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Model: 3250

Water Jacketed Incubator

Manual No: 7023250 Rev-1

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.

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NOTE:

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MANUAL NO 7023250 Rev-1

REV	ECN	DATE	DESCRIPTION
1		12/95	CE Mark added
		4/93	Standard Manual

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GENERAL SAFETY NOTES

~ The Occupational Safety and Health Administration (O.S.H.A.) of the United States has revised Section 1910-147, "THE CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)".

NOTE: Hazardous energy may be: ELECTRIC, AIR, HYDRAULIC, WATER, STEAM, GRAVITY, SPRING & ALL OTHER EQUALLY HAZARDOUS ENERGY.

This revised regulation, states that you will de-energize all potential sources of energy (may be more than one energy source) prior to performing service or maintenance on any equipment. It also states that a lock shall be placed on the de-energized control, along with a verified test (use of a voltmeter or other equipment) to insure no accidental starts. If you are not familiar with this regulation, please review the O.S.H.A. REGULATION, SECTION 1910-147.

In field service, full compliance with this regulation is difficult at best. Troubleshooting must often be performed with hazardous energy applied; therefore extreme caution must be followed during these troubleshooting steps. ONLY QUALIFIED PERSONNEL MUST PERFORM THIS WORK. This phase of the repair work must be coordinated through the customer's facilities maintenance department or designated person.

When performing service or maintenance as an outside contractor/worker, follow the Outside Work Force's Lockout/Tagout system. Be alert for new types of lockout/tagout devices.

~ Always use the correct personnel protective equipment (clothing, gloves, goggles etc.).

~ Always dissipate extreme cold or heat, or wear protective clothing.

~ Always follow good hygiene practices.

~ Each individual is responsible for his/her own safety.

FOR YOUR SAFETY PLEASE ADHERE TO ALL "DANGER" AND "CAUTION" STATEMENTS. FAILURE TO DO SO WILL LEAD TO BODILY INJURY OR PROPERTY DAMAGE OR BOTH. FAILURE TO COMPLY CAN RESULT IN DISCIPLINARY ACTION.

Danger: This word is used to call attention to immediate hazards of equipment or conditions which, if not avoided, could result in personal injury, loss of life or property damage.

Caution: This word is used to call attention to potential hazards of equipment or conditions which, if not avoided, could result in personal injury, loss of life or property damage.

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SECTION 1 - RECEIVING

1.1 Preliminary Inspection

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

1.2 Visible Loss or Damage

If any loss or damage is discovered, note any discrepancies on the delivery receipt. Failure to adequately describe such evidence of loss or damage may result in the carrier refusing to honor a damage claim.

Immediately call the delivering carrier and request that their representative perform an inspection. Do not discard any of the packing material and under no circumstances move the shipment from the receiving area.

1.3 Responsibility for Shipping Damage

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

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

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

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1.4 Unpacking List for Model 3250

If the unit is to be moved by fork lift, leave the incubator on the skid until it has been moved to its designated location. The following items are packed within the incubator:

Item	Part#	Description
1	115018	3/16" Round Stainless Steel Handle
2	22115	6-32 X 1/4" Stainless Steel Screw (Mounting Handle)
3	950013	1/4" ID Vinyl Tubing (CO_2 Supply)
4	190325	Stacking Brackets
5	195125	Bacterial Air Vent (Decontamination Kit)
6	600034	.375" Snapper Hose Clamp (CO_2 Supply)
7	18001	Polypropylene Funnel (Filling Incubator)
8		Line Cord
9	100078	Blower Wheel (1.95 X .625 CCW) (Decontamination Kit)
10	246011	3/8" Vinyl Tubing (Filling Incubator)
11	380284	3/8" Hose X 1/4" MPT Nylon Adapter (Drain Valve Fitting)
12	3250-45-1	Shelf Support (2) Total
13	237013	Humidity Pan
14	224140	Electro Polished Stainless Steel Shelves (5) Total
15	190398	Stacking Pins (2)
16	190388	Telephone Line Cord 12 FT (2)
17	190392	RJ-11 To Screw Terminal Cover (2)

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SECTION 2 - INSTALLATION AND START-UP

2.1 Location

Locate the incubator in a draft-free area away from doors, windows, or air conditioning/heating ductwork. To help prevent microbial contamination, the incubator should also be removed from areas of high personnel traffic.

Place the unit on a firm, level surface capable of supporting the water filled unit. (Approximate weight with water = 342 lbs or 155 kgs).

Note: Adequate space is required behind the incubator for installation (electrical and gas connections) and service.

2.2 Reversing the Door Swing

For side-by-side operation or changing lab layouts, the inner and outer doors are field reversible. The following steps are sequentially called out on the drawings, located at the end of this procedure. The procedure is written from the prospective of changing the door swing from a left-hand to a right-hand swing.

1. Remove the four screws securing the inner door hinges and remove the inner door.

2. Open lower front panel.

3. Locate the retaining rod in the right front corner, securing the lower front panel to the incubator. Slide the retaining rod *out* from its mounting bracket.

4. Remove the two screws securing cable cover (below drawer). Remove cable cover and slide snap bushing and cable out of the end slot. Set cable cover aside.

Note: Do not remove the strain reliefs from the cables. They have been specifically placed at points on the cable, at the factory.

5. Remove the two screws securing the door cable cover. Remove cable cover and set aside.

6. With the assistance of a second person or portable table, remove the four screws securing the outer door hinges to the cabinet. Remove outer door and place it face down.

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7. Note dimple location in hinge. Remove hinges from outer door. Remove the small plastic hole plugs from the (reversible swing) hinge mounting holes. Place hole plugs back into the original hinge mounting holes.

8. Install hinges (same dimple location as when removed) in the reversible swing hinge mounting holes.

9. Turn door cable cover so that strain relief is on the hinge side of the door. Secure door cable cover.

10. Remove the eight plastic hole plugs from the front right corner. Reinstall these eight hole plugs on the left front corner.

11. With the assistance of a second person, align outer door hinges with hinge mounting holes in cabinet. Secure with the four screws. NOTE: Adjust hinges as necessary to align door with cabinet.

12. Locate cable cover (previously mounted below drawer) and slide strain relief bushing/cable back into slot, so that the strain relief bushing is on the hinged side of the door. Secure cable cover with the two screws.

13. Slide retaining rod back into its mounting bracket.

14. Locate inner door strike on shelf support and remove. Reinstall on opposite shelf support.

15. Align hinges on inner glass door with mounting holes in cabinet, and secure with four screws.

Note: The "WARNING" label will be upside down.

16. Loosen nut on back of latch stud and rotate latch tab 180°, then tighten nut.

17. Replace door cable cover.

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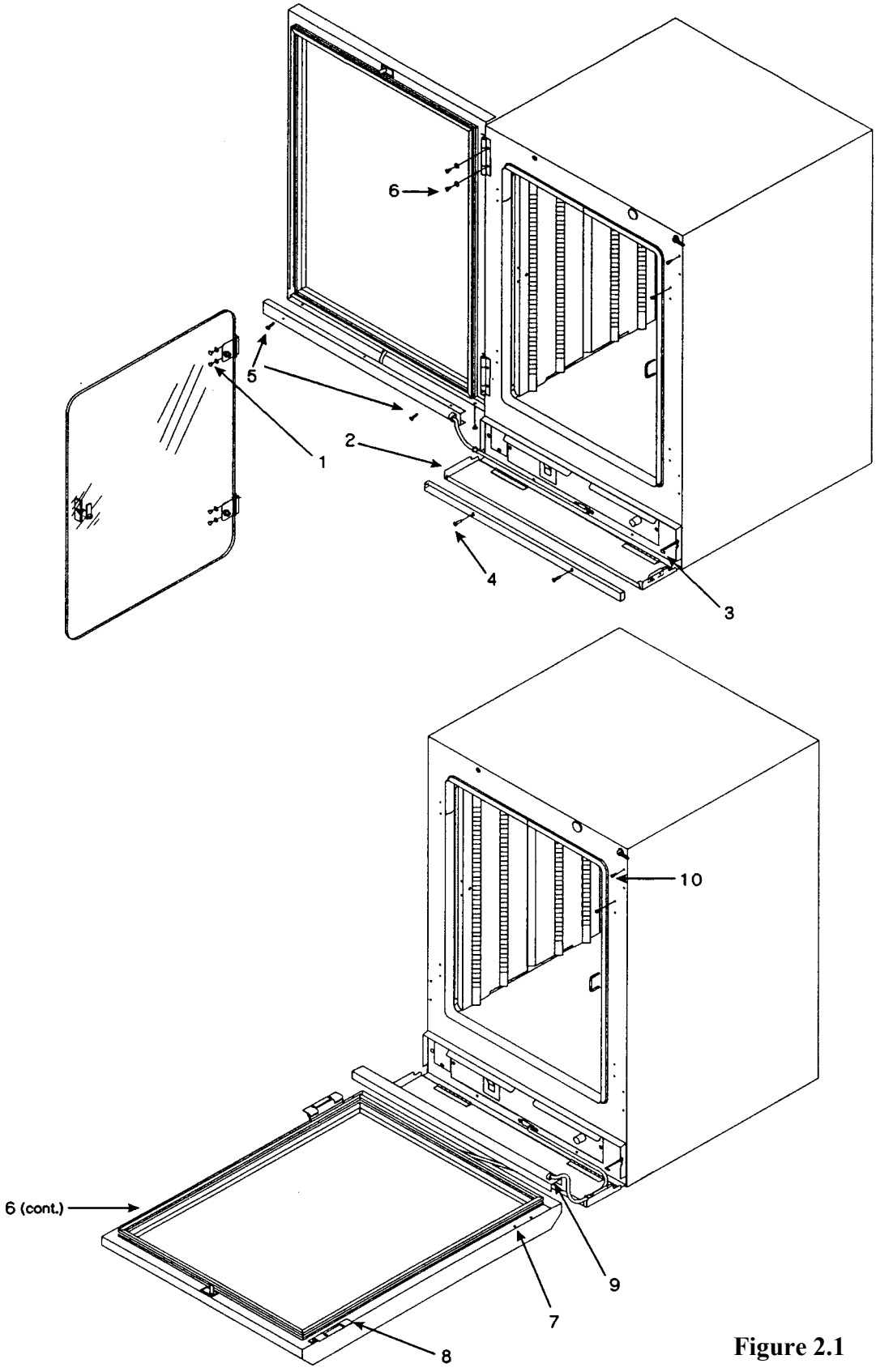


Figure 2.1

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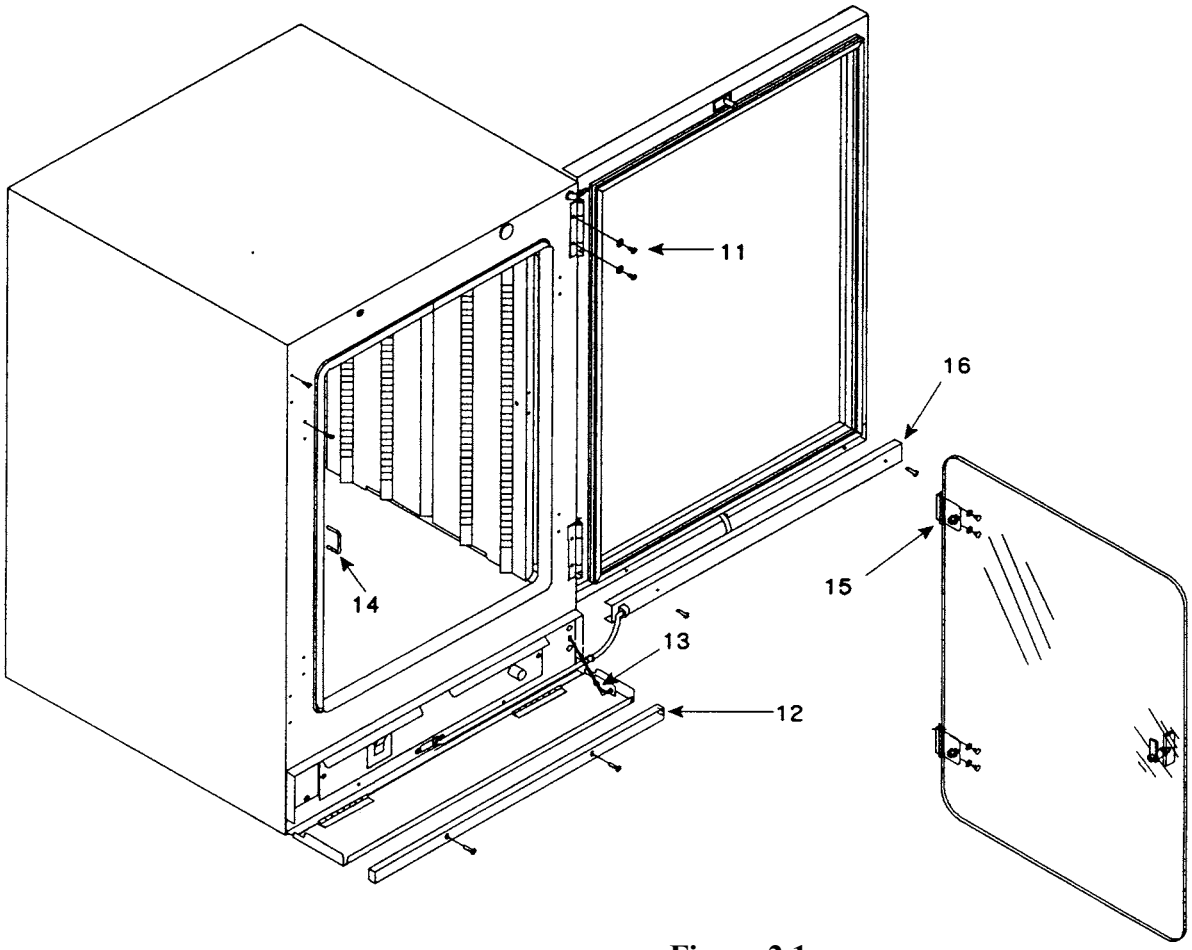


Figure 2.1a

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2.3 Preliminary Disinfecting

A clear plastic film on the side shelf supports protects the finish during shipping and handling. This plastic film must be removed (peeled-off) before protected parts are disinfected and installed.

Note: Refer to Section 4.1 titled "Disinfecting the Incubator Interior", for specific instructions.

Before installation, Forma Scientific Inc. recommends disinfecting the following: shelf supports, shelves, and all interior surfaces including both door gaskets. After disinfecting, rinse the surfaces with sterile distilled water (50K Ohm to 1 Meg Ohm). Also disinfect the CO_2 sensor and the blower wheel (located behind the rear blower plenum) taking care not to saturate the sensor. Repeat rinsing until you are satisfied that all of the disinfectant-detergent has been removed. Proceed with the installation as noted.

2.4 Installing the Side Shelf Supports (Refer to Figure 2.1)

Locate the 3/16" round stainless steel handle and the two #6-32 x 1/4" Phillips head screws (supplied in parts bag). Before installing the side shelf supports, determine the cabinet door swing (right-hand or left-hand). Position the side shelf supports so that the notched edges are at the bottom. Mount the handle on the appropriate shelf support by aligning the handle with the pre-punched holes provided; and use the screws supplied to secure it.

Note: The handle must align with the door strike of the inner glass door.

Install the (2) side shelf supports with the notched edge to the bottom. Locate the grooved studs on the right and left interior wall. Align key holes in side shelf support over grooved studs. Push down on side shelf support to lock into position.

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2.5 Installing the Shelves (Refer to Figure 2.2)

Slide each shelf into the shelf bracket at the desired level. There are a maximum of 22 positions available, excluding the use of the humidity pan.

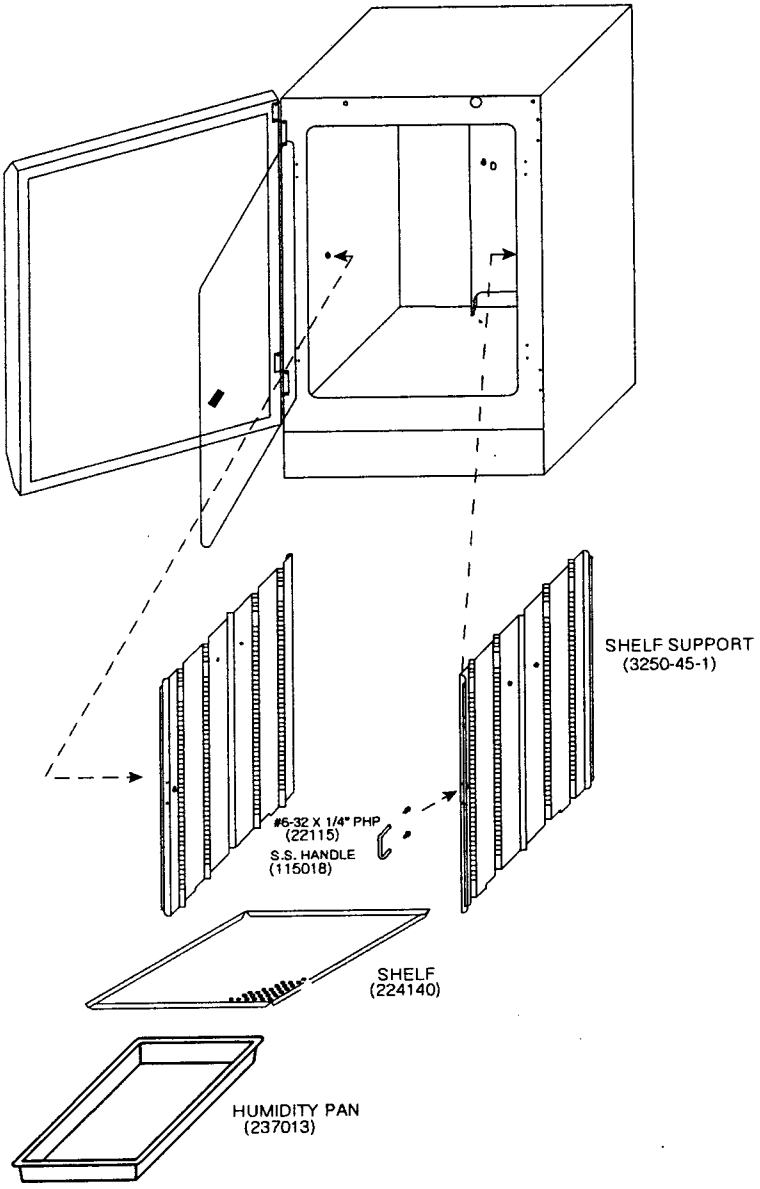


Figure 2.2

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2.6 Leveling (Refer to Figure 2.3)

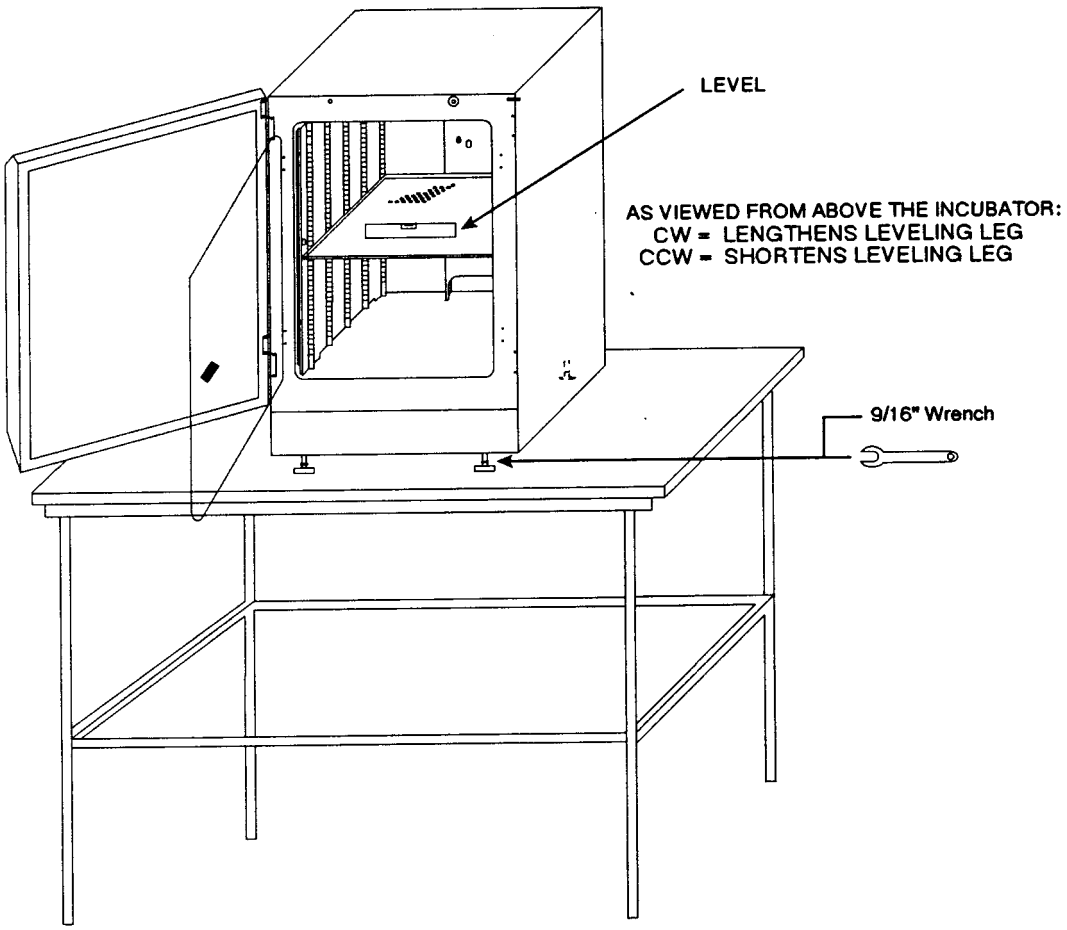
Check leveling by placing a bubble-type level on one of the interior shelves, (level from side to side and from front to back). Using a 9/16" wrench, adjust the leveling leg (four total) clockwise (as viewed from above the incubator) to lengthen the leveling leg, or raise the unit. Turning the adjustment leg counterclockwise will shorten the leg, or lower the unit.

Note: Be sure to level the incubator, before filling the water jacket.

Caution: To prevent injury to personnel and/or damage to equipment, lock inner glass door and secure outer door before tipping unit to adjust leveling feet.

Caution: Do not attempt to tilt the incubator without assistance while adjusting the leveling feet.

FIGURE 2.3



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2.7 Stacking the Incubators (Refer to Figure 2.4)

Note: Two stacking pins and two stacking brackets are included in the parts kit accompanying each incubator.

1. Before placing the top unit into position, unscrew and remove all leveling feet.

Remove the (2) stacking screws from the top panel of the bottom unit.

2. Insert the stacking pins over the. Insert the screws through the stacking pins and tighten.

3. Stack the top incubator over the bottom unit, offsetting the top unit 2-1/4" to 2-1/2" to the front.

4. Align all sides. Slide the top unit back, engaging the stacking pins into the slots in the bottom of the top unit.

5. Remove and save the screws from each top rear corner of bottom incubator (4 screws total). Remote the single screw from each bottom rear corner of the top unit (two screws total).

6. Attach the stacking brackets onto the back of the incubators using the screws and screw holes from step 6. . (Refer to Figure 2.4).

Stacking Incubators - Early Production Series

Early production Incubators (Release 1) are stacked and fastened together using the two stacking brackets on the back of the cabinet and a single stacking screw which connects the top unit to the bottom unit. Release 1 models are identified by a single screw on the top of the cabinet. (refer to Figure 2.5a)

1. Remove the single stacking screw located on the top of the lower incubator.

2. Remove the four leveling feet from the incubator to be stacked on top.

3. Place the unit on top of the bottom unit.

4. Open the control panel cover on the top unit.

5. Remove the two screws which hold the control panel in place and pull the drawer out.

6. Position the drawer so that the access hole on the bottom of the drawer is aligned with the screw hole on the top of the lower incubator.

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7. Insert the stacking screw through the hole and tighten.

8. Remove and save the two screws from each top rear corner of the bottom incubator (four screws total). Remove and save the single screw from the bottom rear corner of the top unit (two screws total).

