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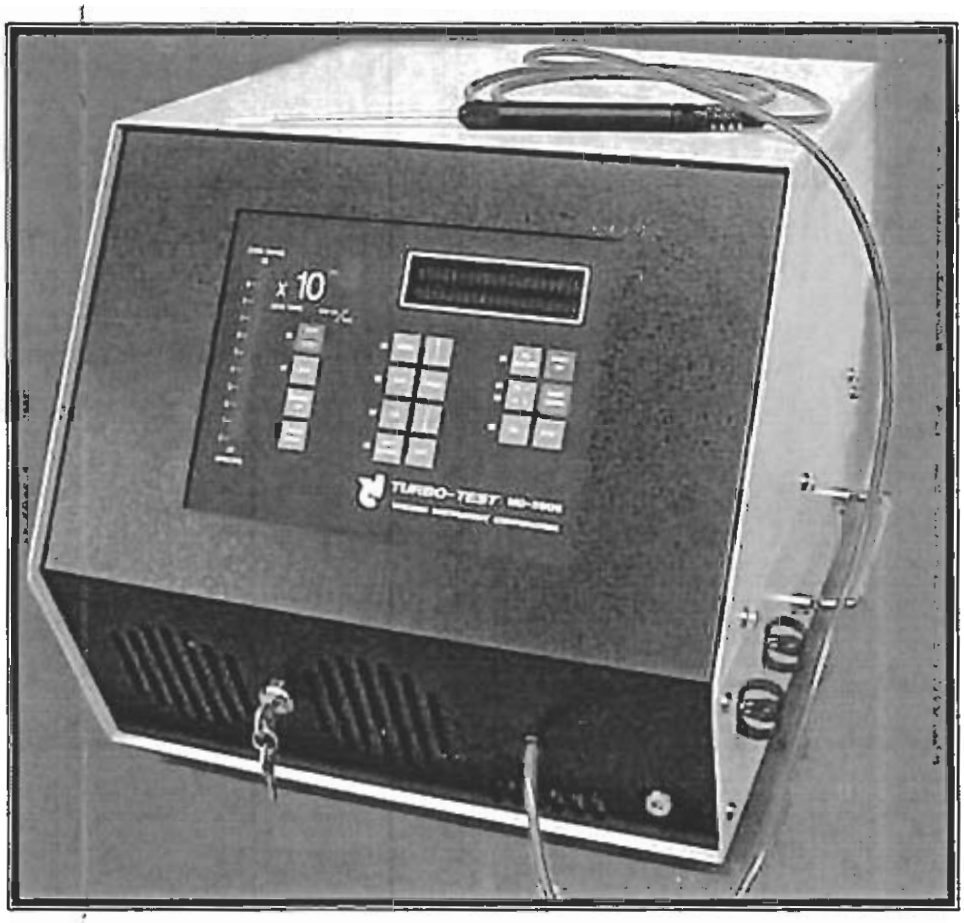
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TURBO TEST™
MD-390S/ MD-391S/MD-391SD
HELIUM LEAK DETECTOR



OPERATION MANUAL

REVISIONS		
DATE	**DESCRIPTION OF CHANGE**	**REV**
7/25/94	FIRST RELEASE	-
9/20/95	REVISED PER PROTOTYPE CHANGES	A
11/09/95	REFORMATTED AND REVISED SECTION 8.4 MECHANICAL PUMP OIL CHANGE" REMOVED AUTO TUNE FUNCTION	B BI
3/28/96	PROGRAM / OPTIONS CHANGES	C
6/5/96	ADD INSTALLATION OF CAL LEAK CYLINDER, REVISED OIL CHANGE PROCEDURE	D
2/11/97	REVISED PROBE BLOCKED PRESSURE, ADDED PC BOARD WARNING, REVISED FUNCTION BLOCK DIAGRAMS, REWROTE APPENDIX 2	E
7/01/97	REVISED SECTION 1.1, UNCRATING, 1.2INSTALLATION, 8.5 VACUUM MANIFOLD REMOVAL PROCEDURE, 8.6 ORIFICE REPLACEMENT, 8.7 MANIFOLD DISASSEMBLY PROCEDURES ADDED ESD NOTE TO SECTION 9.2, PC BOARD REMOVAL / INSTALLATION, ADDED SECTION 11.0, TROUBLESHOOTING GUIDE, REVISED SECTION 12.5, POWER REQUIREMENTS	F
7/08/97	REVISED TO FEEDBACK FROM PRODUCTION	G
3/23/99	UP-DATE DRAWINGS & B.O.M	H
1/14/00	ADD DEFINITIONS FOR RE-CALIBRATING ALARM & TURBO TYPE	I

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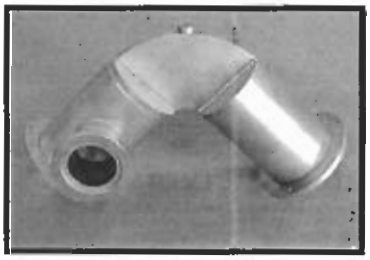
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SECTION 1.0 GENERAL DESCRIPTION

The **TURBO TEST MD-390S/ MD-391S/MD-391SD HELIUM LEAK DETECTOR** are Helium leak detection instruments using a MASS SPECTROMETER sensing device and a gas continuous sampling method.

These instruments are capable of detecting and qualifying Helium leak rates in the range of 10^{-7} to 10^{-2} Atm-cc/sec using the accepted methods of pressure leak testing. The most notable features of the instruments include automatic start-up/shutdown, automatic gross leak crossover with auto-ranging, Auto-Calibration, Probe Blocked Feature, coupled with simplicity in design and ease of maintenance.

1.1 Mass Spectrometer Tube



P/N: 751-112

The heart of the MASS SPECTROMETER LEAK DETECTORS is the MASS SPECTROMETER TUBE. All other components of the LEAK DETECTOR function to create, control, measure and maintain optimum operating conditions for this device. It is within the SPECTROMETER TUBE that the Helium tracer gas is ionized, focused, accelerated, deflected, collected and finally transformed into a visual indication on the LED BAR GRAPH DISPLAY.

The SPECTROMETER TUBE may be divided into three major sections, each performing a distinct function and yet all contributing towards the detection of small quantities of Helium. These three sections are:

1.2 Ion Source

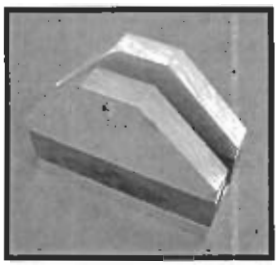


P/N: 651-132

When the gas sample from the object under test enters the mass SPECTROMETER TUBE, it first passes into the source region where the gas is subjected to a beam of electrons. The electron beam is produced from a coated thoria iridium filament, which is heated by passing an electric current through it. As the electron beam bombards the incoming gas sample, electrons, which collide with the gas molecules, cause them to become ionized.

These positive ions are collimated and accelerated out of the source assembly into a conical shaped beam. Since gas entering the tube consists of several element constituents, so will the ion beam contain several kinds of ions, such as nitrogen, oxygen, hydrogen, carbon dioxide and if a leak is encountered, Helium.

1.3 Magnet



P/N: 751-104

A 90 degree fixed magnet, which is mounted external to the vacuum system, separates the Helium ions from all other ions in the beam.

The effect of the magnetic field is to deflect the path of the positive ions. The degree of deflection is determined by the weight of the particles. Therefore, the ion beam, which contains several types of different mass ions, will be segregated into a spectrum of separate beams, each of which contains only ions of the same mass. Heavy ions, such as nitrogen and oxygen are deflected less than other lighter ions, such as hydrogen.

NOTE: "S" STAMPED ON THE FIXED MAGNET INDICATES SOUTH POLE MOUNT TOWARDS SPECTUBE HI-VAC FLANGE.

1.4 Collector and Amplifier



P/N: 651-302

The deflected Helium ions, upon their exit from the magnetic field travel into the collector region of the SPECTROMETER TUBE. Here, the ions strike the target, or collector plate, and give up their charge. The collector plate is connected to the input of a high gain amplifier module, which is located within the SPECTROMETER TUBE. The amplified signal is proportional to the size of the leak in the object being tested. The signal generated from the amplifier module is a voltage which is filtered and scaled to ± 10 VDC. The LED BAR GRAPH is driven by this voltage through an analog to digital converter. The MD-390S is designed so that the system displays the actual leak rate of the product under test.

1.5 Vacuum Pumps

Two vacuum pumps are provided which work in conjunction to reduce the pressure in the system to a value of 10^{-6} Torr.
The MD-390S LEAK DETECTOR model uses the turbo molecular pump model TPH062 (VIC#353-691-1004) and the mechanical pump model PKD41020 (VIC#312-191-1024).
The MD-391S LEAK DETECTOR model uses the turbo molecular pump model TMH-071 (VIC#353-691-1007) and the mechanical pump model PKD41020 (VIC#312-191-1024).
The MD-391SD LEAK DETECTOR model uses the turbo molecular pump model TMH-071 (VIC#353-691-1007) and the diaphragm pump model PKT05043 (VIC#312-191-1063).

1.6 Forepump

The forepump in the MD-390S and MD-391S is a 1.5 CFM two stage rotary vane pump capable of reducing the pressure in the vacuum system to about one (1) micron of Hg or 10^{-3} Torr (0.0000013 Atm.). In operation, an eccentric oil sealed rotor physically sweeps the gas out of the system. The forepump's secondary vacuum stage is utilized to draw a vacuum through the gas handling system.

Since the pump is oil sealed, a weekly check should be made to insure the pump contains adequate oil level. The pump is fitted with an exhaust mist eliminator, which traps the venting oil vapors, thereby preventing the vapors from depositing on the vacuum system and other mechanical components. The filter should be checked for saturation periodically.

The forepump in the MD-391SD is a diaphragm pump capable of reducing the pressure in the vacuum system to about 5 Torr. This pump has a completely oil free operation; this in conjunction with the extremely quiet, noise level (approx. 52dB (A)), makes for an environmentally friendly pump.

1.7 Turbomolecular Pump

Since the vacuum produced by the forepump is not sufficient for proper operation of the mass SPECTROMETER TUBE, a turbo molecular pump is also employed. Model #TPH062 (VIC#353-691-1004) of the turbo molecular pump is used for MD-390S and for MD-391S and the Model #TMH-071 (VIC#353-691-1007) is used for MD-391SD. The turbo pump is a turbine type pump and when used in conjunction with the forepump is capable of reducing the pressure to about 10^{-9} Torr (0.00000000013 Atm.).

The Turbomolecular pump uses an axial blade turbine that compresses gas by momentum transfer from high-speed rotation. The pump has a rotor capable of rotational speeds to 90,000 rpm consisting of a number of slotted disks. These disks are interlaced with stator disks whose slots are diametrically opposed. The relative velocity between the rotor and the stator forces gas molecules from the inlet to exhaust port, The forepump will exhaust the gas to atmosphere.

If the foreline pressure should exceed 500 microns, the turbo pumping action will be greatly reduced and proper high vacuum pressures will not be achieved. When the turbo pump is shutdown, there is a possibility of hydrocarbons building up on the blade sections, either because of pressure equalization between the fore vacuum and high vacuum side, or by molecule migration. This contamination is eliminated when the turbo pump is vented.

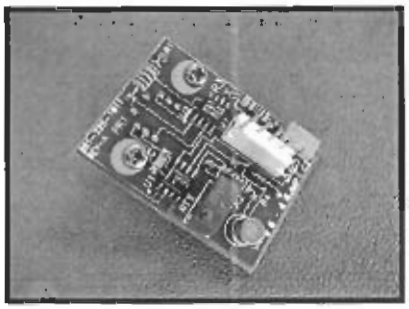
1.8 Turbo Pump Power Supply Module for Md-390S only

The electronic drive module, controls and monitors the turbo pump. The electronic drive unit has two LED displays, yellow and green. The yellow LED indicates that the turbo pump is accelerating, the green LED indicates that the turbo speed is greater than or equal to 50% of its rated speed. When the turbo speed achieves 50% of its rated speed, the yellow LED extinguishes and the green LED illuminates. In standard operation, the green LED should always be on.

1.8A Turbo Pump Power Supply Module for Md-391S and MD-391SD.

The electronic drive module, controls and monitors the turbo pump. The electronic drive unit has two LED displays, yellow and green. The yellow LED indicates that the heater for the turbo pump is on, the green LED indicates that the turbo speed is running. The speed of the Turbo Pump is a preset factory value of 45%. In standard operation, the green LED should always be on.

1.9 Ballast Pressure Sensor



P/N: 584-335

This sensor, located on the manifold, monitors the pressure within the manifold. Sensor operation is performed on the BALLAST BOARD ASSEMBLY utilizing a pressure transducer. This sensor detects changes in sniffer probe gas flow and compares it to an operator programmed setpoint. If the probe becomes clogged or if the pump operation changes, the sensor will detect this and display an audio/ visual alarm if the BALLAST PRESSURE SETPOINT is exceeded. Reference page #6 for the list of drawings.

1.10 Gas Sampling System

The LEAK DETECTOR system utilize a unique gas sampling system, which by design greatly enhances the ability of the operation to quickly pinpoint leak location. These systems consist of a vacuum regulator, fixed orifice, and sniffer probe transport system. The secondary stage vacuum produce by the forepump is utilized to draw the gas sample from the probe to the fixed orifice. As the sample enters the orifice any Helium present in the sample passes through and is detected by the mass SPECTROMETER TUBE.

1.11 Fixed Orifice

The orifice allows the mass spectrometer LEAK DETECTOR high vacuum system to remain at proper working pressure (1×10^{-5} Torr) for high sensitivity while atmospheric pressure is present at the sniffer probe side. The secondary stage of the forepump is utilized to draw the sample from the probe to the orifice.

1.12 Sniffer Probe Transport System

The sniffer probe sample transport system operates in the laminar flow range. The approximately flow through the probe is 200 cc/min. The stream line motion flow through the sniffer allows greater Helium sampling coupled with fast Helium response into the mass SPECTROMETER TUBE (a response time of less than 0.5 seconds).

1.13 Probe Valve

The probe valve is a solenoid operated valve, which exposes the sniffer port to the fixed orifice. This is a NORMALLY OPEN valve, which exposes the gas sample from the test object into the high vacuum system, through the fixed orifice.

1.14 Helium Leak Standard (P/N 752-150)

A standard VIC Calibrated Gas Leak is mounted inside the unit. It is connected directly to an external port and used for system calibration.

A daily calibration check should be performed. A calibration maintains the relative SPECTROMETER TUBE sensitivity to Helium.

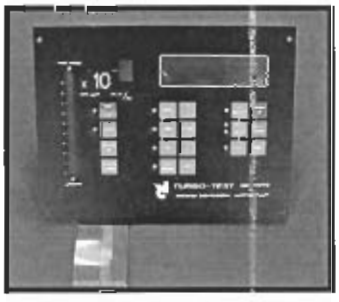
See section 1.16.4 for calibration procedure.

1.15 System Cycling Description

In normal operation, the high vacuum section of the system is maintained at a pressure of approximately 1×10^{-6} Torr by the combined pumping action of the turbo and Forepump. To test a product, it must be backfilled or pressurized with Helium. The product is then checked for a possible leak. The operator utilizes the sniffer probe to probe the product's seams, joints, and other areas that are in question or have the possibility of leaking. Leak test sniffing should be done at a rate of 1" per second.

As the gas samples pass through the sniffer transport system and into the high vacuum section the scaled leak rate is displayed proportionally to the signal detected by the mass spectrometer.

1.16 Console Control Panel



P/N:656-120

The console control incorporates the following controls and indicators:

1.16.1 START UP Key

Green key located on the control panel. Once the Start-Up key has been pressed the unit will begin an automatic start-up sequence, by first turning on the forepump and then begin to accelerate the turbo pump to 66% (for the MD-390S only) at which point the filaments will go on. In the case of the MD-391S and MD-391SD the speed is 45%. This key will only be used if unit is shutdown.

1.16.2 SHUT DOWN Key

The system will automatically go into a shutdown routine when this key is pressed. The routine consists of de-energizing the PROBE VALVE, the SPECTROMETER TUBE filaments, the forepump and the turbo pump. Pressing this key is the best way of disabling the system to prepare it for power down.

1.16.3 FIL ON/ OFF Key

When pressed, the associated LED illuminates to indicate that a filament is ON, A or B. If this LED is blinking, it is an indication that the current filament is non-operational, the probe is blocked, there is a gain error or the unit is in standby. The operator can switch to the alternate filament using the FIL A or FIL B key. The filament is slow started to prevent excessive heating. This key function can be locked out using the LOCKOUT KEY (see section 1.16.15 for LOCKOUT KEY explanation).

Turning the filaments on or switching the filaments will RAMP the filament current up from zero amps. The filament current will not exceed the FIL. CURRENT LIMIT setpoint. The display will indicate when the filament current is ramping up. This value can be set though Menu #1 and viewed for actual measurement through Menu #2

NOTE: WITHOUT THE SPECTROMETER TUBE FILAMENT OPERATING, NO HELIUM DETECTION IS CAPABLE.

1.16.4 CAL Key

The calibration procedure guides the operator through a series of steps. To start a calibration cycle, the machine must be in the TEST MODE and the filaments must be ON. Pressing the CAL. key will prompt the operator to clear the PROBE, by turning it away from the possible leaks. A second press automatically performs an AUTO ZERO FUNCTION (see section 1.16.14) and prompts the user to insert the probe into the calibrated leak. Another key press displays the CALIBRATED LEAK setpoint and then does an AUTO CAL. In this AUTOCAL, the system automatically adjusts the gain output so the leak rate is equal to the value pre programmed in as the leak standard. The CALIBRATION SETPOINT can be changed in MENU #2. This setpoint must be equal to the leak standard that the calibration is being preformed to. This because if the setpoint is higher than the calibrated leak the system will be oversensitive, and if the setpoint is lower, it will be undersensitive, therefore not allowing the system to detect the proper size leak.
This key function can be locked out using the LOCKOUT KEY.

1.16.5 FIL A/ FIL B Key

When pressed, the selected filament is turned ON and the corresponding LED indicator is illuminated. The current is ramped up to prevent heat damage to the filament due to surging.

This key function can be locked out using the LOCKOUT KEY.

Turning the filaments on or switching the filaments will RAMP the filament current up from zero amps. The filament current will not exceed 4 amps. The display will indicate when the filament current is ramping up. The filament current limit is set to 4 amps maximum, with a nominal value of approximately 2.5 amps.

NOTE:

ONLY ONE FILAMENT IS ENERGIZED AT ANY ONE TIME. WHENEVER A FILAMENT IS CHANGED, AN AUTO CALIBRATION SHOULD BE DONE TO COMPENSATE FOR POSSIBLE DIFFERENCES IN FILAMENT SENSITIVITIES.

1.16.6 STBY Key

The STBY key is used to place the unit in an inactive mode. The filaments are turned OFF, the display blanked, the probe valve is closed and the TEST/ STOP LED will blink at a slow rate. This mode is used for idle periods of 2 hours or more, where a quick restart is required. This mode is also ideal for an overnight period. Pressing any key again will return the unit to the TEST or STOP MODE.

1.16.7 MENU Key

When pressed, the MENU LED will illuminate indicating access to the following functions:

MENU #1, SENSITIVITY: Permits access to changing of EMISSION, GAIN and MANUAL TUNING parameters to vary the unit sensitivity. See page #51 for functional diagram.

EMISSION: When accessed, the electron emission can be adjusted using the UP and DOWN arrow keys. Increasing the emission will increase the sensitivity due to higher amounts of ionized gas. Ideally, the emission should be between 0.5 to 2.0 milliamps.

MANUAL TUNE: When accessed, the tune voltage can be adjusted using the UP and DOWN arrow keys, this can be done while sampling the internal gas leak. The ideal tune voltage is reached when maximum deflection is observed on the bar graph.

GAIN: When accessed, the system gain can be adjusted using the UP and DOWN arrow keys. With the probe sensing the CALIBRATED LEAK PORT, observe the LED BAR GRAPH while adjusting to obtain the CALIBRATED LEAK VALUE. This function is normally done automatically when the CAL function is performed.

MENU #2, SYSTEM SETUP: This menu allows the following items to be set. See page #52 for functional diagram

PROBE BLOCKED PRESSURE: The probe blocked pressure is the setpoint at which a probe blocked fault will be indicated. When the probe is blocked, the flow decreases, causing a decrease in ballast pressure. This can occur if either of the (2) probe filters become clogged.

To set the threshold (system should be in TEST MODE) view the BALLAST PRESSURE within the DIAG MENU. Set the PROBE BLOCKED PRESS. setpoint within the MENU #2 approximately 50 Torr below the indicated pressure.

Example:

If the unblocked ballast pressure is 200 Torr, set the threshold to 150 Torr. To test, place a finger over probe tip to block the flow. Fault indication should be displayed when the actual pressure reaches the setpoint value.

SETPOINTS ON/OFF: At this menu selection, use the ENTER key to enable or disable setpoints function. No rejection prompts (REJ#1 or REJ#2) will be displayed when this function is disabled.

SP#1 AND SP#2: At this menu selection, use the ENTER and ARROW keys to change these values. Insure that the key lockout is disabled. Pressing the enter key stores the current digit value and scrolls the cursor to the next digit.

CALIBRATED LEAK: At this menu selection, use the ENTER and ARROW keys to change the CALIBRATED LEAK VALUE. The entered value must match the CALIBRATED LEAK VALUE for proper system calibration. When calibrating the gain will automatically be adjusted so the display reads the programmed value (limits are between 50-200).

LEAK RATE DISP.ON/OFF: At this menu selection, use the ENTER key to toggle the display on and off. When OFF, the only indication of leak rate will be the LED BAR GRAPH. When ON, the digital leak rate is displayed in the center of the alphanumeric display.

PRINT MODE: **(OPTIONAL)** At this menu selection, use the ENTER key to toggle the PRINT MODE function between OFF, LOG and LABEL. In OFF mode, no printing will occur. In LOG mode, print information will be sent to a printer parallel port as testing occurs. In LABEL mode, print information will be sent to a printer parallel port to print on tractor feed labels 3-1/2" W x 15/16" H as testing occurs.

ANALOG OUTPUT: **(OPTIONAL)** At this menu selection, the exponent of the leak rate range can be changed to correspond with the LEAK RATE METER by pressing the UP or DOWN arrow keys. The meter number values correspond to the LED BAR GRAPH numeric increments of 1 - 10. For example, if this value is changed to 4 the LEAK RATE METER will display values in the 10^{-4} range.

AUDIO MODE SELECTION: Two audio modes are available. Use the "Enter" key to select mode 1 or mode 2.

MODE 1
A continuous tone is sounded as soon as the reject setpoint #1 is exceeded. Pitch is directly proportional to leak rate value.

MODE 2
A continuous tone is sounded corresponding directly to the LED BARGRAPH. The lowest audio tone corresponds to the zero (0) value of the range. Pitch is directly proportional to leak rate value. If the AutoRange feature is enabled, the pitch varies exactly for each new decade.

SELECT UNITS: The units used for the setpoint values can be changed between GM/YR, CC/SEC and OZ/YR. Use the Enter key to choose the desired units display. Factory defaults is CC/SEC.

RECALIBRATE ALARM: At this menu selection, use the arrow keys to set the RECALIBRATE WATCHDOG ALARM. This alarm is used to prompt the operator to auto-calibrate. The alarm timer can be set from 1 to 99 hours. To disable, set the timer to less than 1 hour.

TURBO TYPE: Two turbo types are available to insure compatibility with all units. For proper start up and operation the TURBO TYPE parameter must match the type of turbo install.

TYPE1	TMH 071 turbo
TYPE2	TPH 062 turbo

This parameter must be checked when installing a CPU board or program. New units will have the correct type selected. The turbo model number is listed on the specification tag on the turbo body.

MENU #3, OPTIONS: The following options can be checked for their current status, ENABLED or DISABLED and the program revision can also be viewed. An option is enabled only if it is present in the program. If disabled, it is not present in the program.

COMMUNICATION: Displays the COMMUNICATION OPTION status.

LEAK RATE ANALOG OUT: Displays the LEAK RATE ANALOG OPTION signal status.

REMOTE I/O: Displays the REMOTE I/O OPTION status.

PROGRAM VERSION: Displays the PROGRAM VERSION name.

MENU #4, RESET HOURS: The accumulated hours for the following components can be reset by pressing the ENTER key at each sub-menu selection. The components are, in order, TURBO PUMP, FILAMENT-A, FILAMENT-B and the FOREPUMP.

These functions can be locked out using the LOCKOUT KEY.

1.16.8 DIAG Key

When pressed, the DIAG LED will illuminate indicating access to the following system parameters (this is used for diagnostics only, no adjustments allowed):

TURBO PUMP, FOREPUMP RUNNING HOURS

FILAMENTS A & B RUNNING HOURS

TUNE, STF, A PLATE, C PLATE

EMISSION, FILAMENT CURRENT

FILAMENT A AND B GAIN

GAIN FOR FILAMENT A AND B FILAMENT

BALLAST PRESSURE, SETPOINT

COLLECTOR, S-PLATE VOLTAGE

TURBO SPEED, BOARD TEMPERATURE

1.16.9 VOL Key

When pressed, this key will allow changing of the audio alarm volume. To disable, press the VOL key twice. The audio alarm can be turned ON or OFF. The volume level of the audio alarm can be adjusted using the UP and DOWN keys to a comfortable listening level.

1.16.10 AUTO RANGE Key

When pressed, this key toggles auto range function ON or OFF. Auto range is enabled when the led is illuminated. Auto range automatically selects the correct sensitivity decade for the leak display. If a large leak is sniffed the display down ranges to a low sensitivity scale. For small leaks, the most sensitive scale is automatically selected.

There are two methods of choosing a leak rate range, manual or auto.

a) Use the RANGE UP or RANGE DOWN key to adjust the display sensitivity setting. Test Range is 10^{-6} to 10^{-3} Atm-cc/sec.

b) Press the AUTO RANGE key to enable the AUTO RANGE function. The AutoRange LED will illuminate, indicating that the AUTO RANGE function is enabled. To disable the AUTO RANGE function, press the AUTO RANGE key again.

1.16.11 Arrow up Key

This key is used in conjunction with the other function keys to increment a display value.

1.16.12 Arrow down Key

This key is used in conjunction with the other function keys to decrement a display value.

1.16.13 TEST/ STOP Key

When pressed, this key toggles the probe valve to open and close, prompting the TEST and STOP mode respectively. The TEST mode is the normal operation mode and will illuminate the LED. The STOP function will terminate the TEST mode, disable the LED.

1.16.14 ZERO Key

The zero key is utilized to zero out ambient Helium. The led will blink indicating auto zero.

a) To Auto Zero, press the Zero key.

b) To manually zero the display press the UP ARROW or DOWN ARROW key then press the ZERO key at the same time, and hold. This will place the system leak rate level at the exact value it is left in.

1.16.15 LOCKOUT KEY

This key is located on the bottom half of the front display of the MD-390 series units. It allows the operator to lock all options that are adjustable through the menus as well as the calibration function and the turning ON/OFF of the filaments.

1.17 DISPLAYS AND FUNCTIONS

1.17.1 Alphanumeric Display

The display is a user-friendly alphanumeric display (AN) that prompts the users through all system operations. Display format is 2 x 20 characters. The following prompts will appear on the bottom half of the display.

FAULT: COLLECTOR SATURATED:	The collector voltage is at maximum full-scale range of -10.00 VDC.
FAULT: FIL. CURRENT:	The filament is ON and the filament current is less than 1 amp indicating a malfunctioning filament.
FILAMENTS OFF:	The filaments are OFF and unit is in TEST MODE.
FAULT: A-PLATE VOLTAGE:	The A-PLATE input voltage is more than 5% out of tolerance with the A-PLATE output voltage.
FAULT: STF VOLTAGE:	The STF input voltage is more than 5% out of tolerance with the STF output voltage.
FAULT: TUNE VOLTAGE:	The TUNE input voltage is more than 5% out of tolerance with the TUNE output voltage.
FAULT: S PLATE VOLTAGE:	The S-PLATE VOLTAGE is greater than 250 VDC or less than 150 VDC.

FAULT: C PLATE VOLTAGE:	The C-PLATE VOLTAGE is greater than 200 VDC or less than 100 VDC. The nominal C-PLATE voltage is 150 VDC.
FAULT: EMISSION CURRENT:	The measured current does not match the expected output current.
FAULT: BALLAST TXDER:	The ballast pressure transducer is disconnected or malfunctioning. This fault is only displayed in the TEST mode.
FAULT: GAIN ERROR:	The gain factor derived from a calibration is out of system tolerance. The faulty gain error is above 200 or below 50.
FAULT: PROBE BLOCKED:	The ballast pressure is below the PROBE BLOCKED SETPOINT. This fault is only displayed in the TEST mode.
FAULT: TURBO SPEED:	The turbo speed is below 50% and the system is in TEST mode.
FAULT: BOARD TEMP:	The board temperature is greater then 125° F.
FAULT: COLLECTOR WATCHDOG:	The collector voltage did not zero out to +10.00 VDC during startup.
FAULT: PUMPDOWN TIMEOUT:	The TURBO PUMP speed did not reach 60% after three minutes of startup.

1.17.2 Set Point Function

The Set Point menu function allows the user to establish two (2) threshold data points for leak rate detection. These are ideal for go/no-go testing applications. This function is available from the MENU #2.

Reject status is indicated on the top half of the display. REJ#1 appears in the left corner if the leak rate exceeds setpoint #1. REJ#2 appears in the right corner if the leak rate exceeds setpoint #2. Both setpoints can be changed in MENU #2, SYSTEM SETUP.

SECTION 2.0 OPTIONAL EQUIPMENT

2.1 Portable Cart

This ruggedly designed unit accommodates the MD-390 series of leak detectors for comfortable use. Large 8" pneumatic wheels provide easy movement over rough surfaces. It includes a size #4 Helium cylinder holder, outlet power strip, and deep storage drawer for manuals, gas leaks, etc. **V.I.C. PART NUMBER: 918-163.**

2.2 External Calibrated Gas Leak

Glass and metal orifice leaks are calibrated to specifically match your products reject point. Used as an added check, towards the machines performance, and as a master reject leak standard for your product. (i.e. 1.8 x 10-5 Atm-cc/sec) **V.I.C. PART NUMBER: 922-500.**

2.3 Options

Remote Box option: This option provides a method of some basic monitor and control of the unit using a hand held remote box. The remote box is connected to the REMOTE BOX rear panel port using the fifteen (15) ft. industrial coiled cord. This option is convenient for monitor and control of the unit from the rear or a few feet away. The remote box contains the following controls and indicators:

ILLUMINATED LED BAR GRAPH and EXPONENT

TEST/ STOP KEY/ LED

ZERO KEY/ LED

RANGE UP/ KEY/ LED

RANGE DOWN KEY

V.I.C. PART NUMBER: 918-301

Remote I/O option: This option provides some basic input/ output signals for automatic control of the unit by a Programmable Logic Controller. This option has two (2) configurations, AC and DC.

