Operating and Instruction Manual
for
Cobra L/S Autosampler

Limited Warranty

 EST Analytical hereby warrants the equipment supplied herewith to be free from defects in material and workmanship at the time of shipment. EST (the manufacturer), agrees to either repair or replace at our sole option, free of parts and labor charges at our factory, any parts of such equipment which under normal conditions of use prove defective within twelve (12) months (one year) from the date of shipment to the end user. EST has the option of inspecting the goods claimed defective at the Buyer's place of business or having the defective equipment returned to EST, transportation charges prepaid, for inspection. If an item is found defective under warranty, the repaired or replaced item will be returned to the buyer via the same mode of transportation by which it was received. This warranty does not cover equipment or parts of equipment which are modified by the Buyer. The following goods are warranted for the periods set forth only:

(a)   Items produced by third party manufacturers shall carry that warranty provided to EST by said third party manufacturers. Such warranty shall be passed by EST, to the Buyer.

(b)   This warranty does not apply to items consumed in the ordinary course of use of the goods, such as, but not limited to septa, vials, caps, syringes and needles.

(c)   This warranty does not cover bent, broken, or plugged needles, glass breakage, or the replacement or repair of parts due to accident, misuse or contamination, or loss or damage to equipment sustained in transit. Claims for damage sustained in transit must be filed with the transit agency. **Notice: All instruments should be insured with the shipping carrier prior to shipping, even if the repair is covered under warranty. The insurance must be purchased by the customer, not by EST Analytical.**

The foregoing warranty and remedy are exclusive and expressly in lieu of all other warranties, expressed or implied, including but not limited to any warranty of fitness for purpose or any warranty of merchantability.

Safety Information

CAUTION !

The Auto Sampler system will move rapidly to inject the sample into the gas chromatograph. This movement may prove hazardous if untrained personnel are utilizing the system. The system should be operated with all covers and latches secure. The syringe may move at any time. Make certain that all movement paths are clear at all times before powering on the system. Additionally, the syringe or needle may be bent broken very easily if proper setup instructions are not followed EXACTLY. Only trained personnel should attempt to operate the AutoSampler.

The Auto Sampler may operate on 110 VAC to 240 VAC, 50 to 60 Hz, electrical voltage only. This level of voltage may be life threatening if contacted. There are no user serviceable parts located within the housing of the Auto Sampler or power supply. If electrical problems are suspected contact the factory.

Conventions

This manual uses the following conventions:

Bold   indicates emphasis or a minor heading.

Italics   indicates the current function on the display that is being emphasized. It is usually a display parameter that will be changing as the AutoSampler performs a task.

CAUTION !   messages precede warnings of procedures or practices which, if not followed correctly, could cause serious personal injury or damage to instrumentation.

Symbols as Marked on the Equipment or in the Operators Manual.

Protective ground (earth) terminal.

⚠ ATTENTION	This symbol is indicating special care should be given to this section of the manual.
⚠ CAUTION	This symbol is indication any incorrect operation could result in an error or damage to the instrument.
⚠ WARNING	This symbol is indication any incorrect operation could result in personal injurty or damage to the instrument.

◆ All safety precautions MUST be adheared to when installing and operating the Auto Sampler.

◆ Please read this manual throughly before proceeding to install or operate the Auto Sampler.

◆ Be certain all personal in the laboratory are trained and are familar with the operation of the Auto Sampler.

◆ When replacement parts are ordered, use only EST Analytical parts and part numbers.

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1.0 Introduction

1.1 Product Description

The Cobra L/S Auto Sampler combines state-of-the-art component technology with easy-to-use operating features that meet routine as well as research level autosampling requirements.

The Cobra L/S is an all-electric, stepper motor driven autosampler providing rugged reliability and pinpoint injection accuracy. The syringe mechanism moves back-and-forth and in-and-out across the sample tray to access sample vials, multiple solvent vials, standards, etc.

Variable inject volumes, injection speed, needle dwell times, number of samples per vial, multiple methods per run, solvent flush, air gaping, dual column operation and a host of other autosampling options are all standard and easily programmed on the Cobra L/S's menu driven keypad.

The unit uses screw-cap or crimp-top septum vials and easily interfaces with your GC system with all the remote inputs/outputs—ready signal, injection mark, etc.—plus RS 232 for direct communication with an IBM or compatible personal computer. Mounting is easy and allows for quick changes between GC's if desired. Syringe/injector alignment is via the keypad. The control module mounts on either side of the autosampler for easy access.

1.2 Key Features

- Direct Syringe Injection: Uses 1.5µl - 100µl syringes for minimum sample volume and maximum flexibility.

- All Electric: No additional cost for gases.

- Priority Manual Sample feature allows the current analysis to be interrupted for RUSH samples.

- Variable Sample Fill Rate for viscous samples.

- Variable Injection Rate to optimize chromatography based on injector type and analytes of interest.

- Dual Injector Operation allows maximum productivity from GC with dual injectors and columns.

- Programmable Injector Alignment: No manual adjustments to align injection ports.

- Variable Dwell Time for hot needle injection techniques.

- Post Solvent Rinse user definable with two separate rinse solutions.

- Internal Standard Injection

- Two Solvent Rinse capability minimizes cross contamination.

- Easy To Operate Menu-driven system simplifies method setup and allows for multiple method linking. Up to 10 different methods available.

- A sample may be run from any position in the sample tray in Manual or Auto mode.

- Large 120 or 200 position sample tray for overnight operation that lifts off for easy loading.

- The syringe may be programmed for simple or complex injection sequences through a simple keypad entry system allowing for any type of sample handling with one system.

- Totally controlled sequences of syringe purging and rinsing allowing improved peak resolution and minimum compound carry over.

- Fast easy programming from the touch pad keyboard terminal.

- Easily readable backlit LCD display.

- Compact size, requires less space than other autosampler systems.

- Easy hook up and installation.

1.3 Specifications

- Tray Capacity: 120 sample vials — 2 ml, 12 mm x 32 mm vials; 2 Solvent, 1 or 2 Waste, 10 ml vials

- Sample Size Reproducibility   Typically 1% or better.

- Minimum Sample Size: 1% of Syringe Volume

- Sample Injections per Vial: 1 to 100; or sample vial capacity.

- Standard Injection: 1% to 100% of syringe capacity (standard volume plus sample volume cannot exceed the syringe volume.

- Operating Temperature: 15° to 35^oC   Storage Temperature: 0° C to 85° C

- Relative Humidity: 10 to 90%

- Line Voltage: 100-240 VAC; 50-60 Hz, 115-160 VA

- Weight: Auto Sampler Unit - 17 lbs 3 oz..: 7.8 Kilograms

- Size: Auto Sampler Unit - 25 x 10 x 17 inches : 63.5 cm x 35.5 cm x 43.2 cm

2.0 Installation

2.1 Installation Protocol

The complete installation of the Cobra L/S includes the following steps:

1. Unpack the Auto Sampler and make certain all parts and supplies are available.

2. Install the mounting bracket to the GC per separate instructions.

3. Install the Auto Sampler onto the mounting bracket.

4. Install the cable from the Display/Keypad Terminal box to the rear of the Cobra L/S, see Figure 2.0.

5. Connect the Remote I/O cable between the Auto Sampler and the GC or data system. See Section 9.0.

6. Connect the power supply power cord to the rear of the Auto Sampler and then plug the main power cord into a grounded AC power source.

7. Install the syringe assembly. See Section 4.1.

8. Perform the Setup and Target Setup procedures (some of these may require removal of the syringe.) Verify the initial mounting bracket alignment to the injection port on the chromatograph. See Section 5.0.

2.2 Unpacking the Auto Sampler

Carefully unpack and inspect the Auto Sampler. Inspect the instrument for possible shipping damage.
If damage is discovered, immediately notify the shipping carrier and then EST Analytical.
Do not return the instrument without first notifying EST Analytical and obtaining a
Return Goods (RG) authorization number. If possible, please store the shipping cartons and all
packing material for possible future use.

2.3 Parts and Materials

The following parts list is included in the accessory kit.

- Sample Tray
- Power Cord w/ Power supply
- Sample Syringe
- Optional Mount Bracket (This must be
  purchased seperately)

- I/O Cable (comes with bracket)
- 4 Solvent / Waste Vials (10 ml)
- 4 Solvent / Waste Caps with Septa
- 4 extra Waste/Solvent Septa
- Operators Manual

2.4 Power Requirements   ⚠ ATTENTION

The Auto Sampler is an all electric system with only a maximum of 24 VDC present in the cabinet .
No gases or other energy sources are required. The power requirement for the system is an input to
the power supply of 100-224 volts and a line frequency of 50 to 60 Hz.. Make certain the electrical
voltage is a constant source with no severe drops or spikes in the voltage. If the power source is not
certain, install a power conditioner on the electrical line.

2.5 Interfacing to an Analyzer   ⚠ CAUTION

To properly interface the Auto Sampler to the GC, the GC ready (or Analyzer Ready) signal and the
remote start signal must be located on the GC and or Data Collection Device. Each GC is different
and it may be necessary to refer to the instrument's manual, or contact a representative for the correct
location of the ready and start signals. Connection points on gas chromatographs are unique to each
system, therefore, a specially wired cable is required. To insure correct operation of the system
follow the wiring schematic supplied with each cable. If a problem exists please consult the factory.

The Auto Sampler may also be operated in the Local mode if a GC ready signal is not available. The
Local mode allows the Auto Sampler to inject a sample based on a cycle time setting without receiv-
ing a ready signal . See Method Parameters Section for more details.

The connections will be from the Auto Sampler's Remote I/O connector (25 Pin D), located on the
rear of Cobra L/S, to the chromatograph's I/O "D" connector or appropriate terminal block
connector(s).

