0⁴</u>
A-M	<u>Auto</u>	htM	<u>Pid</u>	rA.ht	<u>0.10</u>		
Aut	<u>OFF</u>	Pbht	<u>1.0</u>	A2hi	<u>20.0⁴</u>		

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 4

Service

HONEYWELL TRULINE CONFIGURATION RECORD

SHT 1 OF 4

CUSTOMER: _____
 JOB NUMBER: _____
 UNIT SERIAL #: _____
 CONTROL TYPE: _____
 PREPARED BY: _____ DATE: / /
 COMPLETED BY: _____ DATE: / /

GROUP PROMPT	FUNCTION PROMPT	VALUE OR SELECTION
TUNING1	PROP BD or GAIN	
	RATE MIN	
	RSET MIN or RESET RPM or MAN RSET	
	CYCSEC	
	PROP BD2 or GAIN2	
	RATE2MIN	
	RSET2MIN or RSET2RPM	
	CYC2SEC	
TUNING2	PROP BD or GAIN	
	RATE MIN	
	RSET MIN or RSET PRM or MAN RSET	
	CYCSEC	
	PROP BD2 or GAIN2	
	RATE2MIN	
	RSET2MIN or RSET2RPM	
	CYC2SEC	
SP RAMP1	SP RAMP	
	TIME MIN	
	FINAL SP	
	SP RATE	
	EU/HR UP	
	EU/HR DN	
	SP PROG	
SP RAMP2	SP RAMP	
	TIME MIN	
	FINAL SP	
	SP RATE	
	EU/HR UP	
	EU/HR DN	
	SP PROG	

GROUP PROMPT	FUNCTION PROMPT	VALUE OR SELECTION
CHART	CHRTSPD	7 DAY
	HOURL/REV	
	TIME DIV	21
	MINOR DIV	FOUR
	CONTINUE	NO
	CHART NAME	
	HEADER	YES
	REMSW	NONE
	WAKEMIN	
	WAKE HR	
	WAKE DAY	
	WAKE MON	
TIME	MINUTES	(CURRENT)
	HOURS	(CURRENT)
	DAY	(CURRENT)
	MONTH	(CURRENT)
	YEAR	(CURRENT)
	DAY	(CURRENT)
PEN1	PEN1	ENABLE
	PEN1IN	INPUT 1
	CHART1HI	80
	CHART1LO	-20
	PEN1ON	
	PEN1OFF	
	MAJORDIV	10
	MINORDIV	10
RNG1TAG	TEMP	
PEN2	PEN2	ENABLE
	PEN2IN	INPUT 2
	CHART2HI	100
	CHART2LO	0
	PEN2ON	
	PEN2OFF	
	MAJORDIV	10
MINORDIV	10	
RING2TAG	% RH	
PEN3	PEN3	DISABLE
	PEN3IN	
	CHART3HI	
	CHART3LO	
	PEN3ON	
	PEN3OFF	
	MAJORDIV	
	MINORDIV	
RING 3 TAG		

HONEYWELL TRULINE CONFIGURATION RECORD

SHT 2 OF 4

GROUP PROMPT	FUNCTION PROMPT	VALUE OR SELECTION
PEN4	PEN4	DISABLE
	PEN4IN	
	CHART4HI	
	CHART4LO	
	PEN4ON	
	PEN4OFF	
	MAJORDIV	
	MINORDIV	
	RNG4TAG	
INPUT1	DECIMAL	XXX.X
	UNITS	DEG C
	ENGUNITS	
	IN1TYPE	100 PT
	XMITTER	
	IN1HI	482.2
	IN1LO	-184.4
	CUTOFF	
	INPTCOMP	
	FILTER1	2
	BURNOUT	UP
	INPUT2	DECIMAL
UNITS		EU
ENGUNITS		RH
IN2TYPE		0-5 V
XMITTER		LINEAR
IN2HI		100
IN2LO		0
CUTOFF2		
INPTCOMP		
FILTER2		2
BURNOUT		UP
INPUT3		DECIMAL
	UNITS	
	ENGUNITS	
	IN3TYPE	
	XMITTER	
	IN3HI	
	IN3LO	
	CUTOFF3	
	INPTCOMP	
	FILTER3	
	BURNOUT	

GROUP PROMPT	FUNCTION PROMPT	VALUE OR SELECTION
INPUT4	DECIMAL	
	UNITS	
	ENGUNITS	
	IN4TYPE	
	XMITTER	
	IN4HI	
	IN4LO	
	CUTOFF4	
	INPTCOMP	
	FILTER4	
	BURNOUT	
TOTAL1	(Value)	
	RESETTOT	
	TOTAL1	
	TOTALEU	
	RATE	
	SCALER	
	RSETABLE	
TOTAL2	(Value)	
	RSETTOT	
	TOTAL2	
	TOTALEU	
	RATE	
	SCALER	
CONTROL1	PID SETS	
	SW VALUE	
	SP SOURC	
	RATIO	
	BIAS	
	SP TRACK	
	POWER UP	
	SP HILIM	
	SP LOLIM	
	ACTION	
	OUT HILIM	
	OUT LOLIM	
	DROPOFF	
	DEADBAND	
	OUT HYST	
	FAILSAFE	
	REM SW	
	MAN KEY	
	PBorGAIN	
MINorRPM		
CONT1ALG		
OUT1ALG		
4-20 RNG		
SHEDMODE		
SHED SP		

Section 4
Service

HONEYWELL TRULINE CONFIGURATION RECORD

SHT 3 OF 4

GROUP PROMPT	FUNCTION PROMPT	VALUE OR SELECTION	
CONTROL2	PID SETS		
	SW VALUE		
	SP SOURC		
	RATIO		
	BIAS		
	SP TRACK		
	POWER UP		
	SP HILIM		
	SP LOLIM		
	ACTION		
	OUT HILIM		
	OUT LOLIM		
	DROPOFF		
	DEADBAND		
	OUT HYST		
	FAILSAFE		
	REM SW		
	MAN KEY		
	PBorGAIN		
	MINorRPM		
	CONT1ALG		
	OUT1ALG		
	4-20 RNG		
	SHEDMODE		
	SHED SP		
	OPTIONS	INPUT 1	ENABLE
		INPUT2	ENABLE
INPUT3		DISABLE	
INPUT4		DISABLE	
CONTROL1		DISABLE	
CONTROL2		DISABLE	
REJFREQ		60 HZ	
HF REJ		ENABLE	
AUX OUT		DISABLE	
4mA VAL			
20mA VAL			
RELHUMID		NO	
ATMPRES			
DEVIATION		NONE	
DEVSETPT			
SCROLL		NONE	
INP ALG			
COEFF			
PV HIGH			
PV LOW			
RATIO A			
BIAS A			
RATIO B			
BIAS B			
RATIO C			
BIAS C			
GRANDTOT			
ComSTATE		DISABLE	
ComADDR			
SHEDTIME			
UNITS			

GROUP PROMPT	FUNCTION PROMPT	VALUE OR SELECTION	
ALARMS	A1S1 VAL		
	A1S2 VAL		
	A1S1 TYPE	NONE	
	A1S2 TYPE	NONE	
	A1S1 HL		
	A1S1 EV		
	A1S2 HL		
	A1S2 EV		
	AL1 HYST	0.1	
	A2S1 VAL		
	A2S2 VAL		
	A2S1 TYPE	NONE	
	A2S2 TYPE	NONE	
	A2S1 HL		
	A2S1 EV		
	A2S2 HL		
	A2S2 EV		
	AL2 HYST		
	A3S1 VAL		
	A3S2 VAL		
	A3S1 TYPE		
	A3S2 TYPE		
	A3S1 HL		
	A3S1 EV		
	A3S2 HL		
	A3S2 EV		
	AL3 HYST		
	A4S1 VAL		
	A4S2 VAL		
	A4S1 TYPE		
	A4S2 TYPE		
	A4S1 HL		
	A4S1 EV		
	A4S2 HL		
	A4S2 EV		
	AL4 HYST		
	A5S1 VAL		
	A5S2 VAL		
	A5S1 TYPE		
	A5S2 TYPE		
	A5S1 HL		
	A5S1 EV		
	A5S2 HL		
	A5S2 EV		
	AL5 HYST		
	A6S1 VAL		
	A6S2 VAL		
	A6S1 TYPE		
	A6S2 TYPE		
	A6S1 HL		
	A6S1 EV		
	A6S2 HL		
	A6S2 EV		
	AL6 HYST		