V.I.C. PART NUMBERS: 918-402, AC--918-405, DC

The OUTPUTS are SET POINT #1 and 2, READY SIGNAL, IN TEST SIGNAL and FILAMENT ON SIGNAL. The INPUT signal is AUTO ZERO which, is an active high input.

Analog output option: This option provides an analog output of the leak rate using the ANALOG rear panel port to interface to an external meter or Programmable Logic Controller.

V.I.C. PART NUMBER: 918-403

Communication option: This option provides complete remote monitor and control of the unit using the RS232 rear port and a standard RS-232 serial interface to a remote ASCII terminal. See APPENDIX 1., COMMUNICATION OPTION in this manual for a complete explanation.

V.I.C. PART NUMBER: 918-401

2.4 Carrying Case

This case has been specially designed for repeated shipping of the MD-390 series LEAK DETECTORS. It protects the unit and accessories during transportation. **V.I.C. PART NUMBER: 918-166.**

2.5 Helium Charging Stations

These units can be configured to fit a range of Helium charging requirements. Vacuum Instrument Corp., also offers complete test booth setups incorporating fixturing, fittings, Helium gas charging and recovery.

SECTION 3.0 PORTABLE HELIUM LEAK DETECTOR UNIT SPECIFICATIONS.

3.1 Performance

Sensitivity: Smallest detectable Helium leak rate 2.5 x 10^{-7} Atm-cc Helium (Atmospheric sniffer mode).

Response Time: Approximately 0.5 second using the fast response Hyper-Probe system.

Leak Rate Range: 10^{-2} to 10^{-7} Atm-cc/sec direct reading of Helium leak rate.

Start-Up Time: Less than 3 minutes.

3.2 Spectrometer Tube

Miniaturized 90-deg deflection, fixed magnet design. All stainless steel construction. NW-40 flange for high vacuum connection. Utilizes two (2) non-burnout thoria coated iridium filaments.

3.3 Vacuum System

Forepump: Built-in direct drive 1.5 CFM forepump/ roughing pump for MD390S and MD391S, And a diaphragm pump for MD391SD leak detector

High Vacuum Pump: 30 liter/second air cooled Turbomolecular pump.

Inlet System: Interstage design incorporating integral mass separator high flow atmospheric inlet. Standard sniffer probe hose length 10'. Optional 30' hose available.

Pressure Measurement: Manifold Pressure Sensor Assembly.

3.4 Electrical

Console: Microprocessor-based electronics, incorporating 40 character alphanumeric prompting display. Fully automatic operation including start-up, shutdown, leak rate ranging, zero control, and diagnostics including runtime, and operating parameters.

Optional Remote Operation Box: Contains 40 segment leak rate indicator and operator function controls. A 15' coiled cord is supplied. Longer lengths available on request.

3.5 Power Requirements

Power Requirements: 115 volts, 60 hertz, 6 amps. (Other voltages available on request)

Fuse Listing:

SIZE/ TYPE	RATING	LOCATION	PURPOSE
3/4" Inline Buss type	1 AMP	CENTER SUPPORT BRACKET	Circuit Boards
3/4" Inline Buss type	10 AMP	CPU BOARD	Forepump
Push/reset type breaker	6 AMP	REAR PANEL	Forepump
3/4" Inline Buss type	1 AMP	CPU BOARD	Valve control
3/4" Inline Buss type	1 AMP	CONTROL BOARD	All circuitry
3/4" Inline Buss type	2.5 AMP	TURBO POWER SUPPLY	TURBO PUMP
3/4" Inline Buss type	0.2 AMP	TURBO POWER SUPPLY	TURBO PUMP

SECTION 4.0 INSTALLATION AND OPERATION

4.1 Installation of the mechanical pump MD391SD **(DRY)**

4.1.1 The Diaphragm pump used in the MD391SD **does not** require any oil for operation, the pump is therefore shipped without oil and is ready to begin operation.

4.1.2 Installation of mechanical pump MD390S and MD391S **(WET)**

4.1.3 Move the MD 390S/MD3901S portable Helium Leak Detector to its installation site.

4.1.4 Locate the (3) screws on each side of the unit cover and one on the back of the unit. Back out these seven (7) screws until the cover disengages.

4.1.5 Lift the cover up and place it on the side. Tilt the back panel out to a comfortable position.

4.1.6 Verify that the pump drain screw located on the lower center of the mechanical pump housing is installed.

4.1.7 Remove the NW-16 clamp connecting the Z exhaust pipe to the exhaust flange. Remove the mist eliminator and seal ring.

4.1.8 Remove the exhaust flange from the pump housing using pliers on the flange neck. **DO NOT USE PLIERS ON THE FLANGE SEALING SURFACE.**

4.1.9 Fill the pump with fresh P3 fluid supplied, at the exhaust port to the marked indicated on the sight glass.

NOTE: FOR FURTHER PUMP SPECIFICATIONS REFER TO THE PUMP MANUAL. FOR MAINTENANCE REFER TO SECTION 6.0 MAINTENANCE.

4.1.10 Clean any oil spilled over from the pump.

4.1.11 Verify that the fore pump switch located at the center of the pump has been set to the ON position. This switch is always left in the ON position.

4.1.12 Re-install the exhaust flange to the pump housing.

4.1.13 Re-install the mist eliminator, seal ring and NW -16 clamp to the exhaust flange.

4.1.14 Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the seven- (7) screws.

4.2 Uncrating

Carefully remove the MD-390 series LEAK DETECTORS from its shipping container being certain that the unit is not tipped on its side or turned upside down. The MD-390 series leak test package should contain the following items:

MD-390 series Portable Helium Leak Test Unit
V.I.C. PART NUMBER: 966-101

Sniffer Probe. (Attached to unit)
V.I.C. PART NUMBER: 912-124

Calibrated Leak Cylinder. (Internal to unit)
V.I.C. PART NUMBER: 752-150

Accessory Kit.Power Cable
Operational/Maintenance and Installation Manual
Spare Filaments
1 qt. P3 pump oil
3 sniffer probe tips

NOTE: WE RECOMMEND SAVING THE ORIGINAL SHIPPING CARTON, SO THAT IN THE EVENT THE UNIT IS TRANSPORTED IT CAN BE PACKAGED PROPERLY.

CAUTION: THE FOREPUMP IS SHIPPED WITHOUT OIL. RUNNING THE FOREPUMP WITHOUT OIL CAN RESULT IN PUMP DAMAGE.

4.3 System Start-Up

4.3.1 Insert the power cord into the back of unit, and plug into a 115 volt, 60 Hz, 6 amp supply outlet. Turn on the main power switch located on the back of the unit. The alphanumeric (AN) display will prompt the user: POWER ON PRESS "START UP".

4.3.2 If the AC power is interrupted when the unit is ready, the unit will automatically enter the start up sequence when the AC power is reapplied. Pressing the "Shut down" key, the unit will enable the shut down sequence disabling the automatic start up.

4.4 Sensitivity Check/System Tuning

4.4.1 The MD-390 series is equipped with a non-volatile memory. The memory is designed to store all SPECTROMETER TUBE operating parameters even when power has been disconnected. To check sensitivity sniff the calibrated leak. The display should indicate the value of the leak.

4.5 Comments on Leak Location

4.5.1 The direct probing of leaks to atmosphere technique is used to detect leaks in objects, which have been backfilled and pressurized with Helium tracer gas.

4.5.2 The operator holds the sniffer probe perpendicular to the test object. In operation, as the probe tip is drawn over the exterior of the test object, it samples the atmosphere adjacent to the test object surface. Helium escaping from a leak, will be drawn into the probe tip and pass into the LEAK DETECTOR through the connecting tubing where it becomes visually evident on the leak rate meter.

4.5.3 When probing products for general leakage location, always start leak probing from the lowest point on the product and proceed systematically to the highest point. This will prevent an unusual reading if a large leak is present at the lowest point and rises up. Probe at a rate of (1) one inch per second.

Example: Suppose the leakage area is a welded seam running around a vertical pipe. Holding the probe perpendicular to the surface of the pipe and moving slowly around the pipe weld will effectively locate the leakage point. When a leakage point is discovered, the area of leakage will be indicated by the largest rise in the leak rate meter.

SECTION 5.0 SHUTDOWN

5.1 Temporary/Overnight Shut-Down (Stand By Mode)

5.1.1 The MD-390 series is equipped with a standby mode of operation. This mode is primarily designed to be used when the LEAK DETECTOR is not utilized for extended periods of time. To place the unit into this mode, press the 'STBY' key. Pressing the "Start up" will return the system to the operational start-up routine. See page #13 for "STBY" key details.

5.2 Complete Shut Down of System

5.2.1 Press the 'shut down' key. The system will automatically go into a shutdown routine. The routine will consist of de-energizing all system valves and turning off the SPECTROMETER TUBE filaments.

5.2.2 After approximately 5 minutes or when the turbo speed has been reduced below 10%, the prompt "POWER ON PRESS START UP" will be displayed. Turn off power at the rear of the LEAK DETECTOR. The MD-390S can now be stored or transported.

NOTE: DO NOT MOVE THE UNIT UNTIL THE TURBO HAS DROPPED BELOW 10% OF OPERATING SPEED TO AVOID TURBO BEARING DAMAGE.

SECTION 6.0 MAINTENANCE

6.1 Maintenance Schedule

Sensitivity Check:	Daily
Check oil level in Forepump (for MD390S & MD391S **ONLY**):	Daily
Change oil in Forepump(for MD390S & MD391S **ONLY**):	3 months (3000 hrs)
Change filaments:	As required
Change oil wick assembly in turbo pump:	Annually (or 6000hrs)
Change bearing in Turbomolecular pump:	Every two years
Leak standard calibrated	yearly
Complete inlet manifold replaced	yearly

6.2 Indications of a Contaminated Vacuum System

6.2.1 Background/Leaks

"Internal Background" is an indication that the system may be leaking. To determine if a high Internal Background is present, do the following:

6.2.1 Press the unit "stop" key then turn the filaments off.

6.2.2 Perform an Auto zero function then turn the filaments on.

6.2.3 An internal reading of greater than $7x10^{-6}$ indicates high background with the "stop" key active.

6.2.4 In the Non Sniffing Mode, spray the inlet manifold and associated plumbing with Helium to check for leaks.

6.3 General Remarks on Cleaning Procedures

6.3.1 Vacuum System

In the event the vacuum system and/or SPECTROMETER TUBE becomes contaminated by high vapor pressure materials not easily removed by pumping and mild baking, it is necessary to disassemble and clean all component parts affected.

Many organizations have established cleaning procedures for vacuum apparatus such as electron tube parts, test chambers, etc. These methods will normally be appropriate for cleaning the mass spectrometer and system. Where cleaning procedures have not been established, the following remarks should prove useful to personnel not acquainted with the problems involved.

The specific processes used in cleaning will vary according to the material to be cleaned, nature of contaminant, facilities available and the degree of cleanliness desired. In general, the materials to be cleaned will vary from stainless tubing, to O-rings. Internal surfaces that can be reached with clean cloth swabs should be physically swabbed out, using a minimum of degreasing solvent on the swab. Internal portions of the system that cannot be reached must be flushed with enough solvent to allow all surfaces to be wet, and as much physical action employed (shaking and sloshing) as practical. See section 6.3.3 for solvent types.

6.3.2 Gaskets

Synthetic rubber O-Rings (usually Buna N) are susceptible to absorbing large quantities of the solvents used in cleaning. The subsequent evaporation of these solvents when a system is evacuated must be avoided, therefore, O-Rings and gaskets should be removed from the flange grooves and treated as a separate cleaning problem. O-Rings and gaskets are either replaced at the time of reassemble (and this is recommended), or carefully wiped clean with a lint-free material and inspected for surface damage of any kind before they are used again. New O-Rings should be treated in the same manner as used ones.

Never remove O-Rings with a metal tool, as this will invariably scratch the O-Ring groove, causing a potential, if not actual, leak. Use plastic (e.g., corner of a plastic badge, etc.) or wood (e.g., toothpick), and remove O-Ring by inserting tool between outside of O-Ring groove and sliding around O-Ring. This will cause the O-Ring to "pop-up" (O-Ring may have to be held on opposite side to prevent turning in groove), and generally, gives better results than trying to pry the O-Ring from the groove.

6.3.3 Solvents

The solvents referred to are 99% isoproponol alcohol, trichloroethylene, acetone, or methanol alcohol. Trichloroethylene is used where deposits of grease and oil are to be removed. Acetone is preferred over trichloroethylene although precautions must be taken in either case. The inhalation of these vapors must be avoided, particularly in the case of trichloroethylene, and the flammable nature of the solvent presents an added hazard in the case of acetone.

Other cleaning agents such as soaps, alkali cleansers and synthetic detergents may be used as first-step cleaners provided complete facilities for thorough rinsing with hot distilled water are available.

6.3.4 Fore-pump

The Forepump, a mechanical type pump for the MD-390S and MD-391S only, employs oil for lubrication. Mechanical type pumps often become contaminated with small amounts of water vapors. The recommended cleaning procedure is to run the pump long enough to allow it to reach normal operating temperature, stop the pump, vent the intake line and drain the oil. Flush the pump by closing the drain, adding some more oil, running the pump for a few minutes and draining again. Replace the drain plug and place the recommended amount of oil in the pump. If subsequent operation indicates that the pump is still contaminated, repeat the oil change.
In the diaphragm type pump, for MD-391SD, assure that the pump's motor cannot be switched on before beginning to do any maintenance on the pump. Before dismantling, allow the pump to cool down. Only dismantle the pump as far as it is necessary to effect repairs.
See section 6.6.4, for maintenance procedure, for the mechanical type pump, and section 6.6.4A for the diaphragm pump.

NOTE: DO NOT ATTEMPT TO CLEAN THE ANY OF THE FOREPUMPS WITH SOLVENTS.

6.4 Maintenance of the Vacuum System

A foremost basic requirement of the MD-390 series Mass Spectrometer operation is system cleanliness. The internal surface of the entire vacuum system should be maintained physically, chemically clean, and as free as possible of gas emitting contaminants. Therefore, when repairing or maintaining components of the vacuum system, the utmost care should be exercised to prevent the entry of contaminating substances (oils, grease, lint, dirt, etc.) into the vacuum system. Washable parts generally may be cleansed in a suitable chlorinated solvent. Parts should be given a final rinse in clean solvent, and heat dried. See section 6.6.4 for maintenance procedures (in the case of the MD-390S or MD-391S) or see section 6.6.4A (in the case of the MD-391SD).

6.5 MASS SPECTROMETER TUBE

6.5.1 Source Removal/Installation for Filament Plate Replacement

Required tools: 3/16" Nut Driver

7/64" Hex Key Wrench

1/8" Blade Screwdriver

NOTE: SOURCE ASSEMBLY MAY BE RETURNED TO THE FACTORY FOR COMPLETE CLEANING AND FILAMENT REPLACEMENT.

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Remove the electrical octal connectors from the source and collector assemblies. Pull OUT on the source connector and DOWN on the collector connector.

f) Unscrew the wing nut on the NW-40 quick disconnect clamp mating the SPECTROMETER TUBE to the Turbo pump, and be certain to hold SPECTROMETER TUBE firmly to avoid dropping.

g) Place the SPECTROMETER TUBE in a clean area for repair. Place the NW-40 clamp and seal in a clean place.

h) Remove the three 6-32 hex socket screws securing the source assembly to the SPECTROMETER TUBE body. The source is now free and may be removed by carefully pulling straight out of the body.

i) Make sure the source is in a clean work area where it can be disassembled without the possibility of contamination from dirt or oils.

j) Remove sealing O-Ring from source flange.

k) The source contains a pair of thoria-coated iridium filaments. Each filament is mounted on a disposable Stainless steel plate. To remove the filament plate, first remove the screw, which secures the filaments electrical connection. Then, using a 3/16" nut driver, carefully remove the 3/16" nut located near the top of the filament plate. Once this has been performed, the plate is then lifted straight out by grasping the wire pigtail.

NOTE:

WE RECOMMEND THAT BOTH FILAMENTS BE REPLACED AT THE SAME TIME. THIS WILL ENSURE THAT A SPARE NEW FILAMENT IS AVAILABLE IF NEEDED.

l) At this time, the source must be properly cleaned before the new filaments are installed. Cleaning should be accomplished by first bead-blasting each part with a FINE, DRY glass blast at a low air pressure not exceeding 35 PSI. This is then followed by blowing clean dry air over the source assembly to remove any foreign particles left over from the sand blasting procedure.

m) Install the new filament plates following the reverse order of procedure 7.1.10. Make certain all screws and nuts are securely tightened.

n) Lightly lubricate the sealing O-Ring with high vacuum grease. Before placing O-Ring in groove, make certain

that O-Ring groove is clean. Install O-Ring.

NOTE:

IT IS RECOMMENDED THAT A NEW O-RING BE USED, CONSIDERING THE SENSITIVE NATURE OF THE MASS SPECTROMETER TUBE. SEE GENERAL PROCEDURES FOR CLEANING AND LUBRICATING ELASTOMER HIGH VACUUM SEALS.

o) Clean mating flange on SPECTROMETER TUBE and insert source into tube body. The proper orientation is to have the connector key way on the source at the 2 o'clock location, when holding the SPECTROMETER TUBE assembly with the vacuum manifold connection on the right side.

p) Insert the three 6-32" x 1/2" long hex socket screws securing the source assembly to the SPECTROMETER TUBE body and tighten.

NOTE:

AFTER SOURCE IS SECURED IN THE SPECTROMETER TUBE, ONE FILAMENT PLATE SHOULD BE FOUND VIEWED THROUGH THE VACUUM MANIFOLD CONNECTION.

q) Before installing SPECTROMETER TUBE, clean and lightly lubricate the NW-40 seal ring with high vacuum lubricant.

r) Re-connect the flange to the vacuum manifold connection using NW-40 clamp. Tighten by hand only, do not use tools.

s) Re-connect the octal electrical connections to source and collector assemblies.

t) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six (6) screws.

u) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.5.2 Collector Removal/Installation

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Remove the electrical octal connectors from the source and collector assemblies. Pull OUT on the source connector and DOWN on the collector connector.

f) Unscrew the wing nut on the NW-40 quick disconnect clamp mating the SPECTROMETER TUBE to the Turbo pump, and be certain to hold SPECTROMETER TUBE firmly to avoid dropping.

g) Place the SPECTROMETER TUBE in a clean area for repair. And place the NW-40 clamp and seal in a clean place for proceeding assembly.

h) Remove the three 6-32" hex socket screws securing the collector assembly to the SPECTROMETER TUBE body.

i) Remove collector assembly from SPECTROMETER TUBE body by carefully pulling straight out of tube.

j) Replacement of the collector amplifier or any other component may now be performed in a clean work area to avoid contamination from dirt or oils.

NOTE:

THERE ARE TWO PRECISION EPOXY HIGH VALUE RESISTORS (10^{11} OHMS) MOUNTED TO THE INTERNAL COLLECTOR BOARD ASSEMBLY. DO NOT TOUCH THE EPOXY PORTION OF THE RESISTOR OR SUBJECT IT TO ANY FORM OF CONTAMINATION. OILS FROM FINGERS DEPOSITED ON THE EPOXY PORTION OF THE RESISTOR WILL CREATE A LESS ELECTRICALLY RESISTIVE PATH THAN THE RESISTOR ITSELF. SHOULD SUCH A CONDITION EXIST, SEVERE ERRATIC RESULTS WOULD BE ENCOUNTERED. IF ANY DOUBT EXISTS AS TO THE CLEANLINESS OF THE RESISTORS CAREFULLY CLEAN THE EPOXY WITH A CLOTH AND A CLEANING AGENT SUCH AS ACETONE, OR ALCOHOL.

k) Remove sealing O-Ring from flange, clean, lightly lubricate with high vacuum grease and replace in O-Ring groove.

NOTE: SEE GENERAL PROCEDURES FOR CLEANING AND LUBRICATING RUBBER HIGH VACUUM SEALS.

l) Clean mating flange on SPECTROMETER TUBE and insert collector into tube body.

NOTE:

PROPER CONNECTOR ORIENTATION IS TO HAVE THE KEY WAY ON THE COLLECTOR AT THE 5 O'CLOCK POSITION, WHILE HOLDING THE SPECTROMETER TUBE ASSEMBLY WITH THE NW-40 FLANGE FACING YOUR LEFT SIDE.

m) Insert the three 6-32" x 1/2" long hex socket screws securing the collector assembly to the SPECTROMETER TUBE body and tighten.

n) Before installing SPECTROMETER TUBE, clean and lightly lubricate the NW-40 seal ring with high vacuum grease.

o) Install seal ring and re-connect the spec tube flange to the turbo pump inlet using NW-40 clamp. Tighten clamp by hand only, do not use tools.

p) Reconnect the octal electrical connections to source and collector assemblies.

q) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six (6) screws.

r) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.5.3 Magnet Removal/Installation

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Remove the 10-32 stainless steel screw securing magnet assembly to SPECTROMETER TUBE.

f) The magnet may now be removed by grasping firmly and pulling straight up out of the mounting area.

g) When installing magnet, be certain south pole (marked with an "S") is on the same side of the SPECTROMETER TUBE as the vacuum system connection. Failure to insure this orientation will result in an inoperative SPECTROMETER TUBE.

h) Insure that magnet is firmly seated in the "V" shaped portion of the tube body and secure the magnet to the SPECTROMETER TUBE body using the 10-32 screw provided.

NOTE:

The magnet screw provided is made of either brass or stainless steel for non-magnetic properties. If lost or damaged, do not replace this screw with another which is magnetic.

i) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

j) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.5.4 Removal/Installation of Complete Spectrometer Tube

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Remove the electrical octal connectors from the source and collector assemblies. Pull OUT on the source connector and DOWN on the collector connector.

f) Unscrew the wing nut on the NW-40 quick disconnect clamp mating the SPECTROMETER TUBE to the turbo pump, and be certain to hold SPECTROMETER TUBE firmly to avoid dropping.

g) Place the old SPECTROMETER TUBE in a clean area for later repairs. Place the NW-40 clamp and seal in a clean place for proceeding assembly.

h) Before installing SPECTROMETER TUBE, clean and lightly lubricate the NW-40 seal ring with high vacuum grease.

i) Install seal ring and re-connect the spec tube flange to the turbo pump inlet using NW-40 clamp. Tighten clamp by hand only, do not use tools.

j) Re-connect the octal electrical connections to source and collector assemblies.

k) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

l) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.6 VACUUM SYSTEM MAINTENANCE

6.6.1 Turbomolecular Pump Removal/Installation

Turbo Removal

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Unscrew the wing nut on the NW-16 quick disconnect clamp mating the manifold to the turbo pump, place the wing nut, screw and clamp in a safe place for later reuse. Let the manifold hang over the side of the unit.

f) Remove the electrical octal connectors from the source and collector assemblies. Pull OUT on the source connector and DOWN on the collector connector.

g) Unscrew the wing nut on the NW-40 quick disconnect clamp mating the SPECTROMETER TUBE to the turbo pump, and be certain to hold SPECTROMETER TUBE firmly to avoid dropping.

h) Place the SPECTROMETER TUBE in a clean. Place the NW-40 clamp and seal in a clean area for proceeding assembly.

i) Locate and remove the NW-16 clamp that connects the turbo to the flex bellows. Place the NW-16 clamp and seal in a clean area for proceeding assembly.

j) Gently bend flex bellows out of way.

k) Locate, unlock, and remove turbo pump electrical connector. Lay cable along side the Forepump.

l) Firmly holding turbo with left hand, use #5/32 Allen wrench to remove (4) #10-32 S.H.C. screw from behind the turbo pump. Place screws and washers in safe area for proceeding assembly. Use supplied plugs to cover all ports on the turbo pump.

m) Place original turbo vertically at the center of the work bench.

Turbo Installation

NOTE:
PRIOR TO SEAL RING INSTALLATIONS, CLEAN SEAL RINGS AND LIGHTLY LUBRICATE USING HIGH VACUUM GREASE.

n) Remove any plugs prior to installation. Firmly holding new turbo pump with left hand, install it onto mount bracket using the (4) #10-32 S.H.C. screw.

o) Install electrical connector underneath turbo pump.

p) Install NW-16 seal ring and attach flex bellows onto bottom of turbo pump. Tighten clamp, finger tight only, do not use any tools.

q) Install NW-40 seal ring and attach SPECTROMETER TUBE onto the front of the turbo pump inlet using NW-40 clamp. Tighten clamp, finger tight only, do not use any tools.

r) Reconnect the octal electrical connections to source and collector assemblies.

s) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

t) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.6.2 Turbo Pump Oil Wick Replacement for the TPH062 model

NOTE: THE REPLACEMENT OF THE WICK SHOULD BE PERFORMED ONCE A YEAR OR MORE FREQUENTLY WHEN LONG PERIODS OF USE WITH HIGH AMBIENT TEMPERATURES OR AIR THAT HAS A HIGH PARTICULATE COUNT. THE WICK IS PRELUBRICATED WITH TL011 OIL PRIOR TO SHIPMENT. IT SHOULD NOT BE HANDLED WITHOUT GLOVES.

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Locate the LOCKING COVER at the lower back of the turbo pump. Use a 1/2" square shaft regular blade screwdriver and remove plug.

f) Use assembly tweezers and gently remove old wick from turbo pump. Dispose old wick in accordance with the valid regulations.

g) Use a lint free cloth to clean drain plug, O-Ring, and turbo pump from dirt and debris.

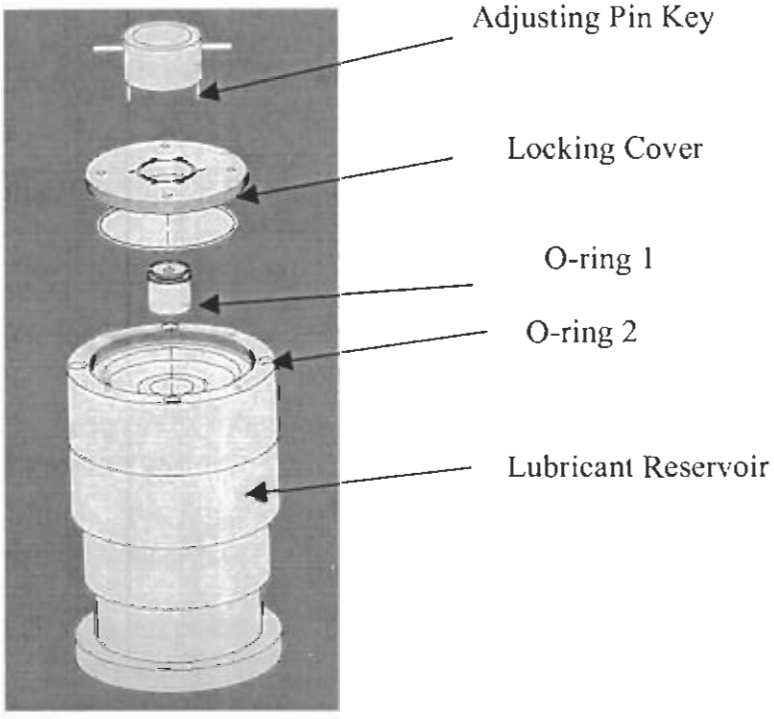
h) Use assembly tweezers to install wick into turbo pump reservoir.

i) Insert O-Ring into place and fit the LOCKING COVER into pump. Make plug firmly hand tight. "Do not make excessively tight".

j) Clean any oil residue from unit.

k) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

l) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.



6.6.2A Turbo Pump Lubricant Reservoir Replacement for the TMH-071 model

NOTE: THE REPLACEMENT OF THE WICK SHOULD BE PERFORMED ONCE A YEAR OR MORE FREQUENTLY WHEN LONG PERIODS OF USE WITH HIGH AMBIENT TEMPERATURES OR AIR THAT HAS A HIGH PARTICULATE COUNT. THE WICK IS PRELUBRICATED WITH TL011 OIL PRIOR TO SHIPMENT. IT SHOULD NOT BE HANDLED WITHOUT GLOVES.

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Locate the LOCKING COVER on the under side of the pump with an adjusting pin key. Be careful with o-ring 1

f) Lever out the lubricant reservoir with the help of two screwdrivers.

g) Use a lint free cloth to clean O-Ring, locking cover and turbo pump from dirt and debris.

h) Insert new lubricant reservoir, which is already filled with lubricant TL 011 up to the o-ring 2 in the pump.

i) Screw in the locking cover with o-ring 1. The lubricant reservoir will adjust itself into the correct position with the locking cover in place.

j) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

k) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.6.3 Forepump Removal/Installation

Forepump Removal

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

c) Remove both NW-16 clamp holding down flex bellows. Place the NW-16 clamp and seal in a clean and safe area for proceeding assembly.

f) Remove flex bellows and place in a clean and safe area for proceeding assembly.

g) Remove nut and washer on pump's feet. Place nut and washer in safe area for proceeding assembly.

h) Remove NW-16 clamp from the Interstage side of the Forepump (in the MD-390S and MD391S only). Place the NW-16 clamp and seal in a clean and safe area for proceeding assembly. Lay Interstage hose assembly over manifold.

i) Locate, unlock, and remove turbo pump electrical connector. Lay cable along side the Forepump.

j) Using both hands slightly lift pump and pull close to you. Angle pump towards you and lift.

k) Place original Forepump at the center of the work bench or safe place.

Forepump Installation

l) Do the reverse of Forepump removal.

m) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

n) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.6.4 Forepump oil change (for MD-390S and MD-391S only)

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described. Do not pivot rear panel.

e) Turn unit 180^0 having the rear of the machine hanging over the edge of the work bench, keeping the rubber feet on the workbench.

f) Position a plastic container under pump and a funnel underneath pump drain plug. Elevate the front of the unit about 3" from work bench.

g) Use #5mm Allen wrench and remove drain screw while holding the drain screw support with a wrench. Drain the pump fluid.

h) Install drain screw. Allow pump to run for 10 seconds with open vacuum connection.

i) Turn pump off. Remove drain screw and drain remaining pump fluid.

NOTE: IF FLUID IS HIGHLY CONTAMINATED, FLUID MUST BE CHANGED SEVERAL TIMES.

j) Clean off drain screw, and O-Ring and install into pump.

k) Remove the NW-25 clamp connecting the external exhaust pipe to the mist eliminator filter. Remove the exhaust pipe and seal ring.

l) Remove the NW-16 clamp connecting the Z exhaust pipe to the exhaust flange. Remove the mist eliminator and seal ring.

m) Remove the exhaust flange from the pump housing using pliers on the flange neck. DO NOT USE THE PLIERS ON THE FLANGE SEALING SURFACE.

n) Fill pump with fresh P3 fluid, at the exhaust port, to the mark indicated on the sight glass.

