

Precision™

Instruction Manual TS-31532-AM-9

Solid State Digital Control

“S” Series Ovens and Incubators
Models 18L, 28L, 4L, 6LM





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Precision™ Instruction Manual

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Solid State Digital Control "S" Series Ovens and Incubators

Introduction

Your satisfaction and safety are important to GCA/PRECISION SCIENTIFIC, and a complete understanding of this unit is necessary to attain these objectives.

As the ultimate user of this apparatus, it is your responsibility to understand its proper function and operational characteristics. This instruction manual should be thoroughly read and all operators given adequate training before attempting to place this unit in service. Awareness of the stated cautions and warnings, and compliance with recommended operating parameters--together with maintenance requirements--are important for safe and satisfactory operation. The unit should be used for its intended application; alterations or modifications will void the Warranty.

<p>WARNING: Always wear safety glasses when working with this apparatus.</p>

This product is not intended, nor can it be used, as a sterile or patient connected device. In addition, this apparatus is not designed for use in Class I, II, or III locations as defined by the National Electrical Code.

Unpacking and damage

Save all packing material if instrument is received damaged. This merchandise was carefully packed and thoroughly inspected before leaving our factory. Responsibility for its safe delivery was assumed by the carrier upon acceptance of the shipment; therefore, claims for loss or damage sustained in transit must be made upon the carrier by the recipient as follows:

Visible Loss or Damage: Note any external evidence of loss or damage on the freight bill, or express receipt, and have it signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier's refusing to honor your damage claim. The form required to file such a claim will be supplied by the carrier.

Concealed Loss or Damage: Concealed loss or damage means loss or damage which does not become apparent until the merchandise has been unpacked and inspected. Should either occur, make a written request for inspection by the carrier's agent within 15 days of the delivery date; then file a claim with the carrier since the damage is the carrier's responsibility.

By following these instructions carefully, we guarantee our full support of your claim to be compensated for loss from concealed damage.

DO NOT -- FOR ANY REASON -- RETURN THE INSTRUMENT WITHOUT FIRST OBTAINING AUTHORIZATION . In any correspondence to GCA/PRECISION SCIENTIFIC, please supply the nameplate data, including catalog number and serial number.



General information

These instructions are applicable to the following catalog numbers:

CAT. NO.	DESCRIPTION	ELECTRICAL CHARACTERISTICS			
		Volts	Hertz	Amps	Watts
31551	MDL: 18L Mech. Conv. Oven	120	50/60	12.1	1460
31552	MDL: 18L Mech. Conv. Oven	220	50/60	6.1	1340
31553	MDL: 28L Mech. Conv. Oven	120	50/60	14.4	1735
31554	MDL: 28L Mech. Conv. Oven	220	50/60	7.2	1590
31532	MDL: 4L Gravity Conv. Incubator	120	50/60	1.2	150
31533	MDL: 4L Gravity Conv. Incubator	220	50/60	.7	150
31534	MDL: 6LM Mech. Conv. Incubator	120	50/60	5.0	600
31535	MDL: 6LM Mech. Conv. Incubator	220	50/60	2.7	600

Incubator:

The digital thumbwheel located on the front panel of the control module affords quite simple temperature settings to 70°C. It is adjustable in 0.1C increments. Manipulating the levers of the thumbwheels will place the desired temperature within the windows. An even (half-time on, half-time off), pulsating lamp, located above the thumbwheels, will indicate when the set temperature in the chamber is stabilized.

NOTE: The thumbwheel temperature select indicator can be turned to as high as 89.9C; however, the rated controllable operating range of the incubator is 5°C above ambient to 70°C.

The power supply for the LED temperature digital display is energized with 120V AC, which, in turn, supplies 9V DC to the temperature readout PC boards.

Ovens:

The digital thumbwheel located on the front panel of the control module affords quite simple temperature settings to 225°. It is adjustable in 1°C increments. Manipulating the levers of the thumbwheels will place the desired temperature within the windows. A pulsating green lamp, located above the thumbwheels, will indicate when the set temperature in the chamber is stabilized.

NOTE: The thumbwheel temperature select indicator can be turned to as high as 299°C; however, the rated controllable operating range of the oven is 70°C to 225°C.

The power supply for the LED temperature digital display is energized with 120V AC, which, in turn, supplies 9V DC to the temperature readout PC boards.

GENERAL INFORMATION (Contd.)

Recorder Binding Posts:

The binding posts are provided to accept a recorder so that the operator can maintain a permanent record of the chamber temperature. The posts are located at the right side of the control panel and supply an output of 20 mv/°C for the incubators (5° above ambient to 70°C) and ovens (70°C to 225°C). The selected recorder should have a range of 0 to 2 volts for incubators and 0 to 5 volts for the ovens (0 volts corresponds to 0°C.), 1 megohm impedance.

NOTE: For better resolution, a recorder of 0 to 1 volt may be used when operating in the 5°C above ambient range for the incubators.

Installation

CAUTION: Installation should be attempted only by a qualified service person.

Location: To assure proper ventilation, allow a minimum of 4 inches of clearance between the rear, top, and sides of the incubator and adjacent walls. If two or more incubators are positioned side by side, allow a minimum of 8 inches between cabinets. Adjust the front leveling feet of the incubator so that the front is higher than the rear. This will assist in door closing (see Fig. A). Choose a site free from rapidly changing ambient temperature conditions or one which will experience high rises in ambient temperature during the summer months.

NOTE: Radiators, air-conditioning outlets, other ventilating system outlets, and drafts can affect the operation of the incubator by a sudden inrush of air that is at a temperature different than operating conditions.