Section 5 Specifications

Temperature

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*

Shelves

Standard	.3911/3913 - 3, 3940/3949 - 6
Maximum	.3911/3913 - 11, 3940/3949 - 19
Dimensions	. . . 30.62"W x 25.81"F-B, (77.78 cm x 65.56 cm)
ConstructionSolid stainless steel reinforced
Surface Area5.4 sq. ft. (.51 sq. m) per shelf
Max. Per Chamber104.3 sq. ft. (9.69 sq. m)
ClearanceAdjustable on 3" (7.62 cm) centers
Loading	. . .35 lbs. (16 kg) (slide in and out), 50 lbs. (23 kg) (stationary)

Construction

Volume3940, 3949 - 29 cu. ft. (821 liters) 3911, 3913 - 11 cu. ft. (312 liters)
Interior304 2B stainless steel
ExteriorCold rolled steel
Insulation2" (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

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

Section 5
Specifications

Weight

Net - 3911/3913300 lbs. (136 kg)
Net - 3940/3949800 lbs. (363 kg)

Shipping

Motor - 3911/3913375 lbs. (170 kg)
Motor - 3940/3949850 lbs. (386 kg)

Temperature Alarm

SensorThermostat
ControllerThermostat
SetpointAnalog reference dial
AlarmAudible/visual

Humidity

Control±5% RH
RangeAbove ambient to 95%
SensorThin film polymer
ControllerElectronic, direct set in % RH
SetpointDigital
DisplayDigital LED
Readability1%
Setability1%
Steam Generator . . Initial fill approx. 1 quart (.95 liters)

Fittings

Fill Port1/8" FPT
Drain Port3/8" (1.9 cm) FPT

Unit Heat Load

6000 BTUH (1750W)

Refrigeration

Compressor1/4 Horsepower, air-cooled
RefrigerantsNon-CFC

Electrical

3911, 3940208-220V, 1 PH, 60Hz, 3P, 4W,
15.0 FLA

3913, 3949 . .220-240V, 1 PH, 50/60Hz, 2P, 3W,
15.0 FLA

Line Cord

Model 3911/394010' NEMA 14-20P

Model 3913/3949 . . none (lockable disconnect provided)

Dimensions

Model 3911/3913

Exterior38.00"W x 51.5"H x 32.00"F-B
(96.52 cm x 130.80 cm x 81.28 cm)

Interior31.00"W x 24.00"H x 27.00"F-B
(78.74 cm x 60.90 cm x 68.58 cm)

Model 3940/3949

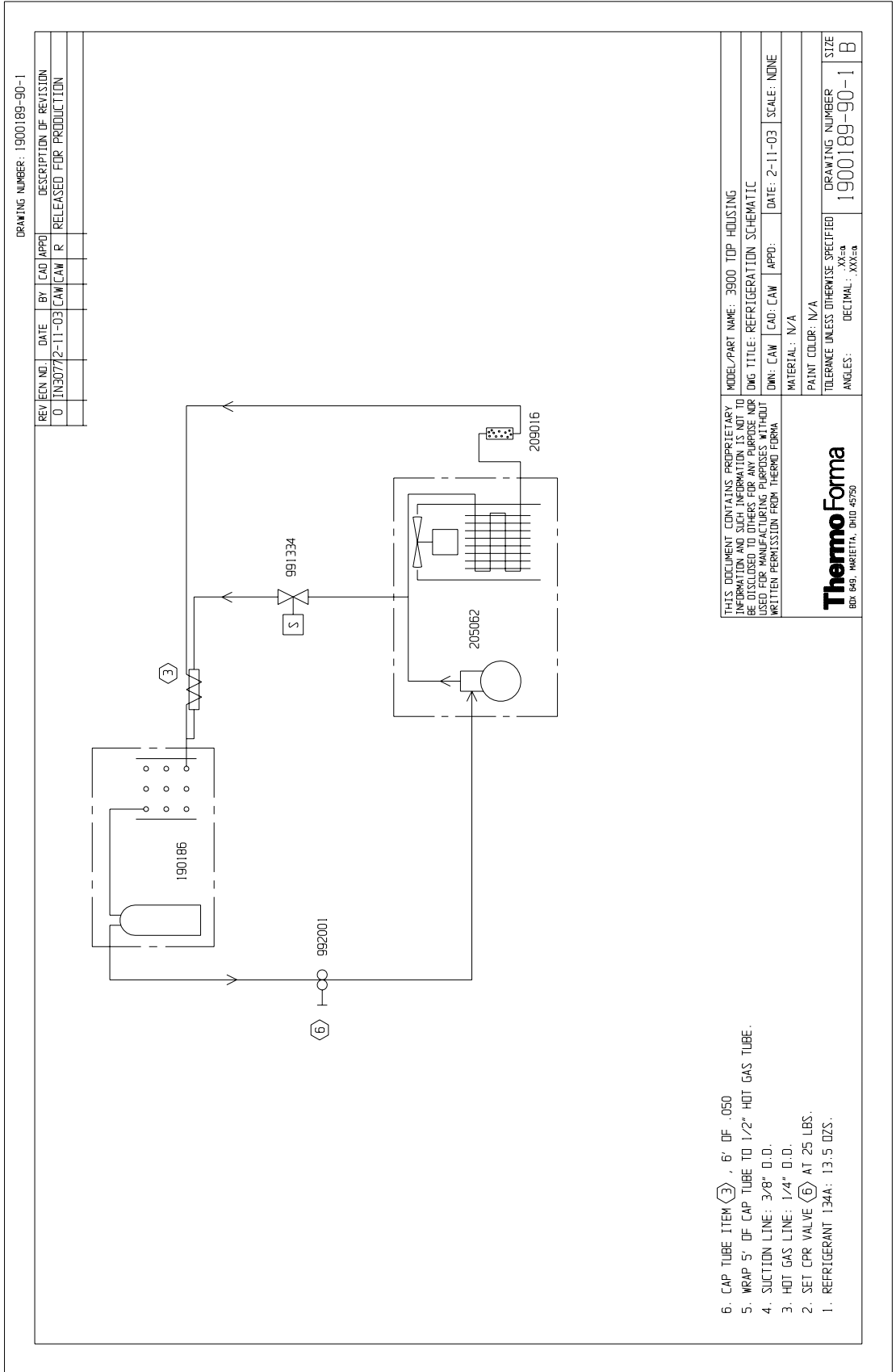
Exterior38.00"W x 88.5"H x 32.00"F-B
(96.52 cm x 224.79 cm x 81.28 cm)

