Tekmar ™ 2000

User Manual

Tekmar Company

14-3912-000
091691

HOW TO USE THIS MANUAL

This manual is organized as a reference guide. Tutorials are included for those who prefer to follow steps to accomplish a task. The manual sections are arranged as follows:

Section 1 - Safety Information and Specifications
This section gives important warnings and cautions when using the LSC 2000. It also includes the unit's specifications in detail.

Section 2 - System Setup and Accessories
This section details electronic and pneumatic connections, as well as how to connect the glassware, install a new trap, replace the ROM, and connect the Sample Heater accessory.

Section 3 - Leak Checking
This section offers instructions for a thorough leak check of the entire system.

Section 4 - Introduction to the Microprocessor
Here it explains how to use the microprocessor, illustrates and defines the keypad, program panel and screens, and has an outline of the program steps.

Section 5 - Powering Up For a Run
This section gets you started. It has the instructions for setting the clock, configuring instruments and checking Method temperatures.

Section 6 - Methods 1, 2, 3 & 4
This section walks you through the default program Methods 1, 2, 3 & 4.

Section 7 - Modifying Methods
In this section is a brief explanation of the parameter values and their ranges, and how to change them. It also includes the use of Auto Drain, Step to Standby, Step to Bake, and Bake Gas Bypass.

Section 8 - System Failures
Here is information for power loss and explanations for "error" and "failure" screens.

Section 9 - Routine Procedures
This section offers information about manual procedures such as preparing and loading standards and samples, and handling fused silica. It includes the EPA Purge & Trap parameter settings and the routine microprocessor procedures like setting the clock, changing instrument configurations, and reviewing temperature values.

Section 10 - Maintenance and Service
This section covers changing and conditioning a trap, cleaning sample lines and glassware, and has a complete list of replacement parts to use when you order.

Section 11 - Troubleshooting
Potential electronic problems with the unit are discussed in this section.

Section 12 - Diagrams
Here are photographs, charts, and diagrams referenced to help you better understand the LSC 2000.

TABLE OF CONTENTS

1.1 Warnings

The LSC 2000 meets Class 1 safety requirements.

= WARNING =

This instrument contains a heater. Touching the heater while in operation could cause a burn. When operating the LSC 2000, keep the trap heater door closed. The heater is on and hot in the following operating modes: DESORB PREHEAT, DESORB, and TRAP BAKE.

The transfer line heater is on whenever the line heater set point is above 30°C. When working near this line, turn the unit off to prevent contact with the hot line.

= WARNING =

Potentially lethal voltage exists inside this instrument. The trap heater door and the panels must be closed when the instrument is operating. ***ALWAYS UNPLUG THE UNIT FROM ITS POWER SOURCE BEFORE SERVICING.***

= WARNING =

This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the manual, it may cause interference to radio communications. This unit has been tested and found to comply with the limits for Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will take whatever measures may be required to correct the interference.

1.2 Specifications

Furnace:	Ambient to 400°C, rise rate approximately 200°C/min.
Traps:	0.123" ± 0.002" O.D. x 12" long x 0.010" wall thickness stainless steel standard. Optional traps include 0.125" O.D. x 1.8 mm I.D. x 12" long glass-lined stainless steel.
Samplers:	5 or 25 ml sampler volume. All glass construction using medium porosity glass frits. Includes manual 3-way valve for sample load/drain. Optional 5 or 25 ml fritless, needle sparge, and 3/4" disposable samplers.
Valving:	Motor-actuated 6-port valve contained in oven for purge and desorb cycles, variable ambient to 300°C. Solenoid-operated 2- and 3-port valves for purge, dry purge, drain, bake and vent functions. Solenoid valves are rated to 20 psi.
Tubing:	All sample lines are 1/16" glass-lined stainless steel or fused silica (0.32 mm or 0.53 mm I.D.), heated, variable ambient to 300°C. Sample flow pathway fittings are gold-plated. The transfer line is available in a 36", 48", or 60" length. Mount temperature is ambient to 200°C.
Electronic Control:	CMOS 8 bit 6303 microprocessor with 64K ROM (Read Only Memory) and 2K RAM (Random Access Memory). Parameter entry is via a tactile response panel including a numeric keypad.
Outputs:	Four second contact closure or contact opening, available at the Start of Desorb and at the End of Desorb.
Inputs:	Accepts contact closure, contact opening, or TTL input to advance from Purge Ready to Purge and from Desorb Ready to Desorb Preheat.
Display:	64 x 240 pixel dot graphics LCD screen.
Serial Interface:	RS232C serial communications port permits interface with a remote PC. Baud rate variable 150 to 19200, software selectable.

1.2 Specifications (cont.)

Environment Requirements:

Operating temperature: 19° to 30°C
Storage temperature: -20° to 60°C
Relative humidity: 10 to 90% with no condensation.

Size:

Depth: 14" (356 mm)
Width: 11" (280 mm)
Height: 22-3/4" (578 mm)

Utilities:

For 120V Operation:
Voltage: 120V ±10%, 960W
Frequency: 50 or 60 Hz ±1%
Purge gas: Ultra high purity (99.999%) helium or nitrogen, 20 to 200 psi. Hydrocarbon content <0.5 ppm.

For 220V Operation:
Voltage: 220V ±10%, 880W
Frequency: 50/60 Hz ±1%

For 100V Operation:
Voltage: 100V +5% -10%, 1000W
Frequency: 50/60 Hz ±1%

2.1 General Information

This section is intended to be as thorough as possible. However, certain items will vary depending upon the make and model of the gas chromatograph and the data system used. If in doubt on any point, please contact Tekmar toll free at (800) 874-2004, or outside the U.S. collect at (513) 247-7000. When installation is not directly performed by Tekmar personnel, the operator must be thoroughly familiar with this manual and all relevant sections of the gas chromatograph manual before proceeding.

2.1.1 Power Requirements

The **110V unit** requires a 50 or 60 Hz single phase power source at 120V ± 10%. The maximum current draw for the 110V unit is 8 amps and maximum power consumption is 960 watts (when accessories are included).

The **220V unit** requires a 50 or 60 Hz single phase power source at 220V ± 10%. The maximum current draw for 220V unit is 4 amps and maximum power consumption is 880 watts (when accessories are included).

The **100V unit** requires a 50 or 60 Hz single phase power source at 100V +5% -10%. For the 100V unit the maximum current draw is 10 amps and the maximum power consumption is 1000 watts.

The **100V and the 110V unit power cord** is terminated with a 3-prong straight blade plug and requires a matching receptacle. The 3-prong plug is a safety feature. Do not defeat its purpose by using it with an inappropriate receptacle.

2.1.2 Recommended Operation

Tekmar Company strongly recommends that the LSC 2000 be kept on at all times (other than when it is being serviced, during power failure, etc.) for best possible unit longevity and reliability.

> ***ATTENTION***
>
> Frequent power down and power up causes undue wear and tear of the unit. Repeated expansion and contraction of components as they are heated and cooled compromises the integrity of the unit's parts. This physical stress manifests itself most often in two ways. First, gas fittings are more likely to leak (this is particularly true of the ferrules that seal the glass lines in the valve oven). Second, undue stress is put on the unit heaters each time they go from room temperature to set temperature. This stress may eventually cause deterioration of the heated lines.

Maintain the LSC 2000 at as constant a running state as possible and it will provide years of reliable service.

2.2 Unpacking the System

Remove the accessory packages and the instrument from the shipping container.

Carefully examine the instrument.

If there is visible damage to the instrument or to the accessories, notify both the shipping carrier and Tekmar Company immediately. Do not continue the installation until directed to do so by a Tekmar Representative.
Failure to comply with these instructions may void your warranty for components damaged in shipment. Do not return any materials to Tekmar without prior authorization. Save all shipping materials until proper operation of the instrument is verified.

> ***ATTENTION***
> The LSC 2000 is delivered with a blank trap installed. This prevents damage to a packed trap if the unit was powered up with no purge gas flow present. Replace the blank trap with a packed trap before running a sample (See Section 2.10).

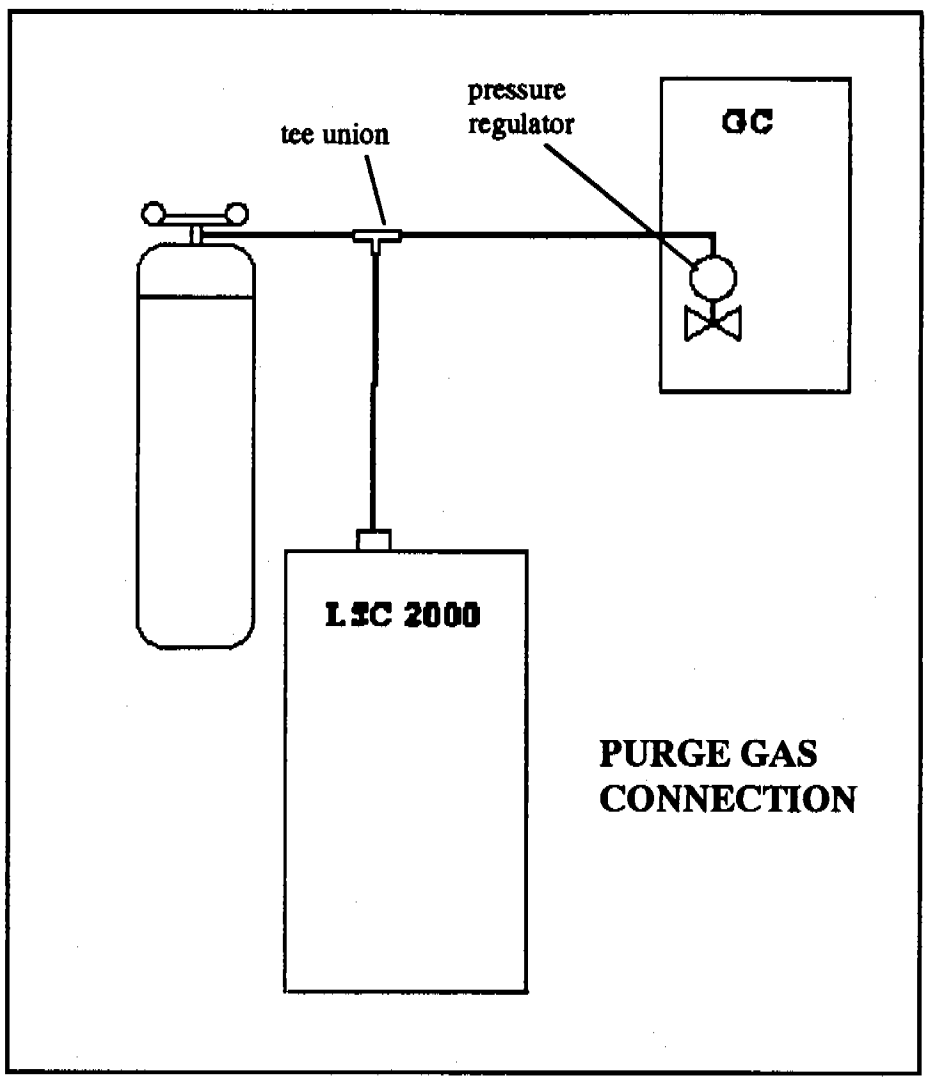
Place the instrument on a sturdy, stable bench surface immediately adjacent to the gas chromatograph. Locate the unit on the side closest to the intended injection port. Allow sufficient space at the rear of the instrument for access and air circulation. Allow approximately 2 ft. of clearance to the left of the instrument for access to the valve oven.

2.3 Purge Gas Connection

Complete all the pneumatic connections before powering up the system.

The concentrator requires a high purity (99.999%, hydrocarbon-tested, or better) helium or nitrogen (do not use argon/methane) gas supply at 20-200 psi. This is usually supplied via a tee union from the tank supplying the GC carrier gas.

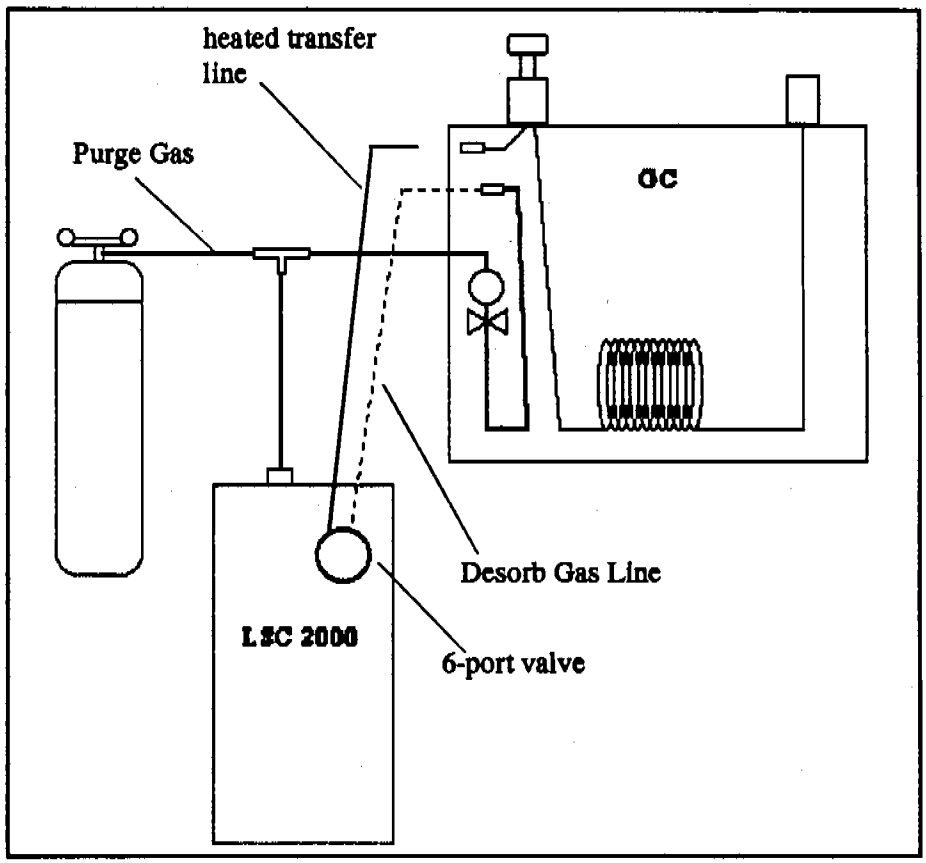
1) Connect the purge gas line to the hydrocarbon trap included in the kit box assembly.
2) Continue the Purge gas line from the hydrocarbon trap to the fitting marked "Purge" at the rear of the concentrator.
3) Turn on the gas supply, set the purge pressure on the front of the LSC 2000 to 20 psi, and do a leak check (See Section 3).



2.4 Carrier Gas Flow Route

Installation instructions for specific gas chromatographs are supplied with the cable interfaces for your particular system configuration. To complete an installation, it is helpful to understand how the GC operates with the concentrator attached.

The GC supplies and controls the carrier gas when it is connected to a concentrator. The carrier gas supply is *always* independent of the purge gas supply.



The carrier gas is rerouted out of the GC (close to where it would normally enter the body of the injection port) to the concentrator by disconnecting a union or cutting the tubing at the injector (see Section 2.5.2). The carrier gas then passes through the six-port valve in the concentrator and returns via the heated transfer line.

No controls are placed on the carrier gas during its loop through the concentrator. Normal GC function is unimpaired by installation of a concentrator except when a Cryofocusing Module is being used. Refer to your Cryofocusing Module Installation Manual for further information.

The transfer line may be connected two different ways:

- It may be connected to the line entering the injection port where the carrier gas is normally supplied (for packed and some wide-bore capillary columns) or
- It may pass through a Cryofocusing Module and then directly into a capillary column.

2.5 Pneumatic Connections

2.5.1 Connecting the Heated Transfer Line

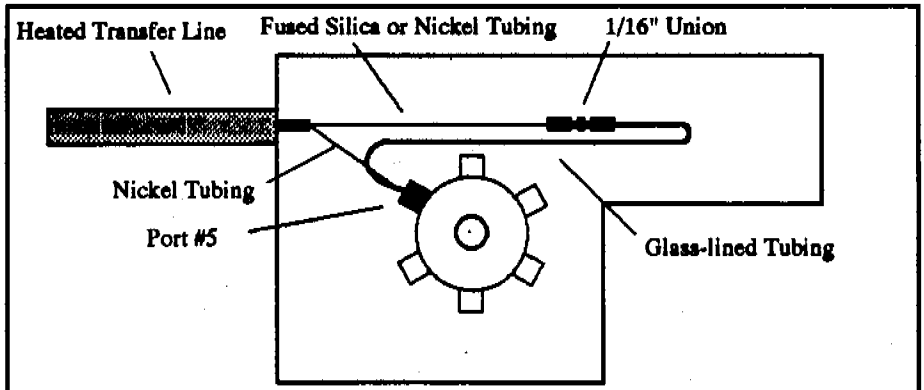
> **ATTENTION**
> This instrument contains glass-lined tubing, which is extremely fragile. If tubing is bent while installing the transfer lines, it will fracture. (Glass-lined tubing can be identified by its blackened appearance.)

Note: Both nickel tubing and .32 mm fused silica tubing are shipped with your LSC 2000 (unless you requested that nickel tubing be installed at the factory, in which case, you can skip the following section and proceed to the next page). If you plan to move your LSC 2000 unit with relative frequency, Tekmar recommends that you use nickel tubing, which is acceptable for all environmental applications.

1) Uncoil the line heater.
2) Pass a length of fused silica (or nickel) tubing through the transfer line.

The internal diameter of the fused silica should be as small as possible without restricting the carrier gas flow.
- For packed columns, order 0.53 mm I.D. (Tekmar P/N 14-2072-002)
- For capillary columns use 0.32 mm (including wide bore columns)

3) Remove the left side panel by turning its four Phillips head screws 1/4 turn each.
4) Slide the panel straight back and then lift it out, away from the unit.
5) Remove the furnace cover by turning the two front panel screws, then sliding the cover forward and out.
6) Remove the valve oven cover by turning the two Phillips head screws at the top and the bottom of the oven 1/4 turn using the long-handled screwdriver supplied in the Kit Box.
7) Refer to the Valve Oven diagram (Section 12) and locate the glass-lined tubing coming out of the #5 port on the 6-port valve.
8) Install the 1/16" stainless steel Swagelok union to the free end of the glass-lined tubing, with a 1/16" graphitized vespel ferrule.
9) Slide the fused silica tubing through the heated transfer line (on the back of the unit) until it enters the valve oven. ***Note: If using nickel tubing, you can run your tubing directly to Port 5 (you must first remove the glass-lined tubing from Port 5).***
10) Connect this tubing to the free end of the Swagelok union using another graphitized vespel ferrule matching the size of your fused silica.
11) Leave the valve oven cover off until all of the fittings have been leak checked (Section 3).



Interior of LSC 2000 Valve Oven

2.5 Pneumatic Connections (cont.)

2.5.2 Connecting the GC Carrier Gas Supply

1) If a column is already installed in the GC, turn off the oven and allow it to cool to room temperature. The carrier gas supply will be interrupted during installation so the column must be cool to avoid damage.
2) Determine which injection port will be interfaced.
3) Remove the covers around the injector to expose the tubing which supplies the carrier gas.
4) This line must be opened either by disconnecting a union (if present) or by cutting the tubing. If no union is present, or if the tubing from the injector to the union exceeds a reasonable length, the cut should be made as close as possible to the injector body, allowing enough length to install a Swagelok union.
5) Connect a piece of 1/8" copper tubing to the line that was originally connected to the injection port (i.e. the line that is supplying the carrier gas).
6) Connect the other end of this copper tubing to the bulkhead union on the rear of the concentrator labeled "Desorb".
7) Briefly turn on the carrier gas and confirm the presence of flow at the end of the heated transfer line. This can easily be determined by holding the end of the line in a small beaker of water. If there is flow, the installation is correct to this point.
8) If no flow exists, there is a wrong connection, a large leak, or a broken line. Carefully examine the installation until the problem is located.

2.5.3 Connecting to Packed Column Injection Ports

This section includes installation of wide-bore capillary columns installed in packed column injectors with adapters.

1) Locate the stainless steel line entering the injection port (Section 2.5.2).
2) Connect the heated transfer line from the concentrator to this stainless steel line.
3) Since the injection port line is metal, trim the tubing back to minimize any unheated length.
4) Using 1/16" stainless steel ferrules, connect the tubing to a stainless steel union only, and connect this to the line entering the injector. If the heated transfer line from the concentrator is fused silica, use a graphitized vespel ferrule.
5) The transfer line should be secured so that all strain from the fused silica tubing is removed.
6) Carefully leak check all of the fittings (Section 3).
   Fittings to be checked include:
   a) Carrier gas to the concentrator
   b) Desorb bulkhead union
   c) Transfer line to the 6-port valve
   d) Transfer line to the injector.

An injection port equipped with a septum purge function must be turned off or capped. If the septum purge is active, it will act as a leak, resulting in loss of sensitivity on concentrator runs.

2.5 Pneumatic Connections (cont.)

2.5.4 Connecting to Capillary Columns

There is a variety of methods of installing capillary columns. If an injection port is used (e.g. wide bore column with adapters in a packed injector, or a capillary injector operated with subambient temperature), refer to Section 2.5.3.

It may be desirable to connect the transfer line directly to the end of the column. This connection should be made inside the oven using a fused silica transfer line. The line should be of a size equal to or smaller than the I.D. of the column.

1) Route the transfer line through any convenient opening in the oven (unused injection ports are suitable and handy, for example) until the heater butts against the outside of the oven. If no ready-made openings are available, small holes can usually be drilled through the oven insulation near the injectors or the detectors.
2) Connect the transfer line to the column using a zero dead volume union.

Zero Dead Volume Union

Making connections with fused silica tubing is far more difficult than doing so with metal tubing. Although fused silica is flexible, it is also brittle and breakable. Care must be taken not to bend the tubing too far or it will fracture. (The minimum bend radius of fused silica tubing is: 3.5" for 0.53 mm, 3.0" for 0.32 mm, and 2.75" for 0.25 mm I.D. tubing.) Also, the tubing must not be scratched or it is likely to break under the stress of bending or vibration that would normally have no effect. When making a connection with fused silica tubing, use the appropriate size graphite, vespel, or graphitized vespel ferrule.

Tekmar recommends graphitized vespel for its ease of use and reliable sealing characteristics.

1) Place the nut and ferrule on the tube, then carefully remove a short (1-2 cm) section of tubing. This ensures that no ferrule particles remain inside the tubing, causing severe adsorption and carryover.
2) Cut the tubing by scoring it with a diamond-tipped pencil or another suitable device (a razor blade works well).
3) Pull the tubing apart by lightly bending it from the side opposite the score.
4) Make the connection with the fitting and tighten it approximately one half turn past finger tight. It may be necessary to secure the center of the union to the column cage (a bent paper clip is handy for this purpose) so that stress caused by the weight of the union is relieved.

3) Anchor the transfer line with a clamp to prevent the fused silica tubing from being broken where it enters the oven.

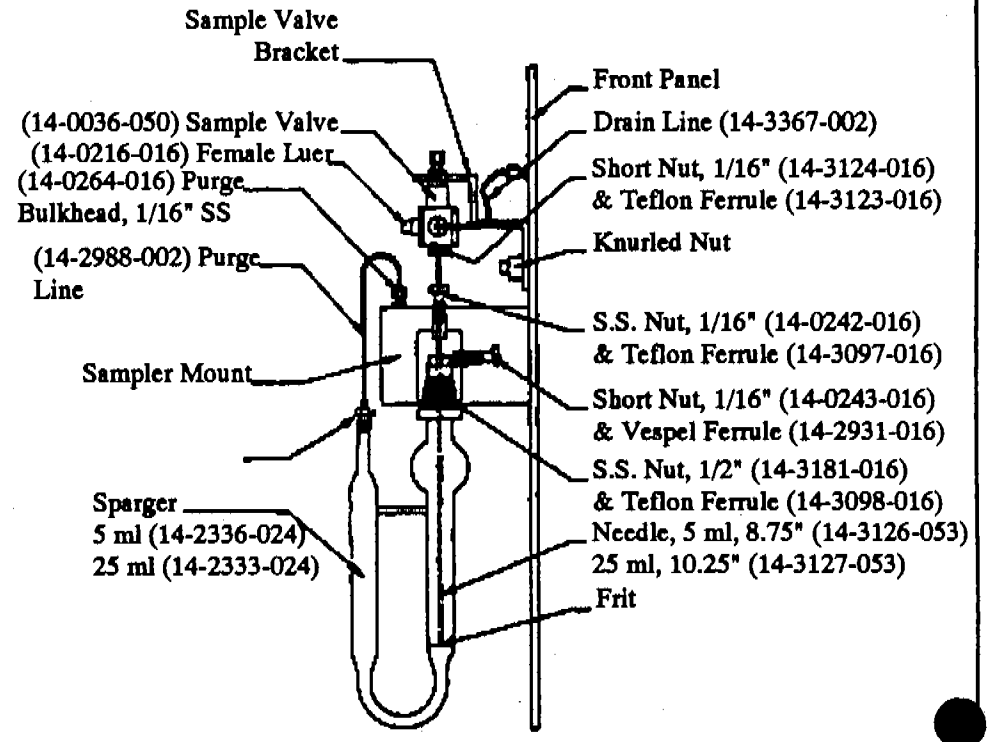
2.6 Installing Glassware

2.6.1 Fritted Disc Sparger

1) Attach the sampler body at the bottom port of the sampler mount.
2) Slide the sampler all the way through the nut and ferrule until it contacts the inside lip of the fitting, then back the sampler out approximately 1/16" .
3) Tighten the fitting 1/4 turn past finger tight. Slide the sample needle into the top of the mount until the tip of the needle just touches the bottom of the sampler.
4) Tighten the stainless steel nut and teflon ferrule into the top of the sampler mount to secure the needle.

Take care when tightening the fitting. Overtightening will damage the teflon ferrule and may cause a leak.

5) Slide the sample valve bracket assembly over the front panel studs.
6) Tighten the sampler needle into the bottom part of the sample valve.
7) Secure the valve bracket with the two knurled nuts provided.
8) Attach the purge line to the bulkhead union which is immediately to the right of the sampler mount.
9) Connect the 1/4" fitting on the nickel purge line to the purge inlet side of the glassware and finger tighten the nut.
10) Attach the drain line to the fitting labeled "Drain".
11) Connect the other end of this line to the port on the left side of the sample valve.
12) Leak check according to Section 3.



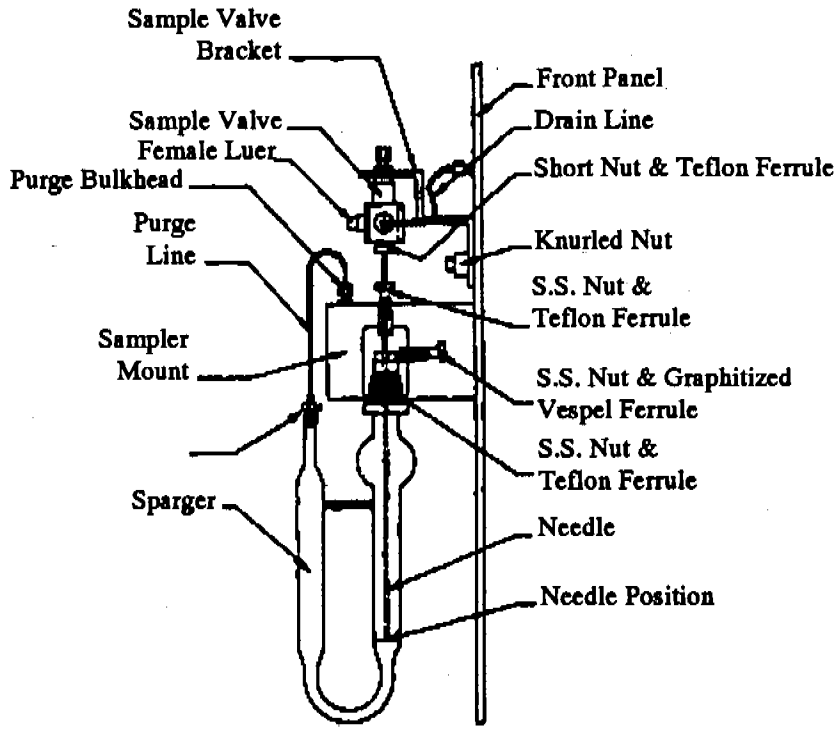
Frit Sparger for the LSC 2000

2.6 Installing Glassware (cont.)

2.6.2 Fritless Sparger

Fritless sparger glassware is installed the same way as the fritted disc glassware except that the sampler needle is adjusted so that it is as close to the bottom of the glassware as possible without obstructing the orifice.

For analyses that do not require the addition of water, remove the sample needle before adding the sample to the glassware. (This keeps the sampler needle clean for applications where it will actually be used). Remove the stainless steel nut and teflon ferrule at the top of the sample mount and replace them with a plug nut.



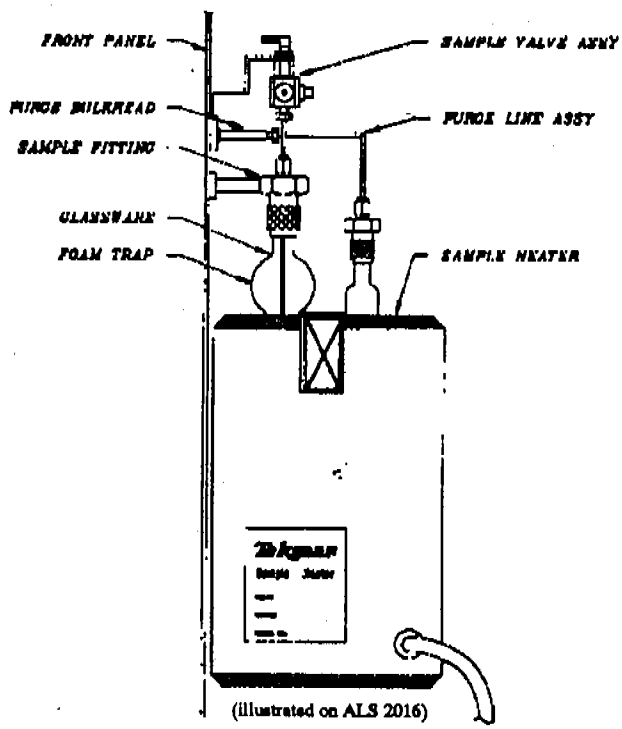
Fritless Sparger for the LSC 2000

If you need a part number for a component shown here, please refer to the Frit Sparger on page 11.

2.7 Installing the Sample Heater

ATTENTION
It is crucial that the glassware be disconnected from the unit when installing the Sample Heater to prevent glassware breakage.

1) Grasp the Sample Heater so that the power cable is to your right and the label on the Sample Heater is facing you.
2) Slide the glassware into the Sample Heater with the purge tube of the glassware to the right and the sample tube to the left.
3) Position the top of the Sample Heater below the foam trap of the sample tube.
4) Slide the velcro strap across the top of the Sample Heater between the sample and purge tubes and attach it to the other side of the Sample Heater.
5) Raise the sample needle sufficiently to clear the glassware.
6) Grasp the glassware by the end of the purge inlet.
7) Insert the glassware into the 1/2" sample mount as far as possible, then back it out approximately 1/16". Tighten finger tight.
8) Lower the sample needle, and tighten finger tight.
9) Connect the 1/4" purge line union on the LSC 2000 to the purge inlet of the glassware, and finger tighten.
10) Check for leaks (Section 3). If a position leaks at these fittings, the sample mount wrench supplied with the LSC 2000 kit box may be used to tighten the fitting. Avoid overtightening, which will break the glassware.
11) Configure the Sample Heater Parameters on the LSC 2000 (See Section 5.5).



(illustrated on ALS 2016)

ATTENTION
Remove the Sample Heater from the glassware only when the glassware is disconnected from the LSC 2000.

2.8 Connecting the Model 4210 VOST Autosampler

Refer to the instruction manual shipped with your Model 4210 for installation procedures. If you do not have a Model 4210 Instruction Manual (#14-2710-000), call our Sales Department at (800) 543-4461 to order one.

2.9 Connecting the Cryfocusing Module

To connect your Cryofocusing module, please refer to the instruction manual shipped with your Cryofocusing module. It should be added to the Accessories Section of this LSC 2000 User Manual. If you do not have a Capillary Interface Instruction Manual (#14-3401-000), call our Sales Department at (800) 543-4461 to order one.

2.10 Changing the Trap

Refer to the Valve Oven & Trap diagram in Section 12. The LSC 2000 is delivered with a blank trap installed. This prevents damage to a packed trap if the unit was powered up with no purge gas flow present. Replace the blank trap with a packed trap before running a sample.

2.10.1 How to Identify a Trap

Traps can be identified by a number stamped on the nut at the bottom of the trap. These numbers are:

Trap Number	Part Number	Type of Trap
0	14-1168-003	Blank
1	12-0083-003	Tenax
2	12-0084-003	Tenax/Silica Gel
3	14-0124-003	Tenax/Silica Gel/Charcoal
4	14-1457-003	Tenax/Charcoal
5	14-2366-003	0V1/Tenax/SilicaGel/Charcoal
6	14-1755-003	0V1/Tenax/Silica Gel
7	14-3347-003	0V1/Tenax
8	14-3928-003	Carbopak/Carbosieve
9	01-xxxx-xxx	Custom
G0	14-4164-003	Glass-lined Blank
G1	14-4045-003	Glass-lined Tenax
G2	14-4046-003	Glass-lined Tenax/Silica Gel
G3	14-4047-003	Glass-lined Tenax/Silica Gel/ Charcoal

2.10 Changing the Trap (cont.)

2.10.2 How to Change a Trap

1) Remove the trap door at the front end of the left panel.
2) ***Make sure the trap is not hot.***
3) If you have already powered up the unit, make sure the system is in Purge Ready or Standby.
4) Loosen the nut at the top of the trap one full turn but do not remove it completely.

The nut at the top of the trap should have been fastened finger tight and loosened easily. If not, the ferrule may need to be replaced.

5) Hold the bottom fitting in place with a 7/16" wrench while using a 7/16" wrench to turn the nut at the bottom of the trap counter-clockwise until the fitting is disengaged.
6) Grasp the trap furnace and trap and carefully pull the trap straight down and out of the upper trap fitting.
7) Grasp the trap furnace in one hand and the lower trap fitting with the other hand and pull the trap out of the furnace.
8) Slide a packed trap into the trap furnace sleeve.
9) Reconnect the top and bottom fittings. Take care not to tighten the top fitting past finger tight as this may result in damage to the teflon ferrule.
10) While holding the fitting in place with a 7/16" wrench, tighten the brass nut at the bottom with another 7/16" wrench 1/8 turn past finger tight.
11) Leak check all trap fittings according to Section 3.

Before running samples, the new trap must be thermally conditioned. Refer to Conditioning a New Trap, Section 10.2.

2.11 Installing the Drain Line

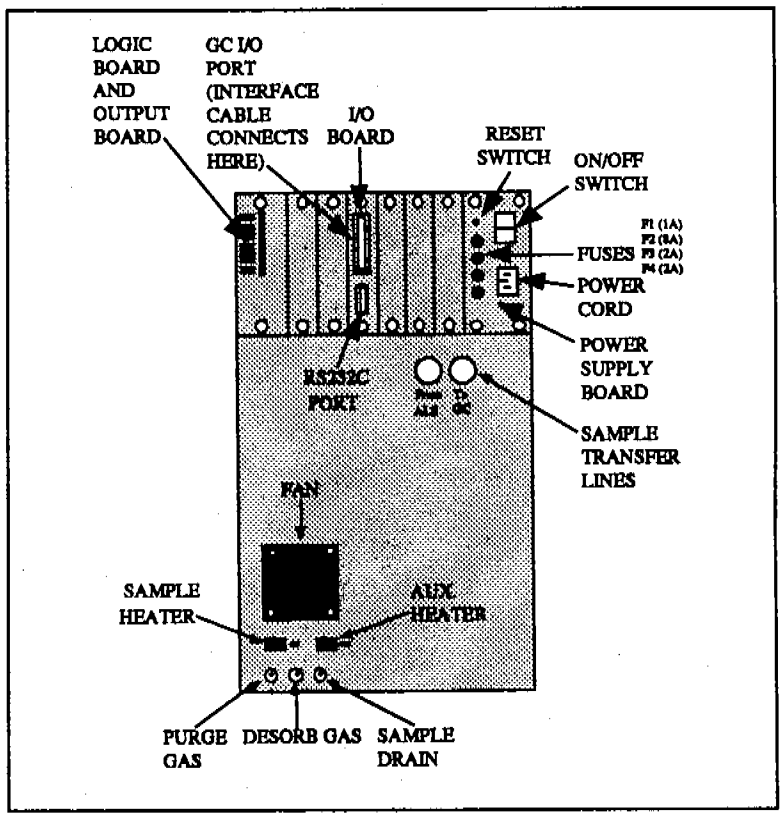
Attach a length of 1/8" I.D. plastic tubing to the fitting marked "Drain" on the back of the LSC 2000. Run this line to a sink or waste bottle.

2.12 Electronic Connections

Electronic connections on gas chromatographs are specific to each particular make and model available. Instructions for connecting an LSC 2000 to a particular gas chromatograph accompany the interface cable necessary to your specific LSC 2000 to GC setup. If you did not specify your GC setup, you will need to order an interface cable from our Sales Department at (800) 543-4461 (outside the U.S. at (513) 247-7000).

When you receive your cable you will also need to set the DIP switches on your LSC 2000's I/O board to acknowledge your GC. Installation instructions are included with every interface cable and should be added to the Accessories Section of this manual for future reference. Check Section 11.4 for further information about DIP switch settings.

2.12 Electronic Connections (cont.)



LSC 2000 REAR PANEL

2.13 Replacing the Microprocessor ROM

It may be necessary to replace the microprocessor ROM chip in order to upgrade the operating parameters of the LSC 2000. When purchasing accessories for your LSC 2000, it may have been verified that an upgraded ROM chip was required. The accessories to the LSC 2000 require a minimum version of 2.0 on the ROM. Versions 2.0 or greater will appear printed in the upper right hand corner of the Configuration screen (press **F4 (Conf)** in Start Up screen). There will be no display of versions previous to 2.0.

To replace the ROM chip:

1) Unplug the power cord from the LSC 2000.
2) Remove the 4 retaining screws located on the sides of the Control Module (see the LSC 2000 Electronics Module Connection diagram in Section 12) and carefully remove this module by lifting straight up on the module.
3) Locate the ground wire.
4) Disconnect it from the lower panel with an 11/32" wrench and slide the wire out of the retaining clip.
5) Lay the module on its top so that the boards and ROM chips are visible.

2.13 Replacing the Microprocessor ROM (cont.)

ATTENTION

The ROM chip is a static sensitive chip. Use caution when handling the chip. Do not touch the pins of the chip.

The microprocessor board and display are mounted to the interior side of the keypad. The ROM chip is on the microprocessor board. The ROM chip is labeled on the LSC 2000 CPU Board & Keypad diagram (Section 12). The chip is mounted in a Z.I.F. (Zero Insertion Force) socket. The Z.I.F. socket has a lever on each end which, when in the down position, applies force to the pins of the chip to make a connection. When the levers are in the up position, it relieves the force on the pins and disconnects the chip for easy removal or insertion.

6) To remove the old ROM, lift up the lever on the Z.I.F. socket and remove the chip by holding each end and pulling it straight out.
7) Note that the ROM chip has a u-shaped groove at one end. This end of the chip goes toward the lever of the Z.I.F. socket. Insert the new ROM chip holding the ends of the chip.
8) Align the pins on the chip with the sockets and *carefully* insert the chip, making sure not to bend the pins, until it seats. With finger pressure still being applied, push the Z.I.F. lever down to lock the ROM chip in place.
9) To replace the Electronic Control Module on the unit, follow the removal procedure in reverse, making sure you run the green/yellow ground wire through the retaining clip before connecting it to the grounding stud.

It will be necessary to re-program all parameters once the instrument has been re-installed.

2.14 Installing Accessory Boards

This section contains the instructions for handling accessory boards and installing them in the LSC 2000. Refer to the LSC 2000 I/O Board diagram (Section 12). The microprocessor ROM may need to be updated when installing accessories. If so, please refer to Section 2.13 to install the ROM chip.