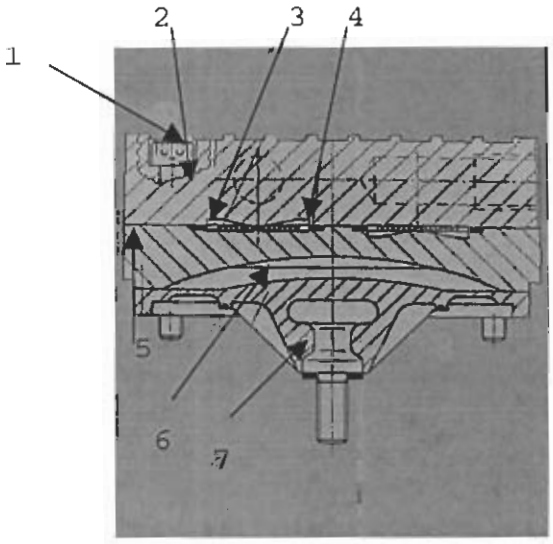
NOTE: FOR FURTHER PUMP SPECIFICATION AND MAINTENANCE SEE THE PUMP MANUAL.

a) Clean any oil spill over from the pump.

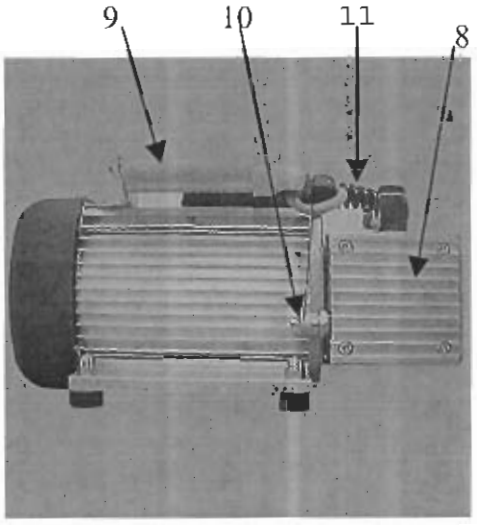
b) Verify that the forepump switch is set to the ON position.

c) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

d) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.



1----Allan Head Screw
2------Head cover
3------Valve plate
4------Sealing ring
5------Intermediate plate
6------Diaphragm
7------Washer
8------Membrane Head
9------Capacitor
10-----Intake Connection
11-----Mains Power Conn.



6.6.4A Forepump Membrane Head change (for MD-391SD only)

a) Allow the pump to cool down before dismantling.

b) Using an SW 14 key, unscrew hollow screw (11) of interhead connection (10) on diaphragm head 1 (see marks on housing).

c) As far as possible place pump on its side so that the head to be dismantled point up.

d) Using an SW 3 key, unscrew the four Allen head screws (1.1) and remove head cover (2), taking care with the two valve plates (3) and sealing rings (4).

e) Remove intermediate plate (5).

f) Use a small screwdriver to carefully ease out diaphragm (6) and manually unscrew from the connecting rod (right-hand thread). Look out for possible washers (7).

g) Clean all parts with alcohol, examine diaphragms, valves and seals for possible damage and renew as necessary. IF a new diaphragm is to be fitted, the washers (7) of the old diaphragm must be used again otherwise the pump will not attain the required pressure.

Reassemble of the Membrane head

a) Assemble all parts in reverse order. The connecting rod should be positioned in the upper dead point when fitting the diaphragm. Ensure correct positioning of all parts.
b) Check correct sealing ring seating.

c) Re-make hose connection and re-tighten hollow screw(11)

d) Test pump for function.

6.6.5 Vacuum Manifold Removal Procedure

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Remove the red hose from the PROBE VALVE.

f) Loosen the two (2) rear SOCKET SCREWS on the CENTER SUPPORT BRACKET.

g) Lift the rear of the TURBO PUMP, with the assembly sliding within the CENTER SUPPORT BRACKET slots.

h) Remove the power cable connection to the TURBO PUMP (GRAY CABLE).

i) Loosen the wingnut on the NW-16 clamp of the FOREPUMP, of the MD-390S and MD-391S, INTERSTAGE PORT.

j) Lift the NW-16 hose connection and flange off of the O-ring on the INTERSTAGE PORT.

k) Disconnect the PROBE VALVE CONNECTOR from the PROBE VALVE BODY.

l) Remove the BALLAST BOARD CONNECTOR from the BALLAST BOARD.

m) Loosen the wingnut on the NW-16 clamp of the TURBO PUMP PORT.

n) Remove the NW-16 clamp off of the TURBO PUMP PORT.

o) The MANIFOLD ASSEMBLY can now be removed.

NOTE: A VACUUM SEAL WILL BE BREACHED WHEN DISCONNECTING THE INTERSTAGE AND TURBO PUMP PORT CONNECTIONS.

6.6.6 Orifice Replacement

a) Unscrew the two #4-40 captive screws securing the ballast board assembly to the manifold assembly. Carefully remove the ballast board and the WASHER SEAL (VIC PART NO. 489-798-0039) and place it in a clean area for the proceeding assembly.

b) Remove the two #6-32 S.H.C. screw securing the orifice manifold to the transport manifold.

c) Carefully separate the two manifold sections.

d) Remove the two (2) O-Rings (VIC PART NO. 492-092-2010) and the orifice.

e) Wipe the manifold surfaces with a clean lint free cloth and alcohol.

f) Reinstall the two (2) O-Rings and the orifice by compressing the ORIFICE between the two (2) O-Rings and placing this assembly into the MASS SEPARATOR COUNTERBORE.

g) Insert the two #6-32 x 1 1/4" long S.H.C. screws into the orifice section of the manifold. Place the orifice section over the MASS SEPARATOR section, aligning the screws. Verify that the manifold mounting flange and the transport tubing are both facing the same direction.

h) Reinstall the ballast board assembly by first placing the WASHER SEAL into the counterbore and tightening equally on both #4-40 captive screws.

6.6.7 Manifold Disassembly Procedures

NOTE: PLEASE REFER TO THE MANIFOLD REMOVAL PROCEDURE IN SECTION 8.5.1 BEFORE PROCEEDING WITH THIS SECTION.

a) Unscrew the two #4-40 captive screws securing the ballast board assembly to the manifold assembly. Carefully remove the ballast board and the WASHER SEAL (VIC PART NO. 489-798-0039) and place it in a clean area for the proceeding assembly.

b) Remove the two #6-32 S.H.C. screws securing the orifice manifold to the transport manifold.

c) Carefully separate the two manifold sections.

d) Remove the two 2-010 O-Rings (VIC PART NO. 492-092-2010 and the orifice.

e) Remove the two #6-32 x 1-1/4" S.H.C. screws securing the orifice manifold to the manifold mounting flange. Also, remove the 2-006 O-Ring.

f) Remove the four #4-40 x 1 1/4" pan head Phillips head screws securing the vacuum regulator to the transport manifold block. Remove vacuum regulator.

g) Using a 5/16" open end wrench, carefully unscrew the sniffer probe fitting from probe valve.

h) Pry off, using a flat blade screwdriver, the retaining clip from the probe valve.

i) Remove the four #4-40 x 1/4" flat head Phillips screws securing the solenoid valve body to the transport manifold block.

j) Carefully lift off the solenoid valve body as not to drop the core assembly and the spring that are contained within.

k) Unscrew the two #4-40 captive screws securing the upper transport flange assembly and remove.

6.7 ELECTRONIC ASSEMBLIES

6.7.1 Turbo Pump Power Supply Removal/Installation

Power Supply Removal For the Md-390S

a) Perform complete Shut Down of System. Refer to SECTION 2.0, sub-section 3.2.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Disconnect the top TCP plug from turbo power supply by pressing latch and lifting connector to 45^0.

f) Remove the bottom TCP cable from retainer.

g) Disconnect the bottom TCP plug from power supply by pressing latch and pushing connector down 45^0.

h) Remove four (4) hex nut using 8/32 short stub nut driver. Place nuts and washers in a safe place for proceeding assembly.

i) Using both hands gently lift power supply from vertical support. Place power supply in a safe location.

Power Supply Installation For the MD-390S

j) Do the reverse of the power supply removal.

k) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

l) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

Power Supply Removal For the MD-391S and MD-391SD

a) Perform complete Shut Down of System. Refer to SECTION 2.0, sub-section 3.2.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

e) Push back vertical support.

f) Remove Power Supply connector (vic#872-821) from bottom of power supply.

g) Remove Power Supply connector (vic#872-822) from top of power supply use Phillips screw driver and a terminal screw driver for the green wire.

h) Remove four (4) hex nut using 8/32 short stub nut driver. Place screws and washers in a safe place for proceeding assembly.

i) Using both hands gently lift power supply from vertical support. Place power supply in a safe location.

Power Supply Installation For the MD-391S and MD-391SD

j) Do the reverse of the power supply removal.

k) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

l) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

6.7.2 PC Board Removal/Installation

ELECTROSTATIC DISCHARGE CAUTION

ELECTROSTATIC DISCHARGE CAN DAMAGE ELECTROSTATIC SENSITIVE ELECTRONIC COMPONENTS. THEREFORE IT IS NECESSARY TO TAKE SPECIAL PRECAUTIONS WHEN HANDLING THESE COMPONENTS AS FOLLOWS:

√ BEFORE HANDLING ANY COMPONENTS OR TOUCHING ANYTHING INSIDE THE SYSTEM, WEAR A PROPERLY CONNECTED GROUNDING STRAP. IF ONE IS NOT AVAILABLE, DISCHARGE YOUR BODY'S STATIC CHARGE BY TOUCHING PART OF THE SYSTEMS METAL CHASSIS.

√ DO NOT REMOVE ANY PARTS FROM THEIR ANTISTATIC BAGS UNTIL YOU ARE GROUNDED AND READY TO INSTALL THEM.

√ DO NOT LAY ANY PARTS ON ANTISTATIC BAGS, THEY ARE ONLY ANTISTATIC ON THE INSIDE.

√ HANDLE ANY PARTS BY THEIR EDGES AND METAL MOUNTING BRACKETS. AVOID TOUCHING BOARD COMPONENTS OR EDGE CONNECTORS.

√ DO NOT SLIDE PARTS ACROSS SURFACES, THIS INDUCES STATIC CHARGE BUILDUP.

√ AVOID PLASTIC, VINYL, STYROFOAM AND FABRICS IN THE VICINITY.

PC Board Removal

a) Perform complete Shut Down of System.

b) When the message "POWER ON PRESS START UP" appears, place the power switch, located on the back panel, to the OFF position. The power light will cease to illuminate.

c) Remove the power cord connector from the back panel.

d) Remove cover as previously described.

NOTE:

IT IS NECESSARY TO WAIT ONE MINUTE AFTER PLACING THE POWER SWITCH TO THE OFF POSITION TO BEGIN REMOVING PC BOARDS. THERE ARE HIGH VOLTAGE CAPACITORS PRESENT WHICH NEED TO DISCHARGE IN THIS TIME AND COULD HAVE A POTENTIALLY HIGH VOLTAGE PRESENT BEFORE ONE MINUTE DURATION.

e) Disconnect all connectors from PC boards and place out of the way.

f) Locate and remove (8) screws and washers and place in a safe location.

g) Gently lift both PC boards from unit. Place boards on the work bench in a safe place.

PC Board Installation

h) Do the reverse of the PC board removal.

i) Tilt the back panel up to its closed position. Place the cover back on and verify that the locating screws align with their mating receptacles. Tighten the six screws.

j) Perform "Start-Up" operating procedures to return the unit back into its operating conditions.

SECTION 7.0 SYSTEM SOFTWARE

7.1 KEYPAD MENU AND DIAGNOSTIC FUNCTIONS

The MD-390S is equipped with a software system menu and diagnostic function accessible from the front panel keypad. This menu system allows MD-390S configuration (setup) and operation monitoring.

There are three (3) primary menu structures; MENU, DIAG and AUDIO. The MENU, DIAG and AUDIO menu displays are started using the MENU, DIAG and VOL keys, respectively. To advance through the displays and make selections the ↑, ↓, ENTER and EXIT keys are used. Generally, these keys are used as follows:

↑ / ↓ to increment/ decrement system values. No special screen prompts are given except an occasional blinking value.

ENTER to toggle a function mode from "ON" to "OFF". Also, used to enter a sub menu, select system units and reset counter values.

EXIT to leave a particular menu.

The MENU displays are composed of four (4) sub menus; MENU #1 - SENSITIVITY, MENU #2 - SYSTEM SETUP, MENU #3 - OPTIONS, MENU #4 - RESET HOURS. From these displays the ENTER and EXIT keys are used to access the specific parameter displays. When in these displays the MENU key is used to view the desired display.

MENU #1 is used to adjust the electron EMISSION, system GAIN and perform a MANUAL TUNE.

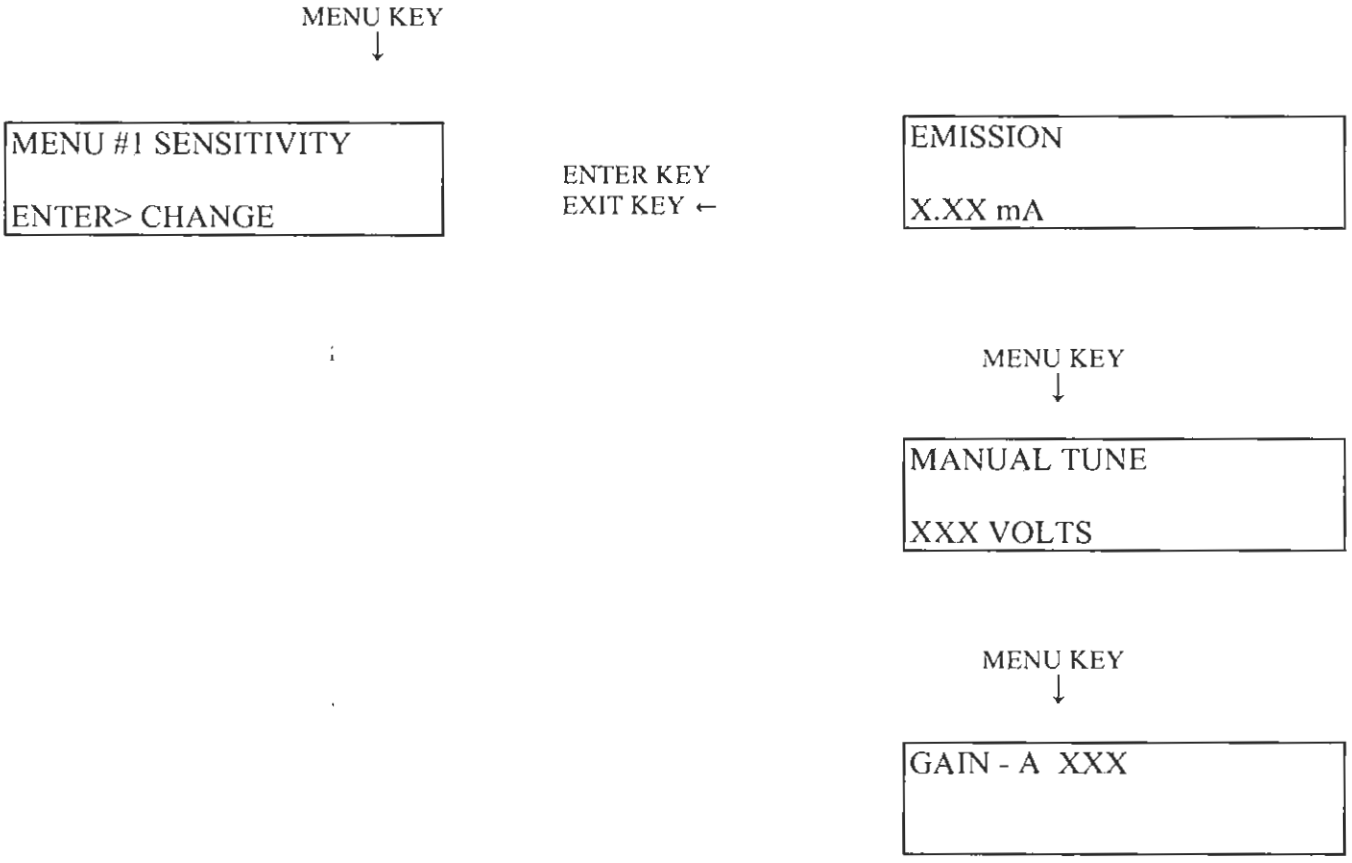
MENU #2 is used to configure the system using six (6) standard and eight optional setup sub-menus.

MENU #3 is used to view the system options and the unit program revision.

MENU #4 is used to reset logged hours for system components.

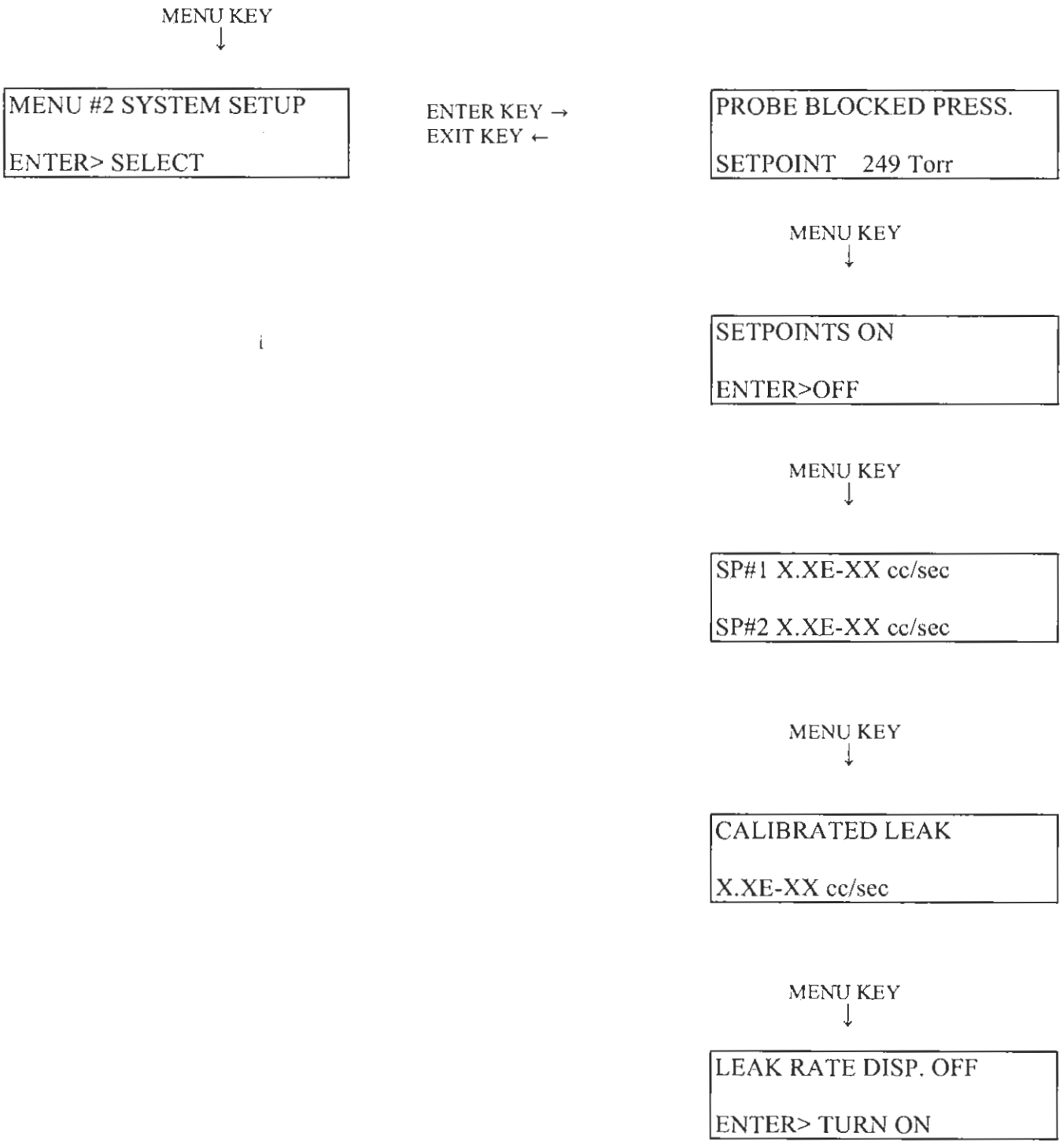
The following diagrams illustrate the actual menu structures.

7.2 MENU #1 FUNCTIONAL DIAGRAM



NOTE: USE UP/DOWN ARROW KEYS ON FRONT MEMBRANE PANEL TO ADJUST. KEY MUST BE IN UNLOCKED POSITION.

7.3 MENU #2 FUNCTIONAL DIAGRAM



7.3 MENU #2 FUNCTIONAL DIAGRAM continued

MENU KEY
↓

PRINT MODE> OFF
ENTER> MORE MODES

MENU KEY
↓

ANALOG OUTPUT MAX.
LEAK RATE 10E4

NOTE: THIS MENU OPTION IS DISPLAYED ONLY IF THE LEAK RATE ANALOG OUTPUT OPTION IS ENABLED.

MENU KEY
↓

AUDIO MODE –1 ON
ENTER>SELECT MODE -2

MENU KEY
↓

SELECT UNITS
GM/YR CC/SEC OZ/YR

7.3 MENU #2 FUNCTIONAL DIAGRAM continued

MENU KEY
↓

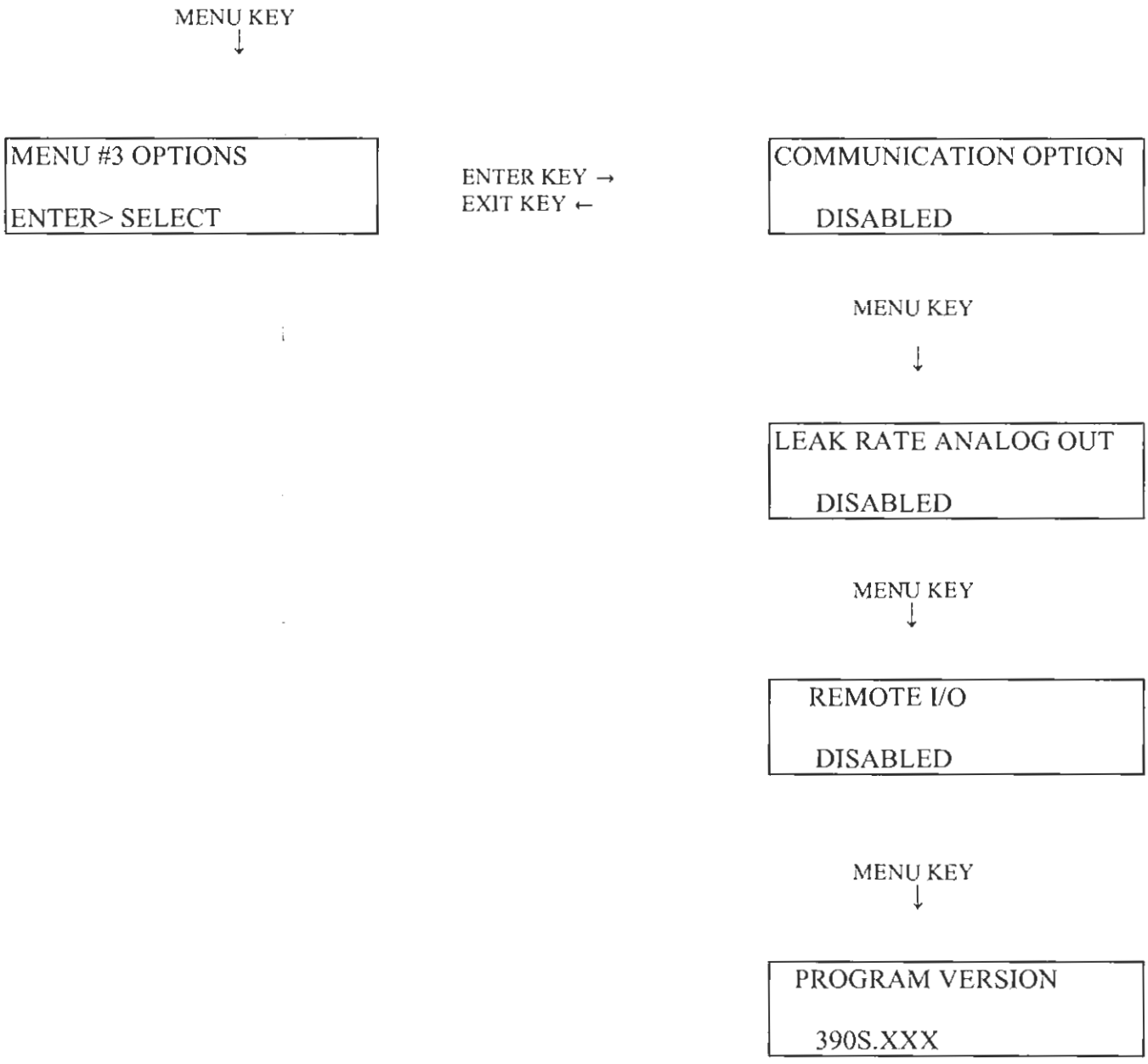
LEAK RATE DISP. ON
ENTER>TURN OFF

MENU KEY
↓

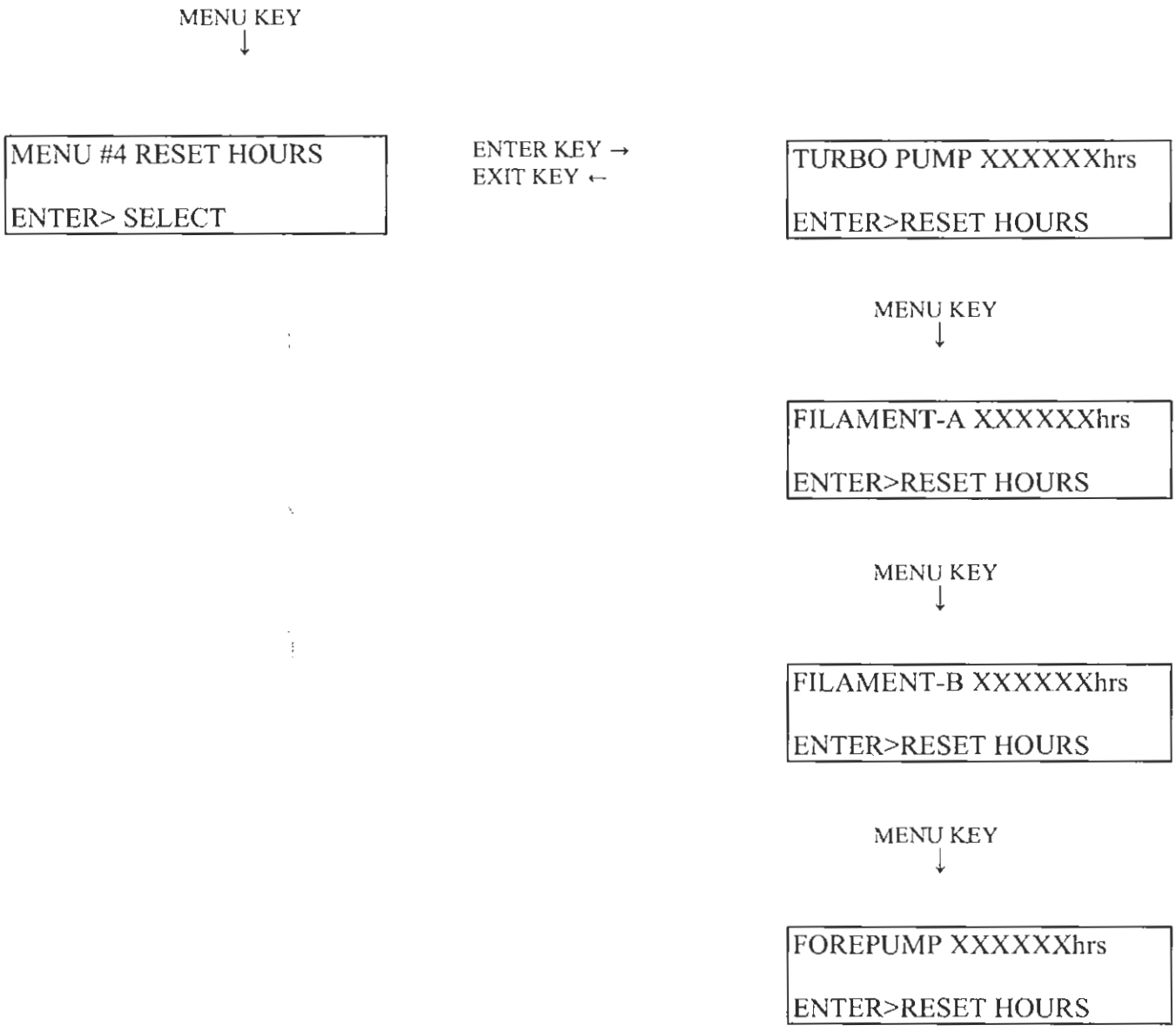
SELECT UNITS
GM/YR CC/SEC OZ/YR

TO FIRST MENU OPTION
↓

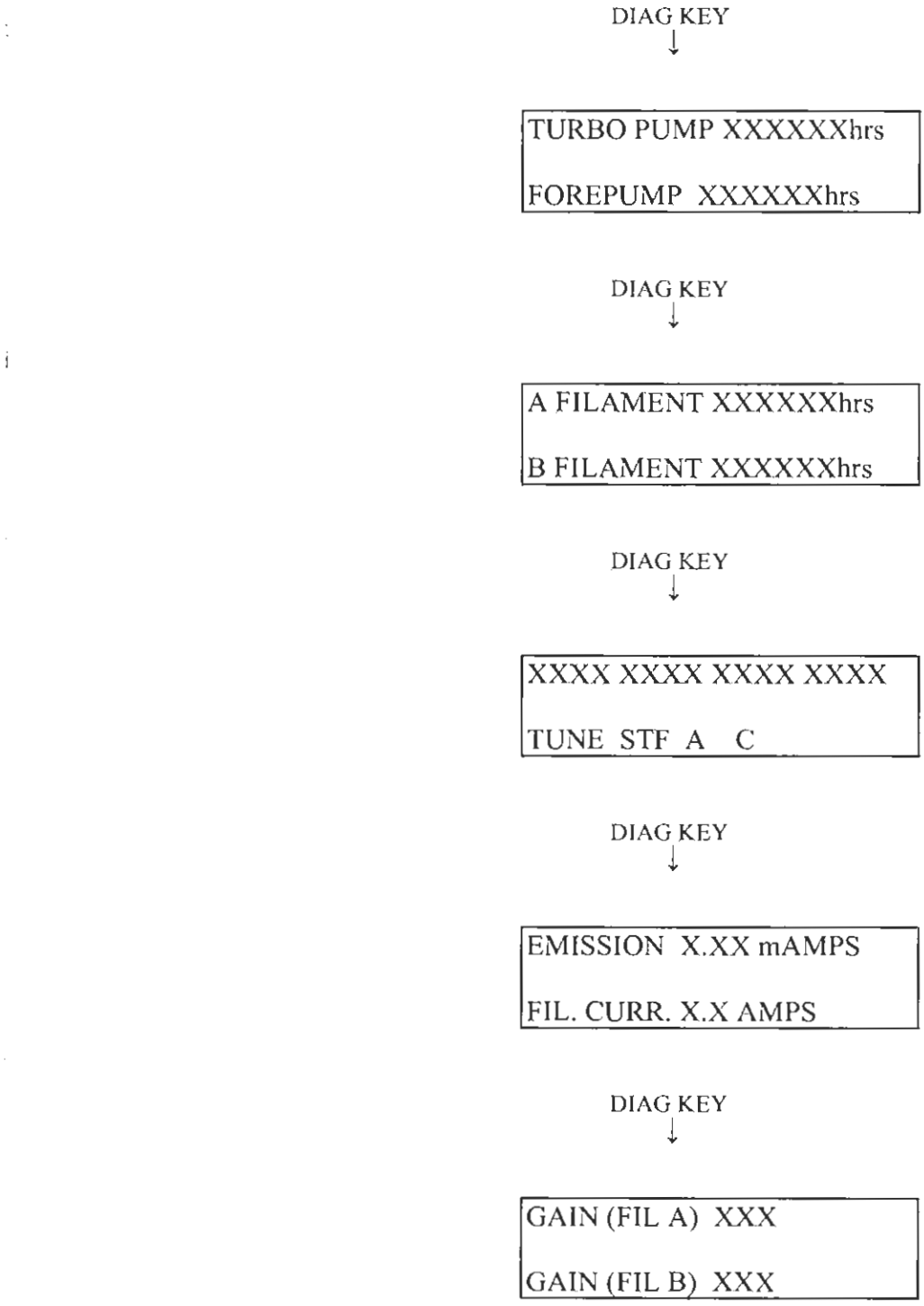
7.4 MENU #3 FUNCTIONAL DIAGRAM



7.5 MENU #4 FUNCTIONAL DIAGRAM



7.6 DIAG FUNCTIONAL DIAGRAM



7.6 DIAG FUNCTIONAL DIAGRAM continued

DIAG KEY
↓

BALLAST PR. XXX Torr
SETPOINT XXX Torr

DIAG KEY
↓

COLLECT XXX.XX VLTS
S-PLATE XXX VLTS

DIAG KEY
↓

TURBO SPEED XX %
BOARD TEMP. XX F

VOL FUNCTION

VOL KEY
↓

VOLUME LEVEL XXX %

VOL KEY
↓

AUDIO OFF
ENTER>ON

SECTION 8.0 TROUBLESHOOTING GUIDE

8.1 SYSTEM WILL NOT POWER-ON.

8.1.1 Check the AC line cord for proper connection to 110 - 120VAC outlet.

8.1.2 Check the AC line voltage for 110 - 120VAC.

8.1.3 Contact VIC Service Personnel for further assistance.

8.2 FOREPUMP WILL NOT POWER-ON.

8.2.1 Check the rear panel 6 amp breaker, reset if necessary.

8.2.2 Check the CPU BOARD 10 amp fuse, replace if necessary.

8.2.3 Contact VIC Service Personnel for further assistance.

8.3 ALPHANUMERIC DISPLAY DOES NOT POWER-ON.

8.3.1 Check the CONTROL BOARD 1 amp fuse, replace if necessary.

8.3.2 Check the HARNESS DISPLAY cable connections.

8.3.3 Check the DISPLAY BOARD, replace if necessary.

8.3.4 Check the CONTROL BOARD, replace if necessary.

8.3.5 Contact VIC Service Personnel for further assistance.

8.4 LEAK RATE METER ERRATIC

8.4.1 Take the unit out of TEST MODE. If the erratic readings stop, there may be an excessive Helium gas background. Vent the area with fresh air.

