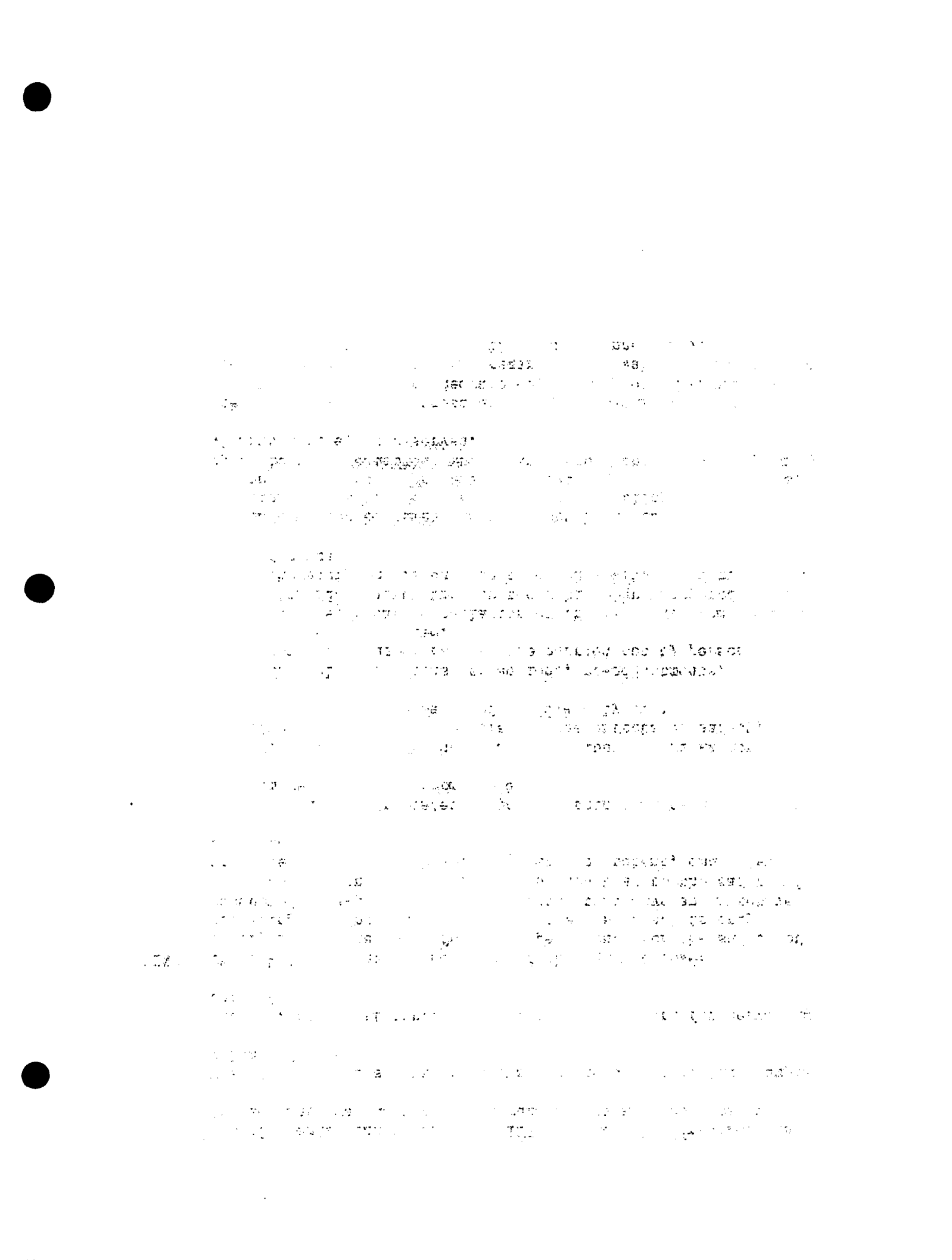
614 Na^+/K^+ Analyzer

Service Manual

CIBA-CORNING

614 89 003N Rev. A, 7/89



The 600 Series instruments are ISE analyzers designed for fast and accurate measurements of serum, plasma and whole blood.

The 614 measures sodium and potassium and uses a minimum sample volume of 35 uL.

The service manual contains complete instructions for servicing the 614.

WARNING The 614 is designed to be grounded through the power supply lead (line cord) for safe operation. For the safety of operating personnel make sure that the instrument is only connected to 3-prong sockets (outlets) that have an effective earth connection. If you are in any doubt as to the safety of your electical supply system consult a competent, qualified electrician.

There are no user replaceable parts within the instrument. Do not remove the covers from the 614.

Ciba Corning and their Authorized Distributors and Agents consider themselves responsible for the effects on safety, reliability and performance of the 614 only if :

(i) assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by them.
(ii) the electrical installation of the relevant room complies with IEC requirements or the local regulatory code, and
(iii) the equipment is used in accordance with the instructions for use.

The information contained in this manual was correct at the time of going to print. However, Ciba Corning policy is one of continuous product improvement and the right to change prices, specification, equipment and maintenance procedures at any time, without notice, is reserved.

The 614 Analyzer is classed as IEC Type B equipment (Class 1 equipment providing an adequate degree of protection against electric shocks particularly regarding allowable leakage currents and reliability of the protective earth connection).

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1.1 Introduction

The 614 is a direct reading, sodium and potassium analyzer. Results and operator interaction are performed via a 20 character alphanumeric display. The 614 is designed for fast, accurate determination of sodium and potassium levels in biological samples, i.e. serum, plasma and whole blood without the need for pre-dilution. It also has the capability to determine sodium and potassium levels in pre-diluted urine samples.

All results and calibrations can be recorded on the integral printer. Minimum sample volume is 35 uL.

This manual contains complete instructions for setting up and servicing CME (IEC) and CMNA (UL/CSA) versions of the 614, with serial numbers of 2001 upwards.

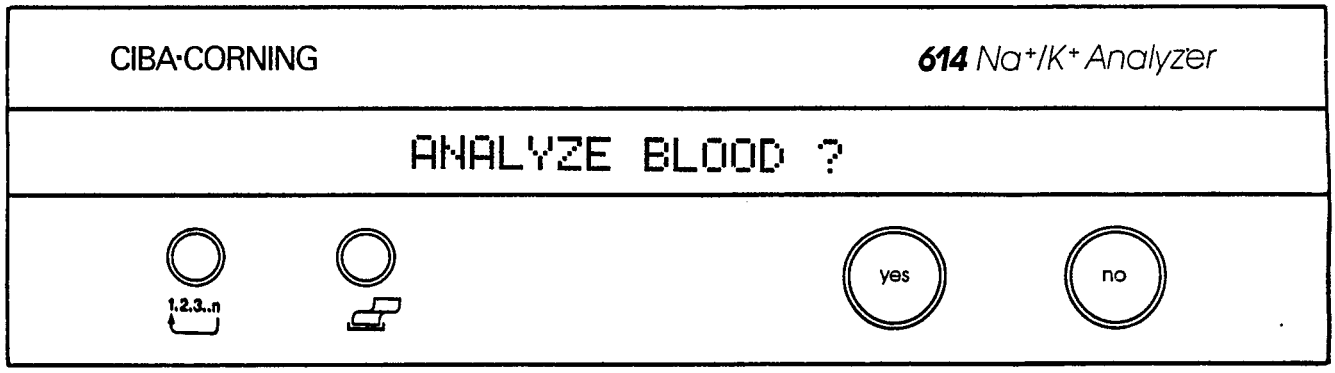
2.1 User Controls and Displays

Alpha-Numeric Display

20 digit character vacuum fluorescent display for presentation of results and operator options and status information.

Printer

16 character dot matrix impact printer for recording results, calibrations and set-up data.



sample number paper advance reset

controls used to respond to questions displayed by the 614

Yes

Control used to accept option offered by display.

No

Control used to reject option offered by display. (Also used to cause scrolling numbers when entering data. When used in conjunction with Sample No. reset causes reverse scrolling of numbers.)

Paper Advance

Control used to advance paper from printer.

Sample No. Reset

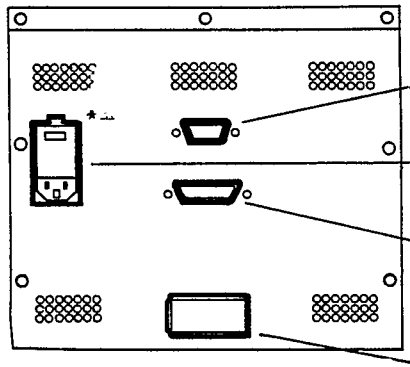
Control used to reset the sample number counter to 1.

N.B. For full details of Yes/No display interaction see Sections 2 and 3 of the Instruction Manual

2.2 Rear Panel Connectors and Displays

Power

Input AC power connector incorporating fuses and voltage selection.



IEC symbol denoting Type B equipment

IEC symbol advising user to refer to accompanying documentation

peripherals control, 15-way D-line socket

power connector, voltage selector and fuses

data output, 25-way D-line socket
Security key is fitted here if SECURITY ON ? is selected

status indicators cover

Peripherals Socket

15-way socket to allow for interconnection with Model 604 Autosampler (see Appendix C of Instruction Manual). (The 604 Autosampler is for use with the 614 only)

Data Output

25-way socket for connection to ticket printers, roll printers and data management systems.. Also used for security key when "SECURITY ON?" is displayed.

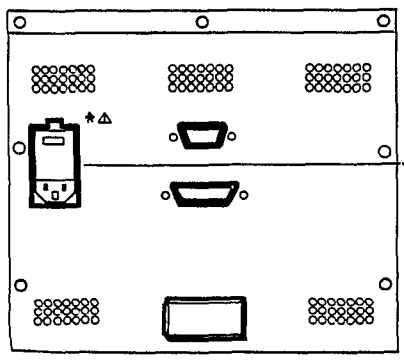
If the hydraulic test simulator (478567) is used then it is plugged into this socket.

Status Indicators

There are ten LED's (Light Emitting Diodes), located under the status indicators cover on the rear panel. Their purpose is to aid in the diagnosis of faults.

N.B. The 614 has no internal adjustments.

2.3 The Rear Panel - Selecting Voltage

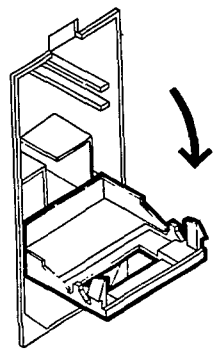


IEC symbol denoting Type B equipment

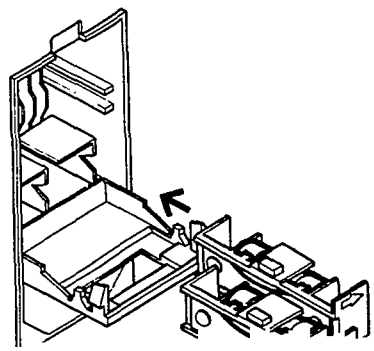
IEC symbol advising user to refer to accompanying documentation

power connector, voltage selector and fuses

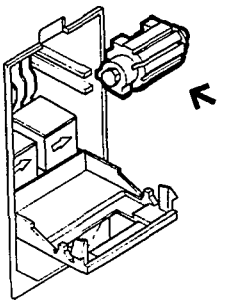
Open the voltage selector cover with the screwdriver supplied



Insert the two fuses into the fuseholders and slide the fuseholders into the voltage selector.



2.3 The Rear Panel - Selecting Voltage (cont)

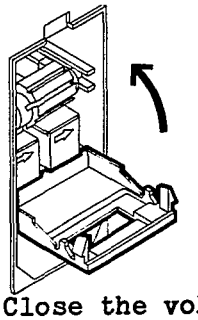


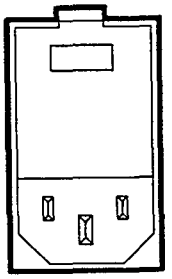
Select the voltage required for the local supply.

Voltage Selected	Voltage Range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

Slide the voltage selector bobbin into the voltage selector so that the selected voltage is visible when the voltage selector cover is closed.

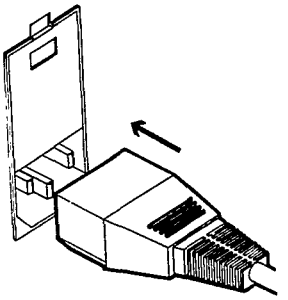
CAUTION : Do not rotate the bobbin when it is fitted in the voltage selector as this will damage the contacts.





Voltage selected

Close the voltage selector cover



If necessary, connect a suitable plug to the line cord. Connect the line cord to the power connector on the rear panel.

NOTE : Do not connect the line cord to the power supply.

3.1 General

The 614 Na/K Analyzer is available in two versions. One for use in the United States of America and Canada which is the UL/CSA version and one for the Rest of the World which is the IEC version. It is also available in four dual language options - English/Spanish, English/German, English/French and English/Japanese.

3.2 Mechanical

Please refer to exploded views EV1 to EV3 when reading the following description.

The casework of the instrument is a combination of plastic mouldings and sheet metalwork. There is a main body moulding, item 29, to which is attached a sheet metal base plate. The main hydraulic components, i.e. the mainfold, solenoid, electrode block, and probe assembly, are mounted on the front of the moulding. The motor/gearbox for driving the pump is mounted on the rear of this moulding.

The touch panel and display are mounted on the front cover moulding which has the electrode door cover hinged to it. The whole assembly fits to the main body of the instrument from the front.

The rear of the instrument contains the electronic system, a transformer assembly and three printed circuit boards which are interconnected by various cables. The main power board is mounted to the base plate, the CPU board is affixed to the rear panel and the amplifier board is attached to the main moulding in the rear at the top. The transformer is fixed to the baseplate with the input filter assembly attached to the rear cover.

3.3 Block Diagram

Please refer to Figures 1a and 1b when reading the following description.

Hydraulics

Solution is aspirated through the probe from either the weir (during cal and flush cycles) or a sample container (during sample measurements). It passes through sample detector 1 (SD1), through the electrodes and sample detector 2 (SD2) through the pump tube cassette to waste. SD1 and SD2 are used by the microprocessor to control the flow of solution during the measurement cycle.

The flow of cal/flush for the weir is controlled by valve 2. Valve 1 directs the flow of slope solution which is delivered to the electrodes during a slope measurement via the T-junction.

The three routines which the instrument carries out during operation are described as follows :

Sample Measurement

- Motor drives slowly to draw sample until detector 1 is reached. Valves 1 and 2 divert slope and cal solution back into reservoirs.
- Motor stops and 'RETURN PROBE' command is displayed upon which motor runs slowly again to advance sample to detector 2. (N.B. This point having been reached is indicated by date/time being printed) Valves 1 and 2 divert slope and cal back into reservoirs.
- Upon completion of measurement (i.e. plateau reached and result displayed/printed) valve 2 changes to supply cal/flush to weir and motor runs fast to clean the electrode system. Valve 1 diverts slope back into its reservoir. Pump 2 removes excess cal/flush solution to waste.

Cal Routine

- Valve 2/pump 4 supplies cal/flush to weir and motor runs fast to prime the system. Valve 1 diverts slope back into its reservoir.
- Motor changes to slow speed and draws cal/flush to detector 1.
- Valve 2 reverts to diverting cal/flush to its reservoir and motor continues to run slow until detector 2 is reached. (N.B. Again indicated by date/time print)
- Upon completion of cal measurement (i.e. plateau is reached and cal value is displayed/printed) flush cycle is performed as for sample measurement routine.

Slope Routine

- Slope always follows cal as described on previous page
- Following cal routine flush valve 1/pump 3 supplies slope solution via the slope input tee. Valve 2 diverts cal/flush back into its reservoir.
- Motor runs fast to prime slope then slowly until detector 2 is reached. (N.B. Indicated by 'Slope' being printed)
- Upon completion of slope measurement (i.e. plateau is reached and slope value is displayed/printed) flush cycle is performed as for sample measurement routine.

Electronics

The signals from the electrodes are connected to the amplifier board via connectors X1-X4. Sample detector outputs and the thermistor sensor are also connected to the amplifier board via PL14. The amplifier board also acts as an interface for the touch panel.

Control of the amplifier board is through the 20 way cable linking PL13 of the amplifier board with PL3 of the CPU board.

The CPU board controls the display through PL16 and supplies data output and sampler control through SK4 and SK5 respectively. It also generates the control signals for the printer and electro-mechanical components which are passed to the power board by the 20 way interconnection PL1 to PL10. Power from the CPU board is derived through the 12 way cable PL2 to PL11.

The power board generates the DC voltage requirements for the system and also the power control of the solenoids, motor and printer. The raw AC power enters the board through PL7.

Control of the printer is through PL8. PL9 delivers the control lines to the two solenoids, the pump motor and acts as an interface for the probe microswitch.

3.4 Circuit Descriptions

3.4.1 Power Board (903 41 001E) Refer to Figure 4

The functions of the power supply board are to generate the various DC voltages needed by the system together with self-monitoring circuitry to ensure reliable fail-safe operation. In addition to DC voltages the board contains the circuitry to drive the various electromechanical devices, i.e. solenoids, motors, printer, etc. It also generates the main reset control lines for the CPU.

a) Power Supplies

AC supplies from the transformer are fed to the power board by PL7.

The +5 volt power supply is generated by rectifying the AC output of the transformer via MR2 and regulation is achieved by IC10.

A regulated +12 volt power supply is generated by MR1 and IC11. The 25 volt supply is derived from the raw DC input to IC11.

An unregulated -12 volt supply is generated by MR3 and C21.

The + and -12v supplies are used to generate a stable ± 6 volt supply for critical analogue circuitry. This is done utilising IC2 and its associated components.

Two other power supplies are included on the board. Firstly a printer supply is generated from the raw DC supply on the imput to IC10. This supply is regulated and controlled through IC8. Secondly the reserve power supply for backing up the system RAM is generated by IC1, TR1 and C14 and maintains the back up power during power down situations.

The status of the printer supply is monitored by IC4 which senses when the printer supply drops significantly below 5 volts. When this occurs, pin 6 of IC4 goes low. This line drives the printer protection circuitry located in the CPU board to prevent damage to the printer.

Advance warning of failure of the main +5 volt supply is detected by D4, D5 and IC6. The output of IC6 (pin 6) goes low switching off the printer power supply through TR2 and TR3. It also drives a line going to the CPU board to generate a high priority interruption the CPU to allow controlled shutdown of CPU operation.