ATTENTION

All accessory boards can be damaged by static discharge. To prevent this damage, the boards are wrapped in anti-static bags.

1) Hold the board (still wrapped in its anti-static bag) in one hand and touch a metal part of the LSC 2000 with the other hand.
2) Carefully remove the board from its anti-static bag.

Hold the accessory board by the bracket or edge of the board only. Avoid touching the components or connections.

2.14 Installing Accessory Boards (cont.)

3) When inserting the accessory board into the LSC 2000, hold the board by its bracket and slide it into an empty slot.
4) Tighten the screws to lock the board in place.

3.1 Leak Checking

The LSC 2000 is not a leak prone system, however, it is very leak sensitive. Utmost care should be taken to ensure that the system is leak tight. All fittings should be thoroughly leak checked. The simplest and most effective way to leak check a system is by bubble leak check.

To begin a complete leak check, place a 1/16" Swagelok cap nut (included in the kit box) on the LSC 2000 vent fitting and tighten it wrench tight.

ATTENTION
Do not use any type of soap solution (e.g. Snoop or Detect) to leak check. If these solutions get into the flow, increased background and adsorption are likely to occur.

Leak checking is best accomplished with an electronic thermal conductivity detector.

Electronic leak detectors do not work well when using nitrogen as the purge gas. If possible, use helium when leak checking.

If an electronic leak detector is not available, a 1:1 solution of isopropanol:water may be used, if done so sparingly.

Complete the following steps:

1) Put 5 ml of organic-free water in the purge vessel.
2) Press STEP to advance the unit to Purge mode.
3) Press HOLD to keep the system in Purge mode. This procedure causes the system to pressurize.
4) Time the bubbling in the purge vessel. If the bubbling stops between 3 to 7 minutes, the system is leak tight and no further leak checking is necessary.

TO DIAGNOSE A LEAK:
First make sure the leak is not at the capped vent. The Swagelok nut may be worn out.
a) If the bubbling stops before 3 minutes have elapsed, it is likely that there is a leak upstream of the purge vessel (before the gas flow reaches the purge vessel). If a leak is indicated, leave the system in purge with the cap on the vent. Capping the vent causes an increase in pressure which will exaggerate the leak and make it easier to find.
b) If the bubbling continues after 7 minutes, a leak downstream of the purge vessel is indicated (after the gas flow leaves the purge vessel).

5) Remove the trap cover at the front left side of the LSC 2000. Check the fittings at the top and the bottom of the trap.
6) Check the 10 fittings inside the valve oven of the LSC 2000.

3.1 Leak Checking (cont.)

7) Check the following 5 fittings around the glassware on the front of the LSC 2000:
   a. purge line fitting (at glassware)
   b. purge bulkhead (at unit)
   c. sample glassware fitting
   d. sample needle nut
   e. sample valve (3 port)
8) Check the 18 Swagelok fittings inside the LSC 2000 by using the LSC 2000 Leak Check Diagram in Section 12.
9) Reinstall the valve heater block on the valve in the LSC 2000. Replace the valve oven cover first, left side panel next, and then the trap cover.

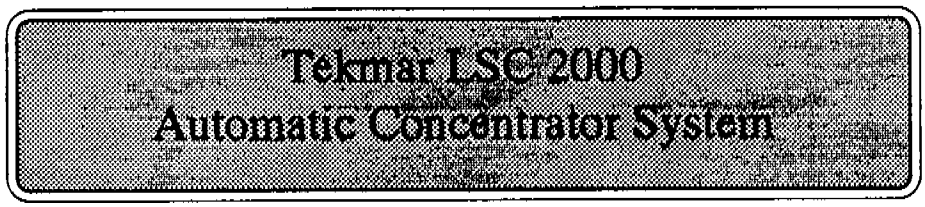
4.1 The Microprocessor

4.1.1 General Description

The LSC 2000 microprocessor programmable control consists of:

- an 8 bit microprocessor with 64K of program ROM (Read Only Memory), 2K of RAM (Random Access Memory), and analog input through which the microprocessor receives information from its peripheral devices (for example, heater thermocouples),
- a membrane keypad with which values for program parameters may be modified,
- and a six line LCD (Liquid Crystal Display) that displays the various steps of program execution.

The controller uses a 6303 eight bit CMOS-type microprocessor to manage the operation of the various functions of the system. The introductory system screen looks like this:

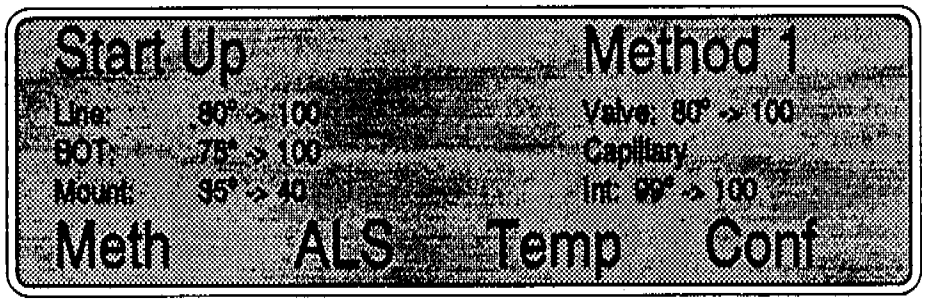


Instructions for the microprocessor are stored in ROM and on each initial power-up the basic program parameters are displayed for running or modification. Battery back-up retains modified parameters when power failure occurs.

The program panel outlines the purging, desorption, and cryofocusing functions that are currently being used in EPA procedures, along with the default values for the set times and temperatures associated with each step.

The controller allows value modifications to be made to the program parameters after power-up, storing the changes in RAM. The controller can store 4 complete sets of program parameters in RAM; these are labeled Method 1, 2, 3, and 4. The defaults for each of the four methods are the same. However, each method can be modified independently to reflect a specific set of parameter values. Because they are stored in the unit's memory, customized methods allow for greater convenience and more efficient process time.

After the system displays the introductory screen, it performs self tests. Following self tests, it will display the Method 1 Start Up screen:



4.1 The Microprocessor (cont.)

4.1.2 Serial (RS232C) Output

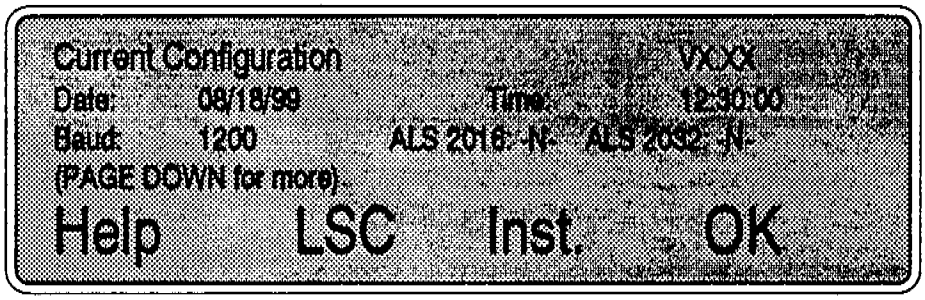
The controller has a serial port that allows communications between the system and a printer. The port will provide the following data in ASCII-coded output:

1) Method listing: Output occurs whenever Method is chosen.
2) Error/fault messages: Output whenever a condition such as "heater fault", or "power fail", etc. are encountered.
3) Running state transitions: Outputs clock time whenever the program makes a transition from one program to the next, starting with Start Up. The name of the program stage is also sent.

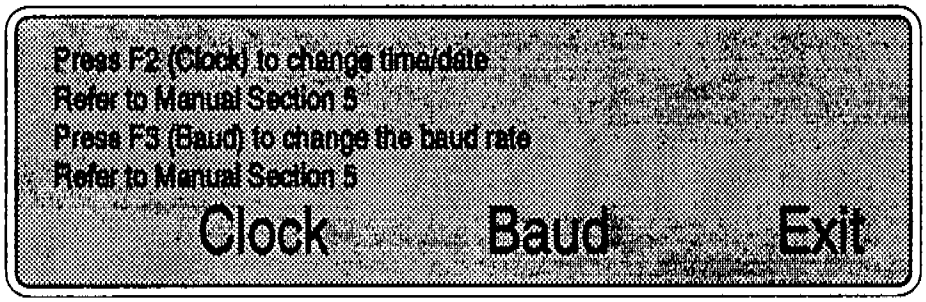
Reviewing and Changing the Baud Rate

To use a printer with the LSC 2000, the baud rate of the printer and the LSC 2000 serial port must match.

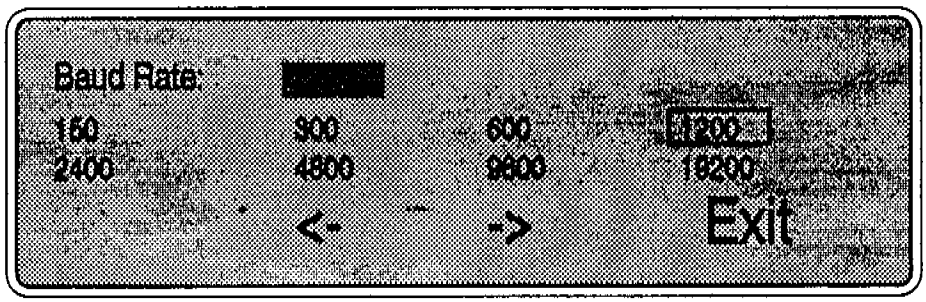
1) From the Start Up screen, press **F4 (Conf)** for the Current Configuration screen.



2) Press **F2 (LSC)** to get the LSC screen:



3) Press **F3 (Baud)** to see the array of values for the serial port baud rate:



4) Press **F2 (<-)** or **F3 (->)** to highlight the desired baud rate and press **F4 (Exit)** for the Method screen.

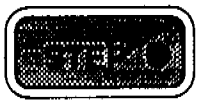
4.2 Keypad Description

The LSC 2000 keypad is the center of control for all operator tasks. The commands available for each program stage are located on the bottom line of the screen. Each command corresponds to the function key found directly beneath it. There are four keys on the keyboard that are designated as function keys. A fifth key, **ENTER**, also serves as a function (command) key, but it will be discussed in Section 7, Modifying Methods.
The components of the keypad and their use follow.

The function keys correspond directly to commands found on the bottom line of the Liquid Crystal Display (LCD) screen. The commands available depend upon the actual program step the system is performing.

Press **AUTO** to signal the system to proceed through the run automatically.

Press **HOLD** to interrupt the system at any point during a run. The system will not proceed until the operator presses **STEP, AUTO, START, STEP TO BAKE,** or **STEP TO STANDBY.**



Press **STEP** to cause the system to proceed to the next system mode.

4.2 Keypad Description (cont.)

Press **STEP TO STANDBY** to cause the system to go directly to Standby. This command avoids 'wear and tear' of the 6-port valve and also avoids start up of the GC. Since this command terminates the run in progress, the system will display a screen asking you to confirm the aborted run .

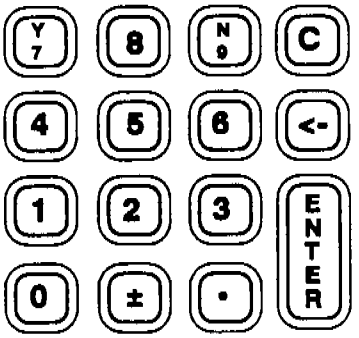
Press **STEP TO BAKE** to cause the system to go directly to the Bake mode. This feature allows the trap to be cleaned immediately and prepared for another run. It is also useful for conditioning new traps.

Press **START** to signal the LSC 2000 to proceed from the Purge Ready mode. A prompt appears on the screen to tell the operator that the unit is ready to load the sample.

Press **DRAIN** to manually open and close the drain, causing the system to drain the sample from the unit. This feature offers the operator greater control over the exact moment a sample is drained. This is useful when the AUTO DRAIN option is turned off, enabling a second run to be performed.

4.2 Keypad Description (cont.)

Press the numbered keys on the numeric keypad to change the values assigned to system Method parameters. Keys 7 and 9 are also used to enter "Yes" and "No" when configuring the system to acknowledge accessories.



Press **CLEAR** or **<-** **(BACKSPACE)** to change or eliminate a value entered from the keypad. The value must be highlighted by the shaded box before it is changed with the keypad.

Press **ENTER** to fix values into system memory. Where no change to a parameter value is necessary, press **ENTER** to return to the Method Parameters listing.

The **PAGE UP** and **PAGE DOWN** keys serve two separate functions. Press **PAGE DOWN** or **PAGE UP** to change the viewing angle of the LCD screen to see the screen clearly from a sitting or standing position. When the screen prompt <PAGE UP/DOWN for more> appears, the **PAGE UP** and **PAGE DOWN** function allows viewing of additional parts of a listing (in Method Edit, Configure, or Instrumentation, for example).

4.3 Program Panel Description

The program panel consists of purge, desorption, cryofocusing, and bake procedures complete with default values for each of the program steps. Each of four methods can be run as is, or the values for each of the program steps can be modified (Section 7).

The program panel is located on the front of the unit next to where the sample is mounted. It lists the program steps in sequence and has LEDs (light-emitting diodes) that indicate which program step is being performed. Whenever the unit is turned on, all modes on the program panel will illuminate red except one. A green LED lights up to indicate the mode the unit is in currently. If a particular mode on the panel corresponds to an accessory that is not installed, the corresponding LED will not illuminate.

ATTENTION

Prepurge and Preheat can only be run when the Sample Heater is installed. Cooldown and Inject can only be run when the Cryofocusing Module is installed.

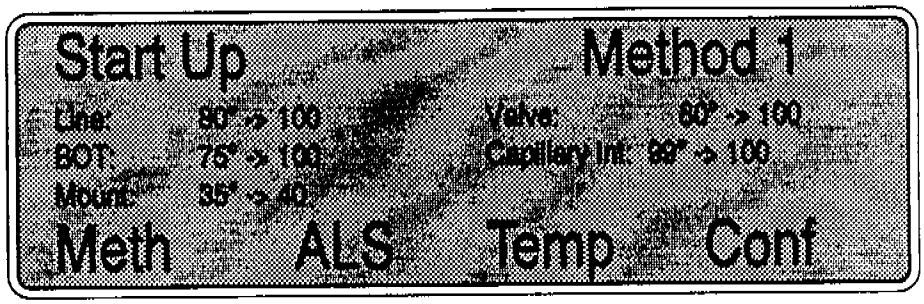
4.4 Program Steps

The following describes the tasks that are performed by the system during each of the program steps:

• STARTUP

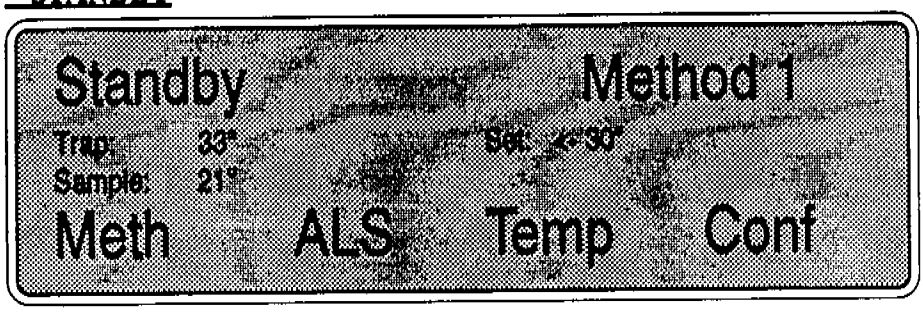
When the system is powered up, Standby establishes initial conditions for a sample run. After a run, initial conditions are recovered in this step. The LCD window displays the Line temperature, BOT (Bottom Of Trap) temperature, Mount temperature (where the sample glassware is attached), and the Valve temperature. The *actual* temperature is to the left of the '>' symbol and changes as the components heat up. The *set* temperature value is to the right of the '>' symbol. If a Cryofocusing Module has been installed, "Capillary Int" will be followed by its union temperature.

4.4 Program Steps (cont.)



The system automatically proceeds to the Standby screen, which is the second phase of Startup mode.

• **STANDBY**

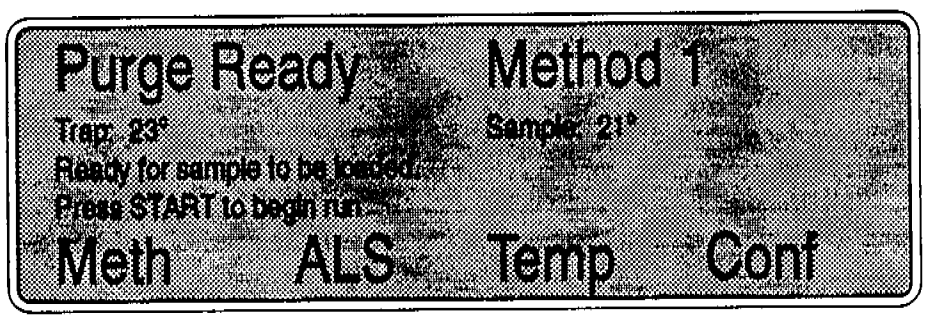


The LSC 2000 is programmed to come up in HOLD as a safety measure. Press AUTO to cause the unit to proceed.

When all five parameters have reached their set temperatures, the Standby light on the Program Panel goes out, the Purge Ready light goes on, and the Purge Ready screen appears.

• **PURGE READY**

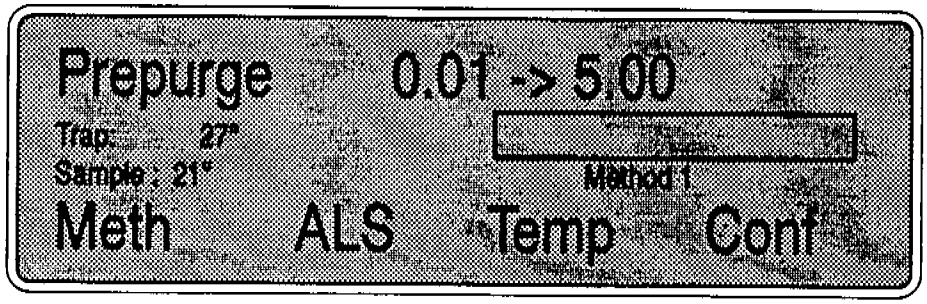
The Purge Ready Step serves as a signal to the operator that proper conditions have been met and the unit is ready to purge the sample. The unit will pause in Purge Ready until **START** is pressed.



4.4 Program Steps (cont.)

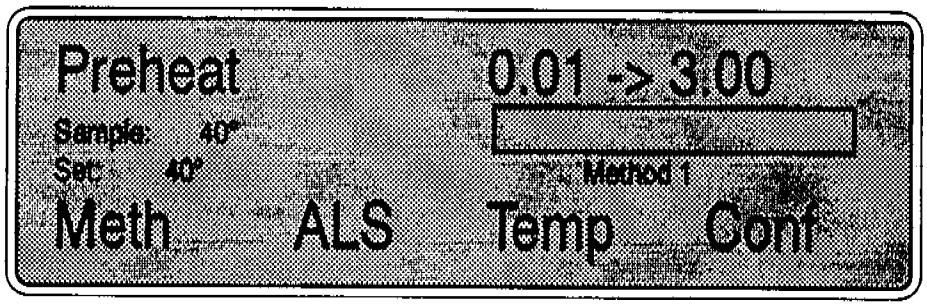
• PREPURGE

Prepurge mode functions only when a sample heater is installed. In this mode, the purge gas is turned on before a sample is heated. This process removes oxygen from the sampler and assures that the sample is blanketed by inert gas when it is heated. The inert gas prevents oxidation of the heated sample.



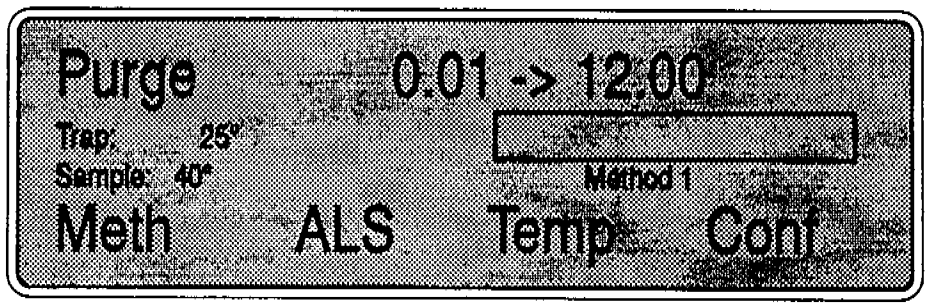
• PREHEAT

Preheat mode functions only when a sample heater is installed. This mode heats the sample in a static condition, i.e., without purge gas flow. This process allows the sample temperature to equilibrate before purging, which enhances quantitative reproducibility.



• PURGE

In Purge mode, volatiles are removed from the sample by passing purge gas through it.

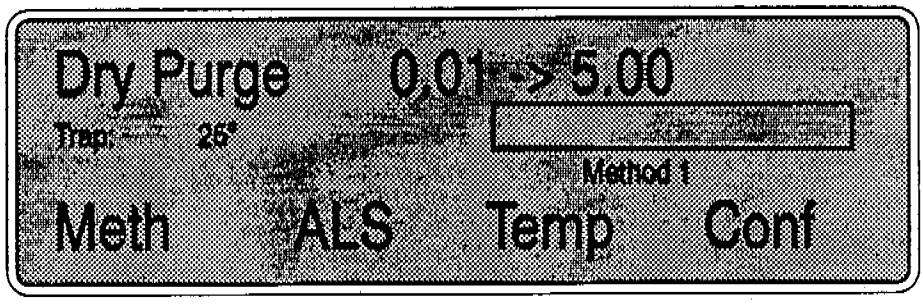


4.4 Program Steps (cont.)

• DRY PURGE

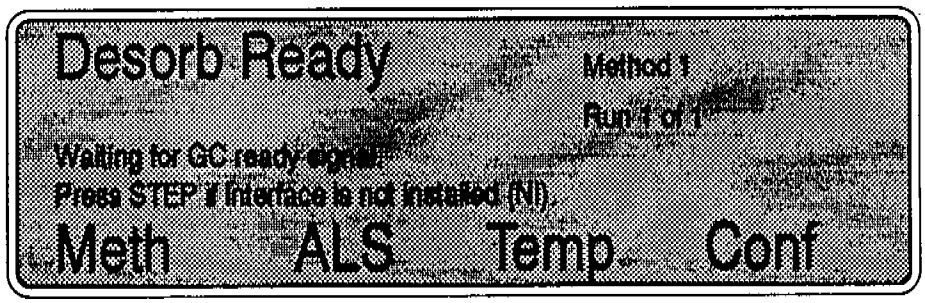
In Dry Purge mode, the purge gas remains on, but flows only through the trap, bypassing the sample. This process causes water in the trap to be removed.

If the trap contains silica gel, water in the trap cannot be removed.



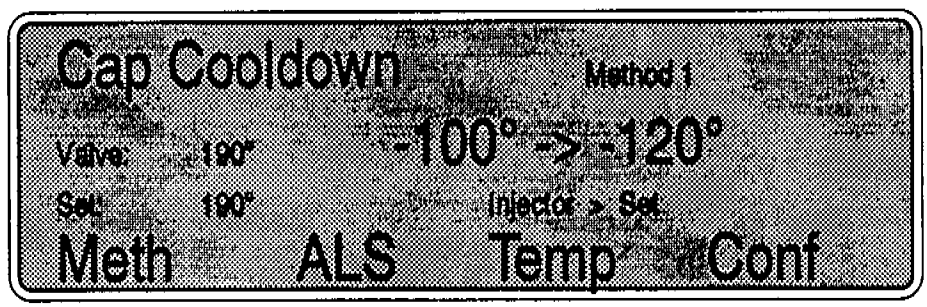
• DESORB READY

In Desorb Ready, the unit signals that it is ready to send the sample to the G.C.



• COOLDOWN

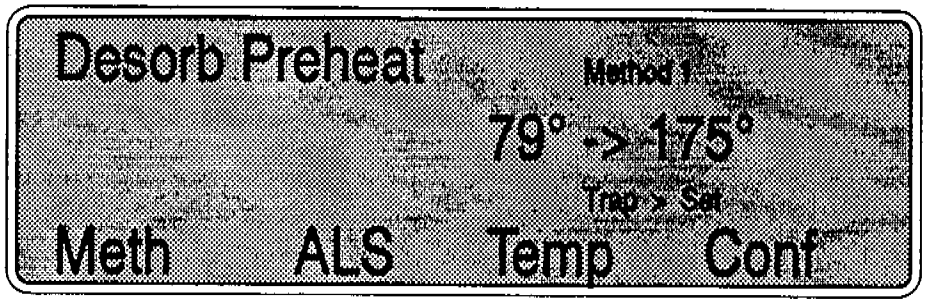
Cooldown mode occurs only when a Capillary Interface is installed. In this mode, the sample is cryofocused (frozen) in the Interface trap in order to improve peak shape during the injection. This process concentrates the injection in order to make it most compatible with capillary column use.



4.4 Program Steps (cont.)

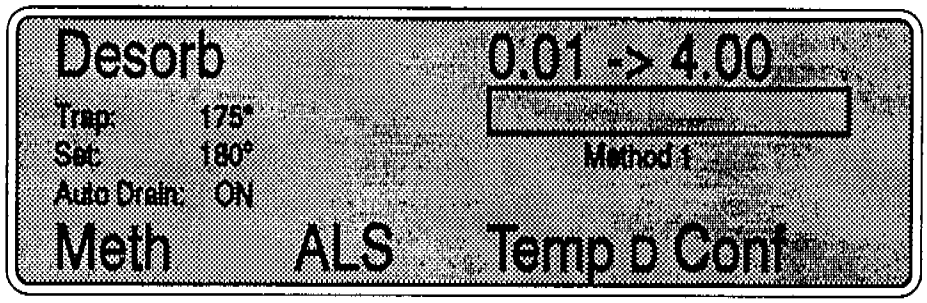
• DESORB PREHEAT

In Desorb Preheat mode, the trap is heated before the 6-port valve is switched, so that the trap is hot before the analytes are backflushed. This process improves the quality of the injection of the sample before it goes into the G.C.



• DESORB

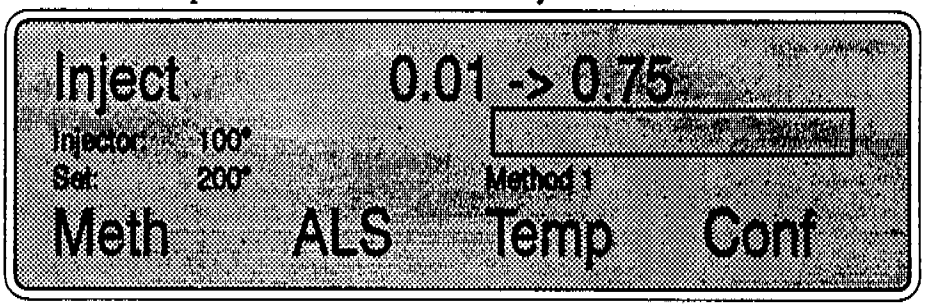
In Desorb mode the sample is injected into the G.C.



The flashing 'D' between (Temp) and (Conf) on the LCD screen indicates that the drain is open. Press DRAIN to close or open the drain.

• INJECT

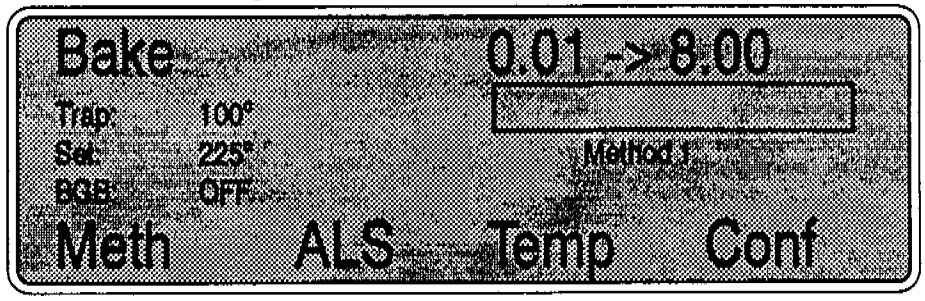
Inject mode occurs only when a Capillary Interface is installed. In this step, the interface trap is heated to release the analytes into the GC column.



4.4 Program Steps (cont.)

• BAKE

In Bake mode the trap is cleaned for the next run.



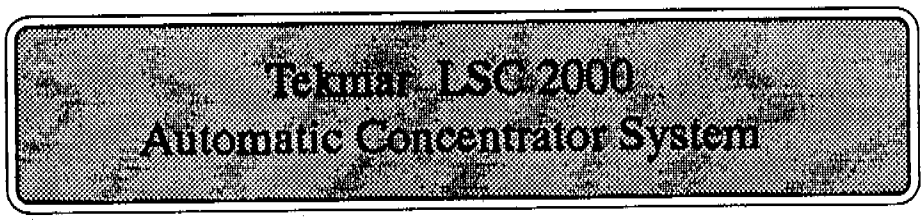
4.5 RS232 Interface

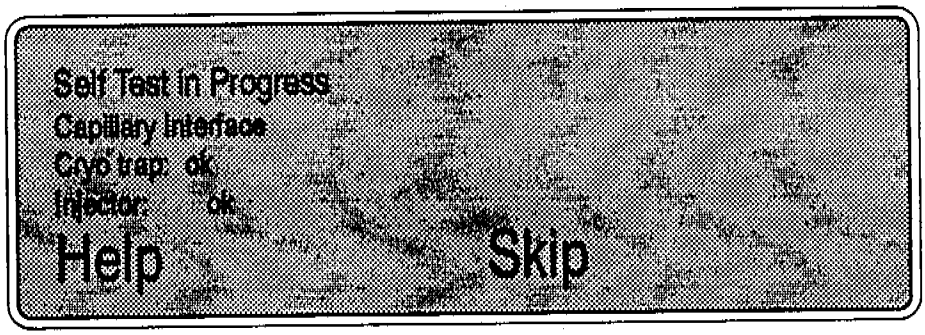
RS232 is a communications protocol feature of the latest LSC 2000 ROM that enables the 2000 user to interface with a remote PC while maintaining complete control over all 2000 operations. For more information about the RS232 interface, please contact the Purge and Trap Product Line Manager at 800-543-4461.

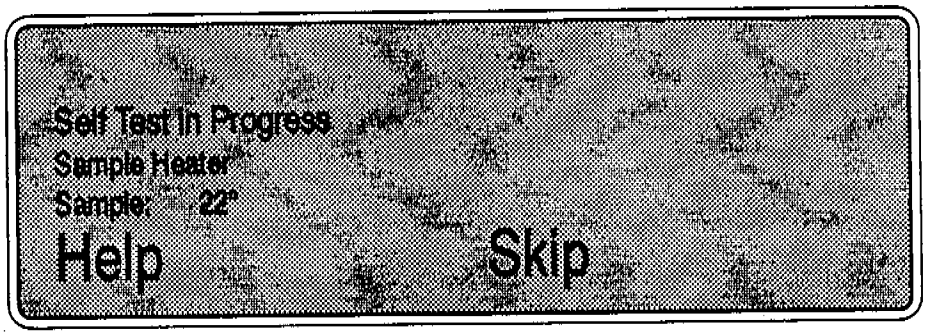
5.1 Running Self Tests

Upon routine power up, the system conducts self tests to confirm that all its heated components are working properly. Default values are loaded into RAM from ROM when either Run or Edit is chosen from the Method menu.

To conduct self tests the system briefly turns on each heater in succession. When the thermocouple for a particular heater registers a temperature increase, the system advances to the next heater.





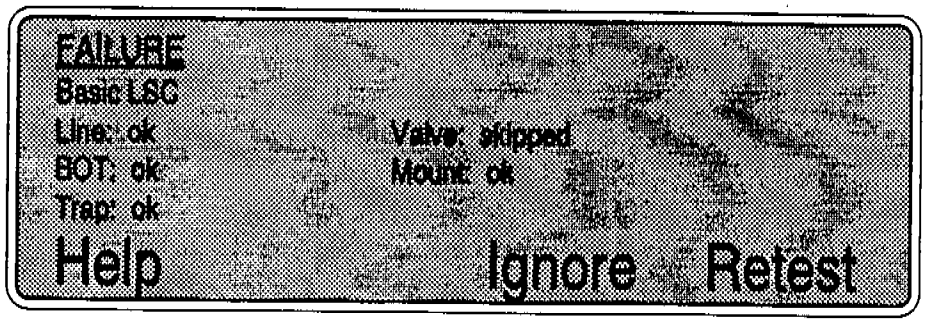


An error screen will appear if there are heater faults (they either go beyond their set point or don't reach it). See Section 8.5 for a more detailed explanation of each fault that could occur.

5.1 Running Self Tests (cont.)

Skipping Self Tests

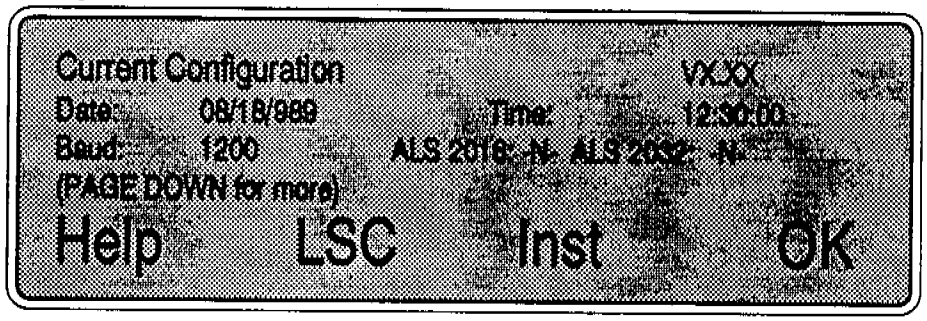
Self tests may be skipped at any time by pressing **F4 (Skip)**. Pressing **F4 (Skip)** will cause the system to advance to the test for the next heater. However, the system responds to skipping a self test in the same manner that it does a failed self test. Both of these conditions require operator intervention.



Press **F3 (Ignore)** to acknowledge that the test was purposefully skipped. If an error message appears for a heater that was not skipped, press **F4 (Retest)** to rerun the self tests on that set of heaters.

If the accessory modules for a Simple Heater or a Capillary Interface are not installed, the tests for these modules MUST be manually skipped.

When the self tests are complete the system goes to the Current Configuration screen:



5.2 Changing the Viewing Angle of the Screen

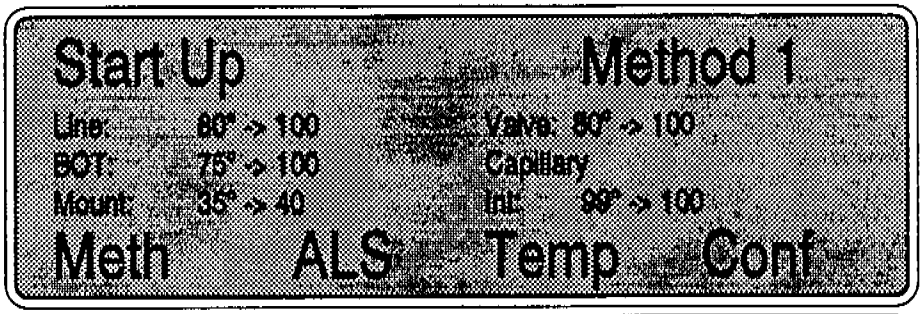
The viewing angle of the LCD screen can be adjusted to optimize readability in a variety of unit setup conditions. Press **PAGE UP** to increase the angle of the screen and **PAGE DOWN** to decrease the angle. Press the key down firmly for a continuous change in the angle or press and release the key for an incremental change.

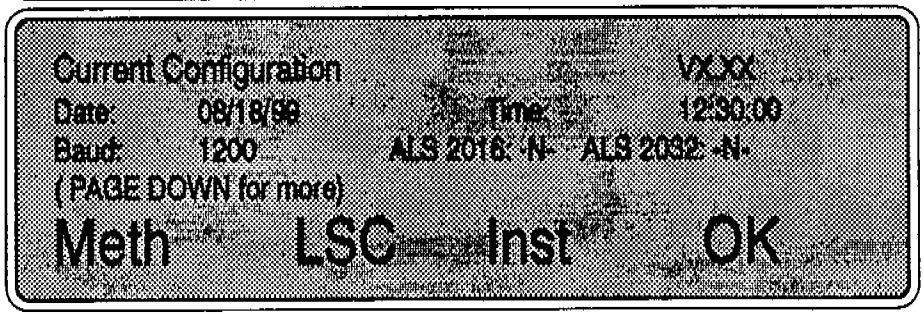
The viewing angle cannot be adjusted while the unit is in a mode where PAGE UP and PAGE DOWN provide other functions (for example, while editing the Method Parameters Listing).

5.3 Reviewing and Resetting the Clock

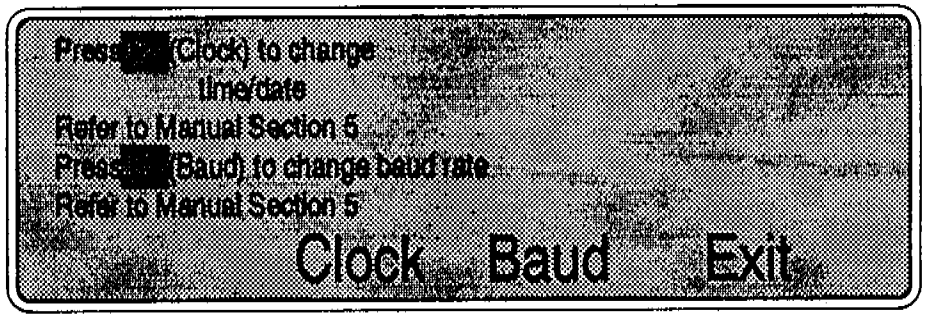
The Clock controls the date and time acknowledged by the system.

1) To view the clock, press **F4 (Conf)** during execution of any program mode. For example, pressing **F4 (Conf)** from the Start Up screen will display the Current Configuration screen.





2) If the time and date are correct, press **F4 (OK)**. To change them, press **F2 (LSC)** to go to the LSC screen:



3) Press **F2 (Clock)**.

4) Press **F2 (<-)** or **F3 (->)** to select the digit that needs to be changed. Press the desired digit on the keypad to enter it into system memory.

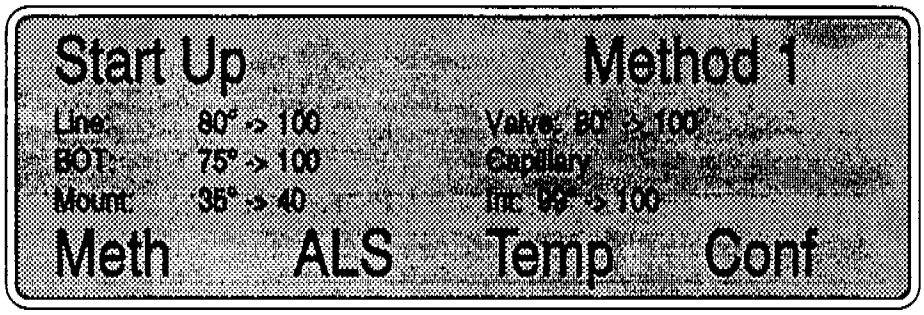
5.3 Reviewing and Resetting the Clock (cont.)

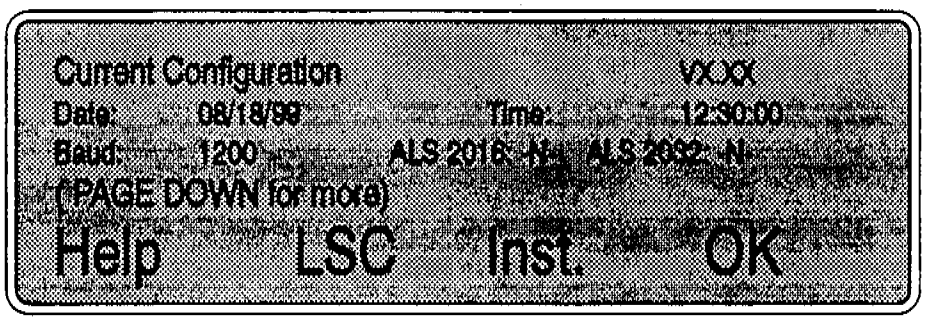
5) When all values are correct, press **F4 (Exit)**.