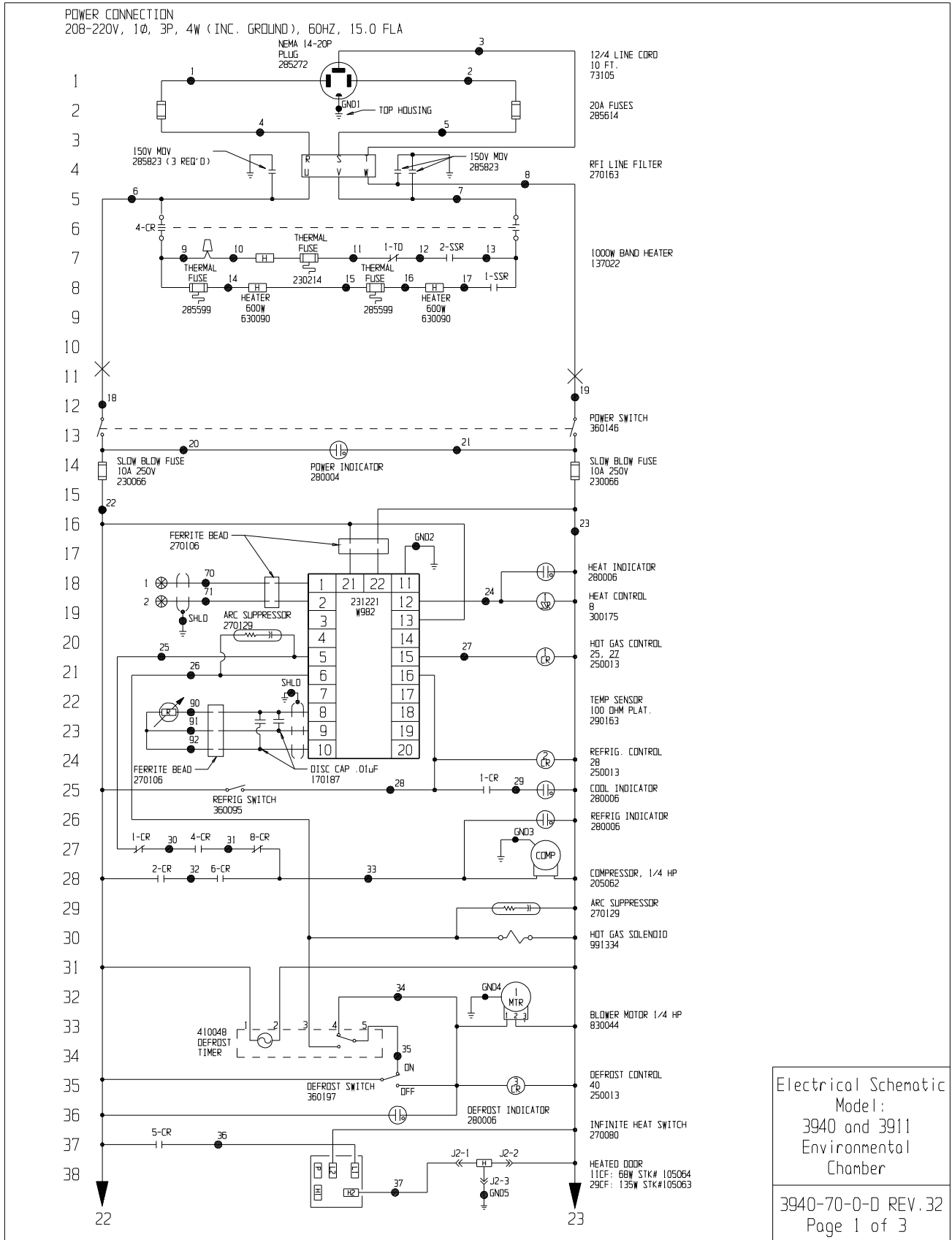
Interior31.00"W x 60.00"H x 27.00"F-B
(78.74 cm x 152.40 cm x 68.58 cm)

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

Section 6 Spare Parts

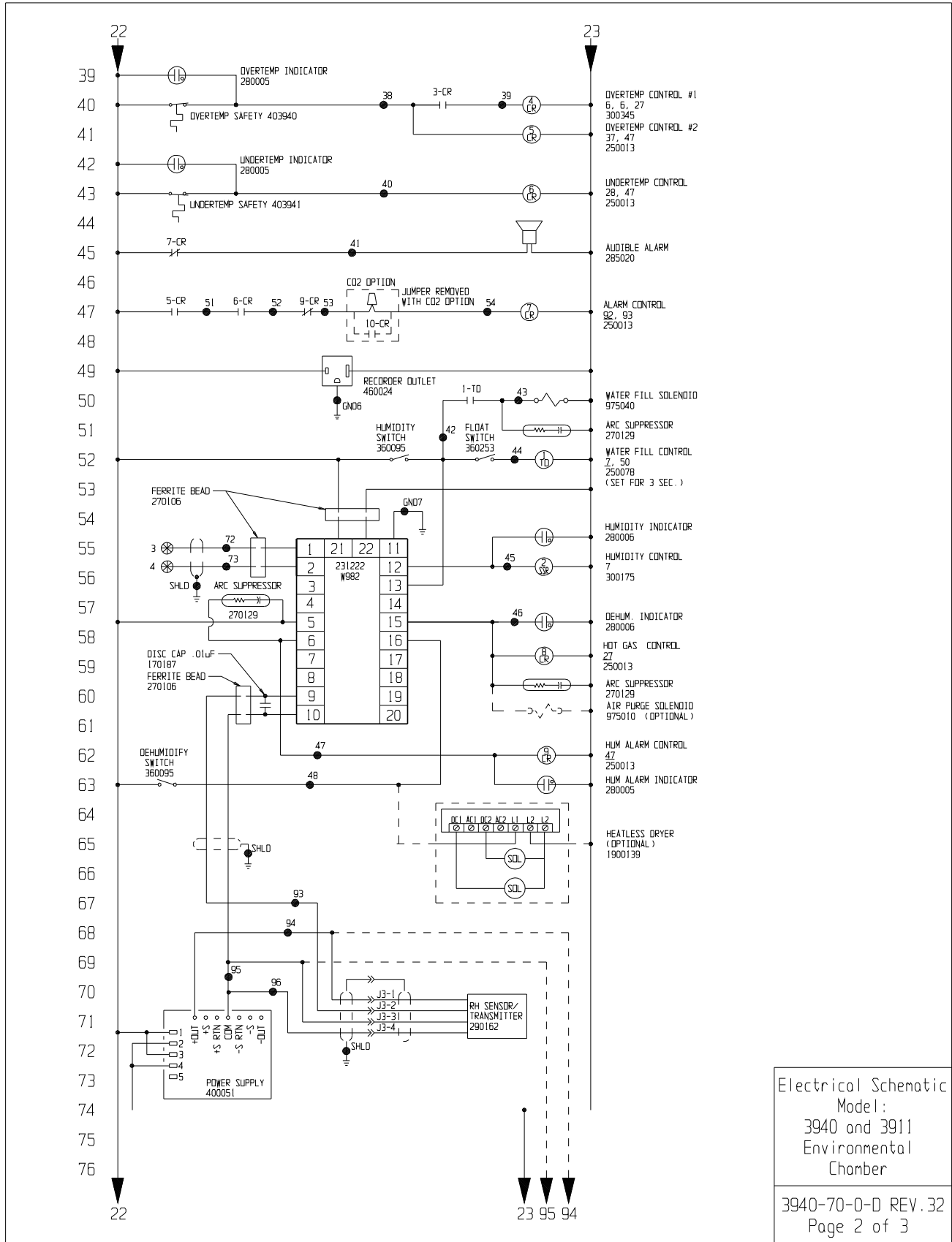
Part No.	Description	Qty
290163	RTD Temperature Sensor	1
230066	Fuse, Ceramic 10A 350V	2
400051	Power Supply	1
290162	RH Sensor	1
231221	Watlow 982 Temperature Controller	1
231222	Watlow 982 Humidity Controller	1
231224	Watlow SD Controller	1
270129	Arc Filter for Watlow 982 Controller	1
285614	20A Fuse	2
137022	Heater (steam)	1
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
991334	Solenoid, 120V .101" Port (Refrig.)	1
230214	Thermal Fuse, 250V 17A	1
830044	Blower Motor, 1/4 HP, 115V	1
110092	SS Humidity tank	1
300175	SS Relay	2