9. Lock the two units together by attaching the stacking brackets onto the back of the incubators using the screws and screw holes from step 8.

Stacking Incubators - Mixed Production Series

When stacking Release 1 and Release 2 incubators, the Release 1 unit must be placed on the bottom. The units are fastened together using the two stacking brackets on the back of the cabinets and a single stacking screw connecting the top unit to the bottom unit. refer to Figure 2.4 and Figure 2.4a.

1. Remove the single stacking screw located on the top of the lower incubator.

2. Remove the four leveling feet from the incubator to be stacked on top.

3. Place the unit on top of the bottom unit.

4. Open the control panel cover on the top unit.

5. Remove the two screws which hold the control panel in place.

6. Remove the two screws which hold the narrow horizontal plate beneath the control panel.

7. Remove the control panel by pulling the drawer out and tilting upward. Remove the drawer completely from the cabinet.

8. Align the top incubator and install the stacking screw into the bottom cabinet to lock the two units together.

9. Replace the horizontal plate and the control panel drawer ant tighten all screws.

10. Remove and save the two screws from each top rear corner of the bottom incubator (a total of four screws removed). Remove the single screw from each bottom rear corner of the top unit (a total of two screws).

11. Attach the stacking brackets onto the back of the incubators using the screws removed in the previous step.

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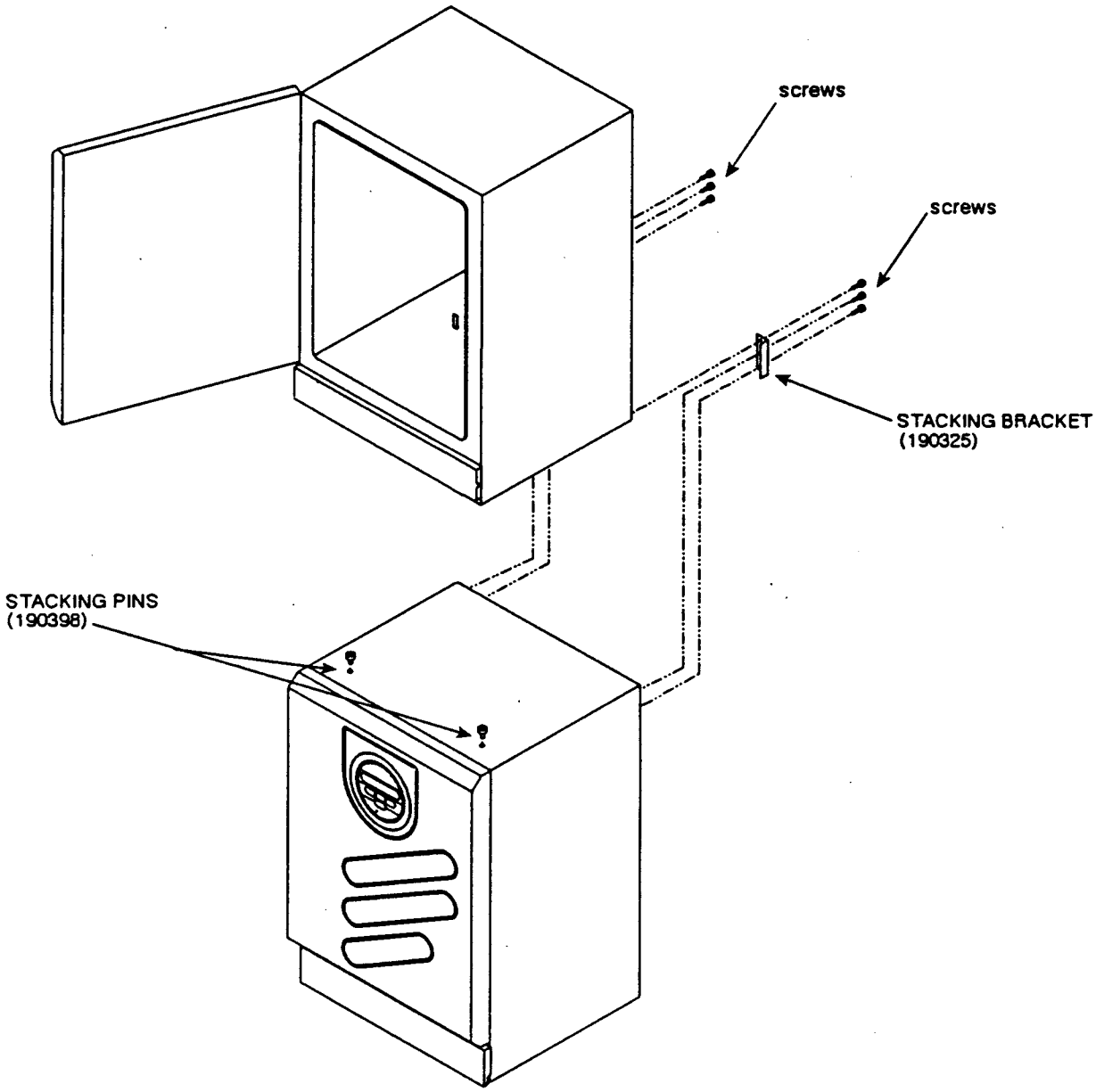


Figure 2.4
Stacking Incubators (Late Production Series)

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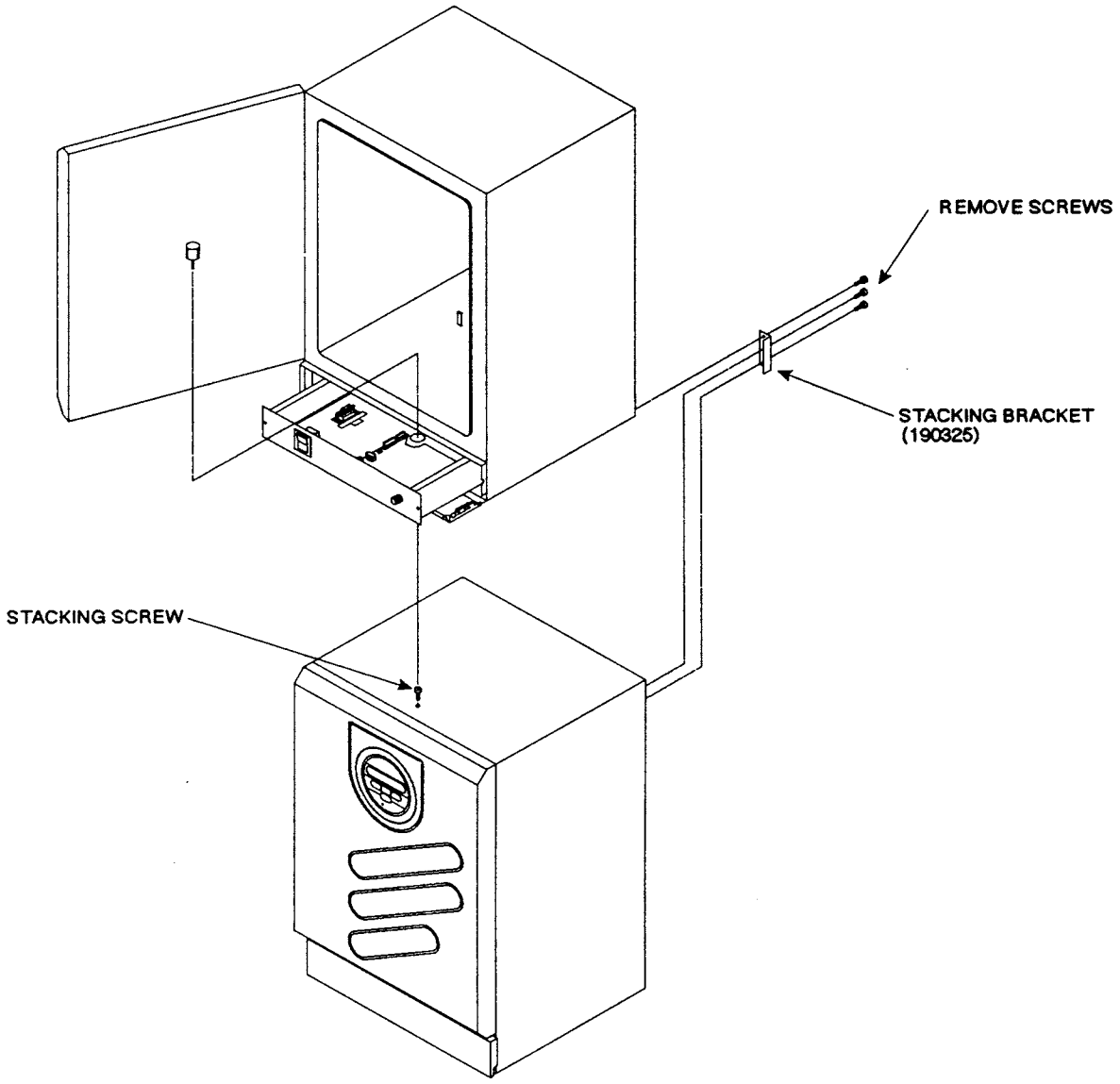


Figure 2.4a
Stacking Incubators (Early Production Series)

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2.8 Installing the Power Cord

Remove power cord from shipping box. Place female end of plug over the male prongs, located on the backside of the incubator.

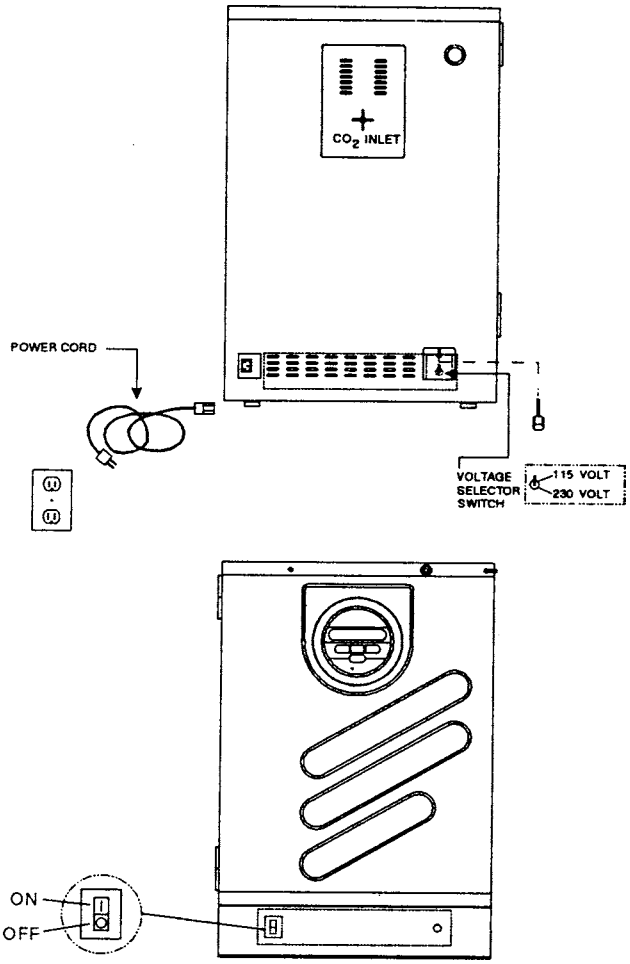
Caution: Power cord voltage rating must <u>always</u> conform to the incubator's operating voltage.If the unit is converted to operate from a 120 Volt power source to a 220 Volt power source, the line cord set must be upgraded to a 220 volt rating.

Line cord sets may be ordered from Forma Scientific, Inc. Contact the Forma Service Department at 1-800-848-3080 OR Fax 1-614-373-4189.

2.9 Connecting to Power

Before connecting the incubator to a power source, remove the cover plate protecting the voltage selector switch (behind the lower front panel, beside the power switch) and place it in the appropriate voltage position, either 120V or 220V. With the incubator power switch OFF, connect the unit to an adequate power source.

Note: Forma Scientific Inc. recommends that the incubator be connected to a separate circuit.



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2.10 Preparing the Incubator for Filling

Approximately 450-500 ML of rust inhibitor was placed in the water jacket before the incubator was shipped. The rust inhibitor mixes with the distilled water (50K Ohm to 1 Meg Ohm) during filling and provides a protective coating on the interior of the water jacket. Do not drain this solution from the water jacket on initial filling.

Note: The fill port is located on front face of unit, directly above outer door seal. This fill port is covered with a plastic plug. The vent hole, in the top left section of the water jacket face, allows the air displaced by water entering the jacket to escape. It also helps prevent distortion of the chamber by allowing air to escape as the unit expands and contracts during heating and cooling.

Caution: Do not plug the vent. A plugged vent will damage the water jacket chamber during the filling of the water jacket.

2.11 Filling the Water Jacket

The water jacket holds approximately 11.7 gallons (44.29 Liters) of water.

- Check drain valve (if unit was previously in use) to ensure that it is closed.-/-

- To prevent mineral buildup and minimize corrosion, use 50K Ohm to 1 Meg Ohm distilled water to fill the water jacket.

Note: The vinyl tubing and funnel, necessary for filling, are contained in the accessories bag included with each incubator. (Refer to Figure 2.5)

1. Open outer door and locate plastic fill port plug. Pull out on plug to remove.

2. Connect one end of the vinyl tubing to the nylon fitting (located behind plug) and the other end to the funnel or a distilled water tap (50K Ohm to 1 Meg Ohm).

3. Lower the bottom front access panel and locate the main power switch. Place switch in the "ON" (|) position.

Note: The display will read "POWER ON" and "ADD WATER TO JACKET". An add water alarm will continue until the water jacket has been filled to the proper level. The display will then read "JACKET FULL", for thirty seconds. If the audible alarm has been silenced from the keypad, a three second tone will occur, when the jacket is full.

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4. Hold funnel up above incubator and pour water into funnel until the add water alarm silences and the display reads "Jacket Full". If using the tap method, turn tap on slowly and fill until the add water alarm silences and the display reads "Jacket Full".

5. Remove tubing and replace fill port plug.

Note: Water seepage may occur from vent port when chamber temperature increases.

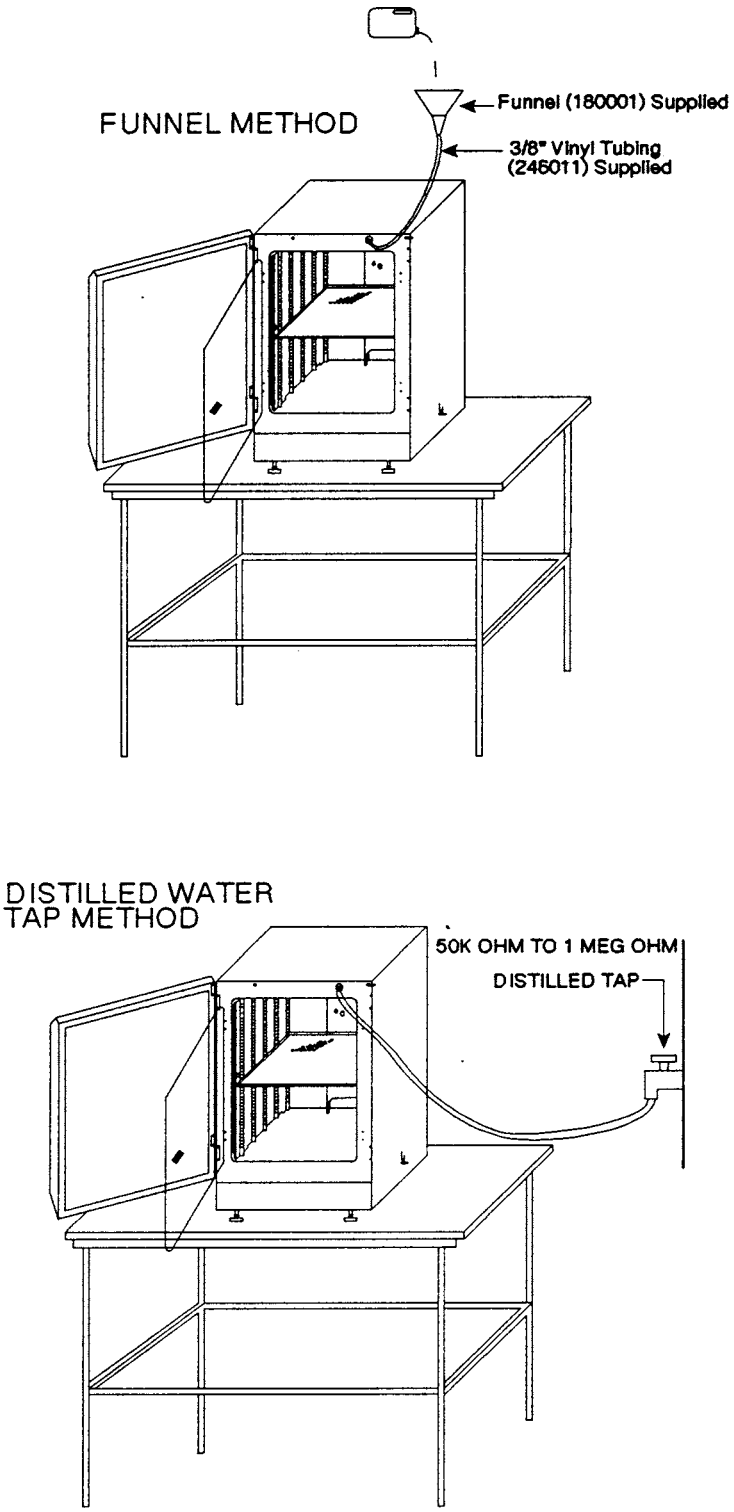


Figure 2.5
cubator Fill Methods

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2.12 Filling the Humidity Pan

Caution: Do not use demineralized or deionized water in the humidity pan unless it has been boiled/sterilized immediately before use, as it may be contaminated with bacteria.

Note: When using the humidity pan, please refer to Section 3.3 "Humidity (RH) Set Sequence", to ensure that the humidity mode is properly set.

The humidity pan holds 6.375 quarts (6 liters) of sterile, distilled (50K ohm to 1 Meg ohm) water.

Note: This pan may be autoclaved!

Center the humidity pan on the incubator floor, for best humidity and temperature response. Position the pan with the long sides running from front to back (short sides running from left to right).

Check the water level in the humidity pan frequently. If a disinfectant has been added to the water, it should be changed once a week to help prevent microbial contamination. If no disinfectant has been added to the sterile distilled water (50K Ohm to 1 Meg Ohm), change the water at least twice a week.

It is very important that the water level in the pan be kept relatively constant, as extreme fluctuations or "dry-outs" will have an unfavorable effect on the humidity level and CO_2 control in the chamber.

2.13 Connecting the CO_2 Supply

For the most economical use of CO_2, a main supply of liquid CO_2 is recommended. The liquid CO_2 should be supplied from tanks, WITHOUT SIPHON TUBES, to ensure that only CO_2 gas enters the incubator injection system.

A two-stage pressure regulator with indicating gauges must be installed at the supply cylinder outlet. The high pressure gauge should have an indicating range of 0 to 2000 PSIG to monitor tank pressure; and the low pressure gauge should have an indicating range of 0 to 30 PSIG to monitor actual input pressure to the incubator injection system. A suitable two-stage pressure regulator is available from Forma Scientific Inc. STOCK# 965010

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The CO_2 source must be regulated at a pressure level of 5 to 10 PSIG. Higher pressure levels may damage the CO_2 system. Pressure levels lower than 5 PSIG will not affect the operation of the incubator, but will increase CO_2 recovery time.

To Connect the CO_2 Supply:

The CO_2 supply fitting is located on the outer, center back wall of the incubator. See Figure 2.7. Using the snapper hose clamps (provided), securely attach the 1/4" ID vinyl CO_2 line (6 ft. supplied), from the CO_2 source to the barbed nylon fitting. Check connections for leaks. After testing for leaks turn main CO_2 supply "OFF".

Note: Permit chamber temperature to stabilize (8-9 hours), turn on CO_2 and select the desired CO_2 setpoint.

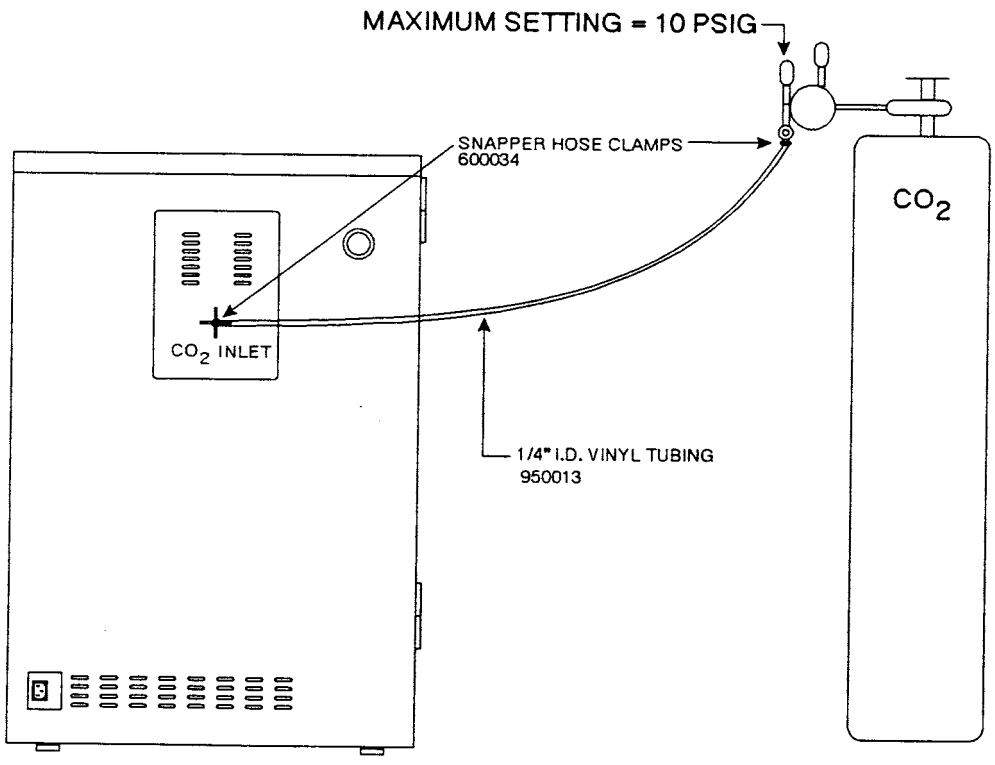


Figure 2.6

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2.14 Access Port

The access port is located on the upper left hand corner, through the rear wall. Inside the chamber it is plugged with a neoprene stopper. To use the access port, remove the neoprene stopper and run the external wires/probes through the opening to the interior chamber. Refer to Figure 2.8 for location of Access Port.

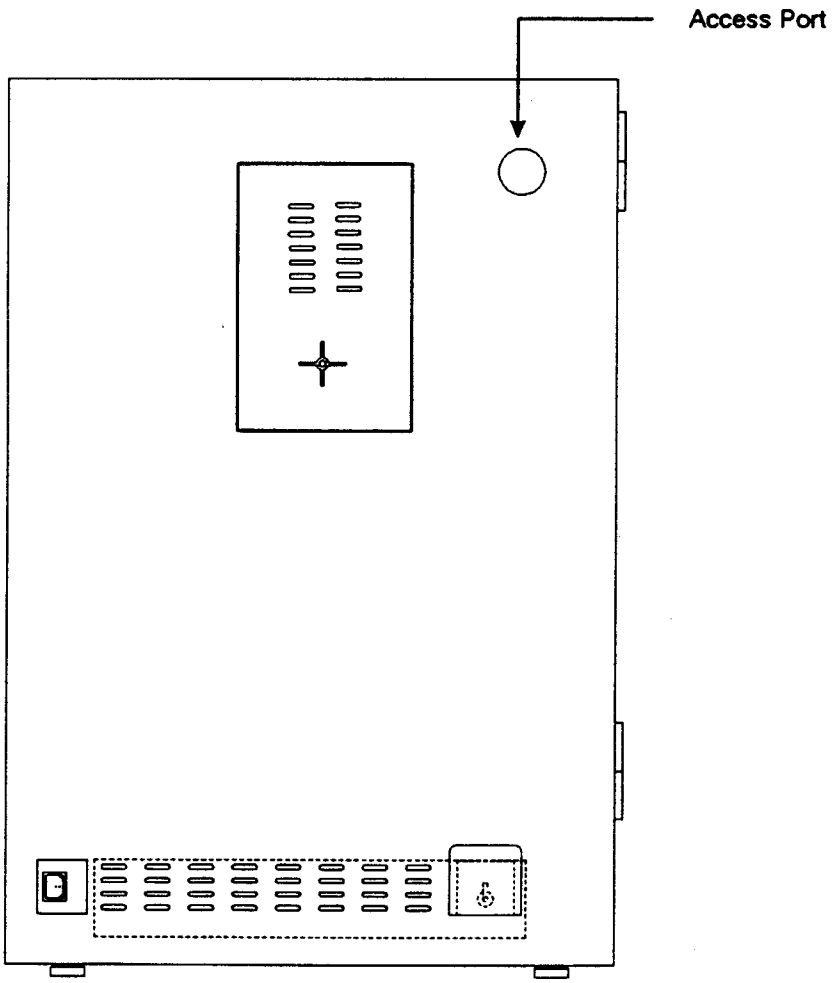


Figure 2.8
Rear View of Incubator
showing access port

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2.15 RS - 232 Computer Interface (factory installed option)

Note: Refer to drawing 3250-75-0-D, located at the end of this section, for further information.