If an invalid key is pressed when attempting to input new time and date values, the message -> INVALID DIGIT/KEY <- lights up on the screen and the system beeps. When the message disappears you may reattempt to enter the new values.

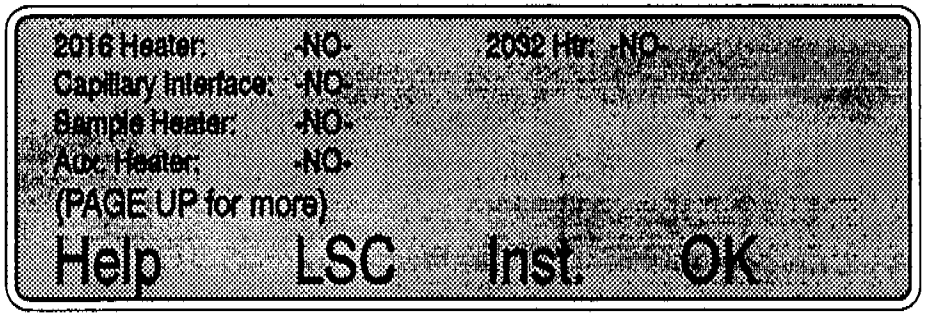
5.4 Reviewing and Changing Instrument and Accessory Configurations

To review the accessories and baud rate configured into the system, press **F4 (Conf)** during execution of any program mode. For example, pressing **F4 (Conf)** from the Start Up screen will display the Current Configuration screen.





Press **PAGE DOWN** on the keypad to see the rest of the Instrument Configuration listing:

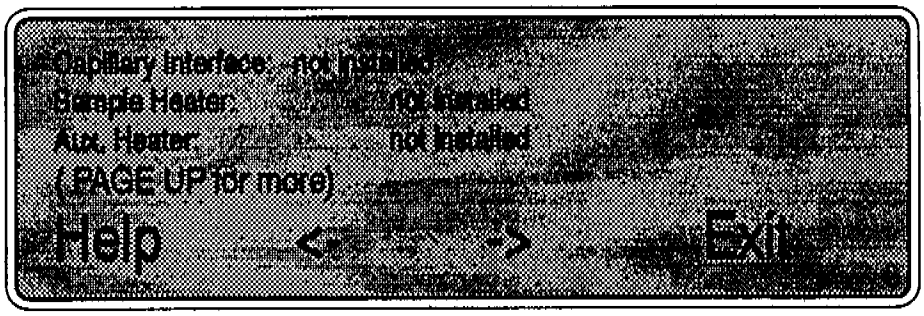


5.4 Reviewing and Changing Instrument and Accessory Configuration (cont.)

If an accessory needs to be configured differently from the way it appears in the listing, press **F3 (Inst)** to access the Instrument screen:

To change an accessory's configuration:

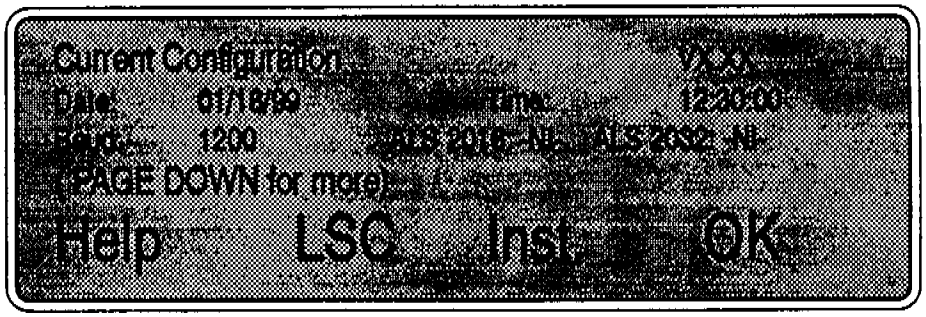
1) Press **F2 (<-)** or **F3 (->)** to move the highlighted box to the desired accessory.
2) With the desired accessory highlighted, press **Y (digit 7)** or **N (digit 9)** to reconfigure the system for that accessory.
3) Press **PAGE DOWN** to access additional accessories in the listing:



(If an accessory is not installed it cannot be turned on (activated).

To turn an accessory on or off:

1) Press **F2 (<-)** or **F3 (->)** to move the highlighted box to the desired accessory.
2) With the desired accessory highlighted, press **Y (digit 7)** or **N (digit 9)** to activate or deactivate it.
3) When all accessories are configured as desired, press **F4 (Exit)** to return to the Current Configuration screen.



4) Press **F4 (OK)** to return to Program mode.

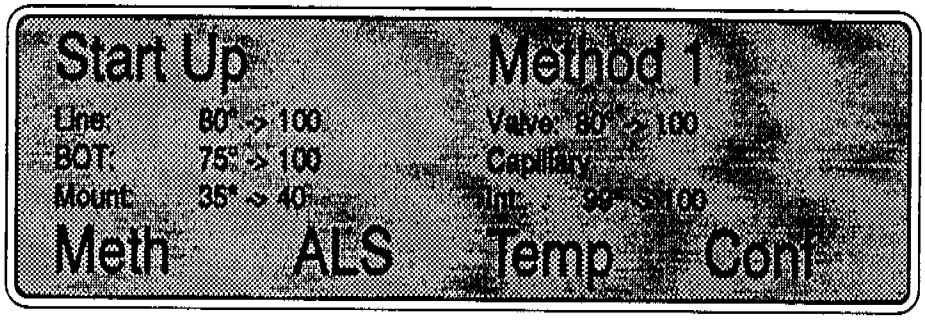
5.5 Configuring the Sample Heater Parameters

The LSC 2000 Sample Heater accessory is activated by setting the Prepurge time, Preheat time, and Sample Heater temperature with the keypad.

1) If you have powered up the LSC 2000, you must push the reset button on the rear panel to configure the Sample Heater into a Method. This will reinitialize the program and the system will run a self test.

> **ATTENTION**
> Do not skip the self test for the Sample Heater. The unit will treat this as failures, and will not allow you to turn on the accessory unit.

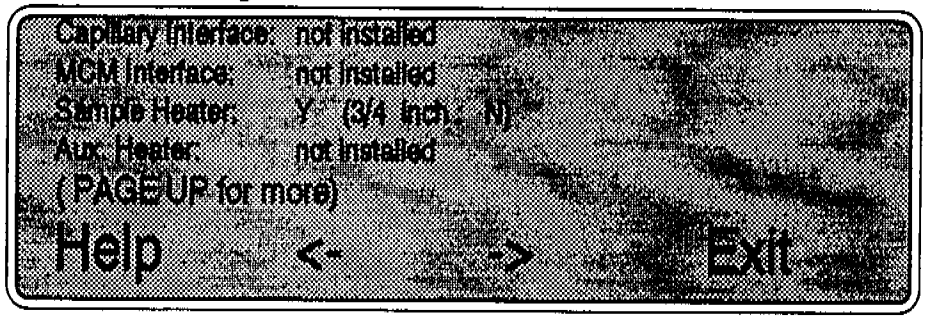
2) With the Start Up screen displayed, press **F1 (Meth)** to modify the parameter values.



> Method Parameter values can be modified for any Method from any Program mode screen. However, if modifications are made from any mode after the start of Preheat, the change will not take effect until the next sample.

First select the type of sample heater you have installed:

1) From the Current Configuration screen, press INST to review the instrument configuration screen:



2) If you select "Y" the cursor will skip to the "3/4 inch: N" option. If you highlight "N" and choose "Y" on the keypad, the 2000 will be configured for the 3/4" silicone tube sample heater.
3) If you select "N" at the "3/4 inch: N" prompt, the 2000 will be configured for the pocket heater.

5.5 Configuring the Sample Heater Parameters (cont.)

There are three parameter settings to consider for the Sample Heater:

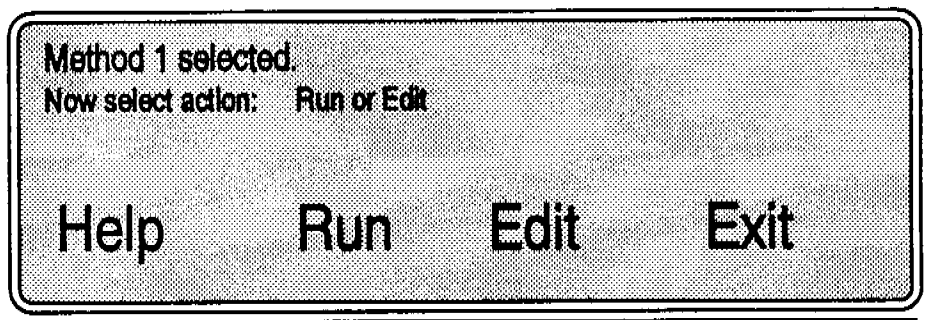
a) Prepurge Time eliminates any air from the sampler before heating to prevent oxidation; desirable for some samples (e.g. oils). The formula used to determine the time is: Volume x 3 / flow rate. *For example*: If a 10 ml sample is used in 30 ml glassware , the remaining volume is 20 ml. If the purge flow rate is 40 ml/min., the prepurge time should be set to 1.5 minutes. **([20 ml x 3] / 40 ml/min. = 1.50 min.).**
The total volume of each sampler is approximately:
- 10 ml for a 5 ml sparger
- 30 ml for a 25 ml sparger

b) Preheat Time is required for the sample to rise and equilibrate at temperature before purging to enhance quantitative reproducibility. The sample heats at an approximate rate of 20°C/min. Additional time should be allotted for larger samples, or solid samples where heat transfer is not as uniform as liquids.

c) Sample Heater Temperature depends on the sample you intend to run.

3) Enter the number of the Method you wish to use.

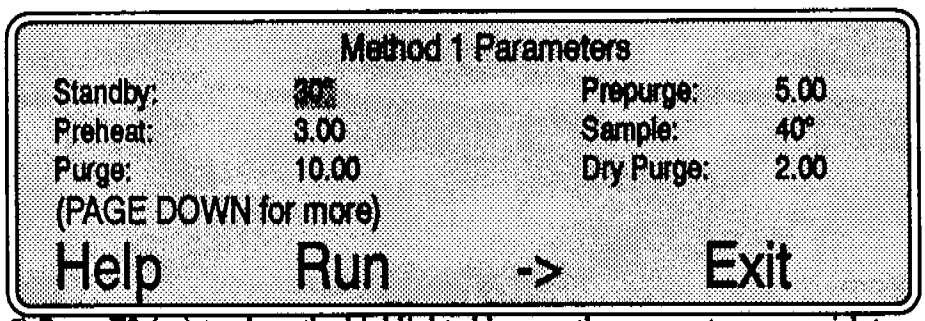
4) Press F3 (**Edit**) to change the parameter values (Prepurge time, Preheat time and Sample Heater temperature) for the Sample Heater.



ATTENTION

The Sample Heater accessory has a set point range from ambient temperature to a maximum heater set point of 200°C. Tekmar recommends that when using Tekmar heaters the parameter not exceed 100° C.

When using the 3/4" silicone tube heaters, the temperature will be displayed slightly higher than the set point for a pre-calculated length of time. This feature allows the sample to reach the temperature setpoint faster.



5) Press F3 (->) to place the highlighted box on the parameters you wish to change. **Prepurge** (time) **Preheat** (time), and **Sample** (heater

5.5 Configuring Sample Heater Parameters (cont.)

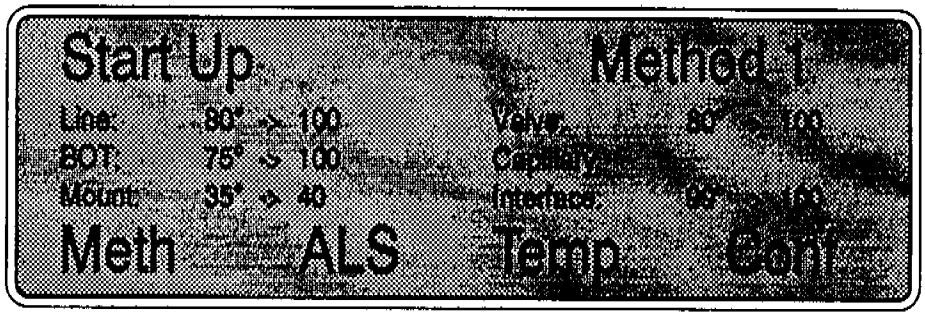
5.6 Reviewing Method Temperature Values

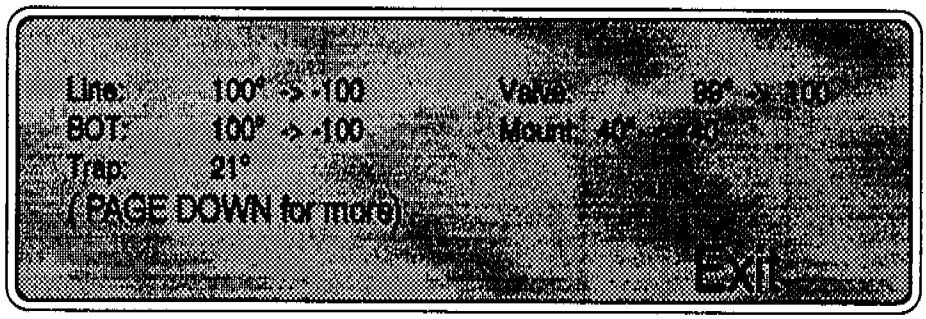
ATTENTION

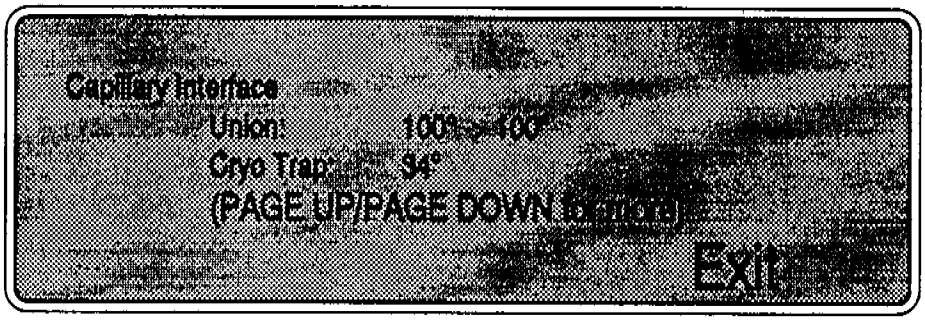
Preheat (time) and Sample (heater temperature) must have values greater than zero for the Sample Heater to function. Prepare (time), however, may have a value of zero if this mode is not required.

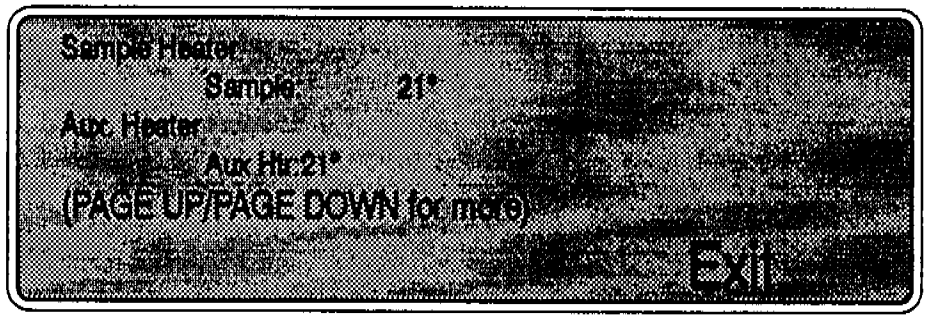
1) For a quick review of temperature and parameter values assigned to a given Method, press **F3 (Temp)** from any Program screen. ***No changes can be made to parameter values from the Temperature menu. To modify parameter values, see Section 7.***

2) Press **F3 (Temp)** from, for example, the Start Up screen to display the Temperature screen:









If no Cryofocusing Module or Sample Heater is installed, the screen displays -not installed- where set temperature values are normally located.

6.1 Loading the Method Default Values Into RAM

Four methods can be stored in the memory of the LSC 2000. When powered up, the unit automatically goes to Method 1. The default values for Method 1 correspond to EPA Method 601 (See Section 7.1).

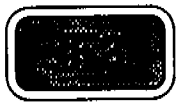
Initial Program Commands

(Meth)

Press to go to another Method or to modify the parameter values for a Method. The system asks which Method (1-4) you wish to use. Press the appropriate digit on the keypad.

(Run)

Press if you wish to run the chosen Method. The system will go to Start Up mode in that Method.



(Edit) (->)

Press if you wish to view or change parameter values. The system will go to the parameter listing for the Method you chose. To view the next section of the parameters listing (there are 5 "pages"), press **PAGE DOWN**. To change a parameter value, move the cursor to the desired parameter and press **ENTER**. Press the appropriate digits to input the new value and press **ENTER** again.

(Exit)

Press to leave the Method Parameters Listing.

Once these procedures have been accomplished, the system will retain the default or modified Method values in memory (except in certain cases of power failure).

Initial Power Up

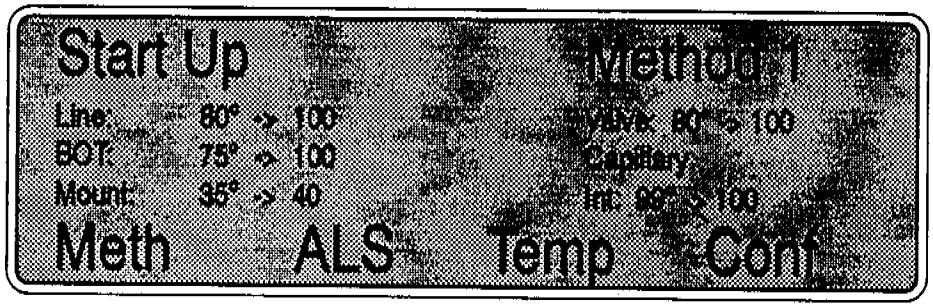
If this is an initial power up (or if this is a power up after a power failure that resulted in memory loss), the "Parameters Invalid" screen will appear. If you press **(Run)** or **(Edit)** you will cue the system to load the parameter default values into Random Access Memory (RAM). Press **F4 (Exit)** to leave the "Parameters Invalid" screen.

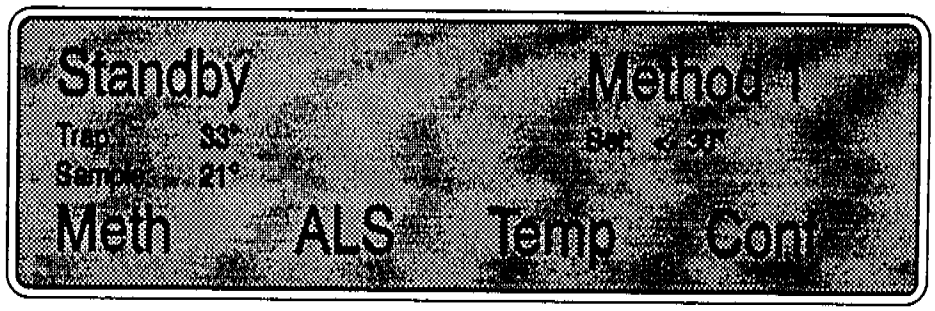
6.2 Running a Default Program

The LSC 2000 system has four default programs, or Methods that are set according to the standards and procedures established by the United States Environmental Protection Agency. To run a sample using the EPA parameter values already configured into the system, start by using Method 1. When the LSC 2000 is powered up, the introductory screen appears first:

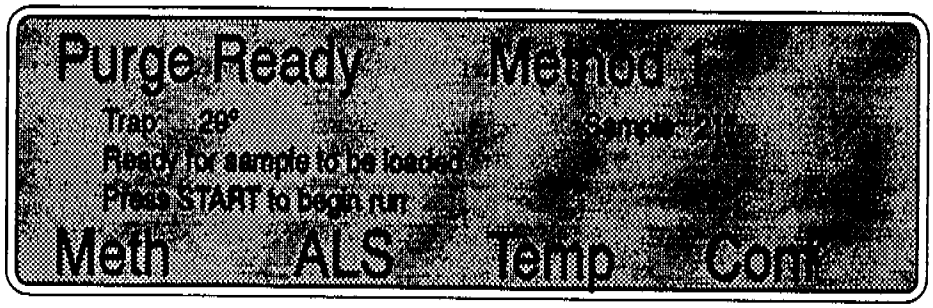
6.3 Using Method 1

The system proceeds automatically to the Method 1 program.



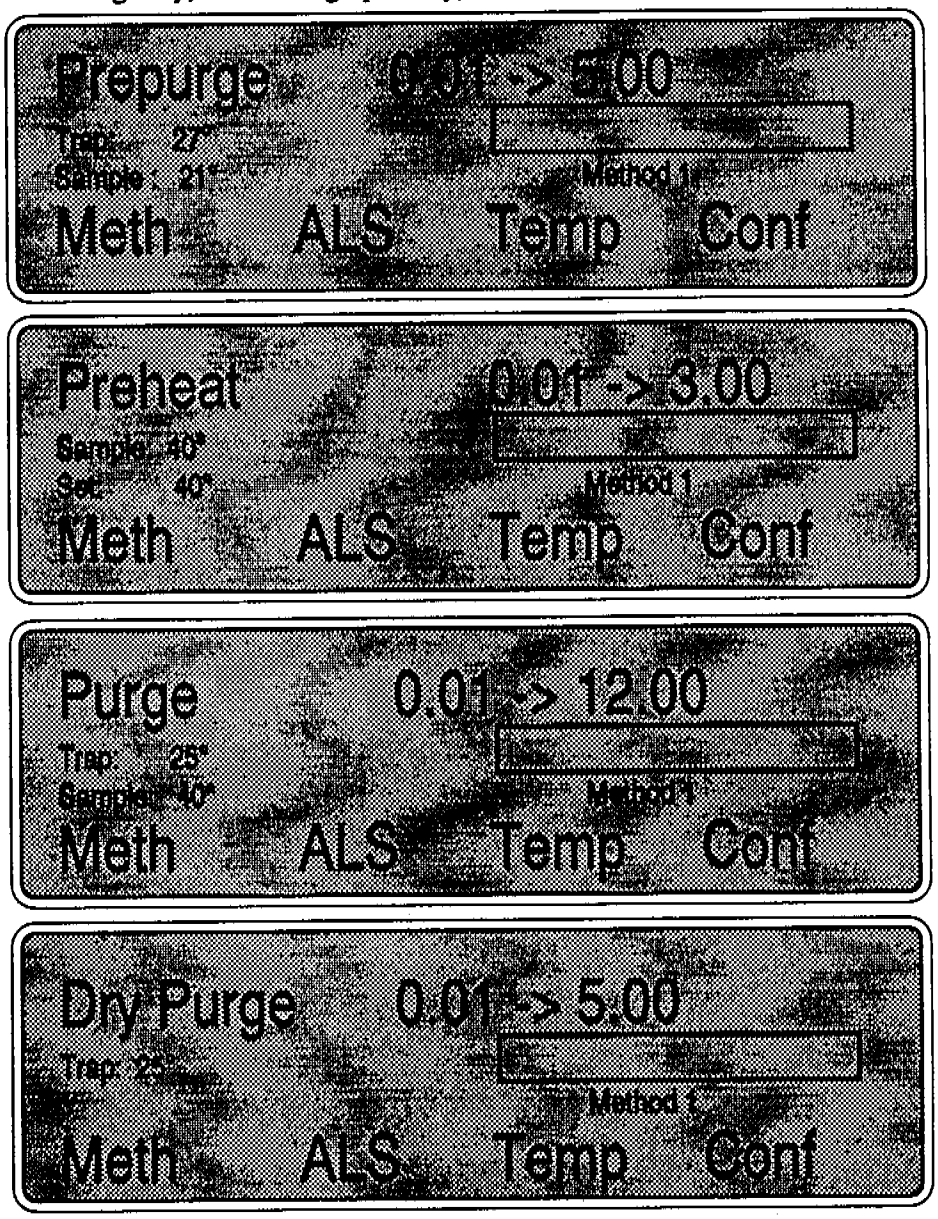


When the unit has met the parameter values set for Method 1, it goes to Purge Ready and displays the Trap and Sample temperatures. The unit pauses at this point until the operator presses **START** on the keypad.



6.3 Using Method 1 (cont.)

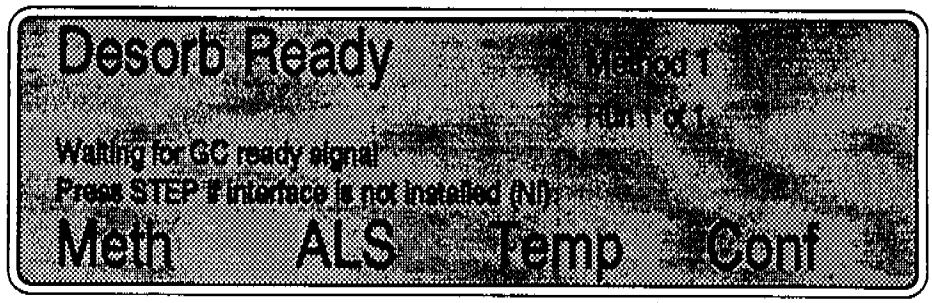
When a sample heater is installed in the system the Prepurge and Preheat screens appear. If a sample heater is installed, Trap, Sample, and Set temperatures are displayed, as well as a timer for each mode. Time elapse is shown digitally, as well as graphically, with a moving bar display.



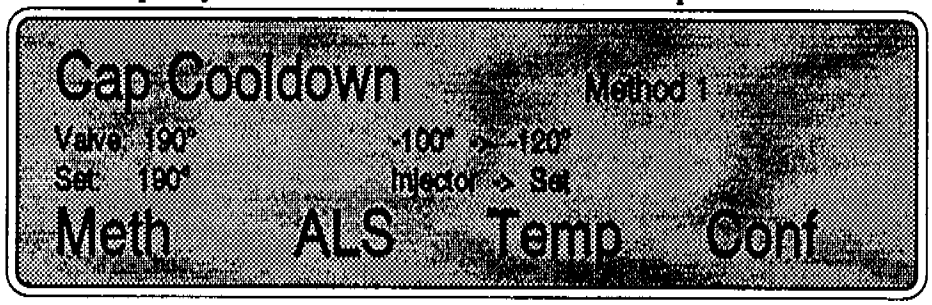
At this point, the LSC 2000 looks for a signal from the GC indicating that the GC is ready to accept the sample.

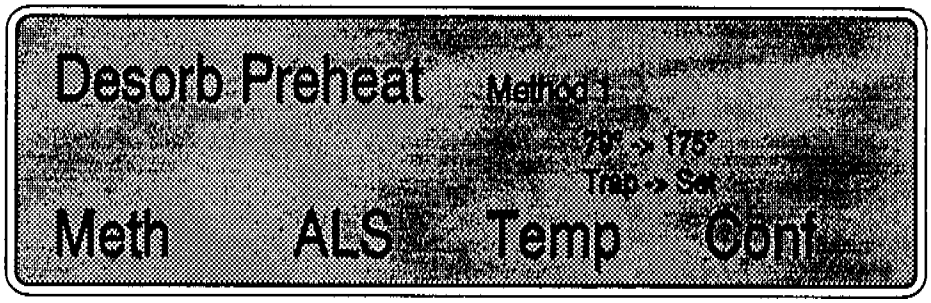
If there is no cable interface between the GC and the LSC 2000, the LSC 2000 will wait for the operator to press STEP.

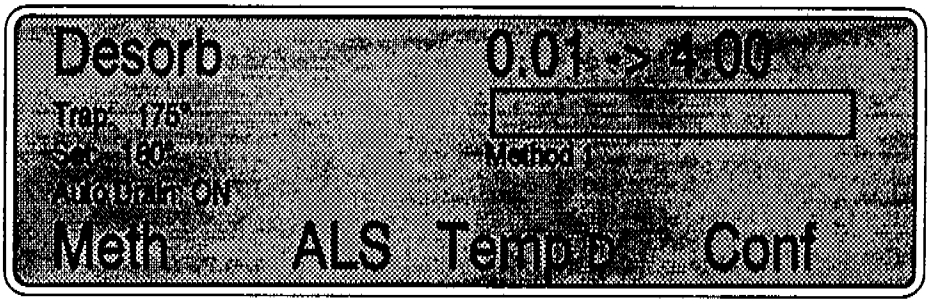
6.3 Using Method 1 (cont.)



When a Capillary Interface is installed the Cooldown step occurs:

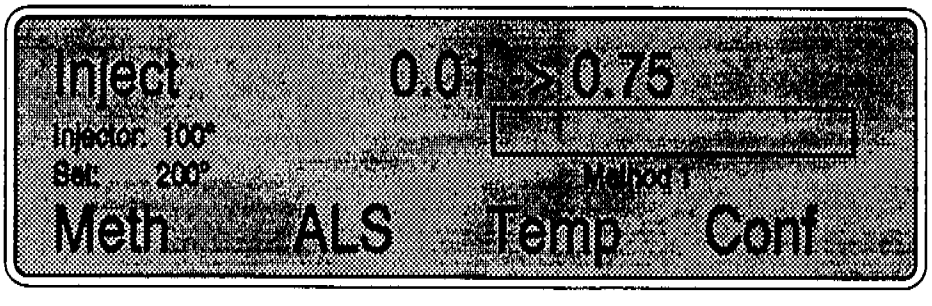




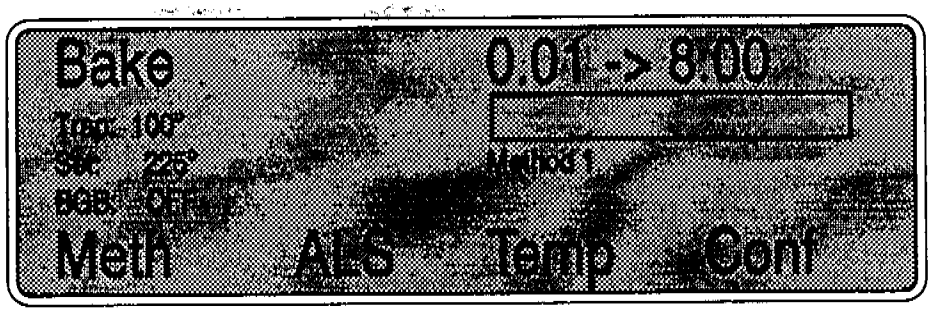


The flashing 'D' between (Temp) and (Configure) on the LCD screen indicates that the drain is open. Press DRAIN to close or open the drain.

When a Cryfocusing Module is installed the Inject mode occurs:



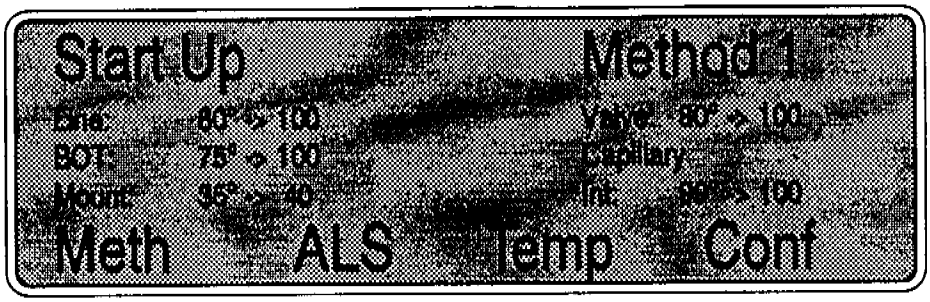
6.3 Using Method 1 (cont.)

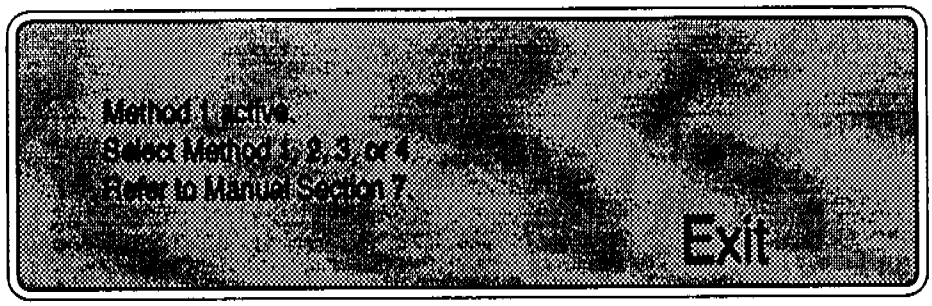


6.4 Using Method 2, 3, or 4

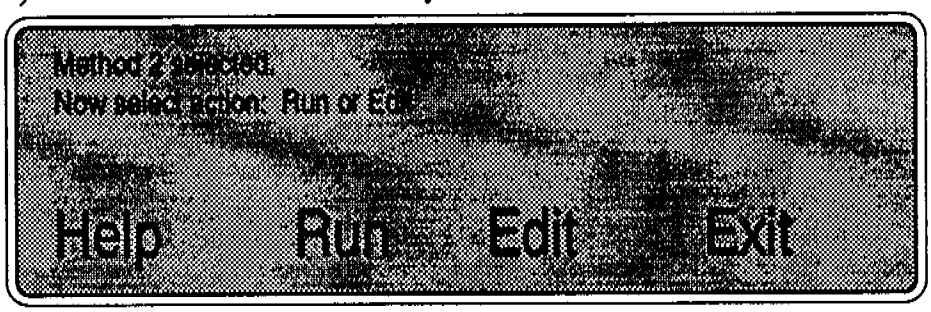
To run a sample using Method 2, 3, or 4, first power up the LSC 2000. The system performs self tests and then proceeds automatically to the Method 1 program.

1) Press **F1 (Meth)** to run a sample using Method 2, 3, or 4.



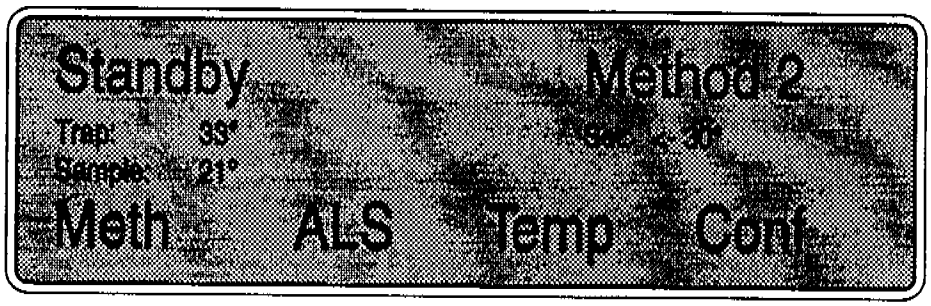


2) Enter the number of the Method you wish to use.

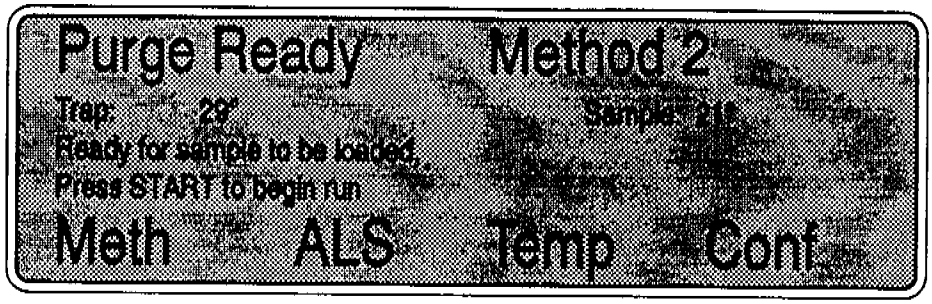


3) Press **F2 (Run)** to start a run using the Method you have just chosen.

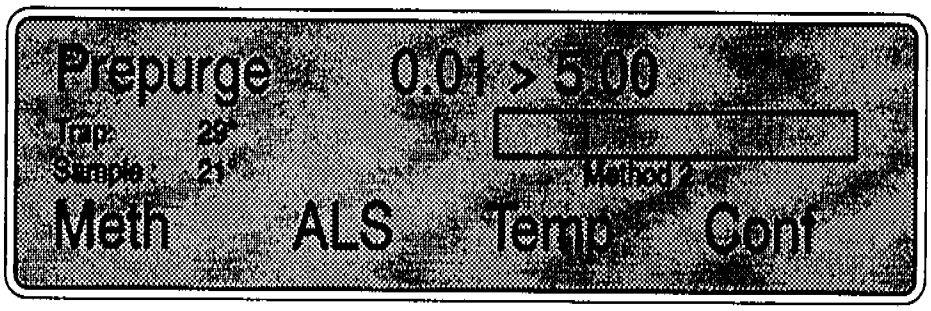
6.4 Using Method 2, 3, or 4 (cont.)

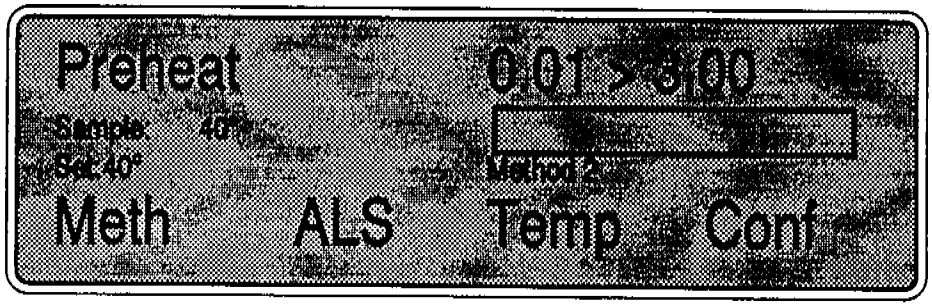


When the parameter values are met for Method 2, the Purge Ready screen displays the Trap and Sample temperatures. The unit pauses at this point until the operator presses **START** on the keypad.

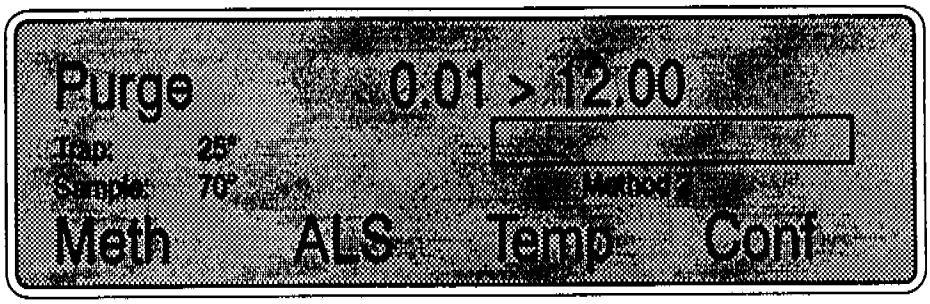


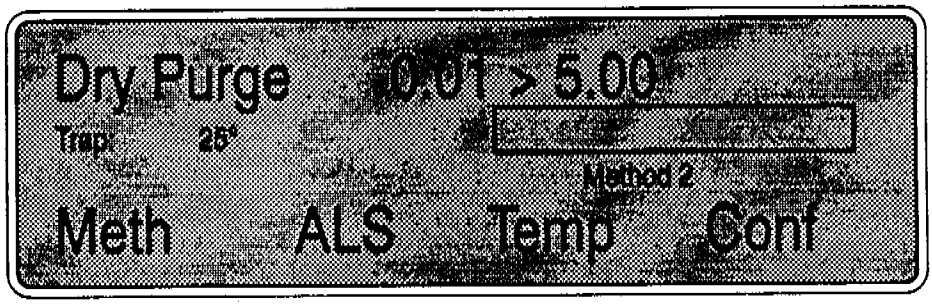
When a sample heater is installed in the system the Prepurge and Preheat screens appear. If a sample heater is installed, Trap, Sample, and Set temperatures are displayed, as well as a timer for each mode. Time elapse is shown digitally, as well as graphically, with a moving bar display.