TECHNICAL DATA SPECIFICATIONS

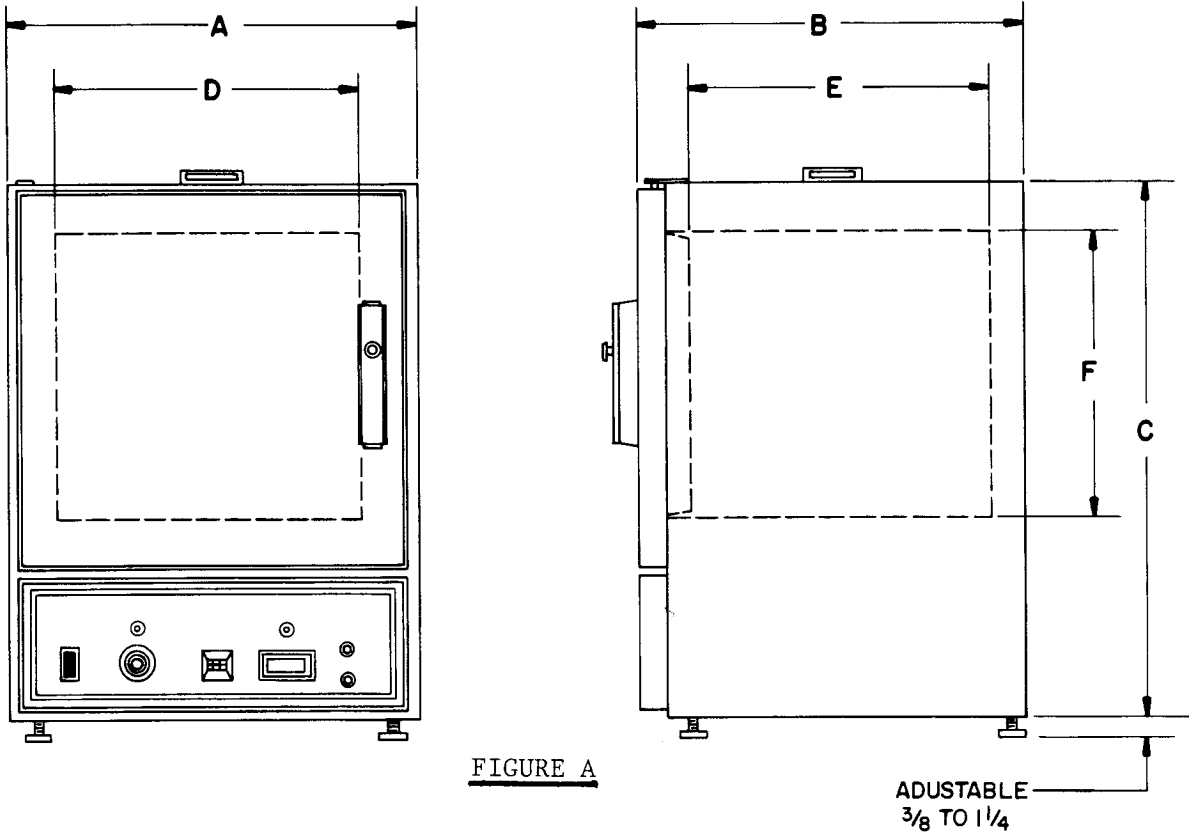


FIGURE A

TABLE I												
	MODEL NO.	CAT. NO.	ELECTRICAL CHARACTERISTICS			DIMENSIONS						
			VOLTS	HERTZ	WATTS	OVERALL			CHAMBER			
						A	B	C	D	E	F	
OVENS	MECHANICAL CONVECTION	18L	31551	120	50/60	1460	24"	18"	32"	18"	14"	19"
			31552	220		1340						
	28L	31553	120	50/60	1735	30"	24"	32"	23"	19"	19"	
		31554	220		1590							
INCUBATORS	GRAV. CONV.	4L	31532	120	50/60	150	22"	21"	39"	17"	18"	27"
			31533	220								
	MECH. CONV.	6LM	31534	120	50/60	600	42"	21"	39"	36"	18"	27"
			31535	220								

Electrical Connections: Important (Please Read Carefully)

WARNING: For personal safety, this apparatus must be properly grounded.

INSTALLATION (Contd.)Electrical Connections (Contd.)

The power cord of this instrument is equipped with a three-prong (grounding plug which mates with a standard three-prong (grounding) wall receptacle to minimize the possibility of electric shock hazard from this apparatus. The customer should have the wall receptacle and circuit checked by a qualified electrician to make sure the receptacle is properly grounded.

Where a two-prong wall receptacle is encountered, it is the personal responsibility and obligation of the user to have it replaced with a properly grounded three-prong wall receptacle.*

WARNING: DO NOT - under any circumstances - cut or remove the third (ground) prong from the power cord. DO NOT use a two-prong adapter plug.

Determine the total amount of current presently being used by other apparatus connected to the circuit that will be used for this unit.

It is critical that the added current demand and other equipment on the circuit not exceed the rating of the fuse or circuit breaker in use.

CAUTION: Be sure that the power supply is of the same voltage as specified on the nameplate.

* Model 28L does not include cord. Because of National Electrical Code regulations, the Model 28L is not supplied with a line cord and plug, but a conduit box is provided. The National Electrical Code states that 80% of the branch circuit load cannot exceed 12 amps. Service wire size to the conduit box should be No. 14 or lower as required by National Electric Code.



Operation

Fully open the exhaust vent shutter cap on top of the cabinet and keep it open at all times. However, when operating at maximum rated temperature, it may be necessary to turn the shutter cap towards the closed position. This will eliminate chamber heat loss.

A certified *thermometer may be inserted in the shutter cap as a secondary means to determine temperature within the chamber.

Turn the line switch "ON" and move the "SET POINT °C" thumbwheel to the desired temperature and the "SAFETY SET" should be moved to its maximum setting (clockwise). Allow the chamber to heat up until steady readings are observed on the LED. The chamber temperature has stabilized when there is uniform cycling of the green control pilot light.

NOTE: A slight vapor discharge may occur on the initial heat up. This is the dissipation of the protective coatings that have been added to the cabinet. Allow for complete dissipation of the vapors before placing samples in the chamber.

A desired operating chamber temperature indicated on the LED can be maintained by setting the "SET POINT °C" at that particular temperature.

Before setting the safety thermostat, the chamber temperature must be allowed to stabilize. Depending on the temperature desired, stabilization will require from 15 to 60 minutes, maximum.

To adjust the "SAFETY SET" (which should be at its maximum setting now), turn the dial back (counterclockwise) until the red pilot light turns "ON". It indicates that the safety has taken over control and that the heater has been de-energized. Once this occurs, turn the dial forward (clockwise) at least one to two settings.

NOTE: This adjustment for the "SAFETY SET" should be done only when the chamber temperature is stabilized (green pilot light uniformly cycling).

Loading: Although the gravity and mechanical convection ovens and incubators rely on different methods of air circulation, general loading procedures are applicable to both types and must be followed. To insure that the circulation of heated air is not restricted in the chamber.

1. At least 1" should be left between objects placed on the shelves.

NOTE: With the mechanical convection cabinets, objects should not be placed on the shelves in such a manner as to block the movement of heated air into the chamber from the side diffuser panels.

* Thermometer not included.

OPERATION (Contd.)

2. The bottom of the chamber must be kept free and clear of objects.
3. At no time should solid shelves be substituted for the shelves that are provided.

After loading, the time required for the chamber to recover to the original stabilized temperature will be directly related to the mass of the load.

WARNING: SAFETY PRECAUTIONS

1. DO NOT place any explosive, combustible, or flammable materials in the chamber.
2. DO NOT place sealed containers in the chamber. Sealed containers, filled with materials, do not provide room for expansion and can develop dangerous vapor pressure as the temperature increases.
3. Avoid spillage of large volumes of liquids.
4. DO NOT evaporate noxious fumes.

CAUTION: DO NOT store containers filled with acidic or caustic solutions, as vapors from these materials will attack the chamber interior and electrical components, thus voiding the warranty.

Servicing

Troubleshooting:

WARNING: Service should be performed by qualified service personnel. Disconnect the unit from its electrical source and remove the shelves. Disconnecting any component from the circuit without prior removal of the power source may cause damage to other circuit components.

Temperature Variance or Fluctuation:

1. Make sure the vent shutter cap is not closed. Open to maximum.
2. Test the unit when empty; if results are satisfactory, the chamber was improperly loaded. Redistribute the load.
3. Be sure to allow ample time for an empty chamber to stabilize at a temperature setting. It could take over one hour to equilibrate, depending upon the difference between ambient and operating temperatures. The mass of the load can also affect stabilization time.

Troubleshooting: (Contd.)

4. Ascertain that severe line voltage fluctuations have not occurred.
5. Make certain that all wire terminal connections are secure.
6. Make certain that an intermittent failure of the switch, thermostat, or wiring has not occurred. Isolate the cause; repair or replace.
7. Check resistance of sensor.

CAUTION: To prevent P.C. board component damage, instrument must be unplugged from electrical source before disconnecting sensor from P.C. board.

Sensor Specifications:

- a. Resistance of sensor
 - 100.0 Ohms ± 0.2 Ohm @ 0°C
 - 138.50 Ohms ± 0.3 Ohm @ 100°C
- b. Operating temperature range: -20°C to +250°C
- c. Thermal time constant @ 2 ft./sec.: 2.5 sec. Max.
- d. Maximum operating current: 20 MA
- e. Resistance between leads and S.S. tubing:
100 Megohms or greater

Heat Loss: Inspect door gasket to make certain it fits firmly against cabinet at all points. Replace if damaged, or adjust the door catch plate (ovens only).