8.4.2 Turn off the filaments. If the erratic readings stop, check the SOURCE ASSEMBLY and related harness and replace if necessary.

8.4.3 Check the COLLECTOR ASSEMBLY and related harness, replace if necessary.

8.4.4 Check the CONTROL BOARD, replace if necessary.

8.4.5 Contact VIC Service Personnel for further assistance.

8.5 TURBO PUMP SPEED INDICATOR DOES NOT REACH 67%.

8.5.1 Check the TURBO PUMP POWER SUPPLY, replace if necessary.

8.5.2 Check the TURBO PUMP CABLE, replace if necessary.

11.5.3 Check the TURBO PUMP, replace if necessary.

8.5.4 Check the vacuum piping for leaks.

8.5.5 Contact VIC Service Personnel for further assistance.

8.6 NO HELIUM SENSITIVITY

8.6.1 Verify that the system is in TEST MODE in accordance with SECTION 1., subsection 9.13.

8.6.2 Perform a system calibration in accordance with SECTION 1., subsection 9.4.

8.6.3 Adjust the system gain to maximum and re-verify system sensitivity.

8.6.4 Verify that the emission circuit is operational in accordance with sub-section 11.9.0. If any voltages are out of range, check the following:

a. Check the Spectrometer Tube magnet for correct orientation.
b. Internal spectrometer tube short.
c. Spectrometer tube electrical connectors not making contact.

8.7 ERROR MESSAGES

All error messages are displayed on the Alphanumeric display when that particular defect is detected.

8.7.1 EMISSION FAULT

a. Check that the SOURCE ASSEMBLY connector is plugged in.
b. Switch to the alternate filament. If the error disappears, replace the primary filament.

c. Check the SOURCE ASSEMBLY for an internal short circuit.
d. Check the CONTROL BOARD and replace if necessary.

8.7.2 ZERO COLLECTOR FAULT

a. Check that the COLLECTOR ASSEMBLY connector is plugged in. If it is, replace the assembly.
b. Check the CONTROL BOARD and replace if necessary.
c. Check the CPU BOARD and replace if necessary.

8.7.3 BALLAST TRANSDUCER FAULT

a. Check that the TRANSDUCER connector is plugged in. If it is, replace it.
b. Check the CPU BOARD and replace if necessary.

8.7.4 GAIN FAULT

a. Check that the GAIN is set within range. Adjust it to within range and recalibrate the system.

8.7.5 PROBE BLOCKED FAULT

a. Check the PROBE TIP for an obstruction and remove.
b. Check that the PROBE FAULT SETPOINT is not set too close to the TRANSDUCER readout (should be about 50 Torr below the TRANSDUCER value).

NOTE: REFER TO SECTION 1.0, PARAGRAPH 9.7, MENU KEY UNDER MENU #2, SYSTEM SETUP FOR PROBE BLOCKED PRESSURE.

APPENDIX 1.

COMMUNICATION OPTION

This option allows an ASCII type terminal, desktop computer or a Programmable Logic Controller to remotely monitor and control the leak detector unit using a standard RS-232 serial interface. It also enables the external printing function, which uses the PRINTER connector on the unit rear panel. All panel functions and menus are duplicated on the remote terminal. A virtual interface incorporating a graphical screen is displayed on the remote monitor. The actual software protocol is simple and concise, making it ideal for integrating into a current operating system.

REQUIREMENTS:

1. Program ROM chipset with the COMM/PRINT option enabled.
2. RS232 serial cable with the leak detector RS232 rear port end terminated with a DB-9 female connector.
3. A host computing system able to emulate ASCII protocol and having RS232 serial port availability.

PROTOCOL DEFINITIONS:

<CR> - ASCII 13 = Carriage return
<LF> - ASCII 10 = Line Feed

PROTOCOL REQUIREMENTS:

1. The leak detector will accept three commands:

    a. FUNCTION command
    b. EDIT or SET command
    c. ENQUIRY command

2. All command strings must end with <CR><LF>.

3. All command strings are acknowledged after <CR><LF>.

4. The host must wait until a confirmation prompt is received before transmitting.

5. All data parameters transferred will follow a specific data format.

6. Set RS232C port parameters to:

    a. Baud = 9600
    b. Parity = NONE
    c. Data = 8 bits
    d. Stop bits = 1

COMMAND STRING FORMAT:

1. FUNCTION COMMAND: <F><TYPE><CR><LF>

2. ENQUIRY COMMAND: <E><TYPE><CR><LF>

3. EDIT/SET COMMAND: <S><TYPE><=><PARAMETER><CR><LF>

ACKNOWLEDGE PROMPTS:

"=>" No errors were detected and the command was successfully parsed and executed.

"?>" A COMMAND ERROR was detected. The command was not executed because it was not understood. For instance, this prompt would be returned if the leak detector was sent a command string, that contained a syntax error.

"!>" An EXECUTION ERROR was detected. The command was understood but not executed. Parameter out of range or parameter syntax incorrect.

GETTING STARTED:

Use a Personal computer with terminal emulation software to test the communication option. Install the serial cable to the COM1 port located on the back of the leak detector.

Each command can be tested by typing the desired command string followed by a <CR><LF>. Start testing the function commands first, for they are the simplest. Below are a few examples:

COMMAND STRING	ACK.	RESULTS
Fa<CR><LF>	=>	TURN SNIFF ON NO ERRORS
Fz<Cr><Lf>	?>	COMMAND ERROR FUNCTION Fz DOES NOT EXIST
Sa=100<CR><LF>	=>	SET GAIN "A" TO 100 NO ERRORS
Sa=250<CR><LF>	!=	SET GAIN "A" TO 250 EXECUTION ERROR (OUT OF RANGE)
Sa=0100<CR><LF>	!=	SET GAIN "A" TO 100 EXECUTION ERROR (PARAMETER TOO LONG)
Ea<CR><LF>	250 =>	ENQUIRE TUNE VOLTS NO ERRORS

The following are commands to inquire about system parameters.

ENQUIRY COMMANDS			
CMDS	DESCRIPTION	DATA FORMAT	VALID RANGE
Ea	TUNE VOLTS	<XXX>	217-277
Eb	STF VOLTS	<XXX>	TUNE-70
Ec	A-PLATE VOLTS	<XXX>	TUNE-100
Ed	C-PLATE VOLTS	<-XXX>	100-200
Ee	S-PLATE VOLTS	<XXX>	150-250
Ef	EMISSION CURRENT (mAMPS)	<X.XX>	0.50-2.50
Eg	FILAMENT CURRENT (amps)	<X.X>	0.0-4.0
Eh	GAIN (FILAMENT "A")	<XXX>	049-201
Ei	GAIN (FILAMENT "B")	<XXX>	049-201
Ej	TURBO SPEED (%)	<XXX>	000-100
Ek	CALIBRATED LEAK (cc/sec)	<X.XESXX>	1.0E-6 - 9.9E-3
El	BALLAST PRESSURE (Torr)	<XXX>	000-999
Em	BALLAST PRESSURE S.P.(Torr)	<XXX>	000-760
En	LEAK RATE (cc/sec)	<SX.XE-XX>	0 - 1.0E-02 Can go NEG.
Eo	SETPOINT #1	<X.XE-XX>	1.0E-6 - 9.9E-3
Ep	SETPOINT #2	<X.XE-XX>	1.0E-6 - 9.9E-3
Eq	MECH. & TURBO PUMP HOURS	<XXXXX>	0 - 99999
Er	FIL "A" & FIL "B" HOURS	<XXXXX>	0 - 99999
Es	16 DISCRETE FAULTS SEE FAULT DESCRIPTION	<XXXXX>	0-65535
Et	COLLECTOR VOLTS	<SXX.XX>	-10.00 - 10.00
?	**HELP MENU**	1000 bytes	

The following are commands to set or edit system parameters.

SET/EDIT COMMANDS			
CMDS	DESCRIPTION	DATA FORMAT	VALID RANGE
Sa	GAIN FILAMENT "A"	<XXX>	050-200
Sb	GAIN FILAMENT "B"	<XXX>	050-200
Sc	CALIBRATED LEAK (cc/sec)	<X.XE-XX>	1.0E-6 - 9.9E-3
Sd	SETPOINT #1 (cc/sec)	<X.XE-XX>	1.0E-6 - 9.9E-3
Se	SETPOINT #2 (cc/sec)	<X.XE-XX>	1.0E-6 - 9.9E-3
Sf	BALLAST PRESSURE S.P.(Torr)	<XXX>	000 - 760
Sg	TUNE VOLTAGE	<XXX>	218 - 277
Sh	AUDIO VOLUME	<XXX>	000 - 100
Si	EMISSION (mAMPS)	<X.XX>	0.50 - 2.50

The following are commands to enable or disable system functions.

FUNCTION COMMANDS	
CMDS	DESCRIPTION
Fa	SNIFF ON
Fb	SNIFF OFF
Fc	AUTO ZERO
Fd	FILAMENT A/B
Fe	CALIBRATE
Ff	START UP
Fg	SHUTDOWN
Fh	STANDBY
Fi	FILAMENTS ON
Fj	FILAMENTS OFF
Fk	AUTO SEND LEAK RATE ON
Fl	AUTO SEND LEAK RATE OFF

FAULT DESCRIPTION:

An unsigned integer is transferred to describe system faults. It has a range of 0-65535 in base 10. Using base 2, we need 16 bits to represent this number. Each bit will represent a system fault as described in Section 10.1, Alphanumeric Display.

B0 - High Board temp (low order bit)
B1 - Turbo speed
B2 - Filament Current
B3 - A-Plate voltage
B4 - STF Plate voltage
B5 - S-Plate voltage
B6 - C-Plate voltage
B7 - Emission fault
B8 - Tune Voltage fault
B9 - Probe Blocked fault
B10 - Collector Saturated

B11 - In Sniff and Filaments OFF
B12 - Gain Error
B14 - PUMPDOWN timeout
B15 - Ballast Transducer fault
B16 - Zero Collector watchdog fault (high order bit)

PRINTING FUNCTION

MENU #2, sub-menu PRINT MODE allows the setup of the desired method of printing. The three (3) printing modes are OFF, LOG and LABEL and described as follows:

OFF: The printing function is disabled.

LOG: The printing function is configured to print to a standard dot matrix type printer through the PRINTER PORT on the unit rear panel.

LABEL: The printing function is configured to print to a standard dot matrix type printer setup with standard 3-1/2" x 15/16" tractor feed labels.

Printing is initiated by pressing the ENTER key on the front panel. The information printed is the actual leak rate, at the time the key is pressed, and a PASS or FAIL result. The criteria for pass or fail is based on the value of setpoint #1 (SP#1) as follows:

IF THE RESULTING LEAK RATE IS GREATER THAN SETPOINT #1, A FAIL IS PRINTED.

IF THE RESULTING LEAK RATE IS LESS THAN SETPOINT #1, A PASS IS PRINTED.

APPENDIX 2.

LEAK RATE ANALOG OUTPUT OPTION

Analog leak rate signals are accessed via a screw terminal located on the back panel. Three (3) signal types are provided:

TYPE 1. LEAK RATE (PIN 1.)

This signal is linear with respect to leakage and has two (2) analog level settings and three (3) sensitivity scale factors. The signal source is a Digital to Analog converter located on the CPU board. Output resolution is 12 bits (4095 counts).

Analog level settings are set via CPU jumper JP1.

0 - 10 volts JP1 open
0 - 5 volts JP1 shorted

Scale factors are set via the menu accessed from the front panel. The scale factor screen is located under the "system setup" group. Scale factor setting determine the sensitivity of the analog output with respect to the leak rate magnitude. Setting of $10E^{-}6$, $10E^{-}5$ and $10E^{-}4$ ranges are available. Maximum analog output voltage will be asserted when the leak rate is equal to 10 times the scale factor selected.

ANALOG OUT MAX. (LEAK RATE)	LEAK RATE SPAN	MAXIMUM OUTPUT LEVEL JP1 OPEN	JP1 SHORTED
$10E^{-}6$	0 - 10X$10E^{-}6$	0 - 10V	0 - 5V
$10E^{-}5$	0 - 10X$10E^{-}5$	0 - 10V	0 - 5V
$10E^{-}4$	0 - 10X$10E^{-}4$	0 - 10V	0 - 5V

TYPE 2. METER OUTPUT (PIN 2.)

For remote leak rate signal indication, connect a needle meter between connection points meter out and ground. Jumper JP1 sets the maximum drive current for the meter.

0 - 1 milliamp JP1 open
0 - 0.5 milliamp JP1 shorted

TYPE 3. COLLECTOR OUTPUT (PIN 3.)

This signal is the raw leak rate signal taken directly from the ion collector amplifier. Signal magnitude is not affected by scale factor settings. Normally this signal is used during troubleshooting, or to obtain high resolution information. The output signal is nonlinear and follows the formula given below:

leak rate = 10 - vcol / (5 x 10^6) x (emsp - (10 - vcol / 20)) x emsp

where emsp = the emission setpoint.

APPENDIX 3.

REMOTE I/O OPTION

This option allows basic signals to be communicated between the unit and a PROGRAMMABLE LOGIC CONTROLLER for the purpose of automatic control by using the REMOTE I/O connector on the unit rear panel. Signal control can be AC or DC, depending on the particular option you have ordered. The functions that can be automatically controlled are as follows:

OUTPUTS:

SETPOINT #1: A signal is sent from the unit if the resulting leak rate is greater than this setpoint.

SETPOINT #2: A signal is sent from the unit if the resulting leak rate is greater than this setpoint.

READY: A signal is sent from the unit if three conditions are met:

1. No faults have occurred.
2. The unit is in TEST mode.
3. The filaments are ON.

INPUTS:

AUTOZERO: An active high pulse applied to this line will cause the unit to perform an AUTOZERO function.

SIGNAL CHARACTERISTICS:

There are two (2) types of signals available, DC or AC. The type of signal depends on the exact option ordered. See Section 11.3, Options for the correct option part number.

AC SIGNAL: All input and output signals are 115 VAC and defined as follows:

OUTPUT: Status driven with an active status drive. Therefore, the presence of a particular signal indicates that the condition is true and will remain true until it changes and causes it to be inactive. For example, if the unit is ready, the READY line will have 115 VAC present with respect to the COMMON line. No more than 1 amp of current can be drawn on each signal line. This is enough to directly drive a relay, low current bulb or PLC AC module input.

INPUT: Pulse driven with an active pulse drive. The AC pulse must be between 0.2 and 1.0 seconds in duration to enable the function. For example, to perform an AUTOZERO function, place a 0.5 second duration, 115 VAC pulse on this line.

DC SIGNAL: All input and output signal levels are defined as follows:

OUTPUT: 5 - 60 VDC

INPUT: 10 - 32 VDC

Signal characteristics are defined as follows:

OUTPUT: Level driven with an high level drive. Therefore, a high level on a particular line indicates that the condition is true and will remain true until it changes and causes the level to go to a low level. For example, if the unit is ready, the READY line will have 5 - 60 VDC level with respect to the GROUND line. No more than 1 amp of current can be drawn on each signal line. This is enough to directly drive a relay, low current bulb or PLC DC module input.

INPUT: Pulse driven with an active pulse drive. The DC pulse must be between 0.2 and 1.0 seconds in duration to enable the function. For example, to perform an AUTOZERO function, place a 0.5 second duration, 10 - 32 VDC pulse on this line.

APPENDIX 4

MD-390S LEAK DETECTOR SPARE PARTS LIST

P/N	DESCRIPTION
651-150	MASS SPECTROMETER TUBE ASSY
651-132	SOURCE ASSEMBLY
651-302	COLLECTOR ASSEMBLY
919-128	FILAMENT KIT 4/BOX
353-691-1004	TURBO PUMP ASSEMBLY
261-011-0003	TURBO PUMP POWER SUPPLY
312-191-1024	MECHANICAL PUMP
918-116	MECHANICAL PUMP OIL MIST ELIMINATOR ASSEMBLY
918-113	REPLACEMENT FILTER ELEMENT FOR OIL MIST ELIMINATOR ASSY
917-117	OIL, MECHANICAL PUMP
917-118	REPLACEMENT PUMP FLUID RESEVOIR FOR TURBO PUMP
919-543	GASKET SET (ALL O-RINGS & SEALS)
752-150	CALIBRATED GAS LEAK ASSY
011-213-1507	SNIFFER TUBING
741-117	FILTER ASSEMBLY SNIFFER (BOX OF 50)
413-613-1003	FILTER PROBE ASSEMBLY S/S
452-681-1032	MANIFOLD, MASS SEPARATOR
452-691-1026	APERTURE, PINHOLE GROSS ORIFICE
425-691-1098	VACUUM REGULATOR, MANIFOLD
656-120	MEMBRANE ASSY CONTROL PANEL
372-692-1010	VALVE, SOLENOID, 3 WAY

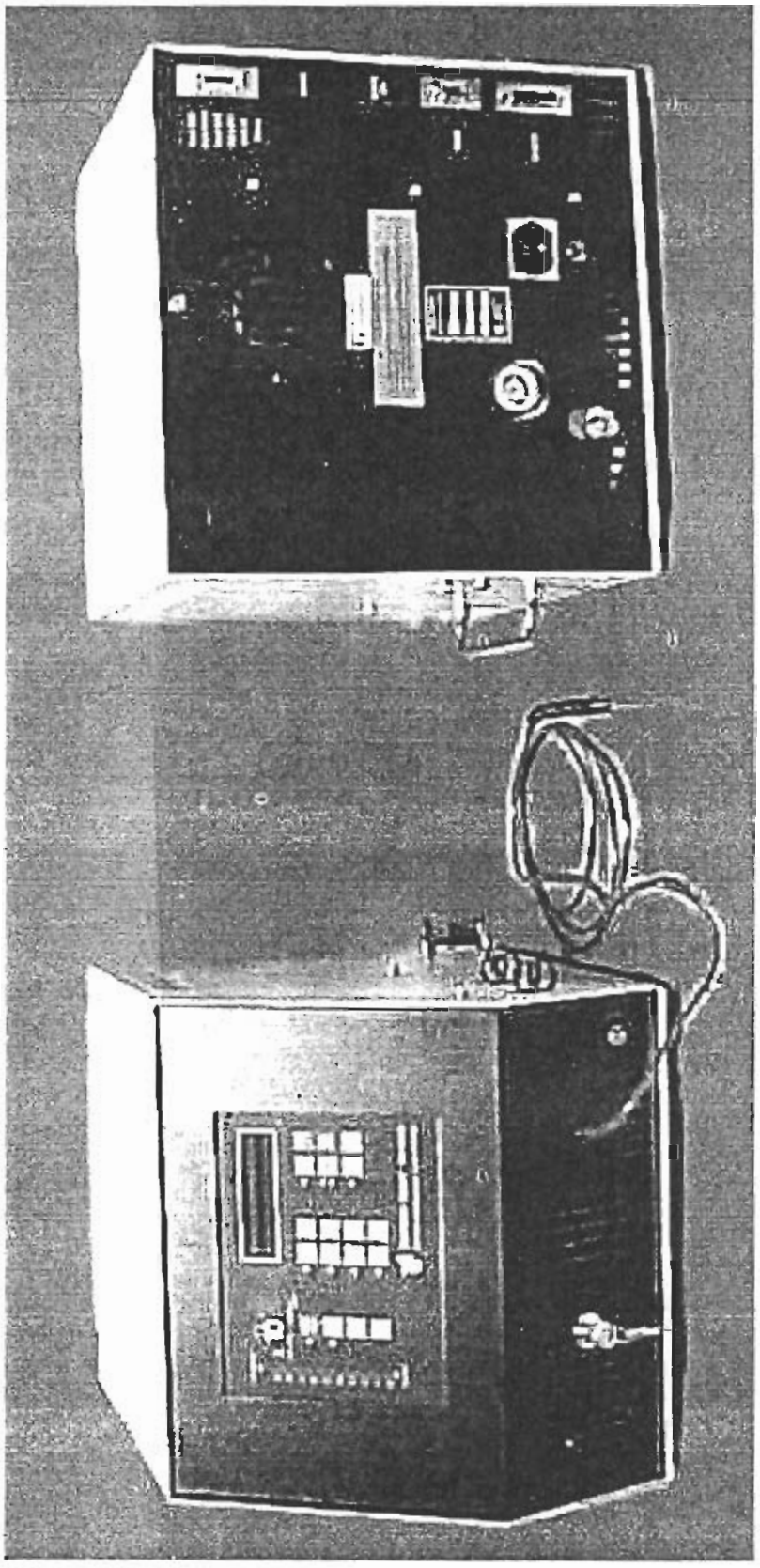
P/N	DESCRIPTION
584-331	PC BOARD ASSEMBLY CPU
584-334	PC BOARD ASSEMBLY CONTROL
584-335	PC BOARD ASSEMBLY BALLAST (TRANSDUCER)
936-245	POWER TRANSFORMER ASSEMBLY
584-330	PC BOARD DISPLAY
583-336	PC BOARD ASSEMBLY, ALPHANUMERIC
366-381-2235	KEY SWITCH
311-111-0011	FUSE, MICRO
331-111-0020	AMP, 250V
658-101	SNIFFER PROVE ASSEMBLY
952-161	MAINTENANCE KITS, MD-390S

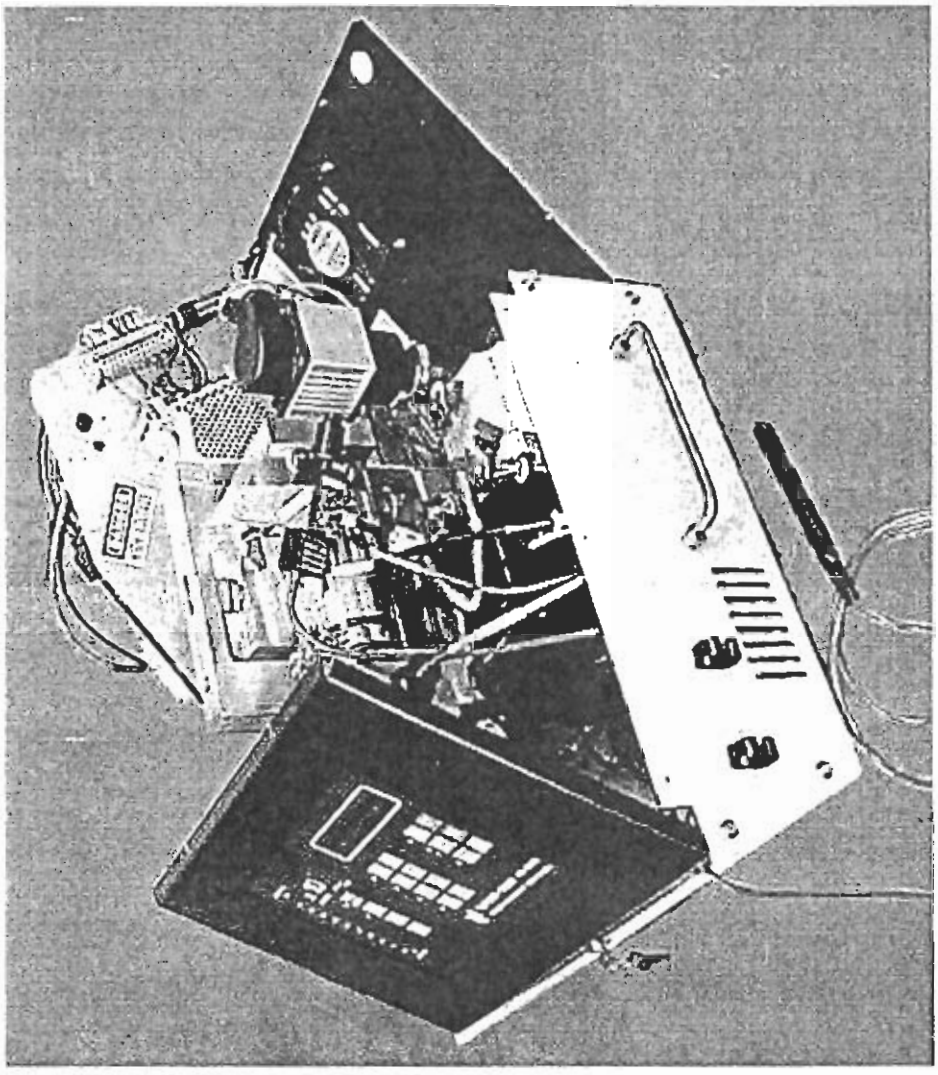
NOTICE

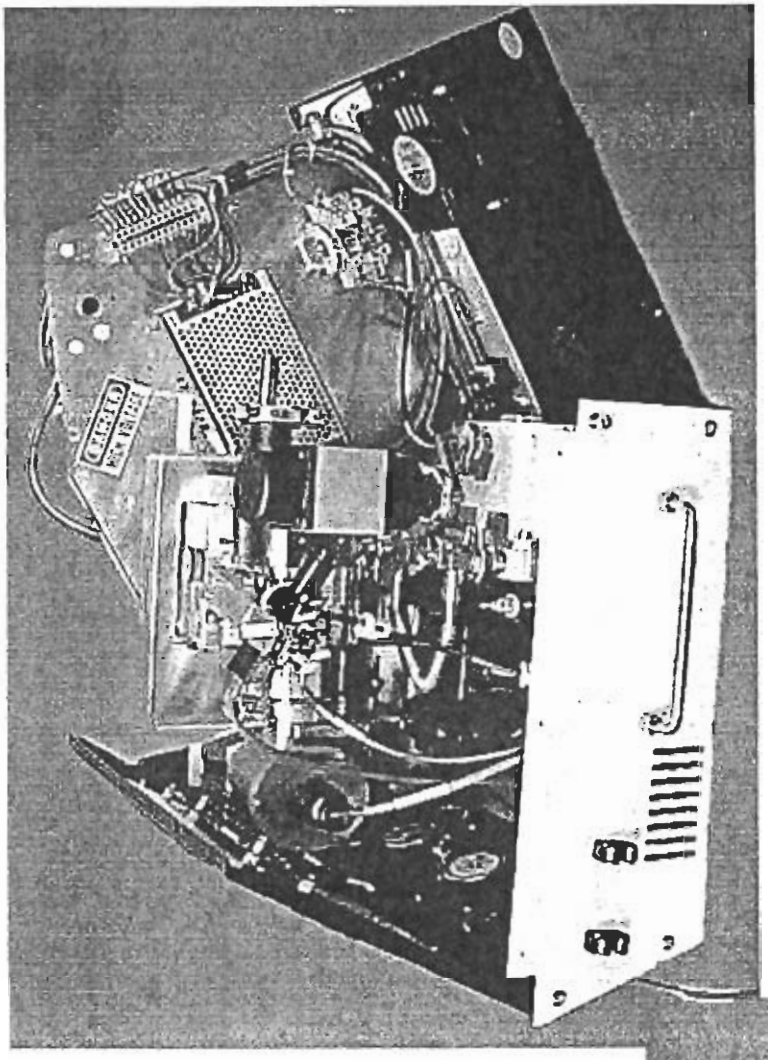
The Turbo-test MD-390S utilizes a fixed reservoir internal calibrated gas leak for purposes of system calibration. This leak standard has a 10% fall-off life as indicated on the attached Certificate of Calibration. For this equipment to properly function, it is recommended that the calibrated gas leak be returned to Vacuum Instrument for recalibration prior to the 10% fall-off date as documented on the enclosed Certificate of Calibration.