The main CPU reset is generated by IC3 which is a precision voltage monitor. If the voltage drops to below 4.65 volts pin 6 goes high generating a system reset. As the voltage drops lower IC5 takes control of the reset function and maintains it to lower voltages. The chain formed by R15, R19 and the three diodes D8, D9 and D10 maintain the reset state at very low voltages.

b) Printer Interface

The printer solenoids are driven by TR11-TR14. D13-D15 protects against back EMF voltages generated by the solenoids. TR7 and TR8 control the printer motor and TR6 generates a square wave from the tachometer in the printer. All the printer signals are fed to the printer via PL8.

c) Pump Control

The analogue voltage which controls the speed of the pump motor is fed in through PL10 pin 5 for IC9-A. The output of IC9-A is coupled to the motor through the emitter-follower TR4. The motor is switched on and off through TR8 and TR10 which are controlled from an output port on the CPU board through PL10 pin 4.

d) Solenoid and Other Control Functions

IC7 controls the slope solenoid and the cal/flush solenoid through PL9 pins 2 and 6. IC7 pin 16 controls the audio generator. IC7 interfaces between output logic signals generated on the CPU board which are fed into the power board via PL10. TR5 can be used to control a heater if required (this function is not used on the 614). It is used on the 634 to maintain the electrode block at 37°C. Control is achieved through software turning TR5 on and off with a variable duty cycle.

e) Connection Summary

PL7	-	AC input from transformer
PL8	-	Printer
PL9	-	Pump/solenoid/probe microswitch I/F
PL10	-	CPU control signal I/F
PL11	-	Power O/P

3.4.2 CPU Board (903 42 001P) Refer to Figure 5

The CPU board design is based on the 8085 microprocessor. The memory can be configured by links (LK1 and LK2) to either 62K PROM and 2K RAM or 56K PROM and 8K RAM. The basic 8085 system is comprised of IC7 (8085 microprocessor), IC3 (512K EPROM),IC6 (2kx8 RAM), IC5 (8251 UART), IC14 and IC19 (8155 I/O and Timer) and IC19 (8259 interrupt controller). The basic configuration is a standard 8085 system design.

Device decoding is done by IC21 which generates the individual chip selects for the various IC's.

Memory decoding is done by the collection of gates formed by IC11-A,IC20-A, IC20-B, IC20-D, IC22-A, IC23-A, IC23-D and IC27-A. With LK1 in place and LK2 in position B the memory map is set for 62K EPROM and 2K RAM for 614 operation.

IC28 is a real time clock device which controls time and date once it has been set.

Input/Output is performed by IC14 and IC19. IC14 uses port B to send data to the display or the printer depending on which one is selected. Port A of IC14 is used to control the DAC IC12 which generates the voltages necessary for electrode offset and pump speed control. The touch panel is interfaced through port C of IC14.

IC19 port B generates control signals for the amplifier PCB. Port A controls the solenoids and turns the pump on and off. Port C generates control signals from the sampler port via the buffer IC18. IC14 and IC19 also generate timing signals. IC14 pin 6 generates the main operating system timer through the RST 7.5 interrupt of the 8085. IC19 pin 6 is used for the baud rate clock generator for the UART (IC5).

Data communication by the UART (IC5) is achieved by the use of IC1 and IC9 as the RS232 transmit and receive buffers respectively. 20 mA current loop operation is done by TR1 (transmit) and IC9 pins 1 and 3 (receive).

Printer control is done through IC10 which is a printer microcontroller chip. The solenoid drivers are buffered through IC1 which is only enabled when the printer power supply is in the right condition.

Analog to Digital conversion of all the main signals is achieved via IC26 which is a single chip (12 bit and sign) A/D convertor. Control of the convertor is through IC22-B, IC22-C, IC23-C and IC27-B. The A/D clock is derived from the system clock through the counter IC17-A which divides the system clock by 16 to generate a suitable frequency for the A/D convertor.

The arrangement of IC's comprised by IC8, IC13, IC15, IC16A, IC16-F, IC20-C and IC22-D is the watchdog circuitry. IC8 is a 200 mS oscillator which would reset the processor every 200 mS if left alone.

The software inhibits the oscillator on a periodic basis by means of the trigger pulses generated by IC21 pin 7 and IC19 port A7. If the software being executed is illegal the oscillator IC8 will cause a reset which will restart the processor under known conditions.

DP1 is an LED bar graph display which indicates the status of various power supplies and control lines.

LED No.	Function	Normal (i.e. Good) Status
1	AC power	On
2	+ 12V	On
3	+ 5V	On
4	- 6V	On
5	Cal/Flush Solenoid	On when active
6	Microprocessor	Flashing
7	Slope Solenoid	On when active
8	Pump Motor	On when rotating
9	Not used	Off
10	Microswitch (probe)	On when probe open

Connection Summary

PL1	CPU Control Signal I/F
PL2	Power I/P
PL3	Amplifier Control Signal I/F
SK4	Data O/P Connector
SK5	Peripheral Control Connector
PL6	Display I/F

3.4.3 Amplifier Board (903 40 001J) Refer to Figure 3

The amplifier board is the interface between the main signal transducers (electrodes, sample detectors, etc) and the rest of the electronics system.

The electrodes are interfaced via a switched differential amplifier system comprised of IC8, IC9, IC10, IC1-A, IC5-A and IC5-B.

IC5-A and B switches the amplifier between the reference electrodes (input X3) and Sodium (X1) and reference (X3) and potassium (X4). The switching is controlled by the microprocessor. The microprocessor also switches the appropriate signal to the A/D convertor through the multiplexer IC2.

IC3-A and IC4-A are gain adjusting and filter amplifiers which also add in the offset voltage generated by the CPU to put the signals in the correct dynamic range.

Sample detector interfaces are done by IC6-A and IC7-A which are unity gain buffers. The outputs are fed to the A/D convertor through the multiplexer IC2 under processor control.

Connection Summary

X1-X4	Electrode interface
PL12	Touch Panel I/F
PL13	Amplifier Control Signal I/F
PL14	Sample Detection I/F
PL15	Heater Drive (not used on 614 only used on 634)

4.1 Scheduled Maintenance

Daily Maintenance

Equipment
Cal-Pak as required;2% activated glutaraldehyde solution(eg CIDEX™)
Clean tissues.

NOTE : Do not add other decontaminants, e.g. hypochlorite, to the glutaraldehyde solution.

1. Check levels of calibrants and replace with new Cal-Pak if necessary, Section 4.2. The Cal-Pak will probably need replacing once a week.

2. Check that the probe is straight and centred over the weir when in the closed position. Realign or replace if necessary, Section 4.12.

3. Wipe the sample area, calibrant compartment and the external surfaces with clean tissues moistened with 2% activated glutaraldehyde solution.

4. Clean the weir cover, Section 4.6.

Three-monthly (Quarterly) Maintenance

Equipment
Items listed under "Daily Maintenance"; pump tube cassette; weir cover, as required; reference electrode cassette; Na+/K+/Ca++ electrode fill solution.

Carry out daily maintenance and :

1. Disinfect the 614, Section 4.3.

2. Replace the weir cover, if necessary, Section 4.6.

3. Replace the pump tube cassette, and clean and lubricate the roller assembly, Section 4.9.

4. Replace the reference electrode cassette (not the inner electrode), Section 4.10.

5. Check Na+ and K+ electrode fill solution and refill the electrodes if necessary, Section 4.11.

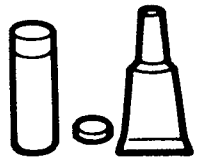
™ Surgikos Ltd., Livingston, Scotland

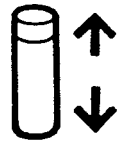
4.2 To change the Cal-Pak, Deproteinize and Condition the Electrodes

Equipment
Cal-Pak, Deproteinizer (D) and Conditioner (C), Cat. 478541 (614), 478548 (634); or Deproteinizer and Condition multi-packs, Cat. 478700 and 478701.

This section also shows the procedure for deproteinizing/conditioning the electrodes using the DEPRO / CONDITION ? routine.

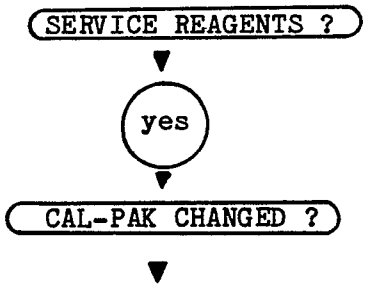
NOTE : Activate the Deproteinizer with a pepsin table before starting this procedure, as the tablet will take between 10 and 15 minutes to dissolve.

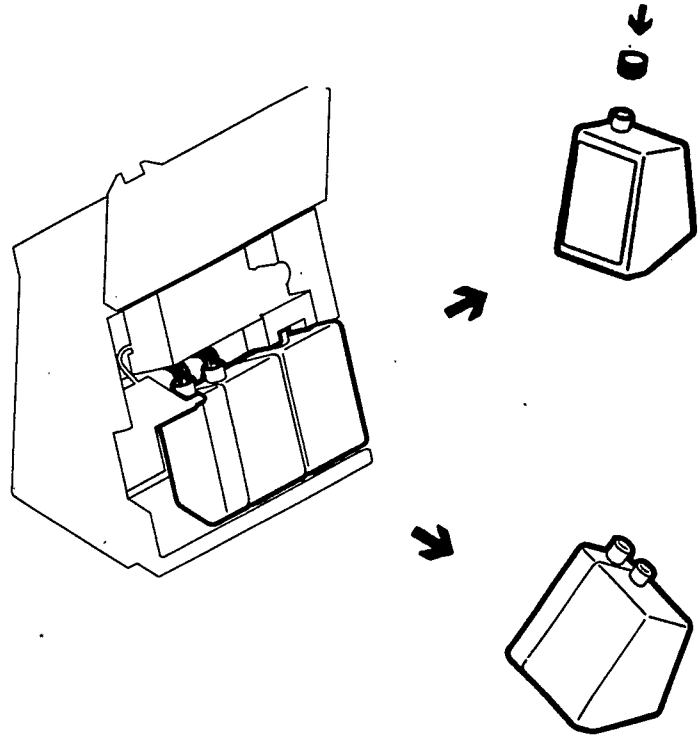




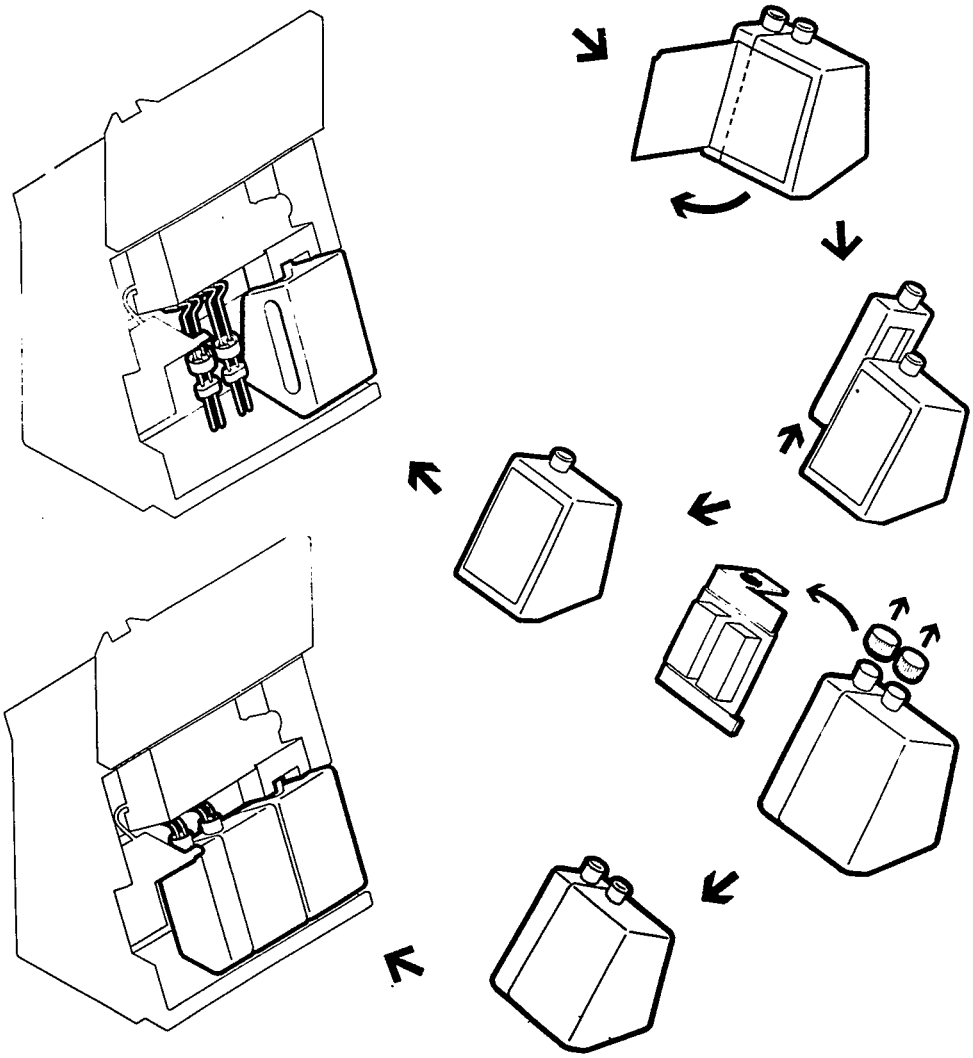
Cap and shake the vial until the pepsin tablet has dissolved, or leave to stand for 15 minutes. The pepsin tablet must be completely dissolved before the solution is used.

If you are deproteinizing and/or conditioning the electrodes and not changing the Cal-Pak, the routine starts on the next page, at DEPRO / CONDITION ?





4.2 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (contd)



▼

▼

▼

yes

▼

WAIT - PRIMING

If you have not changed the Cal-Pak and are deproteinizing and/or conditioning the electrodes using the DEPRO / CONDITION ? routine, start here. If the Cal-Pak has been changed, continue with DEPROTEINIZE ?

DEPRO / CONDITION ?

yes

▼

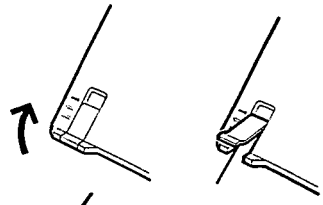
DEPROTEINIZE ?

yes

This message will not be displayed in the SERVICE REAGENTS ? routine

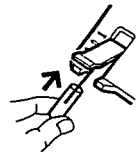
4.2 To change the Cal-Pak, Deproteinize and Condition the Electrodes (contd)

OPEN PROBE



PROBE IN SOLN D ?

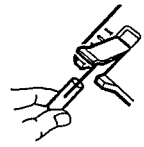
yes



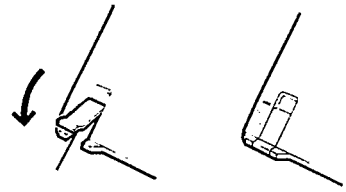
NOTE : SOLN D = Activated deproteinizer

SAMPLING

SAMPLING - WAIT



RETURN PROBE



DEPROTEINIZING

WAIT 5:00 MINUTES (counts down to zero)

If it is essential to measure a sample during this routine, press

no

FLUSHING

CONDITION ?

no

The 614 will standardize

ANALYZE BLOOD ?

When sample measurement is complete repeat the deproteinizing routine.

CONDITION ?

yes

4.2 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (contd)

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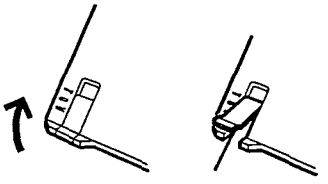
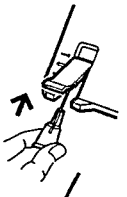
OPEN PROBE



PROBE IN SOLN C ?



NOTE : SOLN C = Conditioner

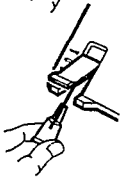
yes

▼

SAMPLING

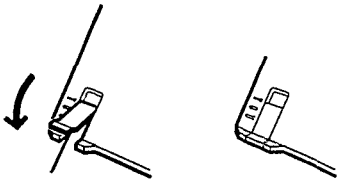
SAMPLING - WAIT

▼



RETURN PROBE

▼



CONDITIONING

WAIT 5:00 MINUTES (counts down to zero)

▼

If it essential to measure a sample during this routine press

no

The 614 will flush then standardize

▼

ANALYZE BLOOD ?

When sample measurement is complete repeat the conditioning routine.

▼

FLUSHING

▼

The 614 will now carry out an automatic standardization

▼

ANALYZE BLOOD ?

4.3 To Disinfectant the 614

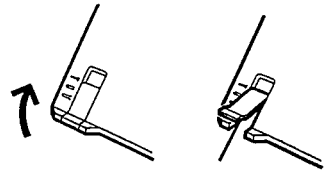
Equipment
Disinfectant - 2% activated glutaraldehyde solution (e.g. CIDEX™)

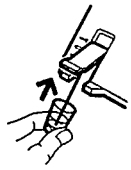
NOTE : Do not add other decontaminants, eg. hypochlorite, to the glutaraldehyde solution.

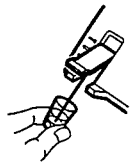
WARNING : This procedure disinfects the 614 sample path and should always be done before replacing the pump tube cassette, connecting tubing etc. It should also be carried out after analyzing a sample known or suspected to contain dangerous pathogens.

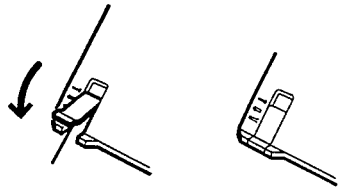
The (DEPRO / CONDITION ?) routine is used to disinfect the 614.