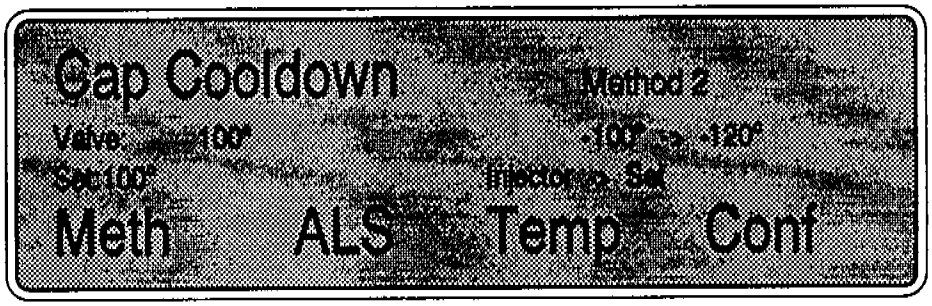


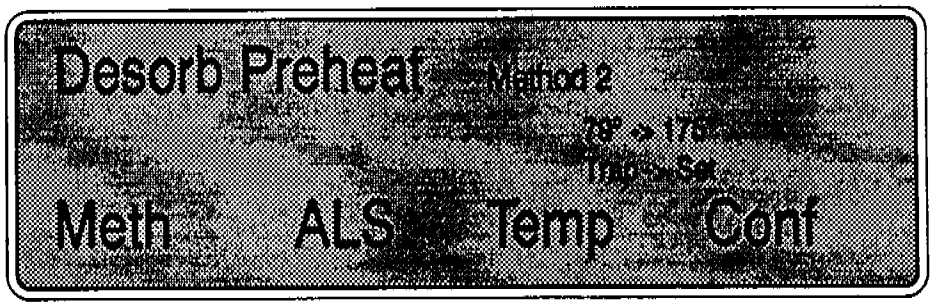


6.4 Using Method 2, 3, or 4 (cont.)

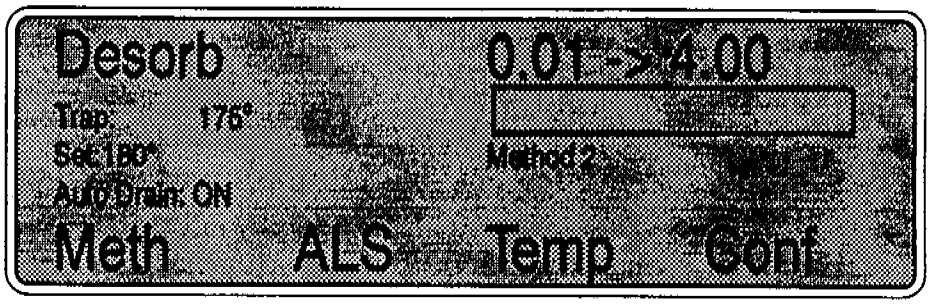




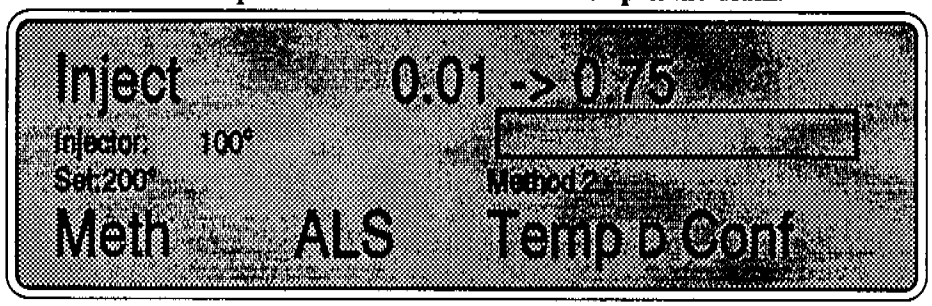


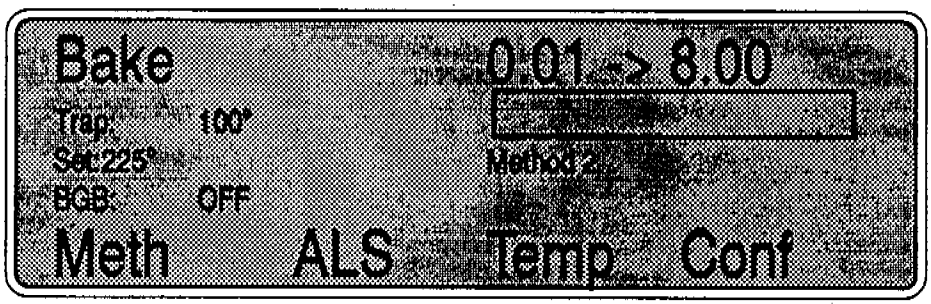


6.4 Using Method 2, 3, or 4 (cont.)



The flashing 'D' between (Temp) and (Conf) on the LCD screen indicates that the drain is open. Press **DRAIN** to close or open the drain.





7.1 Understanding Method Parameter Values

The values selected for each operating parameter depend heavily upon the nature of the sample and the type of information desired. This section discusses typical parameter selections and the results that can be expected for different values.

PREPURGE Time

Prepurge is functional only when a sample heater is installed. It enables the purge gas to be turned on before heating the sample. This serves to displace all oxygen from the glassware before heating. It eliminates the possibility of any heat-induced oxidation occurring in the sample. The time should be chosen so that the total volume of prepurge gas equals about three times the glassware volume. The total volume of a 5 ml sparger is about 11 ml, a 25 ml sparger about 34 ml. For example, if the purge flow rate is 50 ml/min., set the prepurge time to 0.7 of a minute for a 5 ml sparger, 2.1 minutes for a 25 ml sparger.

PREHEAT Time

Preheat is functional only when a sample heater is installed. It allows the sample to be equilibrated at its temperature set point before beginning to purge. This maximizes quantitative reproducibility. The sample heats at about 25°/min. For every 25° above ambient allow one minute preheat time. When not performing quantitative analysis, time can be saved by shortening this step. If you do want to eliminate this step, a time of at least .01 of a minute must be set for Preheat. ***The sample heater will not heat in Purge mode if a zero value is entered as the time parameter for Preheat.***

COOLDOWN Temperature

Cooldown is functional only when a Cryofocusing Module is installed. It is the temperature at which the sample will be cryofocused. This setpoint varies depending upon the lightest compound analyzed, the column diameter, film thickness, flow rate, and whether a precolumn is used. Typical values range from -190° to -90°. Consumption of liquid nitrogen approximately doubles for every 20° drop in setpoint. Set the temperature to the highest value at which peak shapes are still good.

INJECT Temperature and Time

Inject is functional only when a Cryofocusing Module is installed. The temperature chosen must be high enough to drive the least volatile component out of the cryofocusing area, yet not so high as to break down either the stationary phase or the polyamide outer coating of the column. Set the temperature to the same value as the final temperature of the oven temperature program. The time chosen must be long enough to allow the cryotrap sufficient time to reach the temperature setpoint. This cryotrap heats at approximately 500° C/min. Since longer times are not at all damaging, add at least 0.25 of a minute longer than necessary to reach the set point. Typical values are 0.50 to 1.00 minute.

7.1 Understanding Method Parameter Values (cont.)

AUTO DRAIN

AUTO DRAIN empties the purge vessel during DESORB. Note that AUTO DRAIN should be used only with water samples free of particulates. These particulates could clog the drain system.

BAKE GAS BYPASS (BGB)

BAKE GAS BYPASS allows the gas used to clean the trap in BAKE to bypass the purge vessel. Normally this gas passes through the glassware, but if the sample has not been drained it could cause additional volatiles to be purged, thus hindering total cleanup of the trap. Normally if AUTO DRAIN is on then BAKE GAS BYPASS is off, and vice versa.

Bake Gas Bypass (BGB) Delay (ROM Version 1.7 or greater)

The BGB delay should always be activated when using the sample tubes for liquids or soils. Assigning a 2 minute delay will allow the backpressure in the unit to equilibrate before the Bypass valve is turned on. This prevents the sample from being pushed up into the needle and contaminating the 6-port valve and internal lines. See Section 7.7.

VALVE and LINE Temperatures
CRYOFOCUSING MODULE Temperature

The 6-port valve and sample lines of the LSC 2000 and accessories are heated to prevent cross-contamination of samples due to memory effects. These temperatures should be set high enough to prevent this, however, not so high as to cause any degradation of labile compounds. These values are normally set to 100°C as a minimum. If the sample is heated, the valve and lines should be set at least as high as the sample temperature. In cases where contamination does occur, these values can be raised to accelerate cleanup.

MOUNT Temperature

The sampler mount is heated to prevent memory effects. However, it does not need to be turned on all the time, and may occasionally even have an adverse effect on samples by heating the upper part of the glassware. This heat may be conducted to the sample. For water or soil samples the mount should not be heated. In fact, a cool mount allows excess water vapor to condense. For certain types of heated samples (esp. oils) the mount must be heated to prevent memory effects. Set the mount temperature equivalent to the sample temperature.

PURGE Time

The purge time should be chosen with the goal of good sensitivity and reproducibility in mind. Times longer than 15 minutes generally have few benefits, and can lead to breakthrough of the trap depending on the adsorbent. A good starting point is 10 minutes.

DRY PURGE Time

The dry purge time should be about 4 to 6 minutes, depending on the purge flow rate depending on the adsorbent. Allow enough time for 200 to 250 ml of gas to pass through the trap.

7.1 Understanding Method Parameter Values (cont.)

PURGE Flow Rate

The purge flow rate is normally 40 ml/min. Faster flow rates can affect trapping efficiency. Using larger diameter traps (e.g. 1/4") can allow faster flow rates due to decreased linear flow velocity. Slower rates can be beneficial in minimizing foaming or aerosol problems. The flow rate can be measured by attaching a bubble flowmeter or other flow indicator to the vent port located on the front panel of the LSC 2000. (We recommend use of the Tekmar Digital Flow Meter, #13-0079-000.)

PURGE READY Temperature

Purge Ready should be set about 30°C. This ensures good trapping efficiency. Higher settings may be necessary if the ambient temperature makes achieving this difficult.

DESORB PREHEAT Temperature

Desorb preheat is intended to help deliver the sample to the GC in the tightest slug possible. The desorb preheat temperature should be set to 5°C below the DESORB temperature.

DESORB Temperature and Time

The desorb temperature is normally between 150° and 225°C. The exact temperature depends on the sample compounds. For volatile compounds purged from ambient samples, 150°C is good. For higher temperature samples, the desorb temperature must be raised to quickly desorb the less volatile compounds. For environmental samples, a desorb temperature of 225° C and a Desorb time of 2 minutes is optimal. This time is also sufficient for capillary column flow rates when the flow rate is set by pressure control. Mass flow control usually requires longer times of up to 8 minutes.

BAKE Temperature and Time

The bake temperature is normally 225°C. Higher temperatures do not increase the bake efficiency, and can lead to shorter absorbent lifetimes. The bake time is normally 7 to 10 minutes. For heavily loaded traps, or compounds of low volatility, longer times (up to 20 minutes) may be required.

EPA procedures specify values for each parameter. These values are listed for each method as follows:

7.1 Understanding Method Parameter Values (cont.)

Method	501.1	502.1/601	503.1/602	624
Sample Size	5 ml	5 ml	5 ml	5 ml
Purge Time	11 min.	11 min.	12 min.	12 min.
Dry Purge Time	Off	Off	6 min.	Off
Purge Flow	40 ml/min	40 ml/min	40 ml/min	40 ml/min
Desorb Time	4 min.	4 min.	4 min.	4 min.
Desorb Temp.	180°C	180°C	180°C	180°C
Bake Time	NS*	7 min.	7 min.	7 min.
Bake Temp.	NS*	180°C	180°C	180°C
Trap Mat'l **	T	T/SG/C	T	T/SG

*NS= not specified
**T= Tenax, SG= Silica Gel, C= Charcoal

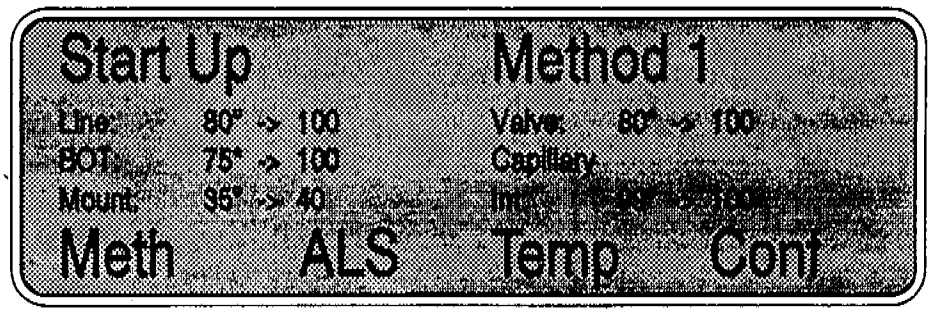
These are the purge and trap parameters specified in various EPA drinking water and municipal and industrial waste water methods. They are listed as a quick reference for customers doing analyses under EPA certification. Different applications or instrumental configurations may be optimized by varying these parameter settings.

7.2 Changing Method Parameter Values

The system offers four programmable Methods to run a sample. To modify the default values in the system, power up the unit (Section 5).

ATTENTION
Once new values have been entered for a Method, those values will replace the default settings unless altered by a power failure.

When the system is powered up, the Introductory screen appears. The system performs self tests and then proceeds automatically to the Method 1 program.

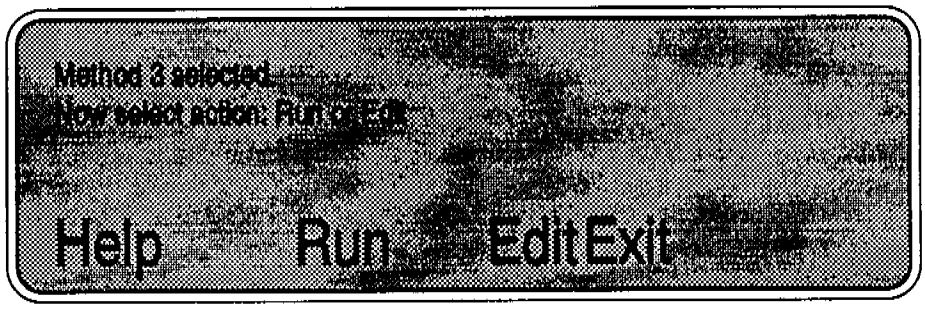


1) To modify the parameter values for Method 1, press **F1 (Meth)**.

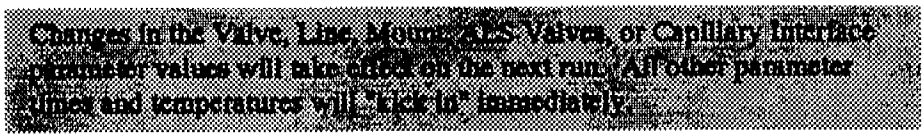
Method Parameter values can be modified for any Method from any Program mode screen. However, if modifications are made from any mode other than Start Up, Standby or Purge ready, the next analysis will be governed by the new parameter values.

7.2 Changing Method Parameter Values (cont.)

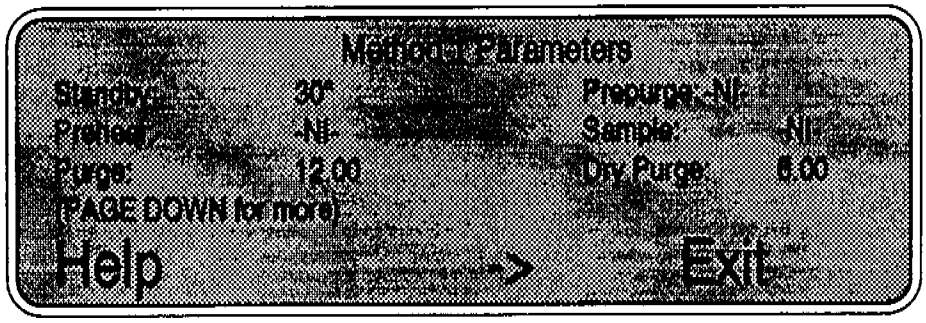
2) Enter the Method number you wish to use.

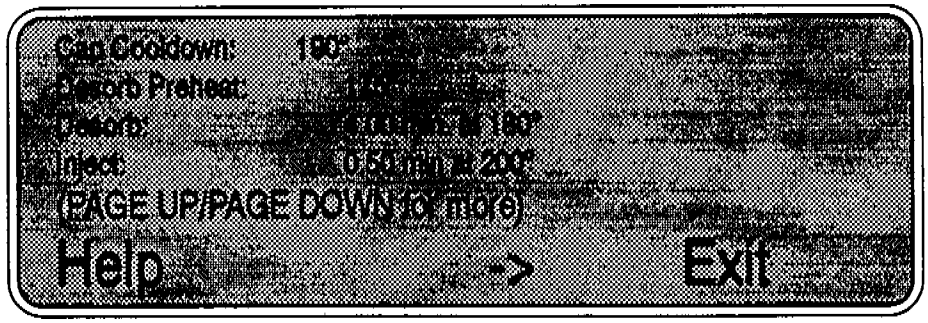


3) Press **F3 (Edit)** to change the parameter values for that Method. If you need help in choosing parameter values for a method, refer to Section 7.1.

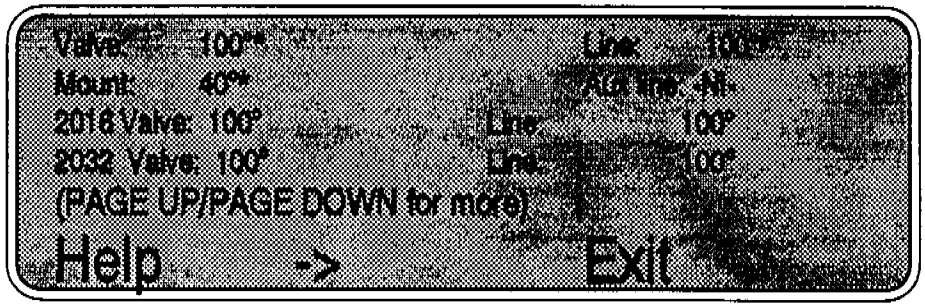


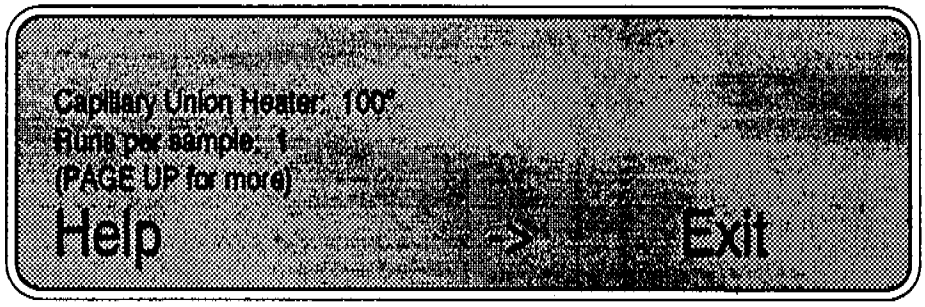
4) Press **F3 (->)** to place the highlighted box on the parameter you wish to change. Press **PAGE DOWN** or **PAGE UP** to view the other Method parameters.





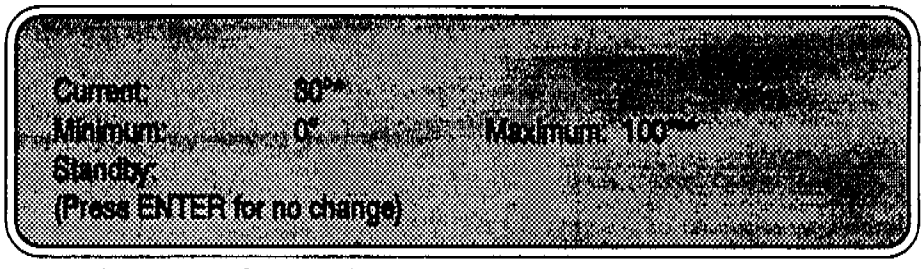
7.2 Changing Method Parameter Values (cont.)





The system will beep if **PAGE DOWN/PAGE UP** is pushed at the first or last screen of the Method Parameters.

5) With the desired parameter highlighted, press **ENTER** to see that specific parameter's settings screen. For example, with the highlighted box on the set temperature for Standby mode, press **ENTER**.



The settings screen for the selected parameter value appears. The settings screen displays:

- * the current value setting
- ** the value range available

6) To change the current value, press the digits on the keypad. If you press the wrong digit use <- (**BACKSPACE**) to erase it.
7) Press **ENTER** to fix the new setting into system memory.
8) Repeat this procedure for each of the parameter values for that Method.
9) When all parameter values are correct, press **F4 (Exit)** to return to the Program mode.

7.2 Changing Method Parameter Values (cont.)

If a run was being performed while the Method Parameters were being changed, the system will return to that Program mode screen.

10) Once in the Method program mode, you may assign new parameters to the other Methods as well.

Valve, Line and Mount temperature changes will take effect on the following run. Other parameter values will "kick in" immediately.

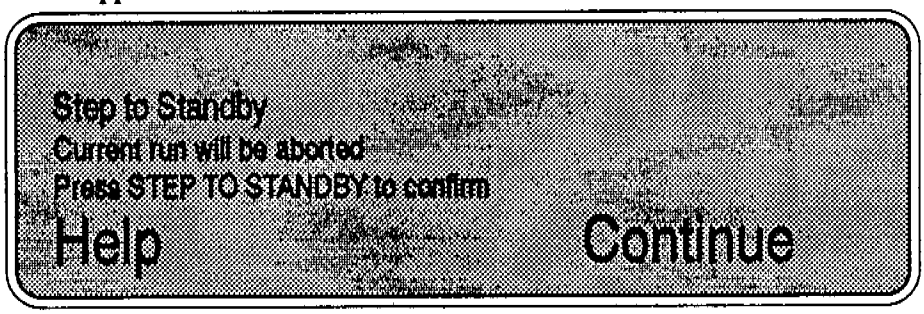
7.3 Value Range for Method Parameters

The system is set to accept a specific range of values that are acceptable under EPA guidelines. Each program mode value range is as follows:

Standby:	0-300° C
Prepurge:	0-99.9 min.
Sample:	0-200° C
Preheat:	0-99.99 min.
Purge:	0-99.99 min.
Dry Purge:	0-99.99 min.
Cap Cooldown:	-190° to +40°C
Desorb Preheat:	0-400° C
Desorb:	0-99.99 min. at 0-400° C
Inject:	0-99.99 min. at 0-300° C
Bake:	0-99.99 min. at 0-400° C
Mount:	0-200° C
Valve:	0-300° C
Line:	0-300° C

7.4 Using STEP TO STANDBY

The Step To Standby feature allows instant termination of a run without undue "wear and tear" to the unit. When **STEP TO STANDBY** is pressed, the system goes directly to the Standby mode from whichever mode it was performing. This command terminates the run in progress and Confirmation screen appears:



Press **STEP TO STANDBY** again to confirm that you really want to abort the run. This feature avoids accidental termination of a run due to an inadvertant keystroke.

7.5 Using STEP TO BAKE

The Step To Bake feature accommodates quick conditioning of new traps, or immediate cleaning of a previously-used trap to prepare it for a new run. Pressing **STEP TO BAKE** causes the system to go directly to the Bake mode from whichever mode it is performing when Step To Bake is pressed.

7.6 Activating Auto Drain

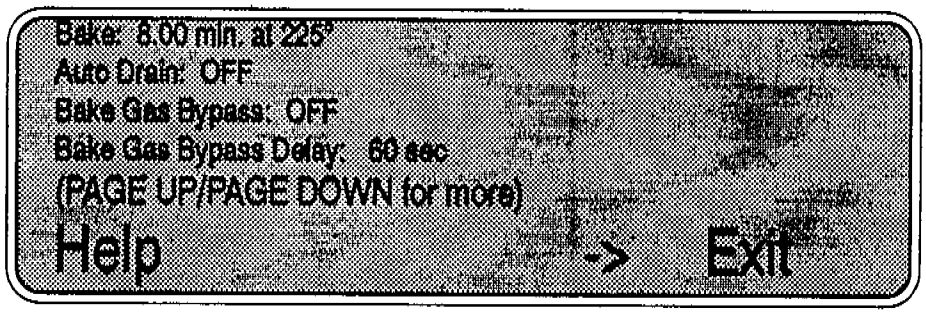
To activate or deactivate Auto Drain for a specific Method, return to the Start Up screen, press **F1 (Meth)**, activate a Method, press **F4 (Exit)**, then **F4 (Edit)** for the Method Parameter screen (for step by step details refer to Section 7.2).

1) Press **PAGE DOWN** to view the Auto Drain parameter:

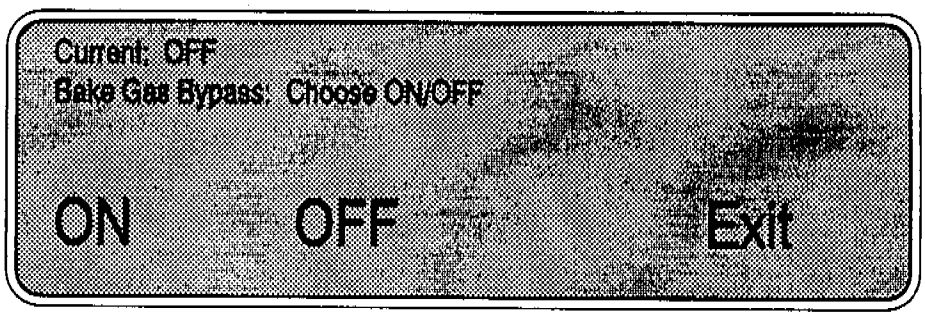
2) Press **F3 (->)** to place the highlighted box on the response for Auto Drain.
3) Press **ENTER** to see the Auto Drain settings screen.
4) Press **F1 (ON)** or **F2 (OFF)** to activate or deactivate the Auto Drain. Selecting ON/OFF automatically changes the selection and takes the user back to the Method Parameter Listing.

7.7 Activating Bake Gas Bypass

1) To activate, deactivate or delay Bake Gas Bypass for a specific Method, return to the Start Up screen, press **F1 (Meth)**, activate a Method, press **F4 (Exit)**, then **F4 (Edit)** for the Method Parameter screen (for step by step details refer to Section 7.2).
2) Press **PAGE DOWN** to view the Bake Gas Bypass parameter:



3) Press **F3 (->)** to place the highlighted box on the response for Bake Gas Bypass.
4) Press **ENTER** to see the Bake Gas Bypass settings screen.



7.7 Activating Bake Gas Bypass, cont.

5) Press **F1 (ON)** or **F2 (OFF)** to activate or deactivate Bake Gas Bypass. Selecting ON/OFF automatically changes the selection and takes the user back to the Method Parameter Listing.
6) Press **F4 (Exit)** to return to the Method Parameter listing.
7) Press **F3 (->)** to place the highlighted box on the response for Bake Gas Bypass Delay and enter a 60 second time if needed (see Section 7.1).

7.8 Activating the Runs Per Sample Parameter

The Runs per Sample parameter gives you the option of running the same sample over again automatically, up to 9 times in a row. To do this:
1) Highlight 'Sample per Run' in the Method Editing screen and press **ENTER**.
2) Enter the number of runs you want for that method from the keypad and press **ENTER**.

7.9 2016 Bakeout Feature

This feature of the LSC 2000 has been added as an option to the method editing function to allow you to automatically bake out the 2016/2032 prior to purging a new set of samples:

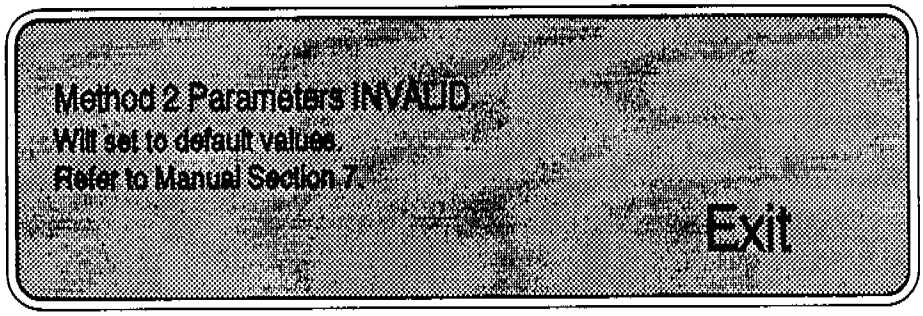
1) From the **Bake Out Y or N** prompt on the screen, select yes or no on the keypad. If you select no, the method will operate as normal. If you select yes, the Standby temperature is set to 300°C automatically causing the Standby mode to be skipped. All other parameters are set to 0 minutes. Upon reaching desorb ready, a contact closure is triggered and the Desorb mode is skipped through to bake mode without starting the G.C. (A set time of 5 minutes on the bake cycle for bakeout should be sufficient).

8.1 System Faults and Failures

System failure can be caused by any unusual circumstance such as power shortage, power outage, operator error, etc. Normally, the battery backup will save data stored in the memory of the microprocessor in the event of a power failure. Depending on where the unit was in the sample run process when the system failure occurred, different means of restarting the system will apply.

8.2 Parameter Errors

If the program detects a parameter error (an invalid or out-of-range value) or if default values are being loaded into RAM (upon initial power up) when **F2 (Run)** or **F3 (Edit)** is chosen from the Method menu, the following screen will appear:



The system is set to accept a specific range of values that are acceptable under EPA guidelines. Each program mode value range is as follows:

Standby:	0-100° C
Prepurge:	0-99.9 min.
Sample:	0-200° C
Preheat:	0-99.99 min.
Purge:	0-99.99 min.
Dry Purge:	0-99.99 min.
Cap Cooldown:	-150° to +40°C
Desorb Preheat:	0-400° C
Desorb:	0-99.99 min. at 0-400° C
Inject:	0-99.99 min. at 0-300° C
Bake:	0-99.99 min. at 0-400° C
Mount:	0-200° C
Valve:	0-300° C
Line:	0-300° C

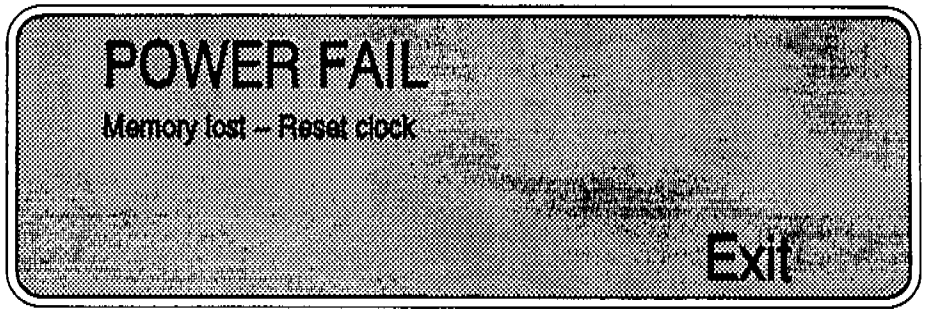
If a Cryofocusing Module is not installed, the values for Cap Cooldown and Inject will read -not installed-. If a Sample Heater is not installed, the values for Prepurge, Preheat, and Sample will read -not installed-.

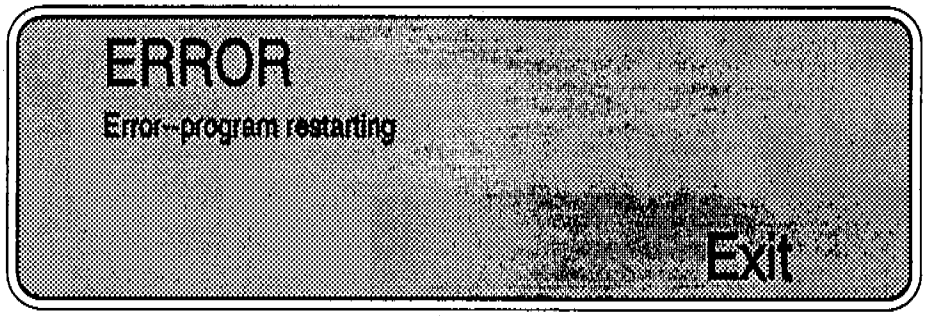
8.3 Restarting After Power Loss

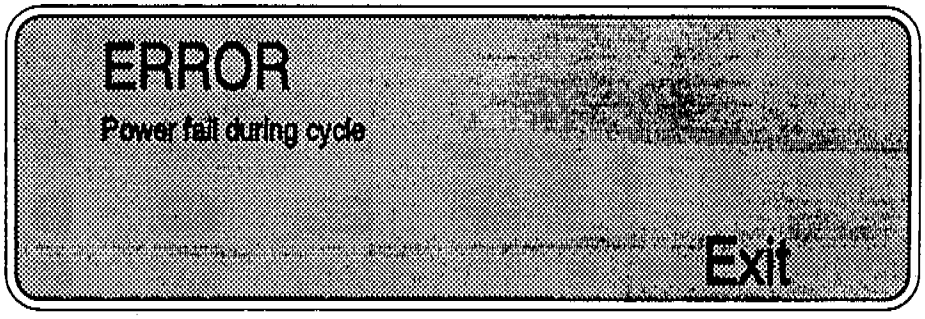
When powering up the system after power loss, operating parameters that had previously been stored in RAM may need to be re-entered. It may also be necessary to re-enter parameter values if a line transient has altered or erased the program parameters stored in RAM.

Keep a hard copy of parameter values used in each Method so that you will have a record of them if a power failure occurs.

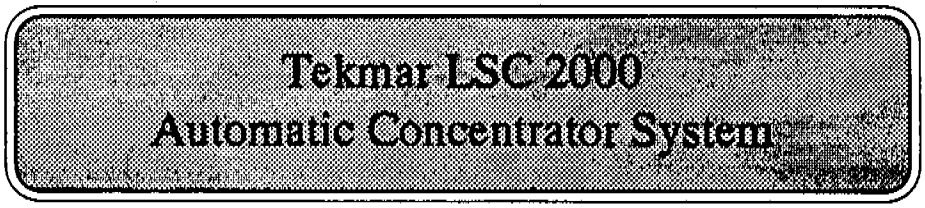
Power failure can cause the system to display one of three "POWER FAIL" screens. "POWER FAIL" screens indicate that the operator may be required to reset parameter values and/or system configuration.







Press **F4 (Exit)** to return to the Introductory screen.



8.3 Restarting After Power Loss (cont.)

ATTENTION

If modified parameter values (values other than the system's default values) were used at the time of the power failure, these values may need to be re-entered. See Section 5.6 to review the parameter temperature values. If the parameter values need to be modified, see Section 7 to set new values for Method parameters. The system clock may also need to be reset after a power failure. See Section 5.3 to review and change the clock.

If power down occurs during Standby or Purge Ready mode, no Power Fail screen will be displayed. The system will proceed on its own to the Introductory screen.

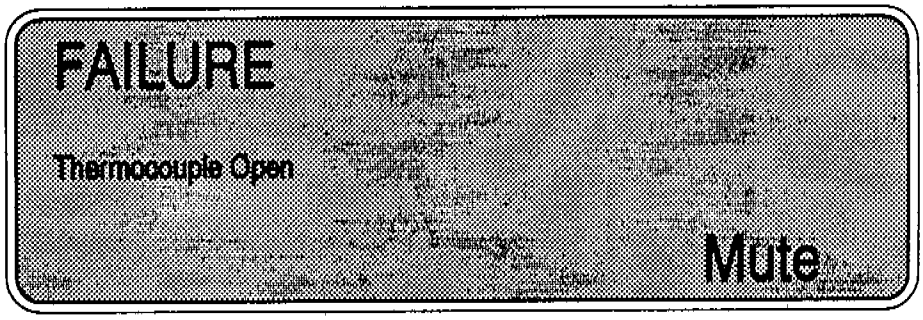
8.4 Self Tests After a Power Loss

After power failure the system conducts self tests to confirm that all its heated components are working properly. To conduct self tests the system briefly turns on each heater in succession. When the thermocouple for a particular heater registers a temperature increase, the system advances to the next heater (for detailed Self Test information refer to Section 5.1). When the self tests are complete the system goes to the Current Configuration screen.

8.5 Heater Faults and Warnings

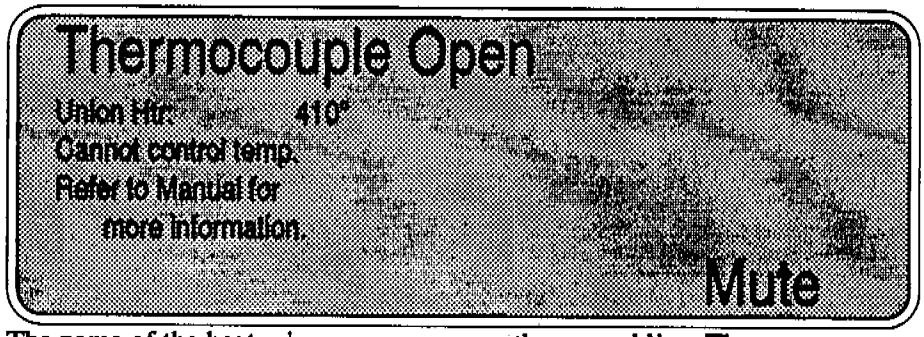
8.5.1 Thermocouple Open

A reading of 410° anytime during operation indicates an open thermocouple. A warning signal will sound and the following error screen will appear:



F4 (Mute) silences the beeper and a more detailed screen appears:

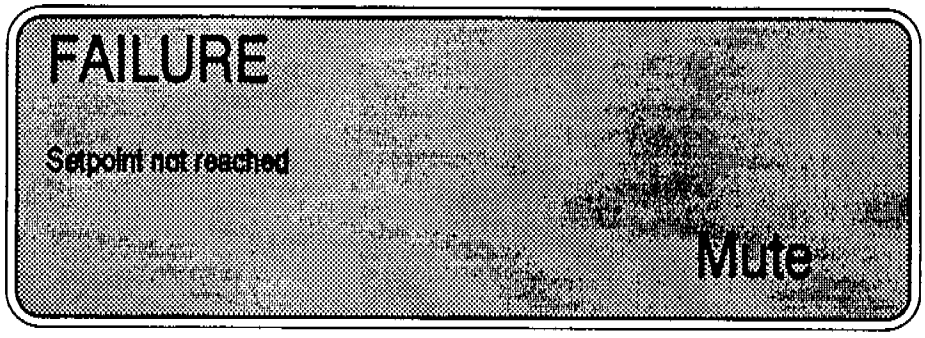
8.5 Heater Faults and Warnings (cont.)



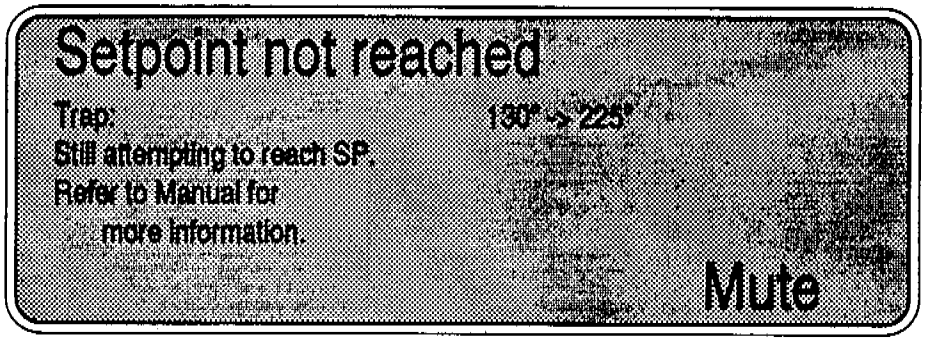
The name of the heater in error appears on the second line. That thermocouple is considered open and power to it is immediately aborted. A loose connection is possible and if you wish to investigate, remove the right side panel to check the thermocouple connectors (yellow) on the Front Panel Display Board (see diagram in Section 12). If the problem is not a loose connection, please call our Service Department at (800) 874-2004 for troubleshooting instructions.