Rear of
Terminal Box

Terminal Cable
Connector

Power In
Receptacle

Remote I/O
Receptacle

Rear of Cobra L/S

Power Switch

COBRA TERMINAL

TERMINAL 24VDC 2.5A REMOTE I/O

USE APPROVED
POWER SUPPLY
ONLY

RS-232

REAR VEIW OF COBRA SAMPLER

POWER

ANALYZER/GC

AC INPUT
100-240V
1.5A 50-60Hz

PC SERIAL PORT
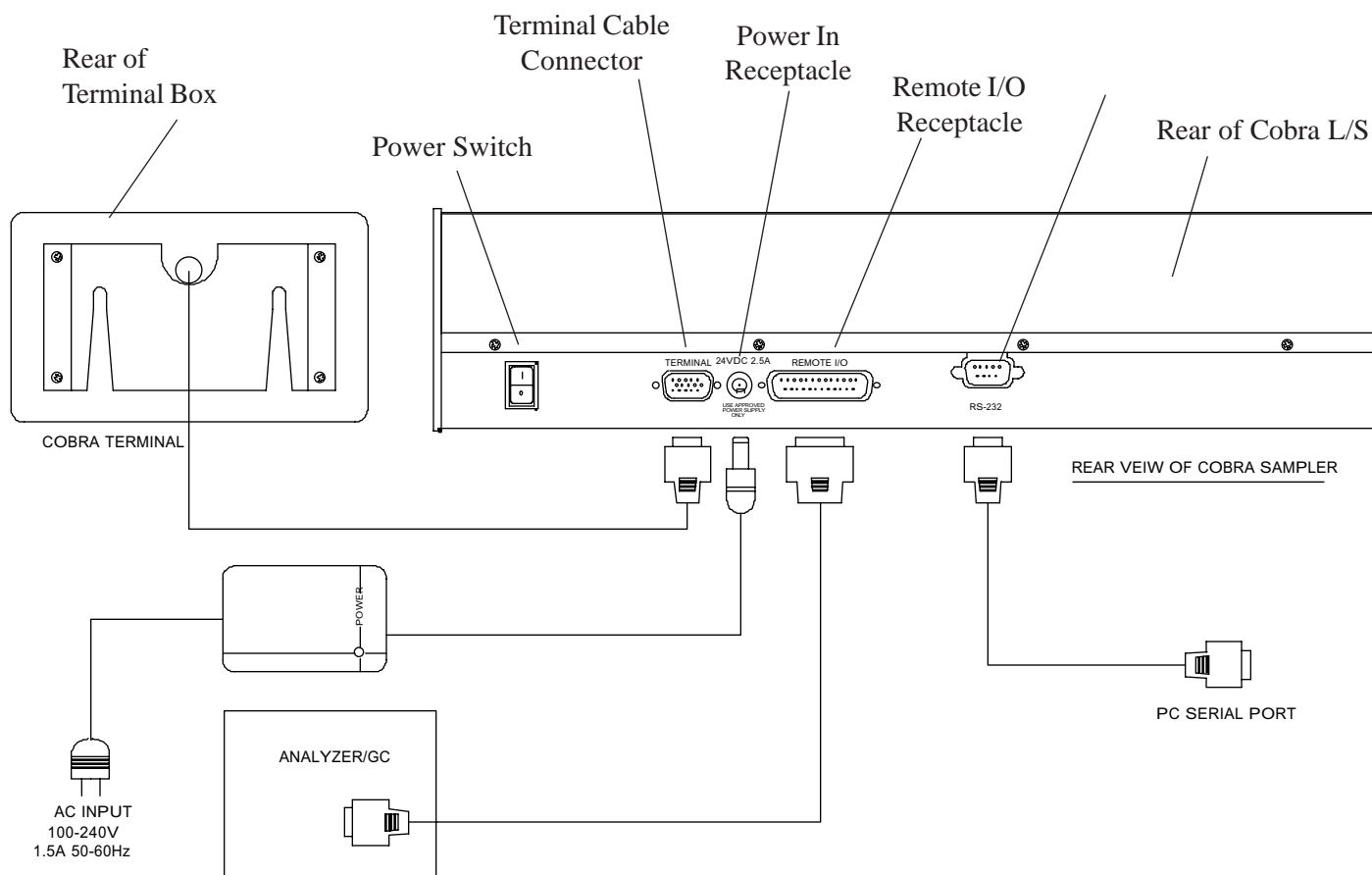
Figure 2.0

Figure 2.0 shows the complete installation of cables to the GC and for RS 232 remote control. **Be certain all cable connections are made before the power to the Cobra L/S is turned on.**

2.6 Sample Tray Installation

Unwrap the sample tray and place it onto the sample tray brackets. The tray will only mount in one direction as there are alignment pegs on the holder brackets and corresponding alignment slots in the tray. Once installed, place an empty vial with cap and septa in vial position #1 and the waste / solvent locations to be used. Be certain the waste/solvent tray is located on the correct side of the sample tray for your GC. Note, the waste / solvent tray may be located on either side of the sample tray, see Figures 2.6 & 2.6 a.

Tray Mount
Pegs

Optional Position
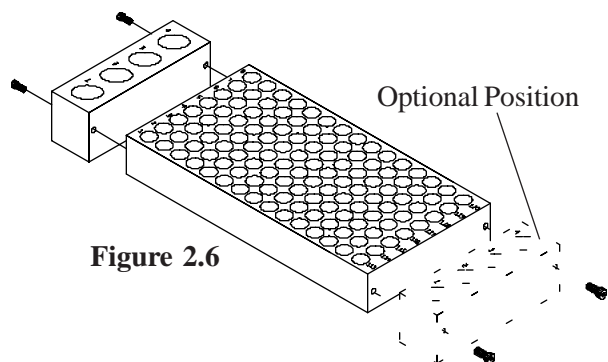
Figure 2.6

Figure 2.6a

Support
Brackets
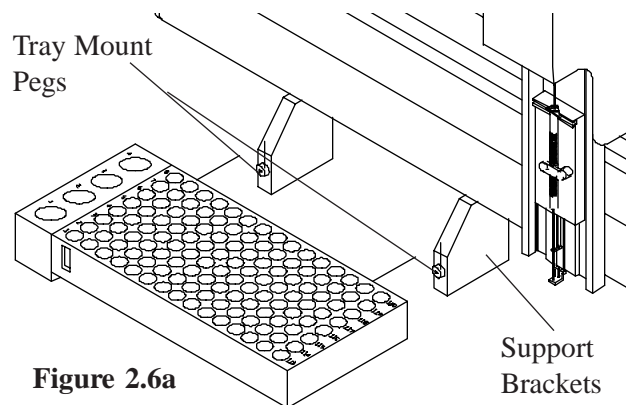
3.0 Keyboard Definition

The keyboard provides for a complete entry of all Setup, Method, Configuration, Diagnostics as well as motor operations. The keys perform the following operations. (See Operational Keys, Section 7.0, for a complete description of Key Functions.)

Hold/Stop Key: Provides both a "Hold" in the current operation and/or a complete abort of the current operation and allows for an exit out of a menu.

Mode Key: Selects the desired Mode of opera tion: Automatic, Manual or Flush.

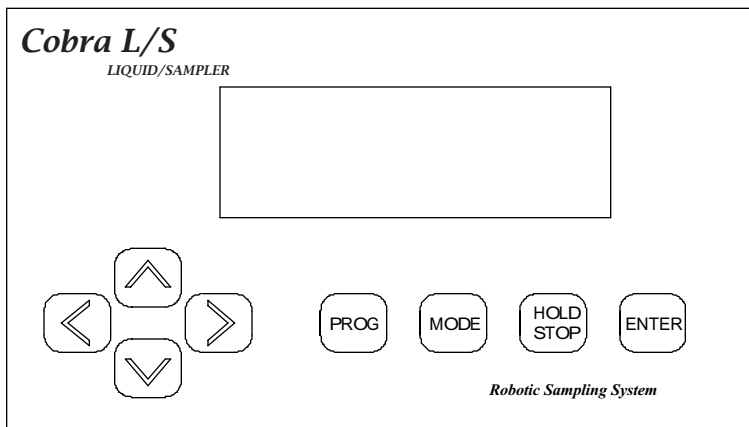**Program (Prog)** Key: Provides access to: Methods, Configure and Diagnostics menus.

Enter Key: Accepts the numeric value entry and/or menu item selection. It also scrolls to the next data entry item in applicable situations.

Arrow Keys: Allows for selection of all data, the L/R keys allow for increasing or decreasing numerical values and the U/D for scrolling within a menu or parameter.

4.0 Syringe Setup

The Cobra L/S will accept most manufacturers syringes however, a SGE 10μl, FN (P/N 506303) is shipped as standard. NOTE: If another syringe brand is used there may be some adjustment required to the lower needle guide.

Select the "Configure" menu using the "Prog" key and follow the instructions for "Syringe Setup".

4.1 Syringe Installation   ⚠ **CAUTION**

1. Loosen the syringe plunger thumbscrew (1) and the two 4-40 socket head screws (4) securing the holder.

2. Insert the syringe needle (10) into the mid needle guide (9) and then down into the lower guide (11).

3. Insert the syringe flange (3) into the notch (4) in the upper section of the syringe holder (8).

Raise the plunger thumbscrew (1), holding it up, insert the syringe plunger thumbpiece (3) into the T-slot in the plunger retainer. Lower the plunger retainer thumbscrew and tighten securely. Rotate the syringe clamp (6), 90 degrees, to hold the syringe (7) in place.

4. Set the plunger to its zero position by sliding the holder (8) up until it touches the needle, **then back it down about 1/64"** and tightening the two 4-40 socket head screws (4).

5. Verify that the needle (10) does not extend beyond the lower needle guide (11). Place your finger under the lower needle guide and check. The needle tip should not be felt. If the needle tip can be felt, the needle guide requires adjustment, consult factory.

1. Plunger Thumbscrew in Plunger Retainer
2. Syringe Flange Holder
3. Syringe Flange
4. 4-40 Socket Screws
5. Syringe Flange
6. Syringe Holder Clamp
7. Syringe
8. Syringe Holder Assembly
9. Center Needle Support
10. Needle
11. Lower Needle Holder

Figure 4.1

4.2 Syringe Calibration

The syringe plunger must be properly calibrated to insure injection accuracy. The procedure is performed in the "Cobra Setup" section of the control program.   Press the "Prog" key and select the "Cobra Setup" menu, press the Enter key and select the "Configuration" Menu line, press Enter. Now, with the down arrow key select "Vol Calib", press Enter. The "Syringe Setup" screen is now showing.