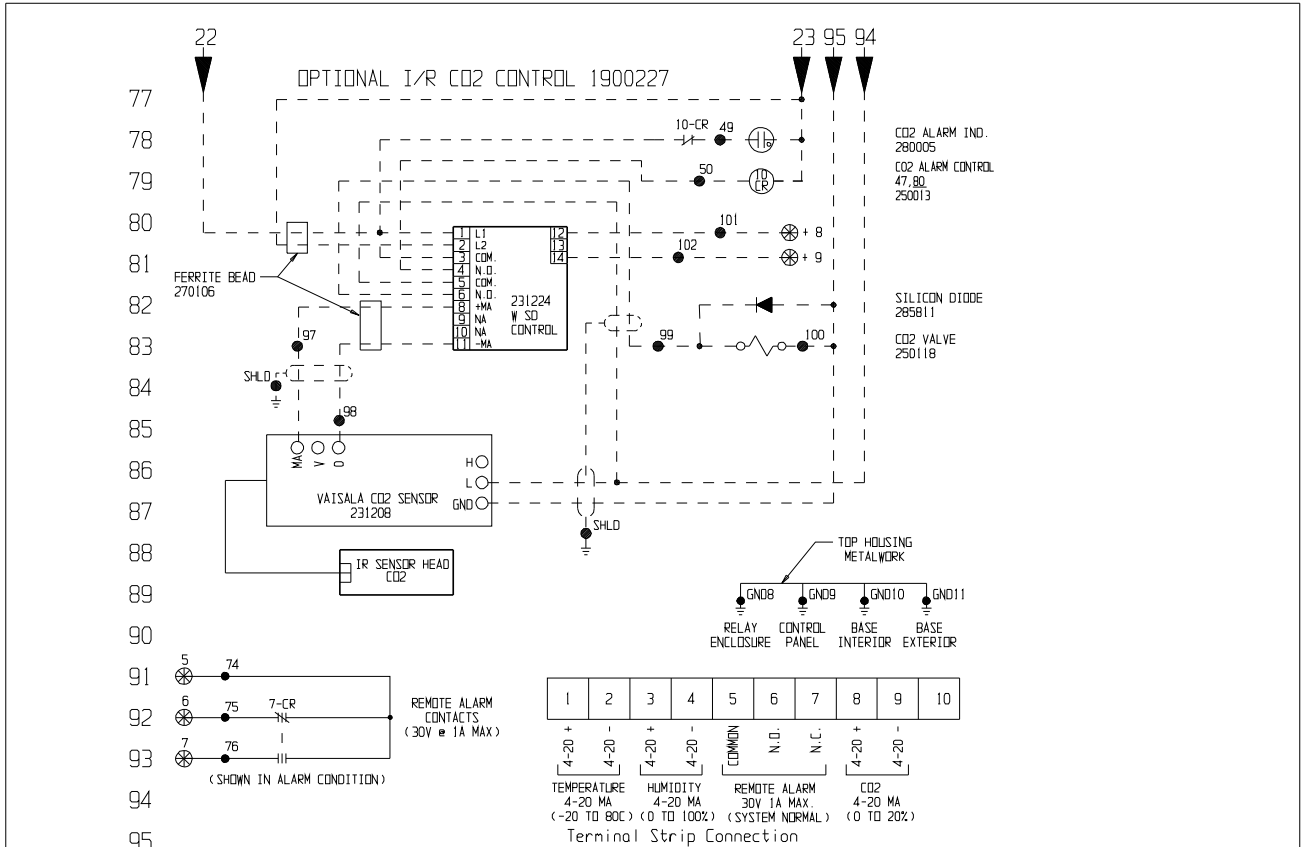
Electrical Schematic
Model:
3940 and 3911
Environmental
Chamber
3940-70-0-0 REV.32
Page 1 of 3

Section 8
Electrical Schematics



Electrical Schematic
Model:
3940 and 3911
Environmental
Chamber

3940-70-0-0 REV.32
Page 2 of 3



WIRE REFERENCE CHART

NO.	AWG	COLOR	NO.	AWG	COLOR	NO.	AWG	COLOR	NO.	AWG	COLOR
1	12	BLK	31	20	PUR	70	22	RED	---	---	---
2	12	RED	32	16	BRN	71	22	BLK	---	---	---
3	12	WHT	33	16	BLU	72	22	RED	90	22	BLK
4	12	BLK	34	16	YEL	73	22	BLK	91	22	RED
5	12	RED	35	16	BRN	74	22	RED	92	22	WHT
6	12	BLK	36	20	RED	75	22	BLK	93	22	RED
7	12	RED	37	20	BLK	76	22	WHT	94	22	GRN
8	12	WHT	38	20	RED	77	N/A	N/A	95	22	BLK
9	16	BLK	39	20	RED	78	N/A	N/A	96	22	WHT
10	16	DRG	40	20	BLU	79	N/A	N/A	97	22	RED
11	16	BLU	41	20	YEL	---	---	---	98	22	BLK
12	16	DRG	42	20	DRG	---	---	---	99	22	RED
13	16	RED	43	20	BLU	---	---	---	100	22	WHT
14	16	BLK	44	20	PUR	---	---	---	101	22	BLK
15	16	BLK	45	20	BLU	---	---	---	102	22	WHT
16	16	BLK	46	20	RED	---	---	---	---	---	---
17	16	PUR	47	20	YEL	---	---	---	GND1	12	GRN
18	14	BLK	48	20	BRN	---	---	---	GND2	16	GRN
19	14	WHT	49	20	YEL	---	---	---	GND3	16	GRN
20	14	BLK	50	20	RED	---	---	---	GND4	16	GRN
21	14	WHT	51	20	PUR	---	---	---	GND5	20	GRN
22	16	BLK	52	20	PUR	---	---	---	GND6	16	GRN
23	16	WHT	53	20	PUR	---	---	---	GND7	16	GRN
24	20	RED	54	20	PUR	---	---	---	GND8	14	GRN
25	20	PUR	---	---	---	---	---	---	GND9	BRAID	N/A
26	20	DRG	---	---	---	---	---	---	GND10	16	GRN
27	20	YEL	---	---	---	---	---	---	GND11	16	GRN
28	20	BLU	---	---	---	---	---	---	---	---	---
29	20	BLU	---	---	---	---	---	---	---	---	---
30	20	DRG	---	---	---	---	---	---	---	---	---

REV	ECN NO.	DATE	BY	APPD	DESCRIPTION OF REVISION
32	IN-3830	12/29/07	GLS	GLS	REVIEW ALARM RELAYS
31	IN-3229	12/21/04	GLS	GLS	REMOVE 270129 FROM TERM 15 1/16 OF TEMP & RH
30	IN-3227	12/14/04	GLS	GLS	REVISED STEAM GENERATOR WIRING
29	IN-3208	07-20-04	GLS	GLS	ADD CO2 4-20MA RETRANSMIT & 270129 TO CONTROLS
28	IN-3077	01-26-04	GLS	psk	CHG. TEMP & HUMIDITY CONTROLLERS AND THERMAL RISE

Electrical Schematic
Model:
3940 and 3911
Environmental Chamber

ATTENTION
OBSERVE PRECAUTIONS
ELECTROSTATIC
SENSITIVE DEVICES

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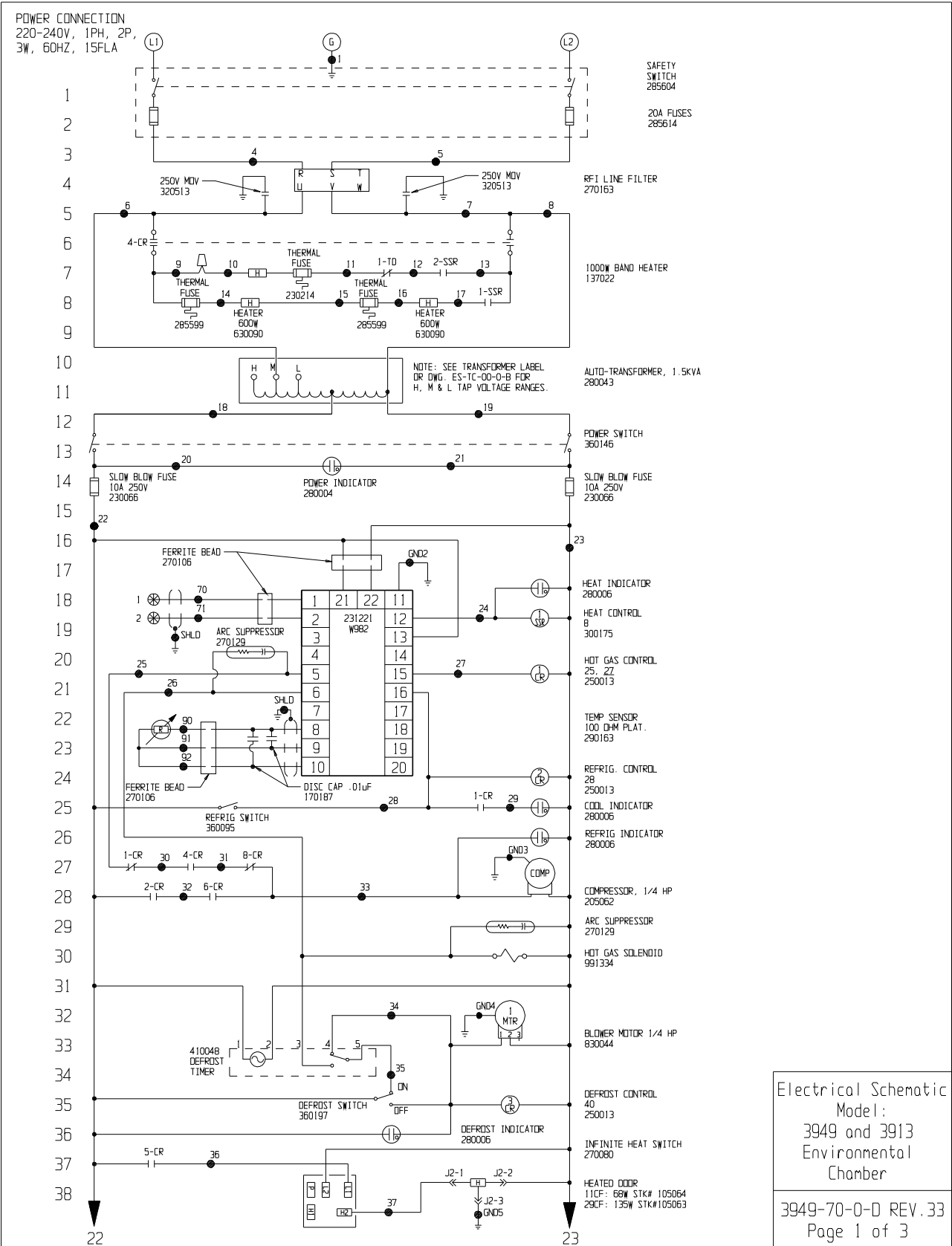
ThermoFisher SCIENTIFIC
BOX 649, MARIETTA, OHIO 45750