8.5.2 Setpoint Not Reached

When default or set temperatures do not reach their setpoint during Start up and normal operation, a warning signal will sound and the following screen will appear:



F4 (Mute) silences the beeper and a more detailed screen appears:

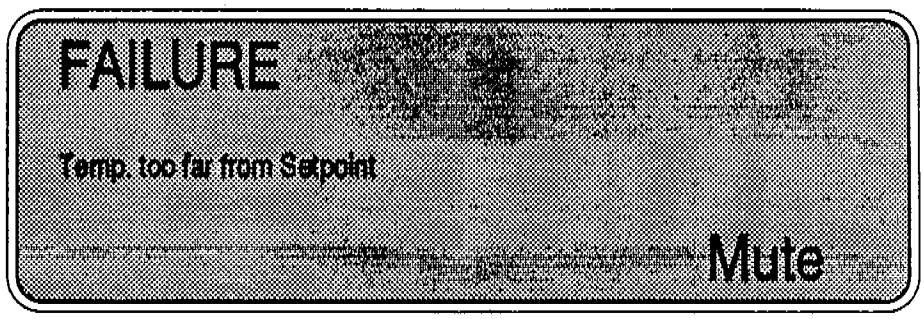


The particular name of the heater in error appears on the second line. In this case, the temperature is OK to maintain, so the temperature control to that particular component is not aborted. If you wish to make the run using the lower temperature, press **F4 (Exit)**. To troubleshoot the problem, call our Service Department at (800) 874-2004.

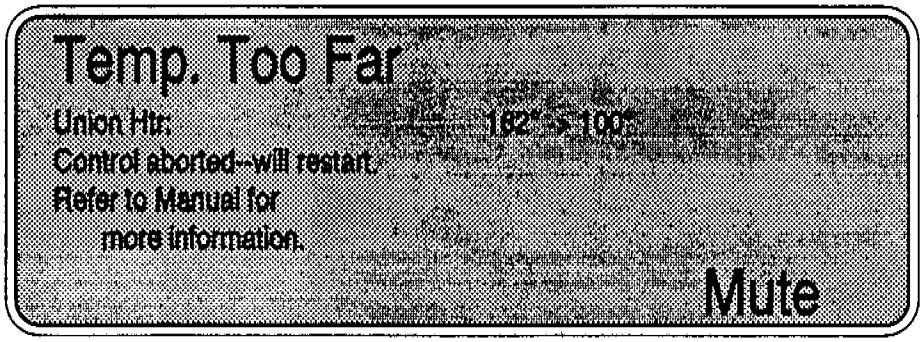
8.5 Heater Faults and Warnings (cont.)

8.5.3 Temperature Too Far

After a setpoint is reached and the temperature deviates from that setpoint by more than 40°, a warning signal will sound and the following screen appears:



F4 (Mute) silences the beeper and a more detailed screen appears:



The name of the heater in error appears on the second line. Control to that component has failed and power to it is immediately aborted If the temperature is too low, the unit will begin operation. If the temperature is too high, it will wait for the temperature to drop below setpoint before beginning operation. If you are having dificulty, please call our Service Department at (800) 874-2004 for troubleshooting instructions.

9.1 Manual Procedures

9.1.1 Preparing Blank Water

Blank water (reagent water or organic-free water) is defined as water that is free of interferences when run by purge and trap analysis. Obtaining blank water can be difficult. Some water purifiers (e.g., Millipore Super Q) can provide accessible quality blank water when freshly charged. However, blank water is more commonly prepared by one of two methods.

1) Pass distilled water through a bed of activated carbon at least 12" deep. Allow the water to flow from bottom to top by setting the column up to siphon by placing the supply vessel high and the collection vessel low, or
2) Boil the water and then purge it while at 80-90° with helium or nitrogen for at least one hour.

With either method the blank water must be used immediately. Always examine the water before use by analyzing it without any added standards.

9.1.2 Preparing a Standard

Preparing proper standards is the key to accurate quantitation. Using a concentrator usually means that the concentration of the analytes is low, so low level standards must be made. Small errors that occur in high level standards are usually insignificant, but the same error in a low level standard can mean a large percentage of error. For this reason, special care must be taken in preparing, using, and especially, in storing the standard. While many commercial standards are available, and most are of high quality, they are of limited usefulness. Either the mixes do not include all of the desired analytes, or extra analytes are present, or the concentration may be off. Also, they are expensive and the EPA does not allow their use. For these reasons, we recommend preparing your own standards.

There are many different ways to prepare your own standards. For water samples it is common to prepare methanol solutions containing known amounts of the compounds of interest. These compounds cannot be prepared directly in water due to their insoluble nature and the instability of aqueous standards. The EPA-recommended procedure is as follows:

All weighings are critical!

1) Fill a 10 ml volumetric flask with about 9.8 ml methanol.
2) Allow the flask to stand unstoppered until all alcohol wetted surfaces have dried.
3) Weigh accurately to the nearest 0.1 mg.
4) Using a 100 ml syringe, immediately add 2 drops of neat standard (minimum 97% purity) to the flask, then reweigh. Be sure that the drops fall directly into the methanol without making contact with the neck of the flask.
5) Dilute to volume, place the stopper on the flask, and mix by inverting the flask several times.
6) Calculate the concentration in micrograms per milliliter from the net gain in weight.
7) Transfer the solution to a 10 ml screwcap bottle with a Teflon cap liner.
8) Store at 6°C.

9.1 Manual Procedures (cont.)

9.1.2 Preparing a Standard (cont.)

These solutions are stable up to 4 weeks except for solutions containing 2-chloroethylvinyl ether, which are stable for only one week. Dilutions in methanol can be made to provide a range of standards. Aqueous standards are prepared by spiking the standard into a 100 ml volumetric flask filled with blank water. Do not inject more than 20 ml of methanol into 100ml of water.

9.1.3 Sample Size

Sample Size

Choosing sample size depends on many factors, including:

- physical state
- homogeneity
- concentration and vapor pressure of target compounds
- type of detector used
- desired detection limits
- type of GC column

Larger samples can provide increased sensitivity, although they can also overload columns and saturate detectors. A good rule of thumb for samples of unknown concentrations is to start small (e.g., 25 mg solids, 0.5 ml liquids) and increase as needed. It is generally easier to optimize results by increasing the sample size rather than decreasing it. Bear in mind that:

1) Capillary columns require small samples or split injection to avoid column overloading.
2) Sensitive detectors (e.g., electron capture) require small samples to avoid saturation.
3) Compounds of low concentration or volatility require larger samples to achieve sufficient sensitivity.

9.1.4 Loading a Sample

When loading aqueous samples through the sample valve with a syringe, turn the arrow on the valve stem so that it points toward the syringe to load a sample, and pointing to the left at all other times. Remove the plunger from the syringe barrel. Carefully pour the sample into the barrel until the sample overflows. Insert the plunger and adjust to the desired volume. Be sure to vent any residual air while adjusting the volume.

Samples can be loaded in 2 ways:

1) Remove the glassware, insert the sample, and reinstall the glassware, or
2) Use a luer-lock syringe to load the sample through the sample valve.

Solids are generally weighed in the glassware, while liquids are usually loaded from a syringe. Loading through the sample valve should be performed only with aqueous samples.

ATTENTION

When loading a solid sample make sure that Auto Drain is turned OFF or the unit will be damaged. See Section 7.6 to turn the Auto Drain off.

9.1 Manual Procedures (cont.)

9.1.5 Loading a Standard

Standards are loaded in the same way samples are loaded. Aqueous standards should be prepared immediately before analysis. Standards can be spiked from stock solutions of the sample compounds in a water-soluble solvent (e.g., methanol, acetone). Spiking can be performed by inserting the needle of a microliter syringe into the luer fitting of the sample syringe.

9.1.6 Quantitating a Run

Quantitation can be accomplished several ways, depending on the type of information required of the sample. For many samples, however, this may not be possible (e.g., outgassing compounds from solids). Quantitation in this case relies on a 3-run purging of the sample. The amount recovered from the first two runs can now be used to calculate the purge efficiency of the first run, resulting in a number which can be used for subsequent samples.

9.1.7 Using Blanks

An instrument blank (i.e., purging a clean, empty sampler) is required to ensure that the purge gas supply is clean and that previous samples have not contaminated the instrument. The number and type of blanks required depends upon the samples run. If any solvents are used they must be run to determine the possible presence of contaminants. Bear in mind that the LSC 2000 is a concentrating system, therefore its purity and cleanliness requirements are more stringent than for any other instrument technique.

9.1.8 Handling Fused Silica Tubing

Making connections with fused silica tubing is far more difficult than doing so with metal tubing. Although fused silica is flexible, it is also brittle and breakable. Care must be taken not to bend the tubing too far or it will fracture. (The minimum bend radius of fused silica tubing is: 3.5" for 0.53mm, 3.0" for 0.32 mm, and 2.75" for 0.25 mm I.D. tubing.) Also, the tubing must not be scratched or it is likely to break under the stress of bending or vibration that would normally have no effect.

When making a connection with fused silica tubing, use the appropriate size graphite, vespel, or graphitized vespel ferrule. Tekmar recommends graphitized vespel for its ease of use and reliable sealing characteristics. Place the nut and ferrule on the tube, then carefully remove a short (1-2 cm) section of tubing. This ensures that no ferrule particles remain inside the tubing; these can cause severe adsorption and carryover. Cut the tubing by scoring it with a diamond-tipped pencil or another suitable device (a razor blade works well). Pull the tubing apart by lightly bending it from the side opposite the score. Make the connection with the fitting and tighten it approximately one half turn past finger tight. It may be necessary to secure the center of the union to the column cage (a bent paper clip is handy for this purpose) so that stress caused by the weight of the union is relieved.

9.2 EPA Purge and Trap Parameters

Method	501.1	502.1/601	503.1/602	624
Sample Size	5ml	5ml	5ml	5ml
Purge Time	11 min.	11 min.	12 min.	12 min.
Dry Purge Time	Off	Off	6 min.	Off
Purge Flow	40ml/min	40ml/min	40ml/min	40ml/min
Desorb Time	4 min.	4 min.	4 min.	4 min.
Desorb Temp.	180°C	180°C	180°C	180°C
Bake Time	NS*	7 min.	7 min.	7 min.
Bake Temp.	NS*	180°C	180°C	180°C
Trap Mat'l **	T	T/SG/C	T	T/SG

*NS= not specified
**T= Tenax, SG= Silica Gel, C= Charcoal

These are the purge and trap parameters specified in various EPA drinking water and municipal and industrial waste water methods. They are listed as a quick reference for customers doing analyses under EPA certification. Different applications or instrumental configurations may be optimized by varying these parameter settings.

9.3 Microprocessor Procedures

9.3.1 Changing the Viewing Angle of the Screen

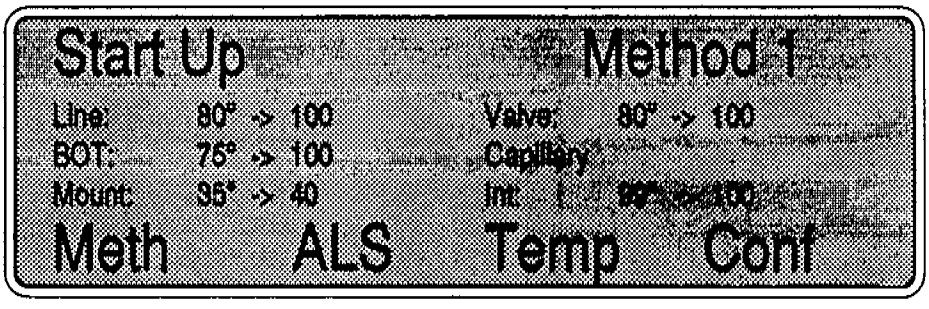
The viewing angle of the LCD screen can be adjusted to optimize readability in a variety of unit setup conditions. Press **PAGE UP** to increase the angle of the screen and **PAGE DOWN** to decrease the angle. Press the key down firmly for a continuous change in the angle or press and release the key for an incremental change.

The viewing angle cannot be adjusted while the unit is in a mode where PAGE UP and PAGE DOWN provide other functions (for example, while editing the Method Parameters Listing).

9.3.2 Reviewing and Resetting the Clock

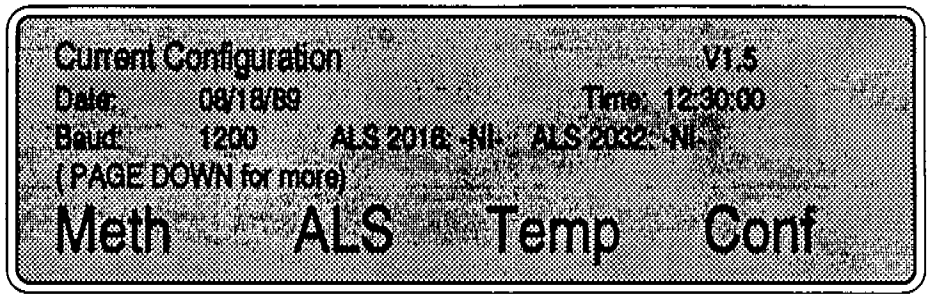
The Clock controls the date and time acknowledged by the system.

1) To view the clock, press **F4 (Conf)** during execution of any program mode. For example, pressing **F4 (Conf)** from the Start Up screen will display the Current Configuration screen.

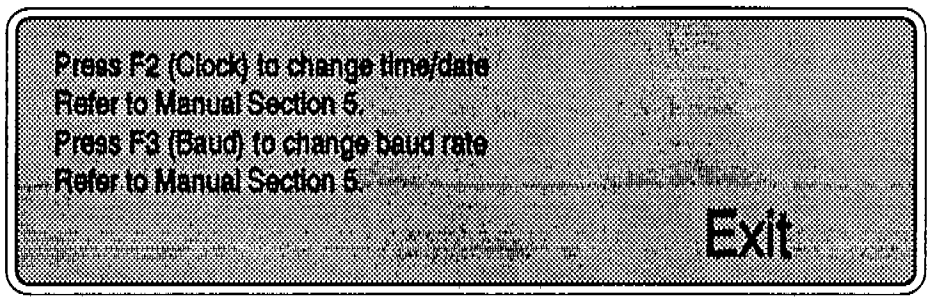


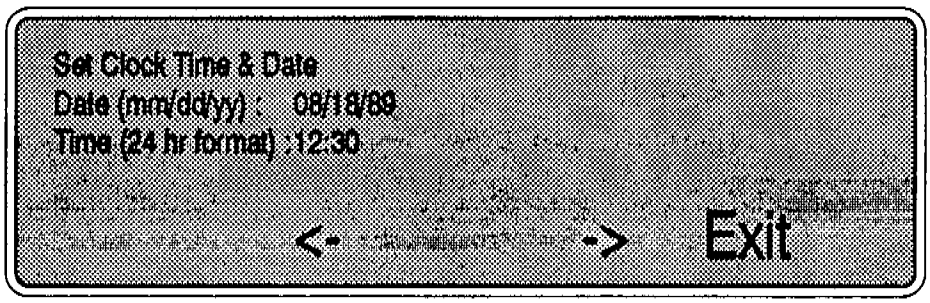
9.3 Microprocessor Procedures (cont.)

9.3.2 Reviewing and Resetting the Clock (cont.)



2) If the time and date are correct, press **F4 (OK)**. To change them, press **F2 (LSC)** to go to the LSC screen:





3) Press **F2 (<-)** or **F3 (->)** to select the digit that needs to be changed. Pressing the desired digit on the keypad instantly enters it into system memory.

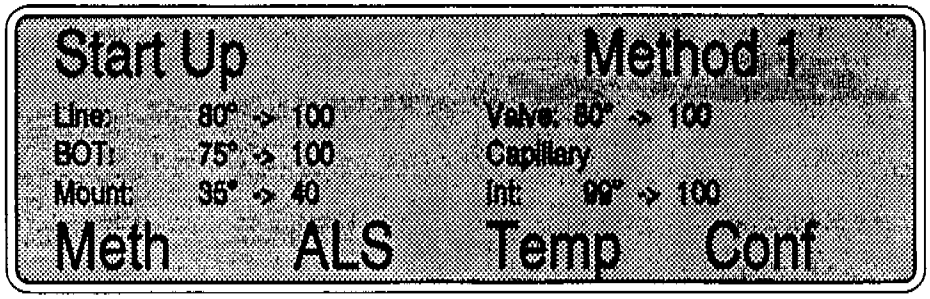
4) When all values are correct, press **F4 (Exit)**.

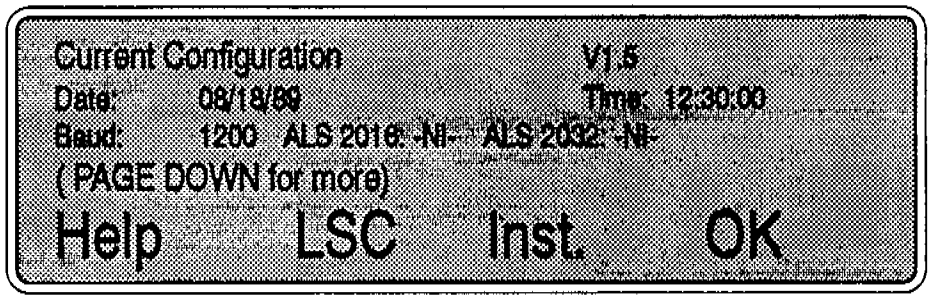
If an invalid key is pressed when attempting to input new time and date values, the message -> INVALID DIGIT/KEY <- lights up on the screen and the system beeps. When the message disappears you may reattempt to enter the new values.

9.3 Microprocessor Procedures (cont.)

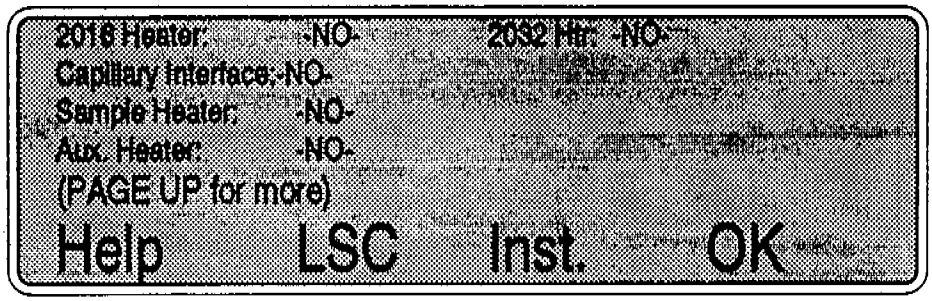
9.3.3 Reviewing and Changing Instrument and Accessory Configurations

1)To review the accessories and baud rate configured into the system, press **F4 (Conf)** during execution of any program mode. For example, pressing **F4 (Conf)** from the Start Up screen will display the Current Configuration screen.





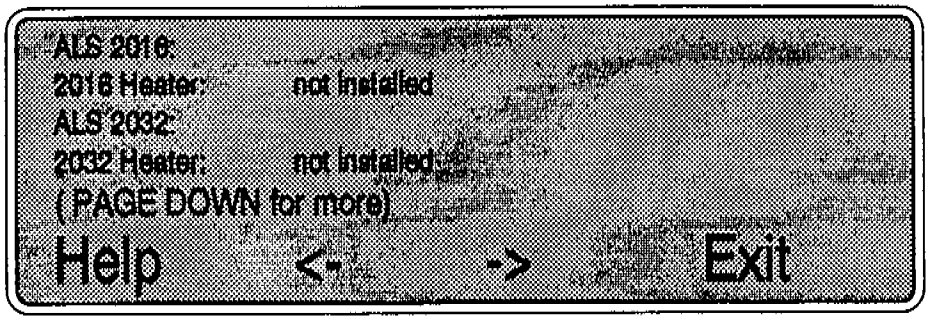
2) Press **PAGE DOWN** on the keypad to see the rest of the Instrument Configuration list:



9.3 Microprocessor Procedures (cont.)

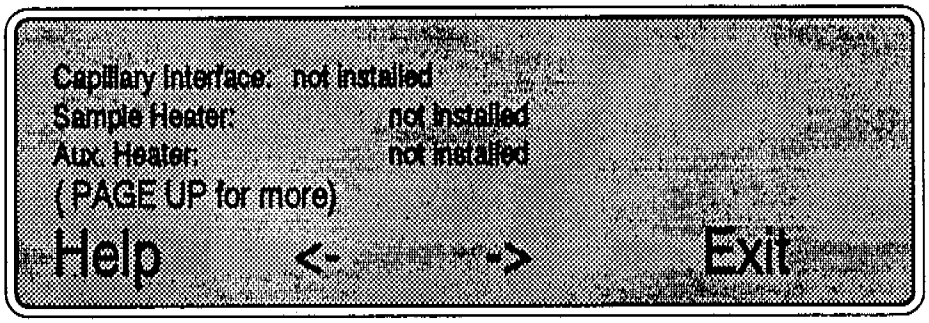
9.3.3 Reviewing and Changing Instrument and Accessory Configurations (cont.)

3) If an accessory needs to be configured differently from the way it appears in the listing, press **F3 (Inst)** to access the Instrument screen:



To change an accessory's configuration:

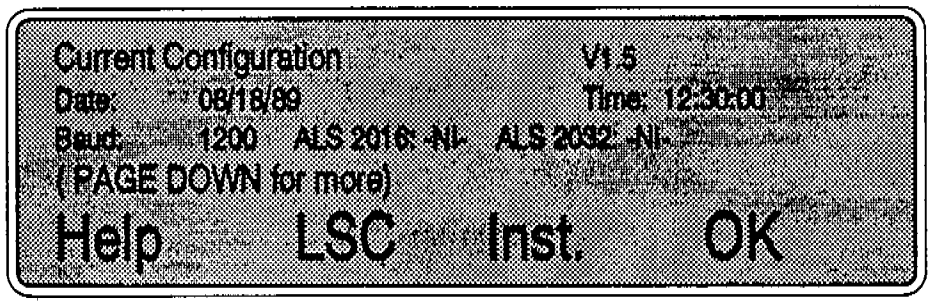
1) Press **F2 (<-)** or **F3 (->)** to move the highlighted box to the desired accessory.
2) With the desired accessory highlighted, press **Y (digit 7)** or **N (digit 9)** to reconfigure the system to acknowledge the instrument.
3) Press **PAGE DOWN** to access additional accessories in the listing:



If an accessory is not installed it cannot be turned on (activated).

To turn an accessory on or off:

1) Press **F2 (<-)** or **F3 (->)** to move the highlighted box to the desired accessory.
2) With the desired accessory highlighted, press **Y (digit 7)** or **N (digit 9)** to activate or deactivate the accessory.
3) When all accessories are configured as desired, press **F4 (Exit)** to return to the Current Configuration screen.



4) Press **F4 (OK)** to return to Program mode.

9.3 Microprocessor Procedures (cont.)

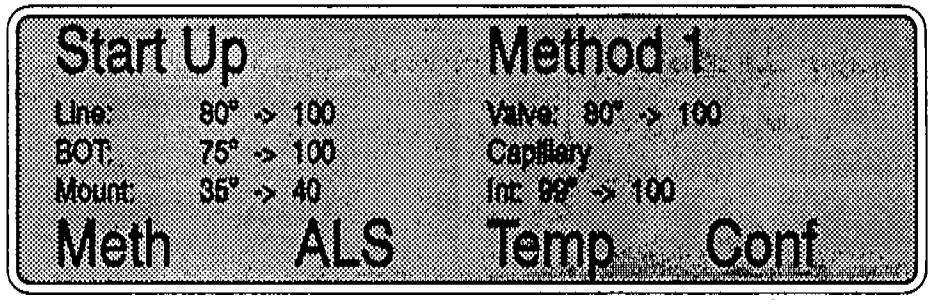
9.3.4 Configuring the Sample Heater Parameters

The LSC 2000 Sample Heater accessory is activated by setting the LSC 2000 Prepurge time, Preheat time, and Sample Heater temperature via the LSC 2000 keypad.

1) If you have powered up the LSC 2000, you must push the reset button on rear panel to configure the sample heater into a Method. This will reinitialize the program and the system will run a self test.

ATTENTION
Do not skip the self test for the Sample Heater. The unit will treat skips as failures, and will not allow you to turn on the accessory unit.

2) With the Start Up screen displayed, press **F1 (Meth)** to modify the parameter values.



Method Parameter values can be modified for any Method from *any* Program mode screen. However, if modifications are made from any mode after the start of Preheat, the change will not take effect until the *next* sample.

There are three parameter settings to consider for the Sample Heater:

a) Prepurge Time eliminates any air from the sampler before heating to prevent oxidation; desirable for some samples (e.g. oils). The formula used to determine the time is: Volume x 3 / flow rate.
For example:
If a 10 ml sample is used in 30 ml glassware , the remaining volume is 20 ml. If the purge flow rate is 40 ml/min., the prepurge time should be set to 1.5 minutes. ([20 ml x 3] / 40 ml/min. = 1.50 min.).
The total volume of each sampler is approximately:
- 10 ml for a 5 ml sparger
- 30 ml for a 25 ml sparger

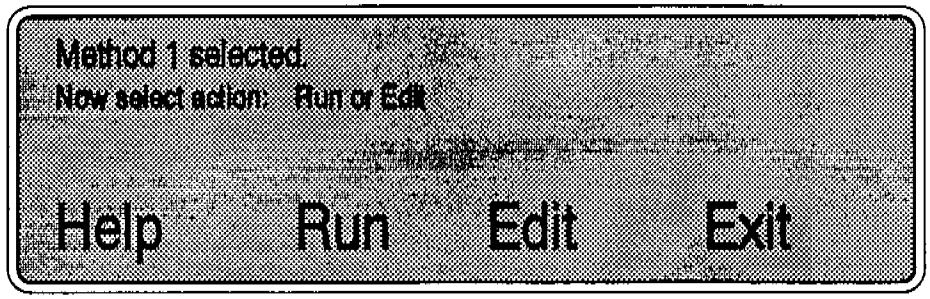
b) Preheat Time is required for the sample to rise and equilibrate at temperature before purging to enhance quantitative reproducibility. The sample heats at an approximate rate of 20°C/min. Additional time should be allotted for larger samples, or solid samples where heat transfer is not as uniform as liquids.

c) Sample Heater Temperature depends on the nature of the sample you intend to run.

9.3 Microprocessor Procedures (cont.)

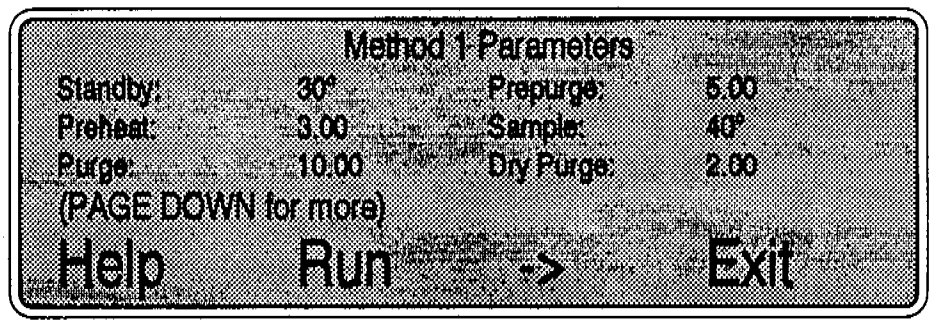
9.3.4 Configuring the Sample Heater Parameters (cont.)

3) Enter the number of the Method you wish to use.
4) Press **F3 (Edit)** to change the parameter values (Prepurge time, Preheat time and Sample Heater temperature) for the Sample Heater.



ATTENTION

The Sample Heater accessory has a set point range from ambient temperature to a maximum heater set point of 200°C. Tekmar recommends when using Tekmar heaters to not exceed 100°C.



5) Press **F3 (->)** to place the highlighted box on the parameters you wish to change. **Prepurge** (time) **Preheat** (time), and **Sample** (heater temperature) should be given values at this time.
6) After all values have been entered, press **F2 (Run)** to begin the Method.

ATTENTION

Preheat (time) and Sample (Heater temperature) must have a value greater than zero for the Sample Heater to function. Prepurge (time) however, may have a value of zero if this mode will not be used.

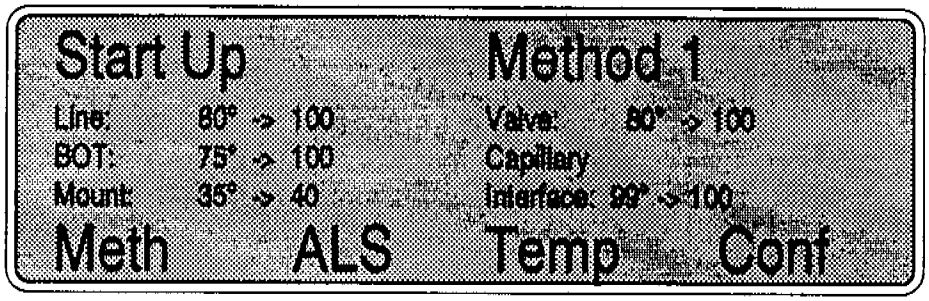
9.3 Microprocessor Procedures (cont.)

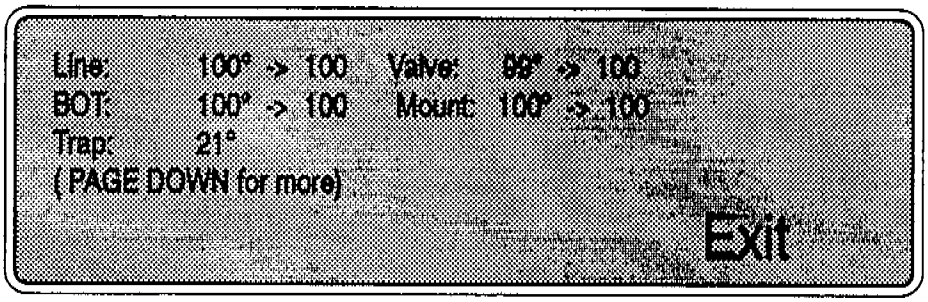
9.3.5 Reviewing Method Temperature Values

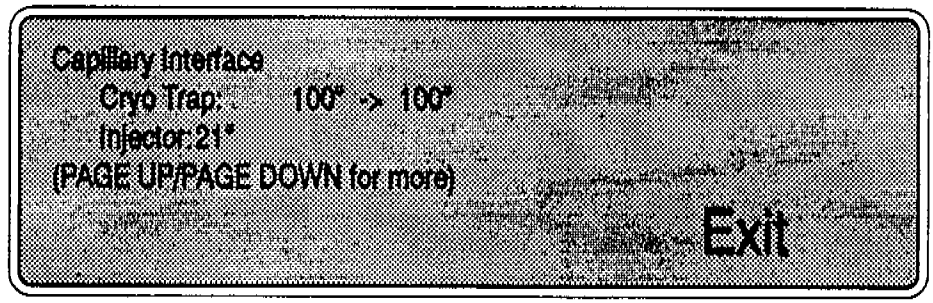
1) For a quick review of temperature and parameter values assigned to a given Method, press **F3 (Temp)** from any Program mode screen.

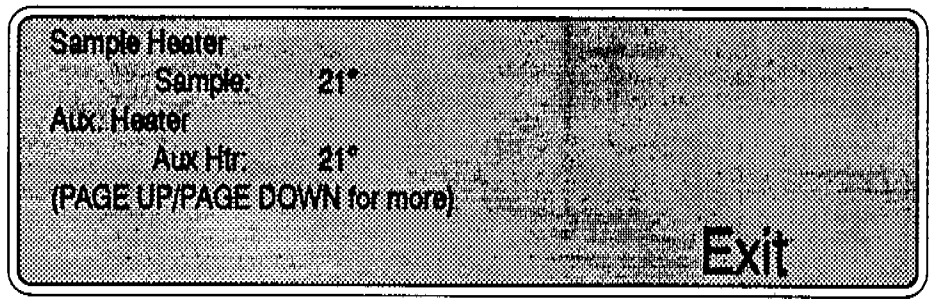
No changes can be made to Parameter Values from the Temperature menu. To modify Parameter Values, see Section 7.

2) Press **F3 (Temp)** from, for example, the Start Up screen to display the Temperature screen:









If no Cryofocusing Module or Sample Heater is installed the screen displays -NI- (not installed) where the set temperatures are normally located.

10.1 Changing the Trap

10.1.1 New Installations

The LSC 2000 is delivered with a blank trap installed. This prevents the damage that would be done to a packed trap if the unit was powered up with no purge gas flow present. ***Replace the blank trap with a packed trap before running a sample.***

Trap Identity

Traps can be identified by a number stamped on the nut at the bottom of the trap. These numbers are:

Trap Number	Part Number	Type of Trap
0	14-1168-003	Blank
1	12-0083-003	Tenax
2	12-0084-003	Tenax/Silica Gel
3	14-0124-003	Tenax/Silica Gel/Charcoal
4	14-1457-003	Tenax/Charcoal
5	14-2366-003	0V1/Tenax/SilicaGel/Charcoal
6	14-1755-003	0V1/Tenax/Silica Gel
7	14-3347-003	0V1/Tenax
8	14-3928-003	Carbopak/Carbosieve
9		Custom
G0	14-4164-003	Glass-lined Blank
G1	14-4045-003	Glass-lined Tenax
G2	14-4046-003	Glass-lined Tenax/Silica Gel
G3	14-4047-003	Glass-lined Tenax/Silica Gel/ Charcoal
G4	14-4939-003	Glass-Lined Tenax/Charcoal

10.1.2 How to Change a Trap

1) Remove the trap door at the front end of the left panel.
2) ***Make sure the trap is not hot.***
3) If you have already powered up the unit, make sure the system is in Purge Ready or Standby.
4) Make sure the unit is in HOLD, not AUTO.
5) Loosen the nut at the top of the trap one full turn but do not remove it completely.

The nut at the top of the trap should have been fastened finger tight and loosened easily. If not, the ferrule may need to be replaced.

6) Hold the bottom fitting in place with a 7/16" wrench while using a 7/16" wrench to turn the nut at the bottom of the trap counter-clockwise until the fitting is disengaged.
7) Grasp the trap furnace and trap and pull the trap straight down and out of the upper trap fitting.
8) Grasp the trap furnace in one hand and the lower trap fitting with the other hand and pull the trap out of the furnace.
9) Slide a packed trap into the trap furnace sleeve.

10.1 Changing the Trap (cont.)

10) Reconnect the top and bottom fittings. Take care not to tighten the top fitting past finger tight. Doing so may result in damage to the teflon ferrule.
11) While holding the fitting in place with a 7/16" wrench, tighten the brass nut at the bottom with another 7/16" wrench 1/8 turn past finger tight.
12) Put the trap door back on.

Before samples can be run, the new trap must be thermally conditioned. Refer to Conditioning a New Trap, Section 10.2.

10.1.3 When to Replace a Trap

Tenax has a significantly shorter lifetime than silica gel or charcoal. Silica gel and charcoal normally do not affect trap longevity. Trap lifetimes range from 2 weeks to 5 years, with the average being approximately 6 months.

Indicators of trap age are:

1) Increase in background. This usually takes the form of benzene and other aromatics in instrument blanks.
2) Losses of brominated compounds while other compounds remain constant.
3) Increase in backpressure.

10.2 Conditioning a New Trap

1) To condition a trap, first make sure you have followed the procedures for loading method default values into RAM (if not, see Section 6). These defaults include a value of 225°C for the Bake mode.
2) Press **STEP TO BAKE** to cause the system to go to Bake mode.
3) Press **HOLD** to keep the unit in Bake mode for at least 10 minutes to thermally condition the trap.

A 10-minute conditioning period at the start of each day is recommended if organic solvents are present in the ambient atmosphere.

- Tenax requires only a short conditioning period, about 10 minutes at 225°C.
- Silica gel and charcoal require about the same conditions.
- For heavily loaded traps or compounds of low volatility, longer bake times may be required.

If a trap is contaminated by a dirty sample, overnight conditioning may be necessary.

Temperatures above 225°C do not speed up conditioning and may shorten trap lifetime.

10.3 Cleaning the Sample Lines

The LSC 2000 can become seriously contaminated from a heavily contaminated sample or from poor quality purge gas.

For sample-caused contamination:

1) Turn Bake Gas Bypass off and install clean, dry glassware.
2) Press **STEP TO BAKE** and then press **HOLD**.
3) Keep the unit in Bake mode for at least 1 hour. In some cases longer durations might be required.

Note: As a secondary measure after bake mode you may want to use a backflushing process with the Tekmar Solvent Flush Kit (P/N 14-5118-000). Please call Tekmar at (800) 874-2004 or (513) 247-7000 for information.

For contamination due to poor quality purge gas:

1) First replace the tank and *all* hydrocarbon traps on the gas supply line. This process may be sufficient to obtain good blanks. If not, press **STEP TO BAKE** and then press **HOLD**.
2) Keep the unit in Bake mode for at least 1 hour. In some cases longer times might be required. If the contamination problem persists, call Tekmar's Applications Department (800) 543-4461 for assistance.

10.4 Cleaning Glassware

Clean glassware is essential to interference-free runs. This applies to flasks and cylinders as well as samplers (i.e., any vessel used to handle samples, standards, blank water, etc). To effectively clean glassware, Tekmar recommends:

1) Using dedicated glassware,
2) obtaining an ultrasonic bath, and
3) obtaining a muffle furnace.

Dedicated glassware refers to glassware that is used for concentrator work *only*. Glassware that is used for other procedures such as extractions, often is not clean enough to use in trace applications.

An ultrasonic bath is a time-saver. Instead of tedious scrubbing alone, a brief scrubbing followed by ultrasonics is far more effective and much less work. Ultrasonic baths can effectively clean the frits and walls of frit samplers that brushes cannot reach. Any of the glassware detergents recommended for use with an ultrasonic bath are acceptable. (We recommend use of the Tekmar Ultrasonic Bath.)

A muffle furnace is excellent for cleaning many samplers that nothing else can touch. Set the temperature to approximately 350-400°C (do not go too high, the glassware may melt) and allow the residues to be oxidized. After the glassware has cooled, the remaining char is easily removed with a brush and a cleaning agent. (We recommend the Tekmar Muffle Furnace.)

The sample needle should also be cleaned on a routine basis. Frequency of cleaning depends on the nature of the sample. Aqueous samples require infrequent cleaning while oils and other messy samples require cleaning after every run.

10.5 Ordering Replacement Parts

Tekmar's factory service facilities are located in Cincinnati, Ohio and may be contacted by calling toll free (800) 874-2004, or outside the U.S. at (513) 247-7000. Our Service Department experts can help locate the cause of a problem and can determine the best way to expedite repair. All replacement parts for the LSC 2000 are described in this section. ***Please include the model and serial number of your instrument when ordering spare parts.***

SAMPLE HANDLING

14-2337-024	5 ml Fritted Sparger (glassware only)
14-2334-024	25 ml Fritted Sparger (glassware only)
14-2336-024	5 ml Fritless Sparger (glassware only)
14-2333-024	25 ml Fritless Sparger (glassware only)
14-3096-000	5 ml Fritted Sparge Kit
14-3095-000	25 ml Fritted Sparge Kit
14-3094-000	5 ml Fritless Sparge Kit
14-3093-000	25 ml Fritless Sparge Kit
14-2052-024	5 ml Needle Sparger
14-2053-024	25 ml Needle Sparger
14-3599-000	5 ml Needle Sparge Kit
14-3600-000	25 ml Needle Sparge Kit
14-3128-050	Sample Valve, 3-Port Assembly
14-0216-016	Female Luer Connector for Sample Valve
14-3367-002	Drain Line Assembly
14-2988-000	Purge Line Assembly
14-3097-016	Ferrule, 1/16" Valco, Teflon (for sample fitting)
14-3181-016	Sample Nut, Valco, 1/2"
14-3124-016	Short nut, 1/16" (for sample needle)
14-3123-016	Ferrule, 1/16", ETFE (for sample needle)
14-3126-053	Needle, 5 ml, 8-5/8"
14-3127-053	Needle, 25 ml, 10.25"
14-1590-016	Plug nut, 1/16", SS
14-0000-000	1/2" to 3/4" Test Tube Type Sampler Kit for 2000

SYRINGES

14-0069-052	5 ml Sample Syringe w/Luer Connector
14-0070-052	25 ml Sample Syringe w/Luer Connector
12-0089-052	10 ml Calibration Syringe

FITTINGS

14-3145-000	Sample Mount Wrench
14-2389-016	Sample Fitting Tee
14-0264-016	Union, Bulkhead, 1/16", SS
14-0356-016	Union, Bulkhead, 1/8", Filter Assembly
12-0064-016	Union, 1/8"-1/8" Stub, Brass, Bulkhead
14-2401-016	Top Trap Fitting, 1/8", Gold-plated
14-2517-016	Top Trap Fitting, 1/4", Gold-plated
14-2628-016	Tee, 1/16", Gold-plated, dry purge
14-0243-016	Nut, Short, for 1/16" tube, Valco
14-0159-016	Nut, 1/16", SS, Swagelok
14-2931-016	Ferrule, 1/16", graphite/vespel
14-0051-016	Union, 1/16", SS
12-0042-016	Union, 1/16"-1/8", Stub, Brass

10.5 Ordering Replacement Parts (cont.)

FITTINGS (cont.)