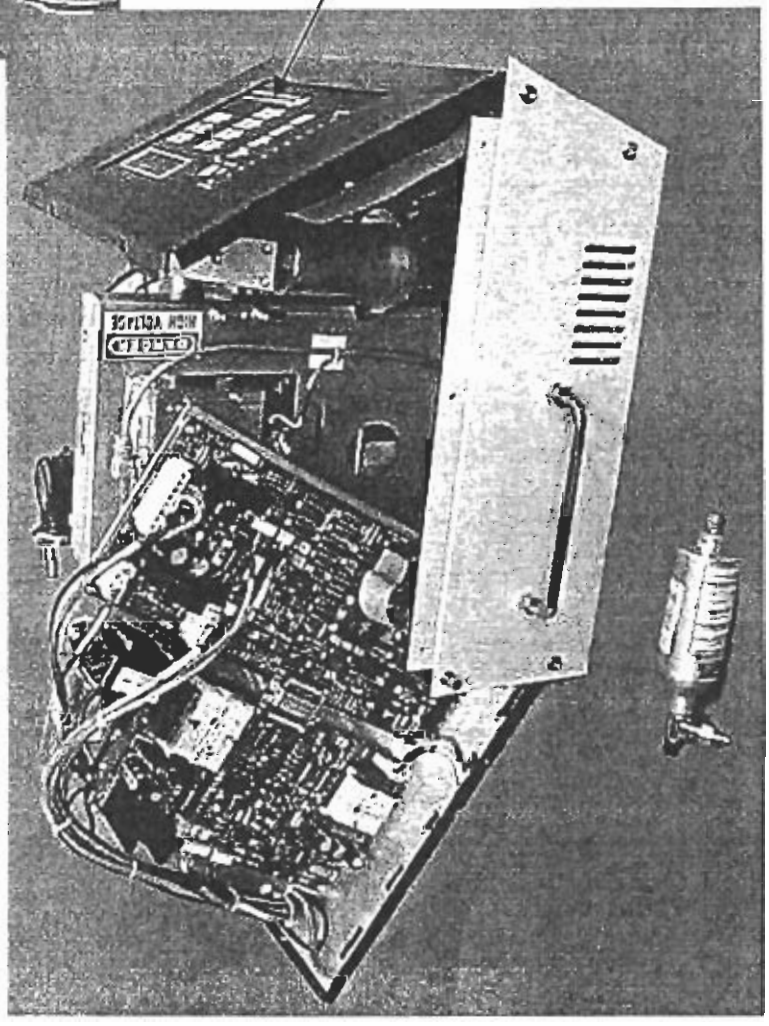
Calibration Laboratory

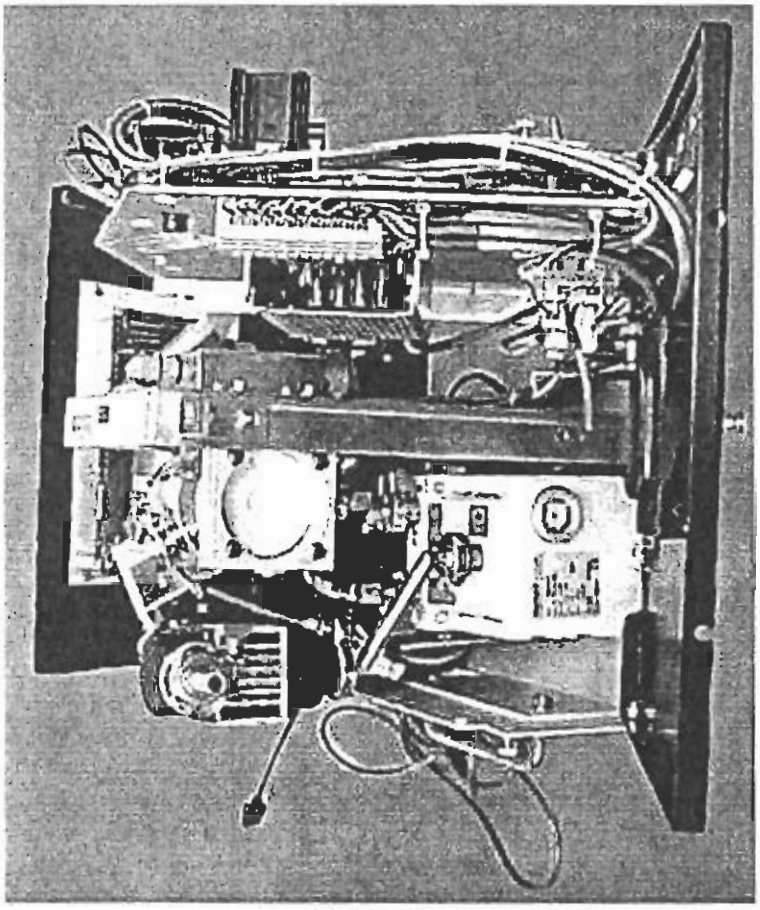
Vacuum Instrument Corporation







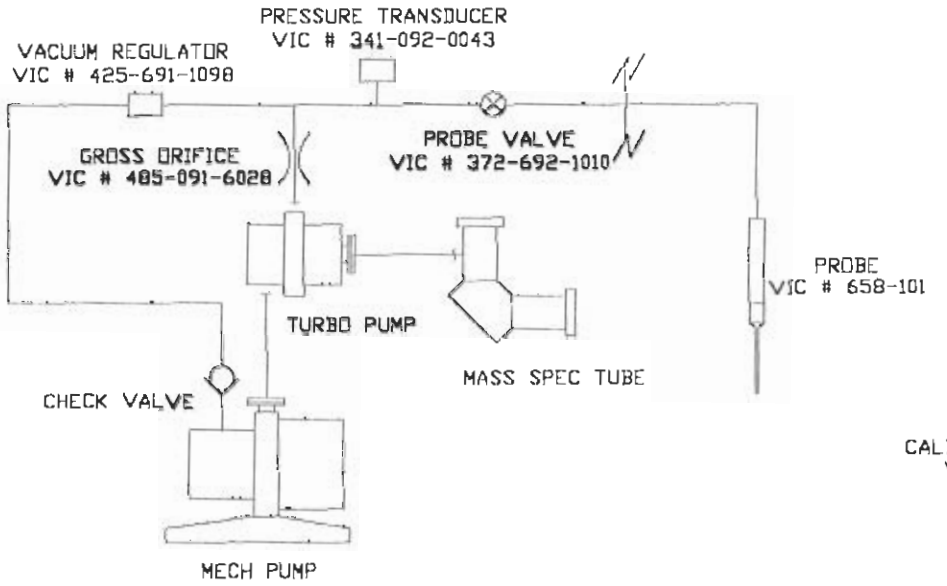




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REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	UPDATED TO AS BUILT	10/97	IAM
B	FLOW RESTRICTOR REMOVED	6/99	BCS





CALIBRATOR CYLINDER
VIC # 752-150

PARTS LIST

CUSTOMER: VIC

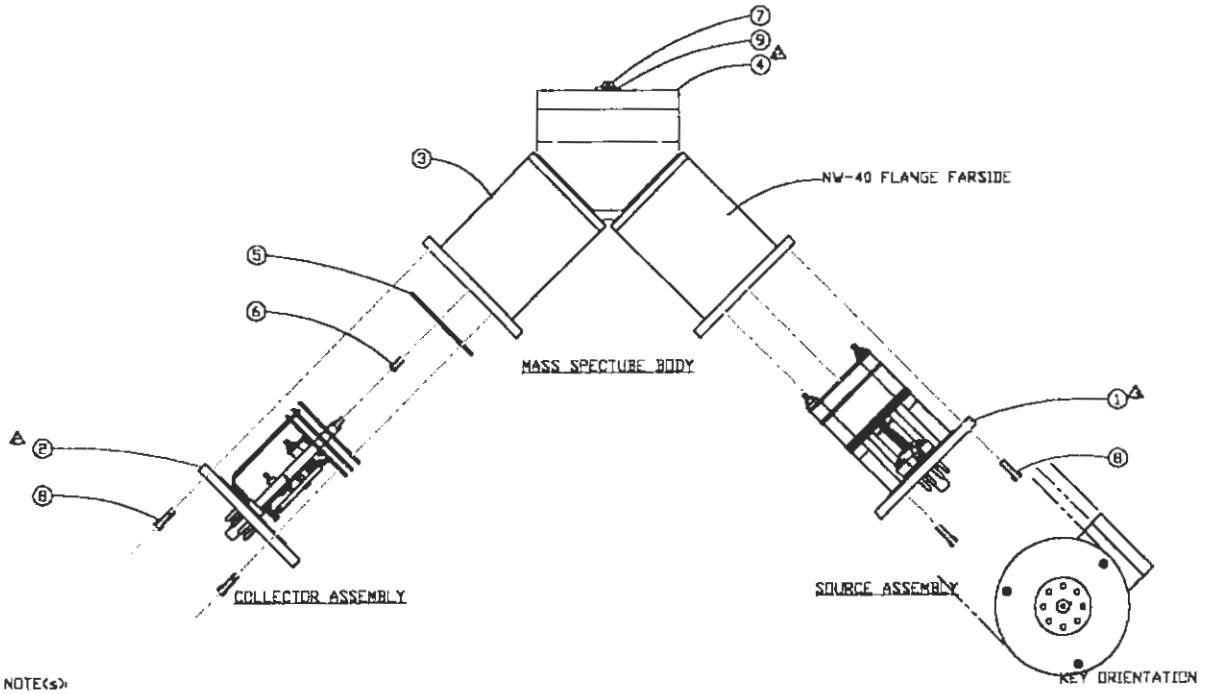
VACUUM INSTRUMENT CORP.
RONKONKOMA, N.Y. 11779

APPROVALS | DATE
DRAWN: SAM | 6/24/99
CHECKED
PRODUCTION
ENGINEERING

MD390S_LEAK_DETECTOR
FUNCTIONAL_DIAGRAM

SIZE: B | DWG NO: 853-601 | REV: B
NEXT ASSY | USED ON
APPLICATION | DO NOT SCALE DRAWING | NONE | D.C. # 853-601 | SHEET 1 OF 1

	A	UNSUPPRESSED DRAWING TO CARD. ITEM #8 WAS FAY HD, NOW IS SKT HD ITEM #9 WAS ADDED. UPDATED DRAWING TO REFLECT M.O.M.	8/26/97 LAK
	B	REPLACED ITEM #8 [489-111-0081] WITH ITEM #489-111-1007 KAR/SSR	12/98 BCH
	C	ADDED B/M TO DWG	8/00 BCH



NOTE(S):

1. NOTE ORIENTATION OF COLLECTOR.
2. THE 'S' ON THE MAGNET IS ON THE SAME SIDE AS THE NW-40 FLANGE.
3. ASSURE CONNECTOR KEY HAS ORIENTATION AS SHOWN.

9	1	489-799-0049	WASHER FLT S/S .205 ID X .440 OD X .065 THK
8	6	489-111-1007	SCREW, 6-32 X 1/2LG SOCKET HEAD CAP
7	1	489-116-0014	SCREW 10-32 X 5/8LG ST. STL.
6	2	489-114-0005	SCREW 4-40 X 3/16LG VENTED S/S
5	1	451-613-1049	PLATE SHELL BAFFLE
4	1	751-104	MAGNET ASS'Y, SPEC TUBE
3	1	751-112	MASS SPECTURE BODY/SHELL S/S
2	1	651-302	COLLECTOR ASS'Y, MD-390S
1	1	651-132	SOURCE ASS'Y

STANDARD

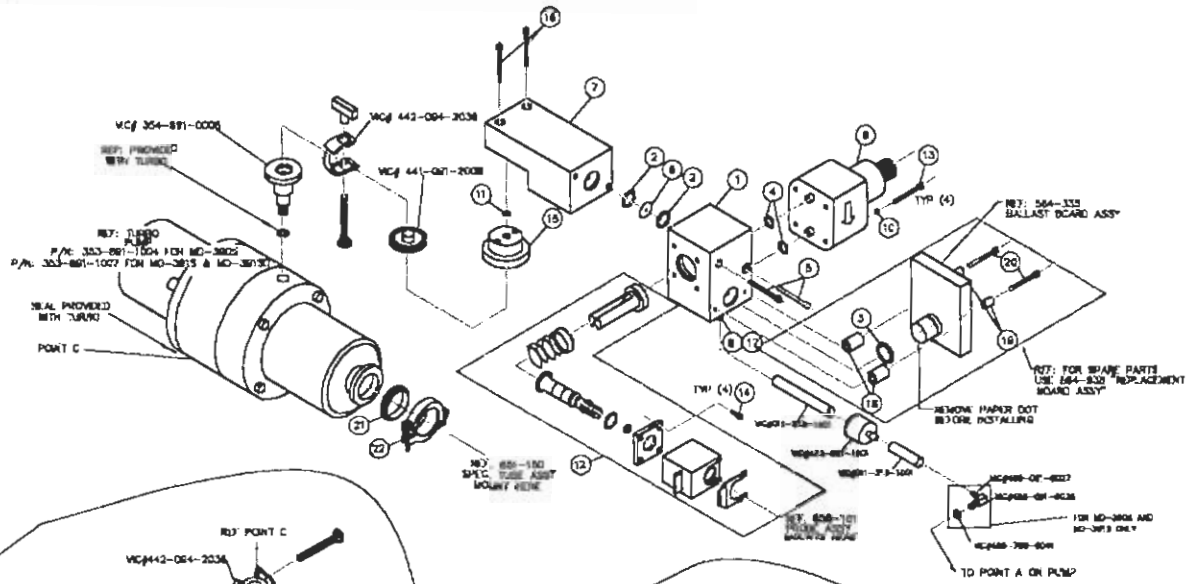
VACUUM INSTRUMENT CORP.

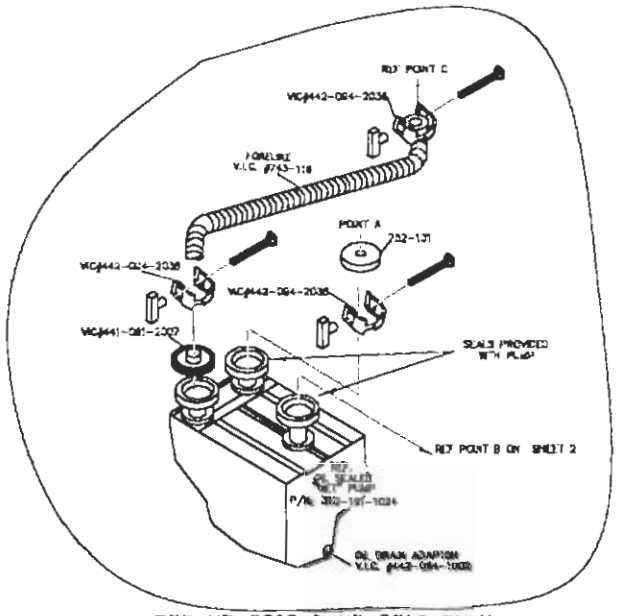
MASS SPECTROMETER ASSY. FOR MD-390S

651-135

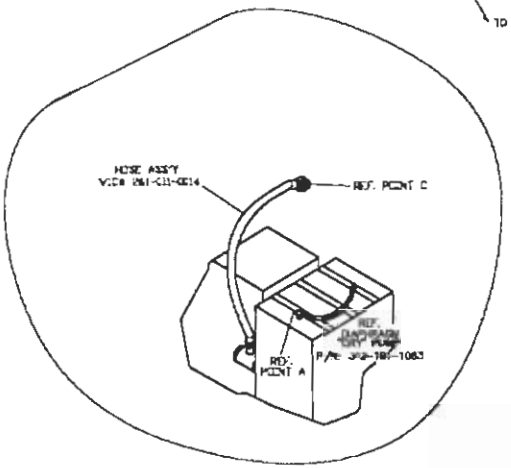
C

	A	MADE AUTOCAD DWG	5/97	BCH
	B	ADDED ITEM #S 21 & 22 REF. ECO #303	11/13/97	IAM
	C	ELBOW P/N 485-091-6027 TO PUMP INTERSTAGE PORT WAS P/N 485-091-1009	4/7 1998	RDN
	D	REF. EAR#348, ECO#402 CHANGED ITEM#8 (APERTURE-VIC#452-891-1024)	1/13/98	
	E	P/N 485-091-6027 WAS AN ELBOW, ADDED SEAL #485-708-0041, ECO#412	8/1/98	BCS
	F	ADDED SHEET #3 CE/MD	9/99	BCS
	G	REMOVED BALZERS REFERENCES IN DWG	3/00	BCS





FOR MD-390S & MD-391S ONLY

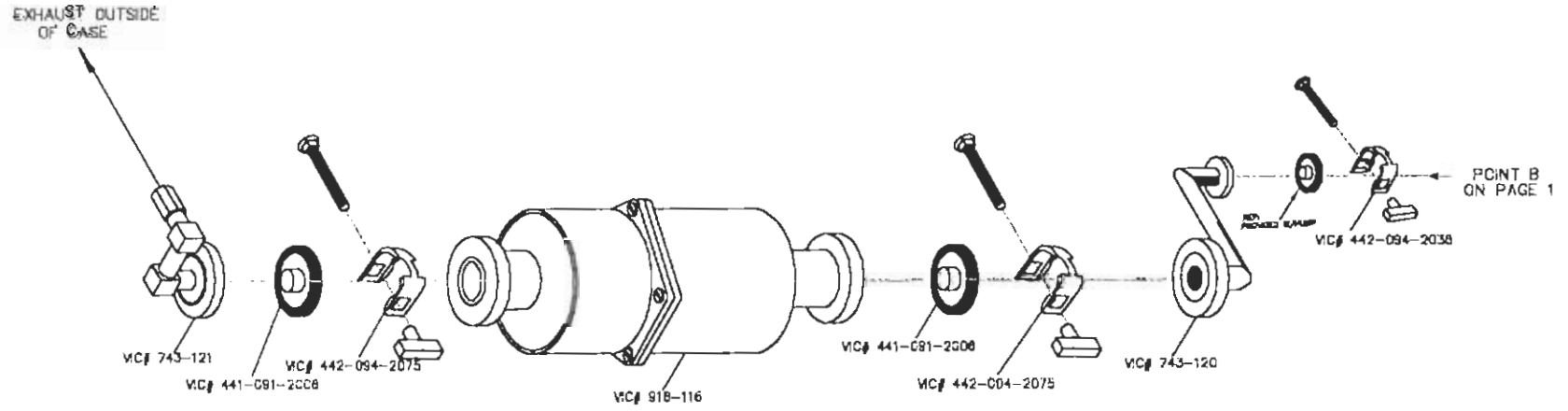


FOR MD-391SD ONLY

VACUUM INSTRUMENT CORP.

STANDARD

MANIFOLD ASS'Y



FOR MD-390S AND MD-391S ONLY

VACUUM INSTRUMENT CORP.

EXHAUST OF MANIFOLD ASSY

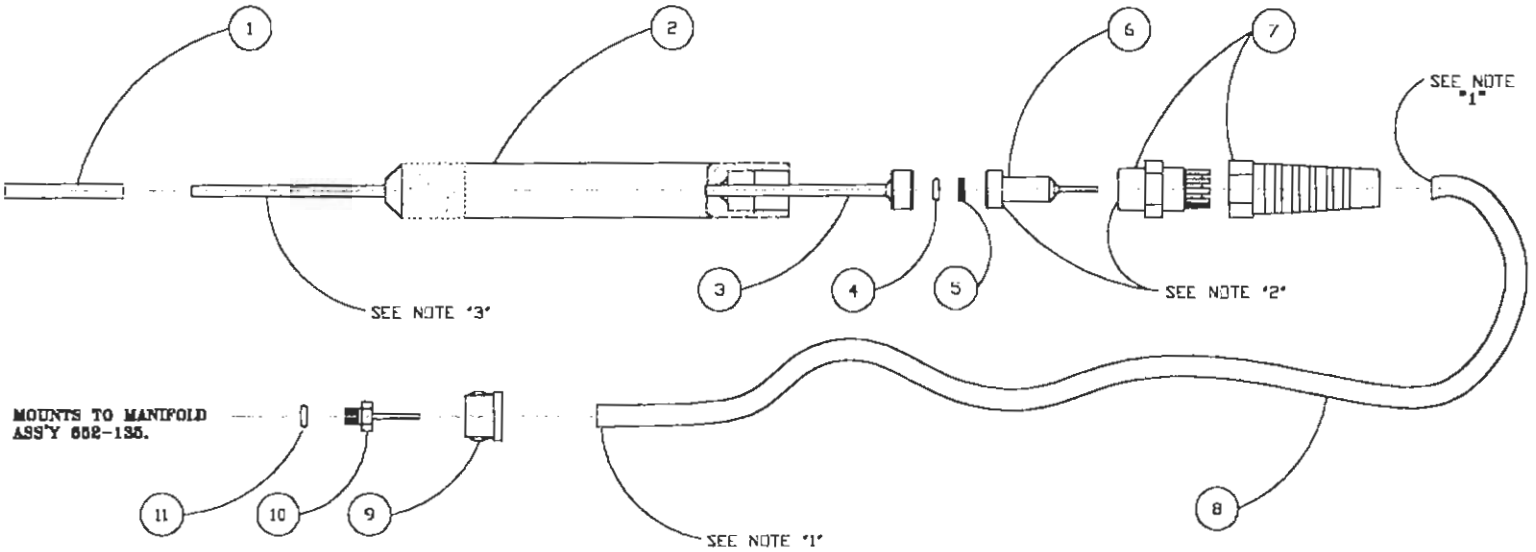
PARTS LIST			
SYN.	AMT	PART NO.	DESCRIPTION
1	1	452-681-1030	MANIFOLD
2	2	492-092-2010	O-RING, BUNA-N IDN#2-010
3	1	489-798-0039	WASHER, NEOPR. SEASTROM #5613-33-31
4	2	492-092-2007	O-RING, BUNA-N PARKER#2-007
5	2	489-116-0019	SCREW, 6-32 X 1 1/4" LG
6	1	452-691-1024	APERTURE, PINHOLE, 40 MICRON TOWNE LAB#C100105-17
7	1	452-681-1032	MANIFOLD, MASS SPECTROMETER
8	1	485-091-6028	ORIFICE, .012, 1/8 BARB, 10-32 OKEEFE# N-12-BR
9	1	425-691-1098	REGULATOR, VACUUM AIRTROL #V-910-30.M-W/OS
10	4	489-798-0018	WASHER, FLAT#4 ID S/S,4-40
11	1	492-092-2006	O-RING, BUNA-N IND# 2-006
12	1	673-109	VALVE ASSY PROBE
13	4	489-115-0022	SCREW, 4-40 X 1 1/8 PAN HEAD PHIL. ZINC PLATED
14	4	489-113-0005	SCREW, 4-40 X 1/4" LG STL. FLAT HEAD
15	1	452-611-1025	FLANGE, MANIFOLD MOUNTING
16	2	489-116-0021	SCREW, 6-32 X 3/4" SOC. CAP
17	1	489-798-0041	WASHER, PLASTIC, 10-32 X 2mm THK SMC # M-5G1
18	2	493-096-1033	STANDOFF, 3/8L X 3/16 D, 4-40, KEYSTONE # 2026
19	2	489-758-0001	WASHER, SHOULDER MICRO PLASTICS # 12SWS0196
20	2	489-114-0017	SCREW, CAPTIVE STL. PHILIPS PROMPTUS# 204-08 ST 4-40
21	1	441-091-2005	SEAL RING, NW-40 HPS#31-2505 KEY #KSCR-1540
22	1	442-094-2011	CLAMP, NW-40 ALUM HPS# 31-2905

SEE SHEET 1 FOR ALL REVISIONS

VACUUM INSTRUMENT CORP.

BILL OF MATERIAL TO MANIFOLD ASSY

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	ADDED ITEM #11	6/97	BCH
B	ADDED B/M TO DWG.	9/99	BCS



ITEM	QTY	PART NO.	DESCRIPTION
11	1	489-798-0041	WSHER PLASTIC 10-32X 2MM THK SMC#M5G1
10	1	754-111	ADAPTOR PROBE END ASSY
9	1	369-321-0007	SNUB BUSHING, 1/4 DIA TUBE HEYCO#2057 OK500-250
8	10FT	011-213-1507	TUBE PVC APAGUE RED .031IDX.2350D NORTON#C-219-D4
7	1	487-691-1005	CONNECTOR, FLEX-PROTECTING HEYCO#3237
6	1	658-104	FILTER HOUSING ASS'Y & DETAILS
5	1	413-613-1003	FILTER SUPER SNIFFER S/S, MOTT#1000-250-.062-40
4	1	492-092-2006	O-RING, BUNA-N IND#2-006
3	1	658-103	PROBE TIP ASSY & DETAILS
2	1	455-612-1078	PROBE BODY MACHINING
1	1	741-116	FILTER ASS'Y SNIFFER PROBE

NOTE(S):

1) PREHEAT HOSE ENDS PRIOR TO INSTALLING ONTO ITEM #6 AND #10.
2) PRESS FIT ITEM #6 ONTO ITEM #7. MAKE INDICATED SURFACES FLUSH.
3) APPLY THIN LAYER OF VACUUM GREASE ONTO PROBE TIP ASSY BEFORE INSTALLING ITEMS #1.

STANDARD

VACUUM INSTRUMENT CORP.

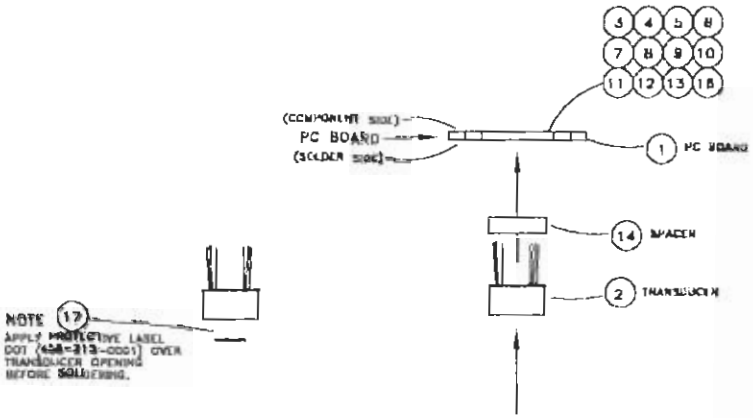
SNIFFER PROBE ASSY. MD-390S

SIZE C | DWG. NO. 658-101 | REV. B

SCALE 1 : 1 | SHEET 658-101B | WEIGHT 1 LB 1

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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	ADDED HARDWARE	5/97	MARK
B	REMOVED HARDWARE TO NEW DWG	6/97	BCH
C	ADDED B/M TO DWG. MADE DWG "B" SIZE	9/99	BCS



17	1	861-103	TEST DOC. MD-390S, BALLAST BOARD MNPR0001.WP6, REVISISON-	
16	1	458-215-0001	LABEL PROTECTIVE DOT, .325 DIA STAPLES	
15	.1FT	013-124-9001	WIRE, GREEN, 24 AWG, SOLID	
14	1	489-798-0042	HEADER, 0.1 LOCKING 5PIN STR, AMP#641215-5	
13	1	282-321-0005	CAPACITOR, 4.7UF, SURFACE AVX#TAJD475K035	
12	1	233-120-4700	CAPACITOR, 100 PF SURFACE AVX#12061A101JAT050M	
11	1	233-120-0001	TRIMPOT, 10K MODEL RJ24FW 103 BECKMAN	
10	1	229-223-1008	RESISTOR 1.65 K 1/4 WATT .25% IRC# RNC55J1651LBS	
9	1	222-556-1653	RSTR, 200K OHM, 1/4W,1%TOL. METAL FILM, DALE#CCF-55 2003F	
8	1	222-556-2005	RSTR,200K OHM 1/4W,1% TOL.,METAL FILM, DALE# CCF-55 1002F	
7	1	222-556-1004	RSTR, 10K OHM, 1/4W, 1%TOL, METAL FILM DALE#CCF-55 2003F	
6	1	222-556-1002	RSTR 1000HM 1/4W, 1%ROL, METAL FILM, DALE#CCF-55 1000F	
5	1	216-300-0295	IC AMPLIFIER DUAL SO8 ANALOG DEVICES #OP-295GS	
4	1	216-300-0004	IC AMPLIFIER INTRUMENT SO8 ANALOG DEVICES # AMP-04FS	
3	1	216-311-0022	IC, 2.5V REFERENCE ANALOG DEVICES AD580LH	
2	1	341-092-0043	TRANSDUCER, 0-15PSIA, TO-8 CAN IC SENSOR#43B-015A	
1	1	281-325-1011	PC, BLANK PCB BALLST MD-390S SH008	
ITEM	QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

DWG. NO 584-335 | SH 1 | REV. C

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XXX ±.0XX ±

MATERIAL

FINISH UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DRAWING

CUSTOMER

APPROVALS	DATE
DRAWN MARK	5/97
CHECKED	
PRODUCTION	
ENGINEERING	

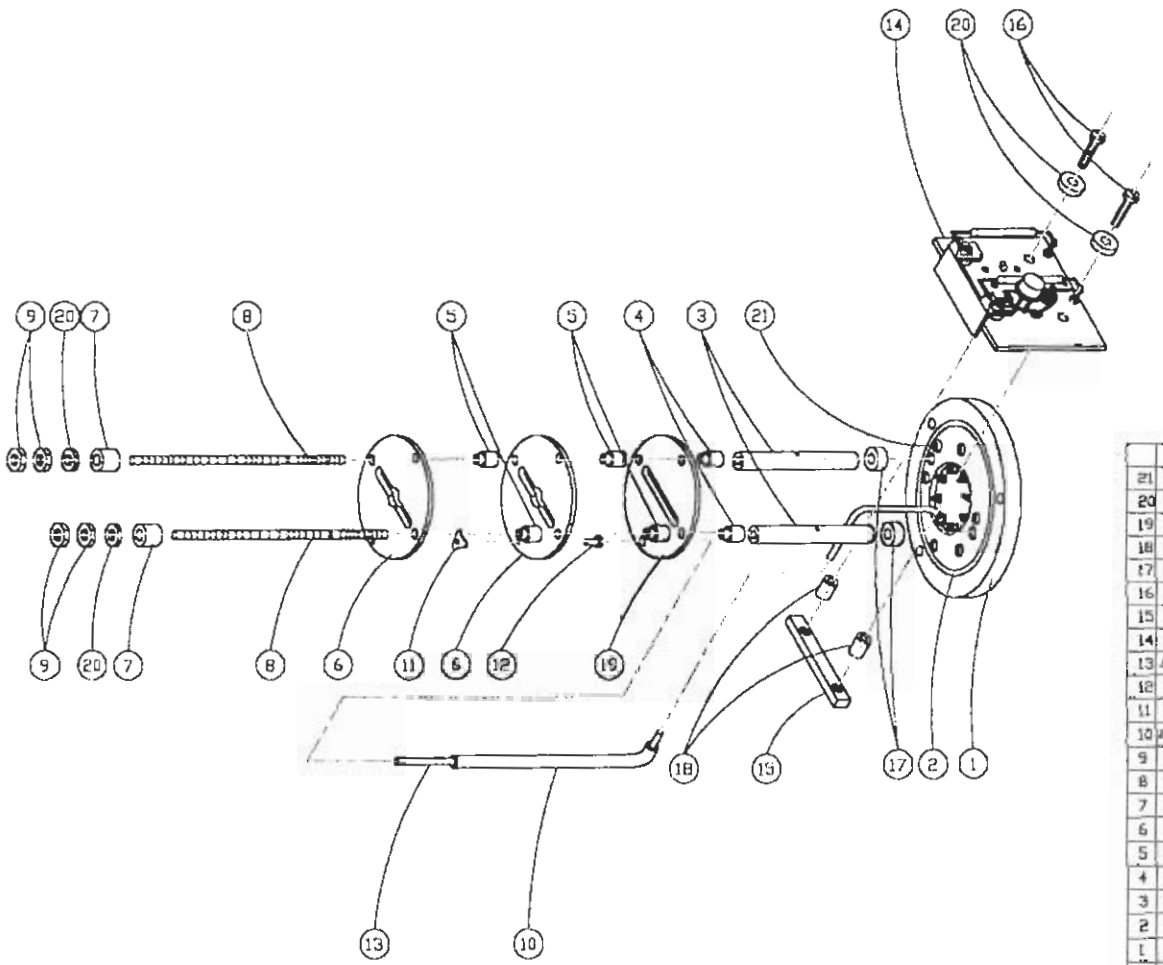
VACUUM INSTRUMENT CORP.
RONKONKOMA, N.Y. 11779

MD390 SERIES BALLAST BRD HARDWARE ASSEMBLY

SIZE	DWG. NO	REV.
B	584-335	C

SCALE 1 : 1 | FILE # 584-335C | SHEET 1 OF 1

A	TRANSFERED DRAWING TO CADD. ITEM 86 WAS QTY (3) NOW QTY IS (2) ITEM 819 WAS ADDED. ITEM 821 WAS ADDED TO B.O.M. UPDATED DRAWING TO REFLECT B.O.M.	5/25/97	JAN
B	ADDED B/M TO DWG.	8/99	BCS



ITEM	QTY	PART NO.	DESCRIPTION
21	1	489-114-0005	SCRE,W, 4-40 X 3/16 LG VENTED S/S FLSTR HD
20	4	489-798-0018	WASHER, FLAT #4 ID S/S 4-40
19	1	451-615-1020	PLATE, GROUND FOCUS, COLLECTOR
18	2	493-096-1020	STANDOFF, INT. COLL. BOARD MCMASTER-CARR#90309A219
17	2	451-615-1018	MOUNTING STANDOFF
16	2	489-114-0007	SCREW 4-40 X 5/8 LG FLSTR HD PHILLIPS
15	1	451-615-1012	AMPLIFIER MOUNTING BRACKET
14	1	585-302	PC BOARD ASSY INTERNAL COLLECTOR
13	AFT	013-120-9001	WIRE, BUS 20 GAUGE U/M FEET
12	1	351-611-1002	BOOT, WIRE END, SOURCE ASSY AMP#1-331677-4
11	1	351-611-1003	RETAINER, TRIAGULAR, SOURCE WALDES#5305-6, .01 THK
10	AFT	011-213-2206	TUBING REFLON SPAGETTI 16 GA. LIGHTWEIGHT WALL
9	4	489-218-0008	NUT, 4-40 S/S WITH 1/4 HEX DRV
8	2	451-613-1073	ROD, THRD, COLLCTR/SOURCE 4-40 THREAD X 3.43 LG
7	2	451-613-1048	CAP END .200 THK X 1/4" DIA, NEW COLLECTOR
6	2	451-615-1011	PLATE BAFFLE SLOTTED UNIV. ST.STL.
5	4	451-613-1052	STANDOFF, 1/4" X 9/32" TEFLON
4	2	451-613-1065	STANDOFF COLLECTOR THREADOR ST. STL.
3	2	451-615-1010	STANDOFF, COLLECTOR, S/S
2	1	492-092-2144	O-RING, BUNA-N PARKER#2-144
1	1	651-130	FLANGE ASSY UNIVERSAL SPEC TUBE MD-290T PORTABLE

851-103	000-101

STANDARD

VACUUM INSTRUMENT CORP.