MODEL/PART NAME: 3911, 3940 REACH-IN INCUBATOR
DWG TITLE: ELECTRICAL SCHEMATIC
DWN: ED CAD: JD APPD: LON DATE: 05/18/92 SCALE: NONE
MATERIAL:
PAINT COLOR:
TOLERANCE UNLESS OTHERWISE SPECIFIED: .XX±
ANGLES: DECIMAL: .XXX±

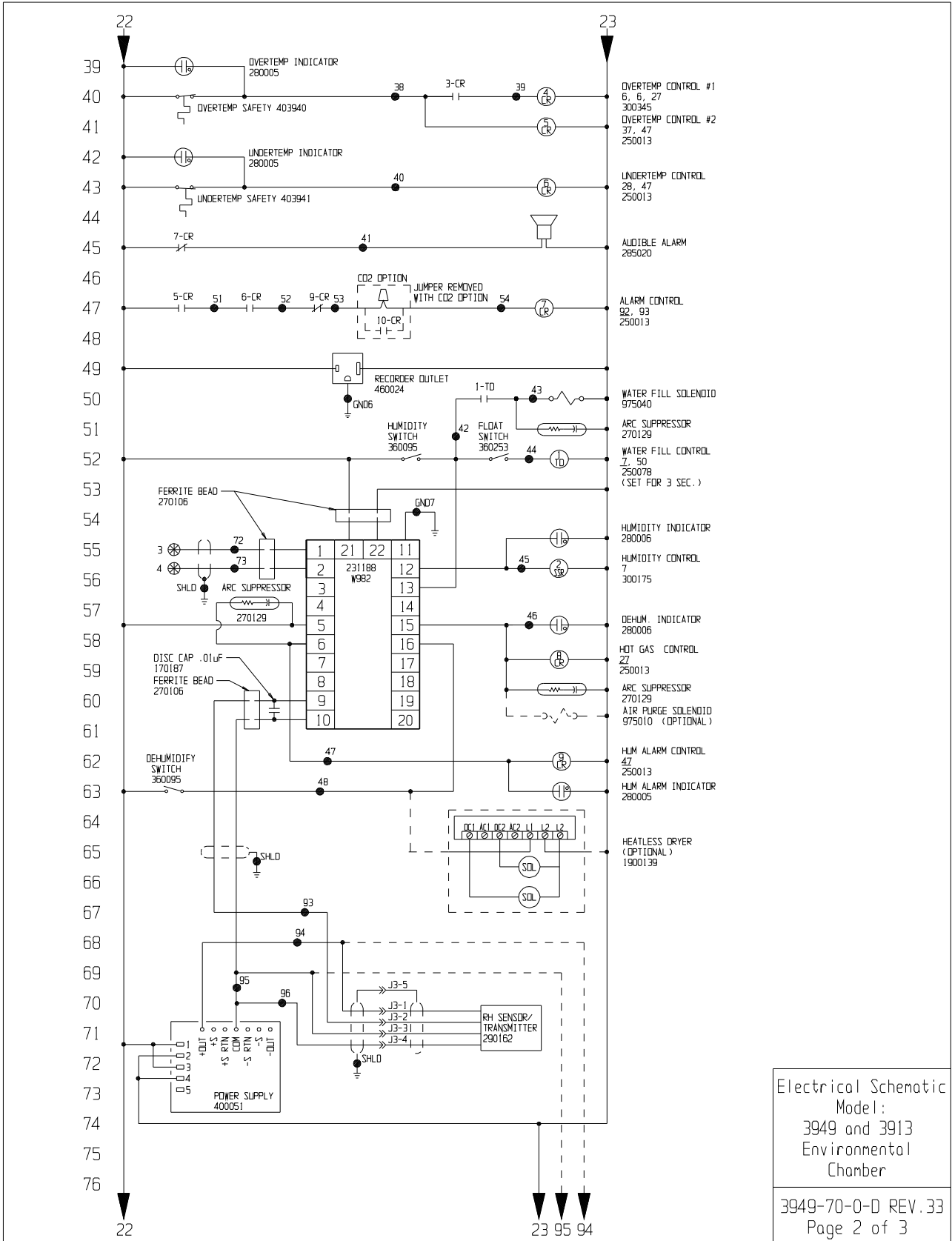
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3940-70-0
SIZE
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3940-70-0-D REV.32
Page 3 of 3