No Heat: If the chamber does not heat, first check the line voltage, the switch, and all electrical connections. Check the heater for continuity. Replace if damaged.

Improper Door Closure: (On ovens only) The plate on the door which engages the magnetic catch on the cabinet is adjustable. Either loosen or tighten it to ensure proper door closure.

Motor Lubrication: (On the mechanical ovens and incubator only) A ball bearing fan-cooled permanently lubricated motor is used. Lubrication should not be necessary for the life of the motor.

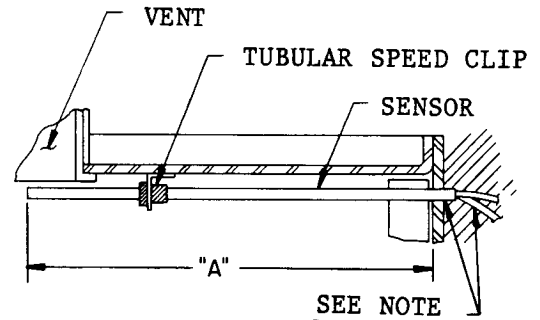
Sensor Assembly Replacement: (Fig. B)

CAUTION: To prevent P.C. board component damage, instrument must be unplugged from electrical source before disconnecting sensor from P.C. board.

1. Remove front panel. (This is done by removing four screws holding the panel in place.)
2. Disconnect the sensor plug (J-102) on the PC board.
3. Remove all screws on rear panel to locate the leads of the sensor.
4. Remove the probe. (The probe is located inside the unit at the top next to the vent opening.)
5. See pages 15 and 16 for recalibration procedures.

SENSOR ASSEMBLY

	MODEL	DISTANCE "A"
O V E N	18L	7 $\frac{1}{2}$ "
	28L	9 $\frac{1}{2}$ "
I N C U B	4L	9 $\frac{3}{4}$ "
	6LM	9 $\frac{3}{4}$ "


FIGURE B

NOTE: PACK INSULATION TIGHTLY AROUND LEADS TO PROBES TO PREVENT HEAT LOSS.

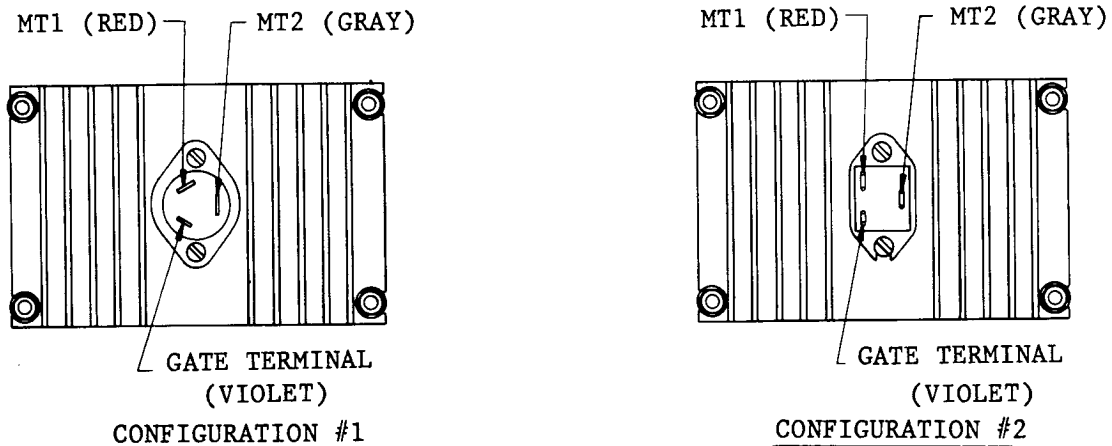
Triac Assembly:

If there is no heat when "SET POINT °C" thumbwheel is set or if there is constant heat even when the "SET POINT °C" thumbwheel is dialed below room temperature, there is a possibility that the triac has malfunctioned. When the triac is energized, it will read an output of 1 volt across MT1 and MT2. If the triac is de-energized, it reads 115 volts across MT1 and MT2 (Fig. C).

CAUTION: Triac heat sink in incubators is electrically hot.

NOTE: The triac in each unit may differ as shown in configuration #1 or #2.

Install triac assembly such that gate terminal (smallest tab) is in the lower left-hand corner and is connected to the violet wire. The MT1 connection should be hooked up to the red lead wire, and the MT2 connection should be hooked up to the grey lead wire (Fig. C).

TRIAC ASSEMBLY

FIGURE C

NOTE: INSTALL TRIAC SUCH THAT GATE TERMINAL IS IN THE LOWER LEFT HAND CORNER OF BASE.

Pilot Light Replacement:

Access to the backside of the control panel is gained by removing the two top and two bottom screws that hold it in place. When replacement of the pilot light is necessary, tag the lead wires with respect to their relative positions, detach them from the pilot light, and push the light outward from the back of the panel. Press the new light into this opening and attach the proper wires to it. Be sure the red light is on the left side. (Fig. E, F).

Switch Replacement:

The switch is held in place by means of spring clips. To replace, tag the lead wires with respect to their relative positions and detach them from the switch, compress the clips and push the switch outward from the back of the panel. Merely press in the new switch and attach the proper wires to it (Fig. E, F).

Thumbwheel Switch Replacement:

The thumbwheel switch can be replaced after the front panel is removed. It is held in place by four spring tabs and is connected to the P.C. board at J101. The incubator thumbwheel switch is a 2-prong plug, and the oven thumbwheel switch has a 13-prong plug.

Thumbwheel Switch Resistance (Incubators):

<u>Setting</u>	<u>Resistance</u>
0.1°C	13 ohms
1.0°C	130 ohms
10.0°C	1300 ohms
37.3°C	4849 ohms

Thumbwheel switch resistance for ovens is tested by checking the continuity of the 13 lead wires.



Troubleshooting (Contd.)

Heater Run On: If the heater is "running on" (green light not uniformly cycling and the temperature continuously increases after it has exceeded the set temperature):

The Safety thermostat will take over. When the red light appears, the heater turns off. The temperature will decrease and thermostat will turn the heater back on (green light "on"). The temperature will increase until the thermostat shuts off the heater again (red light "on", green light "off").

If this is the case, replace the temperature control on the unit.
If the green light is off, check:

1. Sensor assembly (it may not be hooked up).
2. Triac assembly.
3. PC Board.
4. Thumbwheel switch.

Safety Thermostat Replacement: (In all cases, disconnect electrical power to the unit). Remove the control panel. Loosen the set screw on the knob and remove the knob. Remove 2 set nuts located on the inside of the panel (see S2 on Fig. E & F). Next remove the two flathead screws holding the plate on (save plate for installation with new thermostat). Remove thermostat. Reverse the above procedure to install the new thermostat.

Mechanical Convection Ovens:

1. To gain access to the thermostat bulb, remove the bottom diffuser panel. Disconnect the heater assembly from the bus bars and lift it out of the chamber.
2. Remove the control panel. (The securing screws are located on the top and bottom edges.) Disconnect the electrical leads to the thermostat assembly.
3. Remove the control knob set screws and the screws holding the thermostat assembly to the control panel.
4. Twist the retaining clips and work the thermostat bulb out of the chamber.
5. Reverse the above procedure to install the new thermostat assembly.

CAUTION: Do not crimp or sharply bend the capillaries. Be sure there is no contact between the capillary and part of the heater coil.

Gravity Convection Incubator:

1. To gain access to the thermostat bulb, remove the bottom diffuser panel.
2. Remove the control panel. (The securing screws are located on the top and bottom edges.) Disconnect the electrical leads to the thermostat assembly.

Troubleshooting: (Contd.)

3. Remove the control knob set screws and the screws holding the thermostat assembly to the control panel.
4. Work the thermostat bulb out of the chamber.
5. Reverse the above procedure to install the new thermostat assembly.