Manually adjust the plunger to zero (if required) by adjusting the holder up, until the syringe plunger touches the bottom of the syringe, then back it down about 1/64", tighten the two 4-40 socket head screws, press the Enter key.

Properly installed syringe.

Figure 4.1a

The next screen adjusts the maximum stroke of the plunger. With the Left/Right arrow keys, move the plunger up, such that the end of the plunger is on the maximum graduation mark of the syringe installed. (Note, record the value show on the line "Volume" for future use). Press the Enter key. Next, using the Left/Right arrow keys, adjust the plunger stroke to the maximum position allowed on the syringe barrel. This is generally about 10% above the syringe volume. Press the Enter key.
NOTE: If the plunger motor "chatters", the syringe holder is set too high not allowing the plunger sensor to be reached. Loosen the two 4-40 socket head screws and slowly lower the holder until the motor stops chattering. The plunger sensor has now been homed. Look at the plunger to be sure it is at the "0" mark.

The plunger has now been set to the maximum graduation (100%) mark on the syringe scale. This will allow the software to properly calculate the sample and rinse volume parameters.
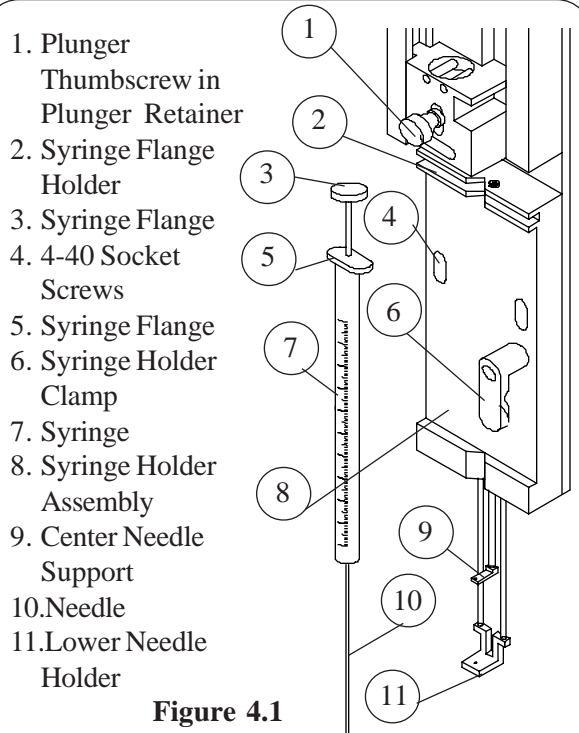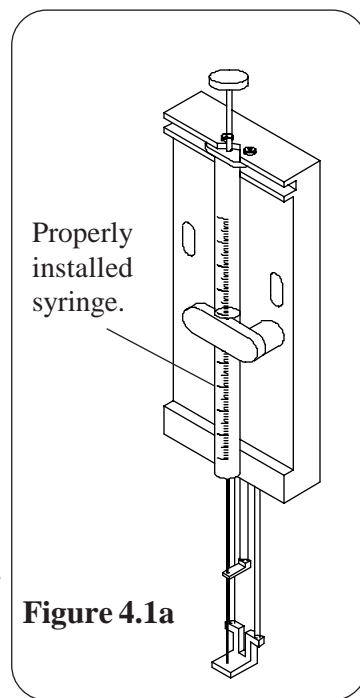
5.0 Target Setup

CAUTION: *Severe damage can occur to the Syringe, Sample Vials, and/or Chromatography Instrumentation if incorrect parameters are set. Remove the syringe from the holder.*

CAUTION: *The mounting bracket must be correctly installed before attempting Target Setup.*

5.1 Target Setup Protocol

The Auto Sampler is designed to inject from up to 220 samples from .8 ml sample vials, however, the 120 position 2 ml vial tray is standard, into most types of GC septum injection ports. Two injection ports may be established anywhere along the travel length of the syringe arm.

Target Setup involves completing the following steps.

1. Installing the Mount Bracket and Auto Sampler to the analyzer.

2. Installing the Syringe Holder and Sample Tray with the Waste / Solvent installed on the correct side for you GC inlet configuration.

3. Syringe Installation and Calibration **(be certain the syringe is removed before beginning Target Setup).**

4. Selecting the Sample Tray Style.

5. Calibrating the sample vial #1 position. **Note, never allow the needle to pierce the septum of an empty vial. Always have liquid in the vial. This will help lubricate the needle in the septum.**

6. Setting Flush Vertical and Waste Vertical positions.

7. Calibrating the syringe to the injection port(s) location(s).

1. 4-40 x 1" Socket Head Screws
2. Waste/Solvent Block
3. 120 Position Sample Tray
4. Optional Waste/ Solvent Position

Vial Position # 1

Figure 5.1
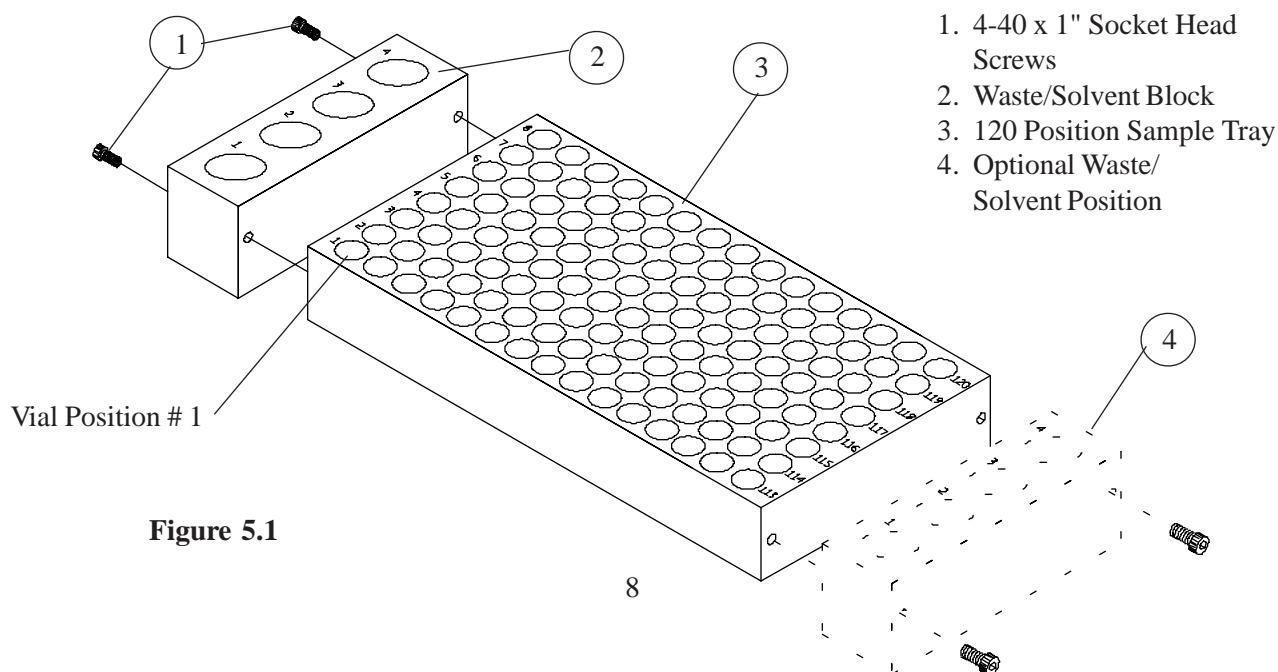
5.2 Motor Positioning Guidelines

! ATTENTION

When setting up the Sample Tray and Injection Inlet positions the arrow keys act as a directional input for axis movement (Left / Right arrow keys for Left / Right movement and the Up / Down arrow keys for Front / Rear movement). This movement is achieved when the operator **"taps"** or pushes a directional arrow key momentarily. If the movement is not "fine" enough, the step rate may be changed from "Continuous" to "Jog", and the number of steps per movement may be changed.

To access this menu, from the "Target Coordinate Setup" menu, move the head to a target and then press the "Mode" key. The "Select:" menu comes up, from here, the type of movement, either Jog or Continuous may be set, also the number of steps per movement. Changes are made by pressing the "Mode" key or the arrow keys.   The default step rate is factory set at 10. To exit the menu press the Stop key.

5.3 Target Coordinate Setup

! CAUTION

Press the "Prog" key and select "Cobra Setup." Select the "Configuration" menu line and press Enter. Scroll to the "Sample 1" line and press Enter. Press Enter and the syringe arm will move slightly to the left and out. The arrow keys are now used to move the syringe arm over to the center of vial #1. Press either the Left or Right arrow key to move the arm to the approximate center position of the first row of vials. Using the Up or Down arrow key, toggle to the "For/Back" menu line, use the Left or Right arrows to move the arm to the approximate center of vial #1. Toggle to the "Vertical" menu line and with the Right arrow key, lower the syringe arm to just above the vial cap. Install the syringe and make the final adjustments to the needle position. **The needle must be positioned down into the vial to not hit the bottom!.** After the setup is complete write down the number coordinates for future use.

Press the Enter key and the arm will move to home, toggle to the next menu line "Waste", press Enter. The same X-Y-Z coordinates must now be established for the Waste (1 & 2) and for Rinse (1 & 2) and for the injection Inlets A & B. The procedure for these settings is the same as for Sample #1. The only difference is the inlets will require a finer adjustment than the vials. Once all the coordinates have been established install the syringe and recheck the target locations.

6.0   Method Definition

6.1 Method Editing

The Cobra L/S allows 10 methods to be saved into memory. To edit a method, press the "Prog" key, select "Method Edit", enter the method number and press Enter. The next menu will allow entry into the selected Method.   Press the Enter key and the parameters will be displayed. The Method parameters will then cycle through with each touch of the Enter key or Up\Down arrow, allowing changes to be made. The method editing may be exited at any time by pressing "Prog" or the Hold\Stop key. If the Enter key has been pressed changes will automatically be saved. If an invalid entry is made, the system will not save the entry. Refer to the following parameter list for values for each parameter. The parameter values are in brackets [xxx].