COLLECTOR ASSEMBLY

D 651-302 B

651-302 SHT 1 OF 1

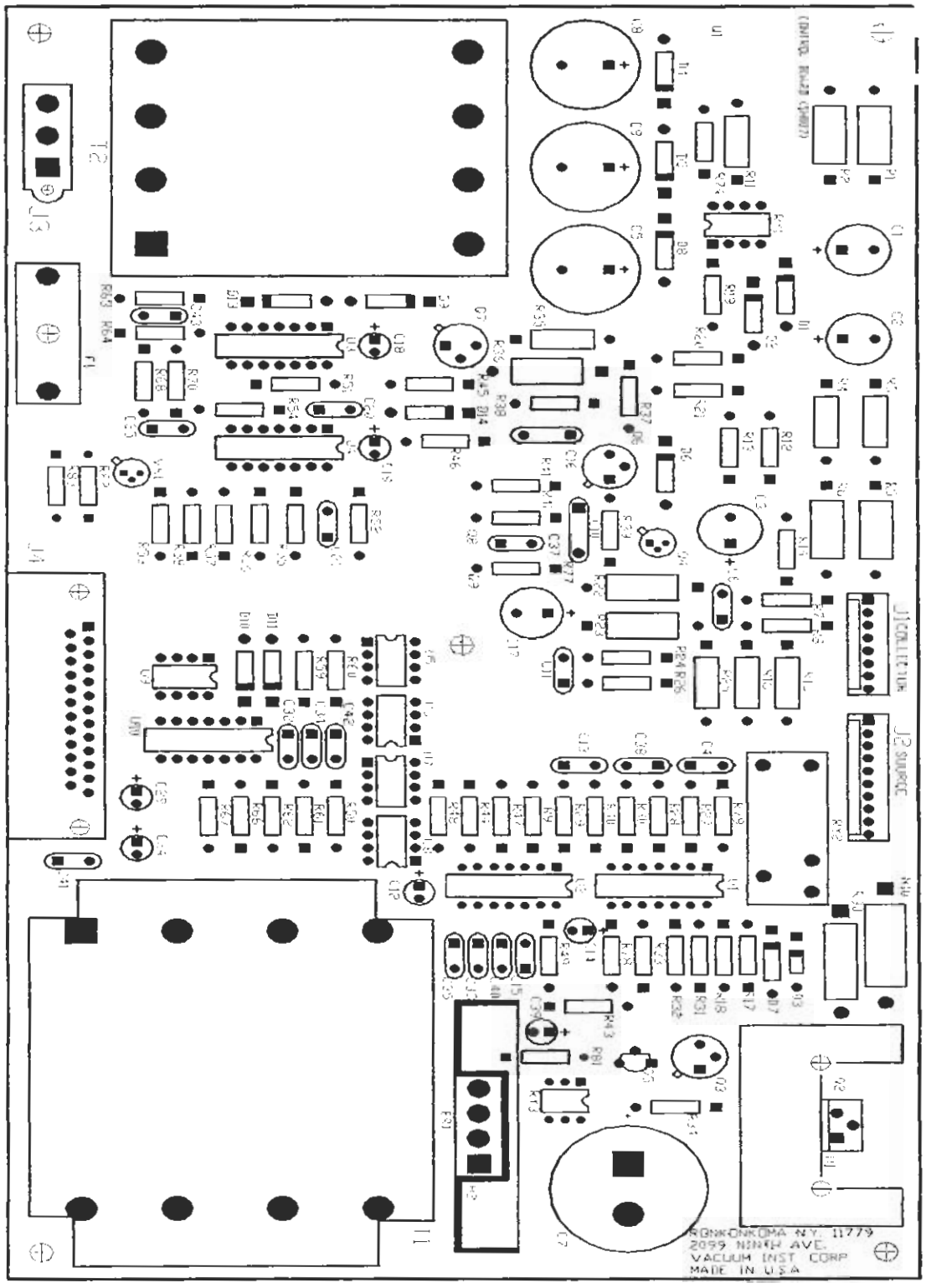


FIGURE 1 – CONTROL BOARD LAYOUT
VIC P/N: 584-334

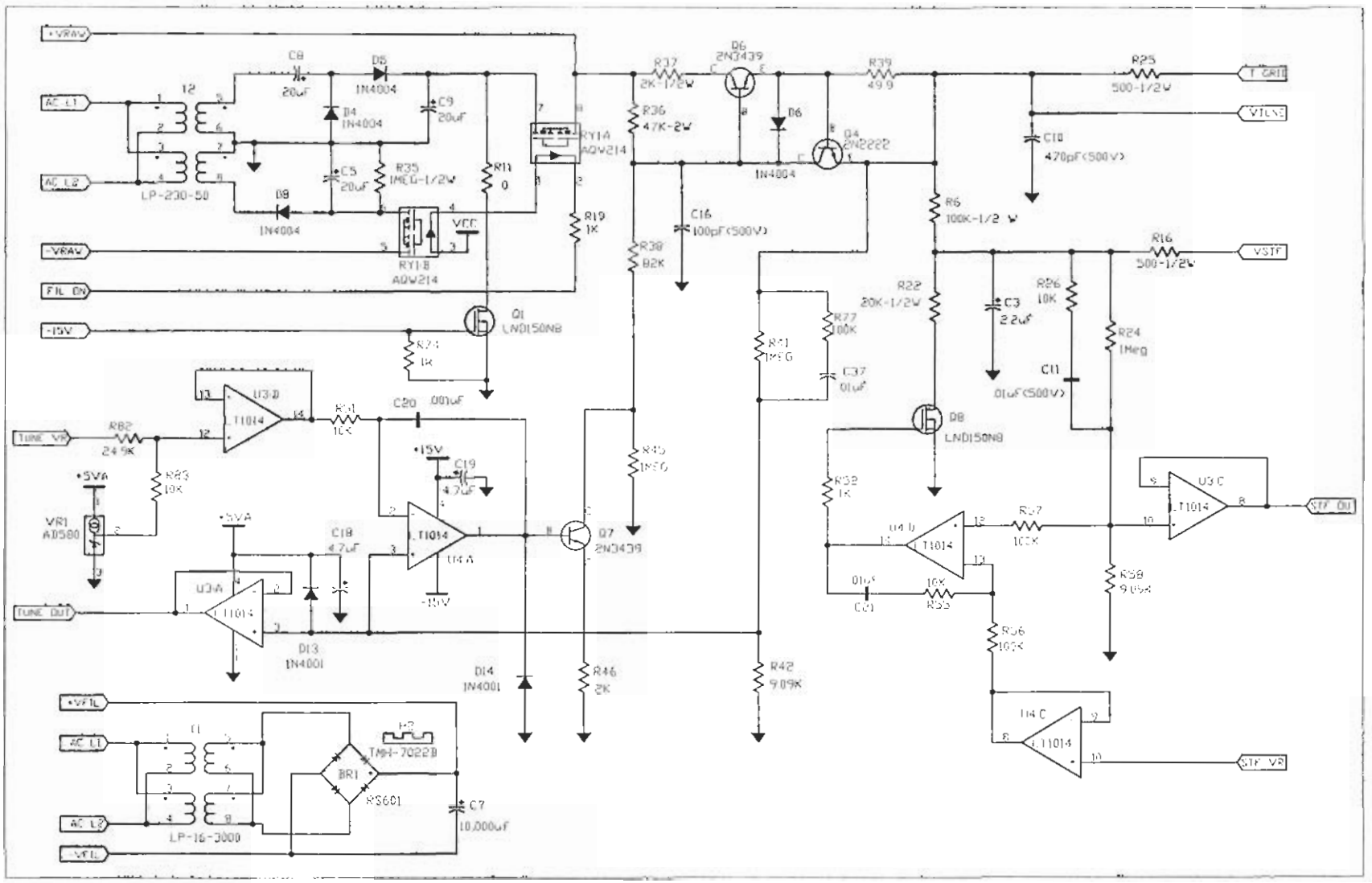


FIGURE 1.1 – CONTROL BOARD SCHEMATICS [Sheet 1 of 4]
VIC P/N: 584-334

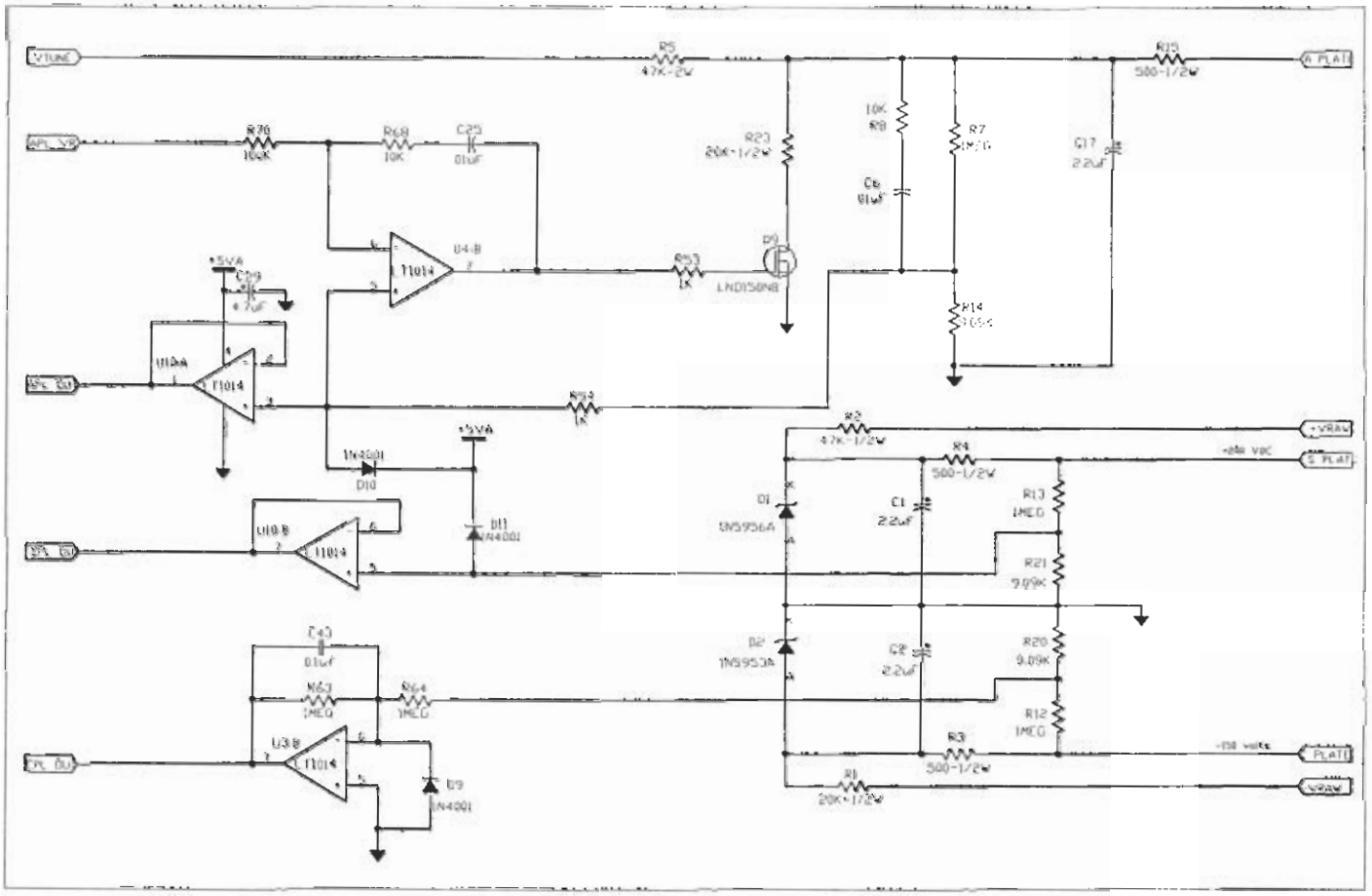


FIGURE 1.2 – CONTROL BOARD SCHEMATICS [Sheet 2 of 4]
VIC P/N: 584-334

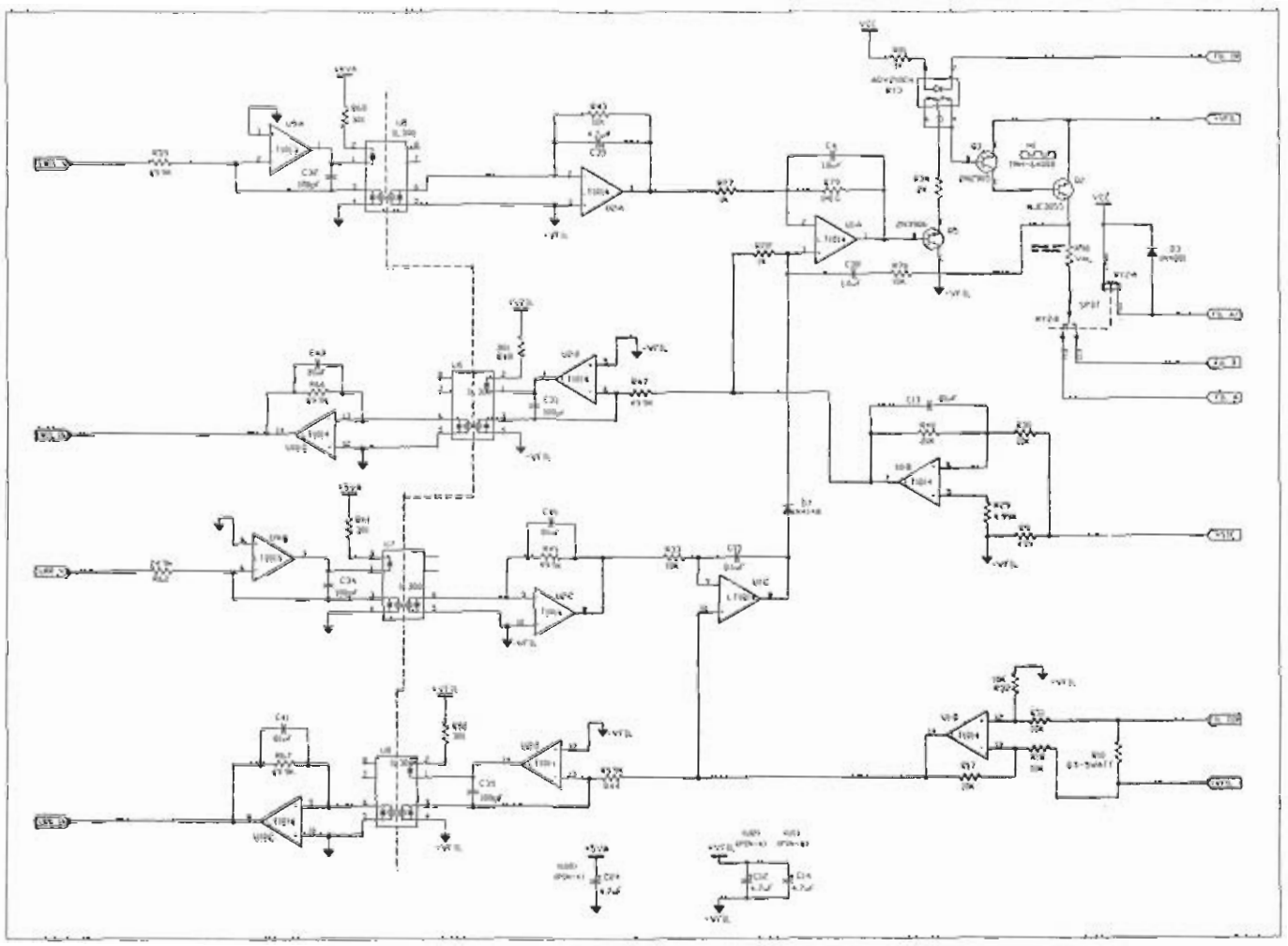


FIGURE 1.3 – CONTROL BOARD SCHEMATICS [Sheet 3 of 4]
VIC P/N: 584-334

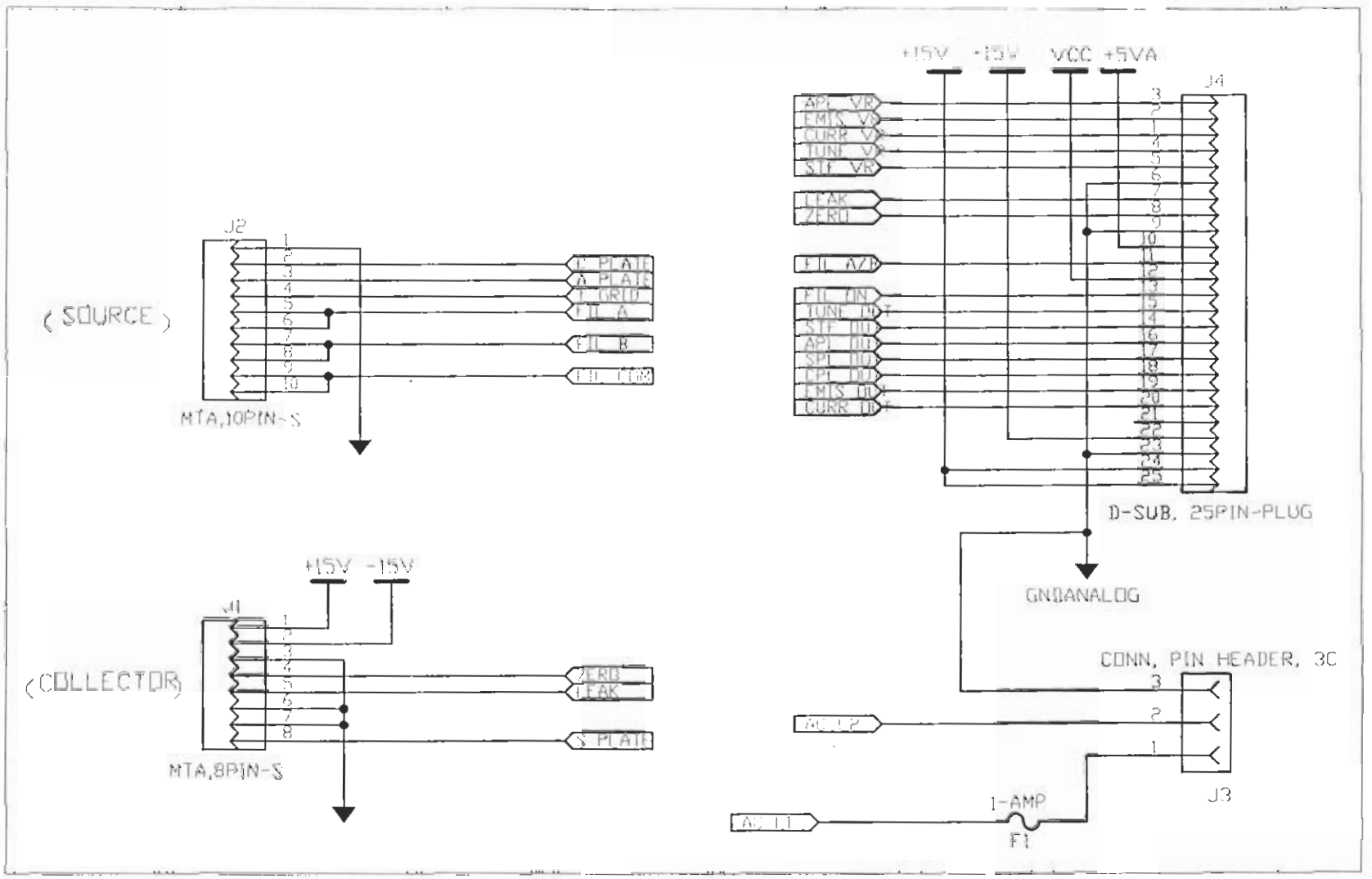


FIGURE 1.4 – CONTROL BOARD SCHEMATICS [Sheet 4 of 4]
VIC P/N: 584-334

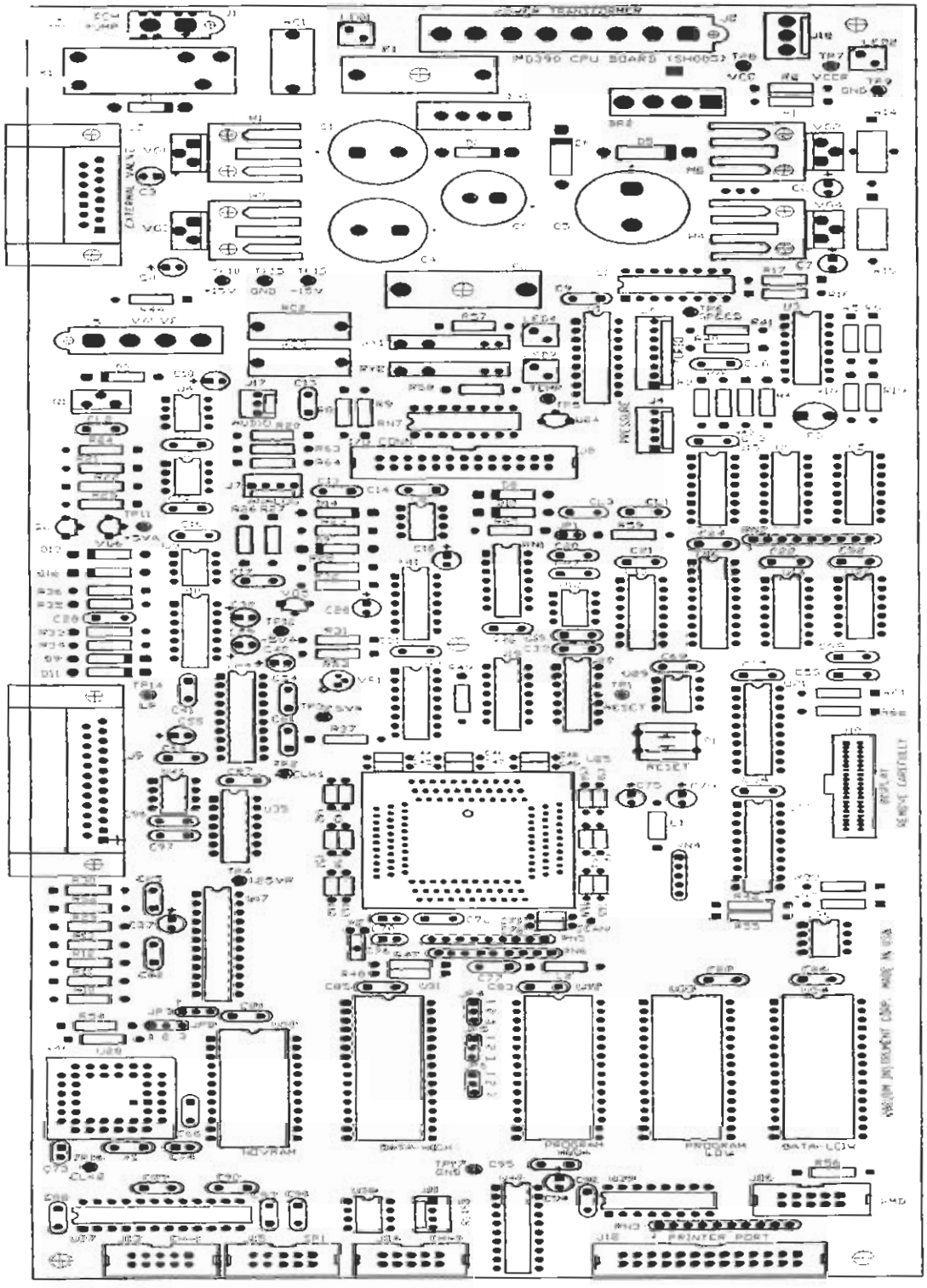


FIGURE 2 – MD-390S CPU BOARD LAYOUT
VIC P/N: 584-331

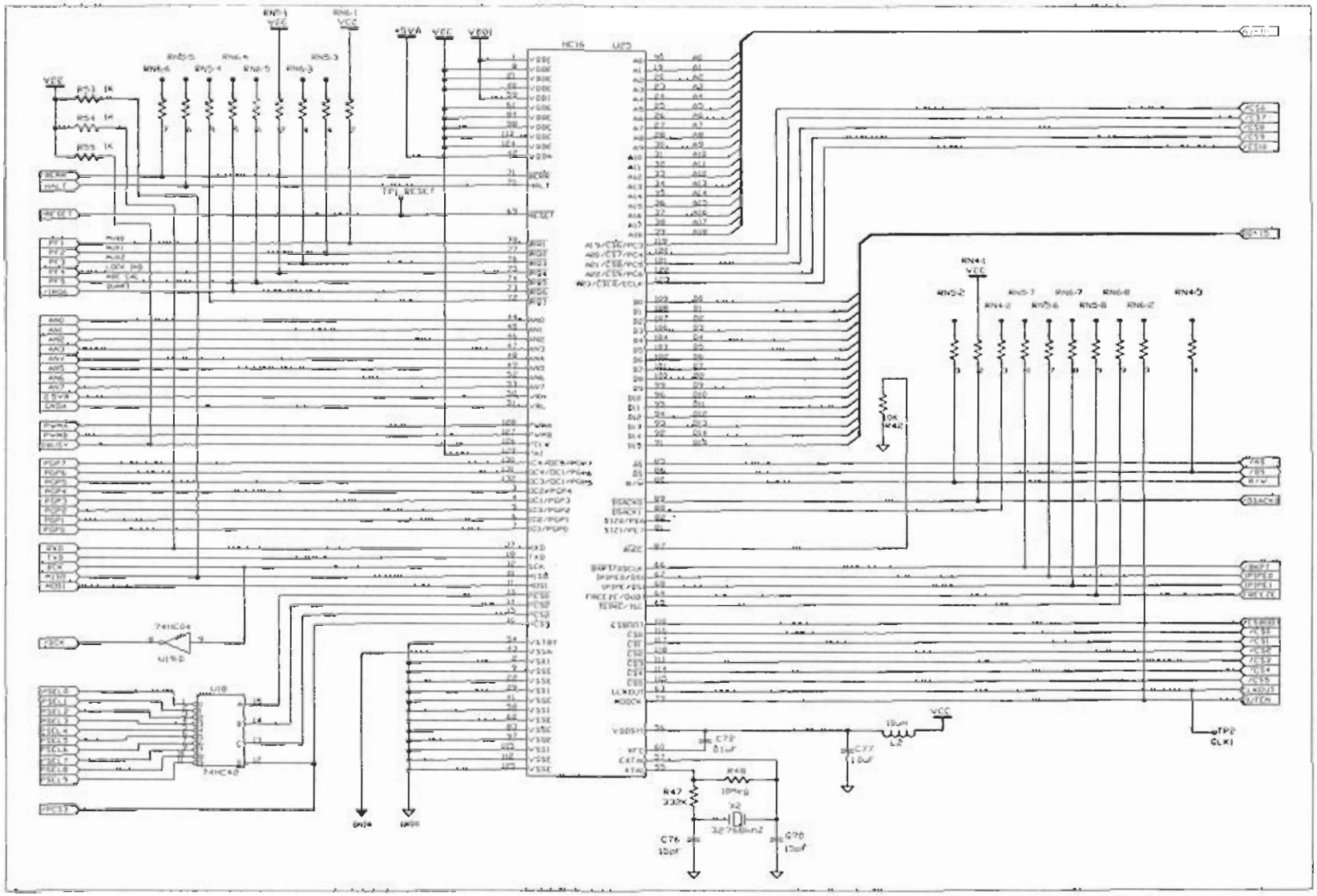


FIGURE 2.1 – MD-390S CPU BOARD SCHEMATICS [SHEET 1 OF 12]
VIC P/N: 584-331

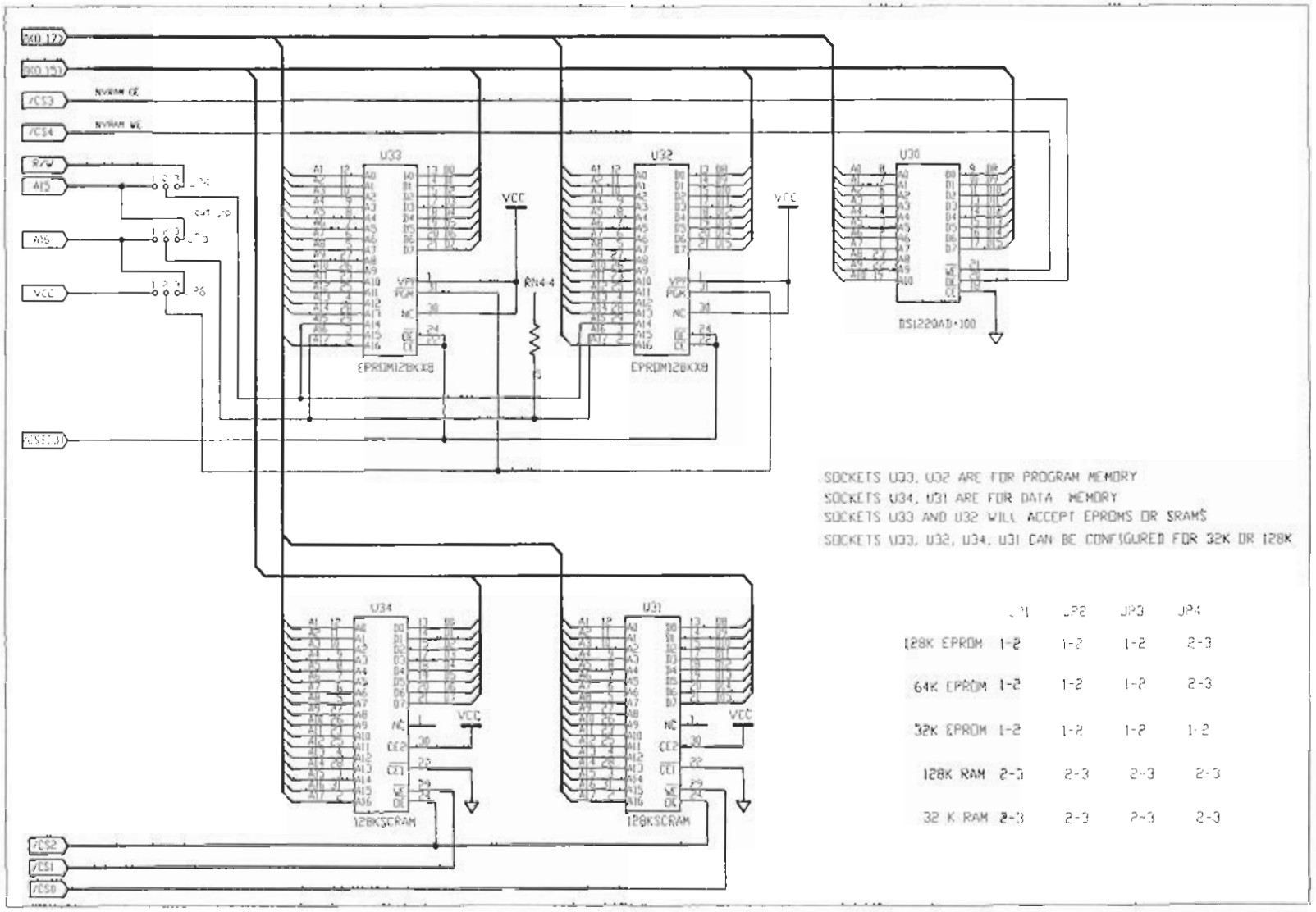


FIGURE 2.2 – MD-390S CPU BOARD SCHEMATICS [SHEET 2 OF 12]
VIC P/N: 584-331