CAUTION: Do not crimp or sharply bend the capillaries, and be sure there is no contact between the capillaries and any part of the heater coil.

Mechanical Convection Incubator:

1. To gain access to thermostat bulb, remove the bottom diffuser panel. Lift out the heater and blower wheel cover. Disconnect the electrical leads of the heater assemblies. Remove the heater retaining screws. Lift out the heater assemblies.
2. Remove the control panel. (The securing screws are located on the top and bottom edges.) Disconnect the electrical leads to the thermostat assembly.
3. Remove the control knob set screws and the screws holding the thermostat assembly to the control panel.
4. Work the thermostat bulbs out of the chamber.
5. Reverse the above procedure to install the new thermostat assembly.

CAUTION: Do not crimp or sharply bend the capillaries. Be sure there is no contact between the capillary and part of the heater coil.

Heater Replacement--Ovens: (Disconnect electrical power to unit.)

On the mechanical convection ovens, the thermostat bulb is beneath the bottom diffuser panel and will not have to be removed.

1. Remove the bottom diffuser panel by removing its retaining screws (2).
2. Remove the screws (4) holding the heater in place.

CAUTION: Do not crimp or sharply bend the thermostat capillary.

3. Disconnect the heater from the bus bars. (Do not allow the bus bars to slip down through the porcelain insulators or you will have to remove the control panel to push them back.) Lift the heater from the chamber. Install the new heater and reconnect the bus bars.
4. Replace heater and reassemble bottom diffuser panel.

Heater Replacement--Incubators: (Disconnect electrical power to unit.)

1. Remove the bottom diffuser panel in the chamber by removing its retaining screws.

Troubleshooting: (Contd.)

NOTE: On the Model 6LM Incubator, also lift out the heater and blower wheel cover to gain access to the heater assemblies.

2. Disconnect the electrical leads at the heater, remove assembly retainer screws, and then remove heater assembly. Install the new heater by following the reverse of the above steps.

Motor Replacement--Mechanical Convection Ovens and Model 6LM Incubator:
(Disconnect electrical power to unit.)

1. Remove the diffuser panel from the bottom of the chamber by removing its retainer screws.

NOTE: On the Model 6LM Incubator, also remove the heater and blower cover.

2. Loosen the set screw that holds the blower wheel on the motor shaft.

NOTE: With a piece of strong string, secure the blower wheel to the heater in several places so that it will not slide out of position. (This step is not necessary on the Model 6LM Incubator; merely remove the wheel from chamber.)

3. Lay the cabinet on its back. Be sure the line cord can hang free and is not pinched against the back of the cabinet and that the doors are closed.
4. Remove perforated panel on the bottom of the cabinet. Disconnect wire leads of the motor.
5. Remove the motor mounting screws and lift out the motor.
6. Install the new motor so that its shaft engages the blower wheel. Proceed in reassembling the unit by then performing the reverse of the above steps.
7. Make sure that the set screw that locks the blower wheel to the motor shaft is fastened securely.

NOTE: The blower wheel should not be in contact with any sheet metal chamber components adjacent to it.

CAUTION: Be sure that when the blower wheel is secured to the motor shaft, the wheel is centered vertically between the panels. This will assure its "free spin." If not centered, the wheel may touch the panels and not rotate freely.

Troubleshooting: (Contd.)

Removal of Temperature Control Board: (Fig. E, F)

1. Unplug unit.
2. Remove 4 screws from front panel.
3. Locate Temperature Control Board.
4. Be careful not to twist or turn board when removing. It should be lifted straight up and with caution.
5. To remove the whole PC Board, pinch the 4 plastic tabs in each corner and lift straight up.
6. When replacing these boards, extreme caution must be taken in order not to break electrical connections or plastic prongs.
7. See pages 15 and 16 for recalibration procedures.

Problem Digital Display Malfunctions.

Symptom: Digits do not register.



Remedy: Check 5 volt supply (J217); if okay, then check voltage at IC 211; if okay, then check voltage at IC 212.

Symptom: One segment of each LED is not lit.



Remedy: Check IC 211 for 5 volts, at each point A-G.

Symptom: If one segment on one LED is not lit.



Remedy: Then the LED itself is bad.

Troubleshooting: (Contd.)

Symptom: On incubators if no decimal point is lit, check for bridging on solder pad #1. This should be shorted together (Fig. D).

Remedy: Bridge should be resoldered.

Recalibration of "S" Series Ovens

1. Install accurate glass thermometer.*
2. Open air exhaust.
3. Replace RTD with decade resistor box.
4. Set High Limit Control fully clockwise.
5. Dial 000 on thumbwheel switch (Set Point °C).
6. Dial 100.00 ohms on resistor box.
7. Adjust ZERO on Temperature Control PCB until the meter connected to the RECORDER jacks reads 0.0 mv + 4 mv. Digital panel display should indicate 000; if not, adjust ZERO trimpot on digital readout PCB (Fig. D).
8. Adjust LOW HEAT trimpot for minimum heat output (Fig. F).
9. Dial 225°C.
10. Dial in 185.03 ohms on resistor box
11. Adjust HIGH HEAT trimpot until the heat output is more than 50%.
12. Check RECORDER jack output; it must be 4500 + 4 mv; if not, adjust SCALE trimpot.
13. Digital panel output should indicate 225; if not, adjust GAIN trimpot on digital readout PCB.
14. Reinstall RTD.
15. Operate oven at 225°C. After oven stabilizes, adjust HIGH HEAT trimpot, if necessary, to get exact 225°C.
16. Recorder jack output should be 450V. If not, adjust SCALE trimpot on Temperature Control PCB.

* Thermometer not included.

Troubleshooting: (Contd.)RECALIBRATION OF SERIES "S" OVENS

17. Temp. readout should indicate 225C. If not, adjust GAIN trimpot on its PCB.
18. Check performance at 100°C. The indicated temperature should be $100 \pm 1^\circ\text{C}$.

Recalibration of "S" Series Incubators

1. Install accurate glass thermometer.*
 2. Open air exhaust.
 3. Replace RTD with decade resistor box.
 4. Set High Limit control fully clockwise.
 5. Dial 00.0 on thumbwheel switch (Set Point °C).
 6. Dial 100.00 ohms on resistor box.
 7. Adjust ZERO on Temp. Control PCB until the meter connected to the RECORDER jack reads 0.00 mv ± 1 mv. Digital panel display should indicate 000; if not, adjust Zero trimpot on Digital Readout PCB (Fig. D).
 8. Adjust LOW HEAT trimpot for minimum heat output (Fig. F).
 9. Dial 70.0.
 10. Dial in 127.07 ohms on resistor box.
 11. Adjust HIGH HEAT trimpot until the heat output is approximately 80%.
 12. Check RECORDER jack's output. It must be 1.400V ± 1 mv; if not, adjust SCALE trimpot.
 13. Digital panel readout should indicate 70.0; if not, adjust GAIN trimpot on digital readout PCB.
 14. Reinstall RTD.
 15. Operate incubator at 70.0 temperature after oven temperature stabilizes. Adjust HIGH HEAT trimpot, if necessary, to get exact 70.0 on thermometer.
 16. Recorder jack output should be 1.4V. If not, adjust SCALE trimpot on Temperature Control PCB.
-

* Thermometer not included.

Troubleshooting: (Contd.)