6.2 Method Parameters

Parameter	Range	Description
First Vial	[1 to 120]	The first sample vial to be injected.
Last Vial	[1 to 120]	The last sample vial to be injected.
#Inject/Sample	[1-100]	The number of injections to be performed on each individual sample.
#Rinse/Solv #1	[0-20]	After a sample is injected, the syringe will be rinsed this number of times using Solvent #1.
#Rinse/Solv #2	[0-20]	After a sample is injected, the syringe will be rinsed this number of times using Solvent #2.
Rinse Volume %	[0-100%]	The percentage of the total volume of the syringe to be used in rinsing, i.e... a setting of 50% when utilizing a 10 μl syringe would allow 5 μl of rinse solution to be drawn into the syringe for every rinse.
Rinse Fill Rate %	[0-100%]	The plunger stepper motor speed will be adjusted to a speed rating per the input value. Use a lower number if more viscous solvents are being used to avoid air bubbles.
Standard Volume %	[0-100%]	The percentage of the total syringe volume used when adding a standard to a sample, i.e... a setting of 10% (when utilizing a 10μl syringe) would cause 1μl of standard solution to be drawn into the syringe each time a sample was to be injected. If this parameter is used, each sample injection will have standard added to the syringe along with the sample. Note, the standard is always drawn into the syringe first and the sum of the standard volume and sample cannot exceed 100%.
Sample Volume %	[0-100%]	The percentage of the total syringe volume used, i.e... a setting of 10% (when utilizing a 10μl syringe) will inject 1μl of sample solution.

Sample Rinse	[0-10]	The number of times the syringe is filled with sample and "emptied" to the waste vial. The volume of sample loaded into the syringe will be according to the Sample Volume % Parameter.
Sample Pumps	[0-10]	The syringe will be flushed this number of times with standard/sample solution before the final standard / sample solution is drawn into the syringe prior to injection. The syringe will remain in the sample vial for this process. This helps to purge air bubbles from the syringe before drawing in the final sample to be injected.
Sample Fill Rate %	[0-100%]	The plunger motor fill rate speed will may be controlled with this value. Use 100% for the fastest plunger operation. Use a lower number if more viscous samples are being used to avoid bubble formation.
Sample Inj Rate %	[0-100%]	The plunger injection speed is controlled with this parameter. Use a lower number if more viscous samples are being used to increase reproducibility. Use 100% for the fastest injection speed.
Syringe Offset %	[0-20%]	The syringe offset determines what volume of sample remains in the syringe at the completion of an injection. A value of 10% to 20% may be useful in avoiding volume errors due to bubbles caused by certain sample types. The offset is ignored during the rinse cycle. This parameter MUST be set to if the Pre-Fill air parameter is being used.
PreFill Air %	[0-100%]	The amount of air to be drawn into the syringe before drawing in the standard/sample. This provides a head space of air to help purge the syringe of the entire sample during injection. The value entered is a percentage of the total syringe volume, i.e. a setting of 10% (when utilizing a 10μl syringe) will draw 1μl of air into the syringe. **See "Syringe Offset Parameter".** Note, the sum of the standard volume & sample volume & Prefill Air % cannot exceed 100% of the syringe capacity.

MidFill Air %	[0-100%]	The amount of air to be drawn into the syringe after drawing the sample/standard volume. This air space will be utilized as a buffer between the two different solutions in the syringe. The value entered is a percentage of the total syringe volume i.e. a setting of 10% (when utilizing a 10μl syringe) will draw 1μl of air into the syringe each time a standard solution is drawn into the syringe. This parameter is not used if the Standard Volume is set to "0".
PostFill Air %	[0-100%]	The amount of air to be drawn into the syringe after the sample is drawn into the syringe. This air volume can reduce "needle burn off" of sample in the injection port. The value entered is a percentage of the total syringe volume, i.e. a setting of 10% (when utilizing a 10μl syringe) will cause 1μl of air to be drawn into the syringe after the sample solution is drawn into the syringe.
Start Delay	[0-999 min.]	This parameter allows the autosampler to begin its sampling sequence at a future time, up to 999 minutes from the start point.
PreInj Delay	[0-600 sec.]	The number of seconds to pause after the syringe needle has entered the sample injection port. In systems where "needle burn" occurs this value can help separate the initial solvent injection from the main sample injection.
PostInj Delay	[0-600 sec.]	The number of seconds to pause (Dwell) after the sample has been injected. This feature allows the sample, time to completely leave the needle, before the needle is withdrawn from the injection port. GC Start and Data Start signals have been activated.
Inject Target	[A, B, A&B, A+B]	There are two injection targets possible, "A" and "B". The sample will be injected into the assigned target(s). The position of the inlets does not matter, they can be left/right or front/rear. Multiple targets may be selected by entering one of the A, B combination values. The Left/Right arrow keys will scroll through the selections available.

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	[A&B]	All volume of standard/sample is drawn into the syringe for both inlet injections. Injection of the sample volume is made into port A and then the syringe goes directly to port B and injects the remaining volume. The injection volume per inlet, is whatever percent was programmed.
	[A+B]	The programmed standard/sample volume is drawn into the syringe and injected into port A. Without rinsing, the syringe returns to the standard/sample vial and draws the programmed volume of standard/sample solution, this is then injected into port B.
PostFill Delay	[0-60 sec.]	This parameter allows a pause after the plunger has pulled the programmed sample volume into the syringe barrel. This delay, in seconds, allows viscous samples to completely fill the syringe barrel before the syringe needle is removed from the sample vial.
Operate Mode	[Remote / Internal]	Remote or Local operating modes are selectable by using the Left/Right arrow keys. In the Local mode, the Cobra L/S operates according to the Cycle Time Parameter. In the Remote mode, a GC Ready or Start signal must be received, and the Cycle Timer must be at "0" before the injection can begin.
Cycle Time Minutes	[0-999 min.]	Begins counting time from when the injection is made, (plunger is depressed). The next sample injection process will not start until this amount of time has elapsed. The syringe will however be rinsed, after the injection, according to the number of Rinses programmed. If the duration of post-rinse sequences requires a longer time period than the Cycle time, this parameter is not the determining time between injection cycles. This parameter is only required when running in the Local mode.
Aux. Time Minutes	[0-999 min.]	The auxiliary timer begins marking time when the sampling sequence begins. At the end of the programmed time, the Auxiliary Output switch is pulsed.

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| Link to Method	[0-10]	Methods may be linked together allowing the Cobra L\S to run multiple methods in a continuous process. Note: Circular linkage of a single method is allowed providing for continuous sample operations. When the method parameter is set to "0", the Cobra L\S will only run the one selected method.

See Section 6.3.2 for an example of Method Parameter Setup values. The Method example may be used for most sample situations.

6.3   Utilizing Standard Solutions

The Cobra L/S allows standard solutions to be automatically added to the sample injection. The syringe will first fill with standard solution and then move to the sample vial and pull up the sample into the syringe. Both sample and standard will then be injected as one "sample".

Standards are loaded into the tray in the far right vial column, vial positions 113 to 120. When a Standard Volume is programmed, the syringe will move to the standard vial position along each row of sample. As an example, all samples processed in vial row #1 will use position # 113 as the standard location. All samples in row # 2 will use position # 114 as the standard location. This pattern is used all the way to row # 8 Standard position # 120. What this means is samples **CANNOT** be loaded in locations 113 -120, this is reserved for Standards **ONLY**!

This method works well for injection methods into single injectors and in the dual inject mode [A+B] (see Inject Target parameter in Section 6.2). It does not work in the dual inject mode [A&B] because the sample and standard are not sufficiently mixed in the syringe.

Standard Vial Position Row,
#'s 113-120.

Figure 6.3

14
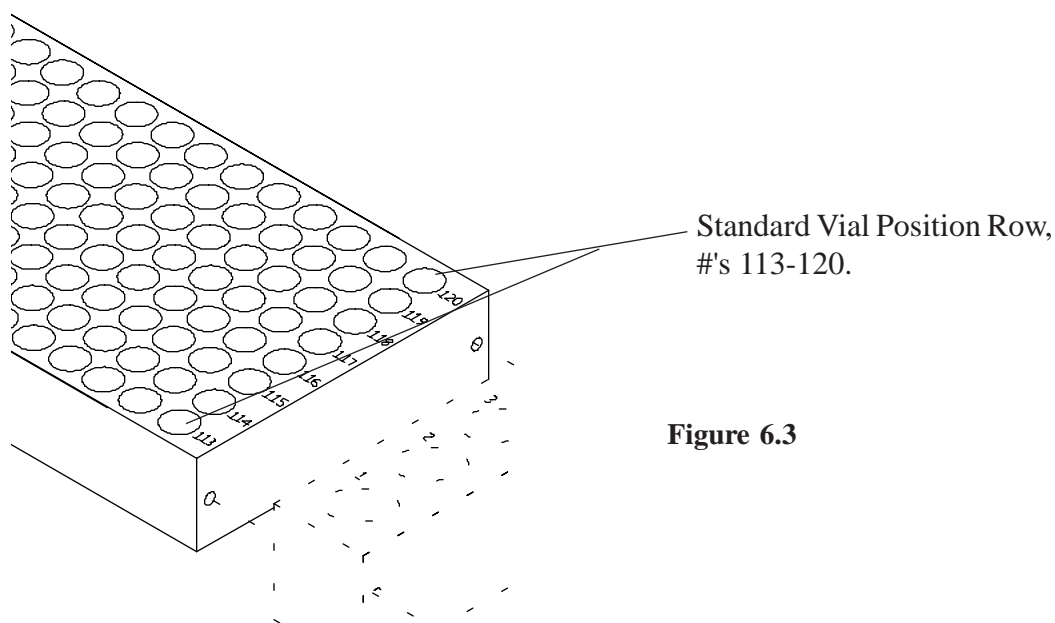
6.4 Suggested Method Parameter Values Utilizing Hexane and Methylene Chloride

Use the following as an example to setup Method Parameter Values. These values are suggested for solvents such as Hexane and Methylene Chloride. This Method is with a 5µl syringe installed. The sample is 1 µl, with a .25 µl offset injecting into inlet A. The syringe will be rinsed with 5µl of rinse #1 twice and #2 once. Prior to injection, it will dump the rinse twice, into waste, and then flush in the vial 5 times. This should eliminate any bubble problems with any solvent.