12-0073-016	Union, 1/8", Brass
12-0070-016	Tee, 1/8", Brass
14-3098-016	Ferrule, 1/2" Valco, Teflon
14-0521-016	Ferrule, 0.4 mm I.D., graphite/vespel
14-0540-016	Ferrule, 0.5 mm I.D., graphite/vespel
14-2074-016	Ferrule, 0.8 mm I.D., graphite/vespel
14-0442-016	Ferrule set, 1/16", Swagelok, Teflon
14-4050-016	Ferrule, 1/8", graphite/vespel

TUBING

14-0546-002	Tubing, 1/8", Copper (price/ft., min. 5 ft.)
14-0441-002	Tubing, 1/16", Nickel, Large Bore (price/ft., min. 5 ft.)
14-1324-002	Tubing, 1/16" Nickel, Small Bore (price/ft., min. 5 ft)
14-2922-002	Tubing, 1/16", Glass-Lined (price/cm)
14-3845-002	Tubing, 1/16", Nickel, Large Bore Flexible price/ft., min 5ft
14-2925-002	Top of Trap Glass Line Assembly
14-2926-002	Sample Glass Line Assembly
14-2927-002	6-Port Glass Line Assembly
14-3592-002	Tubing, Fused Silica, 0.32 mm I.D., (price/meter)
14-3591-002	Tubing, Fused Silica, 0.53 mm I.D., (price/meter)
14-3125-002	Hypodermic Tubing, SS, 16GA, (price/foot)
14-3227-002	Transfer Glass Line Assembly

ELECTRONICS

14-2984-000	Microprocessor Buzzer
14-2884-000	Microprocessor Cable
14-2406-000	Front Panel Keypad
14-4962-190	CPU Board Microprocessor w/ROM
14-4962-090	CPU Board Microprocessor w/o ROM
14-5090-075	ROM for CPU Board
14-2575-000	Power Supply Board (110V)
14-2575-390	Power Supply Board (100V & 220V)
14-3326-000	Power Supply Board (220V)
-14-2576-000	Interface Board ½o
14-3722-000	Logic Board
14-2578-000	Output Board
14-2574-000	Mother Board
14-2579-000	Interconnect Board
14-3723-000	Program Panel Display Board
14-4957-138	Transformer Assembly, 230V-115V (220V)
14-5177-138	Transformer Assembly, 100V-115V (100V)
14-3920-000	Wrapper Assembly (110V)
14-3325-000	Wrapper Assembly (220V)
14-2511-000	Expansion Slot Cover
14-0065-034	Fuses (2), 1.0 amp (110V & 220V)
14-3043-034	Fuses (2), 8.0 amp (rectifier) (110V)
14-3361-034	Fuses (2), 4.0 amp (rectifier) (220V)
14-0140-034	Fuses (2), 2.0 amp (110V & 220V)
14-5180-034	Fuse, 10.0 amp (slow blow) (100V)
14-4961-034	Fuse, 4 amp (slow blow) (220V)

10.5 Ordering Replacement Parts (cont.)

FURNACES, HEATERS and TRAPS

14-2916-000	Trap Heater Assembly, 1/8" (110V)
14-3224-000	Trap Heater Assembly, 1/8" (220V)
14-0653-020	Cartridge Heater, (Sample Mount)
14-2456-000	Sample Fitting Heater Block Assembly (110V)
14-3770-000	Sample Heater (over glassware)
14-3332-000	Sample Fitting Heater Block Assembly (220V)
14-3308-000	Sample Heater Assembly (120V)
14-2917-000	Trap Heater Power Cord Assembly
14-2539-000	Oven Heater Assembly (110V)
14-3340-000	Oven Heater Assembly (220V)
14-3889-000	Oven Fan Assembly (110V)
14-3338-000	Oven Fan Assembly (220V)
14-2874-020	Strip Heater, (Valve Oven) (110 V)
14-3073-020	Strip Heater, (Valve Oven) (220V)
14-3743-000	Transfer Line Assembly, 36" (110V)
14-3746-000	Transfer Line Assembly, 36" (220V)
14-3744-000	Transfer Line Assembly, 48" (110V)
14-3747-000	Transfer Line Assembly, 48" (220V)
14-3745-000	Transfer Line Assembly, 60" (110V)
14-3748-000	Transfer Line Assembly, 60" (220V)
14-2822-000	Bottom Trap Heater Assembly (110V)
14-3225-000	Bottom Trap Heater Assembly (220V)
14-3773-026	T.C. Extension Trap Heater (inside unit)
14-3146-000	Cartridge Heater, 6-Port Valve (110V)
14-3155-000	Cartridge Heater, 6-Port Valve (220V)
14-3148-000	Heat Sink, 6-Port Valve
14-1168-003	Trap, Blank (#0)
12-0083-003	Trap, Tenax (#1)
12-0084-003	Trap, Tenax/Silica Gel (#2)
14-0124-003	Trap, Tenax/Silica Gel/Charcoal (#3)
14-1457-003	Trap, Tenax/Charcoal (#4)
14-1755-003	Trap, OV-1/Tenax/Silica Gel (#5)
14-2366-003	Trap, OV-1/Tenax/Silica Gel/ Charcoal (#6)
14-3347-003	Trap, OV-1/Tenax (#7)
14-3928-003	Carbopak/Carbosieve (#8)
14-4164-003	Glass-lined Blank (#G0)
14-4045-003	Glass-lined Tenax (#G1)
14-4046-003	Glass-lined Tenax/Silica Gel (#G2)
14-4047-003	Glass-lined Tenax/Silica Gel/Charcoal (#G3)
14-4939-003	Glass-lined Tenax/Charcoal (#G4)

VALVES AND PNEUMATICS

14-2647-000	2-Port Valve Drain Assembly
14-2648-000	2-Port Valve Vent Assembly
14-2646-000	3-Port HRP Valve Assembly (inside unit)
14-3128-000	3-Port Sample Valve (outside unit)
14-2658-050	6-Port Valve Slider
14-2657-050	6-Port Valve Actuator (110V)
14-3362-050	6-Port Valve Actuator (220V)
14-3149-050	6-Port Valve Body with slider

800 543-4461

10.5 Ordering Replacement Parts (cont.)

14-2651-050	6-Port Valve Assembly w/actuator (110V)
14-3341-050	6-Port Valve Assembly w/actuator (220V)
14-2862-000	Purge Valve Assembly
14-2861-~~000~~ 050	Dry Purge Valve Assembly
14-1096-000	Pressure Gauge Assembly
14-2865-000	Pressure Regulator Assembly
14-2386-050	Flow Controller
14-3257-100	Kit, Prepurge Retrofit

MISCELLANEOUS

14-5092-000	Installation Kit
14-1362-000	Hydrocarbon Trap Assembly
14-3889-000	Oven Fan Assembly
14-2650-000	Trap Fan Assembly
14-1536-035	2 Conductor MTA Housing, 18GA
14-0509-026	K Thermocouple, (Sample Mount)
14-0164-026	Female Thermocouple Jack
14-0304-035	Terminal Crimp
14-1210-035	2 Conductor Receptacle for Pin
14-1533-035	2 Conductor MTA Housing, 24GA
14-2912-000	Shipping Carton
14-0298-039	Power Cord (110V)
14-2511-000	Expansion Slot Cover
14-2540-000	Oven Lid Assembly
14-2515-008	Fastener, 1/4 turn, #260
14-2516-008	Retainer, SS, for 1/4 turn fastener
14-2492-008	Washer, for 1/4 turn fastener
14-2536-008	Receptacle, 1/4 turn
14-2446-000	Trap Door Assembly
14-0002-031	Control Knob, w/o dot (flow controller, pressure regulator)
14-2454-010	Thumb Nut
14-2440-006	Standoff, Ceramic, (Sample Mount)
14-2432-000	Bracket, Transfer Line
14-2792-016	Cap Nut, brass, Swagelok, 1/16"
14-2438-019	Heater Fan Blade
14-2436-000	Bracket, Sample Valve
14-0067-027	Allen Wrench
14-2987-000	Phillips Screwdriver
14-2428-000	Sample Shroud, Complete
14-3912-000	LSC 2000 User Manual
14-3154-000	LSC 2000 Applications Manual
14-4318-000	Purge and Trap Concentrator Course Manual
14-4319-000	Troubleshooting Manual

INTERFACE CABLES

14-2976-000	HP 5710/30/90 GC w/5970 MSD w/Chemstation using Quicksilver software
14-2990-000	Interface, HP 5880A/5840A
14-2991-000	Interface, Hewlett-Packard 5890 GC

10.5 Ordering Replacement Parts (cont.)

14-3010-000	Interface Kit, HP 5995/85/93/92 GC/MS (requires HP's BATCH or AQUARIUS software & external events relay board to operate w/SIDS Data System)
14-2993-000	HP 5995/96/87/85/88/92 GC/MS w/ HP-1000/RTE GC/MS Software, HP 5890 w/5970 MSD and RTE (RTE-A, RTE-6 or Rev F**
14-2970-000	Interface, Perkin-Elmer Sigma Series
14-3233-000	Perkin-Elmer 8000 Series/Autosystem
14-2968-000	Interface, Varian 3300/3400/3500/3600 with or without Serial I/O
14-2969-000	Interface, Varian 3700
14-2966-000	Interface Kit, Varian Vista (includes I/O Box for switching 2000A to 2000B) also Varian 6000
14-3430-000	Interface, Tracor 585/9000 and Waters Dimension II
14-2972-000	Interface, Tracor 560/565/570
14-2992-000	Interface, Tracor 540 and Waters Dimension I
14-2973-000	Interface, Schimadzu GC9A
14-4610-086	Interface, Schimadzu GC 14A/15A
14-3318-000	HP 5995/85/93/92 w/Chemstation-Quicksilver Software
14-4830-086	Interface, two Tekmar 2000s on one HP 5890 (GC only. 2000s must hook to separate columns.)
14-4188-086*	Interface, HP 5890 w/5970 MSD and Unix or Pascal based software
14-4652-086	Interface, HP 5890 w/5970 MSD and Unix-B or MS-DOS software, HP 5890/5971 MSD and Unix-B or MS-DOS software, and HP 5890/5989 MS Engine
14-2974-000	Interface, Hewlett-Packard 5700 Series (exc. 5710/30/90)
14-3052-000	Interface, A & B to Varian Vista I/O Box
14-4655-086	Interface, two Tekmar 2000s to one Tracor 540 (GC only. 2000s must hook to separate columns.)
14-5044-086	Interface, two Tekmar 2000s to one Varian 3400 GC (2000s must hook to separate columns).
14-4009-000	Interface Splicer Cable, Finnigan 5100/4000/4500 and OWA
14-4938-086	Interface, Carlo Erba Mega and Vega Series
14-3147-000	Interface, General Purpose/HNU 301/321/421***

*Note that this cable requires the HP A111 (HP P/N 05990-60111) or A211 (HP P/N 05990-60211) Accessory Card and Internal Accessory cable (HP P/N 05987-60158) if using the Pascal software. If using Unix software only the Internal Accessory cable (HP P/N 05987-60158) is necessary.
**Revision F uses both master/slave cables. Use pins 27 and 28 instead of 25 and 26 on the MS molex plug.
***Valve driver option necessary from HNU.

ACCESSORY CABLES

14-3017-000	ALS to LSC 2000
14-3018-000	Model 1000 to LSC 2000
14-3257-000	Model 4210 to LSC 2000
14-3372-000	DPU Printer to LSC 2000
14-4352-086	2000/2016/2050 (1.8 ROM or greater)

11.1 Electronic Problems

This section is intended as a guide to electronically troubleshooting your LSC 2000.

#1 No display or erratic display

CHECK	ACTION
A. Are fuses F1, F2, F3 still good?	A. YES: Proceed to B. NO: Replace and try again.
B. With power on, press RESET (located next to the power switch). Does display appear?	B. YES: System is reset. NO: Replace the CPU board or the power supply.

#2 Unsuccessful self tests

A. Is fuse F2 good?	A. YES: Proceed to B. NO: Replace fuse and retest. If failure still occurs, refer to C.
B. Does screen read FAILURE?	B. YES: Proceed to C. NO: Replace the CPU board.
C. Are resistance values for all heaters valid? Refer to Section 11.3 for resistance values.	C. YES: Proceed to D if fuses blow. If not, proceed to E. NO: Replace heater.
D. Remove oven fan and 6-port valve connectors on the inside of the front panel board. Are fuses still blowing?	D. YES: Call the Tekmar Service Dept. NO: Replace oven fan or valve actuator.
E. Did the displayed temperature appear to increase slightly?	E. YES: Replace the CPU board. NO: Proceed to F.
F. Does the thermocouple in question work properly?	F. YES: Proceed to G. NO: Proceed to H.
G. Does the corresponding LED on the back panel come on?	G. YES: Replace the output board. NO: Replace the CPU or the logic board.
H. Disconnect the thermocouple in question from the program panel board. Does the display read 410°C?	H. YES: Replace or repair the thermocouple. NO: Replace the logic board or the program panel board.

11.1 Electronic Problems (cont.)

	CHECK	ACTION
#3 System does not automatically step from Startup to Standby	A. Is the front panel Hold LED on?	A. YES: Press AUTO. NO: Proceed to B.
	B. Is the front panel Auto LED on?	B. YES: Proceed to C. NO: Proceed to D.
	C. Are all temperatures at their set point?	C. YES: Replace the CPU board. NO: Allow time to heat up then proceed to D.
	D. Are all fuses good?	D. YES: Proceed to E. NO: Replace and try again.
	E. Are all resistance values for heaters valid? Refer to Section 11.3 for values.	E. YES: Proceed to F. NO: Replace heater.
	F. Does the corresponding light on the back panel come on?	F. YES: Replace the output board. NO: Replace the logic board or the CPU.
#4 System does not step from Standby to Purge Ready	A. Is trap temperature below the set point?	A. YES: Proceed to B. NO: Wait for the trap to cool past the set point.
	B. Is the system in Auto?	B. YES: Replace the CPU. NO: Press AUTO.
#5 System does not step from Purge Ready to Purge	A. Does the system include an auto sampler?	A. YES: Proceed to B. NO: Press START.
	B. Does the Start LED on the I/O board come on?	B. YES: Replace the CPU or the I/O board. NO: Proceed to C.
	C. Are the DIP switches on the I/O board set correctly? Refer to Section 11.4.	C. YES: Replace the CPU or the I/O board. NO: Set the switches correctly.

11.1 Electronic Problems (cont.)

	CHECK	ACTION
#6 System does not step out of Purge	A. Is system in Auto?	A. YES: Proceed to B. NO: Press AUTO.
	B. Has the preset time elapsed?	B. YES: Replace the CPU. NO: Wait for time to elapse.
#7 System does not step out of Dry Purge	A. Refer to Problem #6.	
#8 System does not step out of Desorb Ready	A. Is the system interfaced to a G.C.?	A. YES: Proceed to B. NO: Press STEP.
	B. Does the Continue LED on the I/O board come on when the G.C. is ready?	B. YES: Replace the CPU or the I/O board. NO: Proceed to C.
	C. Are the DIP switches on the I/O board set correctly? Refer to Section 11.4.	C. YES: Proceed to D. NO: Set the switches correctly.
	D. Is the G.C. definitely providing a Ready signal to the LSC 2000?	D. YES: Replace the CPU or the I/O board. NO: Correct the G.C. problem.
#9 System does not step out of Desorb Preheat	A. Does the trap temp. equal or exceed the set temperature?	A. YES: Proceed to B. NO: Proceed to C.
	B. Is the system in Auto?	B. YES: Replace the CPU. NO: Proceed to C.
	C. Is the trap heater temperature rising from ambient?	C. YES: Allow time for it to rise to the set point. NO: Proceed to D.
	D. Is the resistance value for the trap heater valid?	D. YES: Proceed to E. NO: Replace heater.
	E. Does the Trap Heater LED on the back panel come on?	E. YES: Replace the output board. NO: Replace the CPU or the logic board.

11.1 Electronic Problems (cont.)

CHECK	ACTION
#10 System does not step out of Desorb	A. Refer to Problem #6.
#11 System does not step out of Bake	A. Refer to Problem #6.

11.2 Fuse Ratings

F1 Transformer Primary = 1.0 amp 250V (normal blow)
F2 120V outputs = 8.0 amp 250V (rectifier)
F3 Transformer Secondary = 2.0 amp 250V (normal blow)
F4 Transformer Secondary = 2.0 amp 250V (normal blow)

Power input module = 10 amp 250V (slow blow) (100V)
Power input module = 4 amp 250V (slow blow) (220V)

11.3 Heater Resistance Values

Trap Heater Assembly	105 OHMS
B.O.T. Heater Assembly	270 OHMS
Transfer line (48")	92 OHMS
Mount Heater Assembly	500 OHMS
Oven Heater Assembly	58 OHMS

11.4 DIP Switch Settings

There are 2 DIP switches on the I/O board of the LSC 2000. (A photograph of the I/O board is found in Section 12.) These DIP switches are labeled U012 and U013. DIP switch U012 settings control output information to the user. DIP switch U013 settings control signals from the GC to the CPU (Central Processing Unit) of the LSC 2000's microprocessor. These settings must be set to correspond to the particular configuration that your gas chromatograph/data system requires. Find out if your GC's relay closure is normally open or normally closed when the GC is ready to start a run. Your gas chromatograph manual should contain this information. The corresponding LSC 2000 DIP switch settings are on the following page.

When you receive a new LSC 2000 you will also receive an interface cable to electronically interconnect the LSC 2000 with your GC. Your cable installation instructions will include the DIP switch settings for the GC you have specified with your order.

11.4 DIP Switch Settings (cont.)

DIP Switch U013 Signal	DIP Switch U013 Signal Condition	DIP Switch U013 Switch Settings
Start	Relay Closure N.O. Relay Closure N.C.	6 and 2 are open 6 is closed 2 is open
	True Positive Signal True Ground Signal	6 and 2 are closed 6 and 2 are open
Continue	Relay Closure N.O. Relay Closure N.C.	5 and 1 are open 5 is closed, 1 is open
	True Positive Signal True Ground Signal	5 and 1 are closed 5 and 1 are open ** Switches 3 and 4 should be open for all signals*
DIP Switch U012 Signal	**DIP Switch U012 Signal Condition**	**DIP Switch U012 Switch Settings**
Purge Ready	Relay Closure N.O. Relay Closure N.C.	6 is closed 6 is open
Desorb Ready	Relay Closure N.O. Relay Closure N.C.	5 is closed 5 is open
Beginning of Desorb	Relay and TTL Closure N.O.	1 and 4 are closed 3 is open
	Relay and TTL Closure N.C.	1 and 3 are open 4 is closed
End of Desorb	Relay and TTL Closure N.O.	1 and 3 are closed 4 is open
	Relay and TTL Closure N.C.	1 and 4 are open 3 is closed
End of Cycle	Relay Closure N.O. Relay Closure N.C.	2 is closed

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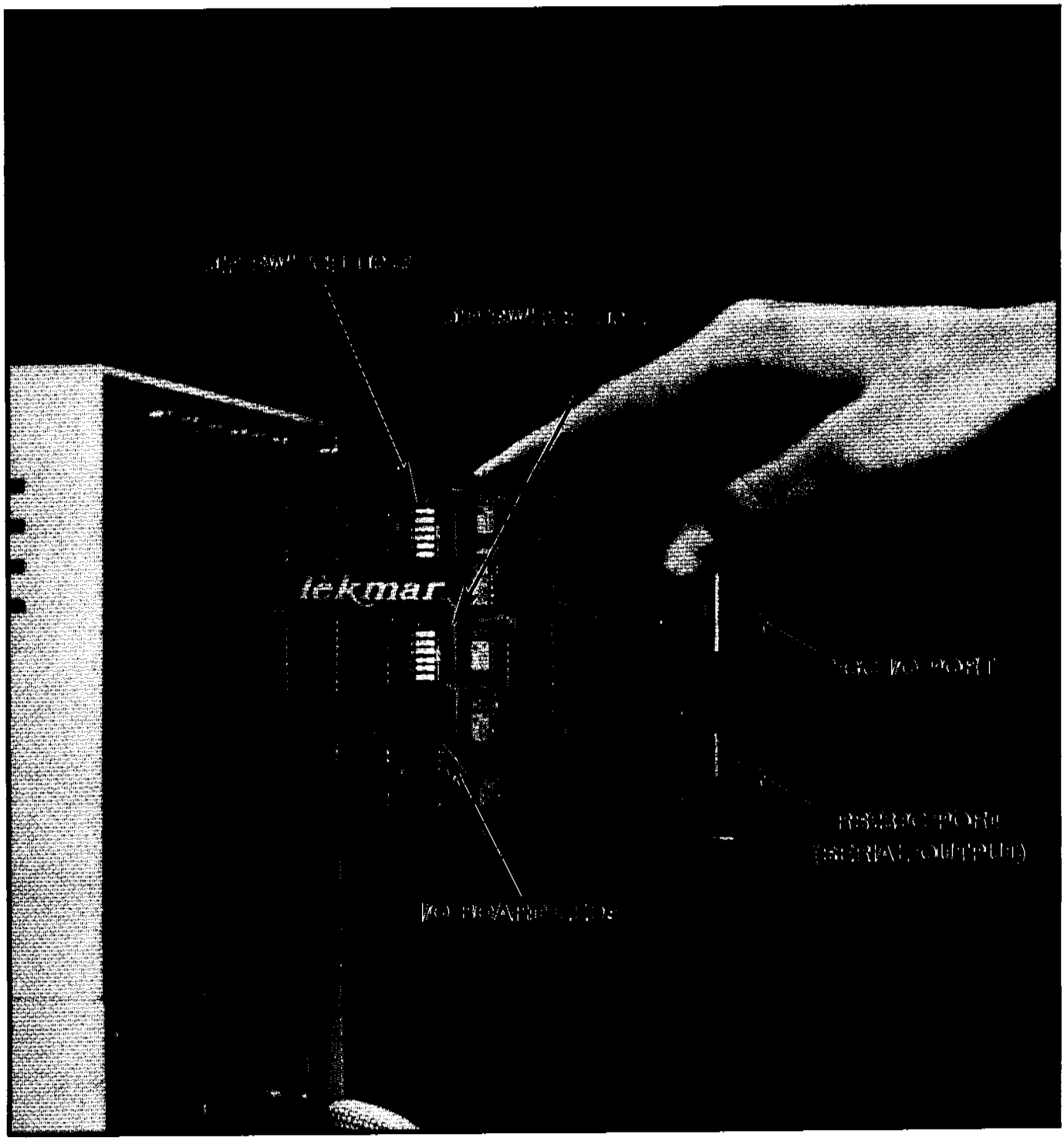

LSC 2000 I/O BOARD

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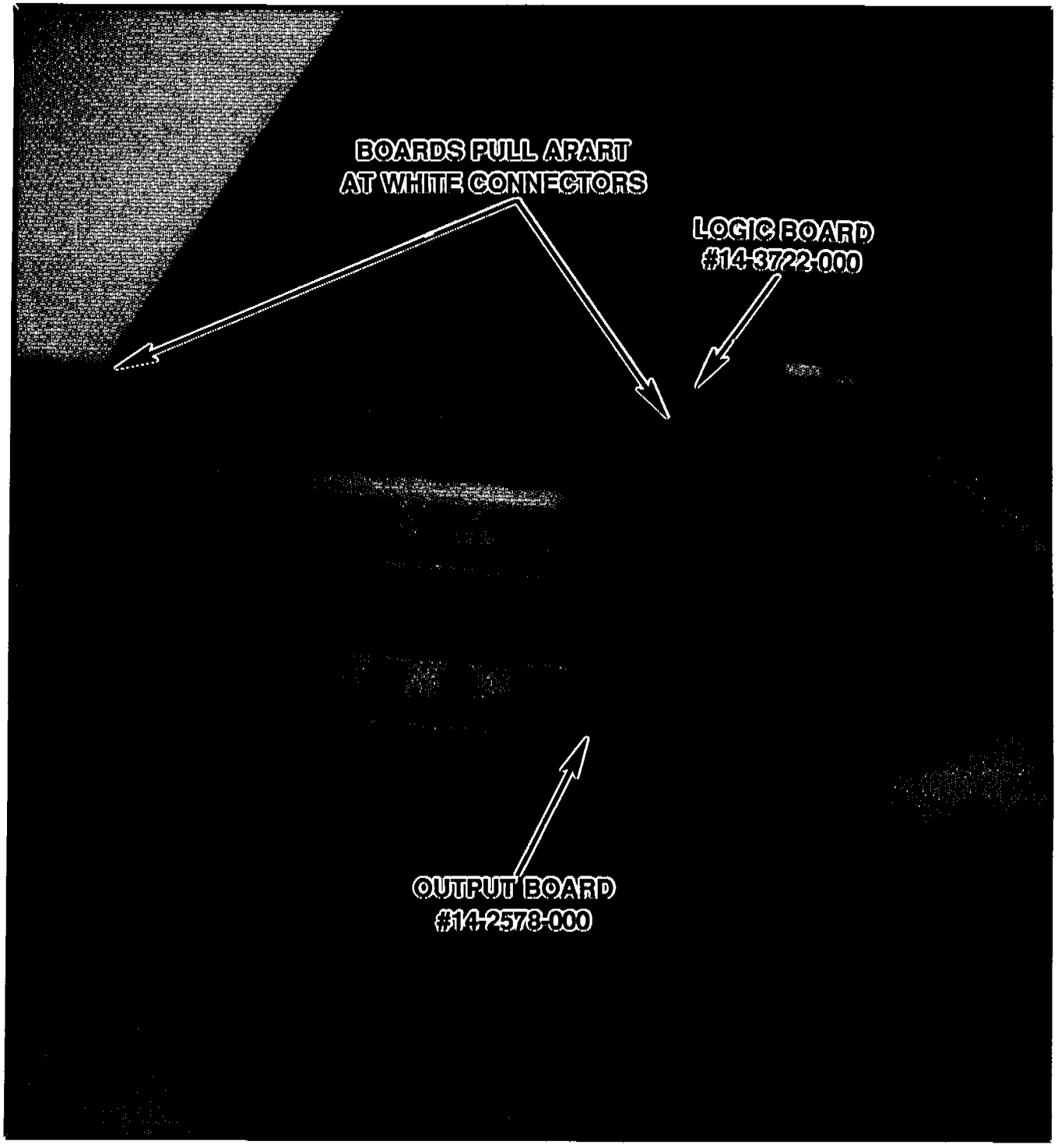
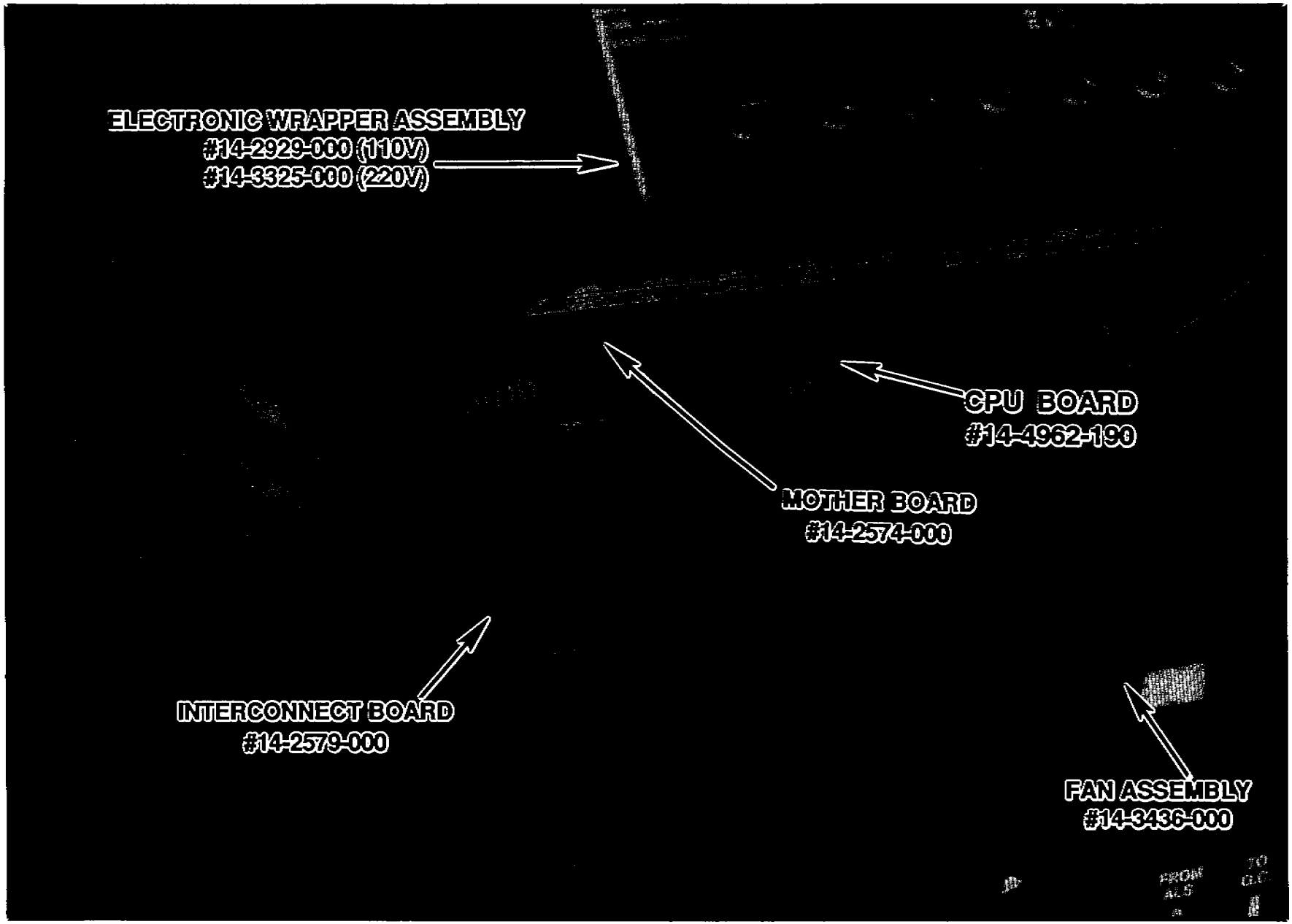


LSC 2000 LOGIC & OUTPUT BOARDS

Tekmar®



LSC 2000 ELECTRONICS MODULE CONNECTION

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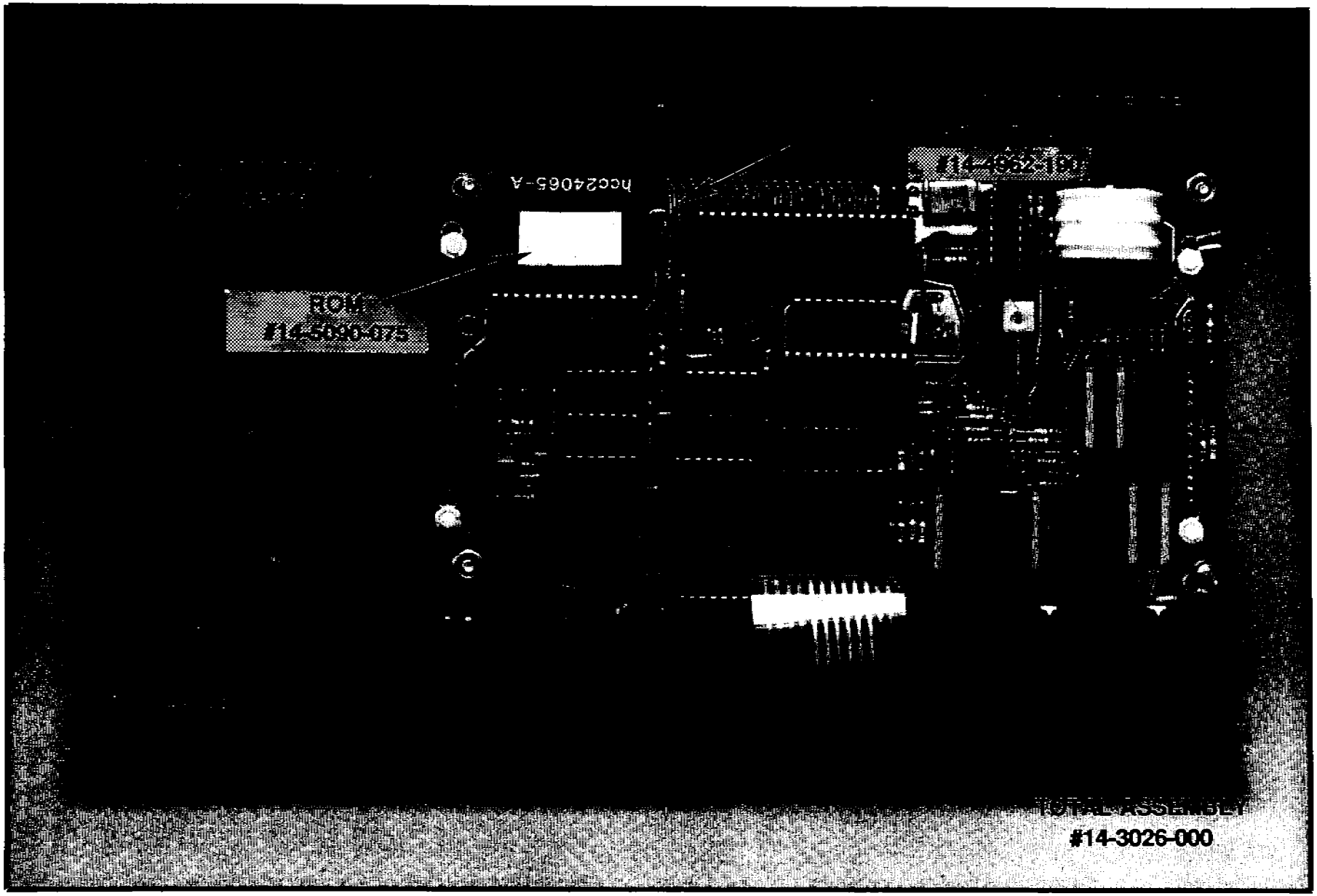

LSC 2000 CPU BOARD & KEYPAD

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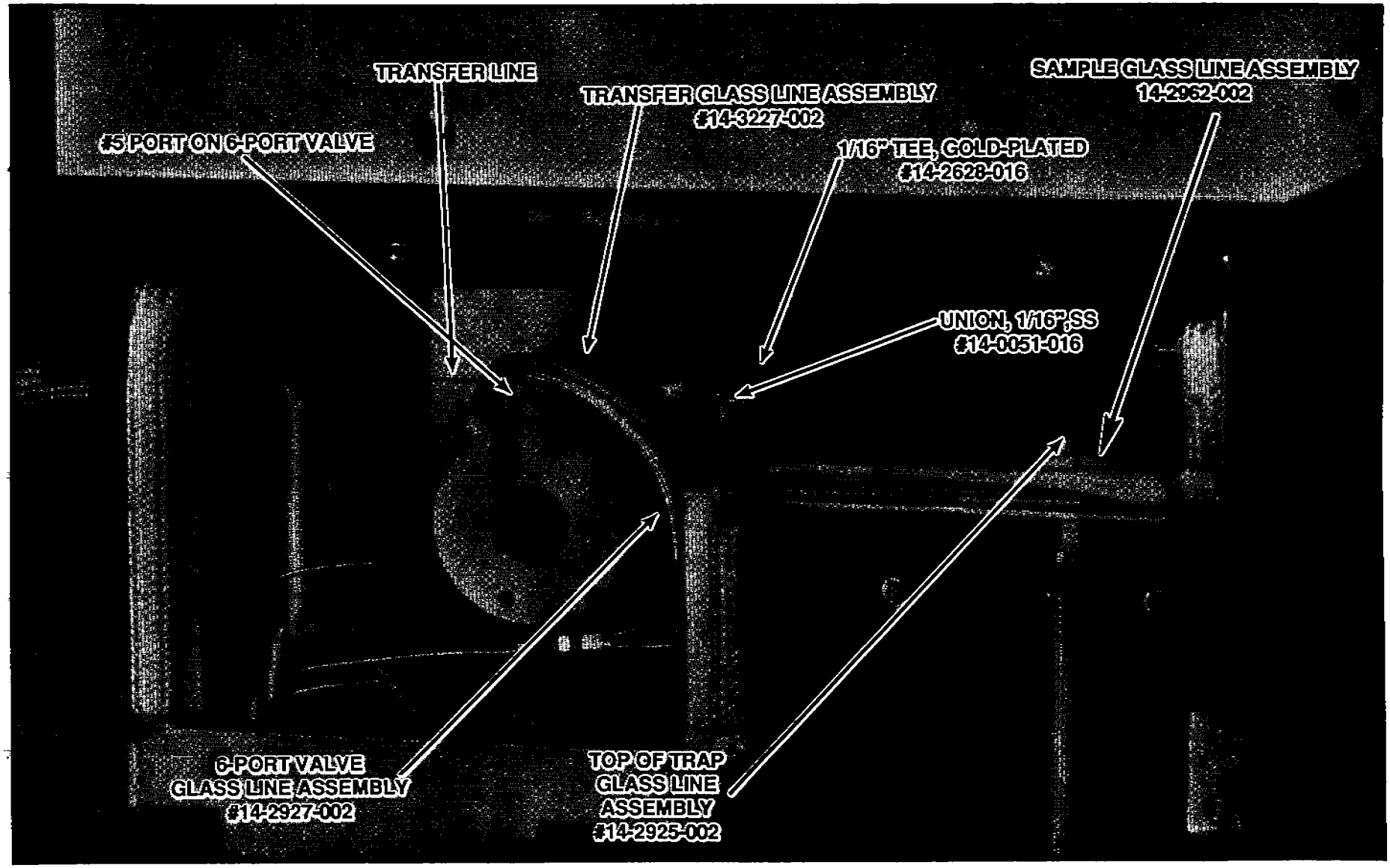
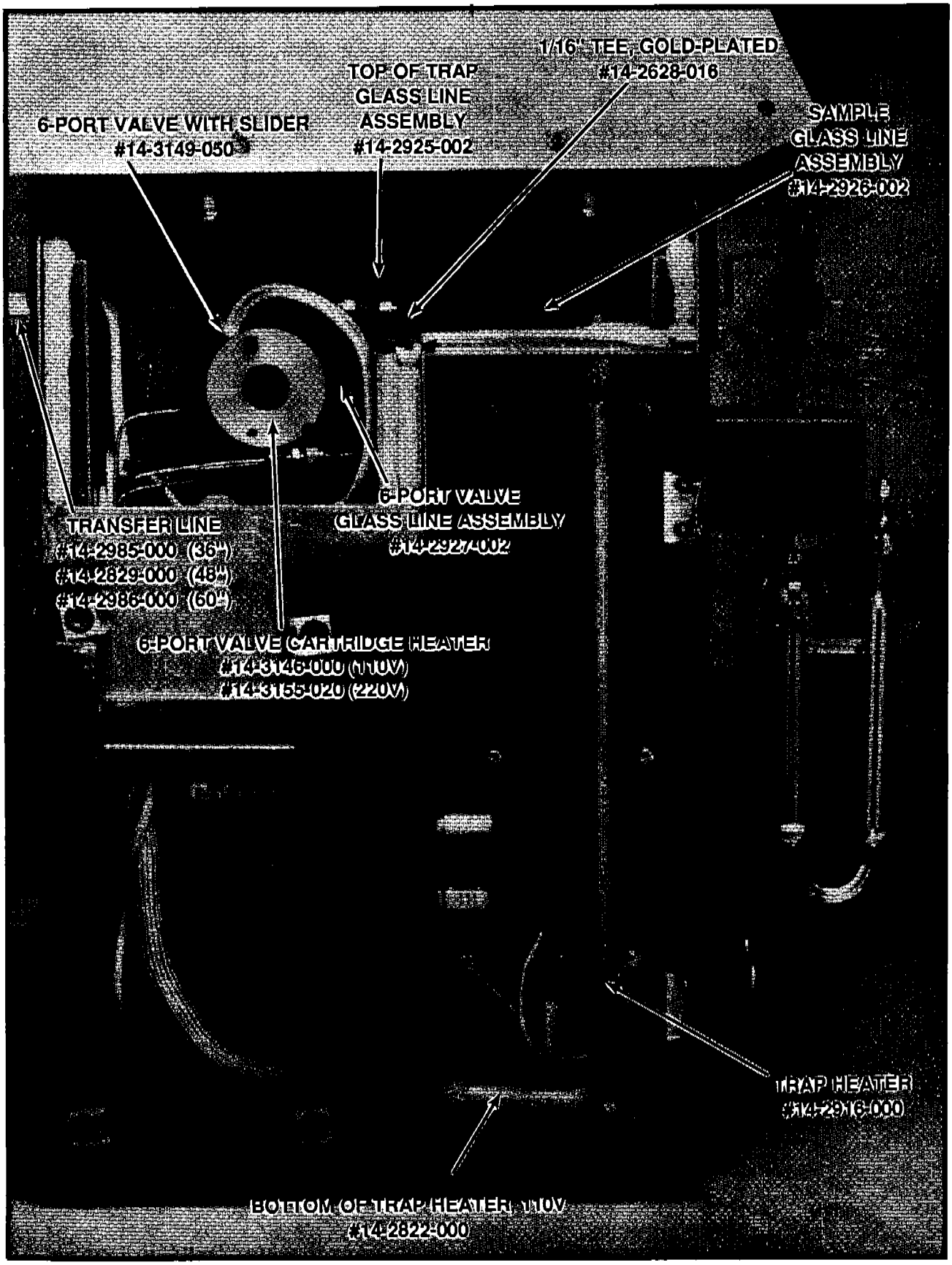