Section 9
Electrical Schematics

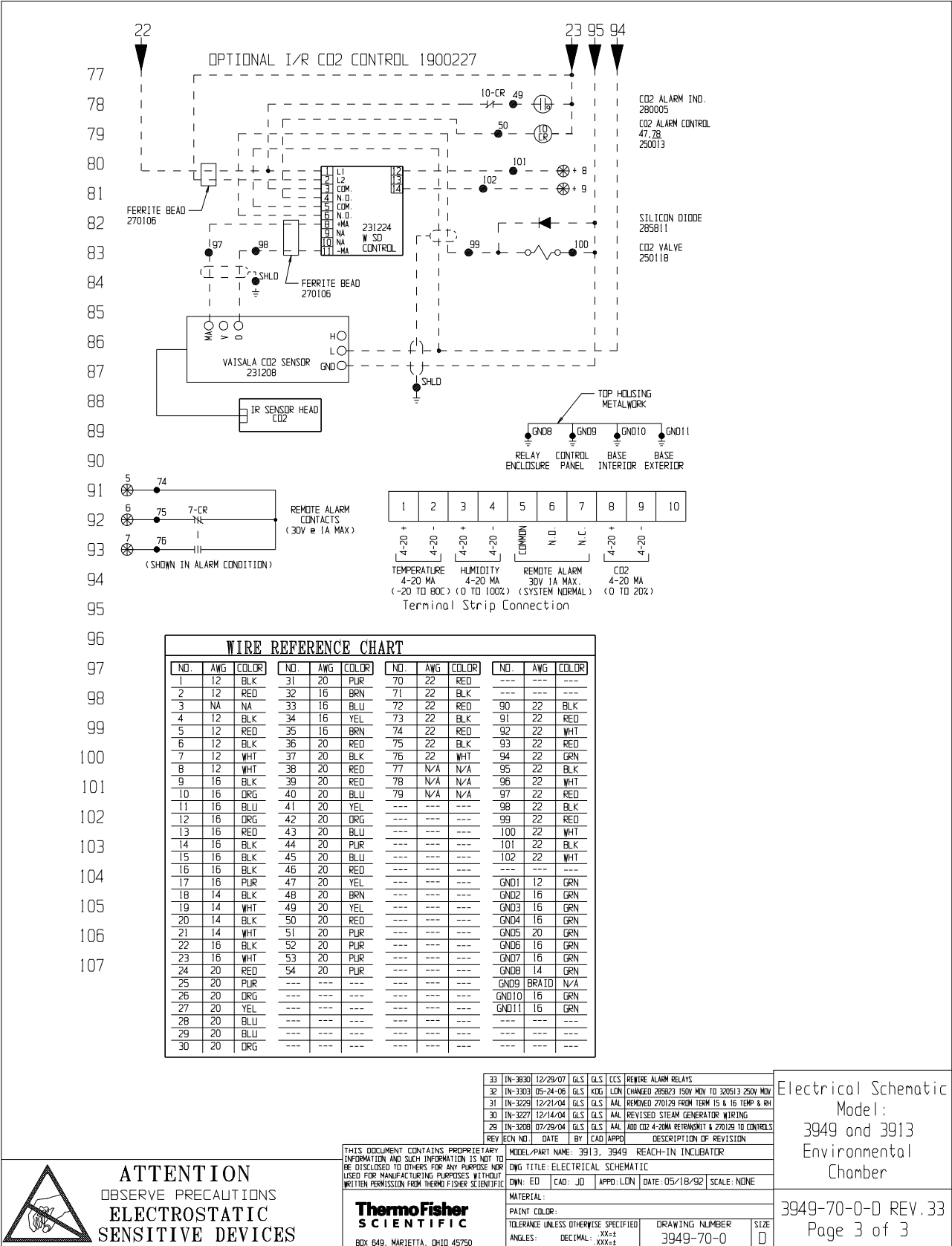


Electrical Schematic
Model:
3949 and 3913
Environmental
Chamber
3949-70-0-D REV.33
Page 1 of 3



Electrical Schematic
Model:
3949 and 3913
Environmental
Chamber

Section 9
Electrical Schematics



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

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.

If equipment service is required, please call your Technical Services Department at 1-888-213-1790 (USA or 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

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.

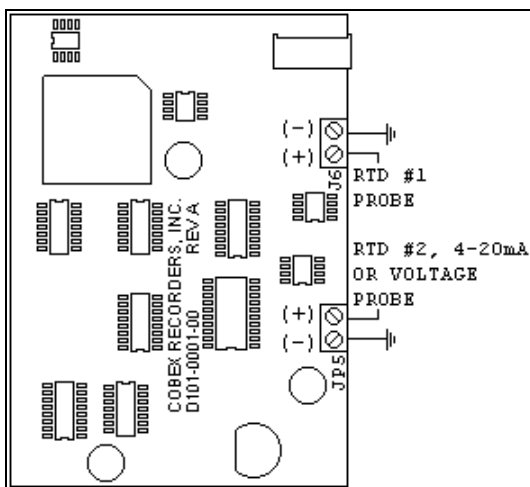


Figure 1A: Microprocessor PC Board (Type "A").

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.

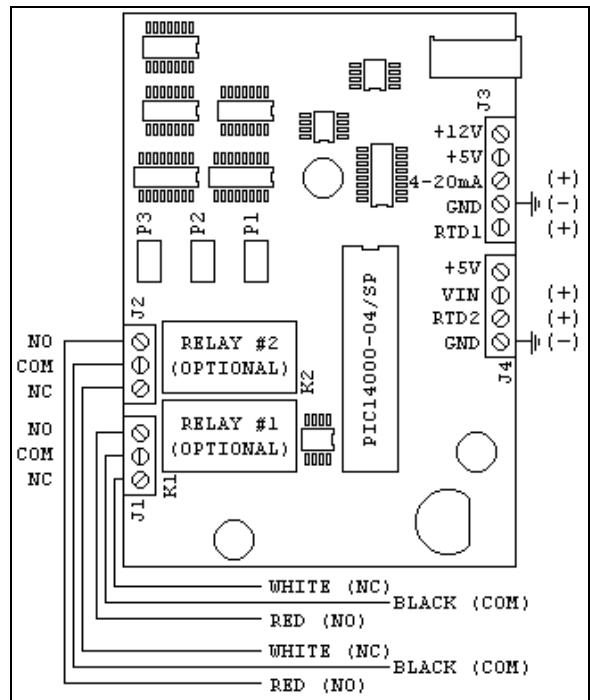


Figure 1B: Micro-Controller PC Board (Type B).

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.

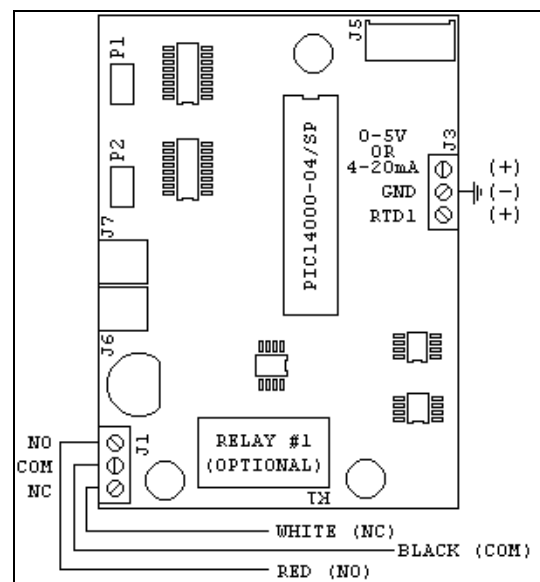


Figure 1C: Micro-Controller PC Board (Type C).

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.

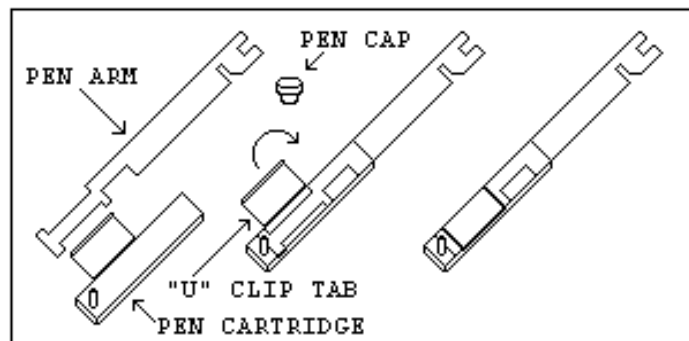


Figure 2: Pen Arm Assembly.

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).

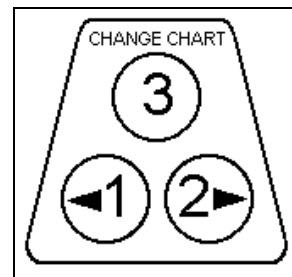


Figure 3: Push buttons.

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.

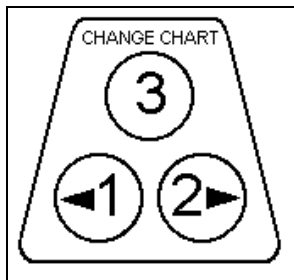


Figure 4: Push buttons.

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 may be 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

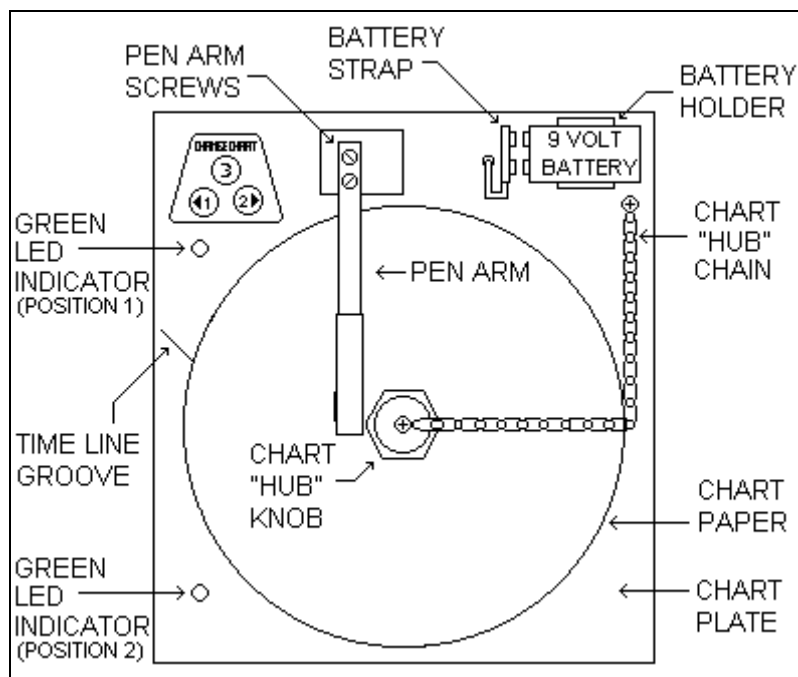


Figure 5: Recorder Assembly (Front View).