Method Parameter	Initial Value
# Inject/Sample	1
# Rinse/Solvent #1	2
# Rinse/Solvent #2	1
Rinse Volume %	100
Rinse Fill Rate %	10
Sample Volume %	20
# Dumps/Inject	2
# Flushes/Inject	5
Sample Fill Rate	10
Sample Inject Rate	100
Syringe Offset	5
Operating Mode	Remote

# 7.0 Operational Keys

7.1 Hold/Stop Key

The Pause/Stop Key performs two (2) functions:

1. Pause the current Auto Sampler operation at its completion. **The sampling continues until a complete sample injection cycle is completed.** The method parameters and/or the system parameters may then be edited or a priority **Manual Injection** may be performed. The system may then resume the AutoRun (where it paused) and complete the method.

2. Abort the current AutoRun or other function. The Syringe contents may be dumped to waste and/or immediately returned to its "Home" position and the AutoRun **may not** be resumed from the point it was stopped.

NOTE: The EndPause can be turned off at any point before it is actually executed by pressing the Enter Key.
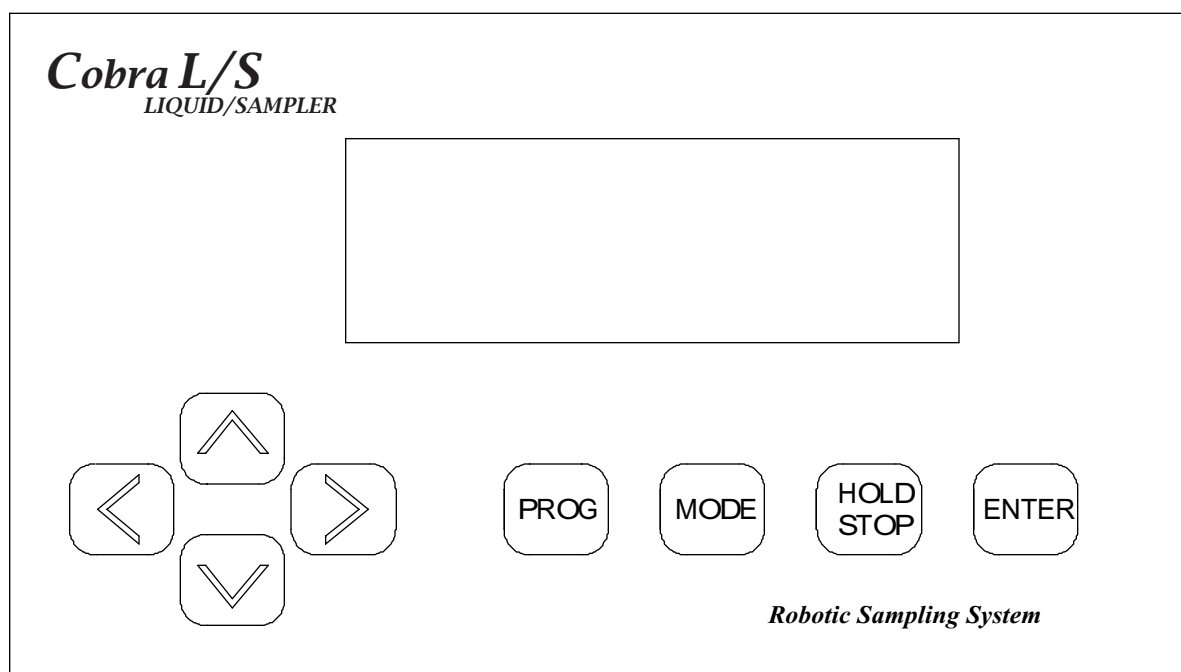
Cobra L/S Keyboard Overlay

Press Hold/Stop Key - One Time.

During any operation of the Auto Sampler the **"Hold/Stop" Key** may be pressed. Hold the key down until the "End Pause" message appears. For an operation pause, the screen will display the prompt "***End Pause***". The Auto Sampler will continue until the current injection cycle is completed.

At this point practically any aspect of the Auto Sampler may be updated. Methods may be edited, a Priority Manual Sample may be performed or any of the System parameters may be changed. To resume the AutoRun from the point it was paused, press the **"Enter" Key**.

Press Hold/Stop Key - Two Times.

Pressing the **"Hold/Stop" Key** the second time will immediately stop the motors. A prompt will appear on the screen to allow the syringe contents to be dumped to the waste vial before returning the syringe to its home position and reset. The method or AutoRun cannot be resumed from the position it was stopped without editing the method and changing the "First Vial Position". If the syringe contains any solution at this point, press the **"Enter" Key** to allow it to be dumped into the waste vial before returning the syringe to its home position.

CAUTION: Syringe contents will be emptied where the syringe is currently positioned if the "Hold/Stop" key is pressed instead of the "Enter" Key. This could cause hazardous and/or corrosive chemicals to be dispensed into the atmosphere and/or onto the Auto Sampler and Analyzer.

7.2 Prog (Program) Key

The Prog Key is used to access the Cobra L/S Method Edit and Setup menus. The user must select either the Method Edit or Setup screen with the Up/Down arrow keys and press Enter. If Method Edit is selected, enter with the Left/Right keys, a method number from #1-10 and press the Enter Key. The display will change to the method number entered allowing for editing or review.

If the Setup menu line is selected, the next screen allows access to the "Configuration, Maintenance, Diagnostics and Motor Speeds" menus. These menus will be discussed in detail in Section 8.

To exit the "Prog" key selection press the Hold/Stop key.

7.3 Mode Key

The mode key allows the user to begin running samples. Press the "Mode" key and the next screen will display the selection of "Auto Run" or "Manual Run." The user can select either mode with the Up/Down arrow keys. If the Auto Run is desired enter the method number, with the Left/Right arrow keys, then press Enter. This will immediately begin the sampling sequence per the Method selected.

If the Manual mode is selected, the next screen allows the user to run a single sample or rinse the syringe. If a sample is to be run the user must enter the Method number and the sample vial number to run. The Left/Right arrow keys are used to enter this data. Press the Enter key and the sequence begins.

If Sample Rinse is selected, the next screen allows the user to enter the Method number to run the rinse syringe sequence. Press the Enter key to begin the sequence.

NOTE: The Auto Sampler will rinse the syringe according to the parameters in the Method number selected. It is advised that a Method be dedicated to the desired syringe flushing cycle and stored for future use.

8.0 Cobra L/S Setup Menus

The Setup Menu allows the user to access the Cobra L/S Configuration, Maintenance, Diagnostics and Motor Speed menus. These menus provide complete setup and diagnostic tools for installation and performance setup. **Note: Several of the menus in this section are intended only for a service technician.**

8.1 Configuration Menu

Configuration menu allows the setup of the sample tray and all needle targets (these were discussed in detail in Sections 4.0 and 5.0).

8.2 Maintenance Menu

Maintenance menu displays the current Firmware revision code and the Plunger count. This is useful in knowing the life cycle of a Teflon tip style syringe plunger. The count can be reset by using the Left/Right arrow keys. To exit the menu press the Hold/Stop key.

8.3 Diagnostics Menu ⚠ WARNING

CAUTION: Only trained personnel should operate the Cobra L/S whenever the Diagnostics menu is accessed. Damage to the syringe, sample vials and/or chromatography instrument could be severe if untrained personnel attempt to use this menu without a complete understanding of is purpose!

This menu will allow the *trained* operator to move the Front/Back, Vertical, Plunger and Right/Left axis. Additionally, the motor movement parameters may be changed. These are the beginning and ending ramping and the final speed settings. **NOTE: If this menu has been accessed, the menu line "Enter To Test", will cause each axis to move until the Stop key is pressed!**

8.3.1 Relay Output Testing

Additional diagnostic information is available for relay testing. These are the GC/Data, Auxiliary and Spare Output relays and the Input signal data. This information is useful for determining if one of the output relays is not working. Relays maybe wired for normally open or normally closed, the closure is for .5 seconds. The default setting is in the N.O. mode.

From the Diagnostics menu, scroll, using the UP/Down arrow keys, to the relay desired for testing, press the enter key. The display will show the selected output, i.e....GC/DATA Start, Enter to test, Stop to exit.

To preform the test be certain the I/O cable is properly connected or a VOM meter is set to the correct position to test the output. Follow the instructions on the display.

8.3.2 Input Signal Test

This screen allows the GC ready signal to be tested. The normal state should be OFF, once an input signal is received, the OFF will toggle to ON. The screen line "Spare 7" is an indicator showing that the spare (these are signal line inputs for future use) signals are floating "high."

8.3.3 Motor Delay ⚠ WARNING FOR TRAINED TECHS ONLY!

CAUTION: Only trained service personnel should operate the Cobra L/S whenever this Diagnostics menu is accessed. Damage to the syringe, sample vials and/or chromatography instrument could be severe if untrained personnel attempt to use this menu without a complete understanding of is purpose! This menu is intended for the service technician.

This menu allows the stepper motor delay time (in milliseconds) to be changed. This time is the duration of pause at the end of one motor movement and the start of the next motor movement. The factory default is 100 ms. The Left/Right arrows will change the value. Press Enter to exit.

To test the new time setting you must scroll to one of the motor axis movement menu lines. The best one is probably the Left/Right axis, follow the screen prompts to access moving "all" motors.

8.3.4 Motor Speeds

> ⚠ **!** **WARNING FOR TRAINED TECHS ONLY!**

This screen allows the service technician access to settings for all the motor speeds. This information should be used for reference only. ***ONLY TRAINED SERVICE TECHNICIANS SHOULD ATTEMPT TO MAKE MOTOR SETTING CHANGES!*** The Motor speed settings are set and confirmed when the individual axis menu is selected.

In the Motor Speeds menu, each axis can be moved for testing, and if necessary, the speed values changed. This allows each of the movement parameters to be altered, ramping for beginning and ending (F; delay between steps for starting rate), (R; delay between steps for final rate), (S; acceleration or ramping speed). Once these settings are entered the Motor Speed menu will allow the user the check the settings.

> The settings are:
> Speed...this is the final speed of the motor.
> Initial Rate (Initrat)...this is the plunger's initial movement speed.
> Acceleration (Accel)...this is the speed for beginning (accelerate) and ending (decelerate) motor speeds for the balance of the motors.