RECALIBRATION OF SERIES "S" INCUBATORS

17. Temp. readout should indicate 70.0. If not, adjust GAIN trimpot on its PCB.
 18. Check performance at 56C and the heated temperature should be 56C $\pm 0.2^{\circ}\text{C}$ and 370 $\pm 0.2^{\circ}\text{C}$.
-

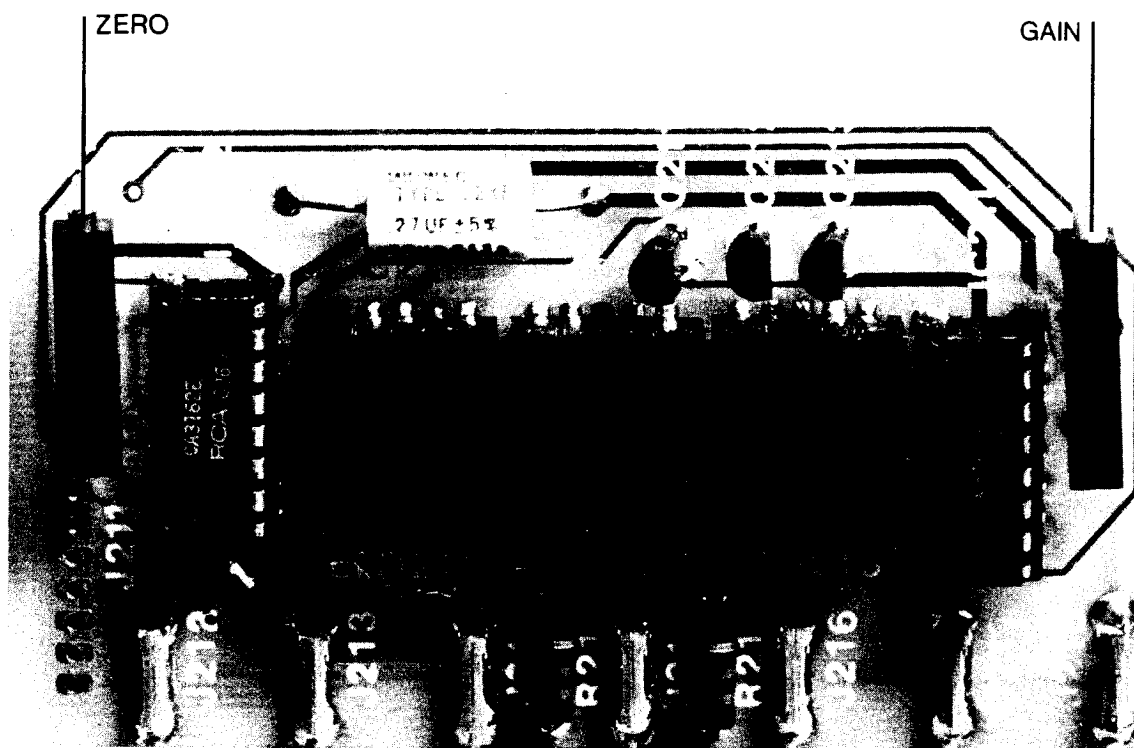


FIG. D Digital display board A200

Maintenance:

The design of the incubator is such that periodic maintenance is kept to a minimum. No lubrication is required. The following paragraphs cover the few minor procedures necessary for continuous operation.

WARNING: Turn off power switch and unplug line cord to incubator.

Cleaning Exterior and Interior - A mild soap and water solution or bicarbonate of soda (1 tbs/gallon of water) is recommended.