The Model 3250 is equipped with an RS-232 Serial Communication Interface for the remote transmission of sensor data. An RJ-11 telephone style connector is located on the rear of the incubator. A cable with RJ-11 plugs, and an RJ-11 to DB-25 adapter connector are also provided.

The data is "dumb terminal" formatted, which permits interfacing with either a computer or a serial printer.

Three wires are used for the RS-232 interface:

1. Transmit data (/TXD) - pin 2 DB-25 connections
2. Receive data (/RXD) - pin 3 "
3. Signal ground (GND) - pin 7 "

The data format is seven bit ASCII, with a leading zero (8^{th} bit). Each character is transmitted with one start bit, eight data bits, and two stop bits, totaling eleven bits. NO parity bit is included. Baud rate is 1200.

Baud	1200
Data bits	8
Start bits	1
Stop bits	2
Parity	none

A data transfer sequence is transmitted according to the following format. X refers to the variable numerical temperature or CO_2 data. The data string always totals 20 characters.

(NUL)XX.XC(SP) (SP)XX.X%CO_2(SP) (LF) (CR)(EOT)

NUL - Null character (0)
SP - Space
LF - Line feed
CR - Carriage return
EOT - End of text (4)

The Model 3250 transmits temperature and CO_2 data one minute after power is first applied, and every 60 minutes thereafter.

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The incubator responds to two ASCII commands from the remote: DC1 (XON), and DC3 (XOFF).

DC1 (17, 11 Hexadecimal)

The incubator will transmit temperature and CO_2 data upon receiving "DC1" (XON) and will restart 60 minute interval transmissions, if they have been inhibited by a "DC3" (XOFF).

DC3 (19, 13 Hexadecimal)

Receiving a "DC3" (XOFF) from the remote inhibits the incubator from sending serial data indefinitely, until a "DC1" (XON) is received (or incubator power is removed and then reapplied).

2.16 Remote Alarm Contact

Note: Refer to drawing 3250-75-0-D, located at the end of this section, for further information.

A SPDT relay contact has been provided for the monitoring of alarms. Connections are made by means of an RJ-11 (telephone style) jack, located on the rear of the incubator. As the unit is shipped from the factory, all remote alarm functions are enabled (turned ON).

Five groups of alarms may be independently disabled (turned OFF), by accessing the "Rmte Alarms" function, located in the SET menu. (Refer to chart in Section "3.4 ALARMS".)

The five groups are:

1. Sensor fault alarms (chamber temp., jacket temp., and CO_2 sensors).
2. Door open alarm.
3. Add water to jacket.
4. CO_2 high, or low.
5. Temperature high, or low.

Note: The Overtemp shutdown alarm *may not* be turned "OFF".

Note: The "Rmte Alarms" menu function will not appear in the display, if the Alarm/Recorder board is not connected.

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2.17 Analog Recorder Outputs

Note: Refer to drawing 3250-75-0-D, located at the end of this section, for further information.

Analog voltage outputs, for temperature and CO_2, are provided for connection to chart recorders, or other voltage monitoring equipment. The output voltages are scaled to 10 Millivolts per degree C or $\%CO_2$, with an output range of 0-1.000 volts.

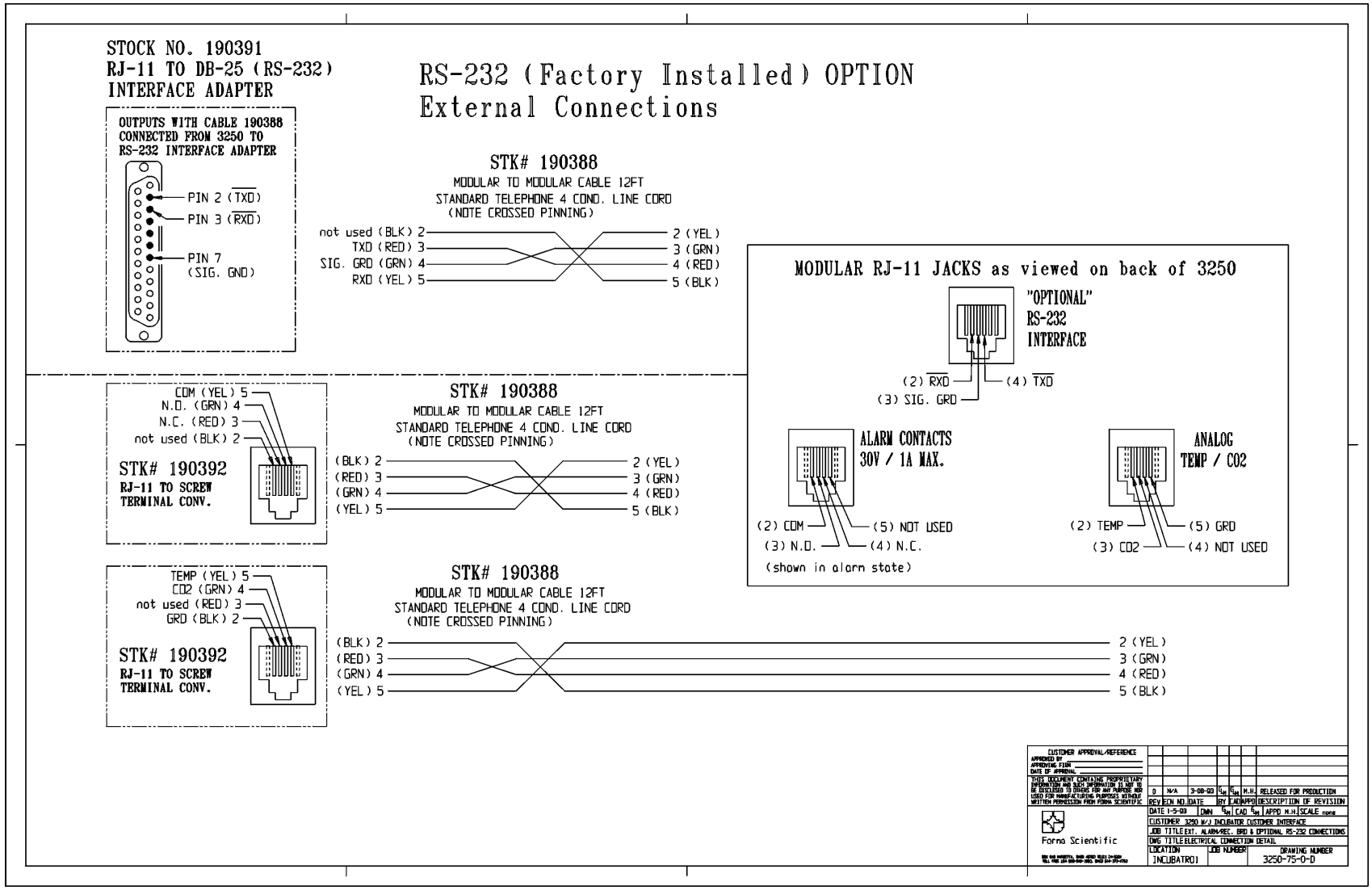
Examples: 37° C = 370 (Millivolts)
5% CO2 = 50 (Millivolts)

Connections are made by means of an RJ-11 (telephone style) jack, located on the rear of the incubator.

2.18 Accessory Outlet

A single, grounded accessory outlet is located on the bottom, rear of the incubator, left-hand side (120 Volt, 50 Watt maximum).

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SECTION 3 - OPERATION

3.1 Factory Setpoints

The incubator is shipped from the factory with the following setpoints. To change these setpoints, please refer to the appropriate operation sections.

The ACCESS CODE is set at (0000). Range is from (0000) to (9999). This access code must be used to view or change any setpoint. To change the access code, please refer to Section 5.6.

The TEMPERATURE SETPOINT is set at (+5° C). At this temperature all chamber heaters are deactivated. All chamber heaters become operational at and above (+5.1° C).

Caution: Do not run incubator above +5° C until it has been properly filled. If the water jacket is dry, damage to the heaters will occur!

Temperature adjustment is from (+5° C to +50° C). Temperature Range is +5 ºC above ambient to +50 ºC.

The CO_2% is set at 0%. Range is from 0% to 20%.
This CO_2 sensor is factory calibrated at the following conditions; (stable at +37 ºC and humidified). The CO_2 ZERO must be recalibrated if (1) Temperature setpoint is other than +37 ºC or (2) Humidification is not being used in cabinet (Refer to Section 3.3 Titled "Humidity (RH) Set Sequence" to insure that the Humidity mode is properly set. Also refer to Section 5 Titled "CALIBRATION PROCEDURES".

In the SET menu the Humidity mode is factory defaulted "RH: "yes".

Note: If the humidity pan is not being used, please set this mode to "RH: "no".

3.2 Overview of Controls (Refer to Figure 3.1)

a. Power Switch/Resettable Circuit Breaker

The main power switch (located behind the bottom access panel) controls the ON/OFF power to the unit. The power switch also acts as a resettable circuit breaker. If an overload condition occurs, the built-in circuit breaker trips and the power switch reverts to the "OFF" position. Turning the power switch back to "ON" resets the circuit breaker.

Note: If the circuit breaker trips again within a short time period, the unit should be checked by a qualified electrician.

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b. Over Temp Setpoint Adjustment Tool

A small screwdriver, (located behind the bottom access panel) directly to the left side of the power switch, has been provided for setting the over temp setpoint. Twist the knob and pull out to release screwdriver.

c. Audible Alarm

The audible alarm is a pulsing "beep" tone that signals an alarm condition. To silence the alarm, press the far right key, beneath the displayed words "Alarm Reset ⇩". The alarm will be silenced for approximately 15 minutes on all alarm conditions, with the exception of the "Add water to jacket" alarm, which will be silenced for approximately 30 minutes. The alarm message remains in the display until the condition is corrected and the reset key is pressed again. If the alarm condition is corrected before the audible alarm is silenced from the keypad, the audible alarm shuts off automatically. The message remains in the display to indicate that the alarm occurred. Only active alarms will be delayed. New alarms get immediate response. When multiple alarm conditions occur, the messages will be displayed sequentially.

d. Gas Sample Port (microbiological filtered)

Note: Sample port filter rating = 0.3 micron DOP particles at 99.97% efficiency.

A serrated nylon gas sample port (located on the upper right front corner) has been provided for checking the CO_2 percentage by an independent measuring device. (e.g. Fyrite).

Caution: The gas sample port should never be capped as it serves as a vent for the incubator chamber.

e. Drain Valve

The drain valve is located behind the bottom front access panel, directly to the left of the adjustment screwdriver. To gain access to the drain valve, remove the two screws securing the drain valve cover plate. To drain the water jacket:

1. Make certain valve is in the "OFF" position.
2. Remove plug from end of valve.
3. Thread drain valve fitting (supplied) into end of valve.
4. Attach a piece of 3/8" ID vinyl tubing to the drain valve fitting. Run the vinyl tubing to a suitable drain or container.
5. Turn drain valve knob to the open position.

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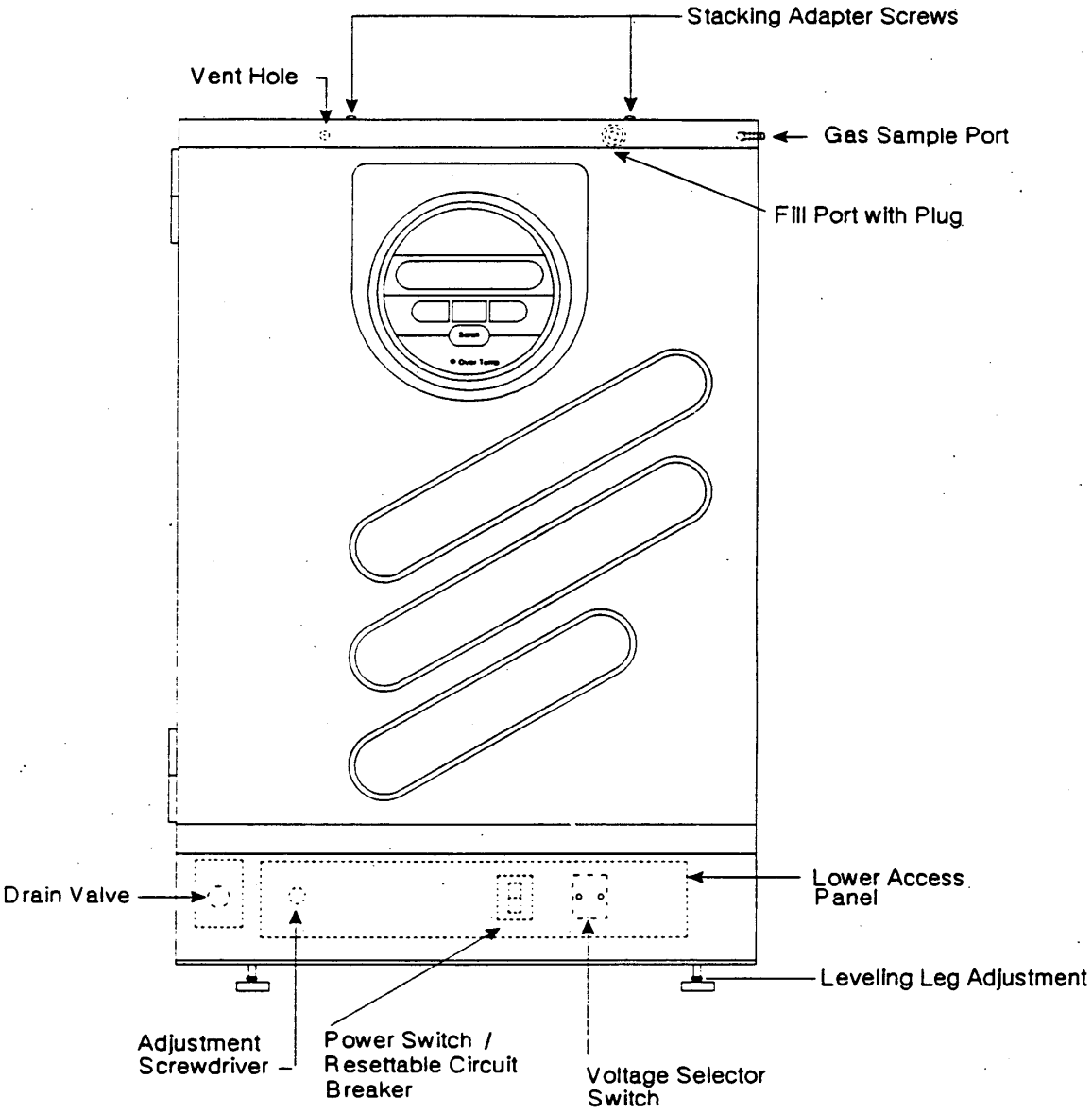


Figure 3.1
Incubator Front View

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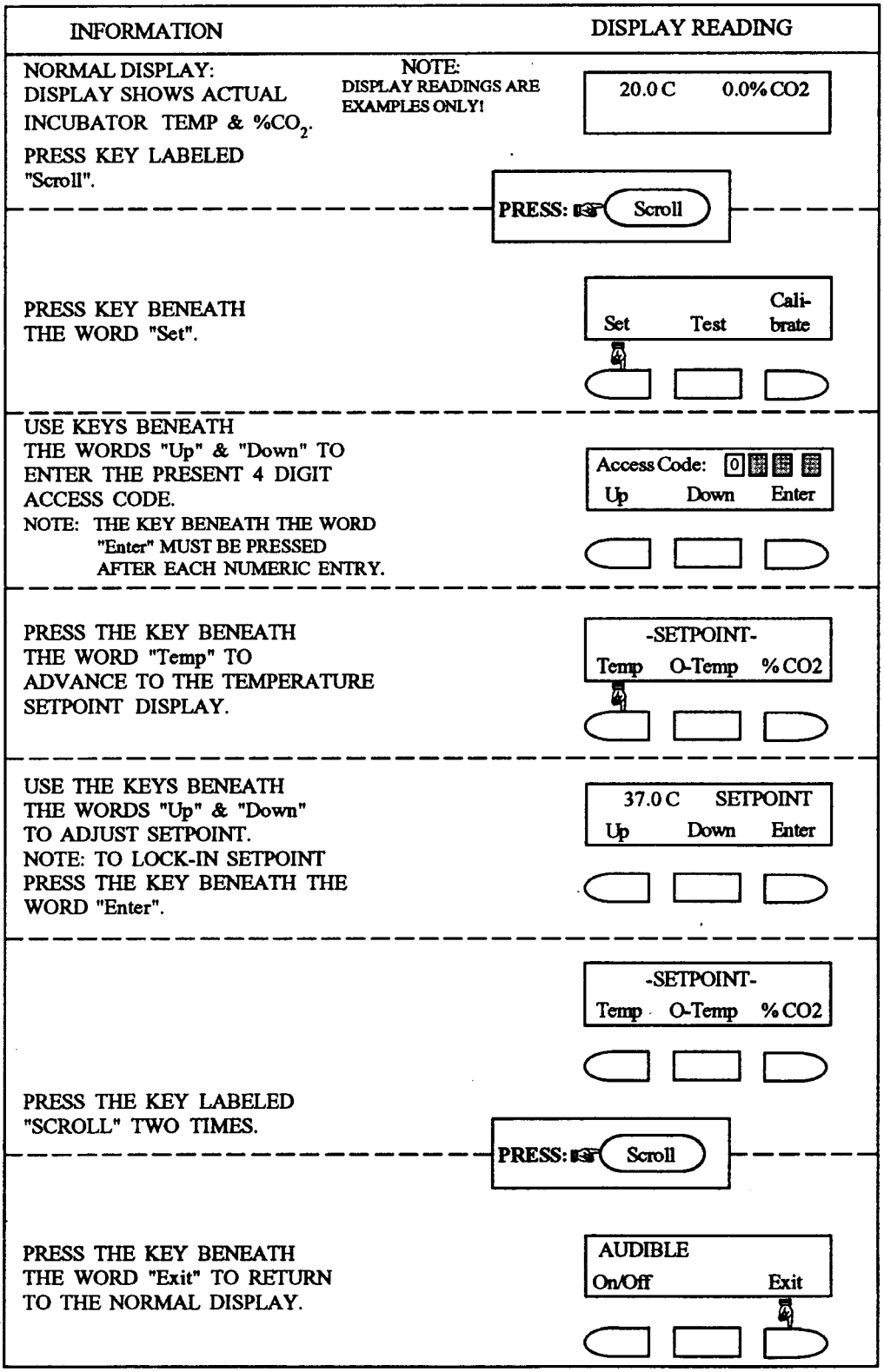
3.3 Operation of "SET" Modes

Listed below and on the following pages are the operation procedures for the three main set modes.

1. Temperature Set Sequence
2. CO_2 Set Sequence
3. Overtemp Set Sequence

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TEMPERATURE SET SEQUENCE



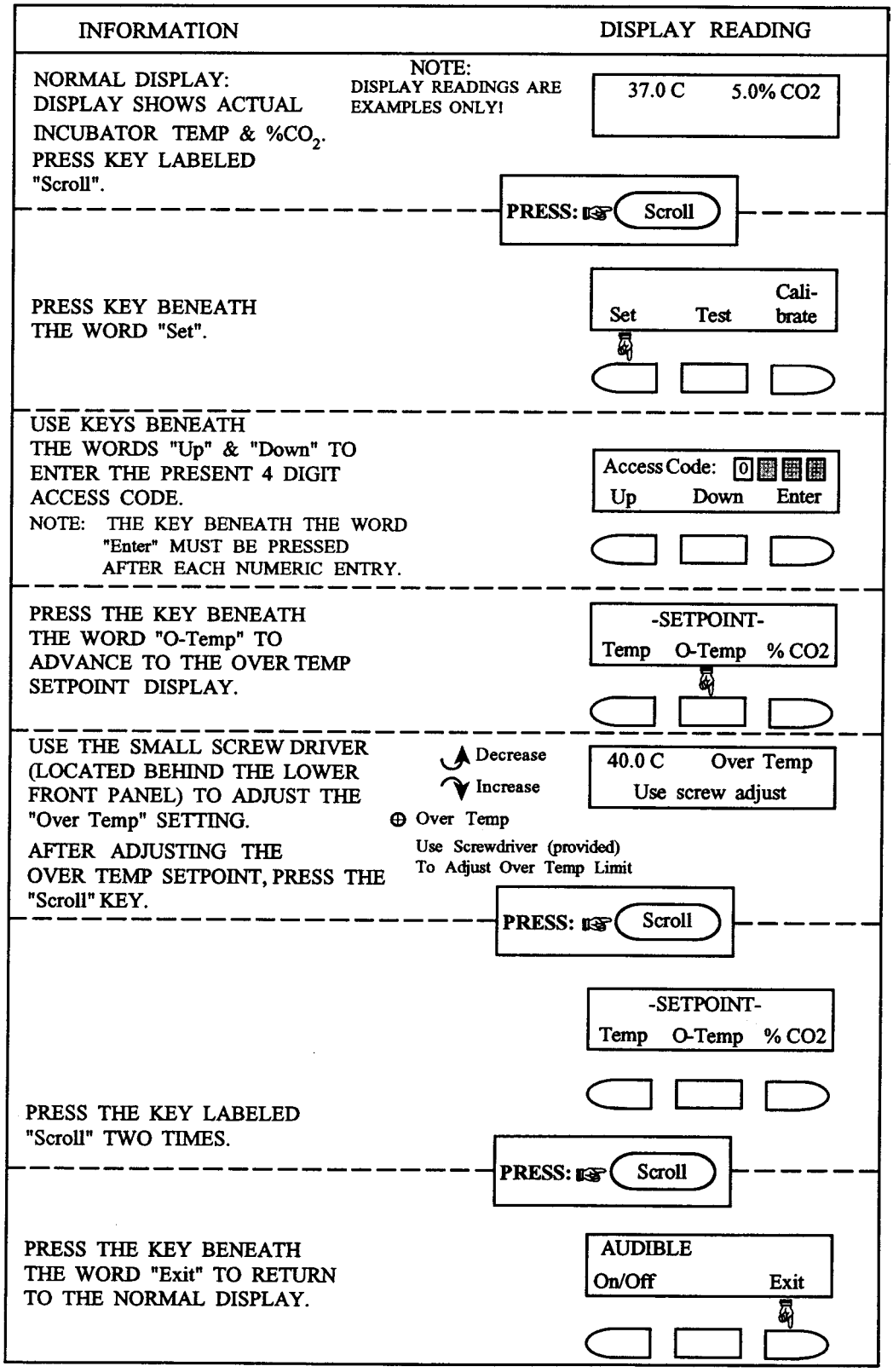
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CO_2 SET SEQUENCE

INFORMATION	DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & %CO_2. NOTE: DISPLAY READINGS ARE EXAMPLES ONLY!	37.0 C 0.0% CO2
PRESS KEY LABELED "Scroll".	PRESS: ☞ Scroll
PRESS KEY BENEATH THE WORD "Set".	Set Test Cali-brate
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE PRESENT 4 DIGIT ACCESS CODE. NOTE: THE KEY BENEATH THE WORD "Enter" MUST BE PRESSED AFTER EACH NUMERIC ENTRY.	Access Code: 0 Up Down Enter
PRESS THE KEY BENEATH THE WORD "%CO2" TO ADVANCE TO THE %CO_2 SETPOINT DISPLAY.	-SETPOINT- Temp O-Temp % CO2
USE THE KEYS BENEATH THE WORDS "Up" & "Down" TO ADJUST %CO_2. NOTE: TO LOCK-IN SETPOINT PRESS THE KEY BENEATH THE WORD "Enter".	SETPOINT: 5.0% CO2 Up Down Enter
	-SETPOINT- Temp O-Temp % CO2
PRESS THE KEY LABELED "Scroll" TWO TIMES.	PRESS: ☞ Scroll
PRESS THE KEY BENEATH THE WORD "Exit" TO RETURN TO THE NORMAL DISPLAY.	AUDIBLE On/Off Exit

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OVER-TEMP SET SEQUENCE



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Door Heat Set Sequence

The door heat helps control door condensation in extreme environments. This heat control may be set from 0% to 100% in increments of 1%. The door heat control is preset at 75% from the factory. Please refer to the procedure on the following pages, for setting the Door Heat %.