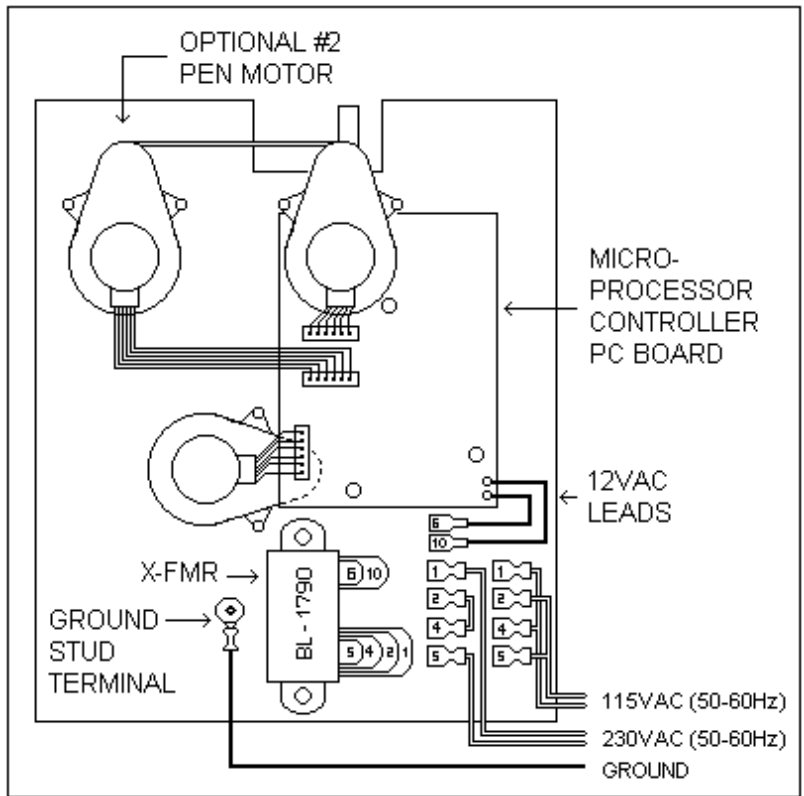


Figure 6A: Recorder Assembly "Type A" (Rear View).

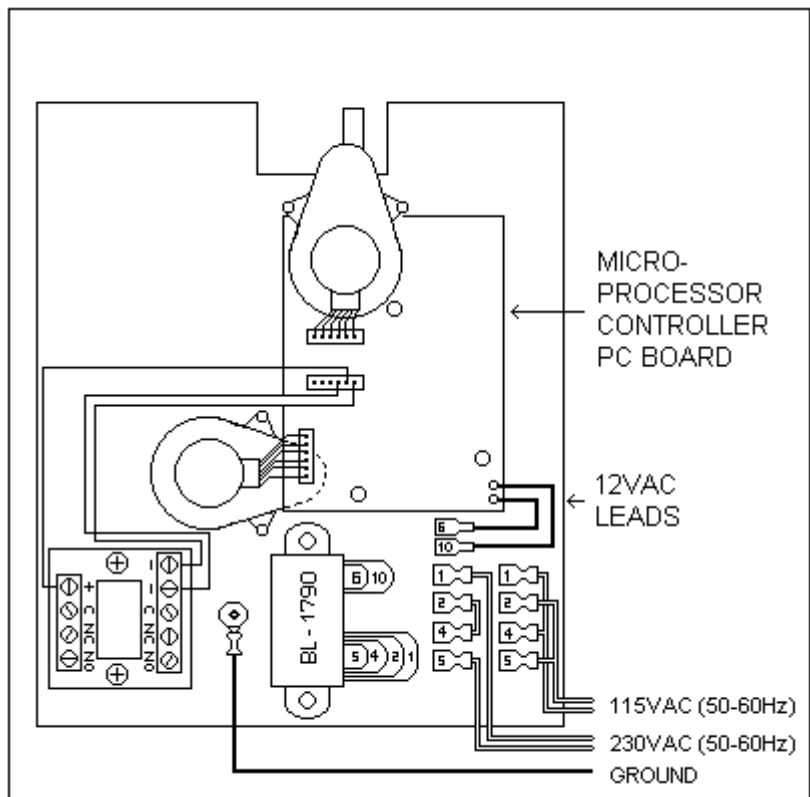


Figure 6B: Recorder Assembly "Type A" with Electric Contact Option (Rear View).

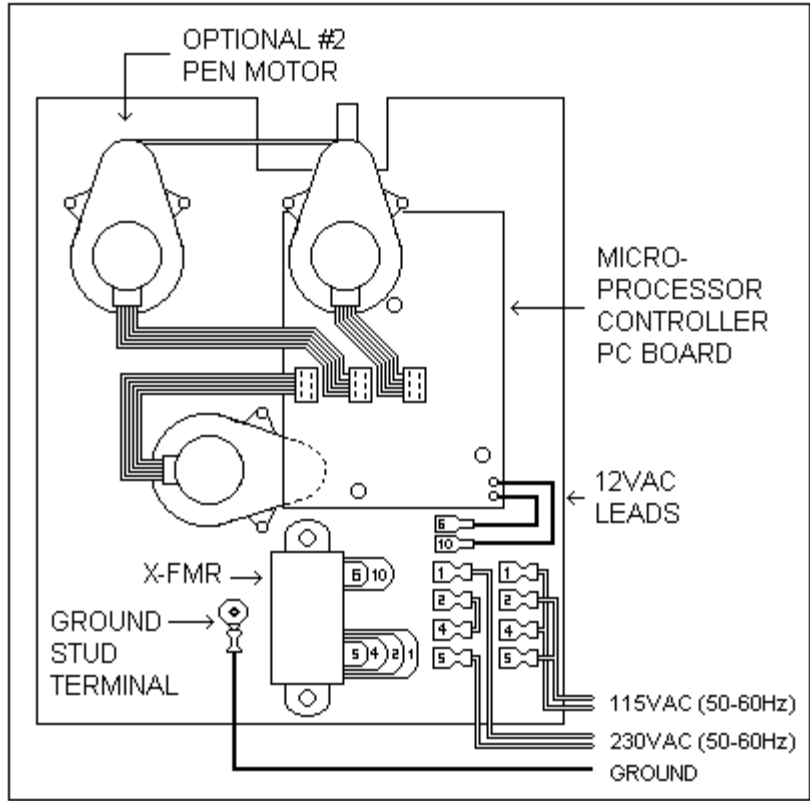


Figure 6C: Recorder Assembly Type "B" (Rear View).

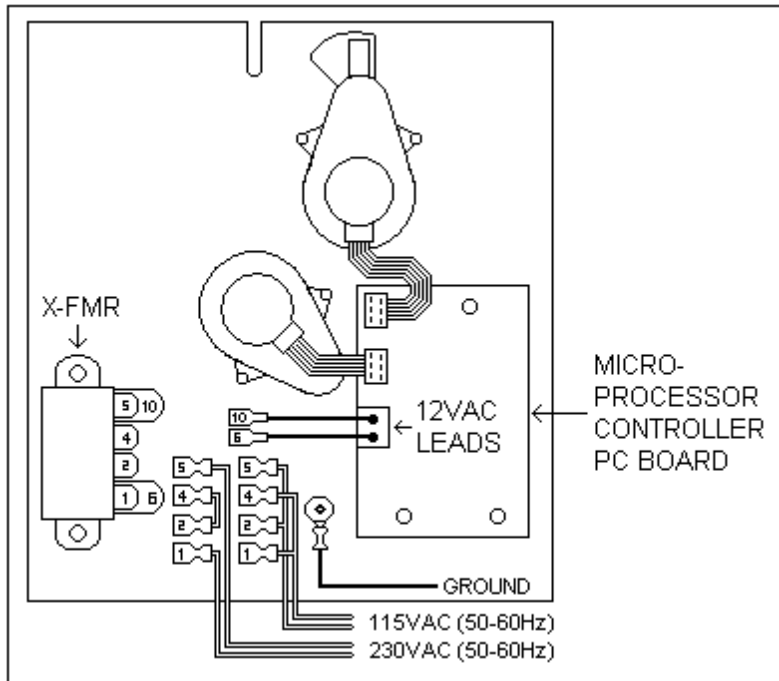


Figure 6D: Recorder Assembly Type "C" (Rear View).