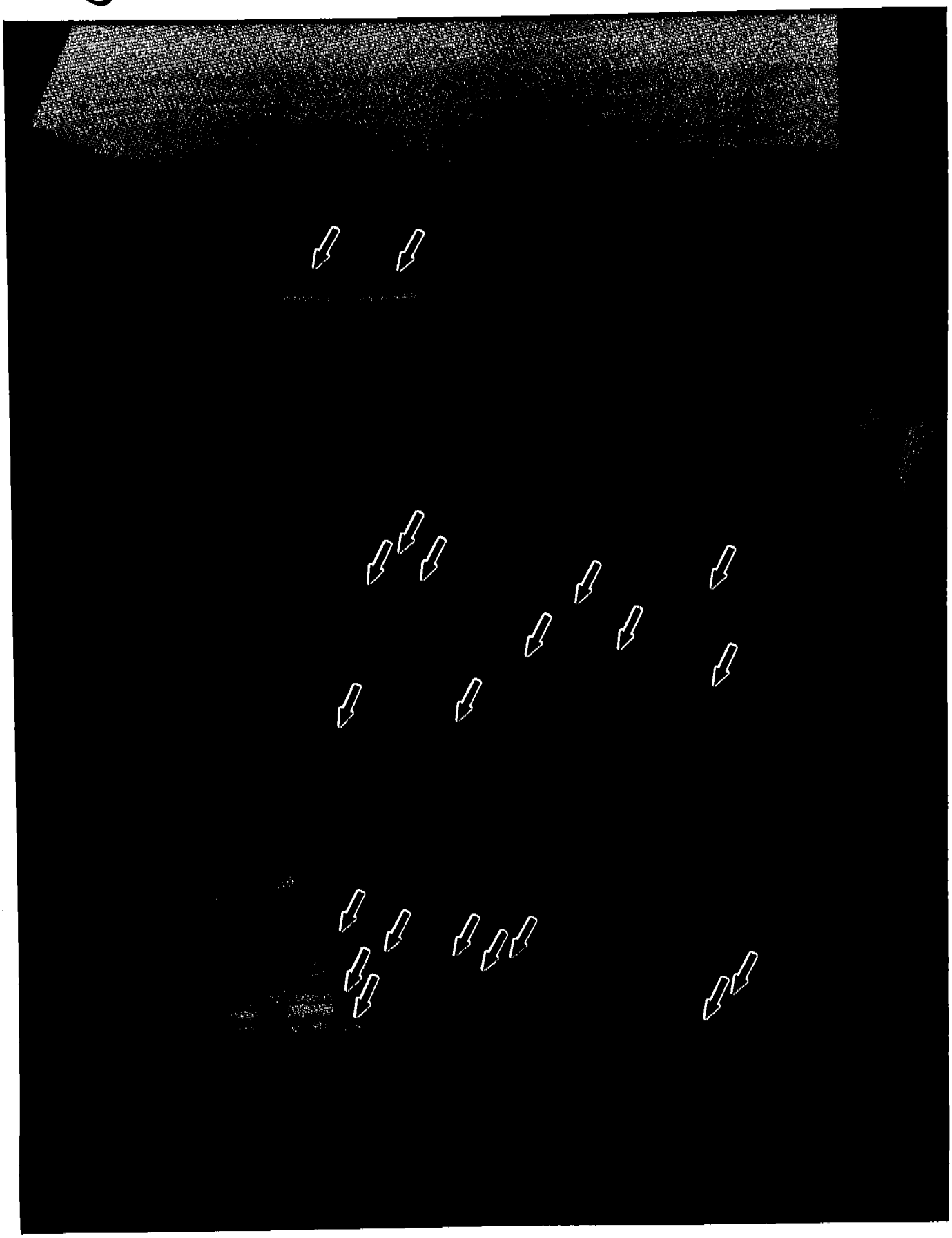
LSC 2000 VALVE OVEN

Tekmar®



LSC 2000 VALVE OVEN & TRAP AREA

Tekmar®



LSC 2000 LEAK CHECK DIAGRAM

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MODES	OUTPUTS						
	PURGE VALVE	VENT VALVE	HRP VALVE	DRAIN VALVE	BYPASS VALVE	SIX PORT VALVE	TRAP FAN
START-UP						P	✱
STANDBY						P	✱
PURGE READY						P	✱
PURGE	✱	✱				P	✱
DRY PURGE	✱	✱			✱	P	✱
DESORB READY						P	✱
DESORB PREHEAT						P	
DESORB						D	
DESORB W/DRAIN	✱		✱	✱		D	
BAKE	✱	✱				P	
BAKE W/BGB	✱	✱			✱	P	

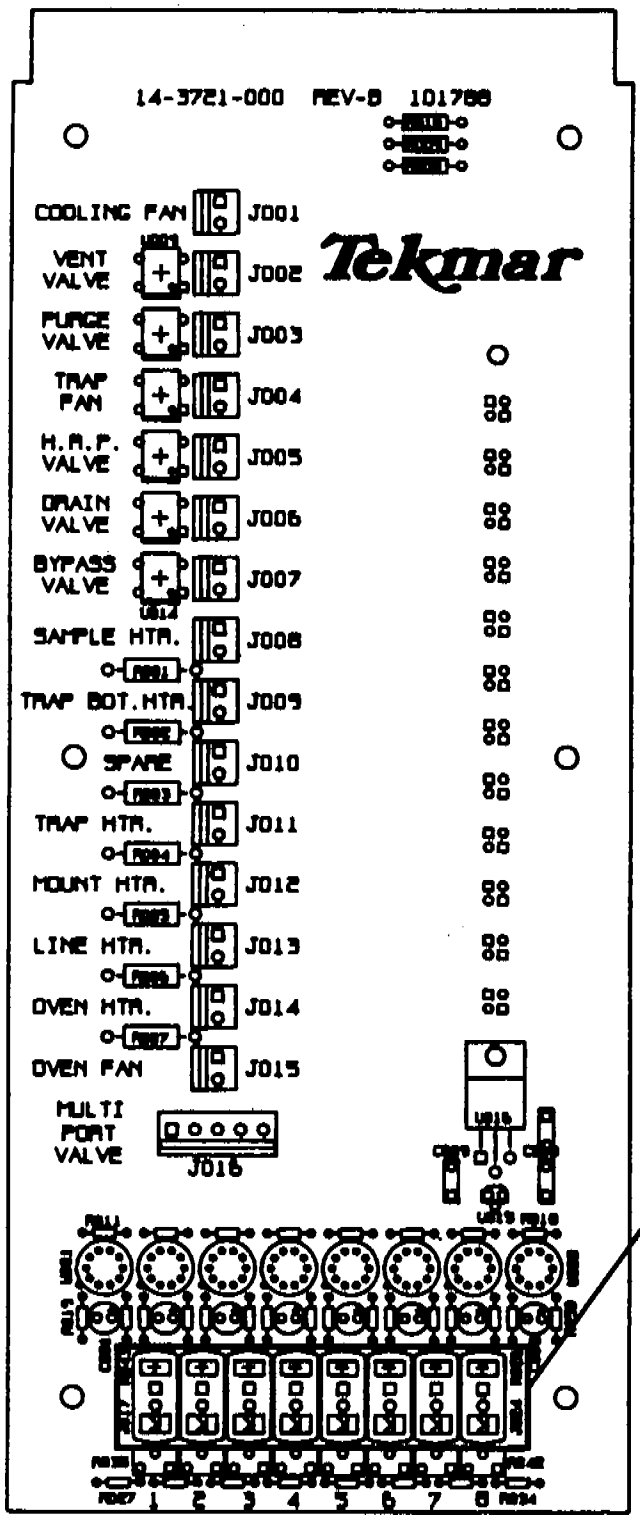
✱ INDICATES OUTPUT IS ON

P = SIX PORT (MULTI-PORT) VALVE IS IN THE PURGE MODE CONFIGURATION. (REFER TO FLOW DIAGRAM)

D = SIX PORT (MULTI-PORT) VALVE IS IN THE DESORB MODE CONFIGURATION. (REFER TO FLOW DIAGRAM)

LSC 2000 OUTPUT OPERATIONAL SUMMARY

INTERIOR VIEW OF THE FRONT PANEL DISPLAY BOARD



THERMOCOUPLE POSITIONS

1. Line Heater
2. Spare
3. Sample Heater
4. Trap Heater
5. Oven Heater
6. Mount Heater
7. Spare
8. B.O.T. Heater

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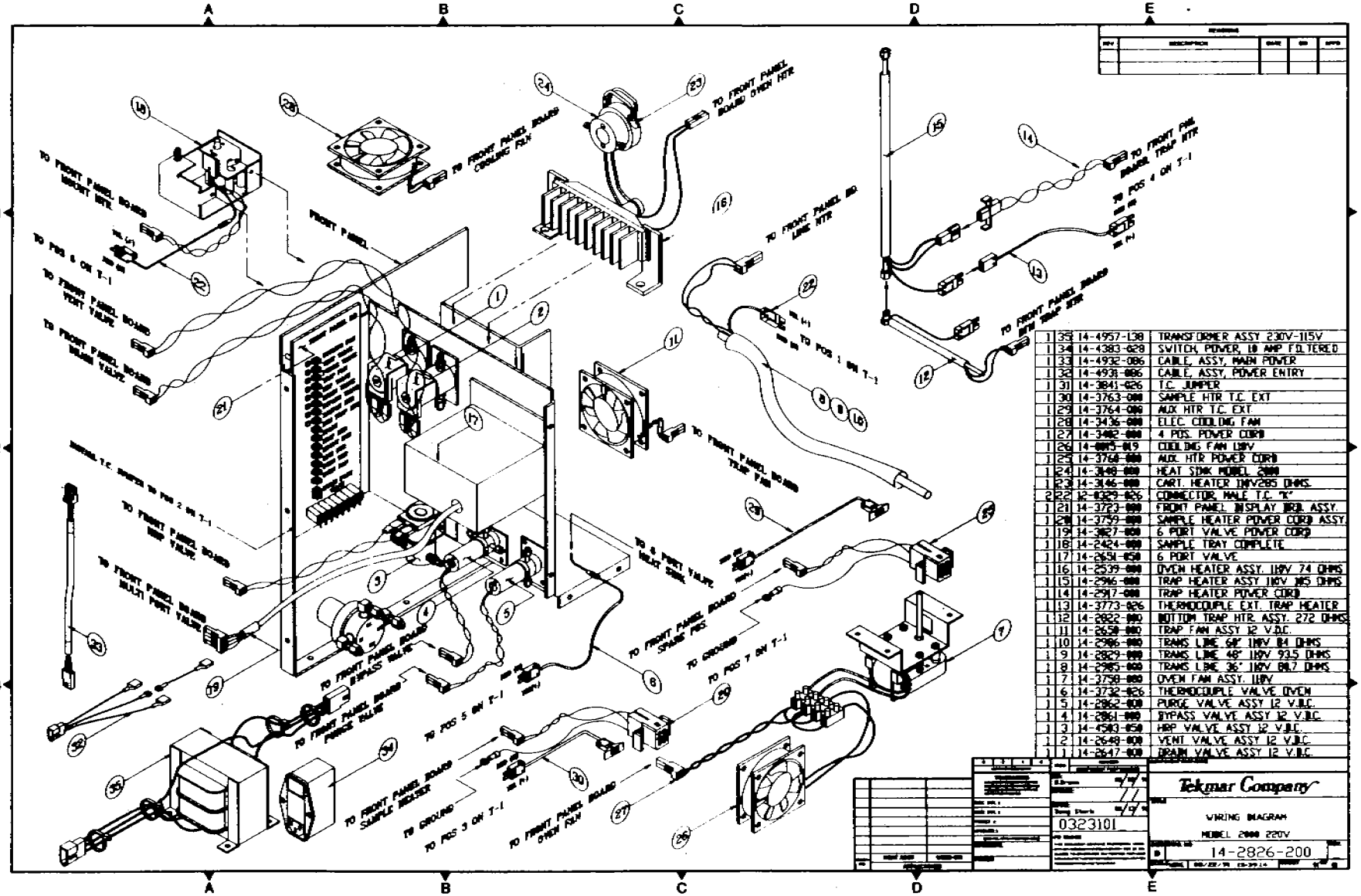


1	35	14-4957-138	TRANSFORMER ASSY 230V-115V
1	34	14-4383-628	SWITCH, POWER, 10 AMP FILTERED
1	33	14-4932-086	CABLE, ASSY, MAIN POWER
1	32	14-4938-086	CABLE, ASSY, POWER ENTRY
1	31	14-3841-626	T.C. JUMPER
1	30	14-3763-088	SAMPLE HTR T.C. EXT
1	29	14-3764-086	AUX HTR T.C. EXT.
1	28	14-3436-088	ELEC. COOLING FAN
1	27	14-3482-088	4 POS. POWER CORD
1	26	14-0895-819	COOLING FAN 115V
1	25	14-3760-088	AUX HTR POWER CORD
1	24	14-3448-088	HEAT SINK MODEL 2000
1	23	14-3146-088	CART HEATER 115V/285 OHMS
2	22	12-0329-826	CONNECTOR, MALE T.C. "K"
1	21	14-3723-088	FRONT PANEL DISPLAY BRD. ASSY.
1	20	14-3759-088	SAMPLE HEATER POWER CORD ASSY.
1	19	14-3827-088	6 PORT VALVE POWER CORD
1	18	14-2424-088	SAMPLE TRAY COMPLETE
1	17	14-2654-858	6 PORT VALVE
1	16	14-2539-088	OVEN HEATER ASSY. 115V 74 OHMS
1	15	14-2966-088	TRAP HEATER ASSY 115V 385 OHMS
1	14	14-2917-088	TRAP HEATER POWER CORD
1	13	14-3773-826	THERMOCOUPLE EXT. TRAP HEATER
1	12	14-2822-880	BOTTOM TRAP HTR. ASSY. 272 OHMS
1	11	14-2658-880	TRAP FAN ASSY 12 V.D.C.
1	10	14-2986-888	TRANS LINE 68" 115V 84 OHMS
1	9	14-2829-888	TRANS LINE 48" 115V 93.5 OHMS
1	8	14-2985-888	TRANS LINE 36" 115V 88.7 OHMS
1	7	14-3758-088	OVEN FAN ASSY. 115V
1	6	14-3732-826	THERMOCOUPLE VALVE OVEN
1	5	14-2862-888	PURGE VALVE ASSY 12 V.D.C.
1	4	14-2861-888	BYPASS VALVE ASSY 12 V.D.C.
1	3	14-4583-858	HRP VALVE ASSY 12 V.D.C.
1	2	14-2648-888	VENT VALVE ASSY 12 V.D.C.
1	1	14-2647-888	DRAIN VALVE ASSY 12 V.D.C.

Tekmar Company

WIRING DIAGRAM

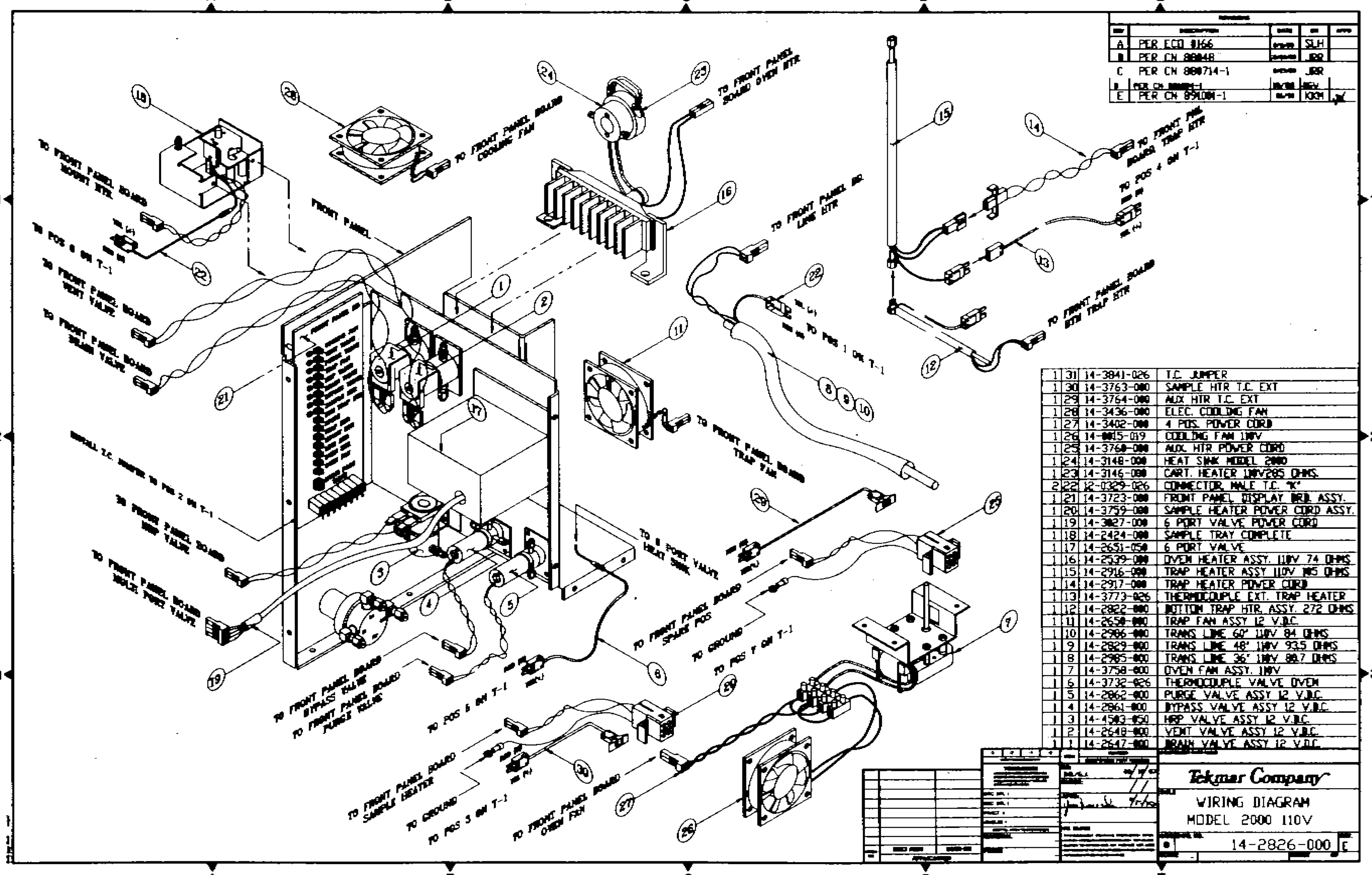
MODEL 2000 220V

0323101

14-2826-200

LSC 2000 WIRING DIAGRAM (220V)

Tekmar



A	PER ECO #166		SLH
B	PER CN 88048		JRR
C	PER CN 880714-1		JRR
D	PER CN [illegible]		REV
E	PER CN 89100-1		KKM

1	31	14-3841-026	T.C. JUMPER
1	30	14-3763-000	SAMPLE HTR T.C. EXT
1	29	14-3764-000	AUX HTR T.C. EXT
1	28	14-3436-000	ELEC. COOLING FAN
1	27	14-3402-000	4 POS. POWER CORD
1	26	14-0015-019	COOLING FAN 110V
1	25	14-3760-000	AUX. HTR POWER CORD
1	24	14-3148-000	HEAT SINK MODEL 2000
1	23	14-3146-000	CART. HEATER 110V285 OHMS.
2	22	12-0329-026	CONNECTOR, MALE T.C. "K"
1	21	14-3723-000	FRONT PANEL DISPLAY BRD. ASSY.
1	20	14-3759-000	SAMPLE HEATER POWER CORD ASSY.
1	19	14-3027-000	6 PORT VALVE POWER CORD
1	18	14-2424-000	SAMPLE TRAY COMPLETE
1	17	14-2651-050	6 PORT VALVE
1	16	14-2539-000	OVEN HEATER ASSY. 110V 74 OHMS
1	15	14-2916-000	TRAP HEATER ASSY 110V 105 OHMS
1	14	14-2917-000	TRAP HEATER POWER CORD
1	13	14-3773-026	THERMOCOUPLE EXT. TRAP HEATER
1	12	14-2822-000	BOTTOM TRAP HTR. ASSY. 272 OHMS
1	11	14-2650-000	TRAP FAN ASSY 12 V.DC.
1	10	14-2986-000	TRANS LINE 60" 110V 84 OHMS
1	9	14-2829-000	TRANS LINE 48" 110V 93.5 OHMS
1	8	14-2985-000	TRANS LINE 36" 110V 80.7 OHMS
1	7	14-3758-000	OVEN FAN ASSY. 110V
1	6	14-3732-026	THERMOCOUPLE VALVE OVEN
1	5	14-2862-000	PURGE VALVE ASSY 12 V.DC.
1	4	14-2861-000	BYPASS VALVE ASSY 12 V.DC.
1	3	14-4503-050	HRP VALVE ASSY 12 V.DC.
1	2	14-2648-000	VENT VALVE ASSY 12 V.DC.
1	1	14-2647-000	DRAIN VALVE ASSY 12 V.DC.

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WIRING DIAGRAM
MODEL 2000 110V

14-2826-000 E

LSC 2000 WIRING DIAGRAM (110V)

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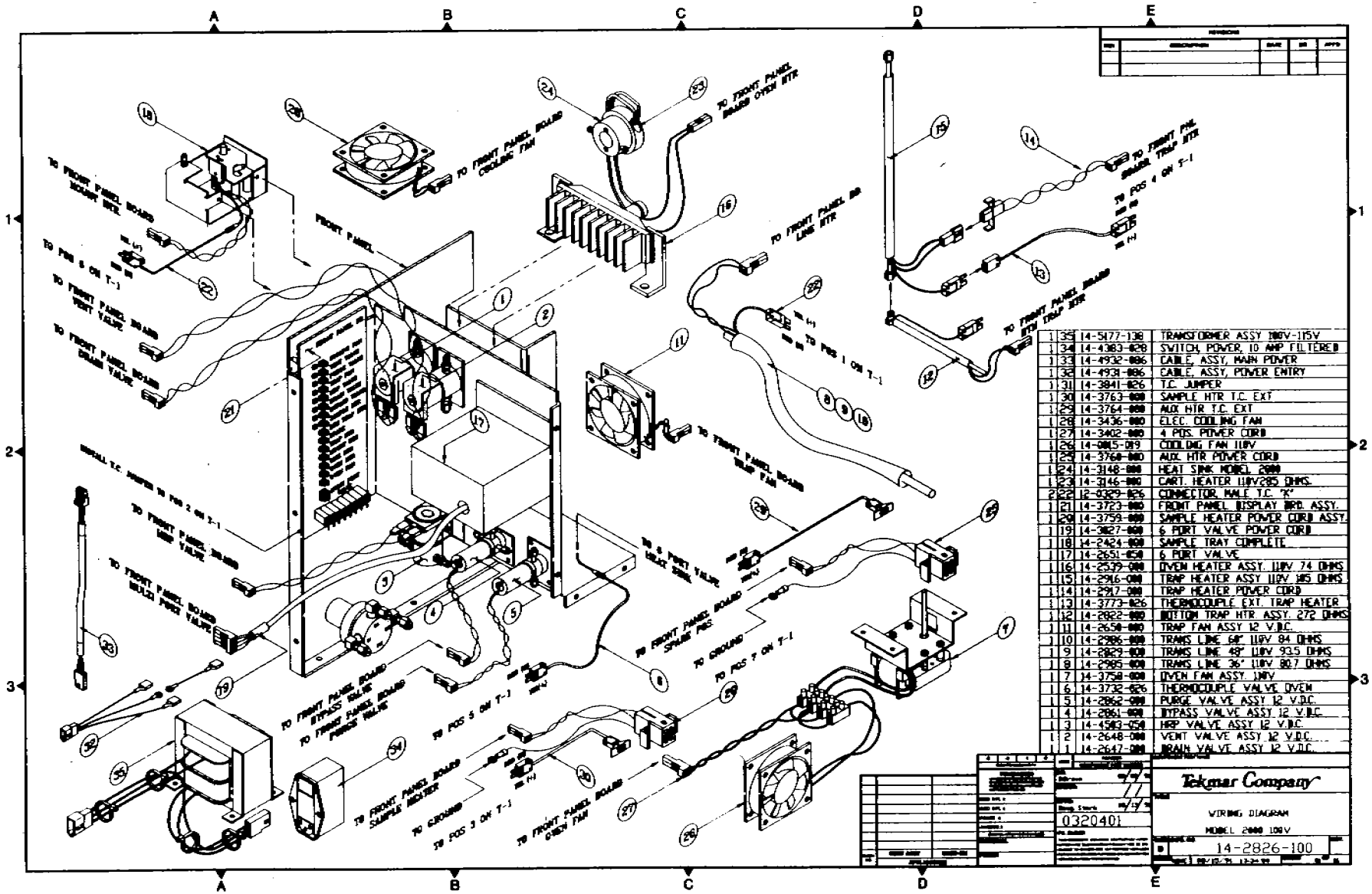

1	35	14-5177-136	TRANSFORMER ASSY 200V-115V
1	34	14-4383-826	SWITCH, POWER, 10 AMP FILTERED
1	33	14-4932-886	CABLE, ASSY, MAIN POWER
1	32	14-4931-886	CABLE, ASSY, POWER ENTRY
1	31	14-3841-826	T.C. JUMPER
1	30	14-3763-000	SAMPLE HTR T.C. EXT
1	29	14-3764-000	AUX HTR T.C. EXT
1	28	14-3436-000	ELEC. COOLING FAN
1	27	14-3402-000	4 PDS. POWER CORD
1	26	14-0815-019	COOLING FAN 110V
1	25	14-3768-000	AUX HTR POWER CORD
1	24	14-3148-000	HEAT SINK MODEL 2000
1	23	14-3146-000	CART. HEATER 110V/285 OHMS
2	22	12-0329-826	CONNECTOR, MALE T.C. "K"
1	21	14-3723-000	FRONT PANEL DISPLAY BRD. ASSY.
1	20	14-3759-000	SAMPLE HEATER POWER CORD ASSY.
1	19	14-3827-000	6 PORT VALVE POWER CORD
1	18	14-2424-000	SAMPLE TRAY COMPLETE
1	17	14-2651-050	6 PORT VALVE
1	16	14-2539-000	OVEN HEATER ASSY. 110V 74 OHMS
1	15	14-2916-000	TRAP HEATER ASSY 110V 185 OHMS
1	14	14-2917-000	TRAP HEATER POWER CORD
1	13	14-3773-826	THERMOCOUPLE EXT. TRAP HEATER
1	12	14-2822-000	BOTTOM TRAP HTR ASSY. 272 OHMS
1	11	14-2650-000	TRAP FAN ASSY 12 V.D.C.
1	10	14-2986-000	TRANS LINE 68" 110V 84 OHMS
1	9	14-2829-000	TRANS LINE 48" 110V 93.5 OHMS
1	8	14-2985-000	TRANS LINE 36" 110V 80.7 OHMS
1	7	14-3758-000	OVEN FAN ASSY. 110V
1	6	14-3732-826	THERMOCOUPLE VALVE OVEN
1	5	14-2862-000	PURGE VALVE ASSY 12 V.D.C.
1	4	14-2861-000	BYPASS VALVE ASSY 12 V.D.C.
1	3	14-4583-054	MFP VALVE ASSY 12 V.D.C.
1	2	14-2648-000	VENT VALVE ASSY 12 V.D.C.
1	1	14-2647-000	BRAIN VALVE ASSY 12 V.D.C.

LSC 2000 WIRING DIAGRAM (100V)

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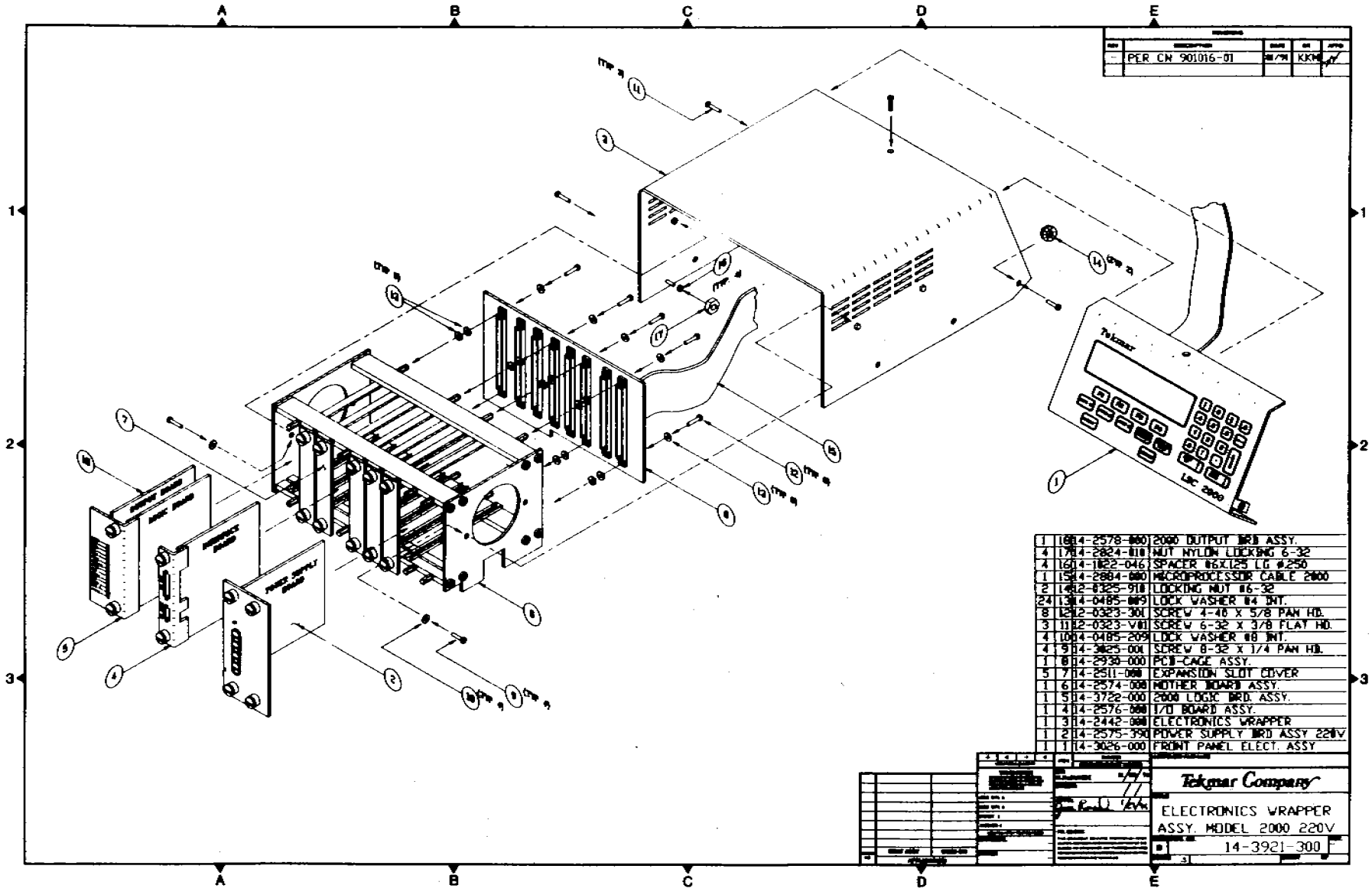
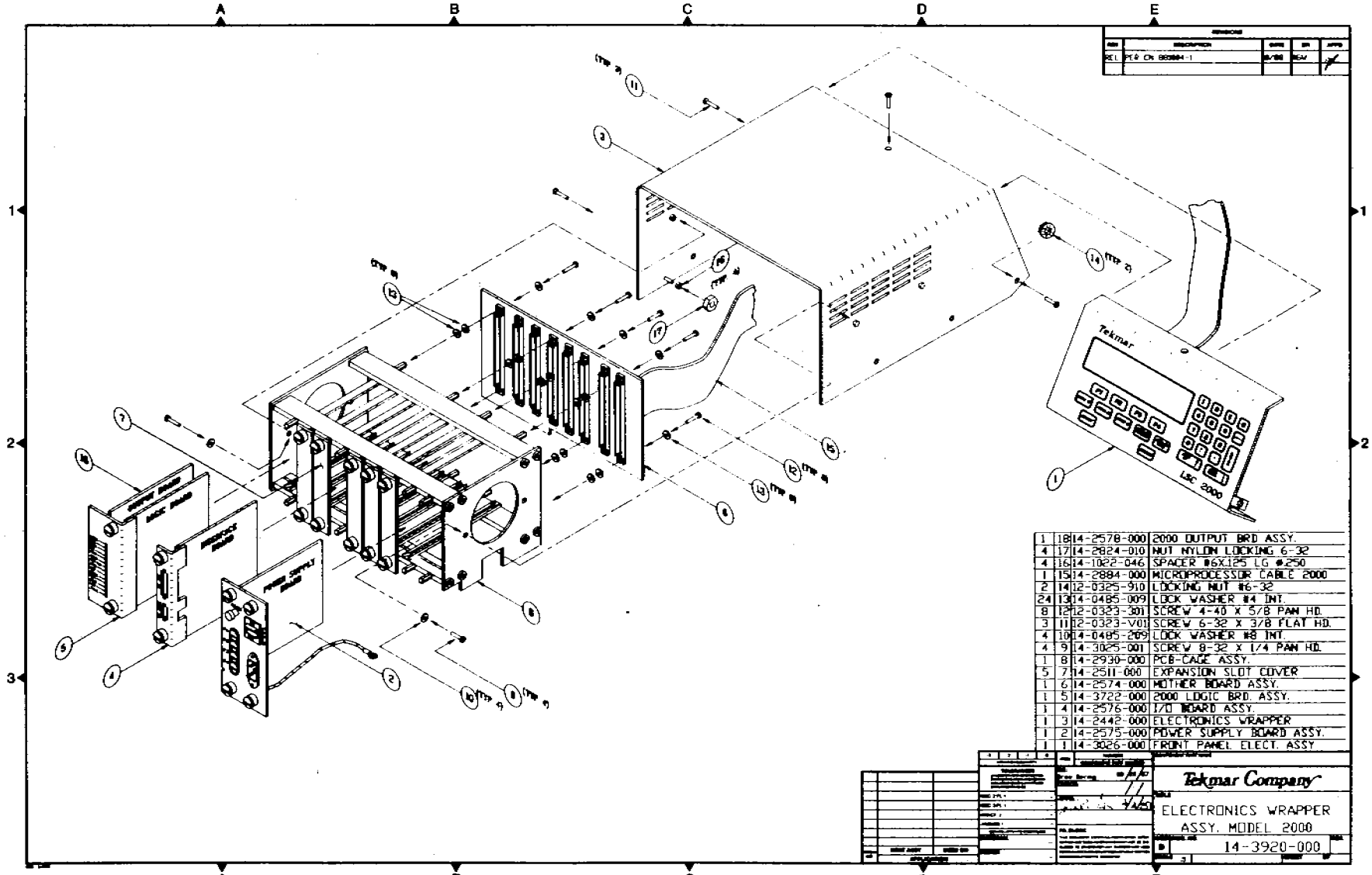


LSC 2000 ELECTRONICS WRAPPER ASSEMBLY (100V/220V)

Tekmar



1	18	14-2578-000	2000 OUTPUT BRD ASSY.
4	17	14-2824-010	NUT NYLON LOCKING 6-32
4	16	14-1022-046	SPACER #6X.125 LG .250
1	15	14-2884-000	MICROPROCESSOR CABLE 2000
2	14	12-0325-910	LOCKING NUT #6-32
24	13	14-0485-009	LOCK WASHER #4 INT.
8	12	12-0323-301	SCREW 4-40 X 5/8 PAN HD.
3	11	12-0323-V01	SCREW 6-32 X 3/8 FLAT HD.
4	10	14-0485-269	LOCK WASHER #8 INT.
4	9	14-3025-001	SCREW 8-32 X 1/4 PAN HD.
1	8	14-2930-000	PCB-CAGE ASSY.
5	7	14-2511-000	EXPANSION SLOT COVER
1	6	14-2574-000	MOTHER BOARD ASSY.
1	5	14-3722-000	2000 LOGIC BRD. ASSY.
1	4	14-2576-000	I/O BOARD ASSY.
1	3	14-2442-000	ELECTRONICS WRAPPER
1	2	14-2575-000	POWER SUPPLY BOARD ASSY.
1	1	14-3026-000	FRONT PANEL ELECT. ASSY.