Note: The door heat control should be changed *only* under extreme ambient conditions.

Caution: Consult Forma Scientific, Inc., Service department, before making any door heat adjustments, as this will affect temperature uniformity. Call 1-800-848-3080 OR FAX 1-614-373-4189.

(Continued)

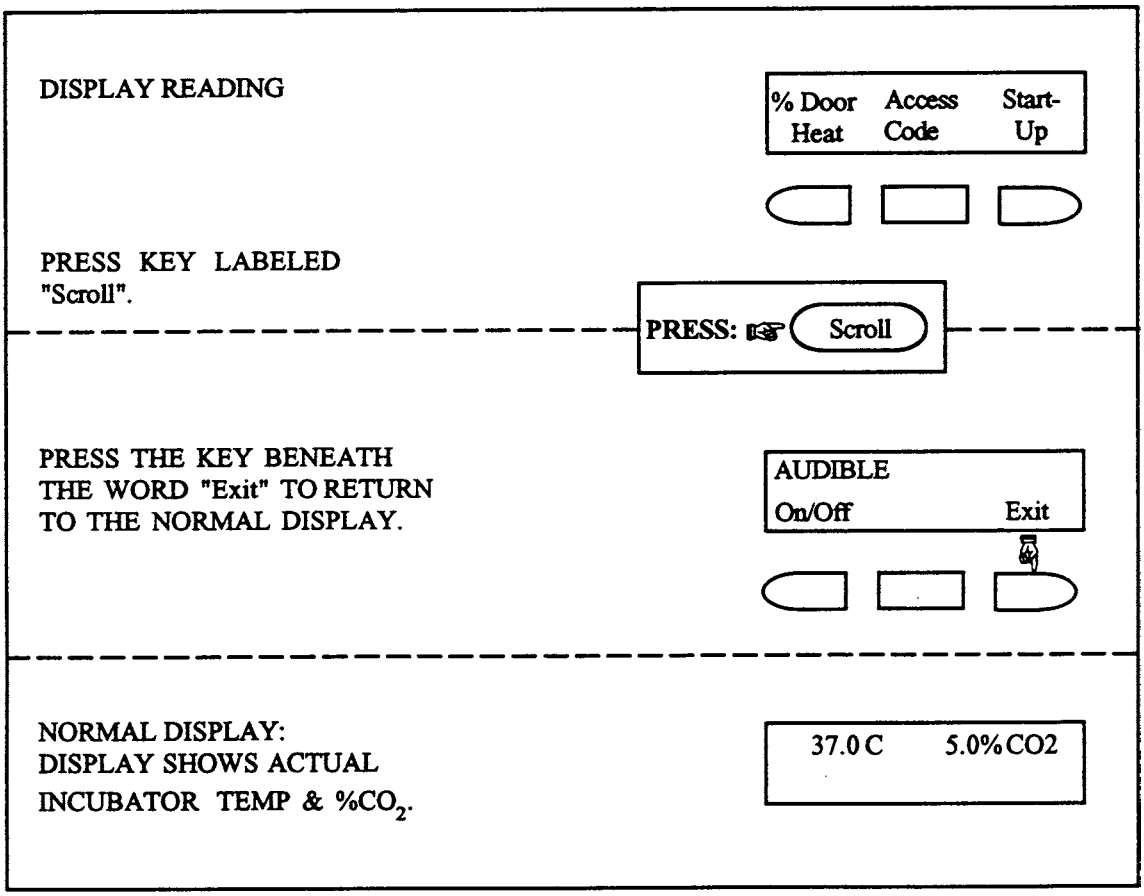
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SETTING THE DOOR HEAT %

INFORMATION	DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & %CO_2. NOTE: DISPLAY READINGS ARE EXAMPLES ONLY!	37.0 C 5.0% CO2
PRESS KEY LABELED "Scroll".	PRESS: ☞ Scroll
PRESS KEY BENEATH THE WORD "Set".	Set Test Cali-brate
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE PRESENT 4 DIGIT ACCESS CODE. NOTE: THE KEY BENEATH THE WORD "Enter" MUST BE PRESSED AFTER EACH NUMERIC ENTRY.	Access Code: 0 Up Down Enter
DISPLAY READING	-SETPOINT- Temp O-Temp % CO2
PRESS KEY LABELED "Scroll".	PRESS: ☞ Scroll
PRESS KEY BENEATH THE WORDS "% Door Heat".	% Door Heat Access Code Start-Up
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE DESIRED % OF DOOR HEAT. RANGE = 0% TO 100%. NOTE: TO LOCK-IN THE DOOR HEAT % VALUE, PRESS THE KEY BENEATH THE WORD "Enter".	Door Heat 75% Up Down Enter

continued

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Start-up Set Sequence

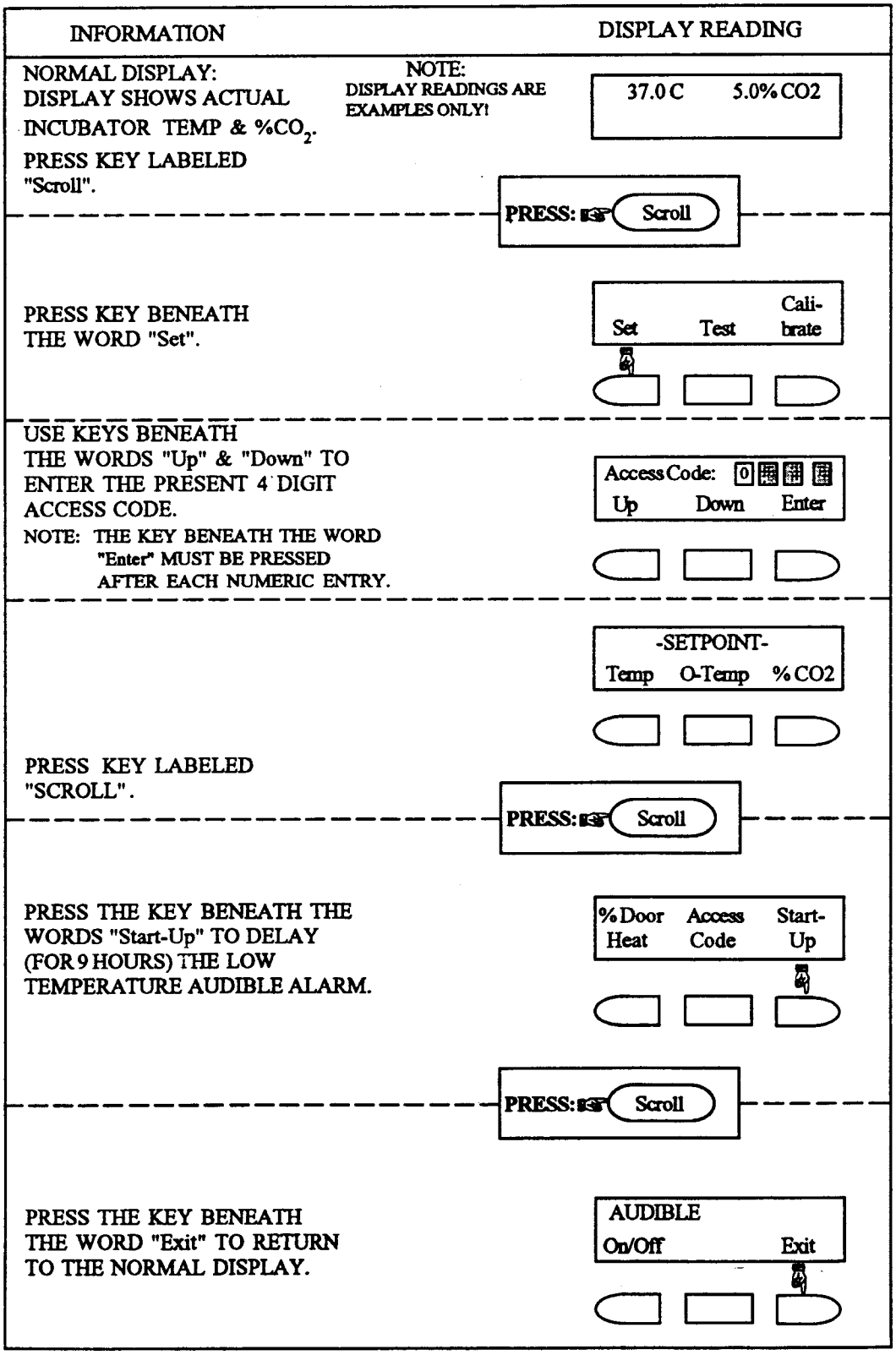
The Low Temperature alarm audible delay can be set to 9 hours by selecting the "Start-up" function from the "Set" menu. In addition, if the Add Water alarm is on, and the (Start-up) function is selected, all other alarms will be inhibited, until the water jacket is full and the "Jacket Full" message appears.

Alarms that are normally sounded after a time delay period will not appear until after the "Jacket Full" message appears, plus any remaining time delay. The "Add Water" alarm will still ring back, after its 30 minute delay period.

(Continued)

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START-UP SEQUENCE



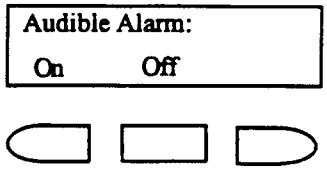
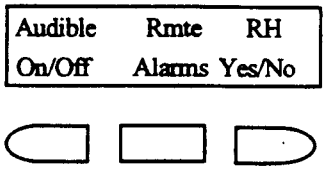
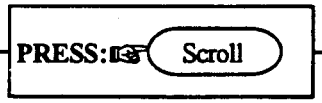
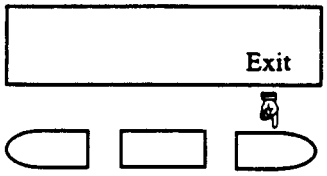
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AUDIBLE ALARM ENABLE/DISABLE SEQUENCE

INFORMATION	DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & $\%CO_2$. NOTE: DISPLAY READINGS ARE EXAMPLES ONLY!	37.0 C 5.0% CO2
PRESS KEY LABELED "Scroll".	PRESS: Scroll
PRESS KEY BENEATH THE WORD "Set".	Set Test Cali-brate
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE PRESENT 4 DIGIT ACCESS CODE. NOTE: THE KEY BENEATH THE WORD "Enter" MUST BE PRESSED AFTER EACH NUMERIC ENTRY.	Access Code: 0 Up Down Enter
	-SETPOINT- Temp O-Temp % CO2
PRESS KEY LABELED "Scroll" TWICE.	PRESS: Scroll
PRESS THE KEY BENEATH THE WORDS "Audible On/Off".	Audible On/Off Rmte Alarms RH Yes/No

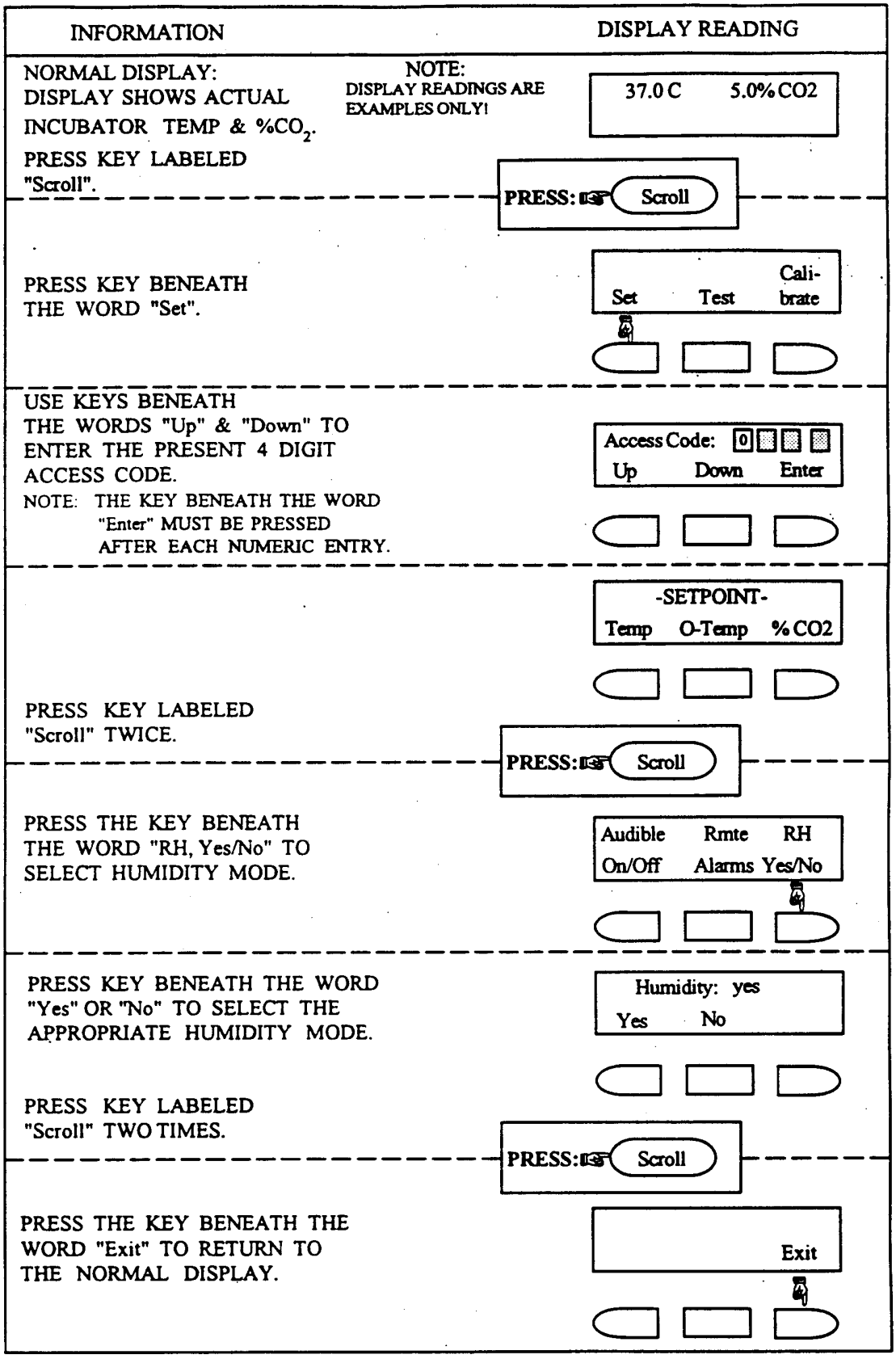
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INFORMATION	DISPLAY READING
PRESS KEY BENEATH THE WORD "On" OR "Off" TO SELECT THE APPROPRIATE AUDIBLE ALARM MODE.	
	
PRESS KEY LABELED "Scroll".	
PRESS THE KEY BENEATH THE WORD "Exit" TO RETURN TO THE NORMAL DISPLAY.	

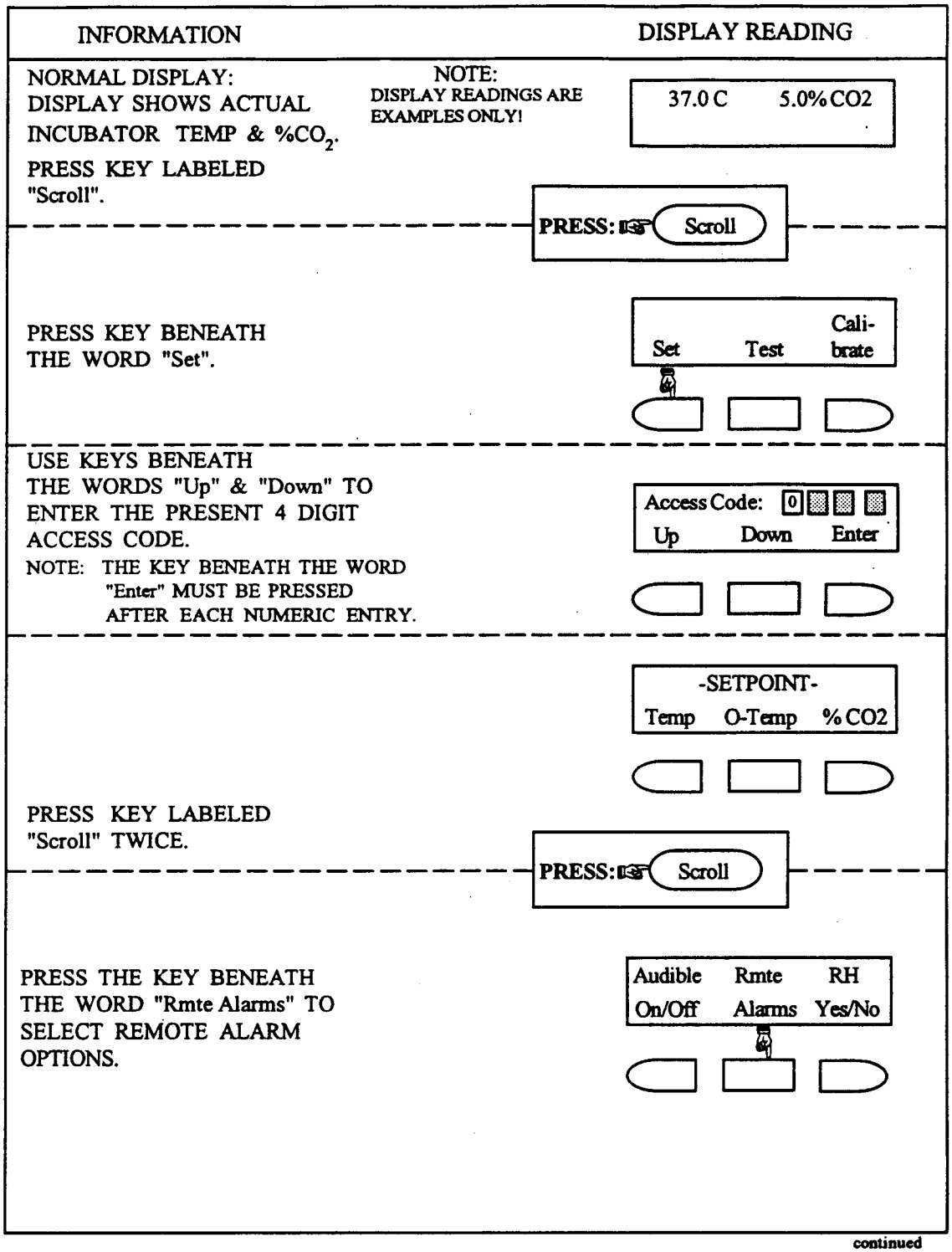
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HUMIDITY (RH) SET SEQUENCE



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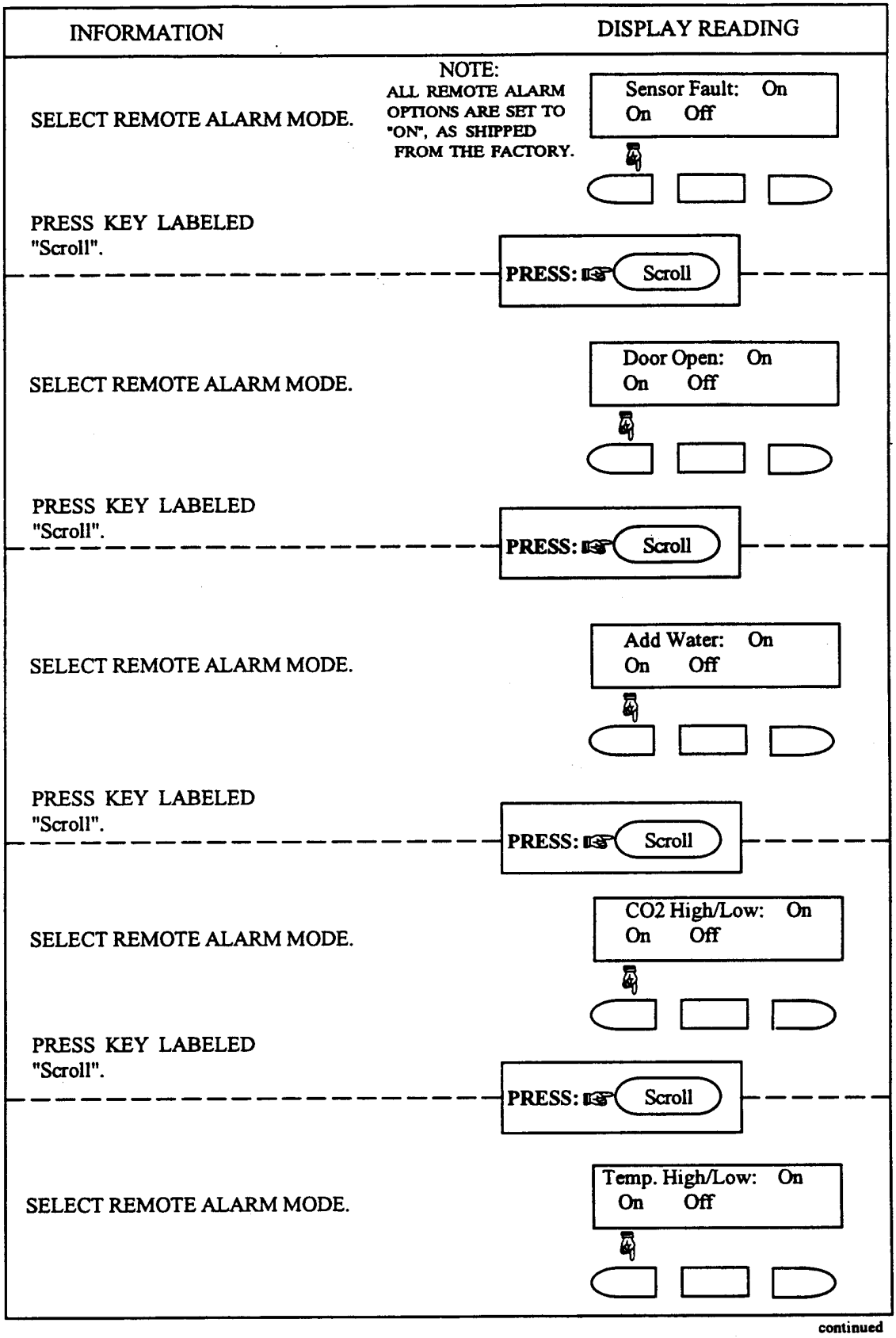
REMOTE ALARM SET SEQUENCE



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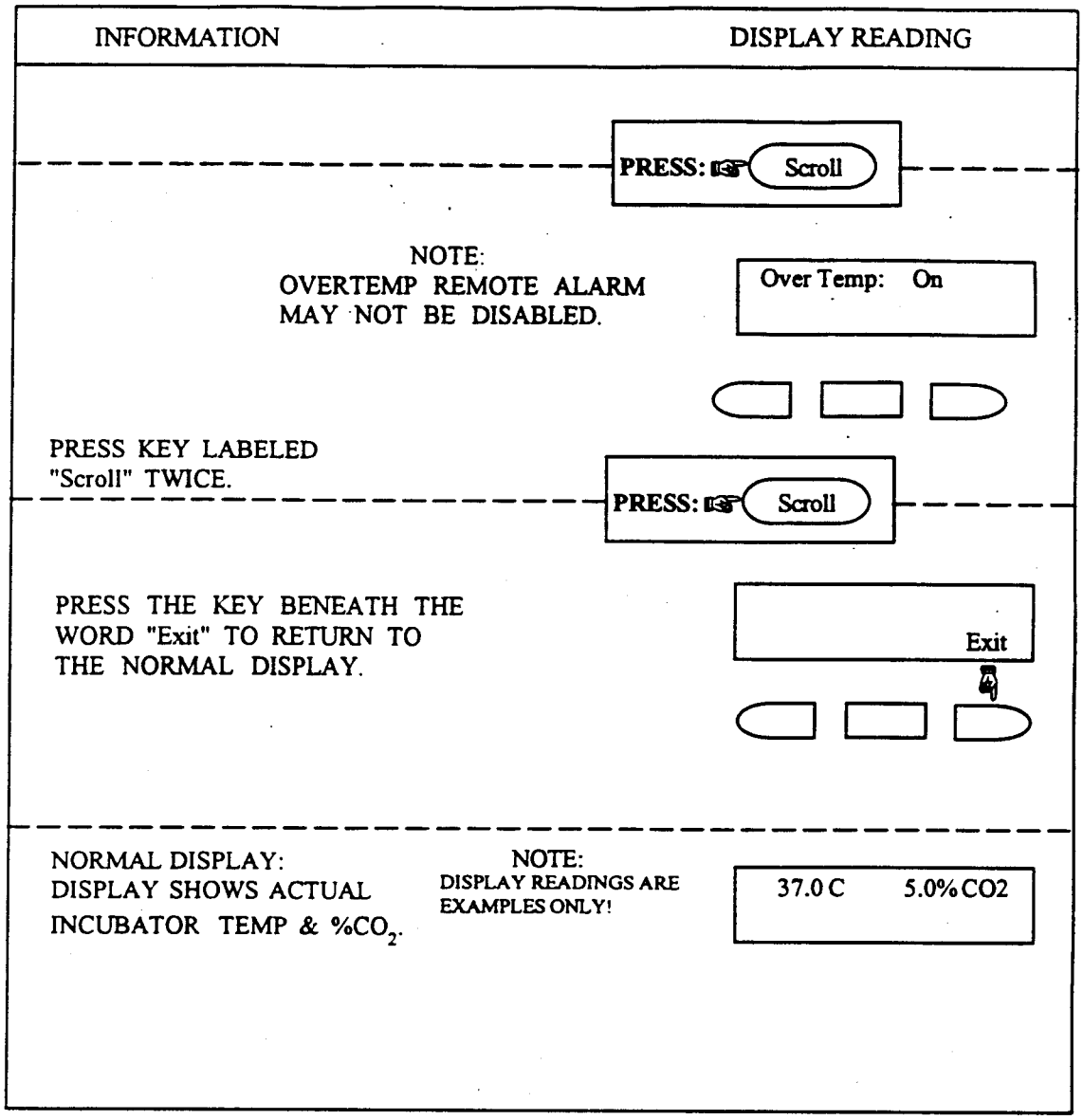
REMOTE ALARM SET SEQUENCE



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REMOTE ALARM SET SEQUENCE



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3.4 Alarms

The following charts represent the Model 3250 multiple alarm system.