9.0 External I/O Connections

The Cobra L/S has a 25 pin "D" connector on the rear of the cabinet for External I/O connections, i.e. GC Ready, GC Start, Data Start, etc. The following is a list and pin locations for the signals. Note: The Cobra L/S is supplied with an External I/O cable that will be specific to your GC system however, not all functions shown will be wired in your cable. Be certain the cable you received is correct for your system, see Figure 9.0 for complete cable connections.

Pin #	Signal
1.	Signal Ground
2.	In 1 Ground
3.	In 2 Ground
4.	In 3 Ground
5.	GC Start N/O
6.	GC Start N/C
7.	Data Start Com
8.	Auxiliary N/O
9.	Auxiliary N/C
14.	GC Ready Input
18.	GC Start Com
19.	Data Start N/O
20.	Data Start N/C
21.	Auxiliary Com
22.	Spare Out N/O
23.	Spare Out N/C
24.	Ground
25.	5 VDC Out

10.0 Remote Control (RS 232 Serial Link)

The Cobra L/S can be Remote Controlled through its Serial Interface Link, labeled "RS 232." This may be accomplished in either the "Remote or Local" Mode (this is programmed in the Methods). Commands may be received from either the Host PC or the keypad, however the keypad is LOCKED out with a message on the on the LCD while the PC is programming. The Cobra L/S is started by a signal generated by either the GC Ready signal, the Host PC or the keypad.

The Cobra L/S requires a 9 conductor cable to Receive, Transmit and Ground, fed straight through. If you do not have a cable consult the factory. Plug the cable into the 9 position "D" connector on the rear of the Cobra L/S labeled "RS 232" and then into the 9 pin serial connector on the rear of your PC.

10.1   Data Format

The Data Transmission from the host to the Cobra L/S and from the Cobra L/S to the host use the same data format. Communications are RS 232 as follows: 19200 baud, no parity, 8 bits, 1 stop bit and no handshaking.

10.2   Command Summary from Host to Cobra L/S

All Commands require 3 bytes, followed by a CR. Shorter commands should be padded with a CR to make them 4 bytes long, total.

Q   Get Cobra's attention (Cobra will stop running, and echo ok) and print "PC Host active" on
         line 4 of the LCD screen. When the PC host releases control, "PC link Idle", will appear
         on line 4 of the LCD, if the Cobra L/S was idle, otherwise, the run will continue from where
         it was interrupted, unless an Rn or Gn command had been issued by the host. Note that
         parameters updated with the MWn command will not take effect until the batch is started the
         next time.

Attempts to communicate with the Cobra L/S while it is performing a manually initiated rinse will be ignored.

After the Cobra L/S has responded to the Q command, the following commands are available:

Note...For commands with a method parameter, the examples use method 1. In the Mode After column, remote indicates the PC Host stays in control after the command is executed, and the Cobra keypad is disabled. Local means control has transferred back to the Cobra.

Command	Example	Mode After	Description
MWn	77 87 01 13	Remote	Program method parameters (requires parameter string to follow)
SW	83 87 13 13	Remote	Program system parameters (requires parameter string to follow)
Rn	82 01 13 13	Remote	Start running method n
V0	86 48 13 13	Local	Turn off Verbose mode, no status messages will be sent while the Cobra is running
V1	86 49 13 13	Local	Turn on Verbose mode, "PC Host active" LCD message changes to "Linked to host"
MRn	77 82 01 13	Remote	Request Method parameters for method n
SR	87 82 13 13	Remote	Request System parameters
ST	87 84 13 13	Local	Request Current status. One of the following series of two binary bytes, followed by CR will be sent: 1-10, 1-12 0-Running method, sample 0, 101 - Manual mode, 0, 102 - Idle
GO	71 79 13 13	Local	Resume running if a method was interrupted, or return to local control if Cobra was not running.

GN	71 78 13 13	Local	Resume running at beginning of current cycle, after dumping syringe contents to waste, or return to local control.
AB	65 66 13 13	Local	Abort current method, dump syringe and return to local control
Q	81 13 13 13	Remote	Echo "ok", useful for synchronizing with Cobra, works to establish communications initially, and does no harm if communications are already working
<ESC>	27 13 13 13	Remote	Return cobra to local keypad control, and continue method if one was interrupted (Same effect ad GO)

For both Rn and Gn, the Cobra will transmit "Run Complete" CR when the method is complete. The system will wait for a keypad press, or any character over the serial link, and then return control to the Cobra. A remote program will have to re-send Q to get back to control. All commands should be terminated with a Carriage Return (binary 13). All method #'s (n) should be binary, not ASCII value, i.e. 77 82 49 01 for MR1, except the Rn command, in which the n can be either the ASCII equivalent, or the binary value, i.e. 82 01 13 13 and 82 49 13 13 will both start Run 1.

10.3   Cobra L/S Command Details

To program a method remotely from a host PC:

1) PC sends a Q to get sampler's attention

2) PC waits for ok, indicating Cobra is ready

3) PC sends "MWn" CR, to indicate method is to be programmed.

4) PC waits for ok CR, indicating the Cobra is ready

5) PC sends the following binary string, all word (2 byte) values:

Byte#	#Bytes	Content	Allowed Range (PC code must enforce these limits)
0	2	First Vial	1-120
2	2	Last Vial	1-120
4	2	Num of repeats/sample	1-100
6	2	# of rinse ones	0-20
8	2	# of rinse twos	0-20
10	2	rinse volume	0-100%
12	2	Rinse fill rate	0-100%
14	2	Standard Volume	0-100%
16	2	Sample Volume	0-100%
18	2	Num of solvent dumps/inject	0-10
20	2	Num of solv. flushes/inject	0-100

22	2	Sample Fill Rate	0-100%
24	2	Sample dispense rate	0-100%
26	2	Syringe Offset	0-20%
28	2	Prefill Air	0-100%
30	2	MidFill Air	0-100%
32	2	Postfill Air	0-100%
34	2	Start delay (seconds)	0-999
36	2	Pause before sample dispense	0-600
38	2	Pause after sample dispense	0-600
40	2	Target	0-3 (0-A, 1-B, 2-A&B 3-A+B)
42	2	Pause after sample fill	0-60
44	2	Operation mode	0-1 (0-continuous, 1-GC trigger)
46	2	Cycle time (secs) when Opmode=0	0-999
48	2	Seconds till auxiliary relay closure	0-999 (clock starts at cycle start)
50	2	Link to method # on method completion	0-10 0 for no link
52	1	CR	

6) Cobra will respond with ok

7) Host sends Rn to start method n. Cobra will respond by starting method. For example, sending R1 (binary 82 49 13 13) starts method 1, whether or not it was just programmed. To start Cobra in Verbose mode, where status reports are sent while running, send the V (86 49 13 13) command first.

10.4   Program System Parameters

1.   PC sends a Q to get sampler's attention

2.   PC waits for ok, indicating Cobra is ready

3.   PC sends "SW" (binary 83 87) to indicate system parameters are be programmed.

4.   PC sends the following binary string:

Byte#	#Bytes	Content	Allowed Range
0	2	Right/Left Final Speed	0-999
2	2	Forward/Back Speed	0-999
4	2	Vertical Final Speed	0-999
6	2	Plunger Final Speed	0-999
8	2	Plunger Initial Rate	0-999
10	1	Plunger Acceleration	0-255
11	1	Normal Acceleration	0-255

| 12 | 1 | Vertical Acceleration | 0-255 |
| 13 | 1 | Tray Size | 0-3 (only 0 currently supported) |

5.   Cobra will respond with ok.

10.5   System Errors

Undefined commands will get a response "Undefined command"
All parameters must be in their allowed range, Cobra will not edit incoming values.
Cobra will wait for an enter key press (ASCII 13) to continue after an error.

10.6 Error codes

- # 1   Undefined command
- # 2   Invalid value
- # 3   Not yet supported
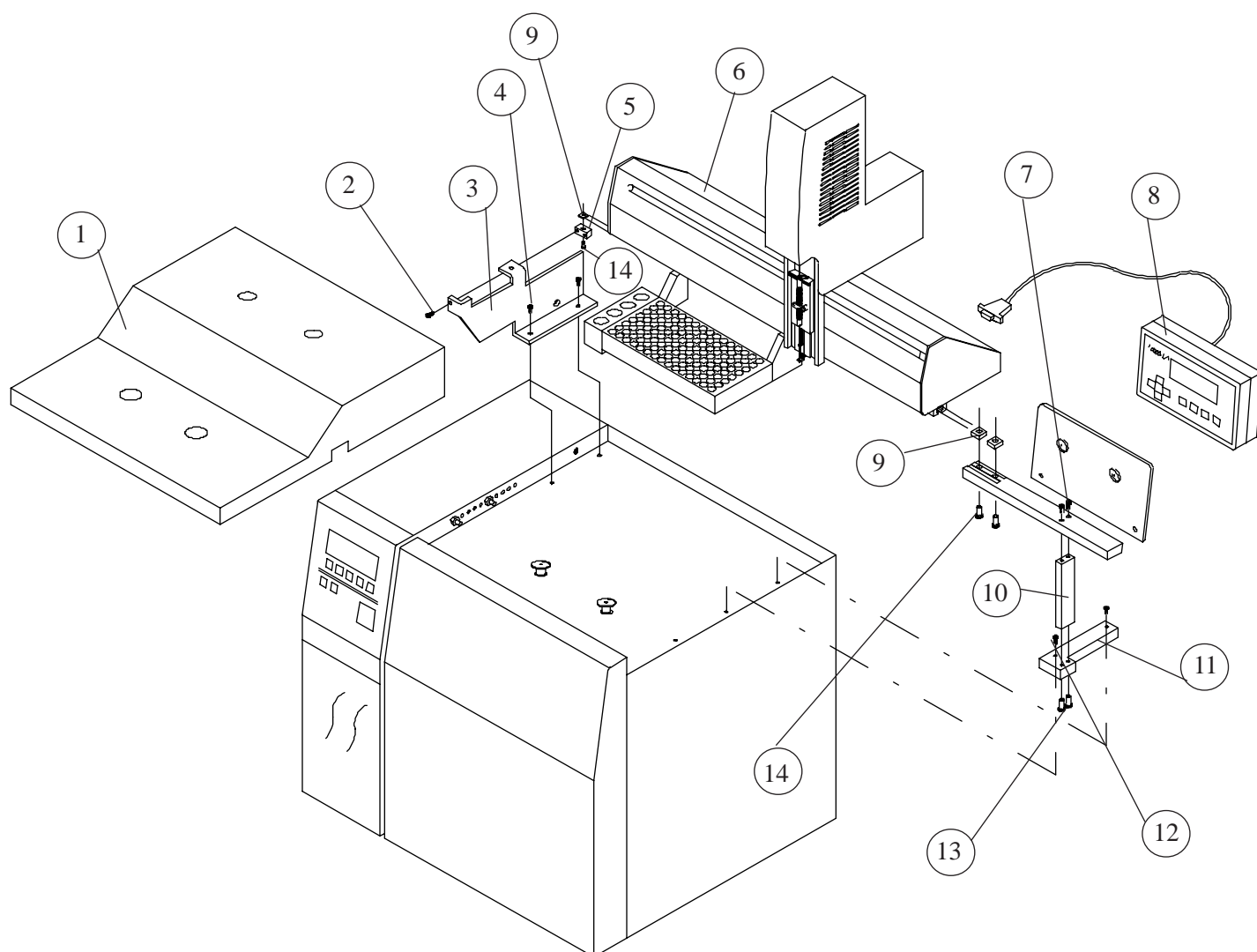- # 4   Current run must be aborted first