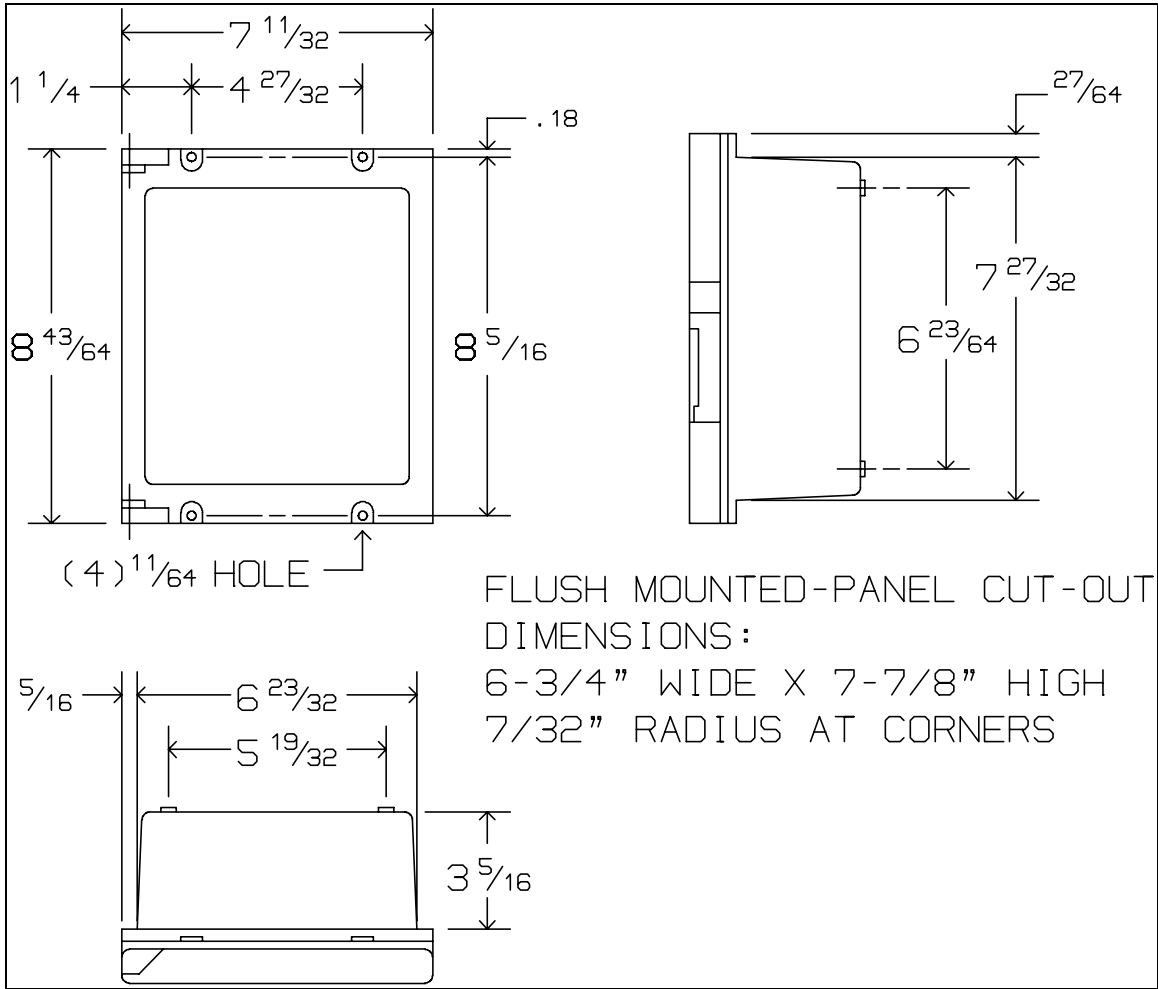


Figure 7: 6" Recorder Case Dimensions.

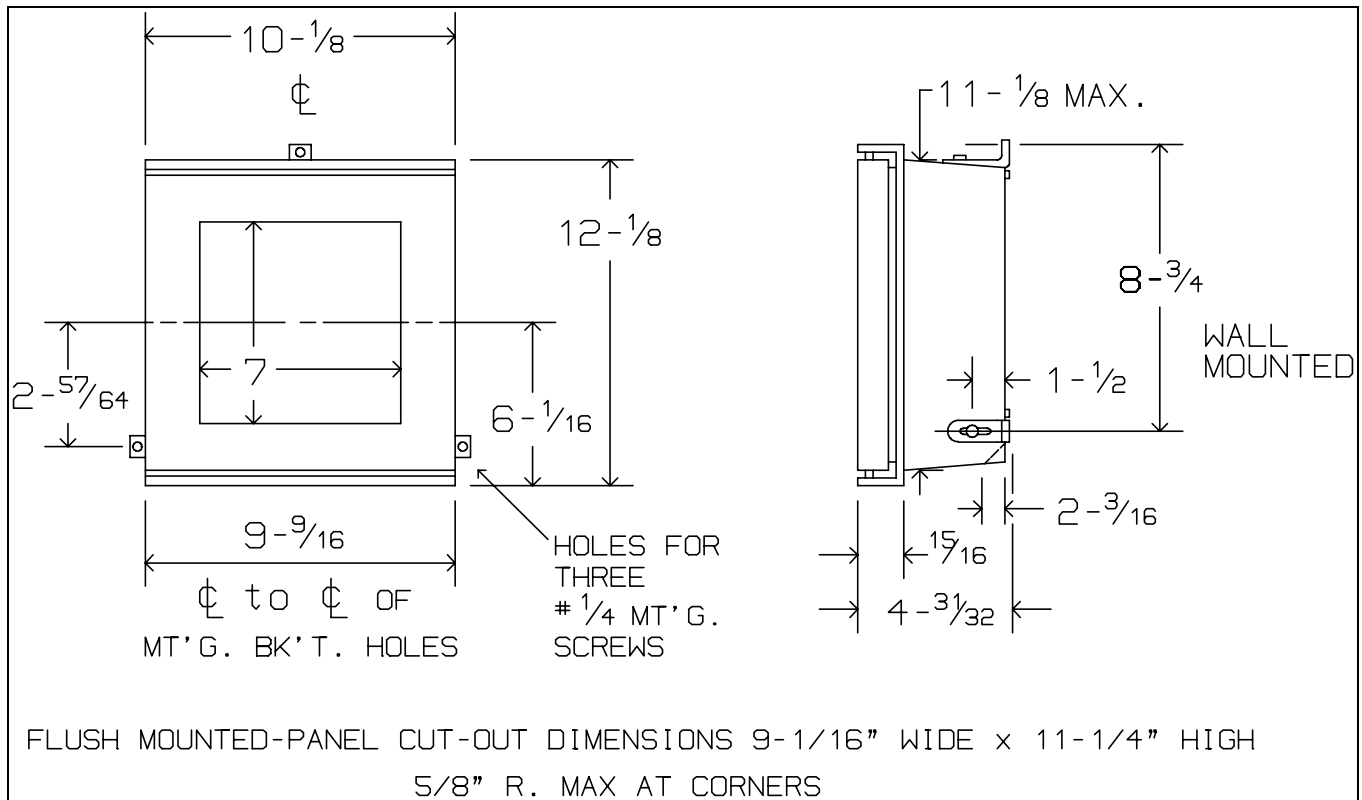


Figure 8: 8" Recorder Case Dimensions.

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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