Note: The alarm message remains in the display until the alarm condition is corrected and the reset key is pressed again.

3250 ALARMS

ALARM PRIORITY	CONDITION	DISPLAY MESSAGE	AUDIBLE DELAY	RESET DELAY (RINGBACK)
1	TEMP.> Overtemp setpoint	Overtemp Shutdown	0	15 minutes
2	Jacket temp. sensor fault	Jacket Temp. Sensor	0	15 minutes
3	CO_2 sensor fault	CO_2 Sensor	0	15 minutes
4	Chamber temp. sensor fault	Chamber Temp. Sensor	0	15 minutes
5	Outer door open	Door is Open	15 minutes	15 minutes
6	Low Water in Jacket	Add Water To Jacket	0	30 minutes
7	$\%CO_2$>setpoint +1%	CO_2 is High	15 minutes	15 minutes
8	$\%CO_2$<setpoint -1%	CO_2 is Low	15 minutes	15 minutes
9	Temp>setpoint +2°	Temperature is High	0	15 minutes
10	Temp<setpoint -2°	Temperature is Low	15 minutes	15 minutes

NOTES:

1. CO_2 alarms are de-activated when CO_2 setpoint = 0%.
2. When multiple alarms occur, messages will be displayed in sequence.
3. The add water audible alarm turns off when the jacket is full (unless another alarm is active). the words "jacket full" will then appear in the display as an alarm message for 30 seconds. if the audible has been silenced from the keypad, a 3 second tone will occur when the jacket is full.
4. The low temperature alarm audible delay can be set to 9 hours by selecting the "start-up" function from the "set" menu.
5. Temperature deviation alarms (9 & 10) are de-activated when the temperature setpoint + 5° c.
6. If the add water alarm is on, and the (start-up) function is selected, all other alarms will be inhibited, until the jacket is full.

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REMOTE ALARM CONTACT
Selection of Monitored Conditions

ALARM PRIORITY	CONDITION	MENU SELECTION	OPTION
1	TEMP.> Overtemp setpoint	OverTemp	(ON only)
2	Jacket temp. sensor fault	Sensor Fault	ON/OFF
3	CO_2 sensor fault	"	"
4	Chamber temp. sensor fault	"	"
5	Outer door open	Door Open	ON/OFF
6	Low Water in Jacket	Add Water	ON/OFF
7	%CO_2>setpoint +1%	CO_2 High/Low	ON/OFF
8	%CO_2<setpoint -1%	"	"
9	Temp>setpoint +2°	Temperature High/Low	ON/OFF
10	Temp<setpoint -2°	"	"

NOTE: Remote Alarm mode is set to "ON", as shipped from the factory. Alarm conditions (2-10) may be disabled by placing them in the "OFF" mode.

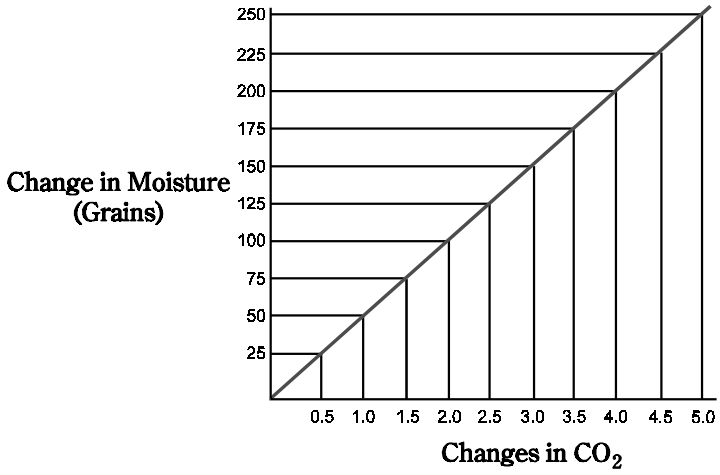
SILENCING ALARMS
(Allowing Ringback Feature)

INFORMATION		DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & %CO2	NOTE: DISPLAY READINGS ARE EXAMPLES ONLY.	3.70 C 4.0% CO2 CO2 is Low
PRESS KEY BENEATH THE ARROW SYMBOL. (SILENCES THE AUDIBLE ALARM FOR THE TIME DELAY PERIOD)		3.70 C 0.0% CO2 Alarm Reset ↓

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3.5 Overview of Humidification and CO_2

Thermal conductivity of the air inside of the incubator is affected not only by the quantity of CO_2 present, but by the quantity of water vapor present in the incubator atmosphere. This effect is linearly related to the absolute humidity of the atmosphere (See figure below).



Moisture Effect on CO_2 Control Calibration

When monitoring the effects of CO_2, absolute humidity must be held constant so any change in thermal conductivity is caused only by a change in the CO_2 concentration. Under the worst circumstances, a change in absolute humidity could cause such a significant change in thermal conductivity that the controller could shift the CO_2 content by as much as 4%.

Maintaining the water level inside the incubator is a simple procedure, but an important one to keep the humidity in the incubator constant. Any water pan, used in lieu of flooding the incubator floor, must be stainless steel and at least 187 square inches of surface area. Tests indicate that smaller pans, bowls or non-metallic pans do not provide adequate humidification, which can lead to incubator humidity variations with ambient humidity shifts, resulting in CO_2 changes in the incubator.

When operating a dry incubator, as opposed to a humidified one, ambient humidity fluctuations will affect CO_2 calibrations. Since the fluctuations possible in extreme ambient changes have less effect on the total absolute humidity, the CO_2 calibration can be affected by as much as 1.5%.

When a change in humidity or temperature is needed, the CO_2 control can be easily zeroed for the new condition.

Temperature changes have little affect on CO_2 calibration, but do cause large changes in the absolute humidity which is reflected in changes in CO_2 calibration.

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SECTION 4 - ROUTINE MAINTENANCE

4.1 Disinfecting the Incubator Interior

Use an appropriate disinfectant. All articles and surfaces to be disinfected must be thoroughly cleaned and rough dried.

Danger: Alcohol, even a 70% solution, is volatile and flammable. Use it only in a well ventilated area that is free from open flame. If any component is cleaned with alcohol, do not expose the component to open flame or other possible hazard.

Caution: Do not use strong alkaline or caustic agents. Stainless steel is corrosion resistant, not corrosion proof.

Caution: Do not use solutions of sodium hypochlorite (purex, clorox, etc.), As they will cause pitting and rust.

1. Remove and wash shelves, side shelf supports and rear blower plenum. Wash all interior surfaces, taking care not to saturate the CO_2 sensor.
2. Rinse the surfaces at least twice with sterile distilled water (50K to 1M Ohm).
3. Thoroughly wash the inner door gasket.
4. Wash inside of glass door with solution, and rinse with sterile distilled water.
5. Rinse all washed surfaces with sterile distilled water.
6. Repeat rinsing until you are satisfied that all of the disinfectant-detergent has been removed.
7. If desired, all surfaces can then be wiped or sprayed with 70% alcohol.
8. Reinstall the rear blower plenum, side shelf supports and shelves.

Caution: After completing the decontamination procedure, it is recommended that the incubator be run and tested before placing any valuable contents inside the incubator chamber.

4.2 Cleaning the Cabinet Exterior

The incubator exterior may be cleaned with soap and water and a general use laboratory disinfectant.

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SECTION 5 - CALIBRATION PROCEDURES

5.1 Calibration Frequency

Calibration frequency is dependent upon use, environmental conditions and accuracy required. Forma recommends a three to four month calibration cycle as a good starting point.

Caution: Before making any calibrations or adjustments to the unit, it is imperative that all reference instruments are properly calibrated.

Note: The calibration procedure may be aborted at any time by repeatedly pressing the "Scroll" key, until the "Exit" display appears.

When in the Set or Calibrate modes, the key beneath the word "Enter" must be pressed to store new values. Pressing the key beneath the word "Scroll" causes previous values to be retained, even if the displayed value has been changed from the keypad.

The display will return to the normal operation mode (Temp and CO_2) after five minutes without a key input.

5.2 Calibrating the %CO_2 Zero

The CO_2 zero adjustment is needed when the incubator is operating at a temperature other than 37C, or non-elevated humidity. The displayed CO_2 value can be adjusted from the keypad to match an independently measured value.

Note: Permit sufficient time for temperature and humidity stabilization. If after zeroing the cabinet, the CO_2 display does not agree with the independent test instrument, please refer to Section 5.3, Titled "CALIBRATING THE %CO_2 SPAN".

Please refer to the procedure on the following page, titled "CALIBRATING THE %CO_2 ZERO".

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CALIBRATING THE %CO_2 ZERO

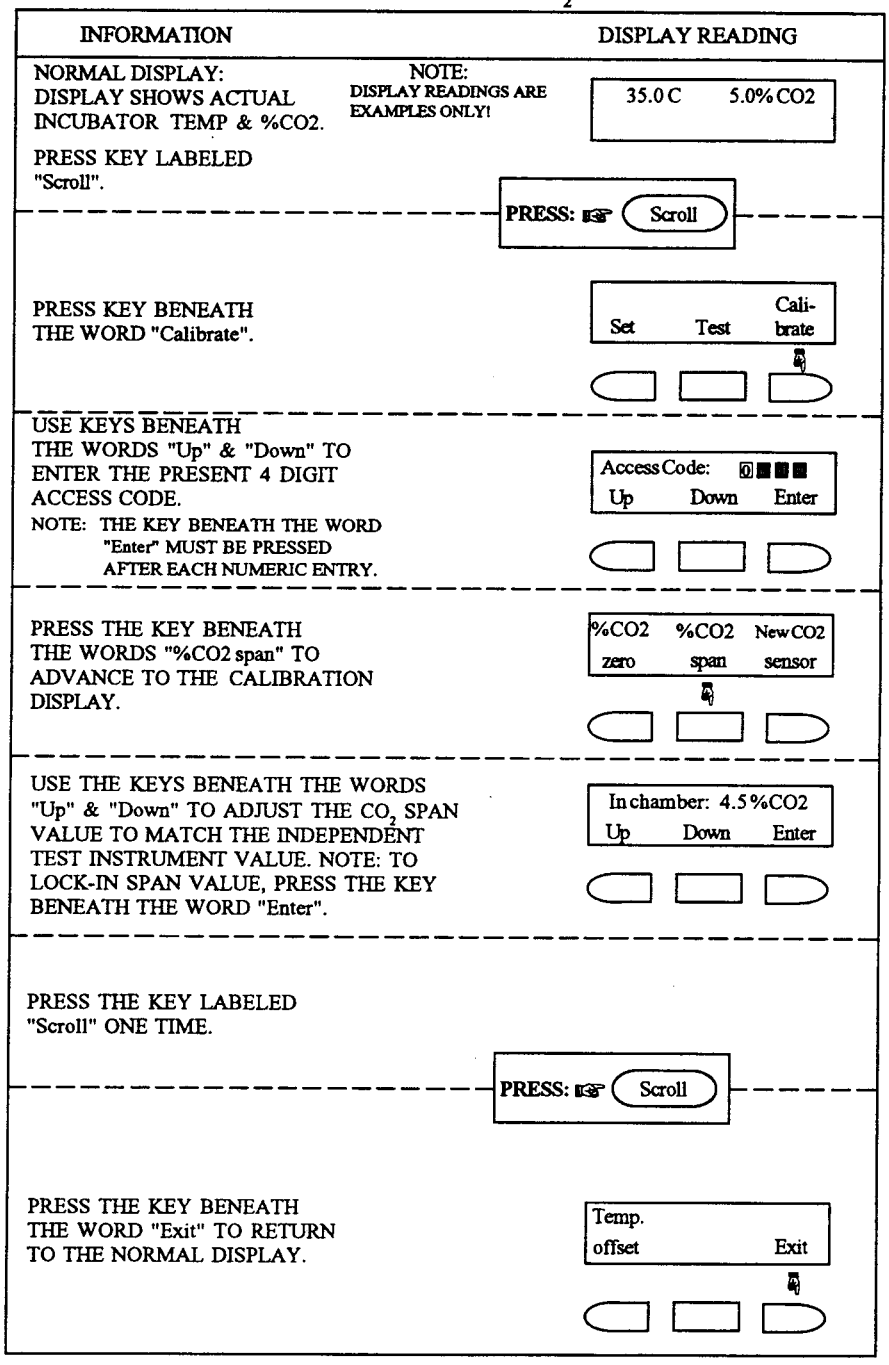
INFORMATION	DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & %CO2. NOTE: DISPLAY READINGS ARE EXAMPLES ONLY!	35.0 C 0.5% CO2
PRESS KEY LABELED "Scroll".	PRESS: ☞ Scroll
PRESS KEY BENEATH THE WORD "Calibrate".	Set Test Cali-brate
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE PRESENT 4 DIGIT ACCESS CODE. NOTE: THE KEY BENEATH THE WORD "Enter" MUST BE PRESSED AFTER EACH NUMERIC ENTRY.	Access Code: 0 ■ ■ ■ Up Down Enter
PRESS THE KEY BENEATH THE WORDS "%CO2 zero" TO ADVANCE TO THE CALIBRATION DISPLAY.	%CO2 zero %CO2 span New CO2 sensor
USE THE KEYS BENEATH THE WORDS "Up" & "Down" TO ADJUST THE CO_2 ZERO VALUE. NOTE: TO LOCK-IN ZERO VALUE, PRESS KEY BENEATH THE WORD "Enter".	In chamber: 0.2 %CO2 Up Down Enter
PRESS THE KEY LABELED "Scroll" ONE TIME.	PRESS: ☞ Scroll
PRESS THE KEY BENEATH THE WORD "Exit" TO RETURN TO THE NORMAL DISPLAY.	Temp. offset Exit

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5.3 Calibrating the %CO_2 Span

The CO_2 span adjustment must be done *only* after CO_2 zero calibration has been properly set. The displayed CO_2 value can be adjusted from the keypad to match an independently measured value. Do not adjust span value below 4.0%. If necessary, raise the setpoint to get a higher reading.

CALIBRATING THE %CO_2 SPAN



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5.4 Calibrating the New CO_2 Sensor

The CO_2 sensors used in the 3250 are all tested under controlled environmental conditions prior to being installed or shipped as replacements. Their outputs at 0% and 10% CO_2 while at 37C and high humidity are measured and recorded. These values are used to derive the "Z" and "S" (Zero and Span) numbers printed on each sensor's serial number tag.

By simply entering the "Z" and "S" numbers from the keypad, a newly installed CO_2 sensor is immediately calibrated for operation at *37C and high humidity*.

Record the "Z" and "S" numbers from the sensor serial tag. To enter the proper "Z" and "S" numbers, access the "New CO_2 sensor" mode. The "Z" number will appear in the display first. Enter/verify the proper "Z" number. Press the key beneath the word "Enter" and the "S" number will appear in the display. Enter/verify the proper "S" number. Press the key beneath the word "Enter". At this time the controller will re-compute the CO_2 calibration values. This will override any zero or span calibrations that may have been previously done since the last "Z" and "S" number entry.

If you are verifying the "Z" and "S" numbers only, press the key under "Enter" while the "Z" number is displayed, then press the "Scroll" key while you are in the "S" number display.

Refer to the procedure on the following page titled "Calibrating the New CO_2 Sensor".

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CALIBRATING THE NEW CO_2 SENSOR

INFORMATION	DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & %CO2. NOTE: DISPLAY READINGS ARE EXAMPLES ONLY! PRESS KEY LABELED "Scroll".	37.0 C 5.0% CO2 PRESS: ☞ Scroll
PRESS KEY BENEATH THE WORD "Calibrate".	Set Test Cali-brate
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE PRESENT 4 DIGIT ACCESS CODE. NOTE: THE KEY BENEATH THE WORD "Enter" MUST BE PRESSED AFTER EACH NUMERIC ENTRY.	Access Code: 0 ■ ■ ■ Up Down Enter
PRESS THE KEY BENEATH THE WORDS "New CO2 sensor" TO ADVANCE TO THE CALIBRATION DISPLAY.	%CO2 zero %CO2 span New CO2 sensor
USE THE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE "Z" READING FROM THE NEW CO_2 SENSOR. NOTE: TO LOCK-IN THIS NEW NUMBER, PRESS THE KEY BENEATH THE WORD "Enter".	ENTER Z: -269 Up Down Enter
USE THE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE "S" READING FROM THE NEW CO_2 SENSOR. NOTE: TO LOCK-IN THIS NEW NUMBER, PRESS THE KEY BENEATH THE WORD "Enter". PRESS THE KEY LABELED "SCROLL" ONE TIME.	ENTER S: 561 Up Down Enter PRESS: ☞ Scroll
PRESS THE KEY BENEATH THE WORD "Exit" TO RETURN TO THE NORMAL DISPLAY.	Temp. offset Exit

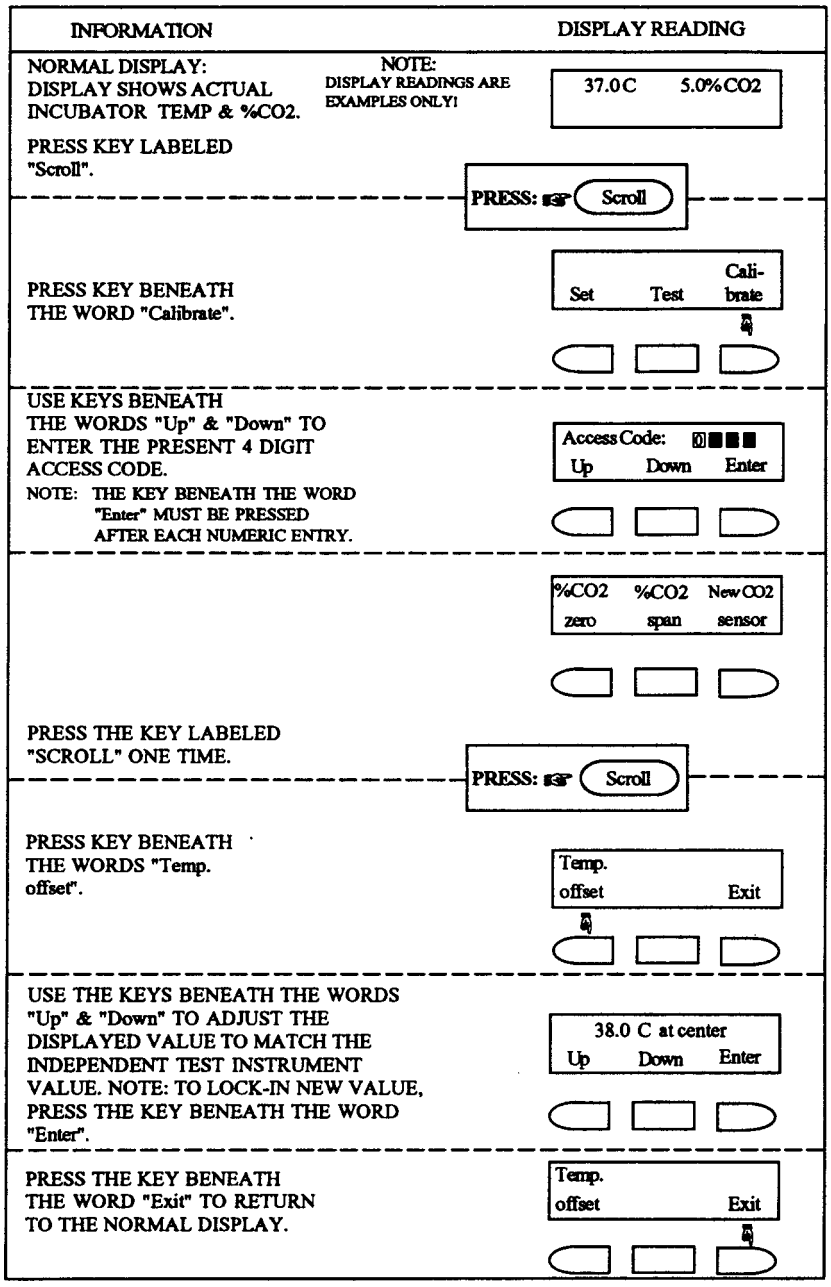
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5.5 Calibrating the Temperature Offset

Note: The "Temperature Offset" calibration adjusts the AIR, WATER, AND OVERTEMP setpoint readings (by the same amount) with a limit of +/- 2° C.

Place a calibrated independent test instrument in the geometric center of the interior cabinet. Allow chamber temperature to stabilize. Enter the "Temp. offset" calibrate mode. The cabinet temperature value will be displayed. To calibrate, press the keys beneath the words "Up" and "Down" to match the ACTUAL chamber temperature. Press the key beneath the word "Enter" to store the new calibration value.

CALIBRATING THE TEMPERATURE OFFSET



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5.6 Changing the Access Code

Note: Key sequences start from the normal display.

1. Press key labeled "Scroll".
2. Press key beneath the word "Set".
3. Enter the present 4 digit access code.

Note: The key beneath the word "Enter" must be pressed after each numeric entry.