(DEPRO / CONDITION ?)
(yes)
(DEPROTEINIZE ?)
(yes)
(OPEN PROBE)
▼
(PROBE IN SOLN D ?)
(yes)
(SAMPLING)
(SAMPLING - WAIT)
▼
(RETURN PROBE)
▼
(DEPROTEINIZING)
(WAIT 5:00 MINUTES) (counts down to zero)
▼









NOTE : In this routine, SOLN D is disinfectant

If it is essential to measure a sample during this routine, press

no

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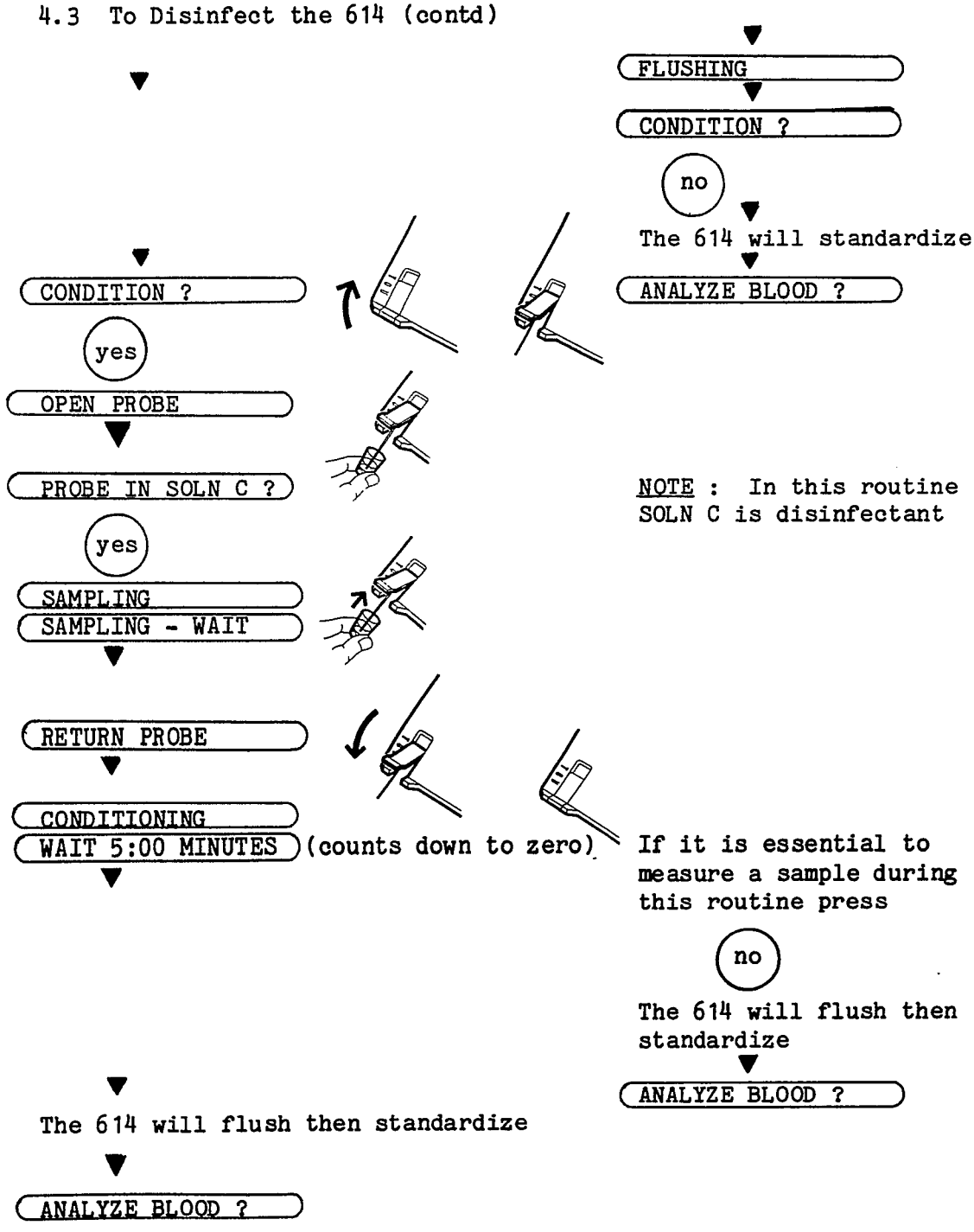
4.3 To Disinfect the 614 (contd)



4.4 Drain Routine

Use this routine when replacing the pump tube cassette, connecting tubing, manifold and solenoids.

DRAIN ?

yes

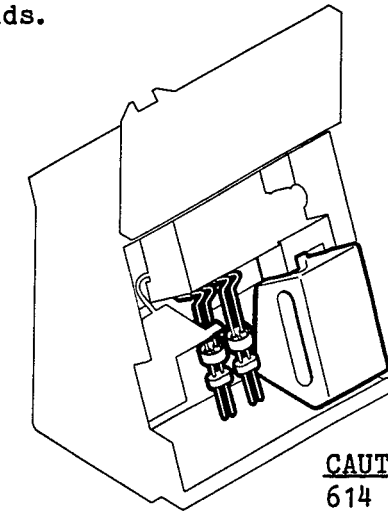
CAL-PAK REMOVED ?

yes

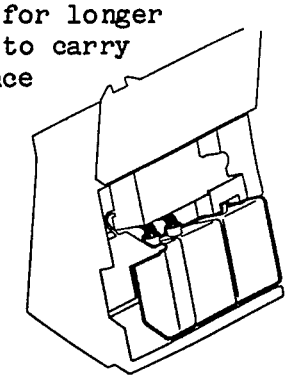
WAIT - DRAINING

DRAINING COMPLETED

CAL-PAK REPLACED ?



CAUTION : Do not leave the 614 in this mode for longer than is required to carry out the maintenance procedure



Carry out the maintenance procedure

yes

WAIT - PRIMING

PRIME AGAIN ? yes → AUTO PRIME ? yes → WAIT - PRIMING

no

no

MANUAL PRIME yes → Press and hold until solution flows into the waste bottle, then press

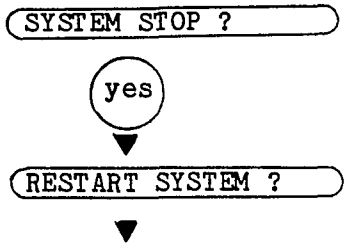
no

The 614 will now carry out an automatic standardization.

ANALYZE BLOOD ?

4.5 System Stop Routine

Use this routine when replacing the electrodes, probe and tubing, micro switch, sample detectors, slope inlet block, or when clearing blockages.



CAUTION : Do not leave the 614 in this mode for longer than is required to carry out the maintenance procedure.

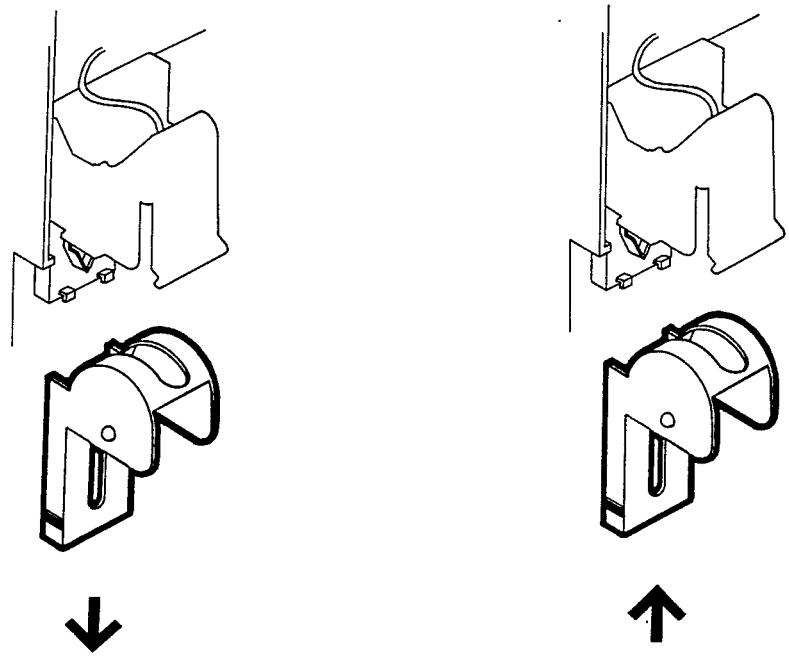
Carry out the maintenance procedure.

The 614 will now carry out an automatic standardization.

4.6 To Clean/Replace the Weir Cover

Equipment

Disinfectant - 2% activated glutaraldehyde (e.g. CIDEX™); Clean tissues; weir cover, Cat. 478633, as required.



To clean the weir cover, wipe with clean tissues moistened with disinfectant.

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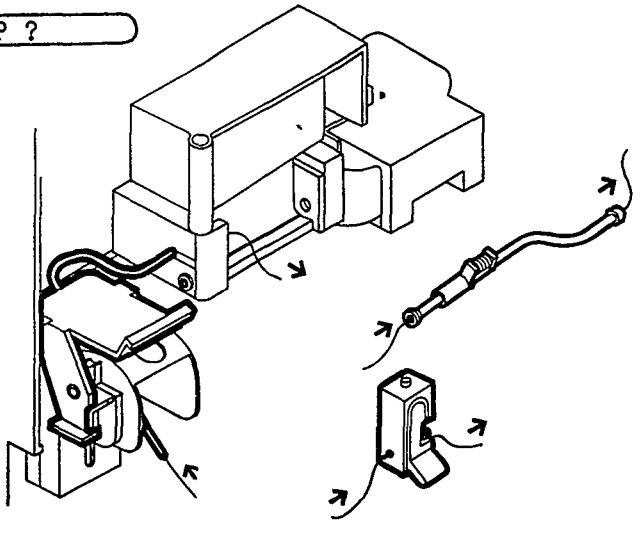
4.7 To Clear Blockages

Equipment
Clot removal line, Cat. 478645; 1ml syringe, as required

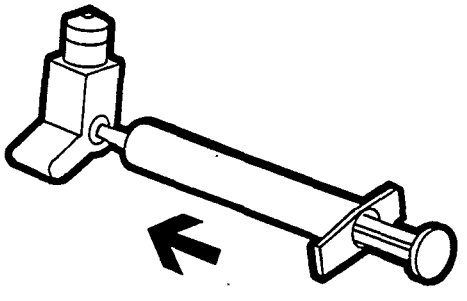
WARNING : Always wear protective gloves when carrying out this procedure.

CAUTION : Only use Ciba Corning clot removal line during this procedure as other materials may damage the 614.

Select (SYSTEM STOP ?)

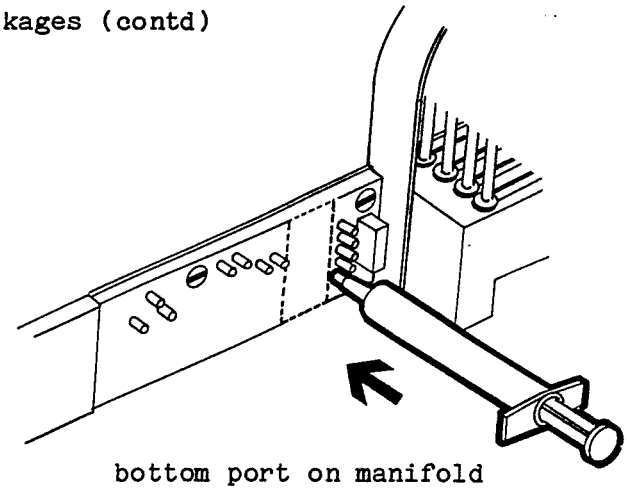


To clear a blockage in the probe, probe tubing or waste tube.



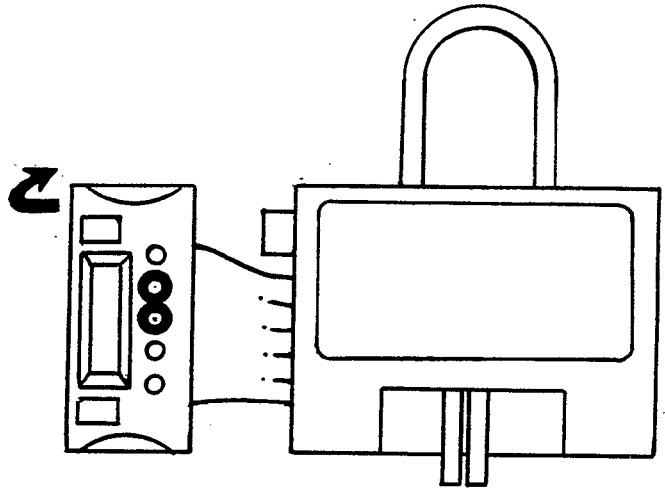
To clear a blockage in the K+, Na+ or reference electrode.
Deionized water may be used.

4.7 To Clear Blockages (contd)



bottom port on manifold

To clear a blockage in the weir drain hole or manifold.



To clear a blockage in the pump tube cassette, inject approximately 5 mL of deionized water into ports 2 and 3, followed by air to remove the water. Hold the cassette block away from you during this procedure.

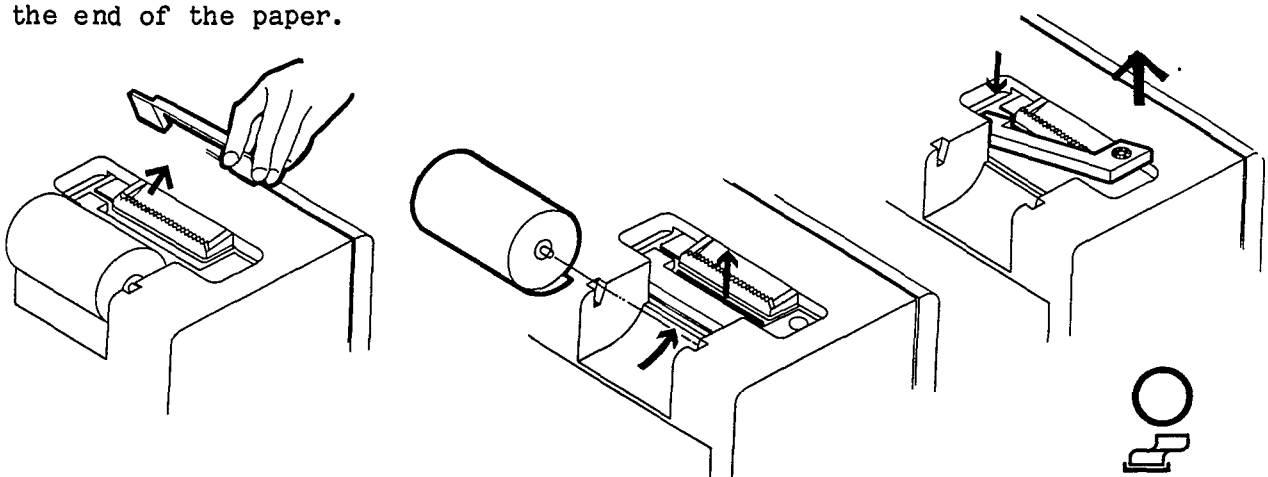
Deproteinize the electrodes, Section 4.2.

4.8 To Replace the Printer Paper and Ribbon

Equipment
Printer paper, Cat.478638; Printer ribbon cassette, Cat.478637.

NOTE :
To clear a paper jam, tear the paper and remove the paper roll. Press to advance the piece of paper through the printer. If this is not possible, pull the piece of paper towards you out of the printer.

Before loading the new paper roll, remove accumulated paper dust with a soft brush, or by blowing. Loading the paper may be made easier by cutting the end of the paper.



NOTE : Fit a new ribbon cassette at every printer paper change. Make sure the printer paper is in place before fitting the printer ribbon cassette.

Pull the printer paper tight towards the rear of the 614 and feed the paper between the ribbon and the cassette. Holding the paper taut, slide the cassette towards the front of the 614, then press down to lock into place.

Replace the printer cover.

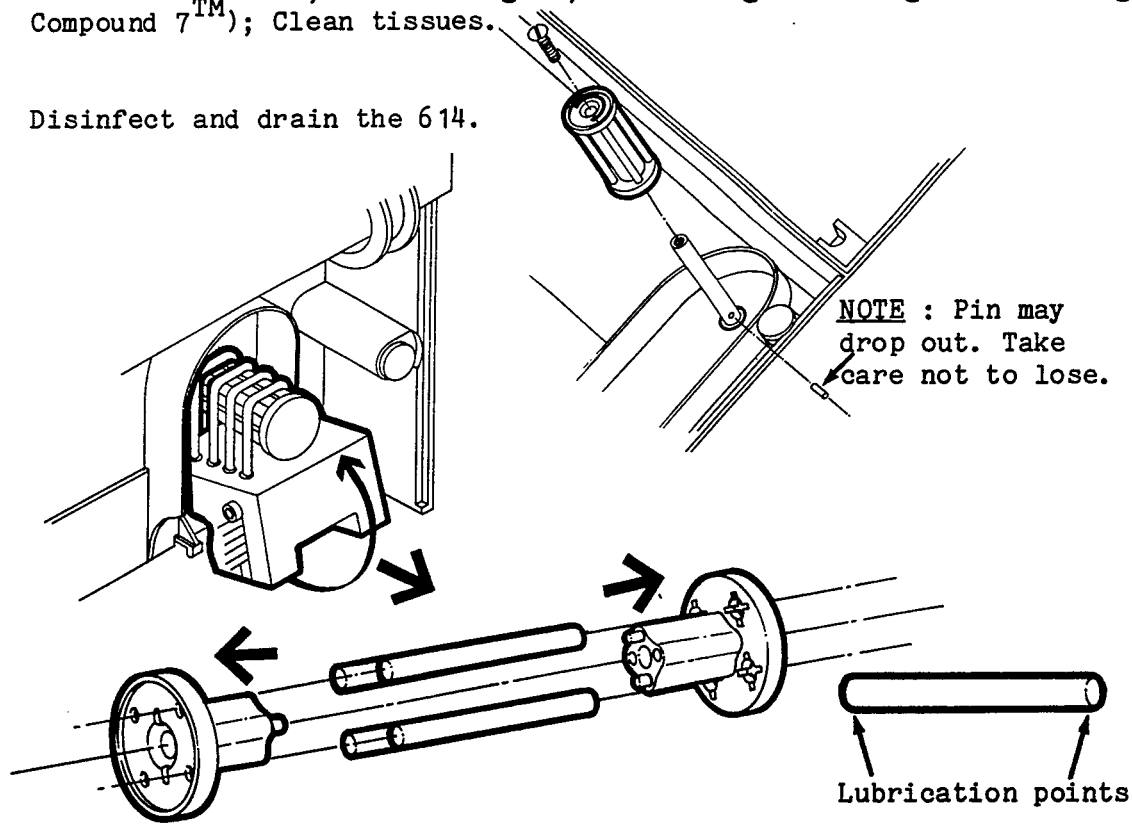
Check that the paper feeds correctly by pressing . Carry out a display and printer test, Section 4.19, to check that the printout is clear.

4.9 To Replace the Pump Tube Cassette, Clean and Lubricate the Rollers

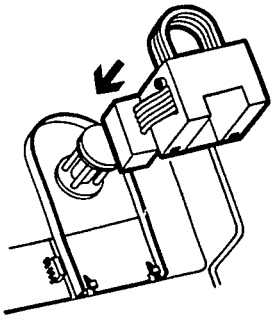
Equipment

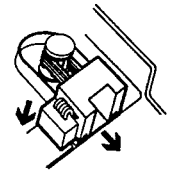
Disinfectant; pump tube cassette, Ca.478639; Screwdriver, supplied with Installation Pack; Mild detergent; Silicone grease (e.g. Dow Corning Compound 7™); Clean tissues.