11.0 Cobra L/S Installation of Cables and Mounting Hardware

The following section details the Cobra L/S mounting bracket hardware and I/O cable installation. Refer to the drawings for detail.
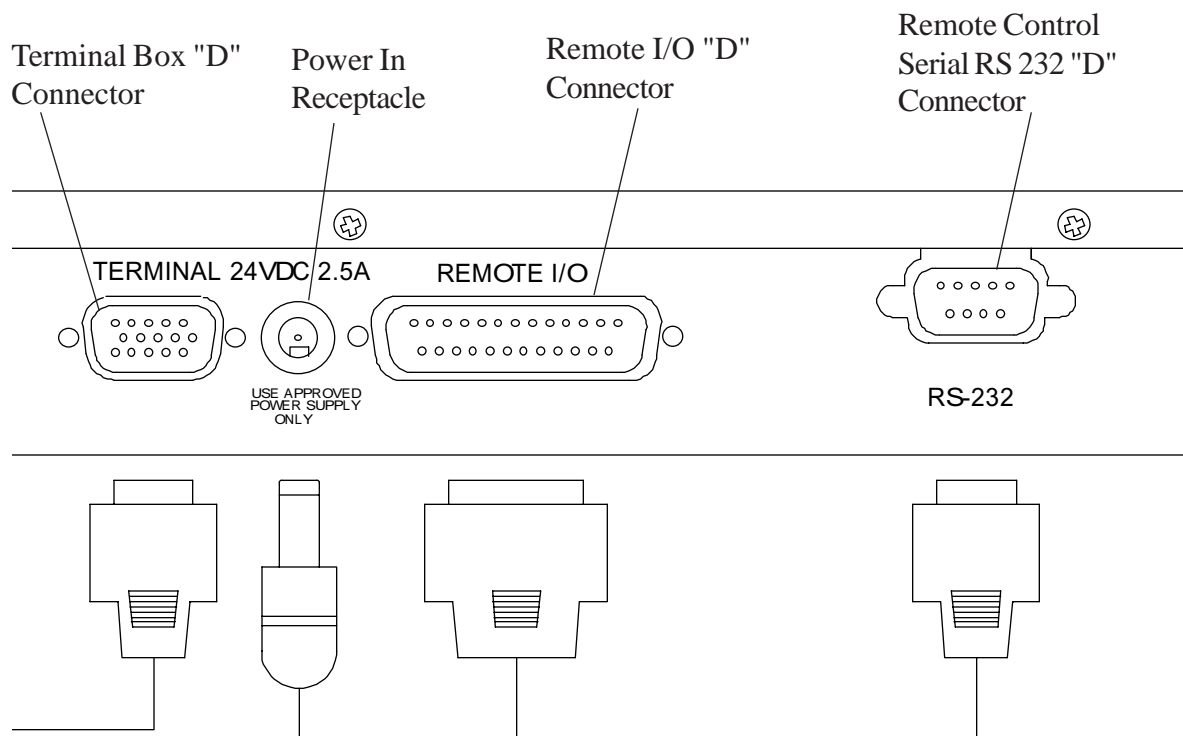

Figure 11.0
Cobra L/S Rear Panel

11.1 Installation of the Cobra L/S to the Gow-Mac 600 Gas Chromatograph

1. GC Oven Top
2. 6-32 x 1/2" SH Screw W/ #6 Lockwashers
3. Left Mount Bracket
4. 10-32 x 1/2" SH Screws W/ #10
    Lockwashers
5. Bracket Mount Block
6. Cobra L/S
7. 8-32 x 1/2 SH Screws
8. Keypad Terminal
9. 10-32 Square Nuts
10. Right Vertical Mount Block
11. Right Bottom Mount Block
12. M4 x 20mm Screws
13. 8-32 x 1/2 SH Screws W/ #8 Lockwashers
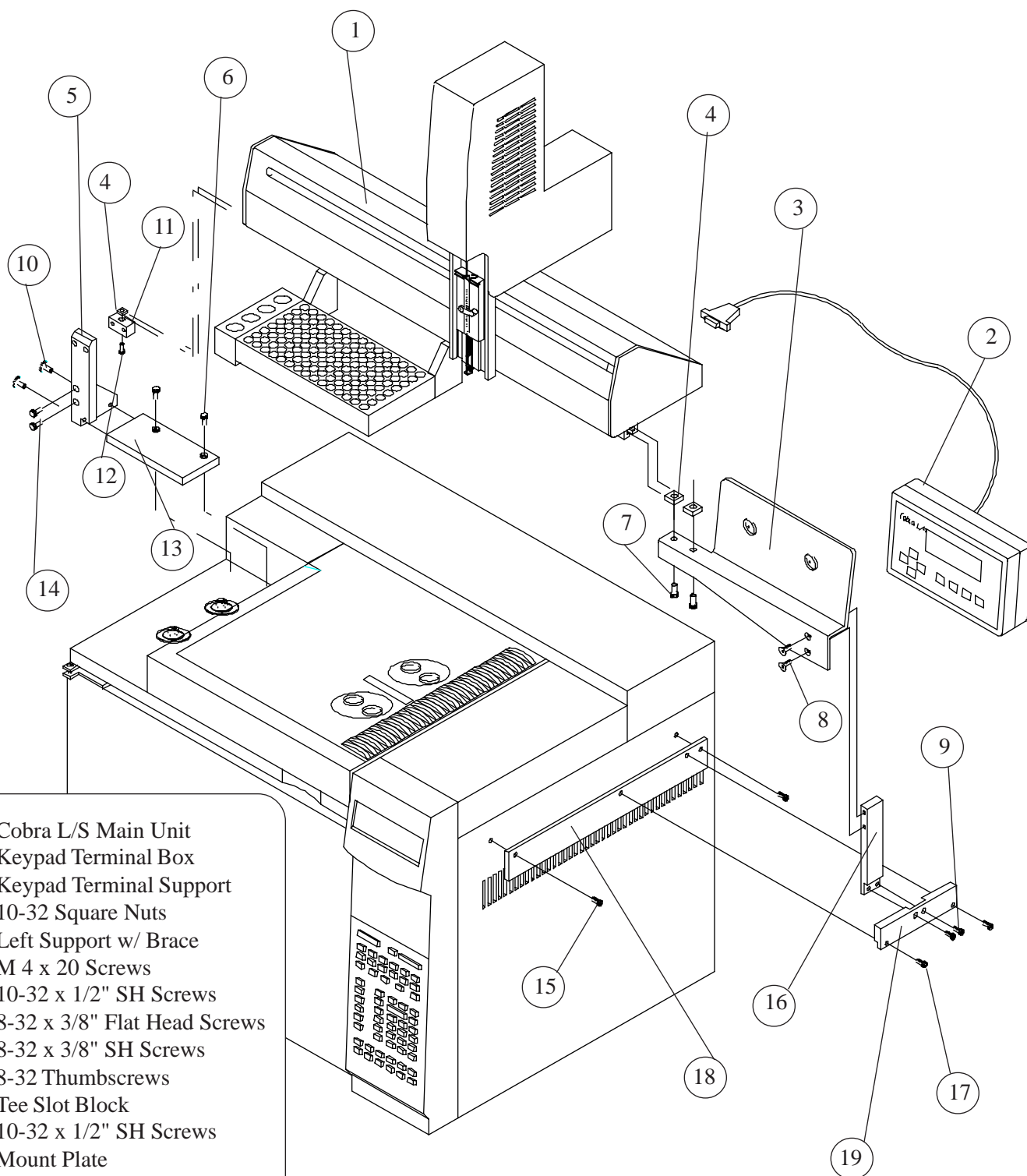14. 10-32 x 1/2" SH Screws