4 Press key labeled "Scroll".

5 Press the key beneath the word "Access Code".

6. Using the keys beneath the words "Up & Down", enter the NEW 4 digit access code.

Note: The key beneath the word "Enter" must be pressed after each numeric entry.

7. Press key labeled "Scroll".
8. Press key beneath the word "Exit" to return to the normal display.

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SECTION 6 - TESTING PROCEDURES

The purpose of the TEST MODE is to assist the user/service technician in the prompt isolation of system failures.

Note: If test data reads outside the normal range, please consult the Forma Scientific Service department at 1/800/848/3080 or 614/373/4763 from 8:00am to 5:00pm EST, or fax 614/373/4189 for further instructions.

6.1 Heater Test (Amp Probe needed)

In the HEATER TEST SEQUENCE you can verify operation of all heaters. Open component drawer and locate "J5" on circuit board. Place an amp probe around the black wire from "J5" and enter the test mode. Compare values to the table listed below. NOTE: ALL VALUES ARE APPROXIMATE! In the "Full heat" mode the Door, Collar and Chamber heaters are turned on together. In the "Door heat" mode only the Door heater is turned on. In the "Main heat" mode the Chamber and Collar heaters are turned on together. Refer to the "HEATER TEST SEQUENCE" Guide on the following page.

TEST CONDITIONS: 115V (+/-) 5%, 230V (+/-) 5%

APPROXIMATE HEATER AMPERAGE
Full heat @115V: Minimum= 2.6 amps, Maximum= 4.0 amps
Full heat @230V: Minimum= 1.3 amps, Maximum= 2.0 amps
Door heat @115V: Minimum= 1.2 amps, Maximum= 1.8 amps
Door heat @230V: Minimum= 0.6 amps, Maximum= .9 amps
Main heat @115V: Minimum= 1.4 amps, Maximum= 2.1 amps
Main heat @230V: Minimum= 0.7 amps, Maximum= 1.1 amps

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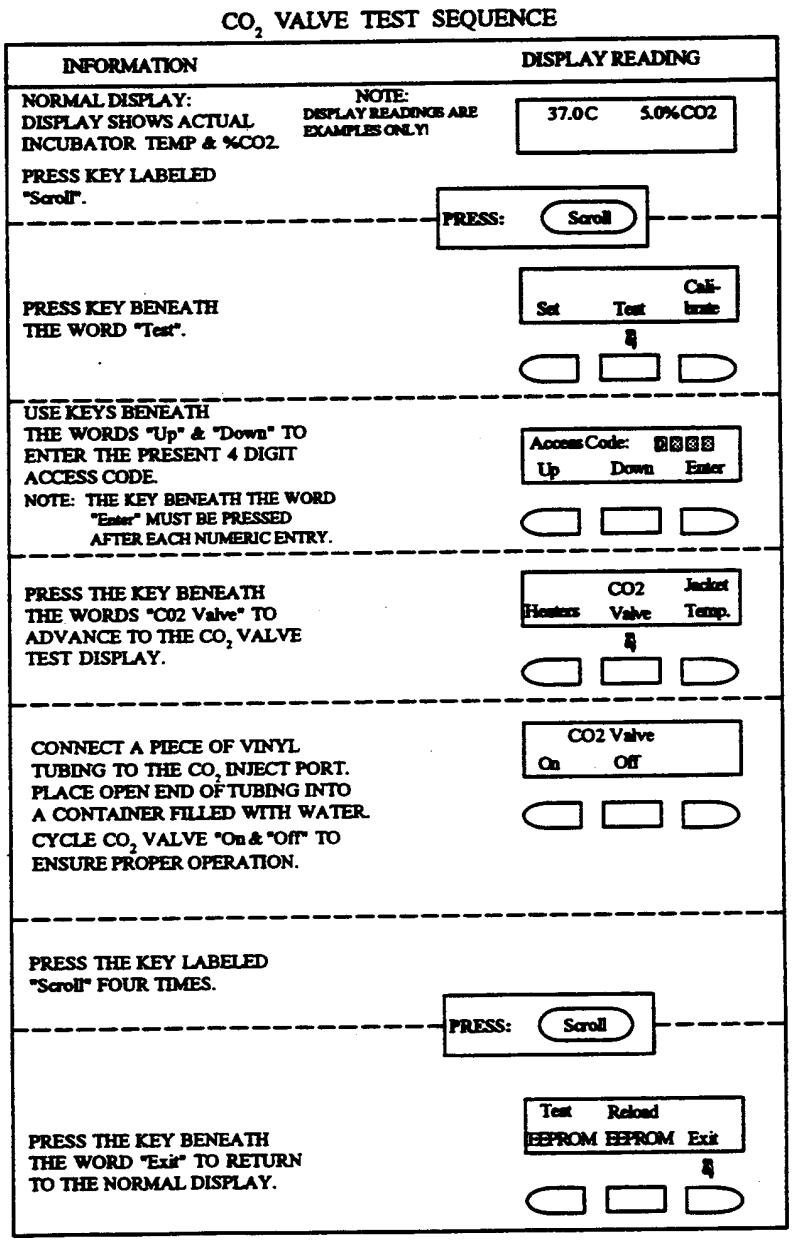
HEATER TEST SEQUENCE

INFORMATION	DISPLAY READING
NORMAL DISPLAY: DISPLAY SHOWS ACTUAL INCUBATOR TEMP & %CO_2. PRESS KEY LABELED "Scroll". NOTE: DISPLAY READINGS ARE EXAMPLES ONLY!	37.0 C 5.0% CO2
	PRESS: ☞ Scroll
PRESS KEY BENEATH THE WORD "Test".	Set Test Cali-brate
USE KEYS BENEATH THE WORDS "Up" & "Down" TO ENTER THE PRESENT 4 DIGIT ACCESS CODE. NOTE: THE KEY BENEATH THE WORD "Enter" MUST BE PRESSED AFTER EACH NUMERIC ENTRY.	Access Code: 0■■■ Up Down Enter
PRESS THE KEY BENEATH THE WORD "Heaters" TO ADVANCE TO THE HEATER TEST DISPLAY.	Heaters CO2 Valve Jacket Temp.
WHILE USING AN AMP PROBE, PRESS THE DESIRED KEY AND VERIFY HEATER OPERATION.	Full heat Door heat Main heat
PRESS THE KEY LABELED "SCROLL" FOUR TIMES.	PRESS: ☞ Scroll
PRESS THE KEY BENEATH THE WORD "Exit" TO RETURN TO THE NORMAL DISPLAY.	Test EEPROM Reload EEPROM Exit

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6.2 CO_2 Valve Test (supplies needed: small container of water, 1ft. of 1/4" ID vinyl tubing)

In the "CO_2 VALVE TEST" sequence you can verify proper operation of the CO_2 valve. Connect a piece of vinyl tubing to the CO_2 inject port (located on the blower plate) and place the other end in the container of water. Press the key beneath the words "On" and "Off" and check the container for bubbles. Bubbles should appear in the "On" mode and no bubbles should appear in the "Off" mode. Bubbles appearing in the "Off" mode indicates a leaky CO_2 valve.

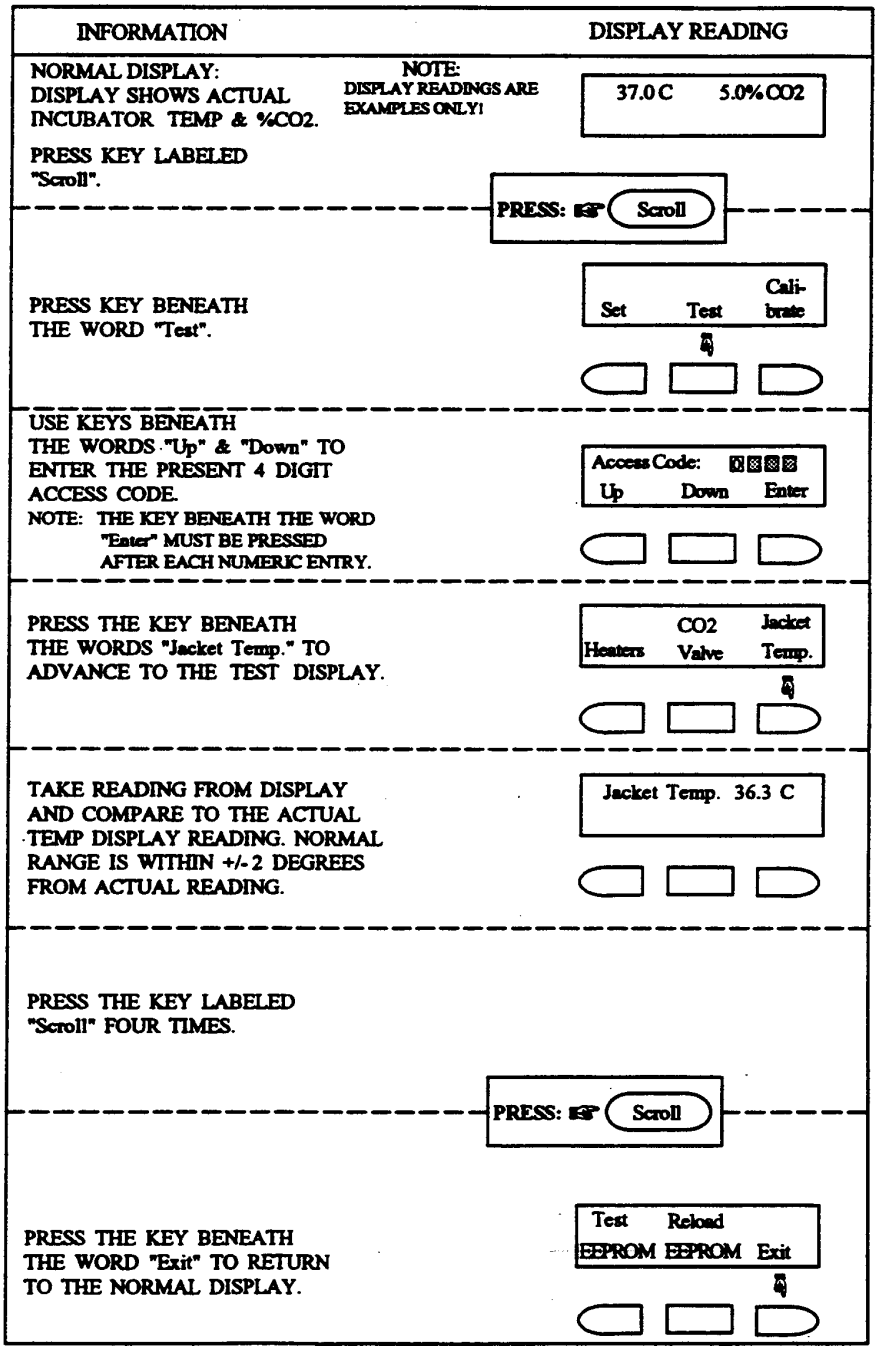


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6.3 Display Jacket Temperature Test

In the "JACKET TEMPERATURE TEST" sequence you can verify the temperature value from the water jacket sensor. After the unit has stabilized, the *water jacket sensor probe* value should be within +/- 2 degrees C from the actual temperature display (*chamber air sensor probe*).

JACKET TEMPERATURE TEST SEQUENCE

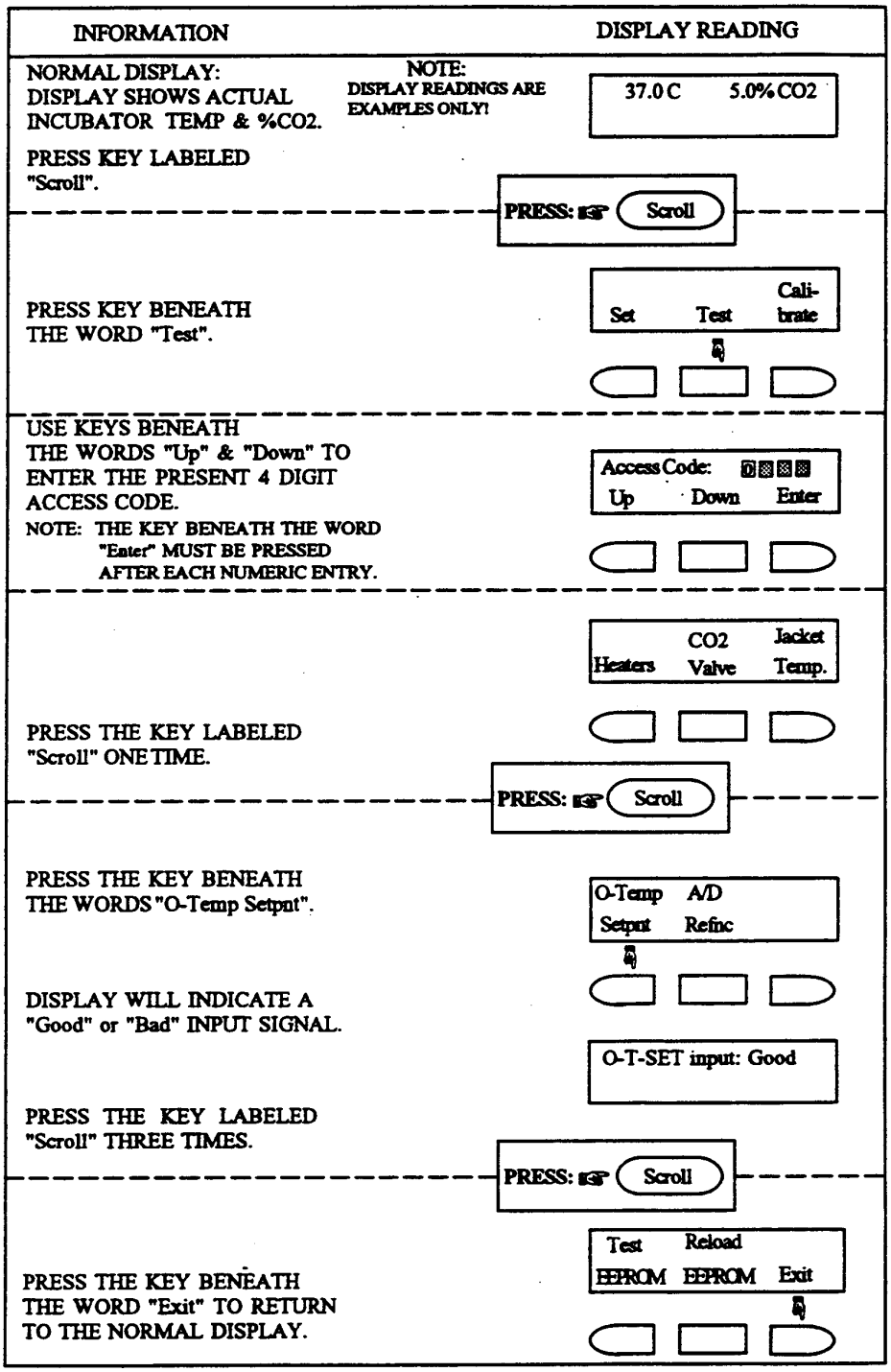


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6.4 Overtemp Setpoint Test

In the "OVERTEMP SETPOINT" test sequence you can verify a "Good" or "Bad" input signal from the overtemp setpoint input circuit.

OVERTEMP SETPOINT TEST

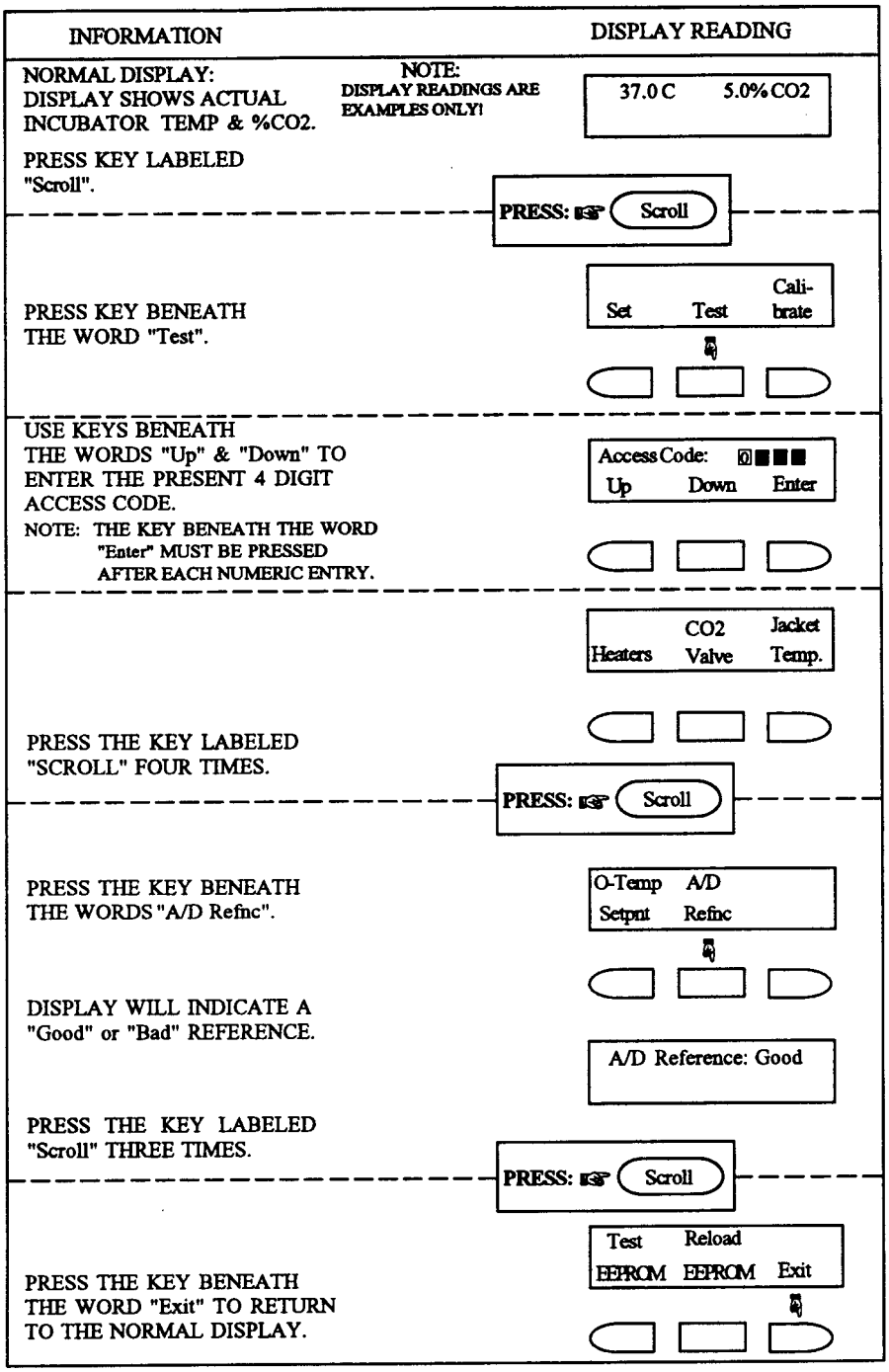


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6.5 A/D Converter Reference Test

In the "A/D CONVERTER REFERENCE" test sequence you can verify the value of the Analog to Digital Converter reference voltage. A "Good" or "Bad" indication will be returned to the display.

A/D REFERENCE TEST



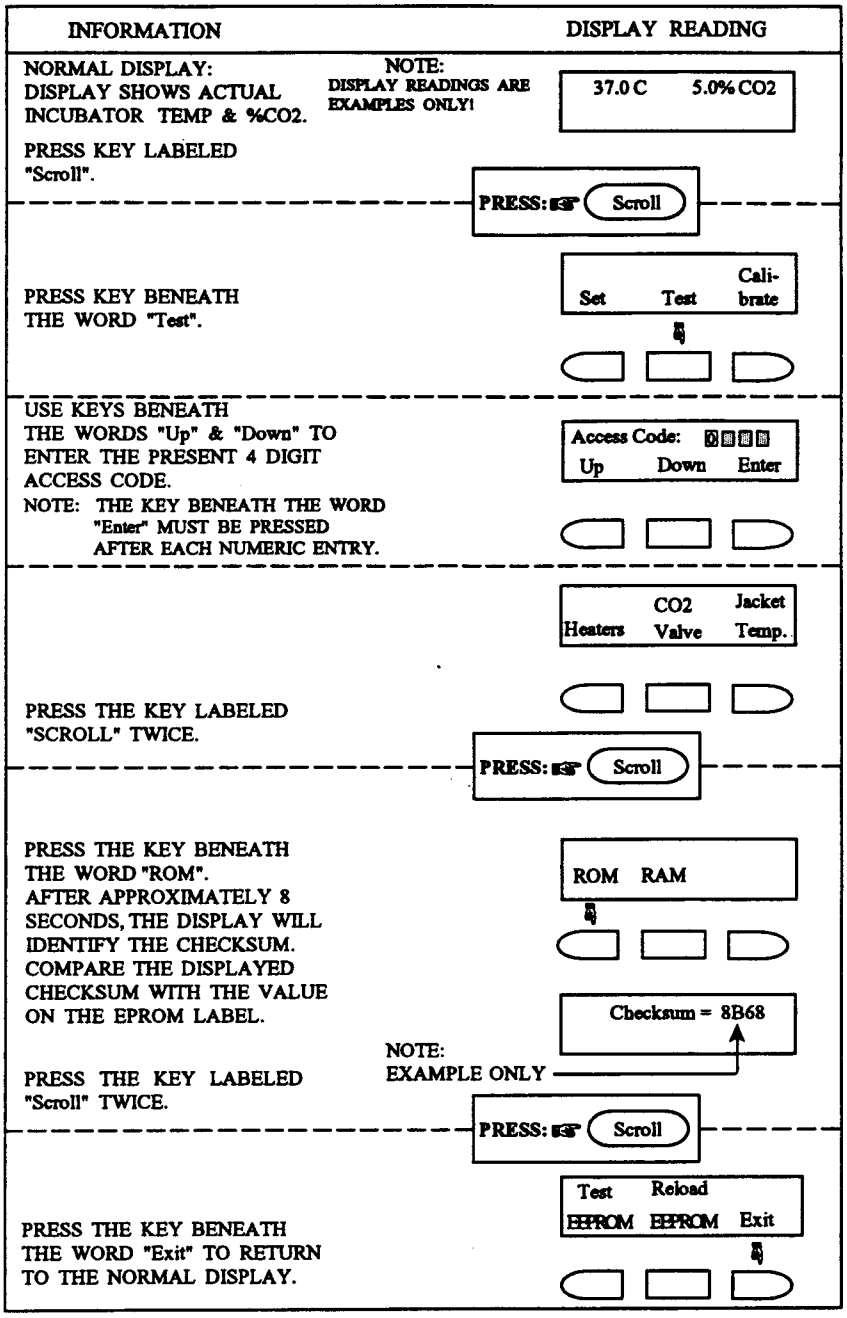
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6.6 ROM (EPROM) TEST

The "ROM" test computes the check sum value for the EPROM on the controller board and returns that value to the display.

Note: It takes approximately 8 seconds before the value is displayed. The displayed value should match the value on the EPROM label.