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ELECTRONICS WRAPPER
ASSY. MODEL 2000

14-3920-000

LSC 2000 ELECTRONICS WRAPPER ASSEMBLY (110V)

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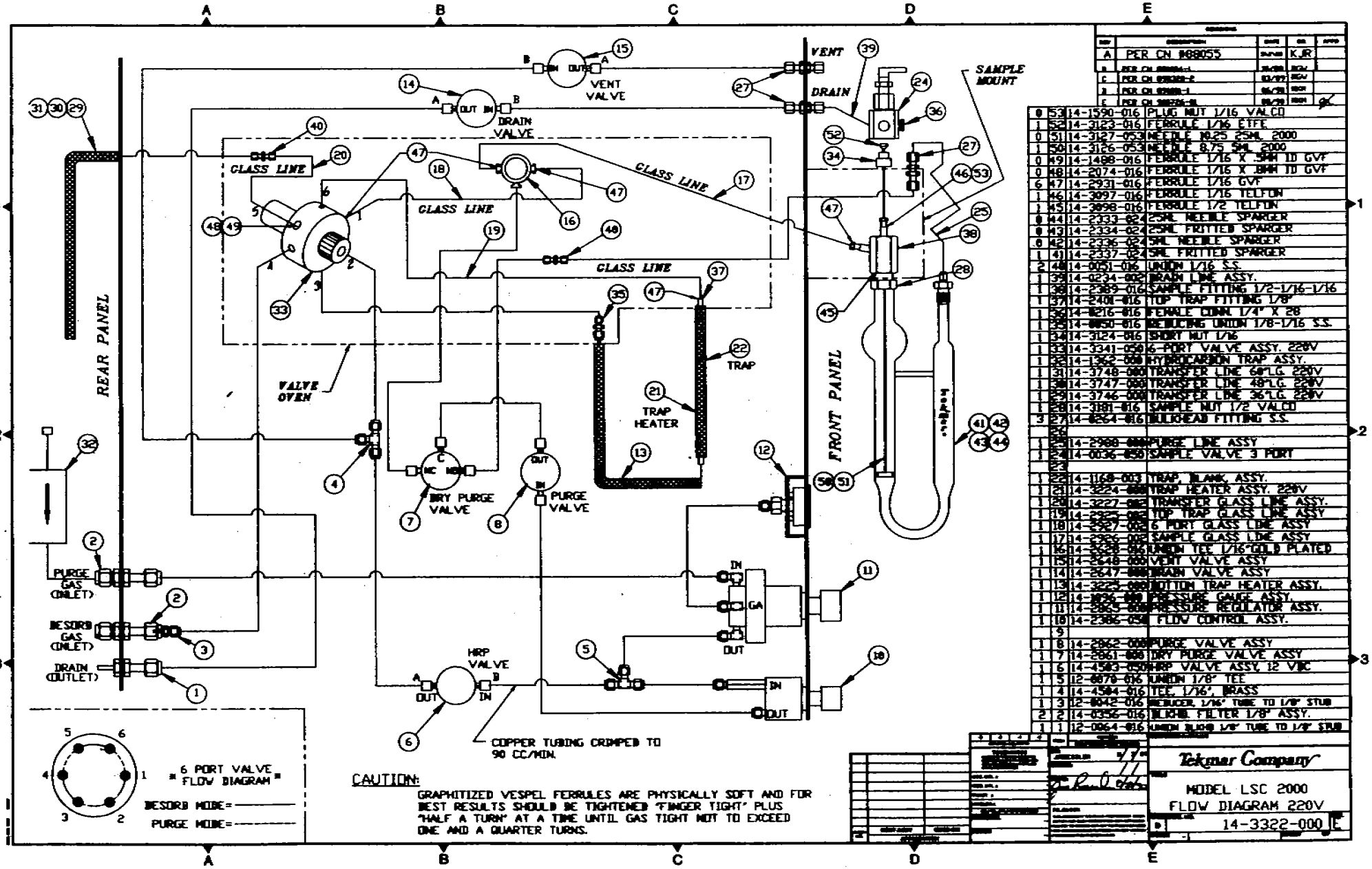

A	PER CN #88055		K.JR	
B				
C				
D				
E				

0	53	14-1590-016	PLUG NUT 1/16 VALCO
1	52	14-3123-016	FERRULE 1/16 ETFE
0	51	14-3127-053	NEEDLE 10.25 25ML 2000
1	50	14-3126-053	NEEDLE 8.75 5ML 2000
0	49	14-1488-016	FERRULE 1/16 X .5MM ID GVF
0	48	14-2074-016	FERRULE 1/16 X .8MM ID GVF
6	47	14-2931-016	FERRULE 1/16 GVF
1	46	14-3097-016	FERRULE 1/16 TELFON
1	45	14-3098-016	FERRULE 1/2 TELFON
0	44	14-2333-024	25ML NEEDLE SPARGER
0	43	14-2334-024	25ML FRITTED SPARGER
0	42	14-2336-024	5ML NEEDLE SPARGER
1	41	14-2337-024	5ML FRITTED SPARGER
2	40	14-0051-016	UNION 1/16 S.S.
1	39	14-0234-002	DRAIN LINE ASSY.
1	38	14-2389-016	SAMPLE FITTING 1/2-1/16-1/16
1	37	14-2401-016	TOP TRAP FITTING 1/8"
1	36	14-1216-016	FEMALE CONN. 1/4" X 28
1	35	14-1950-016	REDUCING UNION 1/8-1/16 S.S.
1	34	14-3124-016	SHORT NUT 1/16
1	33	14-3341-050	6-PORT VALVE ASSY. 220V
1	32	14-1362-000	HYDROCARBON TRAP ASSY.
1	31	14-3748-060	TRANSFER LINE 60"LG. 220V
1	30	14-3747-048	TRANSFER LINE 48"LG. 220V
1	29	14-3746-036	TRANSFER LINE 36"LG. 220V
1	28	14-3181-016	SAMPLE NUT 1/2 VALCO
3	27	14-1264-016	BULKHEAD FITTING S.S.
	26		
1	25	14-2988-000	PURGE LINE ASSY
1	24	14-0036-050	SAMPLE VALVE 3 PORT
	23		
1	22	14-1169-003	TRAP, BLANK, ASSY.
1	21	14-3224-000	TRAP HEATER ASSY. 220V
1	20	14-3227-002	TRANSFER GLASS LINE ASSY.
1	19	14-2925-002	TOP TRAP GLASS LINE ASSY
1	18	14-2927-050	6 PORT GLASS LINE ASSY
1	17	14-2926-002	SAMPLE GLASS LINE ASSY
1	16	14-2508-016	UNION TEE 1/16" GOLD PLATED
1	15	14-2648-000	VENT VALVE ASSY
1	14	14-2647-000	DRAIN VALVE ASSY
1	13	14-3225-000	BOTTOM TRAP HEATER ASSY.
1	12	14-0076-000	PRESSURE GAUGE ASSY.
1	11	14-2845-000	PRESSURE REGULATOR ASSY.
1	10	14-2386-050	FLOW CONTROL ASSY.
	9		
1	8	14-2862-000	PURGE VALVE ASSY
1	7	14-2861-000	DRY PURGE VALVE ASSY
1	6	14-4583-050	HRP VALVE ASSY. 12 VDC
1	5	12-0070-016	UNION 1/8" TEE
1	4	14-4584-016	TEE, 1/16", BRASS
1	3	12-0042-016	REDUCER, 1/16" TUBE TO 1/8" STUB
2	2	14-0342-016	BURNER FILTER 1/8" ASSY.
1	1	12-0064-016	UNION BLOCK 1/16" TUBE TO 1/8" STUB

LSC 2000 FLOW DIAGRAM (220V)

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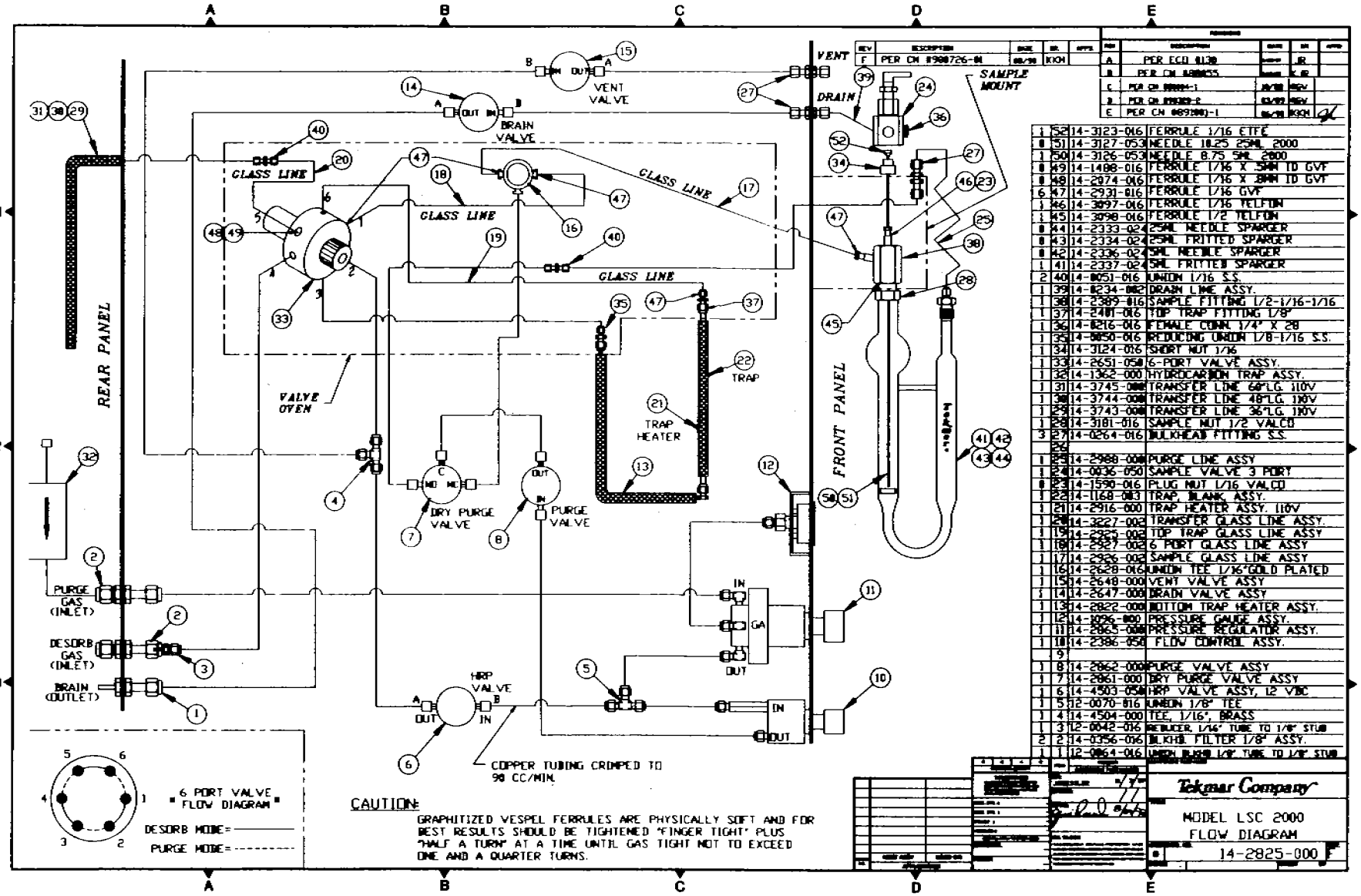

REV	DESCRIPTION	DATE	BY	APPD
E	PER CN 8908726-01	08/98	KKH	

REV	DESCRIPTION	DATE	BY	APPD
A	PER ECO 8138		JR	
B	PER CN 8908655		K KH	
C	PER CN 8908941-1	10/98	KKH	
D	PER CN 8908989-2	03/99	KKH	
E	PER CN 8909380-1	06/99	KKH	

ITEM	QTY	PART NO.	DESCRIPTION
52	1	14-3123-016	FERRULE 1/16 ETFE
51	8	14-3127-053	NEEDLE 18.25 25ML 2000
50	1	14-3126-053	NEEDLE 8.75 5ML 2000
49	8	14-1408-016	FERRULE 1/16 X .5MM ID GVF
48	8	14-2974-016	FERRULE 1/16 X .8MM ID GVF
47	6	14-2931-016	FERRULE 1/16 GVF
46	1	14-3097-016	FERRULE 1/16 TELFON
45	1	14-3098-016	FERRULE 1/2 TELFON
44	8	14-2333-024	25ML NEEDLE SPARGER
43	8	14-2334-024	25ML FRITTED SPARGER
42	8	14-2336-024	5ML NEEDLE SPARGER
41	1	14-2337-024	5ML FRITTED SPARGER
40	2	14-8051-016	UNION 1/16 S.S.
39	1	14-8234-002	DRAIN LINE ASSY.
38	1	14-2389-016	SAMPLE FITTING 1/2-1/16-1/16
37	1	14-2481-016	TOP TRAP FITTING 1/8"
36	1	14-8216-016	FEMALE CONN 1/4" X 28
35	1	14-8050-016	REDUCING UNION 1/8-1/16 S.S.
34	1	14-3124-016	SHORT NUT 1/16
33	1	14-2651-058	6-PORT VALVE ASSY.
32	1	14-1362-000	HYDROCARBON TRAP ASSY.
31	1	14-3745-000	TRANSFER LINE 66"LG. 110V
30	1	14-3744-000	TRANSFER LINE 48"LG. 110V
29	1	14-3743-000	TRANSFER LINE 36"LG. 110V
28	1	14-3181-016	SAMPLE NUT 1/2 VALCO
27	3	14-0264-016	BULKHEAD FITTING S.S.
26			
25	1	14-2988-000	PURGE LINE ASSY
24	1	14-0036-050	SAMPLE VALVE 3 PORT
23	8	14-1590-016	PLUG NUT 1/16 VALCO
22	1	14-1168-083	TRAP, BLANK, ASSY.
21	1	14-2916-000	TRAP HEATER ASSY. 110V
20	1	14-3227-002	TRANSFER GLASS LINE ASSY.
19	1	14-2825-002	TOP TRAP GLASS LINE ASSY
18	1	14-2927-002	6 PORT GLASS LINE ASSY
17	1	14-2926-002	SAMPLE GLASS LINE ASSY
16	1	14-2628-016	UNION TEE 1/16"GOLD PLATED
15	1	14-2648-000	VENT VALVE ASSY
14	1	14-2647-000	BRAIN VALVE ASSY
13	1	14-2822-000	BOTTOM TRAP HEATER ASSY.
12	1	14-1096-000	PRESSURE GAUGE ASSY.
11	1	14-2865-000	PRESSURE REGULATOR ASSY.
10	1	14-2386-050	FLOW CONTROL ASSY.
9			
8	1	14-2862-000	PURGE VALVE ASSY
7	1	14-2861-000	DRY PURGE VALVE ASSY
6	1	14-4503-058	HRP VALVE ASSY, 12 VDC
5	1	12-0070-816	UNION 1/8" TEE
4	1	14-4504-000	TEE, 1/16", BRASS
3	1	12-0042-016	REDUCER, 1/16" TUBE TO 1/8" STUB
2	2	14-0356-016	BULKHD FILTER 1/8" ASSY.
1	1	12-0064-016	UNION BULKH 1/8" TUBE TO 1/8" STUB

LSC 2000 FLOW DIAGRAM (100V/110V)

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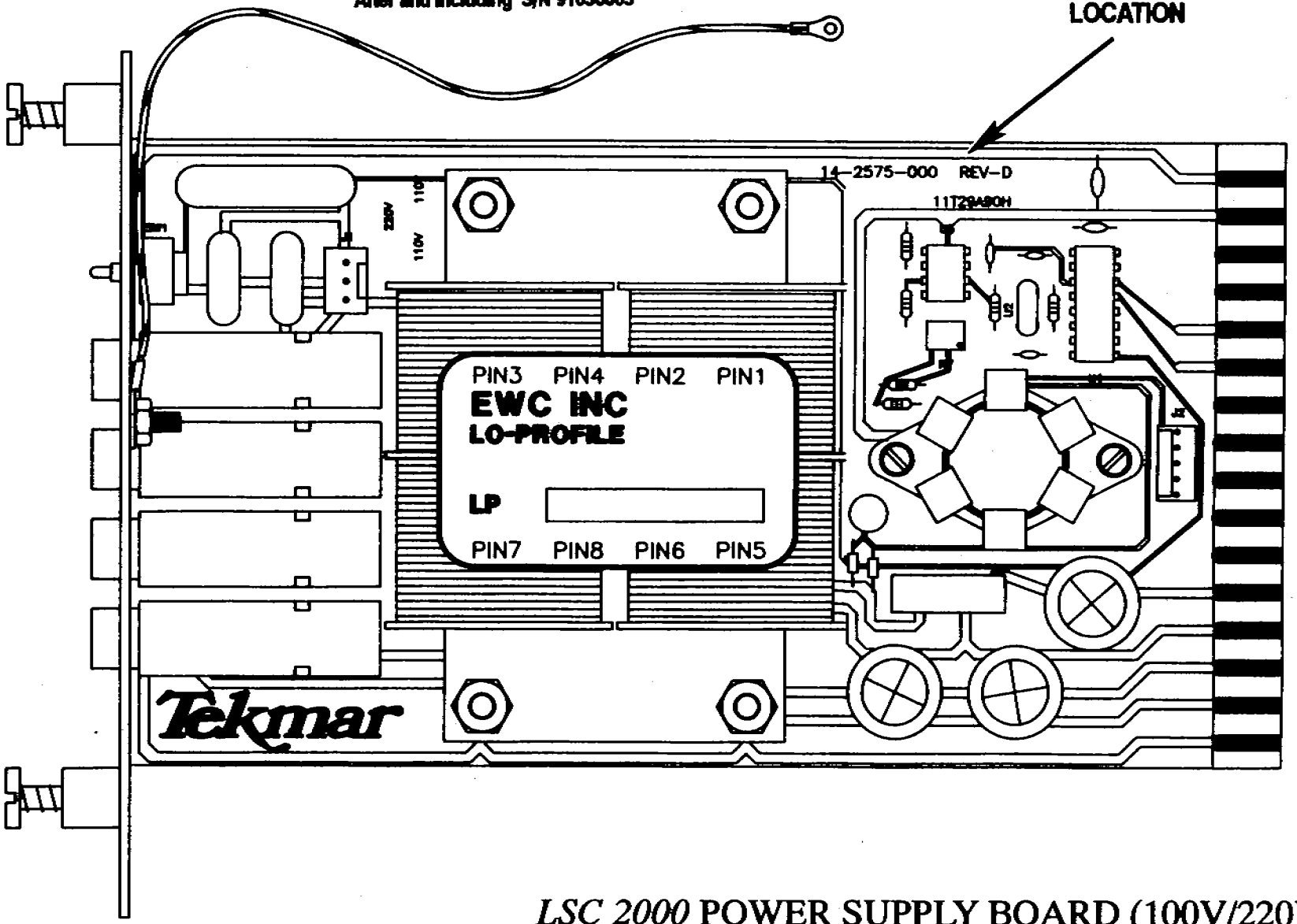
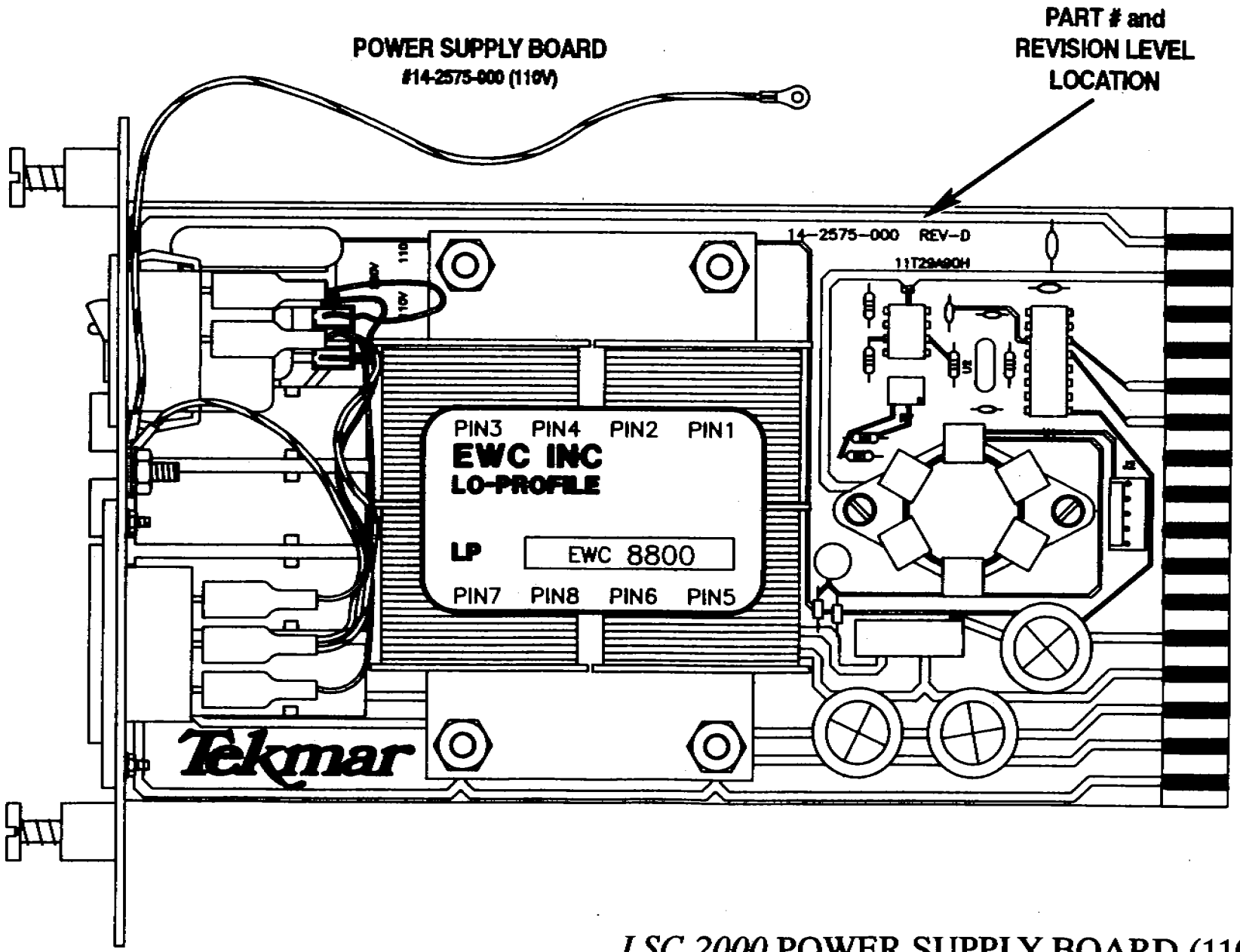
POWER SUPPLY BOARD
#14-2575-390 (220V & 100V)
After and Including S/N 91030003

PART # and
REVISION LEVEL
LOCATION



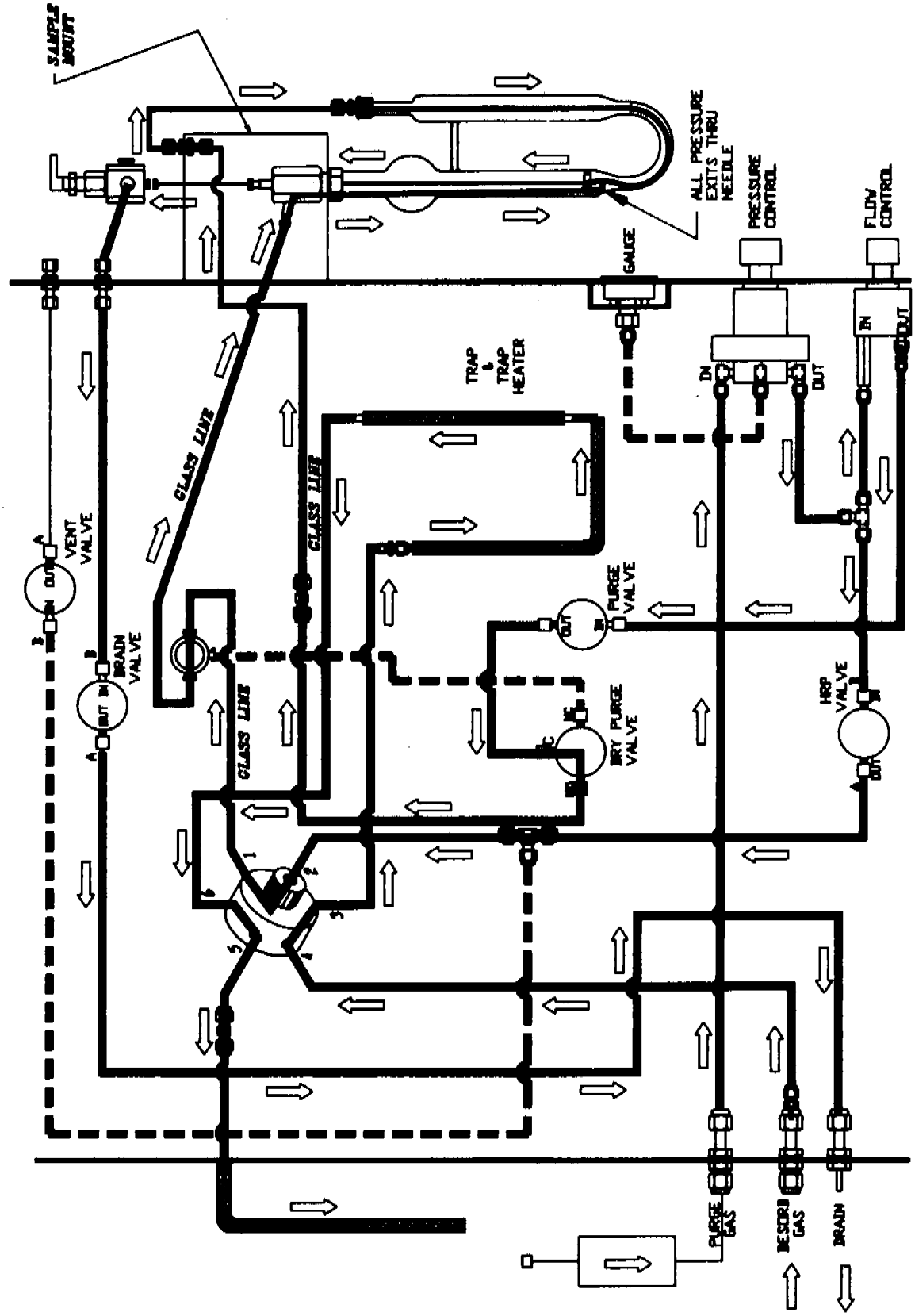
LSC 2000 POWER SUPPLY BOARD (100V/220V)

Tekmar



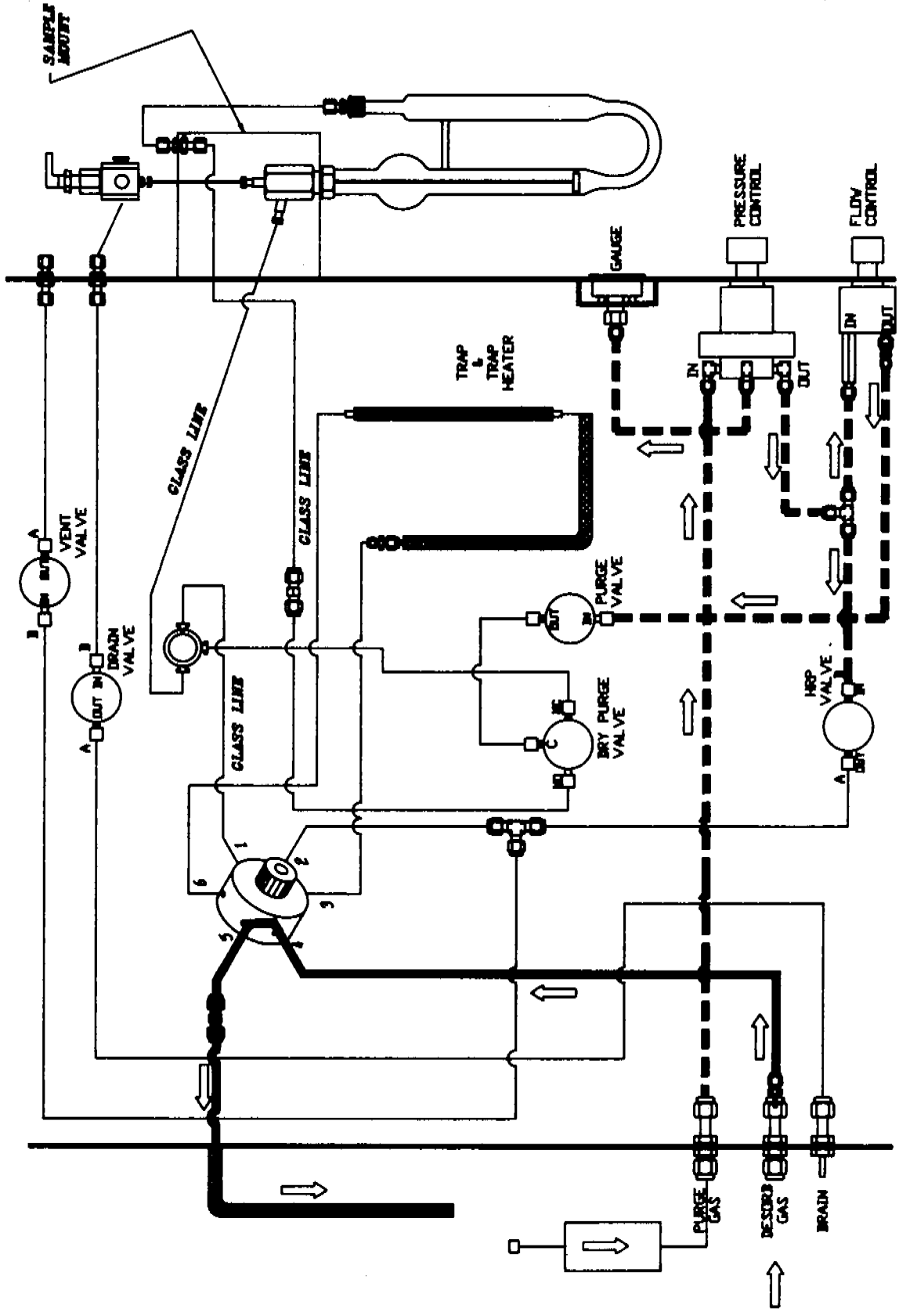
LSC 2000 POWER SUPPLY BOARD (110V)

DESORB & DRAIN MODE



- - - - - - DENOTES PRESSURE ONLY

STANDBY MODE



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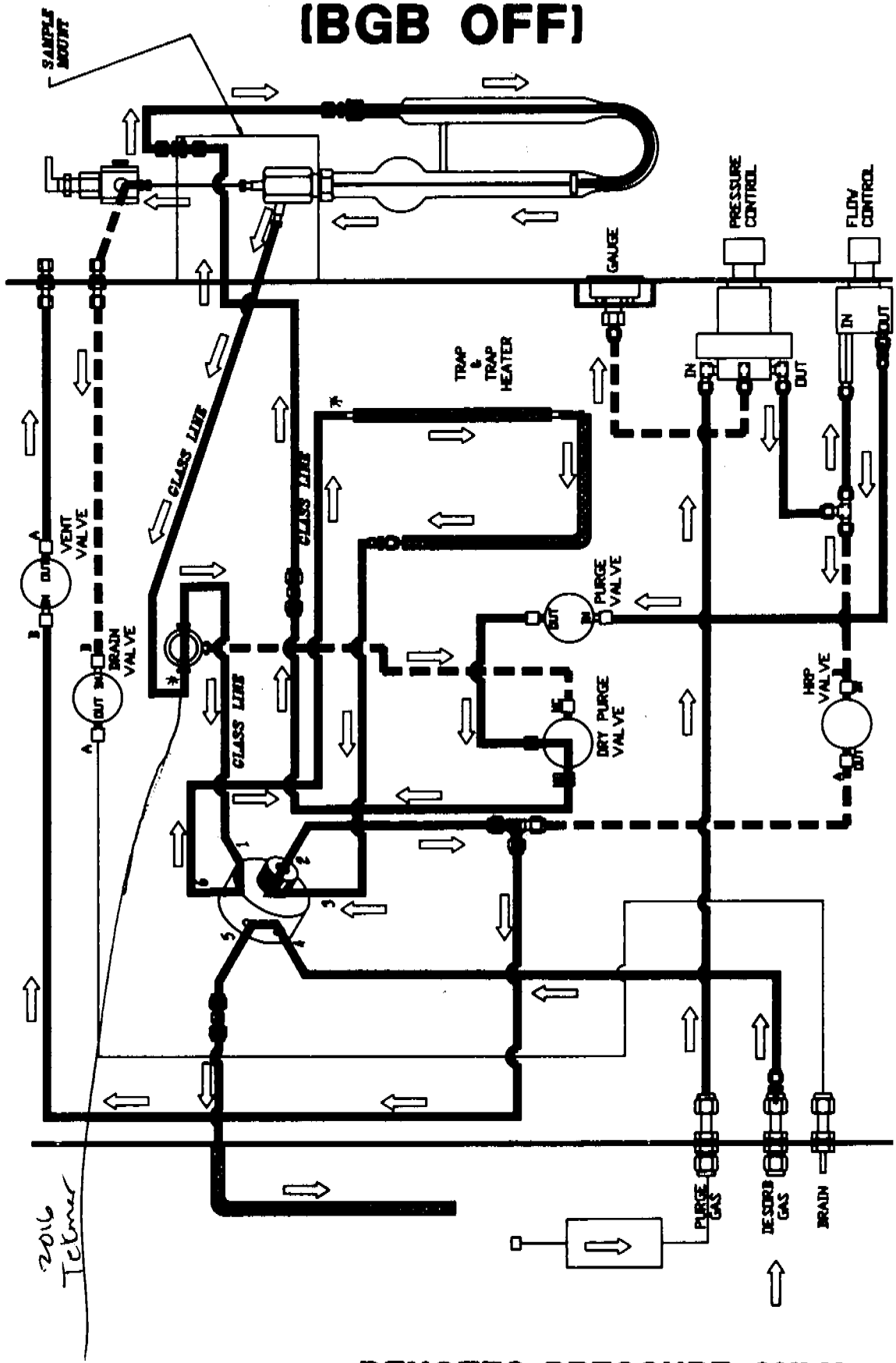
PURGE/BAKE MODE
(BGB OFF)



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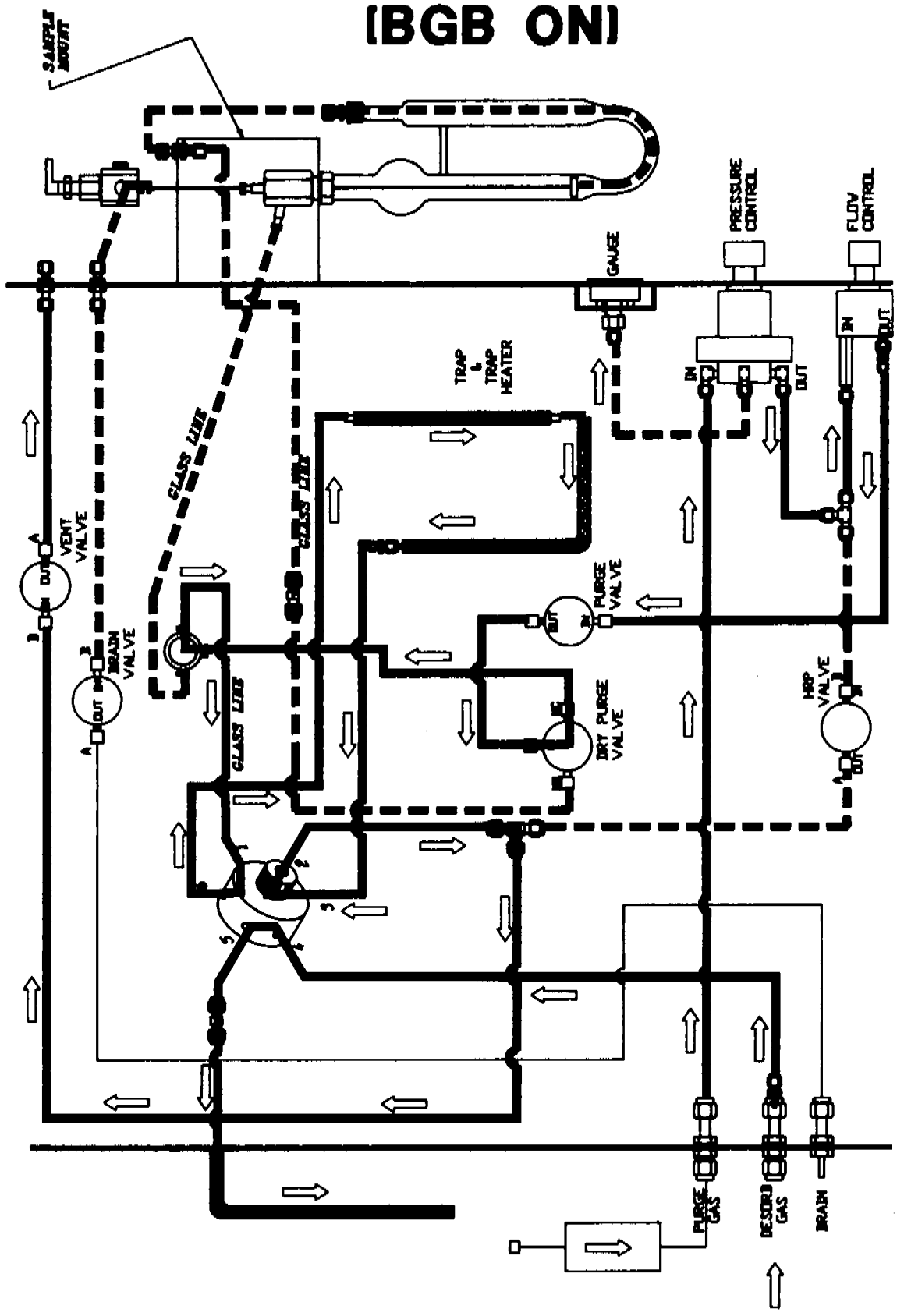
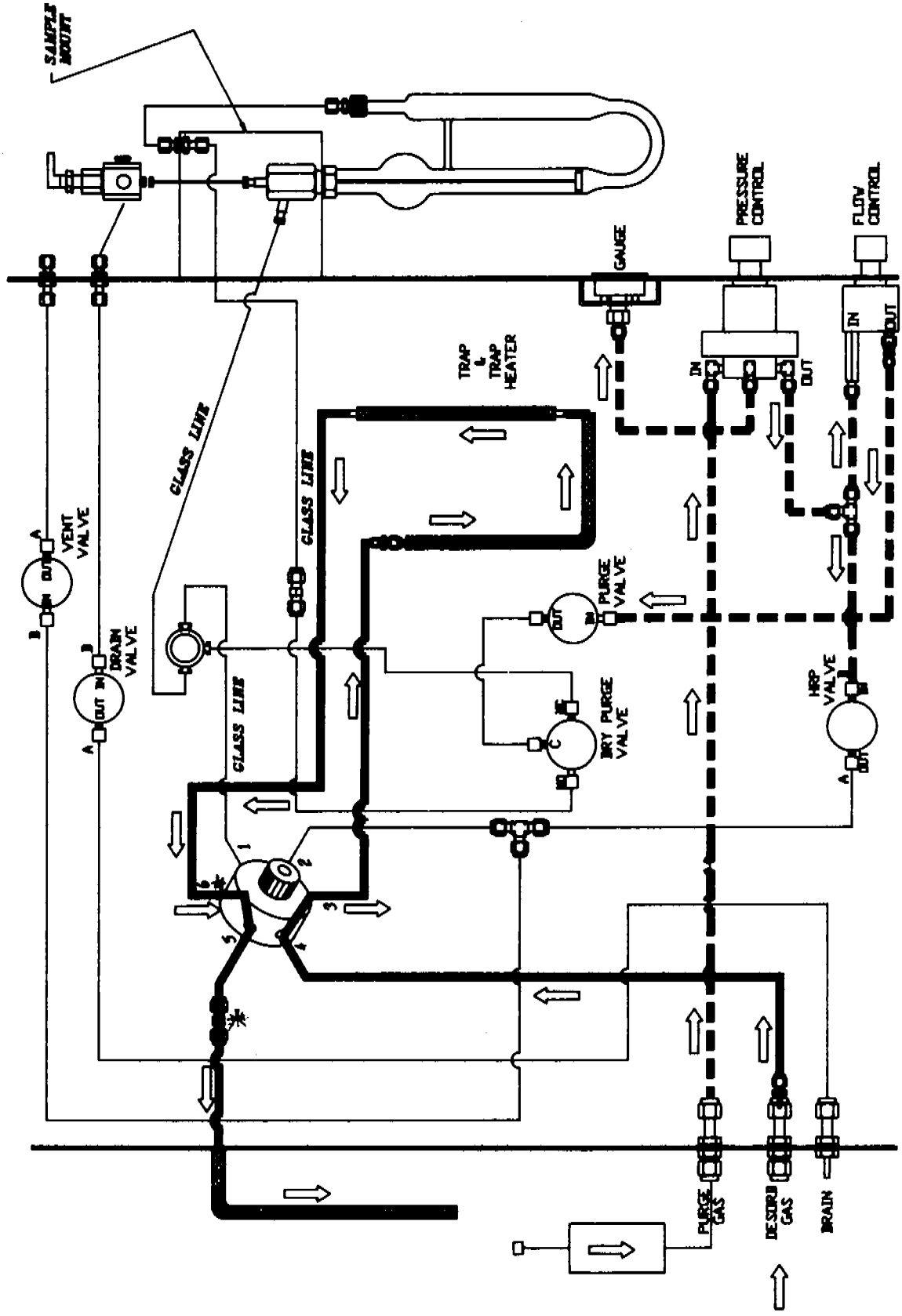
DRY PURGE/BAKE MODE (BGB ON)



▬▬▬ DENOTES PRESSURE ONLY

DESORB MODE



DENOTES PRESSURE ONLY