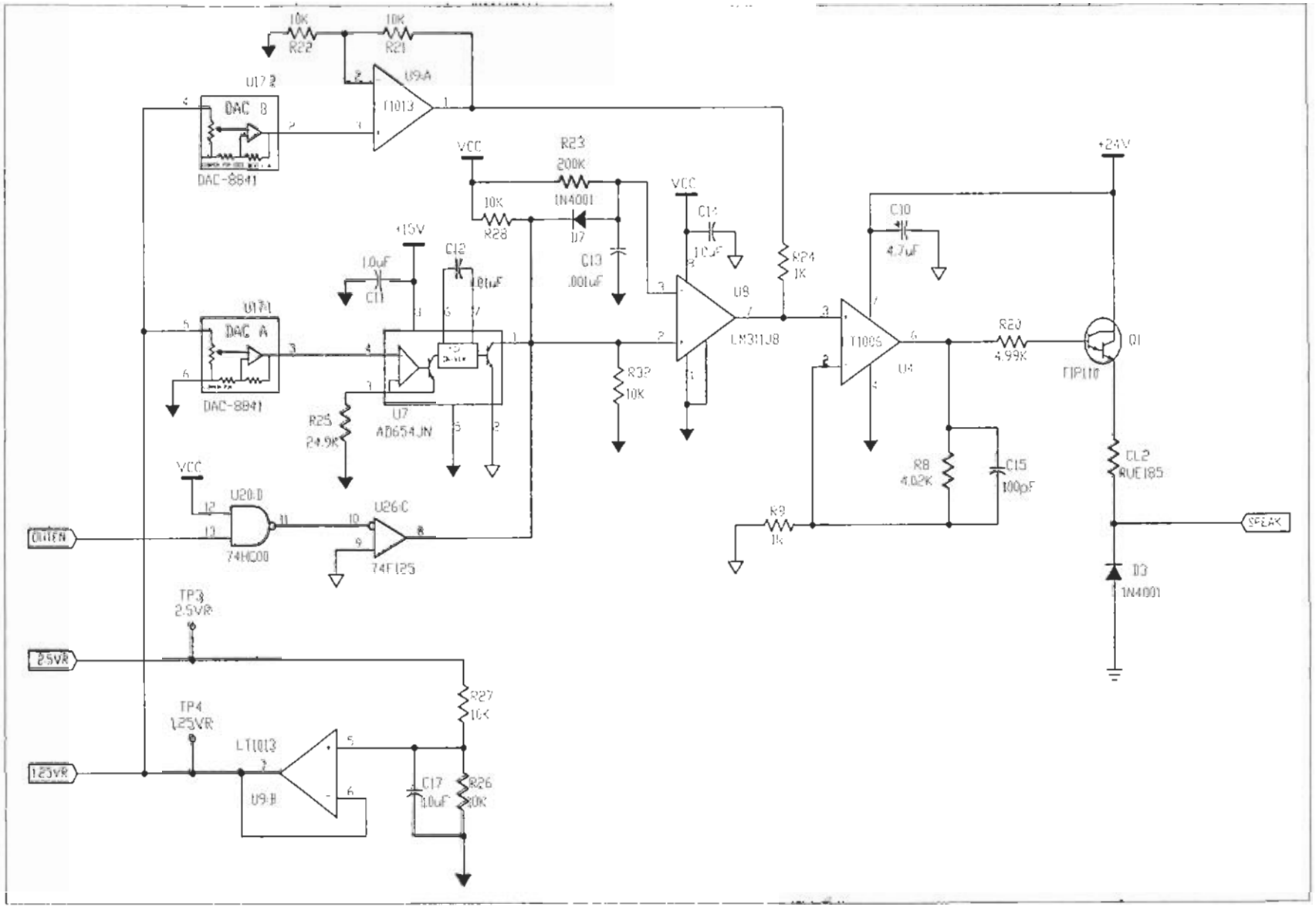


FIGURE 2.3 – MD-390S CPU BOARD SCHEMATICS [SHEET 3 OF 12]
VIC P/N: 584-331

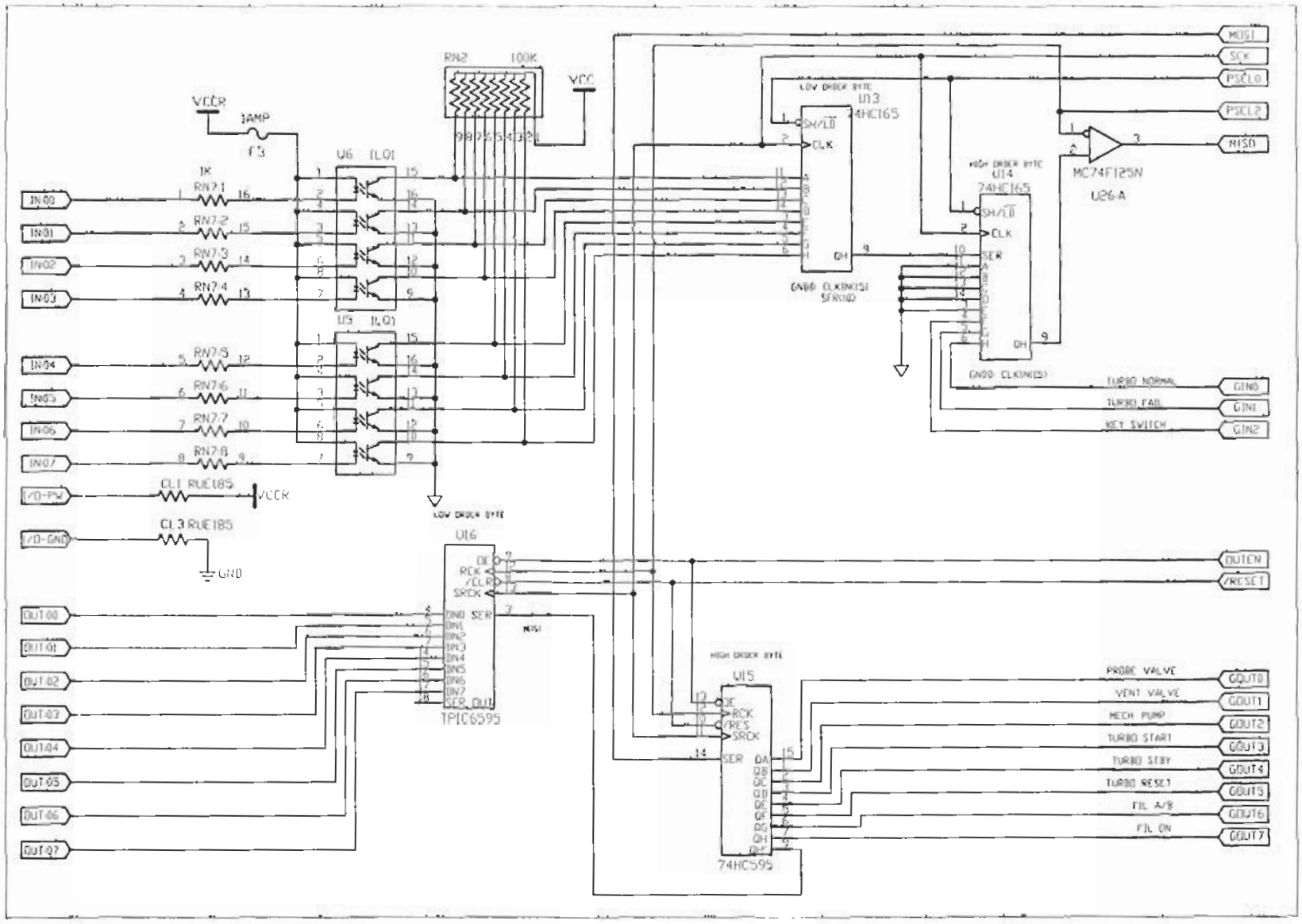


FIGURE 2.4 – MD-390S CPU BOARD SCHEMATICS [SHEET 4 OF 12]
VIC P/N: 584-331

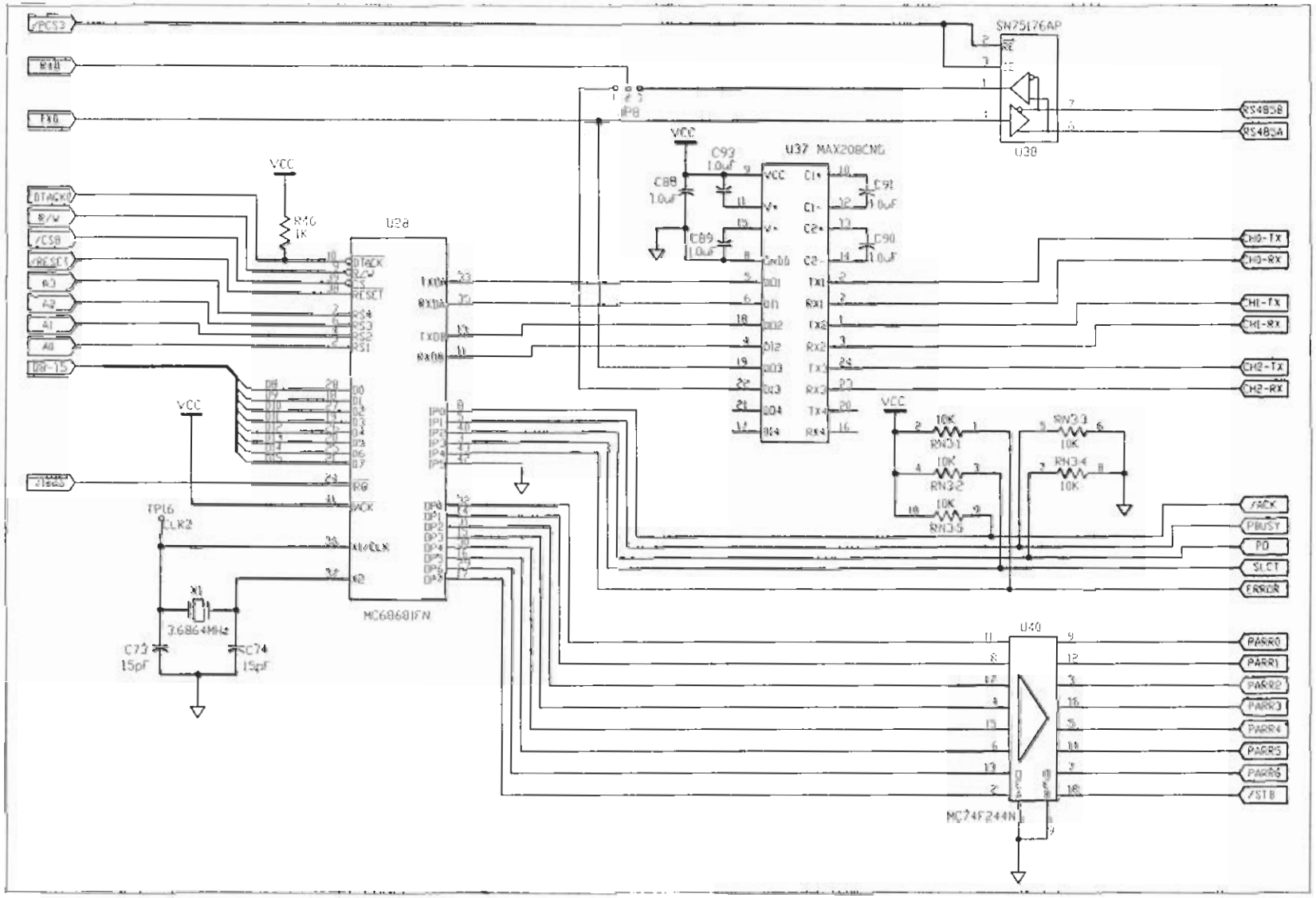


FIGURE 2.5 – MD-390S CPU BOARD SCHEMATICS [SHEET 5 OF 12]
VIC P/N: 584-331

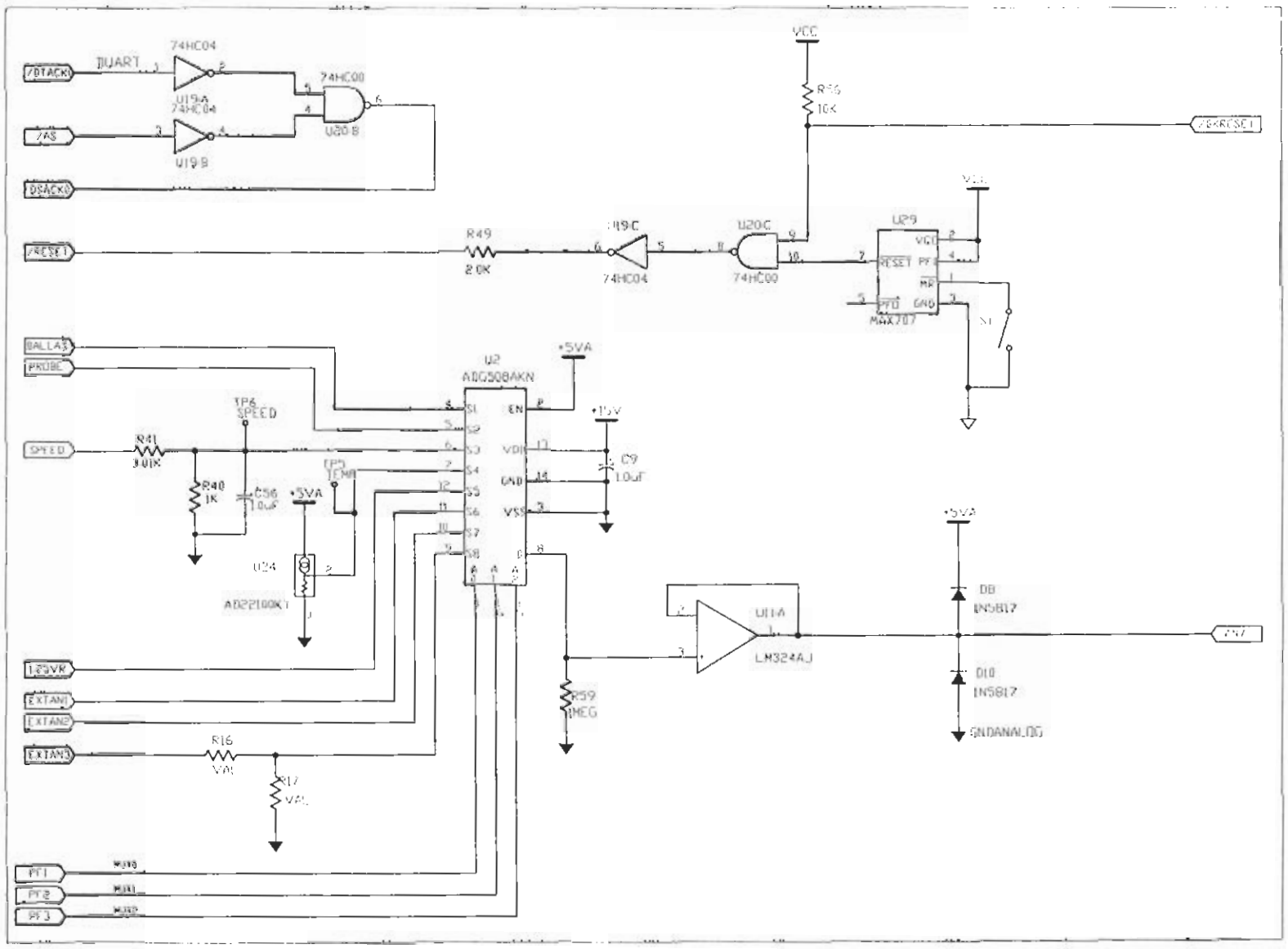


FIGURE 2.6 – MD-390S CPU BOARD SCHEMATICS [SHEET 6 OF 12]
VIC P/N: 584-331

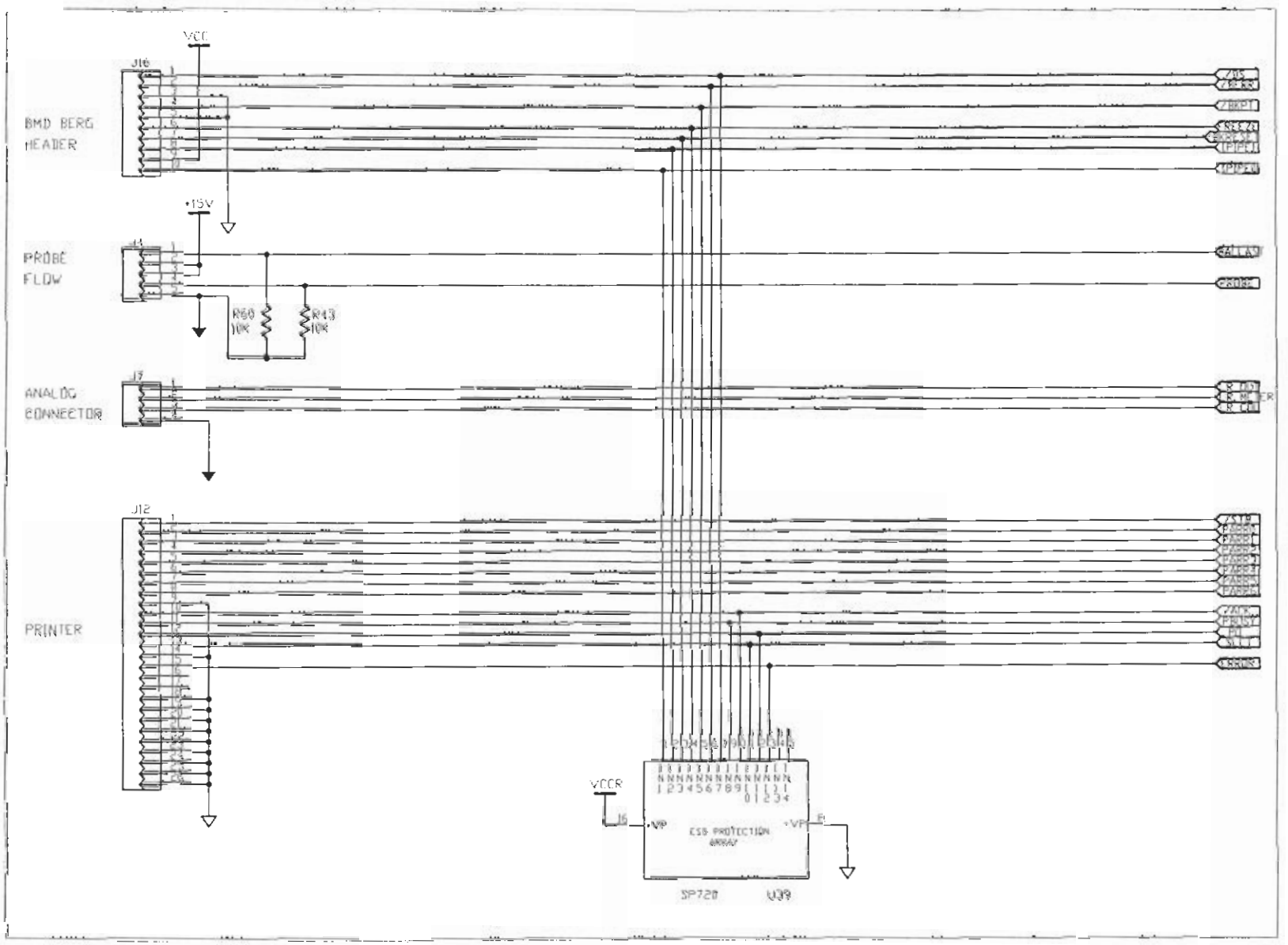


FIGURE 2.7 – MD-390S CPU BOARD SCHEMATICS [SHEET 7 OF 12]
VIC P/N: 584-331

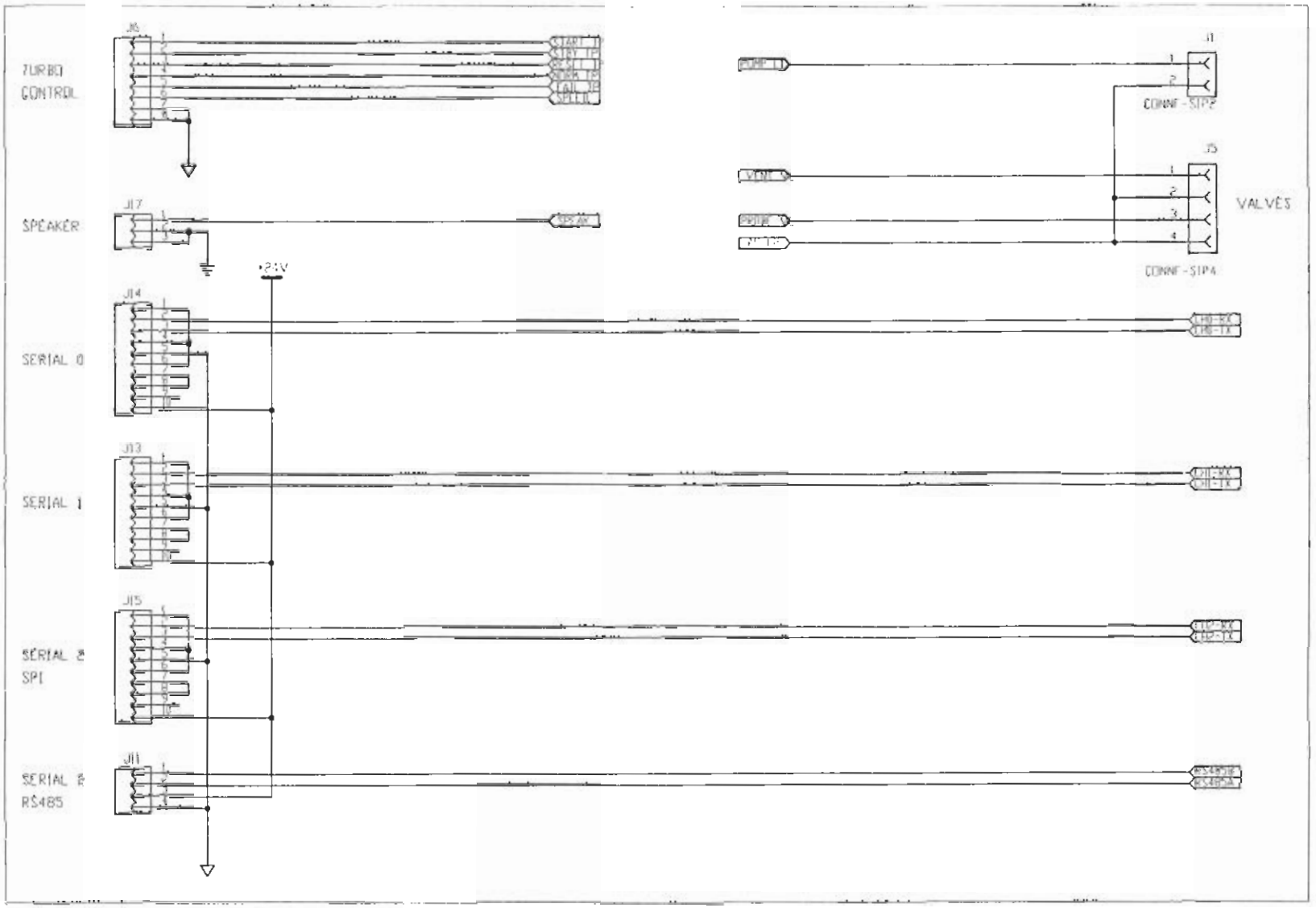


FIGURE 2.8 – MD-390S CPU BOARD SCHEMATICS [SHEET 8 OF 12]
VIC P/N: 584-331

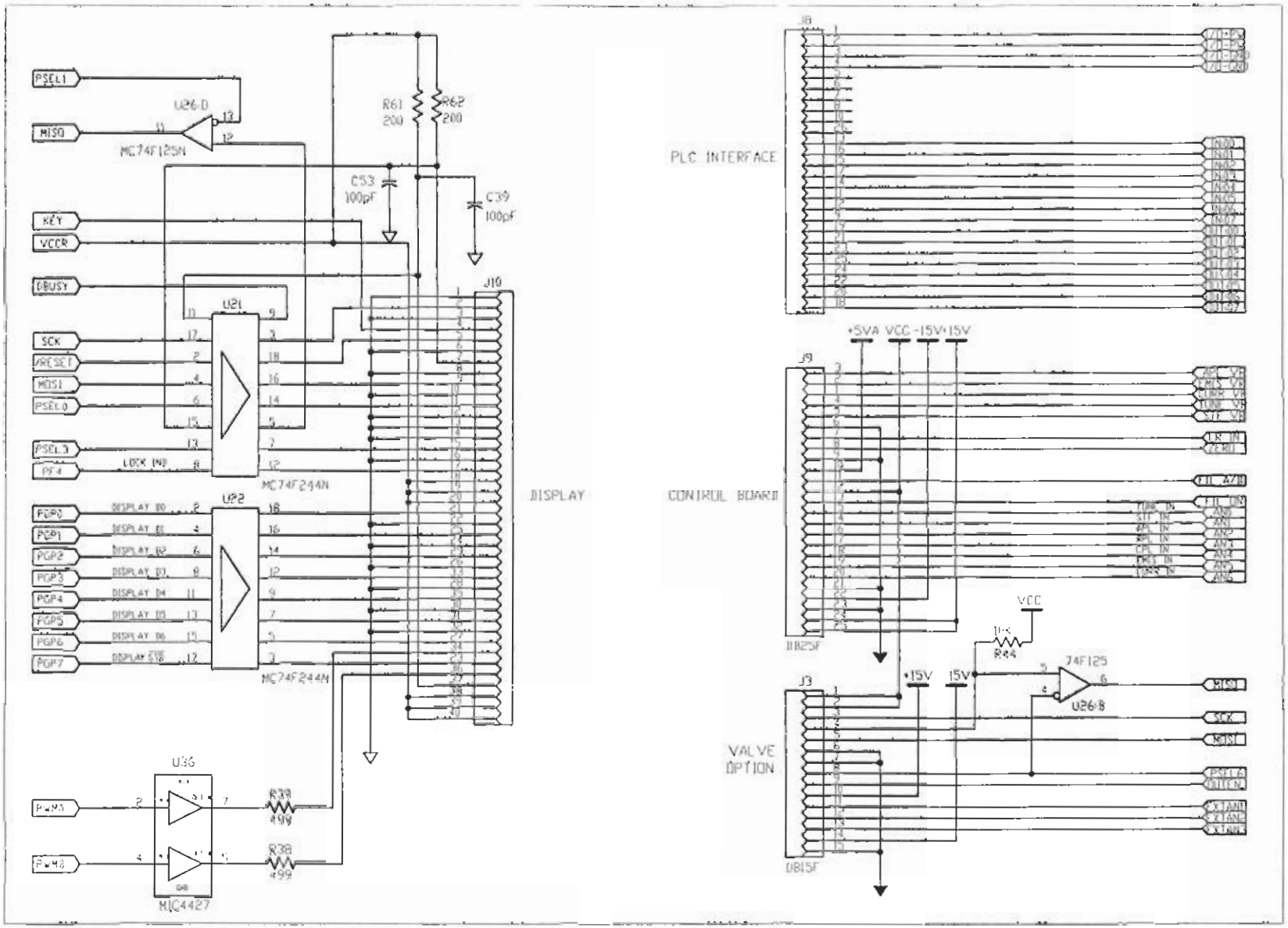


FIGURE 2.9 – MD-390S CPU BOARD SCHEMATICS [SHEET 9 OF 12]
VIC P/N: 584-331

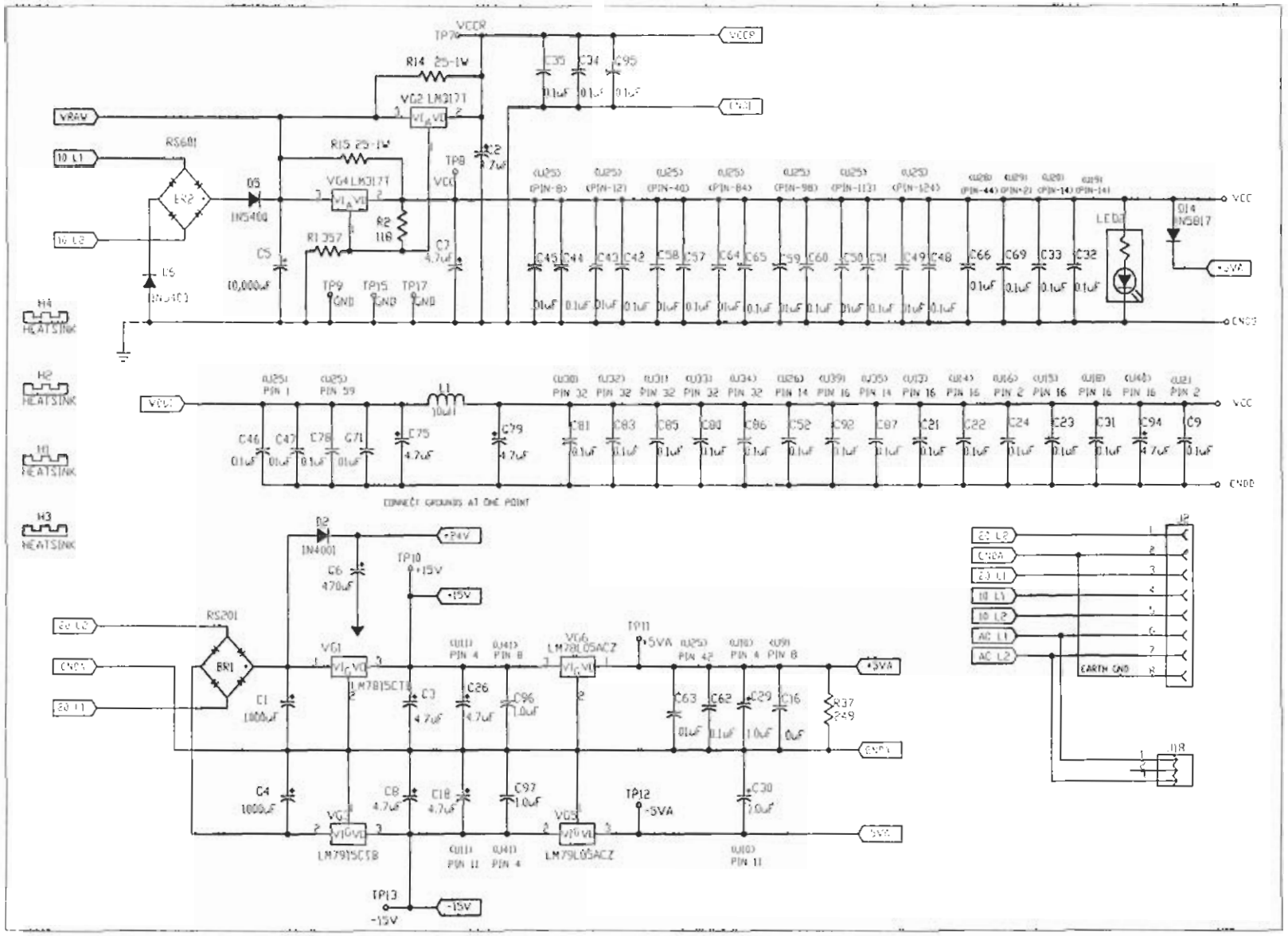


FIGURE 2.10 – MD-390S CPU BOARD SCHEMATICS [SHEET 10 OF 12]