11.2 Installation of the Cobra L/S to the HP 5890 Gas Chromatograph
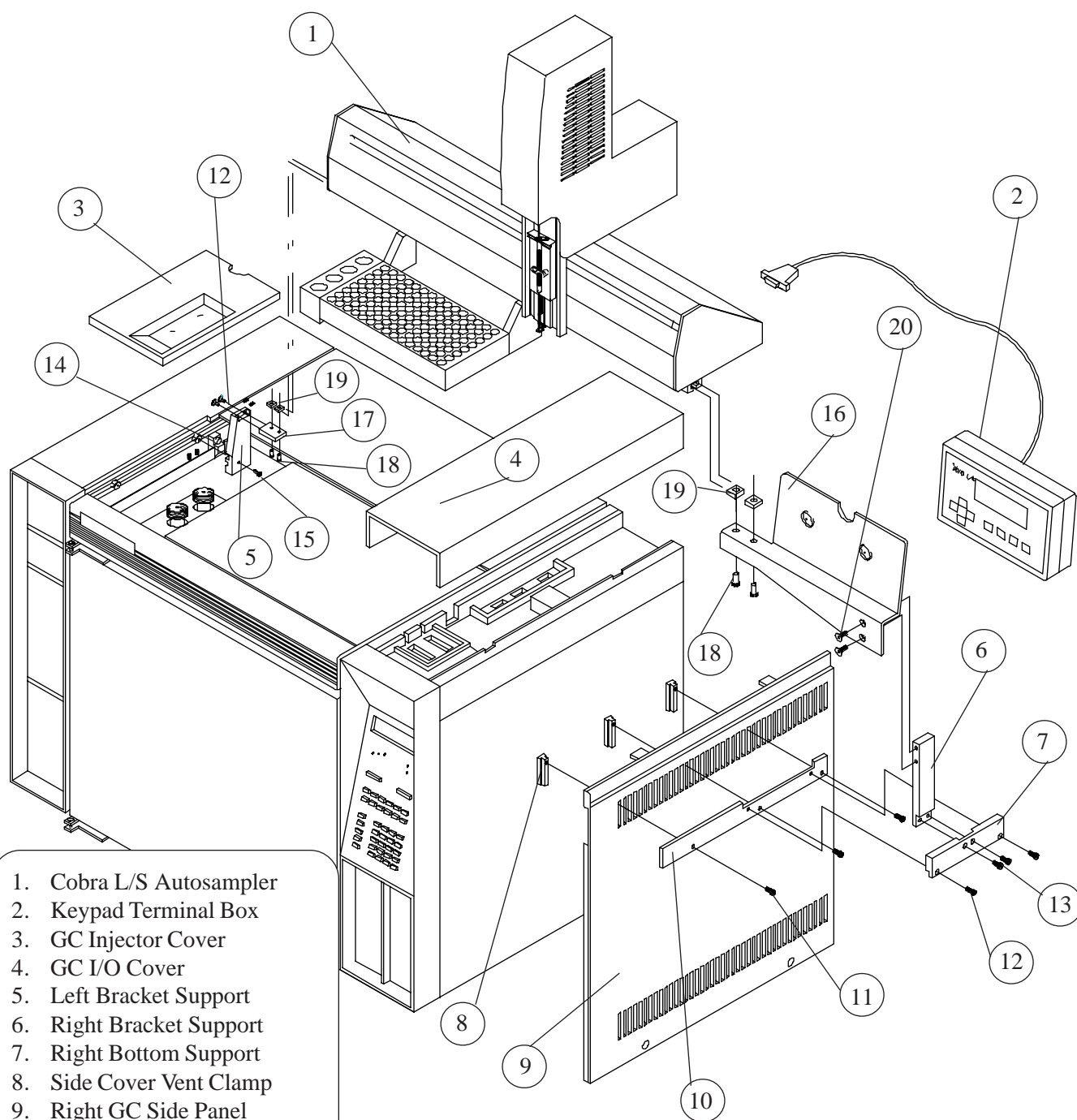
1. Cobra L/S Autosampler
2. Keypad Terminal Box
3. GC Injector Cover
4. GC I/O Cover
5. Left Bracket Support
6. Right Bracket Support
7. Right Bottom Support
8. Side Cover Vent Clamp
9. Right GC Side Panel
10. Side Panel Bracket Support
11. 6-32 x 1/2" SH Screws
12. 8-32 x 1/2" SH Screws
13. 8-32 x 3/8" SH Screws
14. Boss Extension on GC
15. 8-32 x 3/4" SH Screws
16. Keypad Terminal Support
17. Left Tee Slot Block
18. 10-32 x 1/2" SH Screws
19. 10-32 Square Nuts
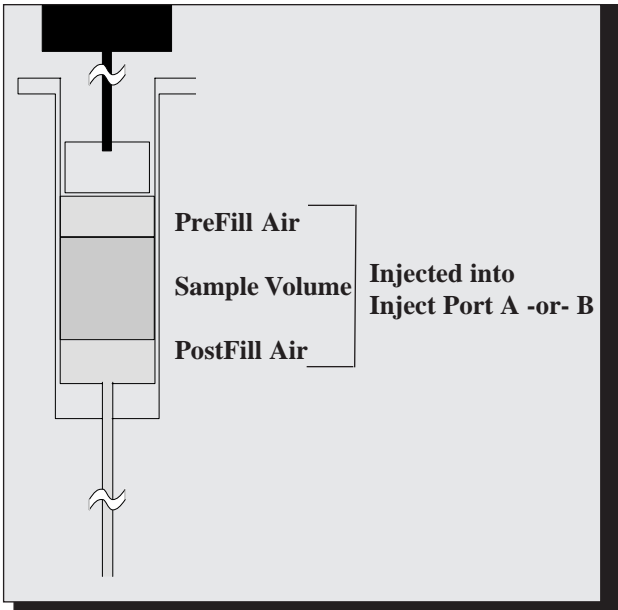20. 8-32 x 3/8" Flat Head Screw

26

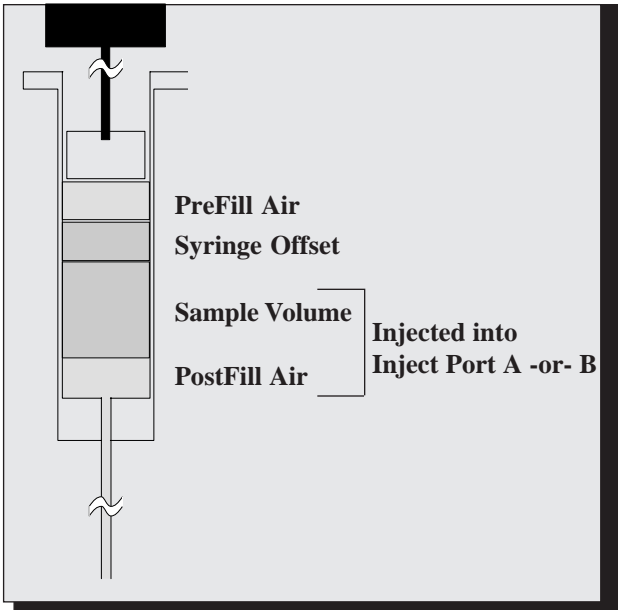## 11.3 Installation of the Cobra L/S to the HP 6890 Gas Chromatograph

1. Cobra L/S Main Unit
2.. Keypad Terminal Box
3. Keypad Terminal Support
4. 10-32 Square Nuts
5. Left Support w/ Brace
6. M 4 x 20 Screws
7. 10-32 x 1/2" SH Screws
8. 8-32 x 3/8" Flat Head Screws
9. 8-32 x 3/8" SH Screws
10. 8-32 Thumbscrews
11. Tee Slot Block
12. 10-32 x 1/2" SH Screws
13. Mount Plate
14. 10-32 x 1/2" SH Screws
15. M 4 x 20 Screws
16. Right Support
17. 8-32 x 1/2 SH Screws
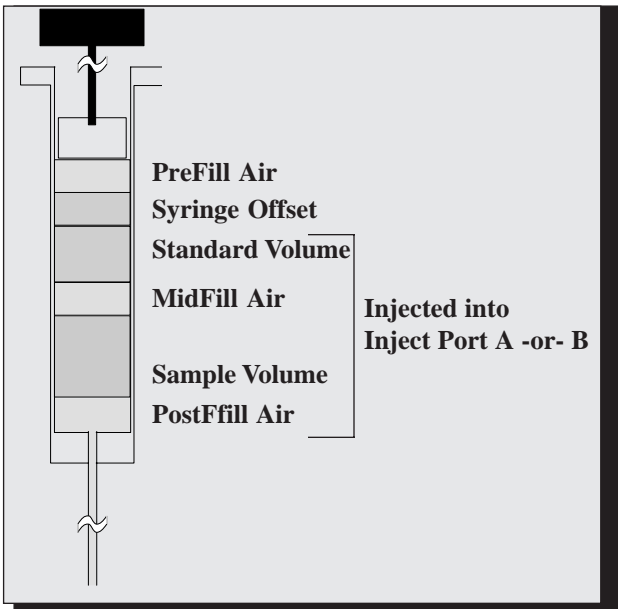18. Right GC Mount Plate
19. Right Mount Bar

Appendix: Syringe Operation Drawings

Example 1 - Standard Injection Setup

PreFill Air

Sample Volume — Injected into Inject Port A -or- B

PostFill Air

Example 2 - Syringe Offset Used

PreFill Air

Syringe Offset

Sample Volume — Injected into Inject Port A -or- B

PostFill Air

Example 3 - Using Syringe Offset and Standard Offset

PreFill Air

Syringe Offset

Standard Volume

MidFill Air — Injected into Inject Port A -or- B

Sample Volume

PostFfill Air
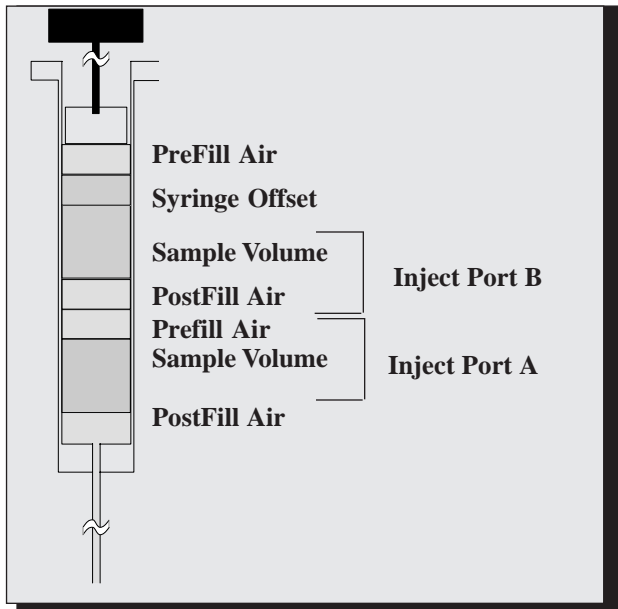
Example 4 - Using Syringe Offset and Inject Mode = A&B

PreFill Air

Syringe Offset

Sample Volume — Inject Port B

PostFill Air

Prefill Air

Sample Volume — Inject Port A

PostFill Air

Use this chart space to log in any method parameters that you must use on a frequent basis.