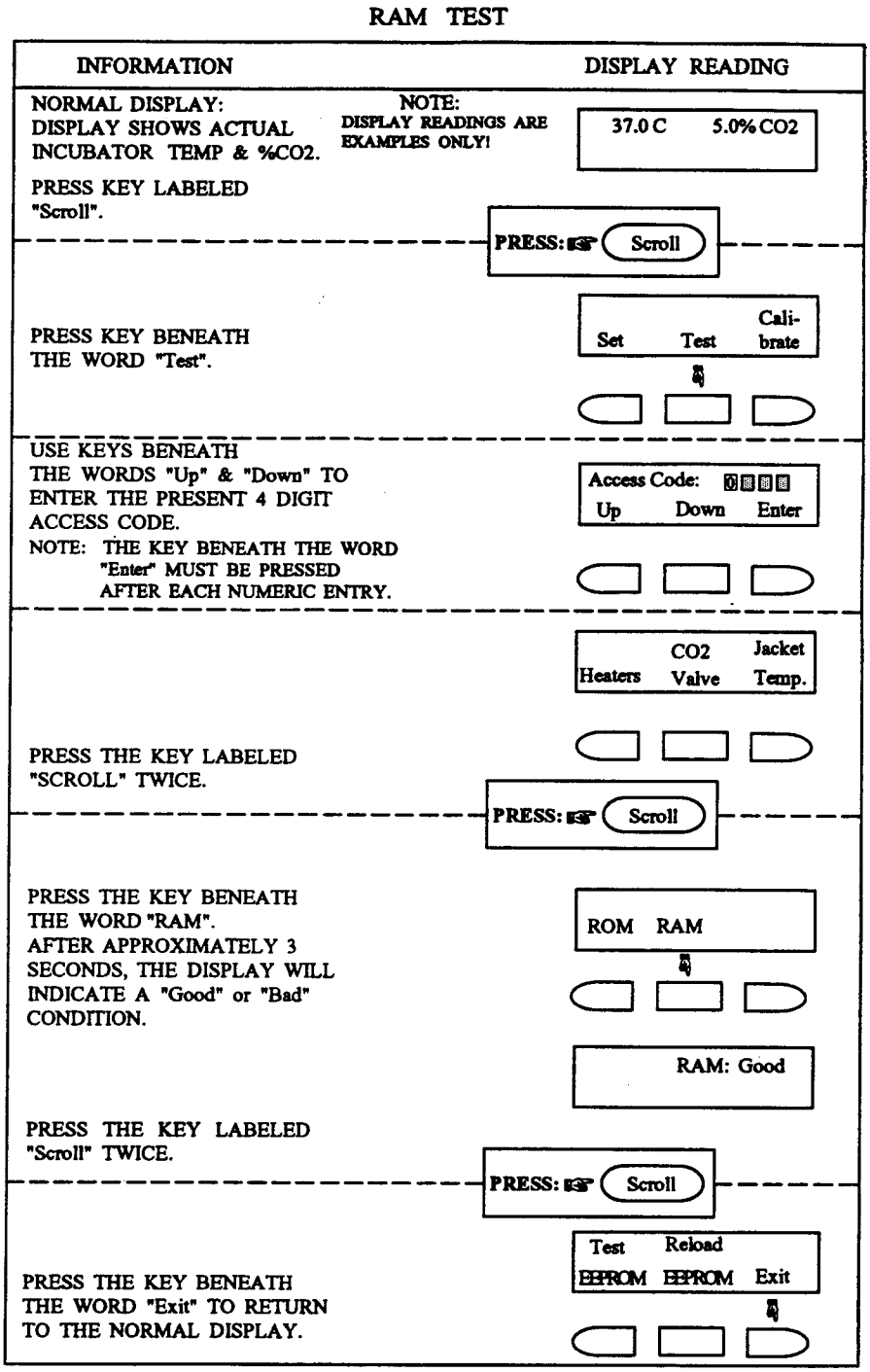
ROM TEST



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6.7 RAM Test

The "RAM" test checks the data memory for proper storage and retrieval.
Note: It takes approximately 3 seconds for the test to be completed.
A "Good" or "Bad" indication will be returned to the display.

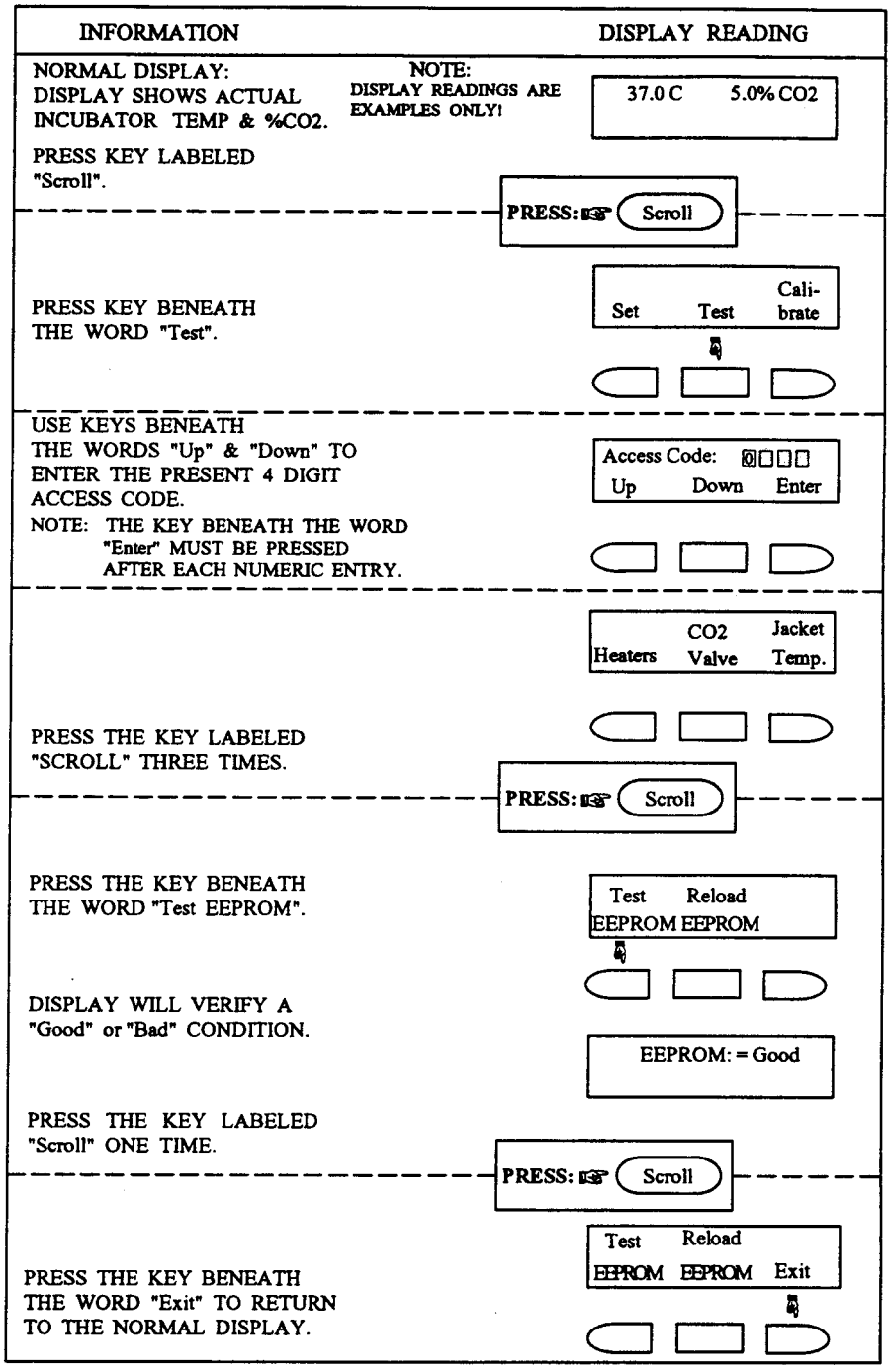


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6.8 EEPROM Test

The "EEPROM" test checks the EEPROM for proper operation by storing a value in a register and then reading it back. A "Good" or "Bad" indication will be returned to the display.

EEPROM TEST



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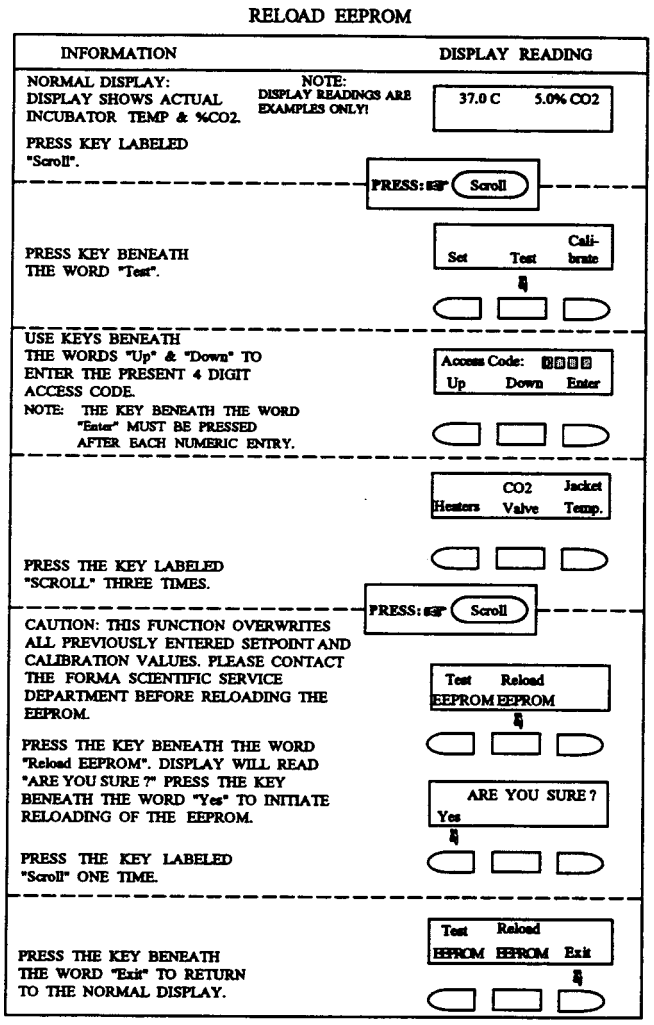
6.9 RELOAD EEPROM

Caution: This function overwrites all previously entered setpoint and calibration values. Please contact the forma scientific service department before reloading the eeprom. **Call 1-800-848-3080 Or Fax 1-614-373-4189.**

The RELOAD EEPROM function loads the EEPROM with *default* values for setpoints, calibration constants, control constants, etc.

Following this procedure, please refer to Section 3 for setting the Temperature and CO_2 setpoints. Calibration (refer to Section 5) must be performed on the following modes.

1. Calibrating the new CO_2 Sensor
2. Calibrating the %CO_2 Zero
3. Calibrating the %CO_2 Span (If required after the %CO_2 ZERO)



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SECTION 7 - SERVICE

Caution: Actual servicing or the unit must be performed by qualified service personnel!

7.1 Replacing the Blower Wheel

1. Turn the power off.
2. Remove shelves.
3. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.
4. Locate blower wheel on blower shield plate. Refer to Figure #1.
5. Grasp blower wheel firmly and pull straight out.
6. When reinstalling the blower wheel, make sure that the backside of the blower wheel is against the snap ring (located on the blower shaft).

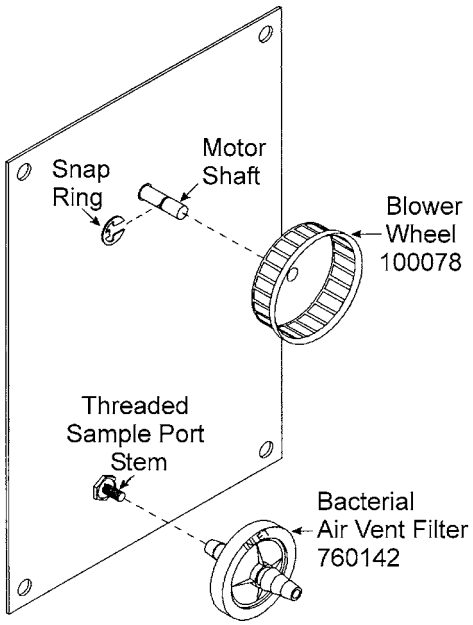


Figure #1

7.2 Replacing the Bacterial Air Vent Filter

1. Turn the power off.
2. Remove shelves.
3. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.
4. Locate Bacterial Air Vent filter on lower left corner of the blower shield plate. Refer to Figure #1.
5. Remove filter by turning it counterclockwise (as viewed from the front). This will unscrew the filter from the Threaded Sample Port Stem.
6. Position new filter over the Threaded Sample Port Stem (WITH THE "INLET" STAMPED SIDE FACING OUT) and turn in a clockwise rotation.

Note: The threaded sample port will actually cut threads in the filter housing.

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7.3 Replacing the Blower Motor

Caution! De-energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. Regulation, section 1910-147.

1. Remove shelves.

2. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.

3. Locate blower wheel on blower shield plate. Refer to Figure #1.

4. Grasp blower wheel firmly and pull straight out. Using a small flatblade screwdriver, remove and save snap ring from blower motor shaft

5. Remove the five wing nuts from the blower shield plate. Using an 11/32" nut driver, remove the nut securing the blower shield plate.

6. Grasp two of the corner flared studs and gently pull blower shield plate forward, exposing the blower motor. Refer to Figure #2.

7. Remove the four Phillips head screws securing the blower motor to the blower shield plate. Refer to Figure #3.

8. Electrically disconnect blower motor. Refer to Figure #4.

10. Remove and replace with new blower motor.

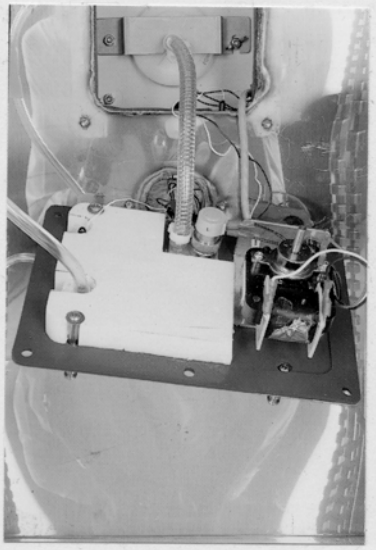


Figure #2

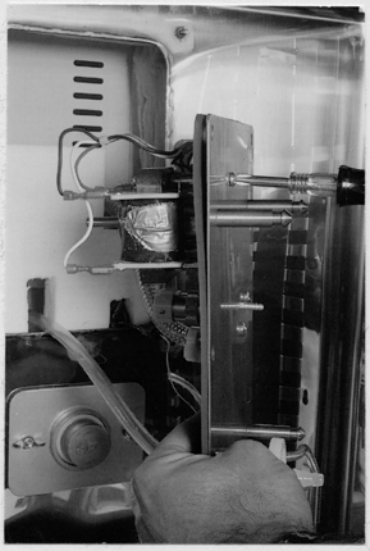


Figure #3

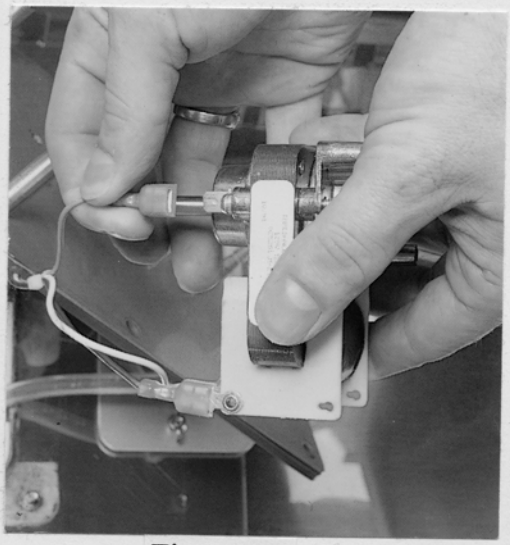


Figure #4

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7.4 Replacing the CO_2 Valve

1. **Caution! De-energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.**

2. Remove shelves.

3. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.

4. Remove the five wing nuts from the blower shield plate. Using an 11/32" nut driver, remove the nut securing the blower shield plate.

5. Grasp two of the corner flared studs and gently pull blower shield plate forward, exposing the CO_2 valve.

6. Locate CO_2 valve (directly beneath the blower motor) and disconnect wiring.

7. Locate and remove the two Phillips head screws on front side of blower shield plate, beside the CO_2 inject tube.

8. Remove the plastic hose clamp from the CO_2 valve.

9. Using a 7/64" (2mm) allen wrench or similar instrument, insert wrench in hole located in base of CO_2 valve. Turn wrench counterclockwise to unscrew valve assembly from brass block.

10. Install new CO_2 valve.

7.5 Replacing the Inline CO_2 Filter

1. **Caution! De-energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.**

2. Remove shelves.

3. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.

4. Remove the five wing nuts from the blower shield plate.

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5. Using an 11/32" nut driver, remove the nut securing the blower shield plate.

6. Grasp two of the corner flared studs and gently pull blower shield plate forward, exposing the CO_2 inline filter, located on the backside of the outer wrap. Refer to Figure #5.

7. Remove plastic hose clamp and CO_2 hose from filter.

8. Loosen both wing nuts and lift up on bracket securing filter.

9. Remove CO_2 hose from external backside of incubator.

10. Replace with new filter.

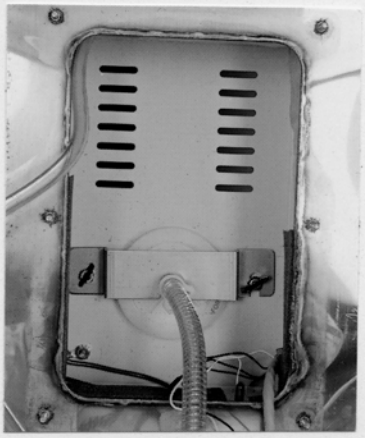


Figure 5

7.6 Replacing The Chamber Air Sensor Probe

Caution! De-energize all potential sources of energy to unit. lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.

1. Remove shelves.

2. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.

3. Remove the five wing nuts from the blower shield plate. Using an 11/32" nut driver, remove the nut securing the blower shield plate.

4. Grasp two of the corner flared studs and gently pull blower shield plate forward, exposing the chamber air sensor probe, located on the bottom right side of the blower shield plate (as viewed from the front).

5. Cut probe wires beyond yellow connectors.

6. Using 3/8" wrench, remove nylon nut.

7. Unthread tube connector from front of plate (1/4" wrench or pliers may be necessary) and remove probe tube assembly.

8. Install probe tube assembly and secure tube connector and nylon nut.

9. Strip 1/4" off incubator probe harness leads and insert into wire connector (24 to 22 gauge), make sure connections are secure.

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7.7 Replacing the Water Jacket Sensor Probe

Caution! De-energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.

1. Drain water jacket to below sensor mount.

2. Remove shelves.

3. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.

4. Remove the five wing nuts from the blower shield plate. Using an 11/32" nut driver, remove the nut securing the blower shield plate.

5. Grasp two of the corner flared studs and gently pull blower shield plate forward.

6. Locate the water jacket sensor probe, on the bottom right corner of the opening. Cut the two connecting wire beyond the yellow connectors.

7. Using a 7/16" wrench, Remove probe.

8. Install new probe, using pipe thread sealer on probe threads.

9. Strip 1/4" off incubator probe harness leads and insert into wire connector (24 to 22 guage), make sure connections are secure.

Note: When the procedure is complete, refill the water jacket (refer to Section "2.12 Filling the Water Jacket".

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7.8 Replacing the CO_2 Sensor

1. Turn the power off.
2. Remove shelves.
3. Remove chamber probe from mounting clip, located on right side of rear blower plenum. Remove blower plenum by lifting plenum up and off of the four flared studs.
4. Locate the brass CO_2 sensor directly beneath the Bacterial Air Vent filter on the center back wall. Refer to Figure #6.
5. Remove the two wing nuts securing the CO_2 seal plate.
6. Grasp CO_2 sensor and pull forward. Disconnect wiring at connector.
7. Hold backside of CO_2 sensor and remove brass ring (turn counterclockwise). Refer to Figure #7.
8. Remove sensor from mounting plate.

Note: Before installing the new CO_2 sensor, record the "Z" and "S" numbers from the serial tag, located on the back side of the CO_2 sensor. These numbers are used in the calibration procedure that *must* follow sensor replacement. Refer to Section 5.4 titled "CALIBRATING THE NEW CO_2 SENSOR".

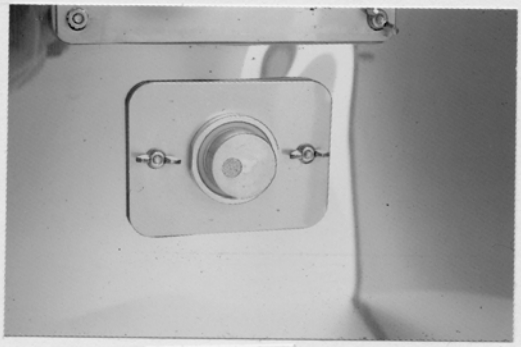


Figure #6

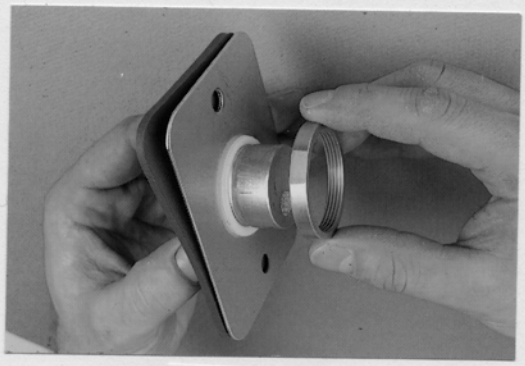


Figure #7

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7.9 Replacing the Water Float Switch

1. Turn the power off.
2. Remove the five Phillips head screws securing the backside of the top panel. Remove the large Phillips head screw securing the front of the top panel.
3. Remove top panel by sliding it toward the backside of the incubator. Lift top panel up and remove.
4. Locate the water float switch in the right rear corner (as viewed from the front).
5. Gently push insulation away from float switch area. Refer to Figure #8.
6. Remove four Phillips head screws securing the float switch plate.
7. Cut electrical wires approximately two inches from float switch.
8. Remove nut from top of assembly.
9. Remove float switch.
10. When installing new float switch, place a small amount or RTV silicone around the threaded stem. Position float switch through metal bracket and secure with plastic nut.
11. Reconnect electrical wires.



Figure #8



Figure #9

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7.10 Replacing the Microprocessor Board

Caution: Use the grounding wrist strap provided when installing the microprocessor board. Failure to do so may cause damage to the electronic components.

Caution: De-energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.

1 Lower front panel.

2 Remove the two Phillips head screws securing component drawer.

3 Slide component drawer out and locate the microprocessor board on the front left side. Refer to Figure #10

4. Record and remove all wiring connectors.

5. Remove the four Phillips head screws securing microprocessor board.

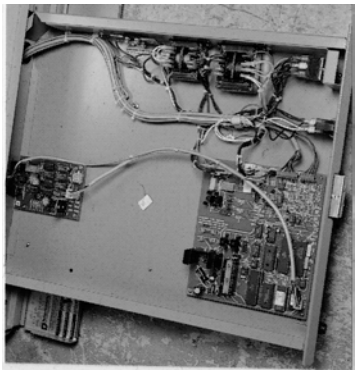


Figure #10

6. After installing the new board, the "Z" and "S" numbers must be re-entered. Refer to Section 5.4 Titled "Calibrating the New CO_2 Sensor".

7.11 Replacing the Fuses

There are four replaceable glass type fuses (three 1.5 amp and one .5 amp), located in the component drawer. Two of the fuses are located on the front side of the microprocessor board and are labeled "F1" and "F2". The other fuse is located directly in front of the transformer.

Caution! De-energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.

1. Lower front panel.

2. Remove the two Phillips head screws securing component drawer.

3. Slide component drawer out and locate the defective fuse.

4. Remove fuse from (fuse clip) and replace with the Forma Part #230106.

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7.12 Replacing the Display Board and Assembly

Caution: Use the grounding wrist strap provided when installing the display board. failure to do so may cause damage to the electronic components.

1. ***Caution: De-Energize all potential sources of energy to unit. Lockout/tagout de-energized control per O.S.H.A. regulation, section 1910-147.***

Note: There are four stud pins that secure the control panel.

2. Place a flat blade screwdriver behind the control panel groove and *carefully* pry each corner of the display out.

3. Grasp control panel and gently pull forward.

4. Carefully remove electrical connector from printed circuit board. Refer to Figure #11.

Note: Please refer to drawing #140122, for further illustrations.