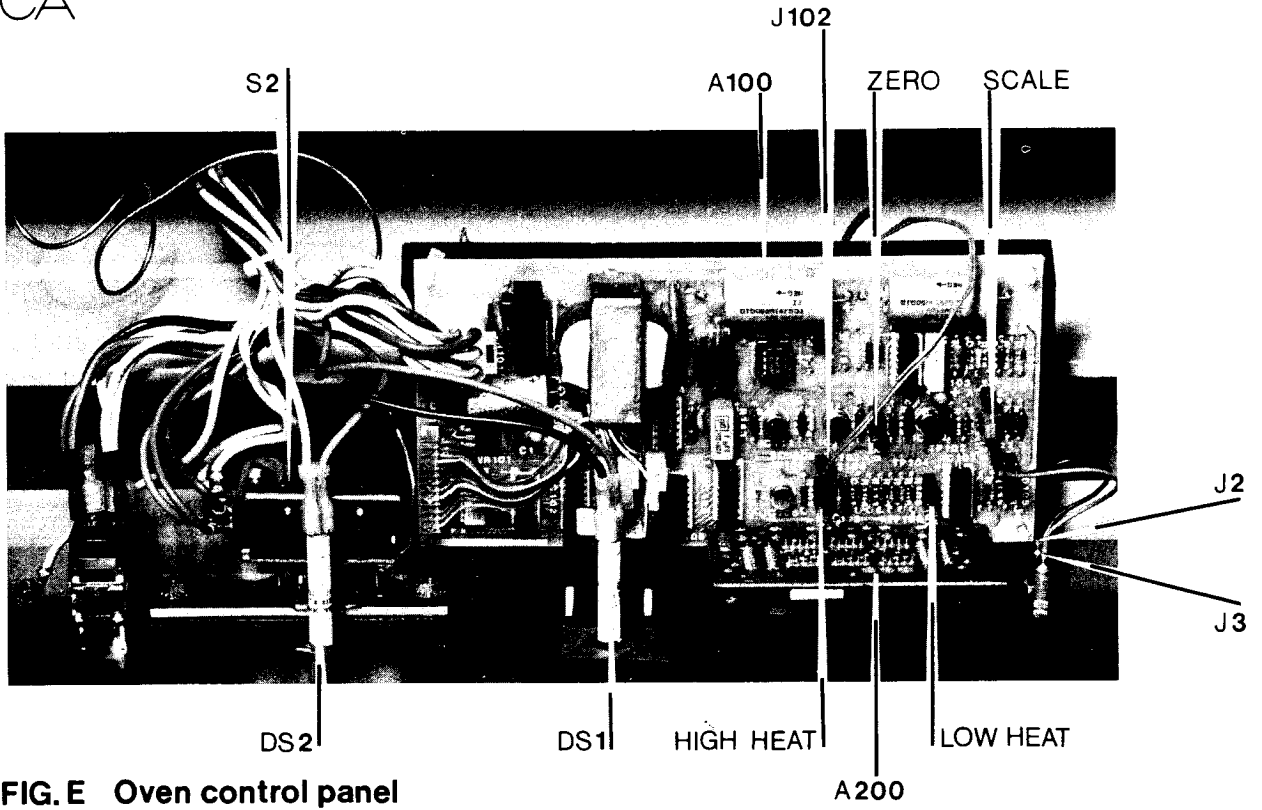


FIG. E Oven control panel

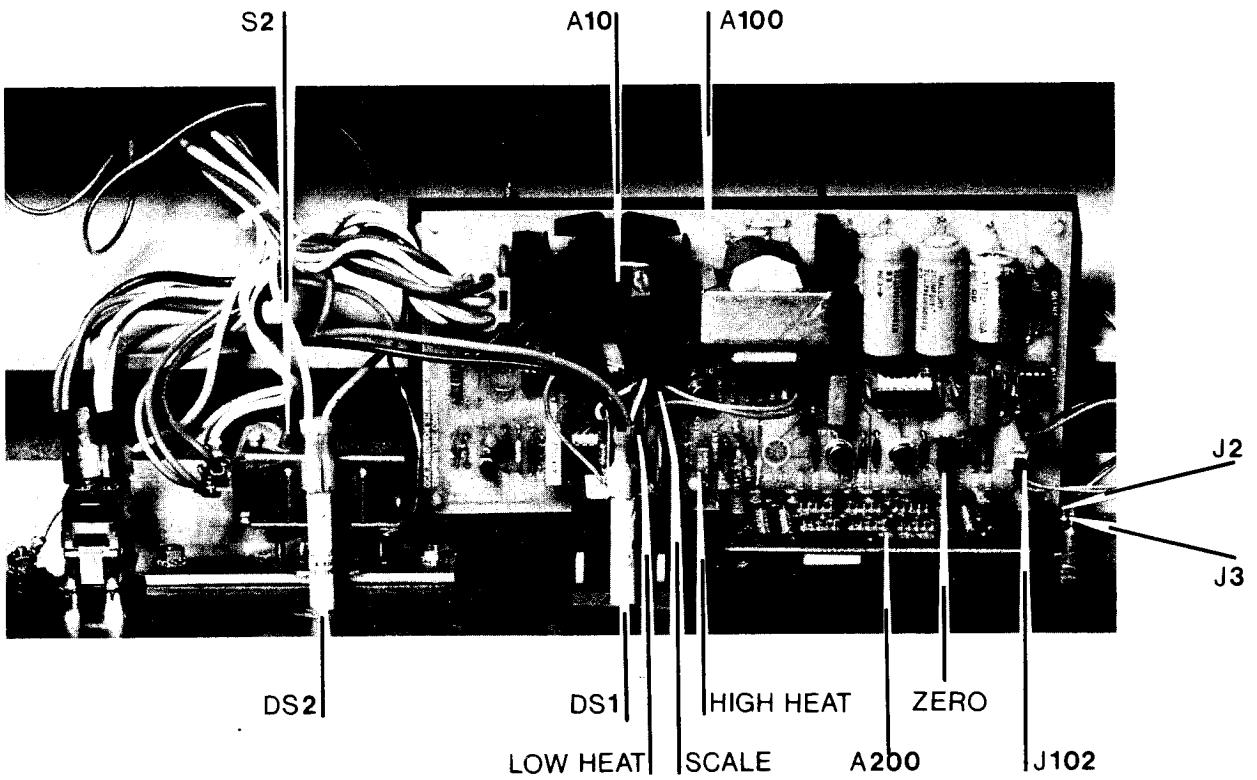


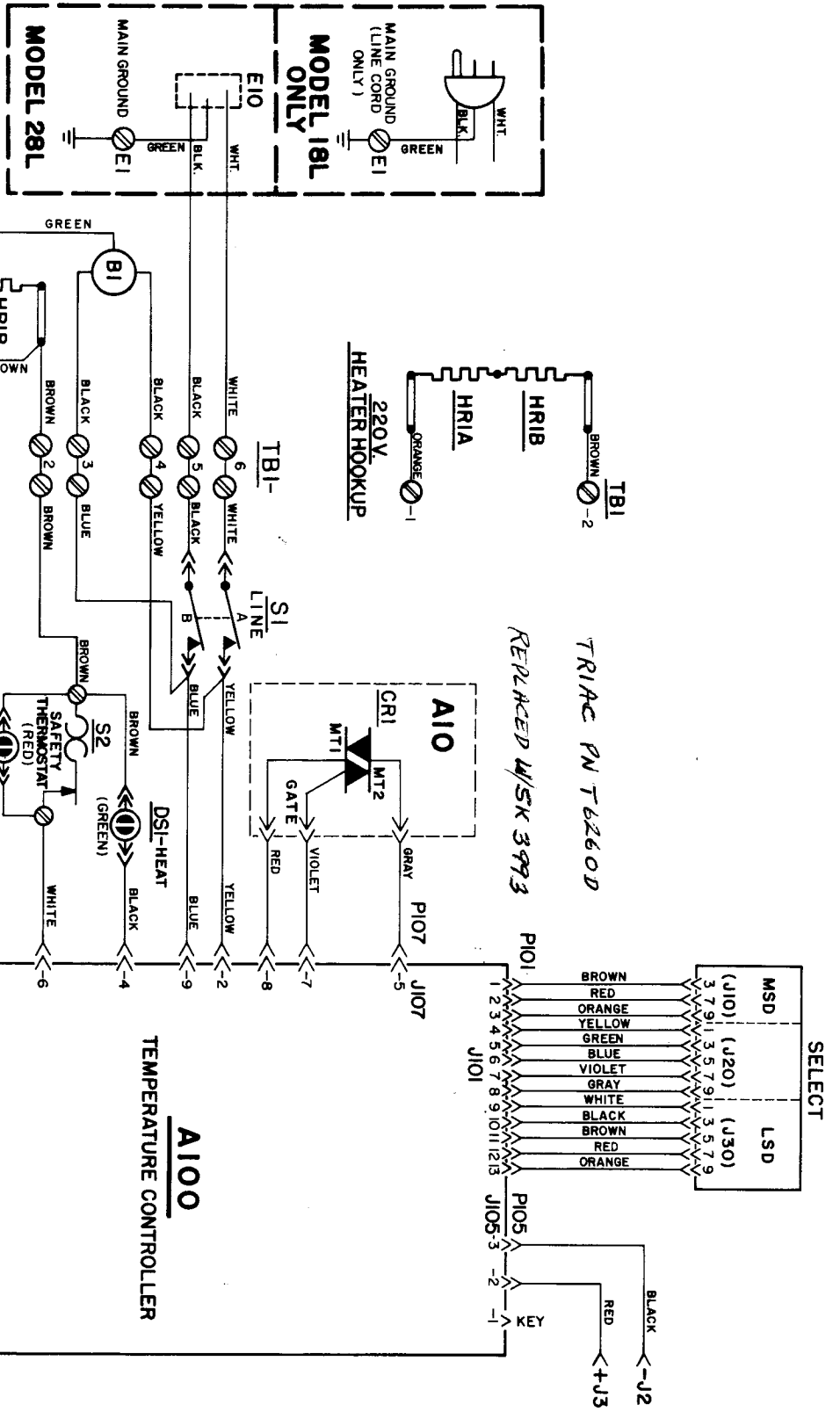
FIG. F Incubator control panel



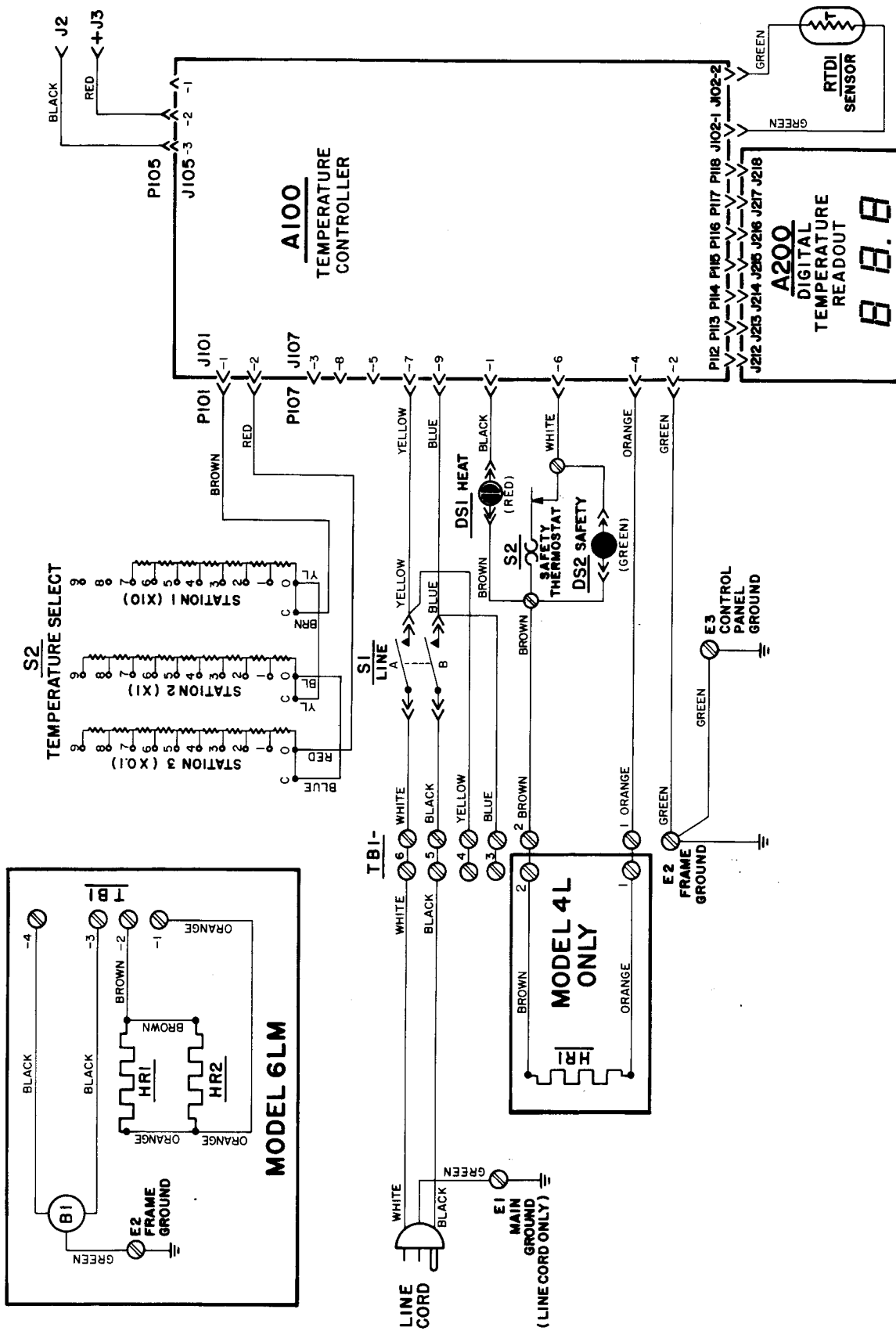
Parts list

Symbol	Description	Qty.	OVEN		INCUBATOR	
			18L	28L	4L	6LM
1	Control Assembly					
2	DS2 Pilot Light, Red (120V)	1		234174		
	DS2 Pilot Light, Red (220V)	1		234175		
3	DS1 Pilot Light, Green (120V)	1		234190		
	DS1 Pilot Light, Green (220V)	1		234189		
4	J3 Recorder Jack, Red	1		236164		
5	J2 Recorder Jack, Black	1		236165		
6	S1 Switch, DPST	1		240304		
7	A200 Temp. Readout PCB Ass'y	1	00803901		00803902	
8	A100 Temp. Contr. PCB Ass'y (120V)	1	00803601		00835401	
	A100 Temp. Contr. PCB Ass'y (220V)	1	00803602		00835402	
9	S3 Thumbwheel Switch Ass'y	1	00878701		00878801	
10	Bezel and Filter Ass'y	1		539817		
11	Barrier (fish paper)	1		00843701		
12	RTD1 Sensor Assembly Temp.	1	00870601	00870602	00870602	00870602
13	A10 Triac Assembly	1	00870301			N/A
14	S2 Thermostat (Safety)	1	239091		239134	
15	HR1 Heater Assembly (120V)	1	247276	247278	247204	247252(2)
	HR1 Heater Assembly (220V)	1	247276	247278	247284	247273(2)
16	B1 Motor Assembly (120V)	1	538997	538997	N/A	538997
	B1 Motor Assembly (220V)	1	538998	538998	N/A	538998