Disinfect and drain the 614.



Wash the rotor assembly in mild detergent solution, rinse and dry with tissues. Lightly lubricate each roller at the points shown. Reassemble.





Date the pump tube cassette label three months ahead

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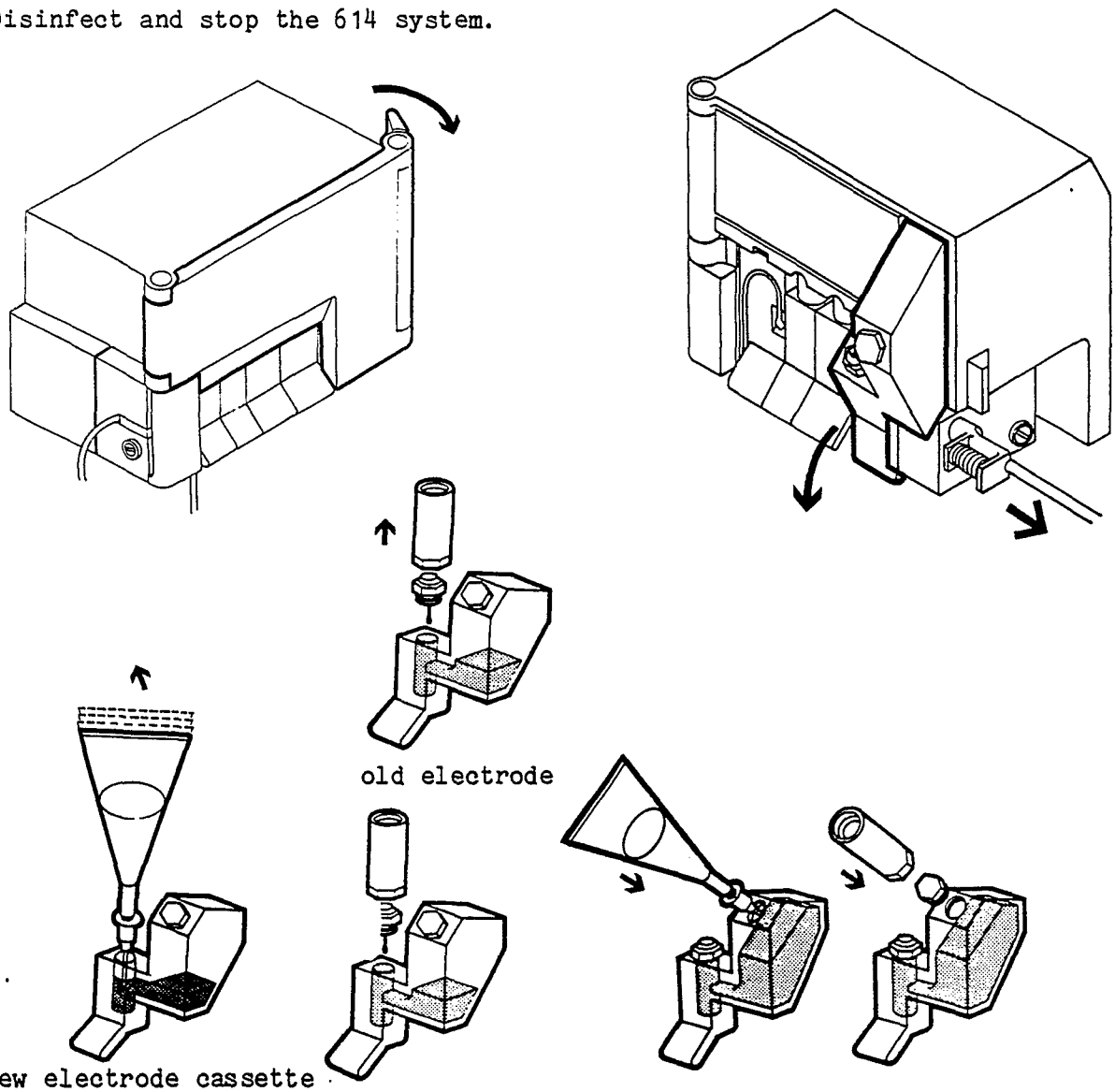
4.10 To Replace the Reference Electrode Cassette

Equipment

Disinfectant; Reference electrode refill, Cat. 478498.

Disinfect and stop the 614 system.

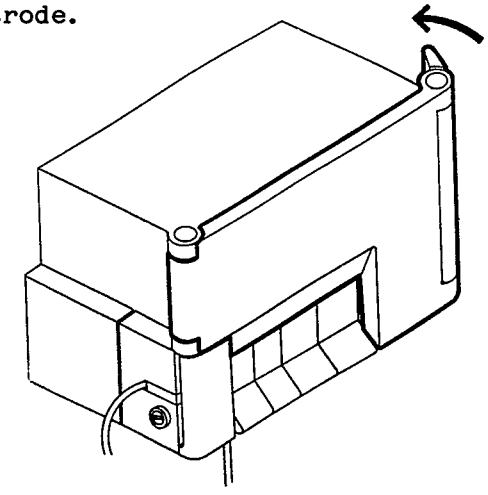


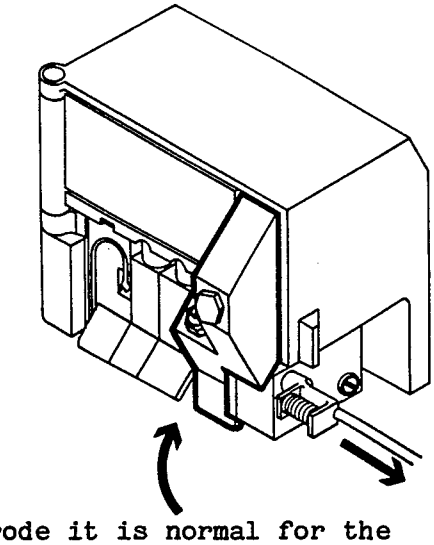
Use the hex tool supplied to unscrew and tighten the reference electrode inner and reservoir sealing plug. Remove the electrode plug and the reservoir sealing plug. Break the top off the reference electrode fill solution container, and fit the needle.

4.10 To Replace the Reference Electrode Cassette (contd)

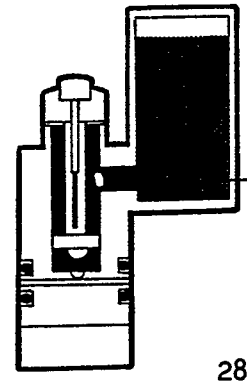
CAUTION : Do not use Na+/K+/Ca++ pH electrode fill solution

Slowly inject solution into the reference electrode fill hole, avoid trapping air bubbles. Tap the electrode during filling to dislodge air bubbles. Continue filling until a bubble of solution appears at the electrode fill hole - the level of solution in the electrode cassette will decrease until the KCl crystals are wet. Remove the electrode inner from the old cassette and screw into the electrode fill hole. Continue to inject the remaining fill solution into the reservoir, but be careful not to overfill. Replace the plug. Shake the electrode down, like a thermometer, to dislodge air bubbles at the electrode tip. Make sure the vent hole is not blocked. Carefully clean off any excess fill solution using dry tissue and, if necessary, fit an 'O' ring to each side of the electrode.





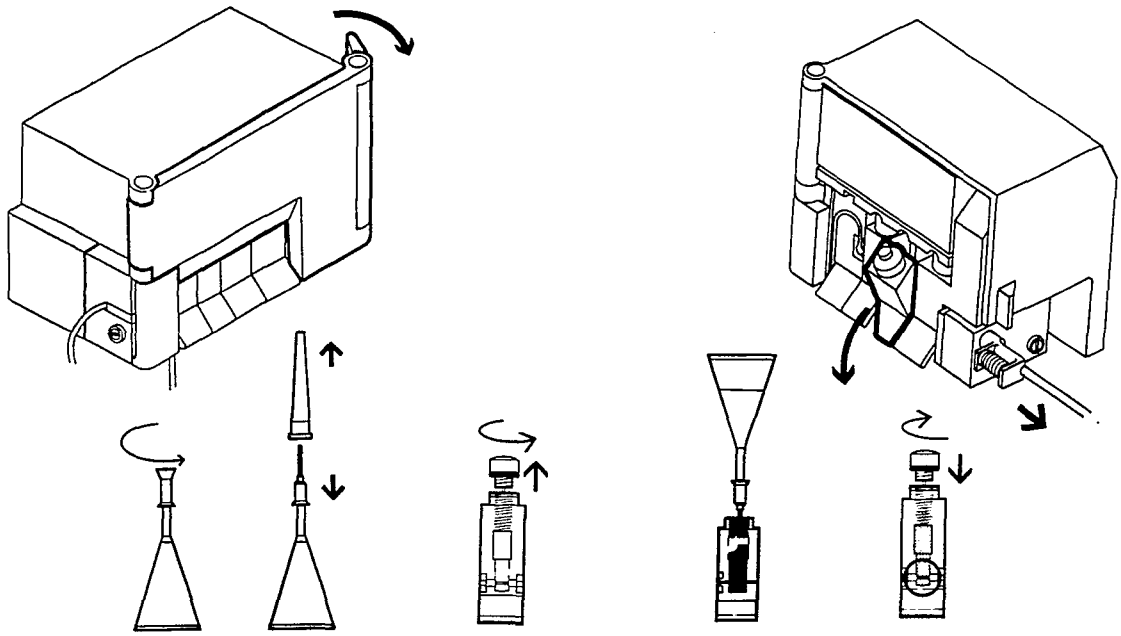
NOTE : Following a change of reference electrode it is normal for the 614 to require a stabilization period of 30 minutes before optimum performance is obtained. If an OVER RANGE or UNDER RANGE reading is displayed on both channels, there is probably an air bubble trapped in the reference electrode. Remove the electrode and tap it until the air bubble has been dislodged. Re-install the electrode.



4.11 To Fill the Na+ and K+ Electrodes Ca++ and pH electrodes

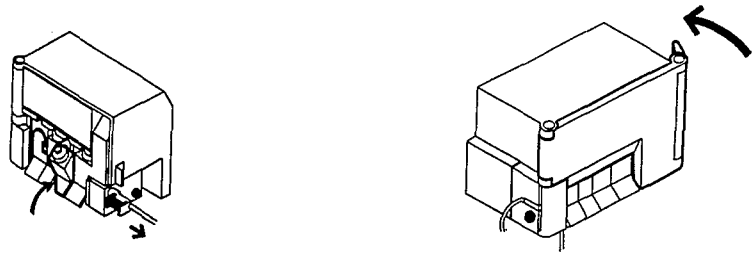
Equipment
Disinfectant; Na+/K+/Ca++ electrode fill solution, Cat.478535

Disinfect and stop the 614 system



CAUTION: Do not use reference electrode fill solution

Unscrew the inner electrode and empty out the solution. Fit a needle to the Na+/K/Ca++ electrode fill solution container, rinse out the electrode and refill to the bottom of the screw thread. Tap the electrode during filling to dislodge air bubbles. Replace the inner electrode - screw down tightly. Shake the electrode down like a thermometer, to dislodge air bubbles at the electrode tip. Wipe the electrode with a dry tissue and check that there is an 'O' ring on the left hand side - fit one if necessary.

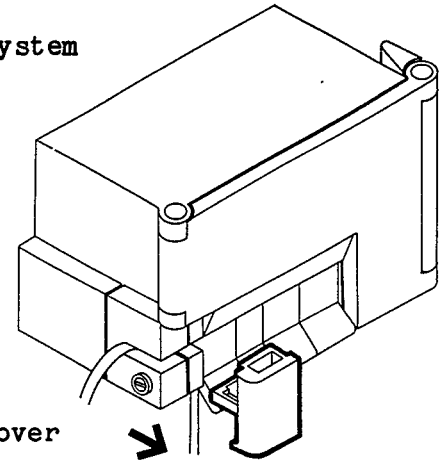


NOTE: Ciba Corning recommend that a deproteinizing and conditioning routine (Section 4.2) is carried out after this procedure.

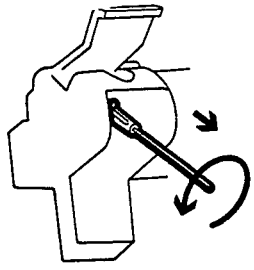
4.12 To Replace the Probe, Probe Tubing and Waste Tube

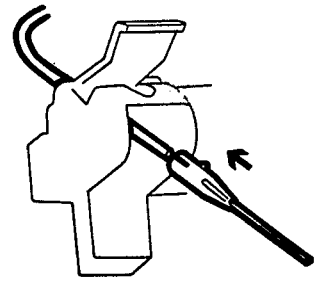
Equipment
Disinfectant; Probe and tubing kit, Cat. 478634.

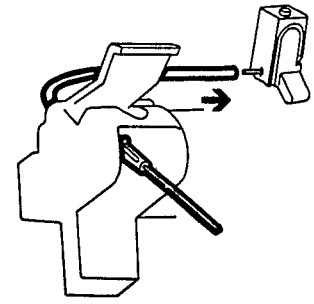
Disinfect and stop the 614 system

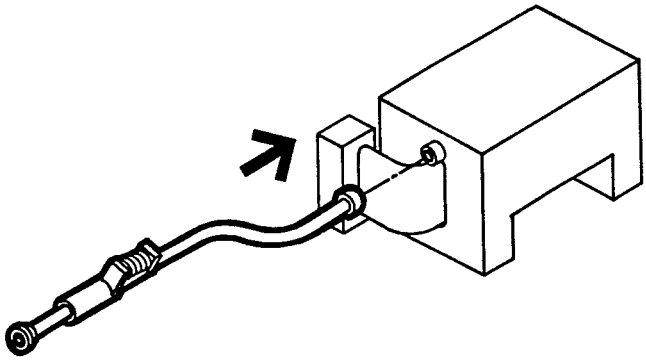


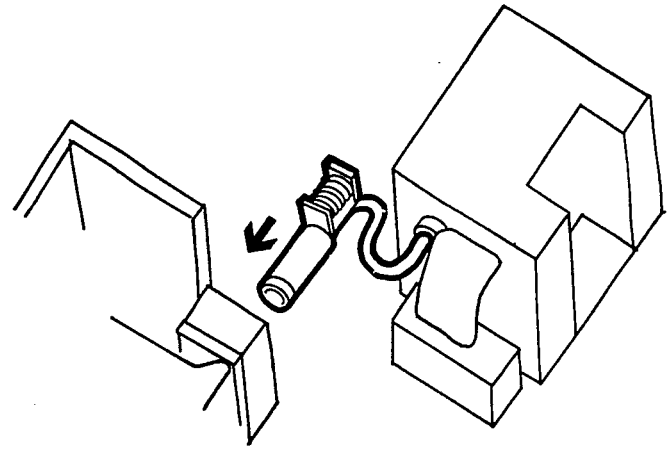
Remove the sample detector cover









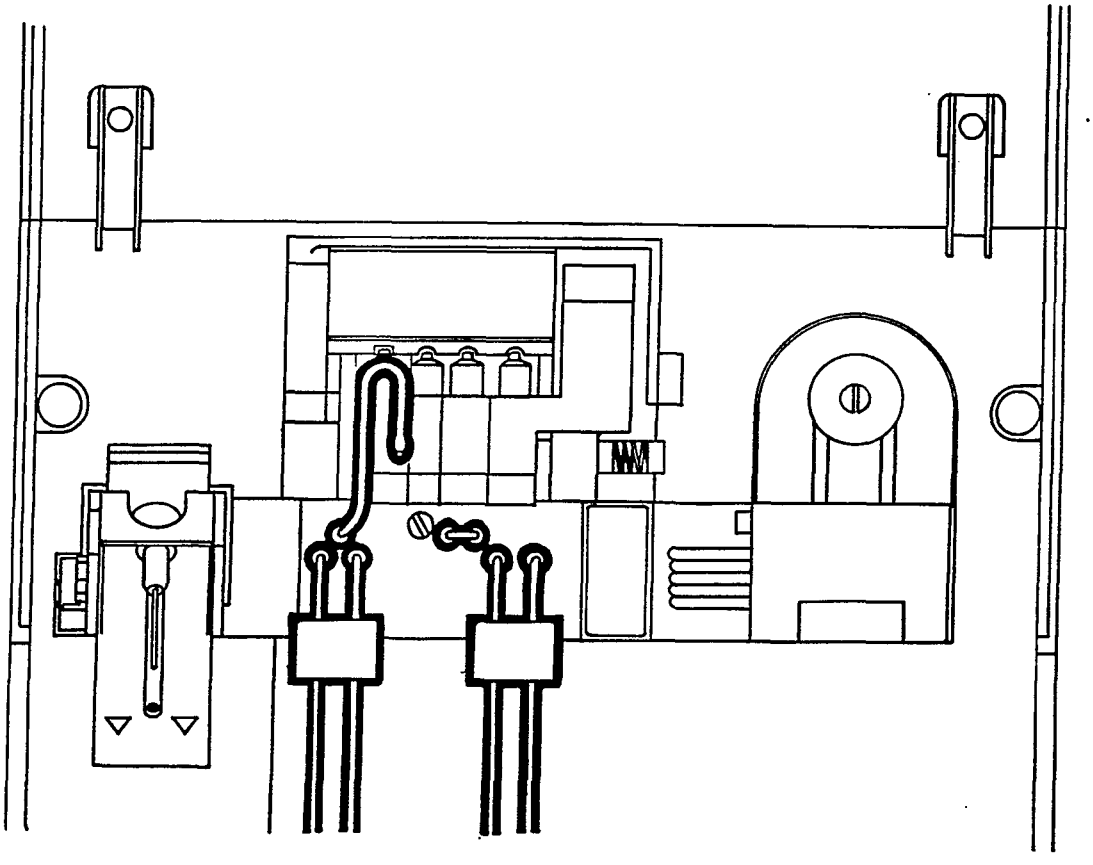


Replace the sample detector cover

4.13 To Replace the Connecting Tubing

Equipment
Connecting Tubing Kit, Cat. 478653

Drain the 614.