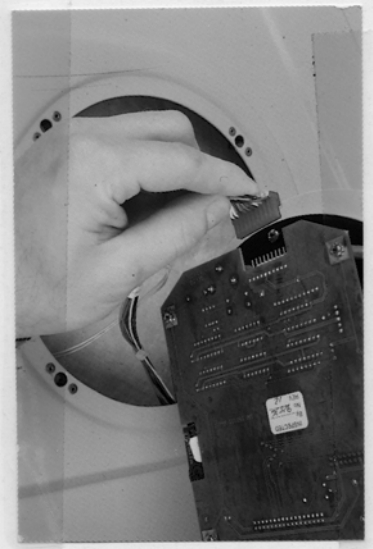


Figure #11

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SECTION 8 - SPECIFICATIONS AND ACCESSORIES

Specifications

Temperature

Control	± 0.1°C
Range	+5°C above ambient to +50°C
Sensor	Precision thermistor
Controller	Microprocessor controlled PI type with patented interactive dual probe system
Setpoint	Digital
Display	Digital vacuum fluorescent
Uniformity	±0.2°C @ +37°C
Tracking Alarm	+2.0°C overtemperature, -2.0°C
Differential/Delay	undertemperature for longer than 15 minutes

Temperature Safety

Sensor	Precision thermistor
Controller	Independent analog electronic
Setpoint	Digital (tamper resistant screwdriver adjust)
Display	Audio/visual
Readability	0.1°C
Setability	0.1°C

CO_2

CO_2 Gas Control	Better than ±0.1%
Range	0-20%
Inlet Pressure	10 PSIG
Supply Inlet	0.2 micron, disposable
Sample Port	HEPA filter, disposable
Sensor	Thermal conductivity
Controller	Microprocessor controlled PI type
Setpoint	Digital
Display	Digital vacuum fluorescent
Readabilty	0.1%
Setpoint	0.1%
Alarm Differential and Delay	±1.0% for longer than 15 minutes

Humidity

Humidity	Ambient to 95% @ +37°C
Humidity Pan	1.6 gal. (6 liters)

Fittings

Fill Port	3/8" (.95cm) hose (barbed)
Drain Port	1/4" (.64cm) FPT
Access Port	1.25" (3.18cm) removable plug
CO_2 Inlet	1/4" (.64cm) hose (barbed)

Unit Heat Load

344 BTUH (100 watt)

Shelves

Standard	5
Maximum	22
Dimensions	17.75" (45.09cm) x 17.75" (45.09cm)

Construction	Stainless steel, perforated, electropolished
Surface Area	2.2 sq. ft. (0.2 sq.m.)
Max. Per Chamber	48.4 sq. ft. (4.50 sq.m.)
Flatness	±.032" (.08cm) off horizontal plane
Clearance	Adjustable on 1" (2.54cm) centers
Loading	35 lbs. (16 Kg) slide in and out 50 lbs. (23 Kg) stationary

Construction

W/J Volume	11.7 gal. (44.3 liters)
Interior Volume	5.7 cu. ft. (161.4 liters)
Interior	20 gauge, 304 stainless steel (mirror finish) RMS Value 2-3 µ
Corners	1/2" (1.27cm) radius coved
Exterior	18 gauge, cold rolled steel
Insulation	1-1/2" (3.81cm) and 1" (2.54cm) fiberglass
Inner Door	1/4" (.64cm) fully tempered safety glass with cam action latch
Inner Door Gasket	Non-porous feather edge silicone
Outer Door Gasket	Four sided molded magnetic vinyl
Finish	Powder coated, white (Pantone Cool Gray 2) with blue trim (Pantone 5415 U). Salt spray test exceeds 1,000 hours per ASTM Standard B117-85.

Electrical

3250	90-125 VAC 50/60 HZ, 1PH, 4.5 FLA 180-250 VAC 50/60 HZ, 1PH, 2.5 FLA
Circuit Breaker/ Power Switch	5 Amps/2 Pole
Cabinet Power Interconnect	IEC 320, male
Power Inlet Cord	8' (2.4m) with IEC 320 female plug (cabinet interconnect) and country specific plug
Accessory Outlet	120 VAC 50 Watts max

Certification

C.S.A.	Standard C22.2 #151
U.L. Listed	U.L. 1262

Dimensions

Exterior (single)	24.5"W x 36.5"H x 26.75"F-B (62.23cm x 92.71cm x 67.95cm)
Interior	19.25"W x 25.625"H x 20.0"F-B (48.90cm x 65.09cm x 50.80cm)

Weight

Net	232 lbs (105 kg)
Net Operational	330 lbs (150 kg)
Shipping	
Motor	292 lbs (132 kg)
Air	292 lbs (132 kg)
Ocean	292 lbs (132 kg)

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

201089	0°C to +60°C, 6", 7-Day, Single Pen Recorder, 115V 60 HZ, FACTORY INSTALLED
201095	Same as 201089, but 220V 50 HZ
201094	0°C to +60°C, 6", 7-Day, Dual Pen Recorder, 115V 60 HZ, FACTORY INSTALLED
201096	Same as 201094, but 220V 50 HZ
	When ordering recorders, please specify top or side mounted.
190338	Floor Stand
190336	Stacking Adapter for stacking 3250 with 3158 (3164), 3193 (3194), 3546 (3588)
190337	Caster Dolly
190340	Right-hand hinged door, FACTORY INSTALLED
190323	Decontamination Kit
770001	Disposable Microbiological Gas Filter, 99.97% efficient
190399	Exterior Door Lock Assembly
190386	RS-232 Computer Interface (Factory Installed)

Ordering Information: Please specify left or right hand door swing and country of final destination for proper power line cord.

A comprehensive one year parts and labor warranty is offered on the Model 3250 cell culture incubator.

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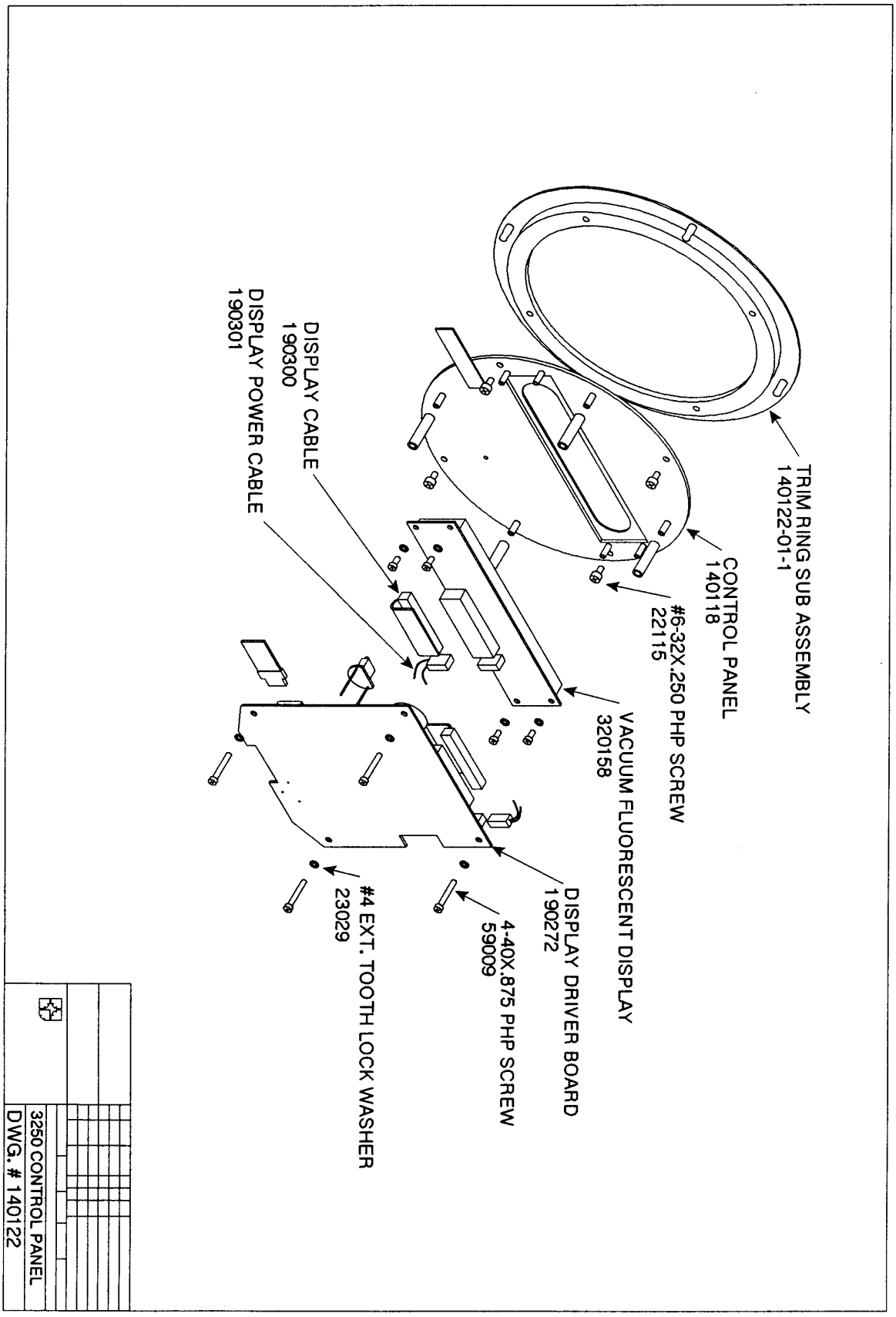
SECTION 9 - PARTS LIST

STOCK #	DESCRIPTION
140122	Control Panel Assembly
100078	Blower Wheel
760142	Bacterial Air Vent Filter
103030	Blower Shield Plate Gasket
156080	Blower Motor
290137	Chamber Probe Assembly
290138	Jacket Probe Assembly
770001	CO_2 Inline Filter
190271	Microprocessor Board
190272	Display Driver Board
320158	Vacuum Fluorescent Display
290090	CO_2 Sensor Assembly
360171	Water Float Switch
250088	Solenoid Valve

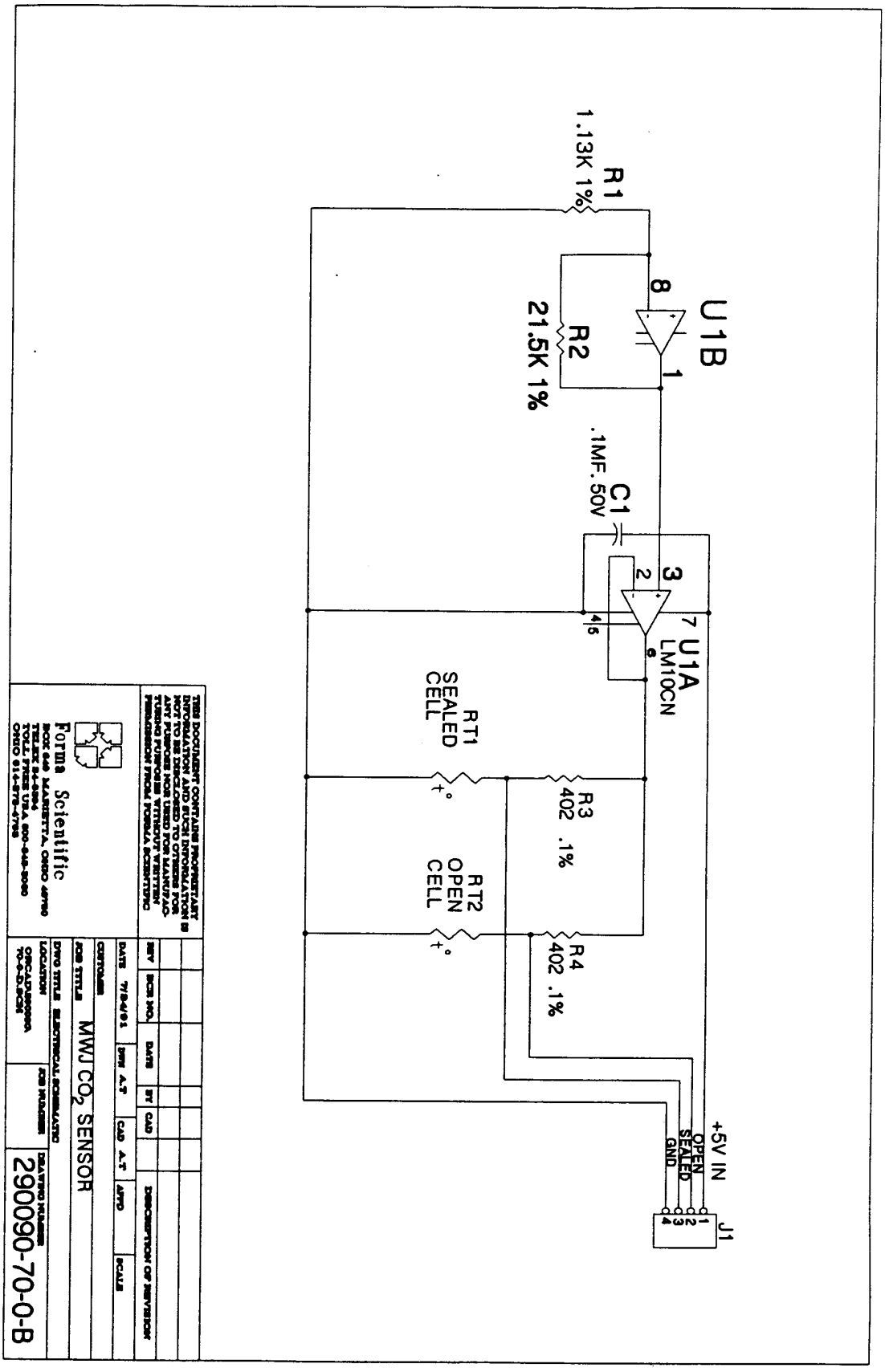
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SECTION 10 - SCHEMATICS

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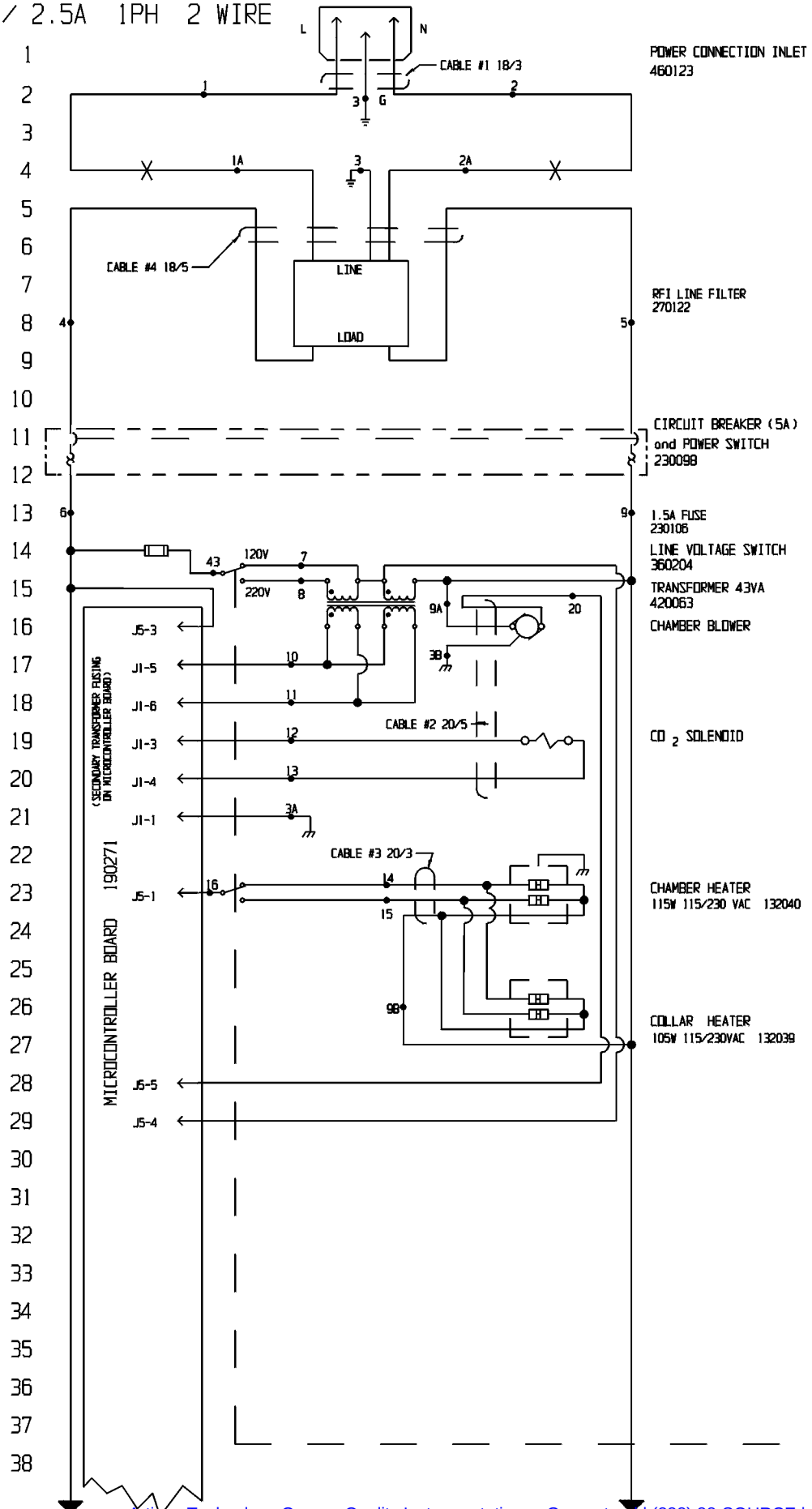


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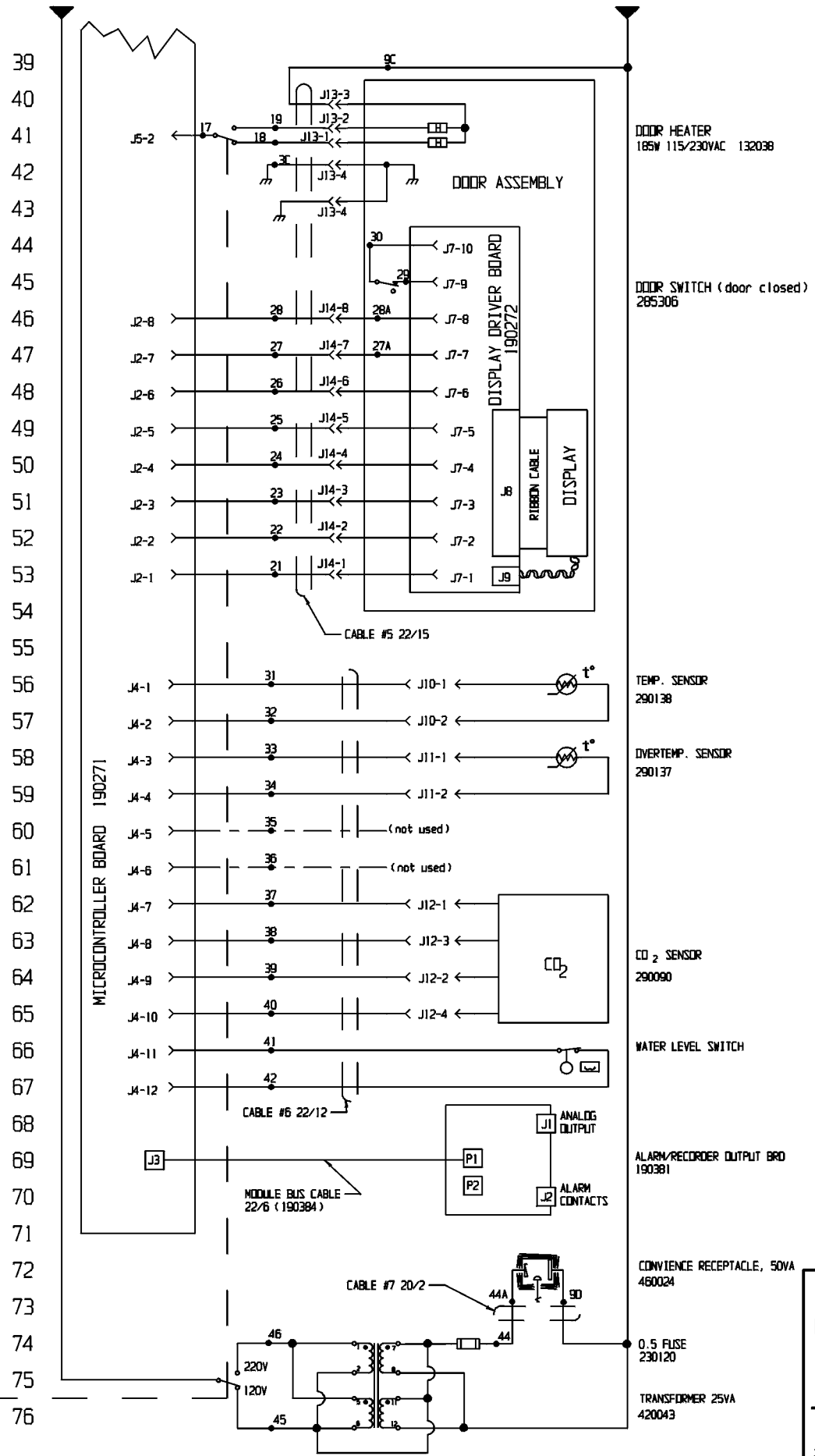
POWER CONNECTION
90-125V / 180-250V 50/60HZ
4.5 / 2.5A 1PH 2 WIRE



Electrical Schematic
Forma Model:
3250 Rel. 2

3250-70-0-D Rev. 6
Page 1 of 3

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Electrical Schematic
Forma Model:
3250 Rel. 2

3250-70-0-D Rev. 6
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WIRE CHART

WIRE	GAUGE	COLOR	CABLE NO.
1	18	BLACK	1
2	18	RED	1
3	18	GREEN	1
3A	20	GREEN	
6	20	BLACK	
7	20	YELLOW	
8	20	ORANGE	
9	20	WHITE	
10	20	RED	
11	20	PURPLE	
3B	20	GREEN	2
9A	20	WHITE	2
12	20	BLACK	2
13	20	BROWN	2
20	20	RED	2
9B	20	WHITE	3
14	20	BLACK	3
15	20	RED	3
1A	18	BLACK	4
2A	18	RED	4
3D	18	GREEN	4
4	18	BROWN	4
5	18	WHITE	4
16	20	BROWN	
17	20	BLUE	
3C	22	GREEN	5
9C	22	WHITE	5
18A	22	BLACK	5
19A	22	RED	5
21	22	RED/BLK	5
22	22	BLUE	5
23	22	ORANGE	5
24	22	ORG/BLK	5
25	22	BLU/WHT	5
26	22	WHT/BLK	5
27	22	RED/WHT	5
28	22	BLU/BLK	5
29	22	YELLOW	
30	22	YELLOW	
31	22	BLACK	6
32	22	RED	6
33	22	WHITE	6
34	22	BROWN	6
35	22	GREEN	6
36	22	TAN	6
37	22	BLUE	6
38	22	ORANGE	6
39	22	YELLOW	6
40	22	PURPLE	6
41	22	GRAY	6
42	22	PINK	6
43	20	BLACK	
44	20	BROWN	
45	20	PURPLE	
46	20	RED	
44A	20	BLACK	7
9D	20	WHITE	7

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APPROVING FIRM

DATE OF APPROVAL

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REV	ECR NO.	DATE	BY	CAD	APPD	DESCRIPTION OF REVISION
6	IN-2016	12-07-95	BKH	BKH		ADD 270122 LINE FILTER
5	IN-1779	05-26-94	JAS	KDG	LDN	CHG. 420075 TRANSFORMER TO 420043
4	IN-1589	5-27-93	GLM	KDG	LDN	REV. J13 & COLORS TO WIRES
3	IN-1542	02/19/93	GLM	DB	LDN	REV TO RELEASE #2
2	IN-1348	4-14-92	GLM	GLM	LDN	ADD POWER CONNECTION

DATE 10-19-92 | DWN G_M | CAD G_M | APPD M.H. | SCALE NONE

CUSTOMER

JOB TITLE 3250 WATER JACKET INCUBATOR REL. #2

DWG TITLE ELECTRICAL SCHEMATIC

LOCATION	JOB NUMBER	DRAWING NUMBER
INCUBATR01		3250-70-0-D

Forma Scientific

BOX 649 MARIETTA, OHIO 45750 TELEX 24-5304
TOLL FREE USA 800-848-2080, OHIO 614-373-4763

Electrical Schematic
Forma Model:
3250 Rel. 2

3250-70-0-D Rev. 6

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