17	Insulator Porcelain (Bus Bar)	3	250161			N/A
18	Blower Wheel	1	275024		N/A	275024
19	Glass Door Ass'y, Inner	1	N/A		535233	535234
20	Plate Glass	1	N/A		531464	531465
21	Hinge	1	N/A		535247	
22	Knob	1	N/A		220147	N/A
23	Handle	1	N/A		N/A	535235
24	Seal, Center Neoprene	1	N/A		N/A	165697
25	Magnetic Catch (on cabinet)	1	270052			N/A
26	Bullet Catch (on cabinet)	1	N/A		270060	
27	Catch, Inner Door	1	N/A		288026	
28	Knob, Thermostat, Safety	1		220159		
29	Handle, Door, Outer	1		535181		
30	Leaf, Top Hinge	1		535085		
31	Leaf, Bottom Hinge	1		535088		
32	Pin, Hinge	2		535086		
33	Washer #8	2		449131		
34	Nut #8	2		449526		
35	Gasket, Door, Outer	1	167319		534999	535000
36	Strike Plate (on door)	1	535450			N/A
37	Locknut	1	344079			N/A
38	6-32 x 3/8 Screw	1	449609			N/A
39	Shelf	2	535095	535097	535094	535099*
40	Shelf Support	4	536796	536798	536797	536797*
41	Shutter Cap Vent	1		535187		
42	Cord and Plug	1	353015	N/A		353014
43	Screw Leveller "FH"	4		241048		
44	Cap Leveller	4		241047		

* 6LM contains 4 shelves.
 * 6LM contains 8 supports.



"S" SERIES OVEN
WIRING DIAGRAM



"S" SERIES INCUBATORS
WIRING DIAGRAM



PARTS LIST

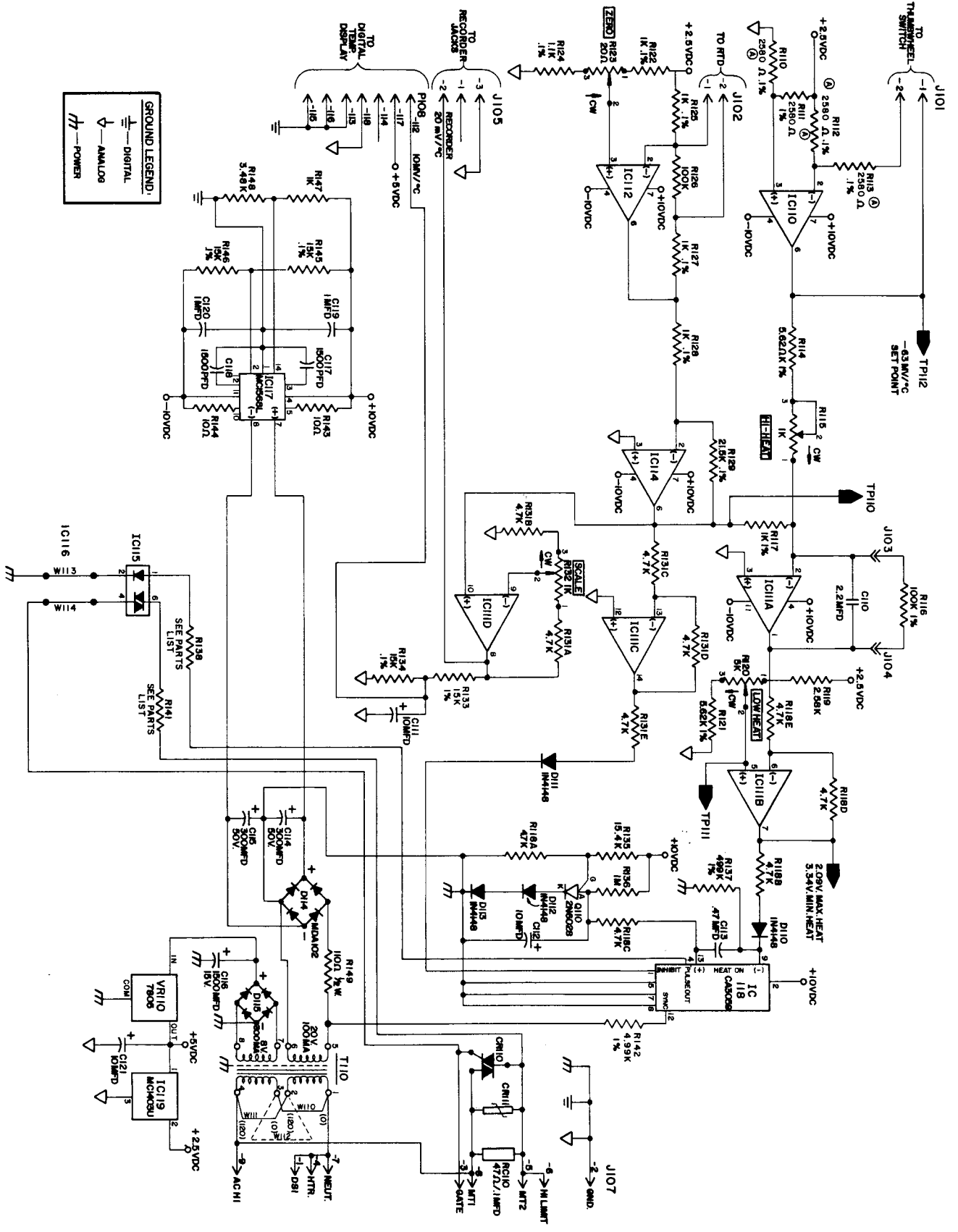
Temperature Controller PCB (A100)
('S' Series Incubators)