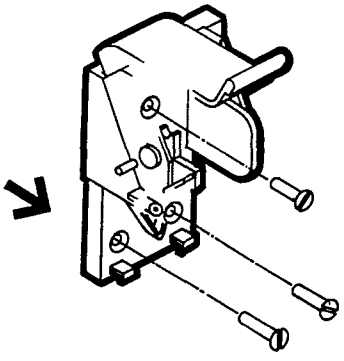
4.14 To Replace the Probe Micro Switch

Equipment
Disinfectant; Screwdriver, supplied with Installation Pack; Micro switch, Cat. 478623.

Disinfect and stop the 614 system.

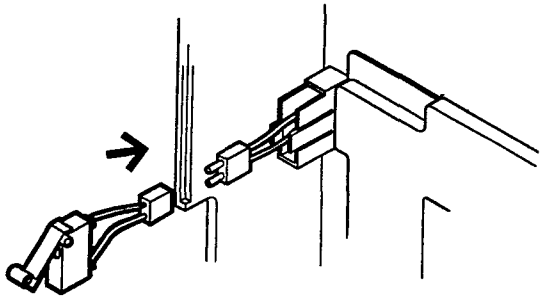
Remove the weir cover, Section 4.6.

Remove the probe and tubing, Section 4.12.



Remove the probe assembly.

If necessary, remove the transit strap from the micro switch connector.



If desired, refit the transit strap.

Replace the probe assembly, probe and tubing and weir cover. Check that the micro switch is operating, Section 5.3, paragraph 4.

4.15 To Replace the Manifold and Solenoids

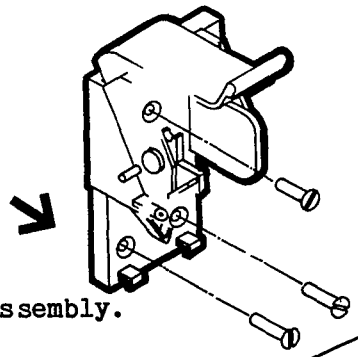
Equipment
Disinfectant; Manifold, Cat. 478841; Solenoid assembly, Cat.478842; Manifold plug, Cat.478825; Manifold gasket, Cat. 478824; as required; Screwdriver, supplied with Installation Pack.

Disinfect and drain the 614.

Remove the weir cover, Section 4.6.

Remove the probe and probe tubing, Section 4.12.

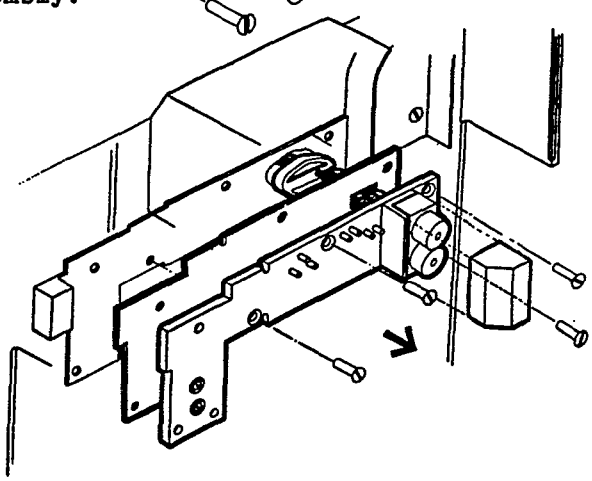
Remove the pump tube cassette. Section 4.9.



Remove the probe assembly.

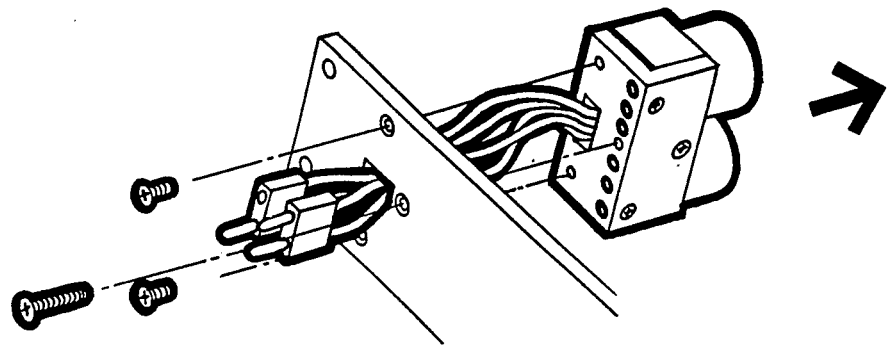
Manifold plug

Manifold gasket



Disconnect all tubing from the manifold, and remove the manifold. Remove the manifold plug. If necessary, remove the transit straps from the solenoid connectors, and disconnect.

4.15 To Replace the Manifold and Solenoids (contd)



Remove the solenoid assembly, take care not to lose the '0' rings.

Using new parts as required :

Replace the solenoid assembly on the manifold. Make sure the '0' rings are still fitted.

Feed the connectors through the manifold gasket and reconnect. If desired, refit the transit straps.

Slide the solenoid leads into the manifold plug, and replace the plug.

Replace the manifold.

Replace all tubing (Section 4.13).

Replace the pump tube cassette.

Replace the solenoid cover.

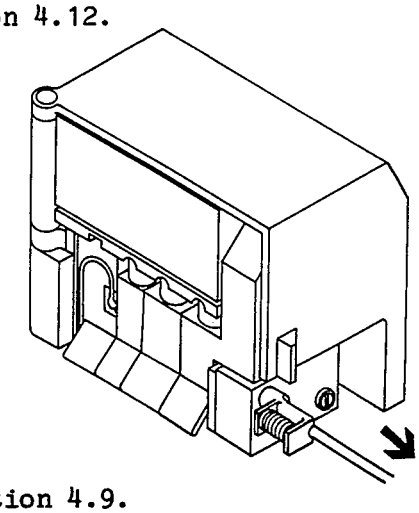
Replace the probe assembly, probe, probe tubing and weir cover. Check that the micro switch is operating, Section 5.3, paragraph 4.

4.16 To Replace the Sample Detectors

Equipment
Disinfectant; Screwdriver, flat blade, small; Sample detector (inlet) Cat. 478673; Sample Detector (outlet) Cat. 478674.

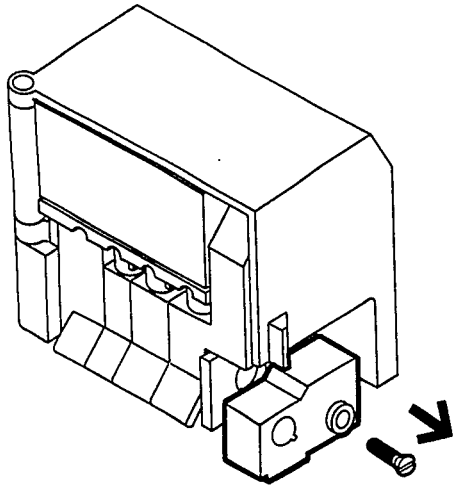
Disinfect and stop the 614 system.

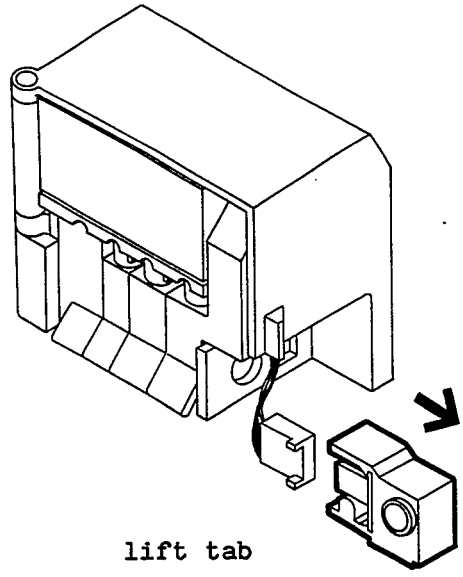
Remove the probe and tubing, Section 4.12.



Remove the waste tube and plunger

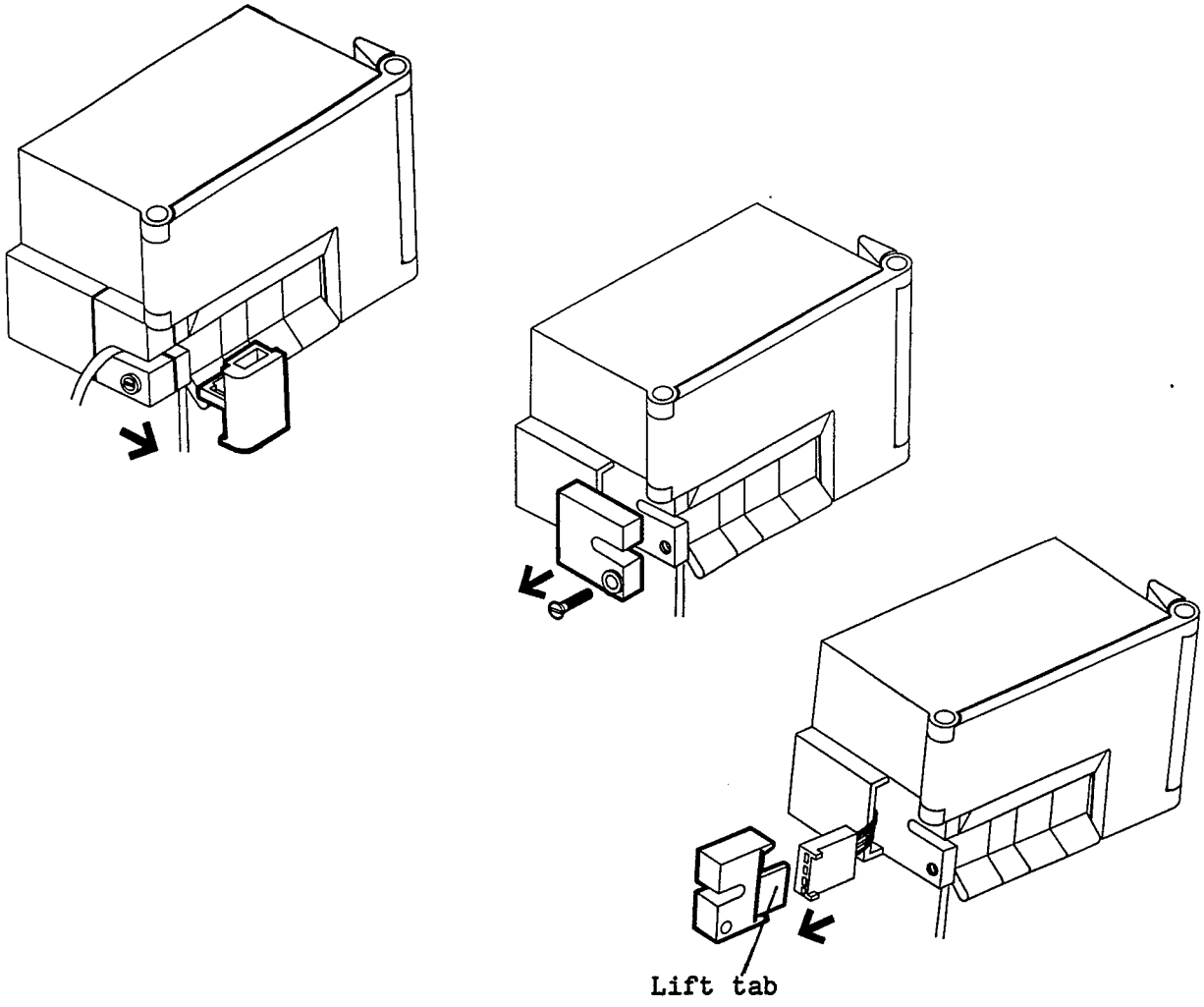
Remove the pump tube cassette, Section 4.9.





lift tab

4.16 To Replace the Sample Detectors (contd)

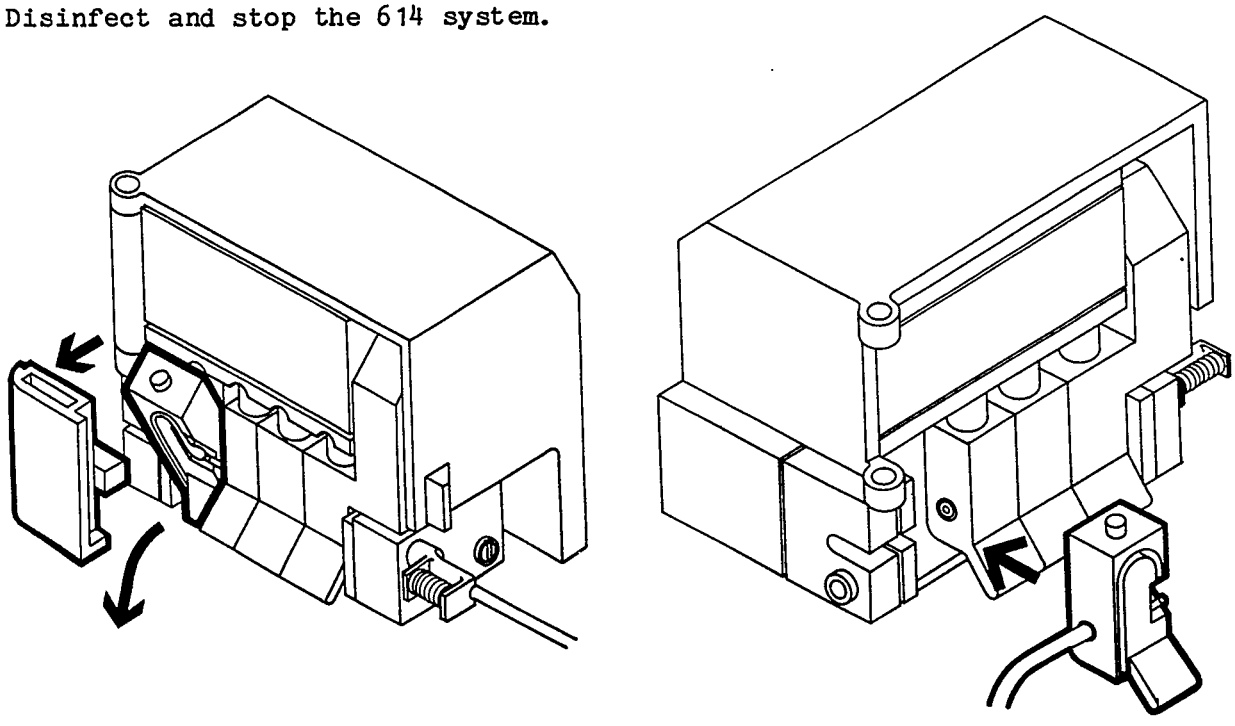


Reassemble in reverse order

4.17 To Replace the Slope Inlet Block

Equipment
Disinfectant; Slope inlet block, Cat. 478542

Disinfect and stop the 614 system.

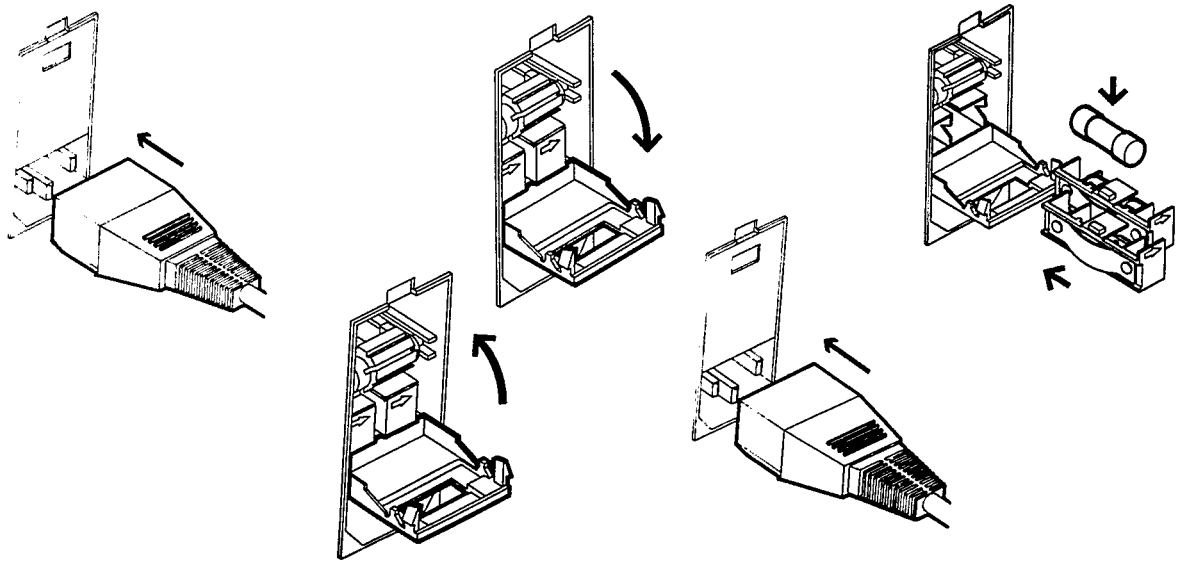


Remove the probe tubing and slope tube from the slope inlet block and fit to the new block.

4.18 To Replace a Fuse

Equipment
Fuses, Cat. 478648

WARNING : For continued protection against fire hazard use only the same type and rating of fuse that was fitted originally to the 614 - refer to instrument rear panel.



Make sure that the voltage selector bobbin is set to the correct voltage for the local power supply.