VIC P/N: 584-331

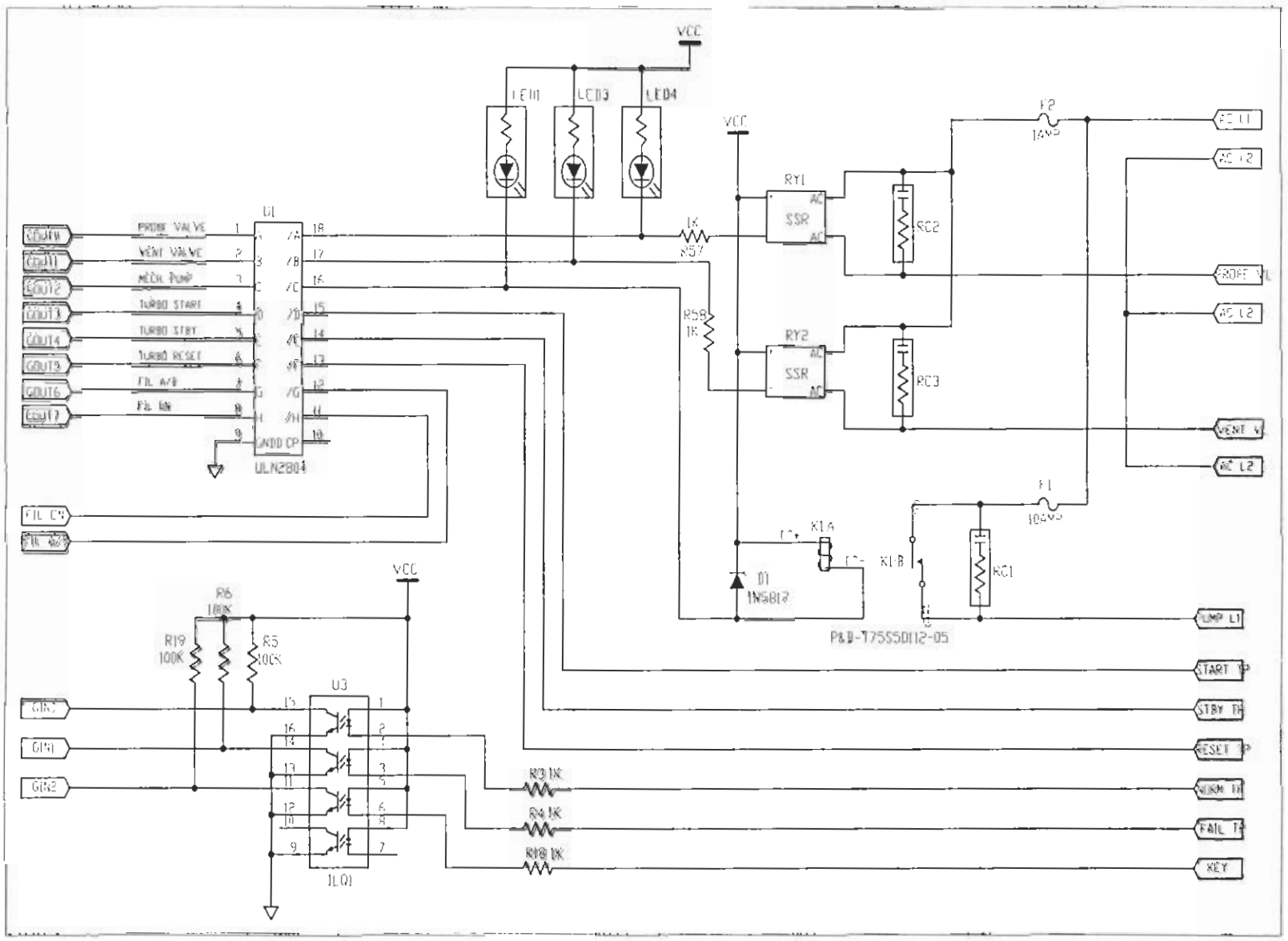


FIGURE 2.11 – MD-390S CPU BOARD SCHEMATICS [SHEET 11 OF 12]
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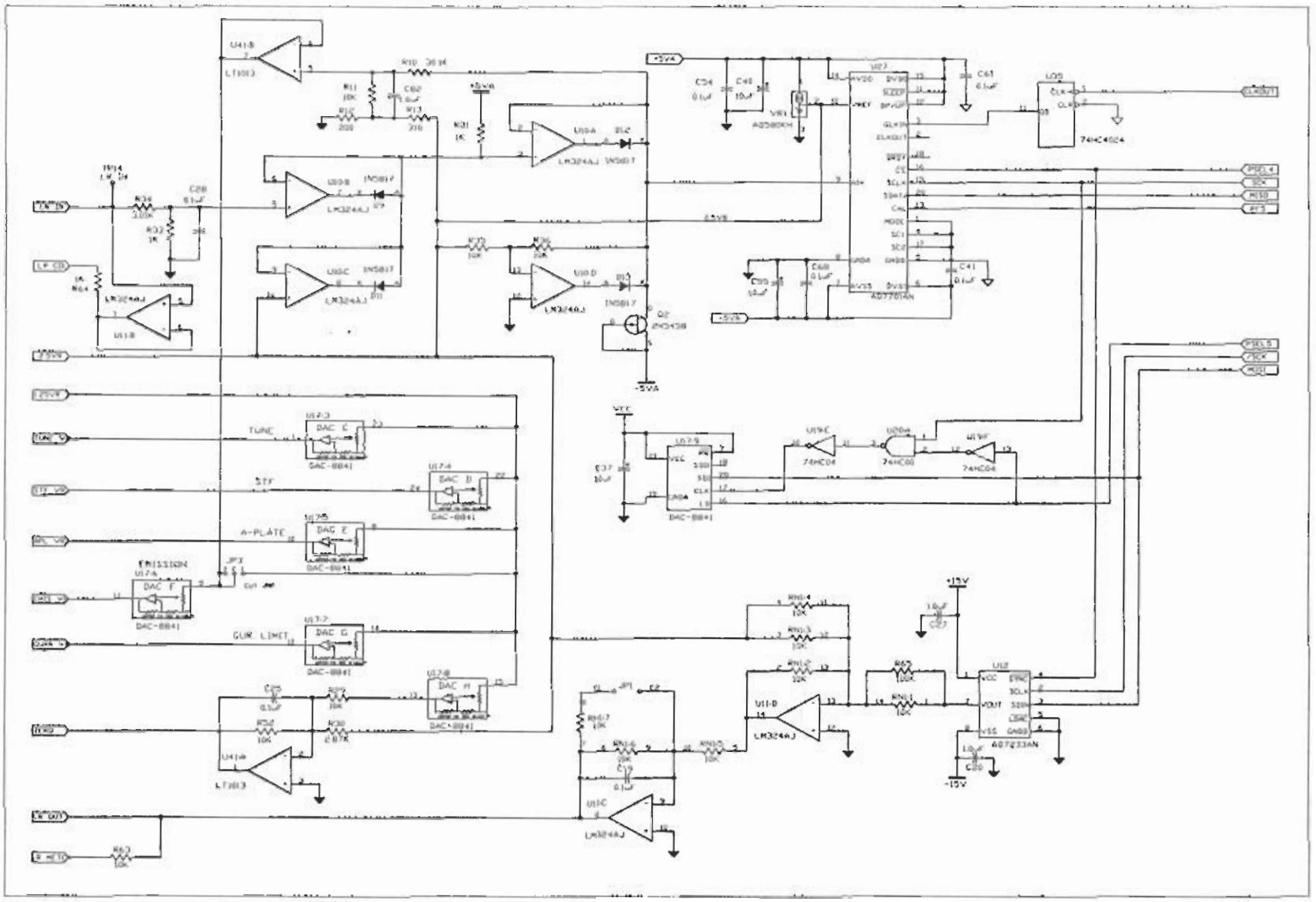


FIGURE 2.12 – MD-390S CPU BOARD SCHEMATICS [SHEET 12 OF 12]
VIC P/N: 584-331

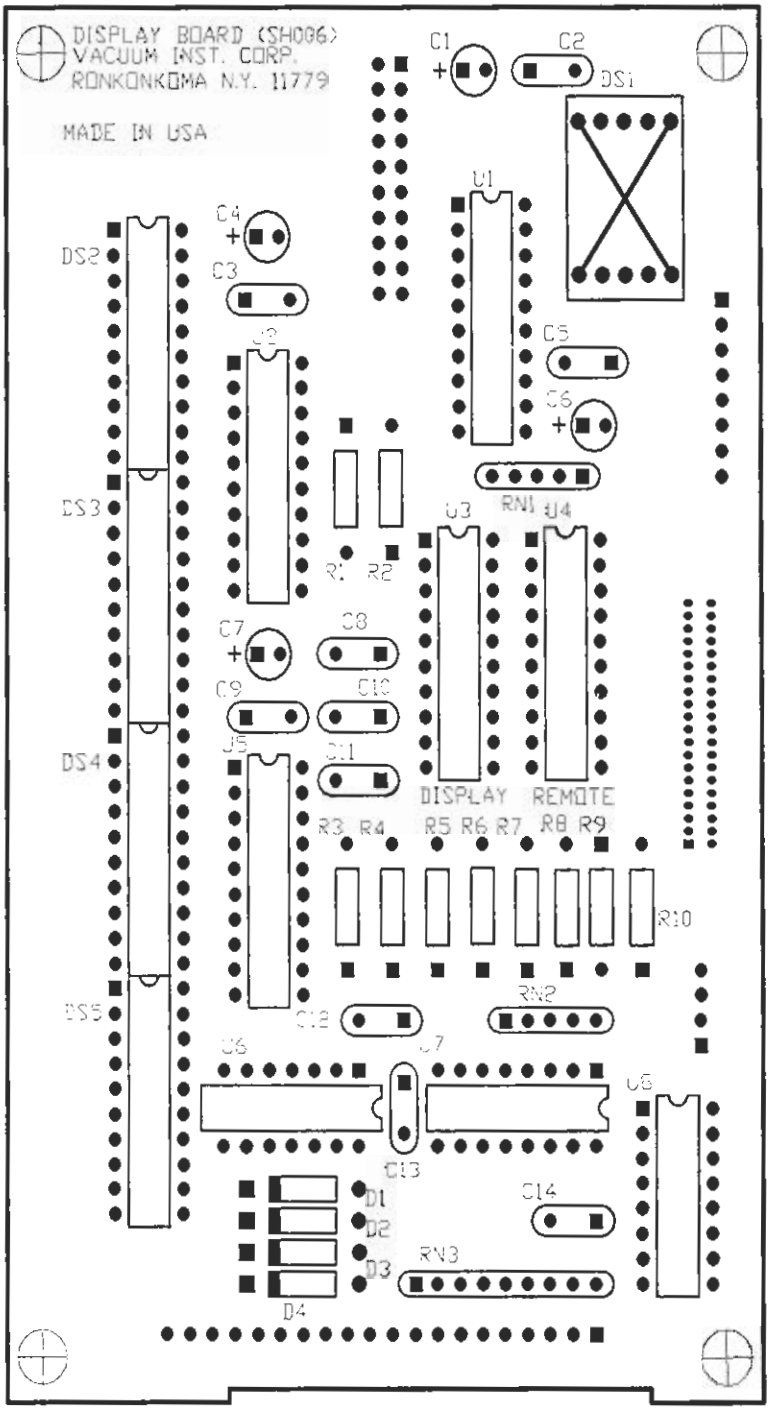


FIGURE 3 – MD-390S DISPLAY BOARD LAYOUT
VIC P/N: 584-330

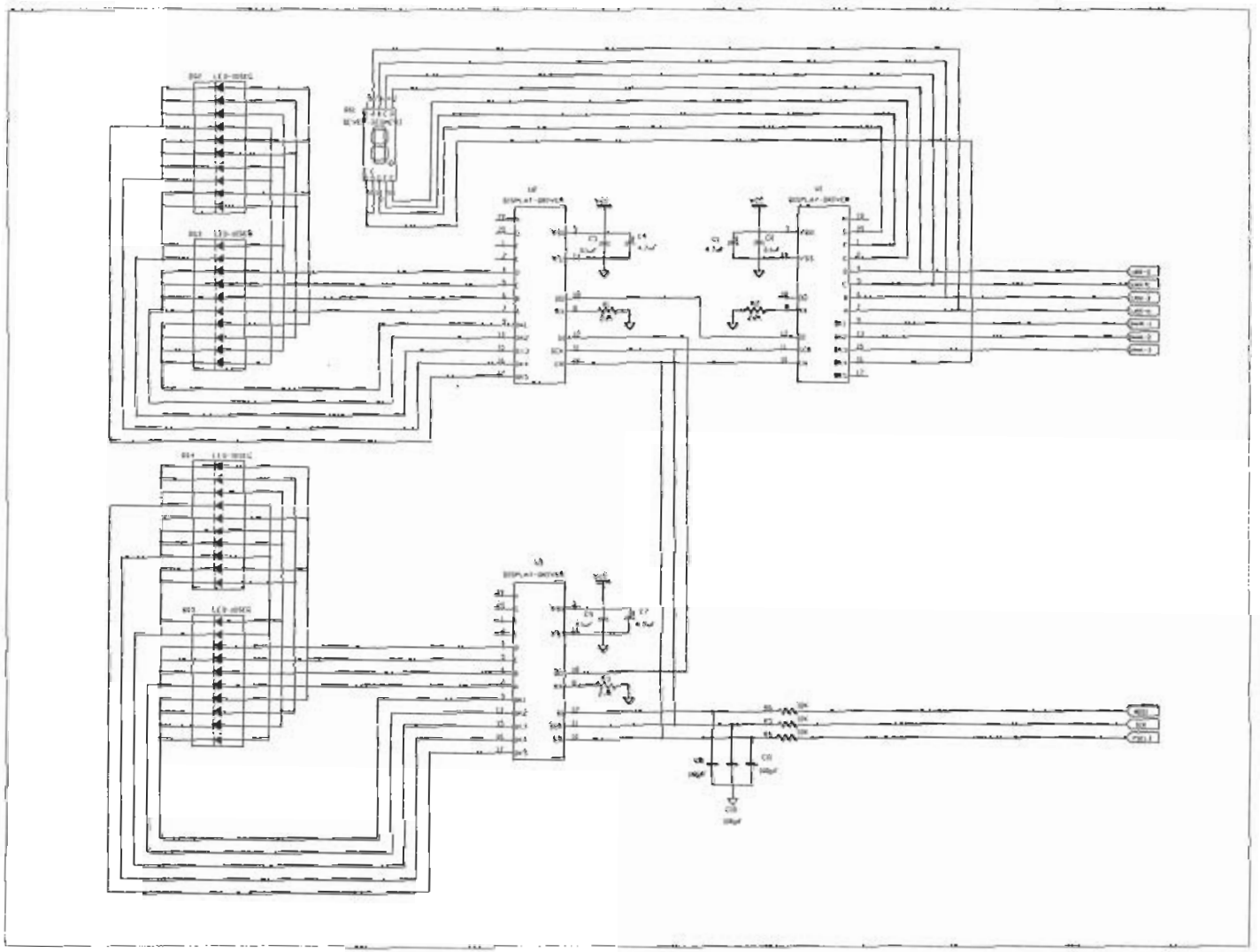


FIGURE 3.1 – MD-390S DISPLAY BOARD SCHEMATICS [Sheet 1 of 4]
VIC P/N: 584-330

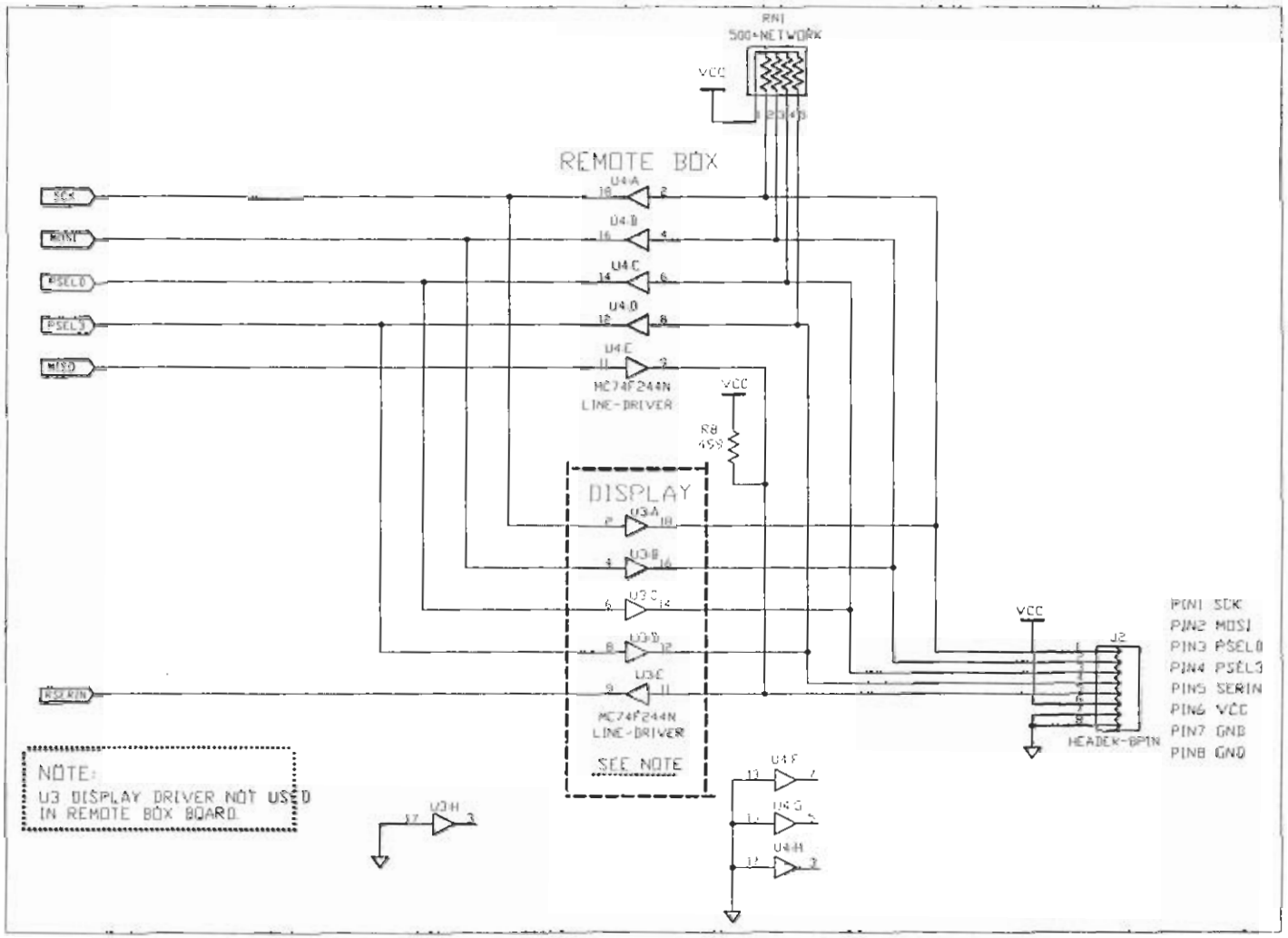


FIGURE 3.4 – MD-390S DISPLAY BOARD SCHEMATICS [Sheet 4 of 4]
VIC P/N: 584-330

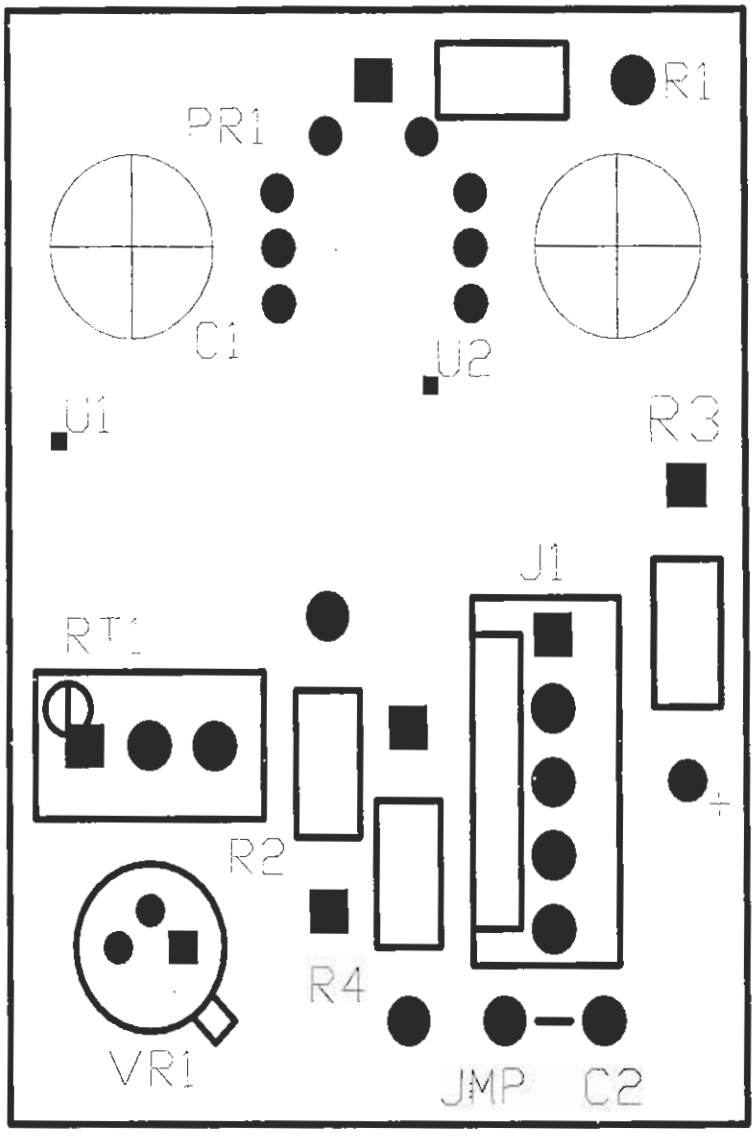


FIGURE 4– MD-390S BALLAST BOARD LAYOUT
VIC P/N: 584-335

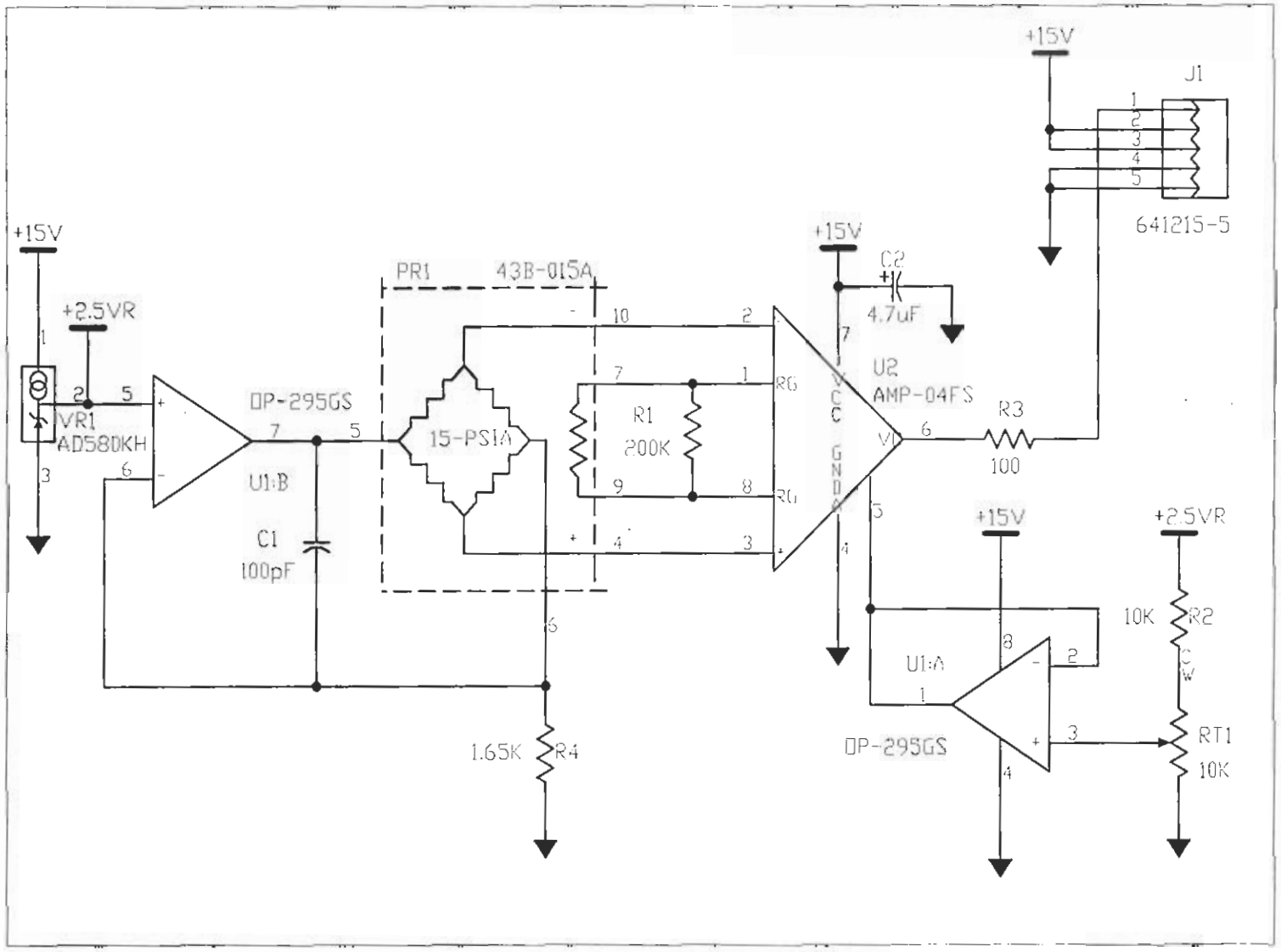


FIGURE 4.1 – MD-390S BALLAST BOARD SCHEMATIC [Sheet 1 of 1]
VIC P/N: 584-335

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