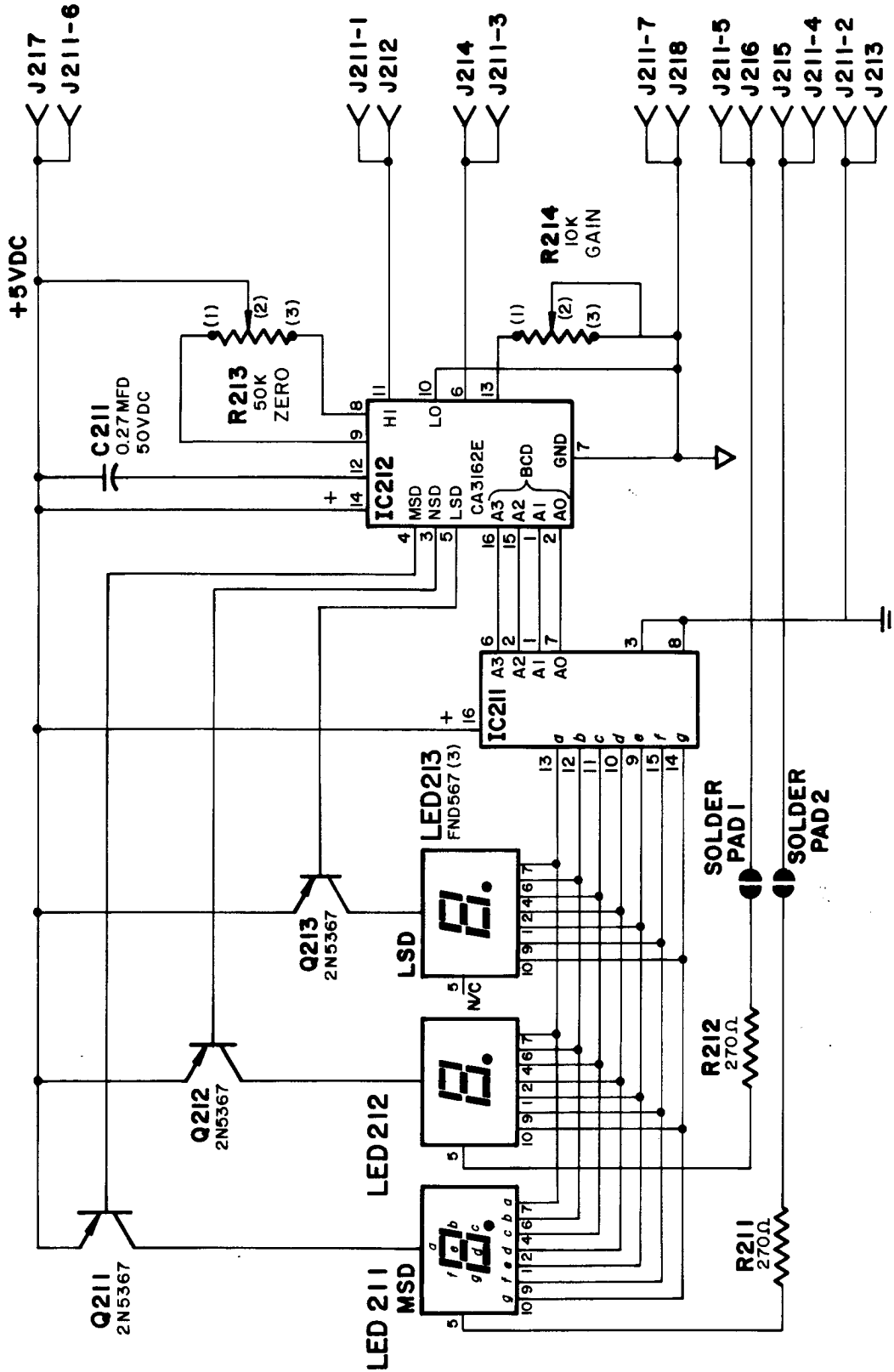
<u>SYMBOL</u>	<u>DESCRIPTION</u>
CR110	Triac, 8 Amp MAC222A-8
D114 & D115	Bridge Rectifier, MDA102A
IC110,112,114	I.C.-OP Amp u A714 HC,OP-07C7
IC111	I.C.-OP Amp OP-11EY
IC118	I.C. Zero Switch, CA3059
IC117	I.C. Dual Voltage Regulator, MC1568L
IC119	I.C. Voltage Ref., MC1403u
T110	Transformer 120/240 VAC PRI.
VR110	Voltage Regulator +5V #7805
<u>120 VOLT</u>	
CR111	Varistor 130 LA 10A
IC115	Triac Driver MOC3011
R138	Resistor, 412 ohms
R141	Resistor, 180 ohms
W110 & W111	Jumper
<u>220 VOLT</u>	
CR111	Varistor 250 LA 10A
IC115	Triac Driver, MOC3021
R138	Resistor, 200 ohms
R141	Resistor, 330 ohms
W112	22 AWG Tinned Copper Bus

Temperature Controller PCB (A100)
('S' Series Ovens)

<u>SYMBOL</u>	<u>DESCRIPTION</u>
D101	Diode, Schottky HP5082-2811
IC101-104	I.C., 4 Bit Adder
IC105	I.C., 8 Bit D/A Converter
IC106,111,112	Amplifier, 8 Pin
IC107	Amplifier, 14 Pin
IC108	I.C., ZVS 14 Pin DIP
IC113	I.C. Multiplier
IC114	Regulator, 14 Pin
IC116	I.C., Low Voltage Ref.
T101	Transformer 120/240 VAC PRI.
<u>120 VOLT</u>	
IC109	I.C. Triac Driver
<u>240 VOLT</u>	
IC109	I.C. Triac Driver

A10 TRIAC PN T6260D — REPLACED w/ SK 3993
400V 25 AMP





NO. OF DECIMAL PLACES	BRIDGE SOLDER PAD 1	BRIDGE SOLDER PAD 2
NONE	NO	NO
ONE	YES	NO
TWO	NO	YES

SYMBOL	DESCRIPTION	CAT. NO.
IC211	I.C. DECODER & DRIVER	296184
IC212	I.C. A/D CONVERTER	296185

TEMPERATURE READOUT PCB (A200)
FOR OVENS & INCUBATORS