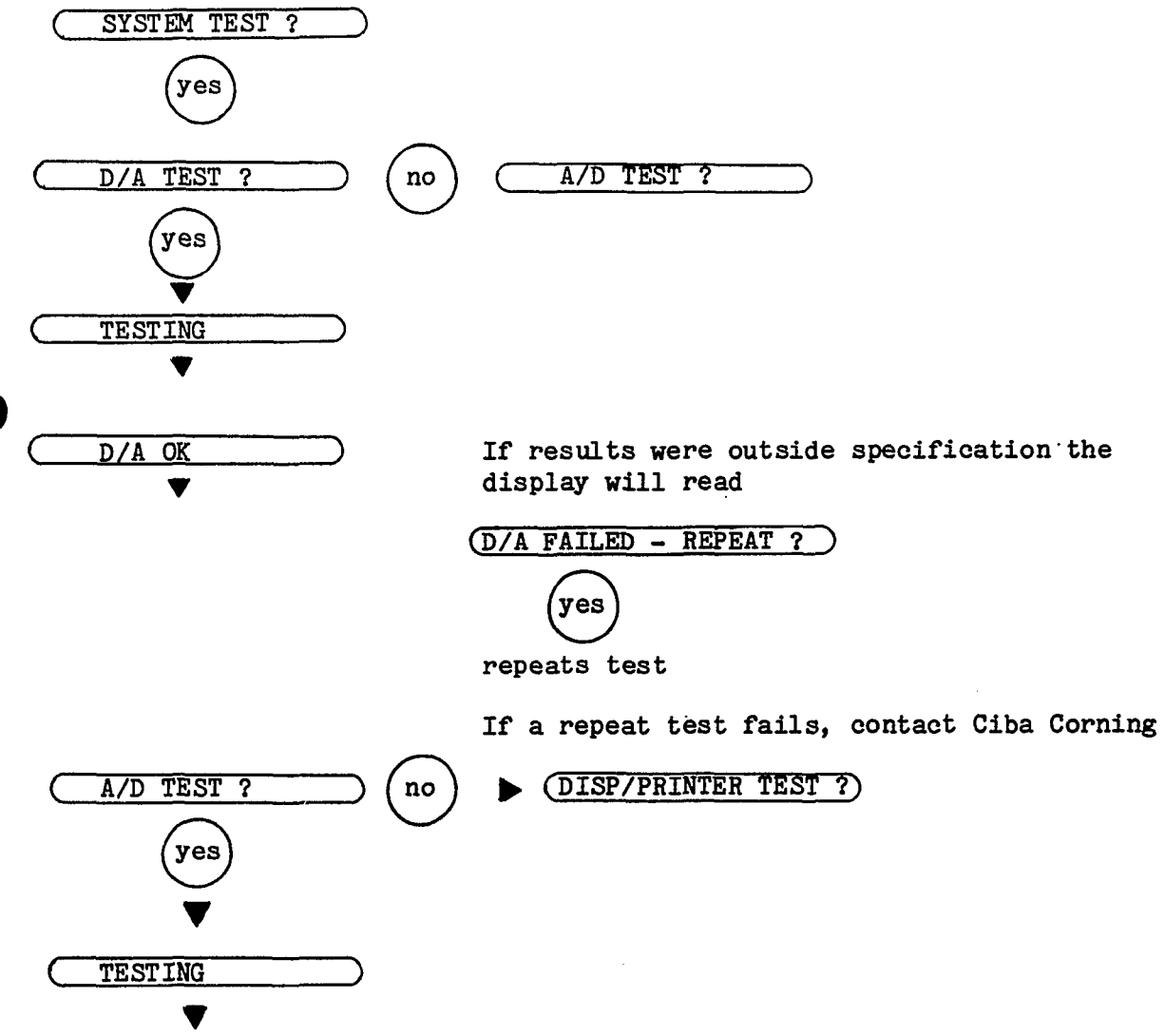
Voltage Selected	Voltage Range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

CAUTION : Do not rotate the voltage selector bobbin when it is fitted in the voltage selector as this will damage the contacts.

4.19 System Test Routine (refer to Appendix C for 634)

This routine allows the user to check the instrument functions. The following test routines are available : D/A converter, A/D converter, display and printer and electrode outputs. If the integral printer is enabled the date, time and result of each test will be printed.

NOTE : The electrode output routine will not be accessible if SYSTEM TEST ? is entered from ANALYZE URINE ?



4.19 System Test Routine (Contd)

A/D OK

If results were outside specification the display will read

A/D FAILED - REPEAT?

yes

repeats test

If a repeat test fails, contact Ciba Corning.

DISP/PRINT TEST ? no ▶ ELECTRODE O/P TEST?

yes

HHHHHHHHHHHHHHHH

yes or no (or 10 seconds)

IIIIIIIIIIIIIII

yes or no (or 10 seconds)

################

yes or no (or 10 seconds)

ELECTRODE O/P TEST? no ANALYZE BLOOD ?

yes

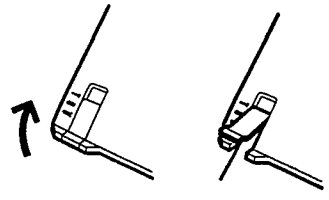
NOTE : If SYSTEM TEST ? was entered from ANALYZE URINE ? mode the electrode output test routine will not be available.

mV MODE ? yes ▶

no

Select the mV mode to check electrode mV output The mmol/L mode can be used to visually monitor electrode signal output.

mmol/L MODE ? yes OPEN PROBE



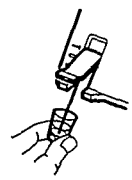
4.19 System Test Routine (contd)

PROBE IN TEST SOLN?

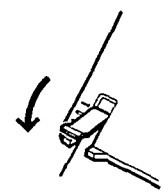
yes

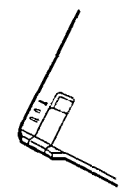
SAMPLING

SAMPLING - WAIT



NOTE : TEST SOLN in mV mode should be Cal/Flush or slope solution for comparison with mV values given





RETURN PROBE

(If the probe is not returned within 10 seconds the tone will sound)

MEASURING

PLEASE WAIT

Na=XXX.X K=XXX.X mV

or

Na=XXX K=X.XX mmol/L

The results are displayed and will change as the electrode outputs plateau. After 30 seconds the display is frozen. If in mV mode check that the readings are within:

	Minimum mV	Maximum mV
Cal/Flush	35	100

Slope Na should be between 4.7 and 8.8 mV less than the measured Cal/Flush mV level.

Slope K should be between 13.5 and 19.6 mV more than the measured Cal/Flush mV level.

If the results are outside these ranges, refill the Na+ and K+ electrodes, Section 4.11.

ELECTRODE O/P TEST ?

yes repeats test

no

ANALYZE BLOOD ?

4.20 Pre-service Protocol

Prior to any of the procedures detailed in sections 4.21 to 4.29 being carried out the following steps should be taken :

(i) Select RETURN TO SET-UP? on the display. Press "Yes"

(ii) Wait for Set-up menu to be printed. Retain printout for future reference

(iii) Disconnect instrument from mains electricity supply

(iv) Carry out service procedure

(v) Perform post service protocol (Section 4.30)

4.21 To Replace the CPU Board Cat.No. 478678

Remove the seven screws holding the rear panel in place. Lay down the rear panel. Remove connectors from PL2, PL3 and PL6. Remove the ribbon cable connector from PL10 on the power supply board. Unscrew the four nuts holding the CPU board in place (EV3). Unscrew the four hexagonal retainers associated with the 'D' type connectors (EV3 ref. no. 98). Lift out the CPU board. Replace the board by carrying out the above steps in reverse order.

When replacing the CPU board care should be taken to ensure that the correct language option and instrument software is maintained. The spare CPU board is shipped as an English/Spanish option. The replacement should be handled as follows :

614 English/Spanish	-	Direct replacement of CPU board
614 English/French 614 English/German 614 Englsh/Japanese	- - -	Remove IC3 from the CPU board in the instrument and exchange it for IC3 in the spare CPU board

N.B. The CPU board is a multilayer board and repair of the board should only be carried out by qualified personnel. It is recommended that faulty boards should be returned to Ciba Corning or their distributors for repair.

4.22 To Replace the Power Supply Board Cat.No. 478677

First remove the rear panel as described in 4.20. Remove the connectors from PL7, PL8, PL9, PL10 and PL11. Remove the screw at the left hand rear corner (viewed from the rear) of the board. Remove the large screw in the centre of the heatsink attached to the right hand panel (viewed from the rear) of the instrument. The board can then be removed by sliding out to the rear of the instrument. Refitting the board is achieved by carrying out the above steps in reverse order.

4.23 To Replace the Amplifier Board Cat.No. 478679

First remove the rear panel as described in 4.20. Remove the connectors from PL12, PL14 and PL15 and the four electrode leads. Remove the ribbon cable connector from PL3 on the CPU board. Unscrew the two retaining screws and remove the board (the two screws will be retained in the board). Refitting the board is achieved by carrying out the above steps in reverse order.

4.24 To Replace the Transformer Assembly Cat.No. 90416032A

First remove the rear panel as described in 4.20. Remove the connector to the power board (PL7). Unscrew the two screws either side of the voltage selector and the four screws securing the transformer to the base plate. Refitting the transformer is achieved by carrying out the above steps in reverse order.

If a new transformer assembly is fitted ensure that the voltage selector is set to the correct voltage and that fuses are in place. (Refer to Section 2.3)

4.25 To Replace the Electrode Door Assembly Cat.No. 90416031P

Lift the door to its upright position. Remove the screw in the cover over the braid connection (EV2 ref. 51). Place the cover and dome washer to one side. Remove the two screws holding the door to the hinges and remove the door. When replacing the door, check the alignment by closing the door and adjust as necessary. Replace the braid, dome washer and braid cover.

4.26 To Replace the Display Board Cat.No. 478656

First remove the rear panel as described in 4.20. Unscrew the two long screws inset in the top of the instrument case. Unscrew the two screws inside the case. Pull the panel and cover forward. Disconnect the braid connected to the screen behind the display and the braid connection to the front panel. Remove the four screws holding the display screen in place. Remove the display screen. Disconnect the display from the interconnection cable and remove it. Replace the display board and reassemble the screen and attach the braids before refitting the display panel.

4.27 To Replace the Printer Assembly Cat.No. 478661

First remove the display cover as described in 4.25. Detach the printer support plate by unscrewing the three nuts holding it in place. Disconnect the printer from PL8 of the power board. Remove the printer assembly. Remove the printer from the printer support plate. Replace the adhesive pads on the plate and attach the new printer to the plate. Reassemble the printer in place and refit the display cover.

4.28 To Replace the Motor/Gearbox Assembly Cat.No. 478666

First remove the rear panel as described in 4.20. Then remove the rotor assembly as described in 4.9. Remove the transit strap from the two halves of the in-line connection for the motor. Unplug the motor and unscrew the two screws at either side which retain it in place. Pull the motor out. Refit the new motor/gearbox assembly by following the above steps in reverse order.

4.29 To Replace the Electrode Block Assembly Cat.No. 478828

First remove the rear panel as described in 4.20. Remove the sample detectors from the block. Remove the amplifier board as described in 4.22. Unscrew the four screws retaining the block assembly in place. Remove the block assembly from the front. Remove electrodes from the block and refit new block by reversing the above procedure.

4.30 Post-Service Protocol

On completion of any of the procedures described in sections 4.21 - 4.29 the following steps should be taken :-

(i) Reconnect the instrument to the mains electricity supply

(ii) If a warm start occurs, allow the instrument to calibrate. When it displays ANALYZE BLOOD? select the RETURN TO SET-UP? option, press "Yes" and allow the set-up menu to be printed. Check that the menu is the same as obtained prior to the service being carried out.

(iii) If a cold start occurs, enter the correct data and time values and input data which corresponds to the menu as set prior to the service.

(iv) When the instrument returns to "ANALYZE BLOOD?" measure three levels of QC (Certain ISE) and check that the results are correct.

(v) Initiate a 2 point standardization.

(vi) Measure 10 replicates of a serum sample and check that the CV is within the instrument specification.

(v) Initiate a 2 point standardization

5.1 General

Section 6.1 of the Instruction Manual has complete troubleshooting charts. The information in this section describes aids to troubleshooting and some recommended procedures to remedy certain problems which may occur.

5.2 Power Supply Checks

Basic indications of whether the main power supplies are functioning can be derived from the status control LEDs (refer to section 5.3.1).

The following checks are carried out on the Power PCB. All voltages are measured with respect to 0V. (A convenient point is the negative connection of C16)

Voltage	Test Point	Reading
+ 5V	C27 +	+ 4.75 to + 5.25
+ 12V	D17 +	+ 11.50 to + 12.50
- 12V	C21 -	- 9.6 to - 14.4
+ 6V	IC2 pin 1	+ 5.8 to + 6.2
- 6V	IC2 pin 8	- 5.8 to - 6.2
+ 25V	C17 +	+ 19.2 to + 28.8

5.3 Status Indicator Checks

The status indicators are under the plastic cover on the rear panel.

LED Number	Check
1	a.c. power secondary
2	+12V
3	+5V
4	-5V
5	cal/flush solenoid
6	microprocessor
7	slope solenoid
8	peristaltic pump motor
9	not used
10	micro switch

5.3.1 Check that LEDs 1 to 4 are on. If any are dim or off it indicates a failure of that power supply. If the check in Section 5.2 was successful then there is probably an interconnection failure between the Power and CPU boards.

5.3.2 Check that LED 6 is flashing. This indicates that the microprocessor is functioning. If it is not flashing disconnecting and reconnecting the power should restore normal operation. If this action does not rectify the problem, there is a fault with the CPU board.

5.3.3 Perform a manual 2 point standardization. During this routine LEDs 5 and 7 should come on and go off. LED 8 should come on/go off/change brightness. Failure of any of these LEDs indicates a failure of the associated drive circuitry of the solenoids or the pump motor.

5.3.4 Raising and lowering the sample probe should cause LED 10 to come on/go off in synchronisation with the probe movement. Failure of this indicates a probable microswitch failure.

5.4 Electrode Test Simulator

During troubleshooting it may be difficult to distinguish between electrode and electronic problems. If this is the case, the Electrode Test Simulator (part no. 478723) can be used to aid in troubleshooting. Instructions for use are as follows :

The test set simulates the mV output of the electrodes and can be used to simulate a sample, a calibration routine (one point or two point), or the mV/mmol readings in the electrode test routine.

Methods of Use

a) Installation

Remove the electrodes and the slope block from the 614. Reinstate the sample flow path using the enclosed T piece and tubing (ensure the tubing passes through the blood detectors).

Plug the contact strip into the front of the electrode block - the pins fit above the electrode contacts, between the contacts and the electrode block.

b) Procedures

When using the test set it should first be used to perform a 2 point calibration.

2 Point Calibration Simulation

Install the test set as previously described

Set the test set selector switch to "Cal"

Initiate a two point calibration procedure on the 614 (calibrants will be required to operate the optical detectors)

Wait until the "CALIBRATION OK" message is displayed

Set the test set selector switch to "Slope"

Wait until the "SLOPE OK" message is displayed

The 614 is now calibrated with the test set as its 'electrodes'

Sample Simulation

Ensure "ANALYZE BLOOD?" is displayed on the 614

Install the test set as previously described

Select the "Cal" or "Slope" mode on the test set

Initiate a sample routine on the 614 (a sample will be required to operate the optical detectors)

When the 614 has endpointed the display reading will depend on the slope and intercept values entered in memory, but should be consistent if two or more consecutive sample simulations are run.

Electrode Test Simulation

Install the test set as previously described

Initiate the electrode test routine

If mV selected -

When the 614 has endpointed the display will read :

(i) With test set switched to "Cal"

Na within the range 50 to 100 mV (Result A)
K within the range 50 to 100 mV (Result B)

ii) With test set switched to "Slope"

Na Result A - 6 mV
K Result B + 17 mV

If mmol selected -

When the 614 has endpointed the display will read :

Na = 140 K = 4.00 mmol/L with test set switched to "Cal"
Na = 110 K = 8.00 mmol/L with test set switched to "Slope"

Note - the display will only read the above figures if a two point calibration has been performed using the test set. If a two point calibration has not been performed the display and mmol/L results will be dependant on the difference in output between the test set and the instrument's own electrodes.

5.5 Hydraulic Test Simulator

In order to exercise the hydraulic system of the instrument to determine the cause of the problems the use of this test simulator (part number 478567) can help. Instructions for its use are as follows :

The functions the test set enables the user to check are :-

a) Solenoid operation/solution path
b) Pump operation
c) That the RS232 outputs data

Warning - Hazardous potentials are present on the mains input socket, therefore care should be taken when using this test set.

Methods of Use

1. Installation

a) Remove power from the instrument
b) Unscrew rear panel and connect the test set plug to the data output socket
c) Remove test set cover (push in direction of 'open' pointer).
d) Disconnect the molex connector with cableforms going to the solenoids and pump, and connect it to the test set molex connector.

2) Procedures

Pump Operation

a) Power up instrument
b) The 20 mA LED on the test set should illuminate
c) Switch test set pump control to 'OFF'. The pump should now be stationary
d) Switch test set pump control to 'ON'. The pump should now rotate at a slow but constant speed

RS232 Check

a) Power up instrument
b) The 20 mA LED on the test set should illuminate
c) Whatever status the instrument is in - step through the menu to 'RETURN TO SET UP'
d) Press 'YES'
e) Print out of set-up menu will occur. (Note if DMS mode A is already selected the 20mA and RS232 LED will flash during print out.
f) Select DMS Mode A
g) Exit set-up menu - the 20 mA and RS232 LEDs will flash during printing

Solenoid Operation/Solution Path

a) 'Power up' instrument
b) Switch 'solenoid control' to 'OFF'. The solution path should now be from A to F and H to D.
c) Switch 'solenoid control' to 'Cal'. The solution path should be from A to G.
d) Switch 'solenoid control' to 'Slope'. The solution path should be from H to I.

Note - A,D,F,G,H and I refer to the tubing ports as detailed in Figure 6

3. On Completion of Test

a) Disconnect mains
b) Unplug molex connector from test set, clip test set cover back in place
c) Connect molex connector to its original connector on the I/O board
d) Reassemble rear panel on the instrument ensuring that all of the fixing screws are secure

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5.6 Troubleshooting Hints

5.6.1 Electrode Problems

If there are problems with electrodes, i.e. unstable readings or out of range readings a series of steps should be taken :

(a) Visually inspect the whole electrode area for signs of KCl leakage. Remove the electrodes and ensure that no leaks have occurred resulting in alternative conductive paths for signals. Examine the electrode contacts for signs of corrosion.

(b) Remove any bubbles from the Reference Electrode. This can be done by tapping or shaking the electrode to manipulate the air bubble into the cassette chamber. The bubble can also be removed by unscrewing the nafion inner by means of the small hexagonal tool in the electrode box and allowing KCl solution to flow up and displace the bubble.

(c) If the previous two steps are unsuccessful and the Na and K electrodes have sufficient fill solution in them, then deproteinizing and conditioning should be carried out (see Section 4.2).

Note - After deproteinizing and conditioning the electrodes may take up to 2 hours to return to stable operation.

(d) The electrode O/P test option should be used to determine if the electrodes are performing within specification. (See section 4.19). Large negative millivolt readings are usually indicative of bubbles in the reference electrode. If the electrode O/P test results indicate satisfactory electrode performance and the standardization of the instrument is persistently failing then the problem is probably hydraulic.

(e) Frequent occurrences of unstable readings can be due to bad earth connections to the electrode door. Continuity between the main earth stud on the base plate and the electrode door should be checked. N.B. The door must remain closed in normal operation.

(f) If none of the above steps resolves the difficulties, use of the electrode test simulator can determine if the problem is an electronics or electrode/hydraulics failure.

5.6.2 Hydraulics Problems

Hydraulics problems can usually be categorized as follows :

a) Cal solenoid failure - will be indicated by lack of solution delivered to the weir (or continuous delivery of solution to the weir).

b) Slope solenoid failure - indicated by no slope solution or continuous slope solution delivery. The latter instance will manifest itself by solution coming out of the probe.

c) Pump tube cassette failure - this can be seen in a number of ways. Insufficient delivery of cal, slope or sample solution during the relevant parts of the hydraulic sequences is the main evidence for pump tube cassette failure.

   N.B. The pump tube cassette is a consumable and should be replaced at regular intervals (typically 3 monthly).

d) Leaks - these can usually be detected by visual inspection.

e) Blockages - when blockages are discovered they can be cleared as described in section 4.7.

Use of the hydraulic test simulator should ease the determination of hydraulic problems.

5.6.3 Electronic Problems

Electronic problems should normally be corrected by replacement of PCBs. Attempted repair of PCBs is not recommended as the boards are high density, multi layer PCBs.

6.1 Ordering Information

When ordering spares or accessories for the 614, please give the following information to your Ciba Corning distributor :

614 Serial Number
Catalog Number of Part (Cat.)
Description
Quantity Required

This will make sure that your order is dealt with quickly and efficiently.

The number shown in the third column (Quantity) is the quantity of items that are supplied against the stated Catalog Number. If the quantity is greater than 1, the only multiples of that quantity can be supplied.

6.2 Engineers Spares Kit

The following is the Engineers Spares Kit for the 614 (serial numbers 2000 upwards) :

Cat No.	Description	Quantity
478840	Engineers Spares Kit 614	1
containing -		
478822	Reference Electrode Solution	1 pack of 4
478498	Reference Electrode Refill	1
478509	Reference Electrode Inner & KCl	1
476270	K+ Electrode	1
476266	Na+ Electrode	1
478535	Na+/K+/Ca++ Fill Solution	1
478536	Security Key	1
478542	Slope Inlet Block	1
478623	Probe Microswitch	1
478624	Printer Paper Spindle	1
478633	Weir Cover	1
478634	Probe & Tubing Kit	1
478841	Manifold Perspex	1
478842	Solenoid Assembly (NR)	1
478824	Manifold Gasket	1
478825	Manifold Plug	1
478637	Printer Ribbon Cassette	2
478638	Printer Paper	1 pk of 2 rll
478639	Pump Tube Cassette	2
478645	Clot Removal Line	1
478648	Fuse Pack (2 x 1A slo-blo)	1

Cat No.	Description	Quantity
478775	Solenoid Cover	1
478826	Fuse Pack (3 x 3A Slo-blo)	1
478653	Connecting Tubing Kit	1
478654	Probe Lever	1
478656	Display Board	1
478657	Manifold Mounting Plate	1
478661	Printer Kit	1
478662	Thermistor Kit	1
478828	614 Electrode Block Assembly	1
478664	Rotor Kit	1
478666	Motor/Gearbox Kit	1
478678	CPU PCB	1
478677	PSU PCB	1
478679	Amplifier PCB	1
478673	Inlet Sample Detector	1
478674	Outlet Sample Detector	1
478694	Printer Cover	1
478700	Deproteinizing Solution	1 pack of 5
478701	Conditioning Solution	1 pack of 5
478835	Service Manual	1
478829	Probe Mount Moulding	1
478830	Hardware	1 pack
478831	Marine Sealant	1
478949	Silicone Grease	1
478836	PROM Kit English/Spanish	1) Select 1
478837	PROM Kit English/German	1) option
478838	PROM Kit English/French	1) when
478839	PROM Kit English/Japanese	1) ordering
478832	Display C/F	1
478833	Main C/F	1
478834	Power C/F	1

When ordering an Engineers Spares Kit please specify which dual language option is required.

6.3 Other Spares

478723	Electrode Test Simulator
478567	Hydraulic Test Simulator
478677	Power PCB (packaged)
478678	CPU PCB (packaged)
478679	Amplifier PCB (packaged)

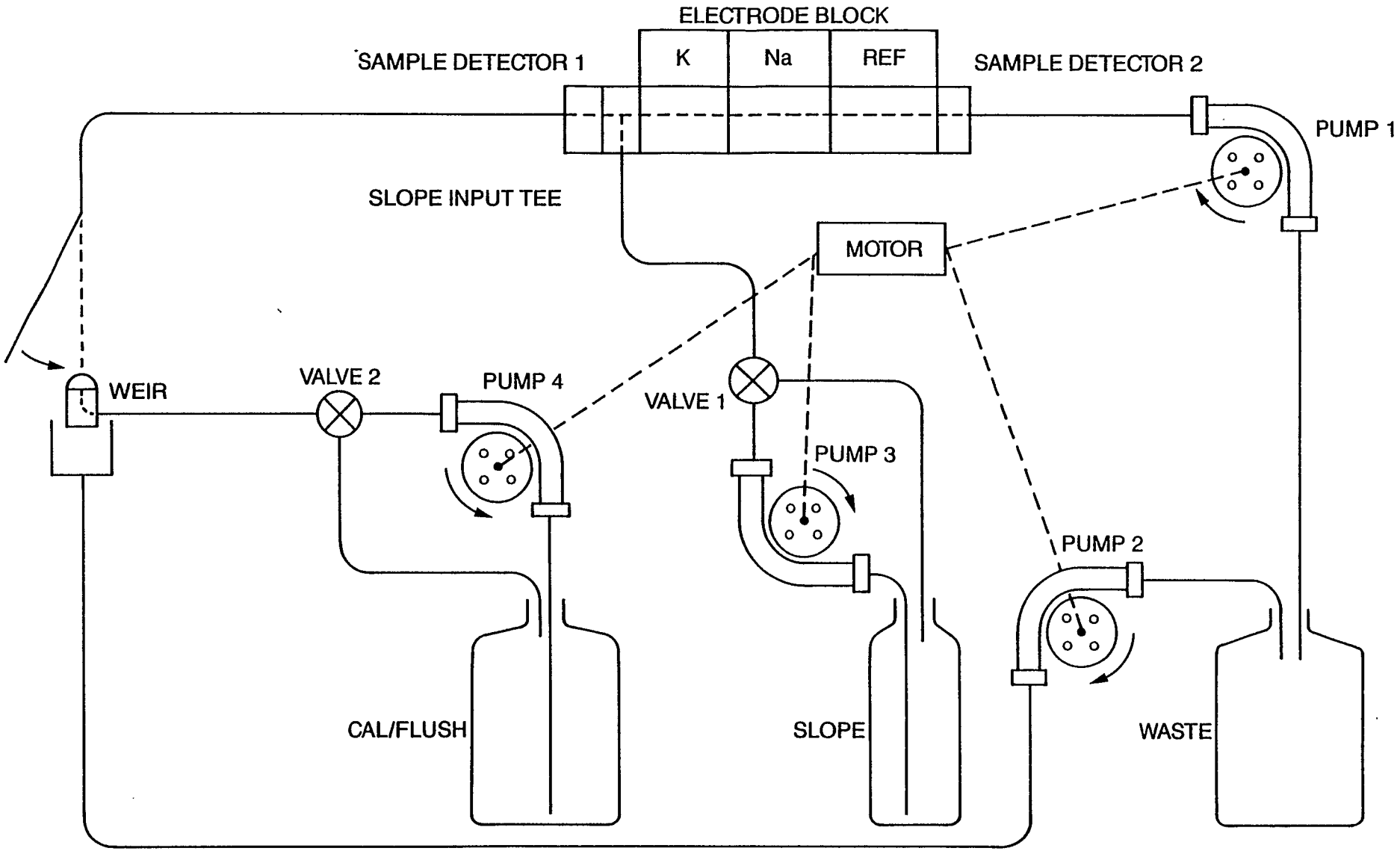


Figure 1a - Hydraulics Block Diagram

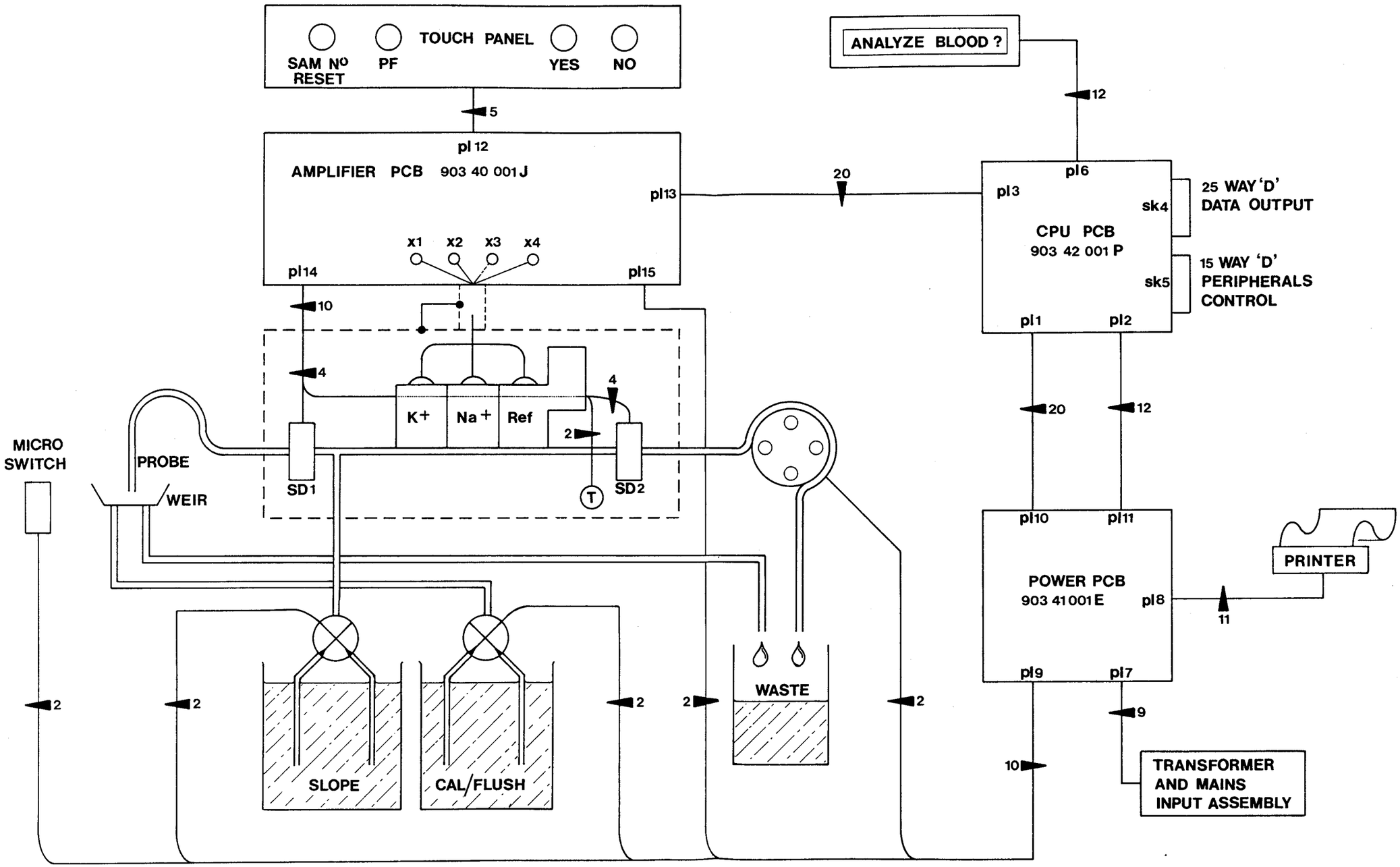
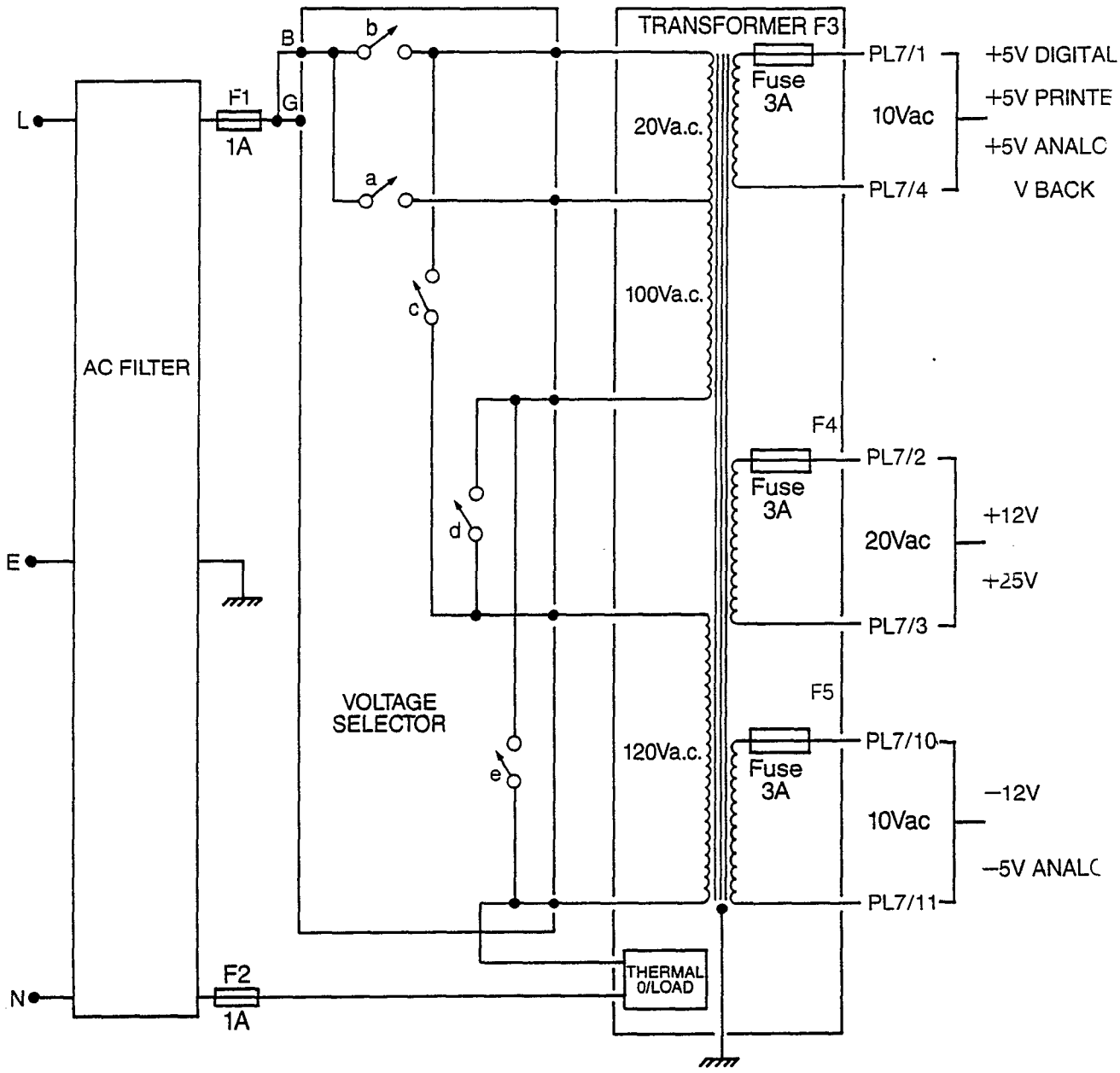


FIG 1b : 614 BLOCK DIAGRAM

Figure 2 - A.C. Power Supplies



NOTES: 1 THE SWITCHES 'a' TO 'e' ARE OPERATED BY THE VOLTAGE SELECTOR. THERE ARE FOUR POSSIBLE VOLTAGE SETTINGS AND THE CLOSED SWITCHES FOR EACH VOLTAGE ARE SHOWN BELOW. THE SWITCHES ARE CLOSED BY THE 'FINGERS' ON THE SELECTOR 'BOBBIN' WHEN IT IS INSERTED INTO THE VOLTAGE SELECTOR.

100V	a	c	e
120V	b	c	e
200V	a	d	
240V	b	d	

2 F1 AND F2 ARE INCLUDED IN 478648
F3, F4 AND F5 ARE INCLUDED IN 478826

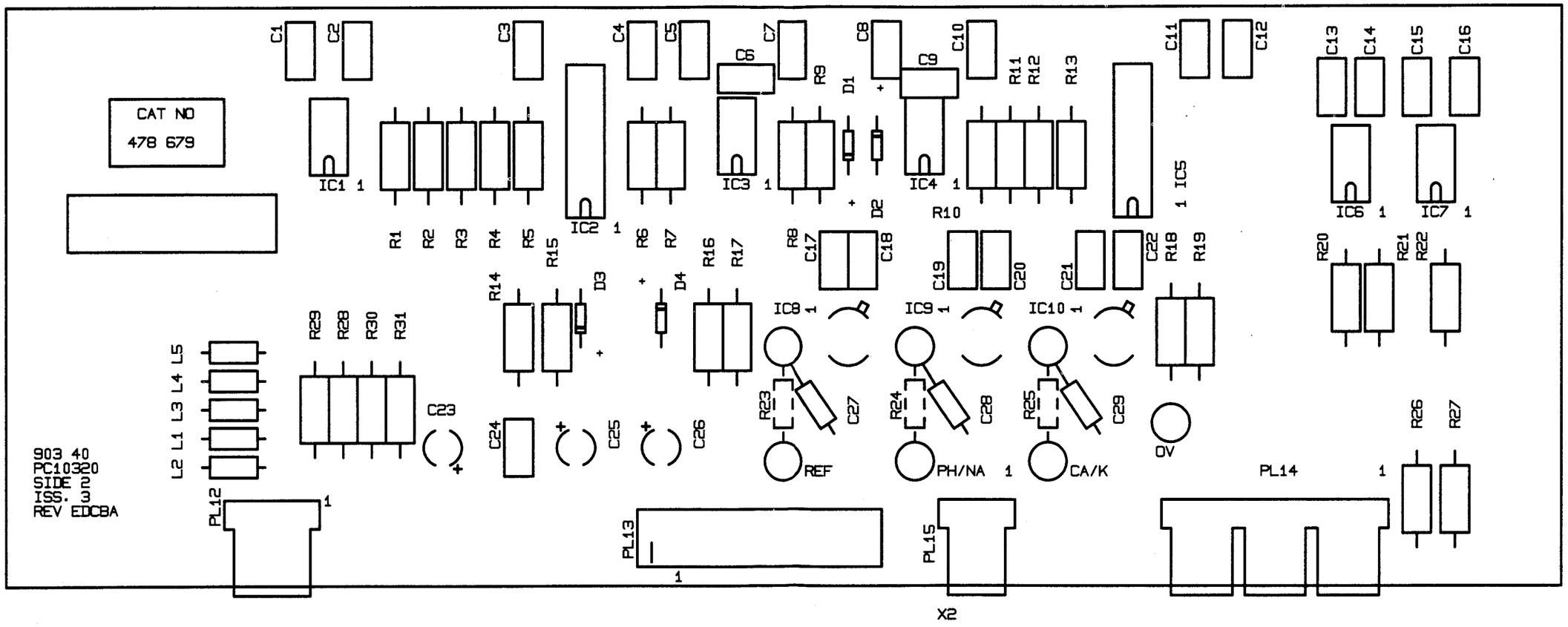


Figure 3a - Amplifier PCB
903 40 001J

SPARES

AMPLIFIER BOARD - 90340001J

Packed spare 478 679

Cct.Ref	Cat.No.	Description
Resistors		
R1,R2,R4,R5		
R16-R19	-	100 Kohm 1% 1/2W
R3	-	4.75 Kohm 1% 1/2W
R6,R9	-	6.49 Kohm 1% 1/2W
R7,R13	-	42.2 Kohm 1% 1/2W
R8	-	3.6 Kohm 2% 1/2W
R10,R14,		
R28-R31	-	10 Kohm 2% 1/2W
R11	-	3 Kohm 2% 1/2W
R12	-	75 Kohm 1% 1/2W
R15	-	43 Kohm 2% 1/2W
R20	-	28.7 Kohm 1% 1/2W
R21-R22	-	6.8 Mohm 5% 1/2W
R23-R25	-	100 Kohm 5% 1/4W
R26-R27	-	150 Ohm 2% 1/2W

Note : All resistors are metal film unless otherwise stated

Capacitors		
C1-C22,C24	-	Ceramic 100 nF, 63VW, -20/+80%
C23,C25,C26	-	Tantalum Bead, 33mF 16VW ±20%
C27-C29	-	Polystyrene (High Insulation) 160VW ±2.5%
Diodes		
D1-D4	900149207M	IN4148
Integrated Circuits		
IC1,3,4,6,7	900149710X	CA3140E
IC2	900149783L	CD4051BE
IC5	900149750N	CD4053BC
IC8	900149779A	ICL7611DCTV
IC9,10	900149731K	AD545KH
Links		
L1-L5	-	Wire Link
Plugs		
PL12	900142873M	5 way rt angle plug
PL13	990340020M	20 way ribbon cable assembly
PL14	900142875P	12 way rt angle plug
PL15	900142874N	4 way rt angle plug

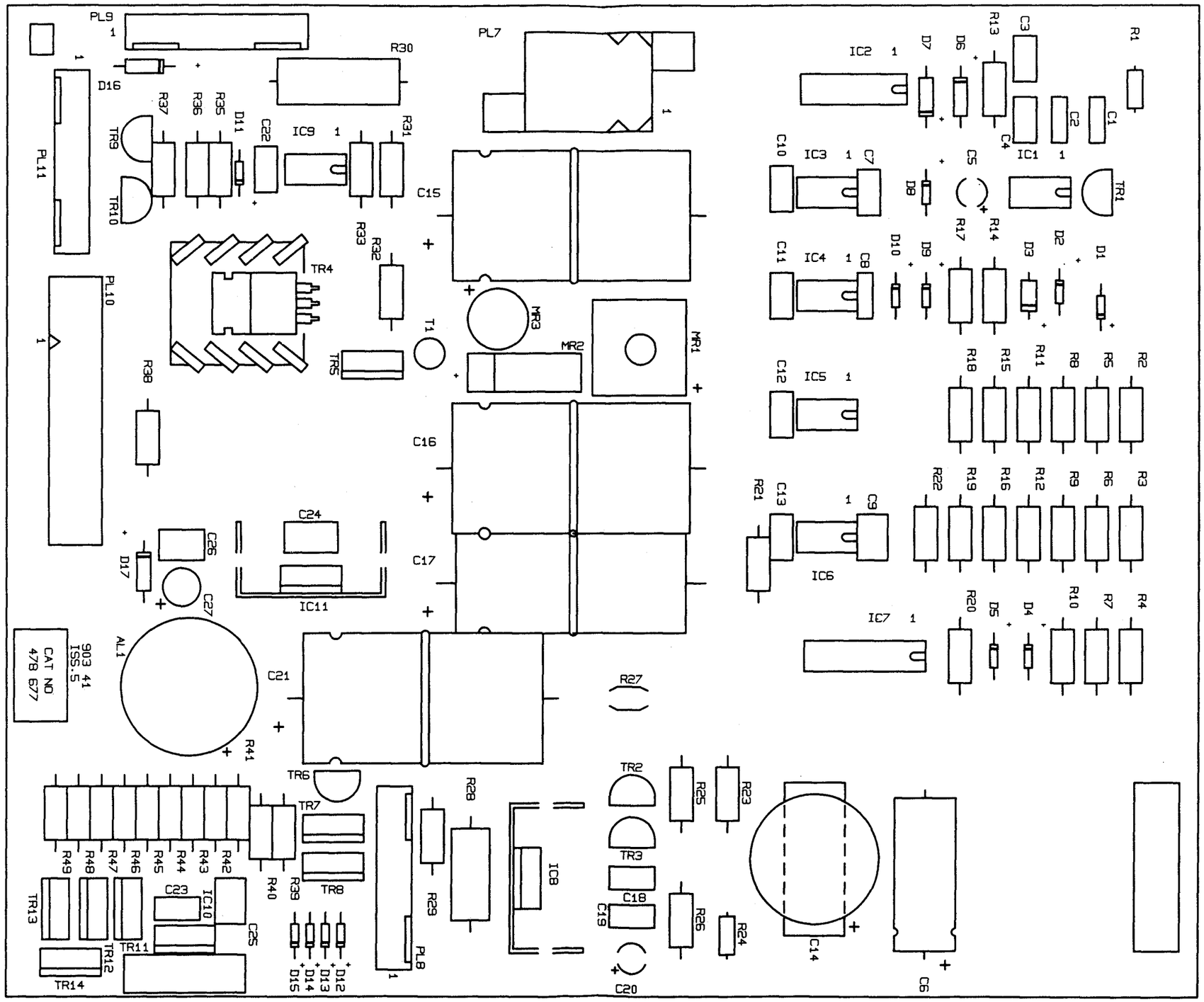


Figure 4a - Power PCB
903 41 001E

Plugs		
PL7	900142747E	12 way connector
PL8,PL9,PL11	900142801F	12 way connector
PL10	900142904P	20 way connector
Heatsinks		
H1	990341021K	Heatsink - 5 volt regulator
H2,H3	900149793N	Heatsink TV1505
H4	900149559P	Heatsink TV4
Diodes		
D1,D2,D4,D5,D11	900149207M	IN4148
D3	900149832A	6.8v Zener
D6,D7,D16,D17	900149181F	IN4007
D8,D9,D10	900149833X	IN4153
D12-D15	900149834E	7.5v Zener
Integrated Circuits		
IC1	900149155X	741
IC2	900149839L	4194
IC3	900149840A	TL7705
IC4,IC6	900149841X	3425
IC5	900149842E	ICL8211
IC7	900149797E	ULN2003
IC8	900149730J	LM317T
IC9	900149710X	CA3140E
IC10	900149843F	LM340AT5
IC11	900149725M	7812
Rectifiers		
MR1	900149716L	S005
MR2	900149788X	KBL02
MR3	900149293A	W005
Transistors		
TR1	900149835F	BC337
TR2	900149836H	BC212L
TR3	900149837J	BC182L
TR4,TR7,TR11-TR14	900149795A	BD677
TR5	900149139X	2N4920
TR6	900149838K	BC183L
TR8	900149794P	BD676
TR9	900149669J	PSA13

SPARES

POWER BOARD 90341001E

Packed Spare 478 677

Cct.Ref.	Cat.No.	Description
Audio Alarm		
AL1	900153298K	Audible alarm
Resistors		
R1	-	7.5 Kohm 1% 1/4W
R2,R6,R7,R9, R25,R29,R32,R40		
R42,R47,R49	-	10 Kohm 2% 1/2W
R3	-	39 ohm 2% 1/2W
R4,R21	-	100 Kohm 2% 1/2W
R5,R35	-	18 Kohm 2% 1/2W
R8,R12,R38	-	4.7 Kohm 2% 1/2W
R10,R15,R16,R20	-	1 Kohm 2% 1/2W
R11	-	27 Kohm 1% 1/2W
R13	-	15 Kohm 1% 1/2W
R14	-	100 Ohm 1% 1/2W
R17,R41,R43,R46,R48	-	390 Ohm 2% 1/2W
R18	-	75 Kohm 1% 1/2W
R19	-	330 Ohm 2% 1/2W
R22	-	470 Ohm 2% 1/2W
R23	-	100 Ohm 1% 1/2W
R24	-	12 Kohm 1% 1/4W
R26	-	300 Ohm 1% 1/2W
R27	-	Varistor V22ZA1
R28	-	820 Ohm 5% 1W
R30	-	68 Ohm 5% 6W Vitreous Enamel
R31,R33	-	20 Kohm 2% 1/2W
R36	-	2 Kohm 1% 1/2W
R37	-	10 Ohm 2% 1/2W
R39,R44,R45	-	2.2 Kohm 2% 1/2W

Note : All resistors are metal film unless otherwise stated

Capacitors		
C1,C2	-	Ceramic 1nF 100VW ±20%
C3,C4,C7,C10-C13		
C18,C19,C22,C23	-	Ceramic, 100nF, 63 VW +80/-20%
C5	-	Tantalum Bead 4.7mF 35VW ±20%
C6	-	Electrolytic 1000mF 10VW +50/-20%
C8	-	Metallised Polyester 0.068mF 63VW ±20%
C9	-	Metallised Polyester 330nF 63VW ±20%
C14	-	Memory back-up 0.1F 5.5VW +80/-20%
C15,C16	-	Electrolytic 4700mF 16VW +50/-10%
C17,C21	-	Electrolytic 2200mF 35VW +50/-10%
C20	-	Tantalum Bead 10mF 25VW ±20%
C24	-	Metallised Polyester 220nF 63VW ±20%
C27	-	Electrolytic 33mF 35VW +50/-10%

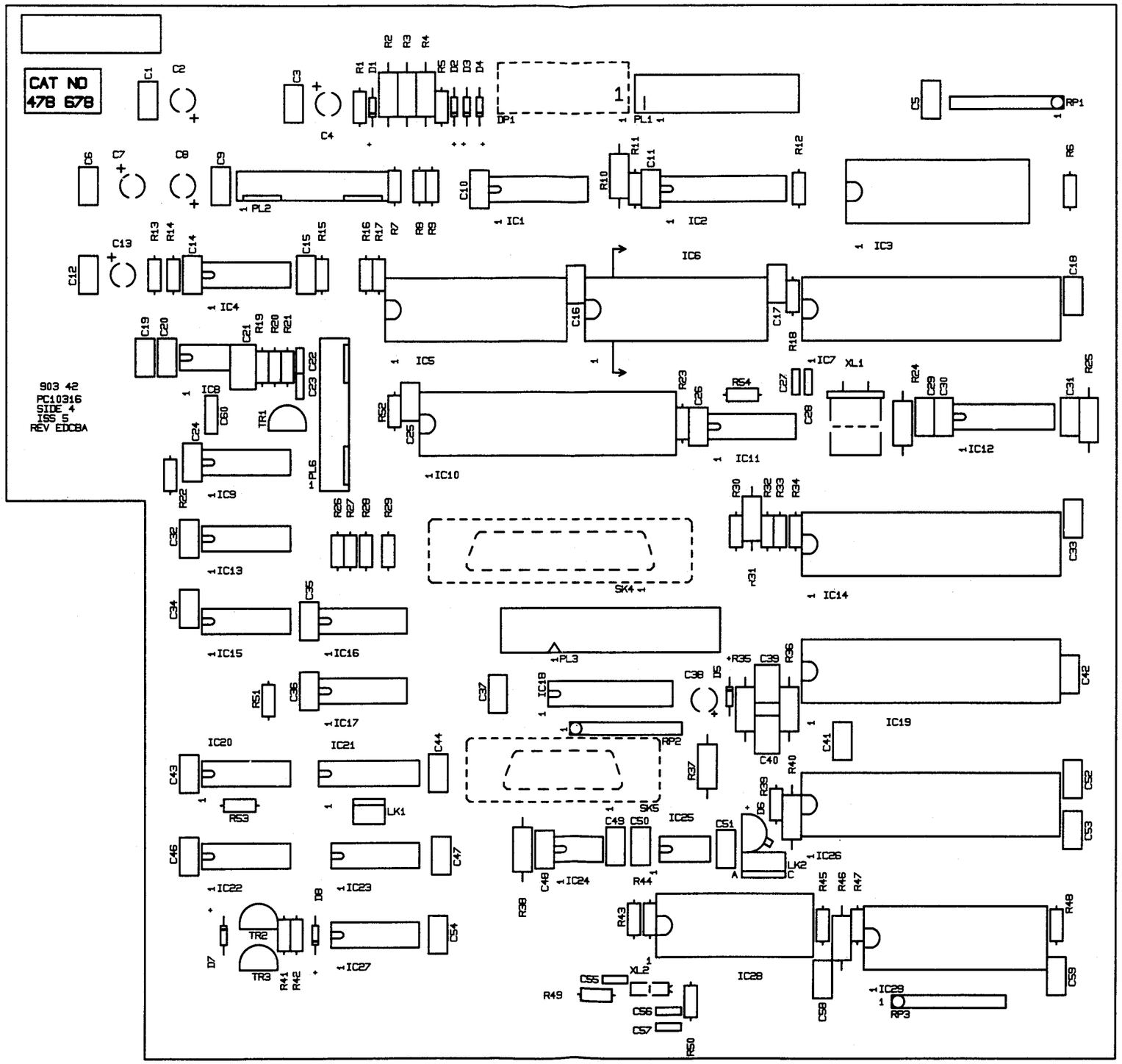


Figure 5a - CPU PCB
903 42 001P

CPU BOARD 903 42 001P

Packed Spare 478 678

Cct.Ref.	Cat.No.	Description
Resistors		
R1,R8	-	220 ohm 5% 1/4W
R2-R4	-	330 ohm 2% 1/2W
R5	-	150 ohm 5% 1/4W
R6,R11,R12, R15-R18,R20,R23 R26,R27,R30, R32-R34,R43-R45 R47,R48,R51-R54	-	10 Kohm 5% 1/4W
R7	-	27 ohm 5% 1/4W
R9	-	120 ohm 5% 1/4W
R10	-	510 ohm 2% 1/2W
R13	-	620 Kohm 5% 1/4W
R14	-	6.2 Kohm 5% 1/4W
R19,R21	-	47 Kohm 5% 1/4W
R22	-	2 Kohm 1% 1/4W
R24,R25,R37,R38	-	2 Kohm 1% 1/2W
R28	-	100 ohm 5% 1/4W
R29	-	2.2 Kohm 5% 1/4W
R31,R35	-	1 Mohm 2% 1/2W
R36	-	62 Kohm 2% 1/2W
R39,R41,R42	-	1 Kohm 5% 1/4W
R40,R46	-	10 Kohm 0.1% 1/2W
R49	-	5.6 Mohm 5% 1/3W
R50	-	150 Kohm 5% 1/4W

Note : All resistors are metal film unless otherwise stated

Resistor Networks		
PR1-PR3	-	RESNET 10 Kohm sil pack ±2% 0.15W/Resist
Capacitors		
C1,C3,C5,C6 C9-C12,C14-C18, C20,C24-C26, C29-C37,C42-C54, C58-C59	-	Ceramic 100nF 100VW +80/-20%
C2,C4,C7,C8,C13	-	Tantalum bead 33mF 16VW ±20%
C19	-	Ceramic 10nF 100VW ±20%
C21	-	Metallised Polyester 0.47MF 63VW ±20%
C22,C23	-	Ceramic Plate 390PF 63VW ±10%
C27,C28	-	Ceramic Plate 22PF 100VW ±5%
C38	-	Tantalum Bead 4.7MF 25VW ±20%
C39	-	Metallised Polyester 47NF 63VW ±20%
C40	-	Metallised Polyester 0.068MF 63VW ±20%
C41	-	Metallised Polyester 1MF 50VW ±20%
C56,C57	-	Ceramic Plate 33PF 63VW ±10%
C60	-	Ceramic 1NF 100VW ±20%

Links		
LK1	900142907E	2 position link } cut to
LK2	900142907E	3 position link } size
REF6	900142908F	Micro link 2 way (LK1,LK2)
Plugs		
PL1	990341020J	20 way ribbon cable assembly
PL2,PL6	900142801F	12 way connector
PL3	900142904P	20 way connector
Sockets		
SK4	900142419M	25 way connector 'D' type
SK5	900142420X	15 way connector 'D' type
REF3	900142812X	28 pin Dil Skt (IC3,IC6)
Crystals		
XL1	900153314X	6.144 MHz
XL2	900153315E	32.768 KHz
Diodes		
D1	900149834E	7.5v Zener
D2,D3	900149262H	2.7v Zener
D4	900149846K	8.2v Zener
D5,D7,D8	900149207M	IN4148
D6	900149796X	ICL8069
Displays		
DP1	900149851F	10 element LED
Integrated Circuits		
IC1	900149858M	74HCT366
IC2,IC18	900149828H	74HCT373
IC3	See Note	
IC4	900149762E	MC1488
IC5	900149744A	8251A
IC6	900149802J	2K X 8 RAM
IC7	900149733M	8085AC
IC8	900149331X	NE555N
IC9	900149790K	MC1489
IC10	900149799H	1601
IC11	900149852H	74LS05
IC12	900149800F	DAC0800LCN
IC13,IC15	900149823P	74HCT74
IC14,IC19	900149734N	P8155
IC16,IC27	900149830N	74HCT04
IC17	900149829J	74HCT393
IC20	900149824A	74HCT00
IC21	900149827F	74HCT138
IC22	900149826E	74HCT32
IC23	900149825X	74HCT08
IC24,IC25	900149820L	CA3140AE
IC26	900149736A	ICL7109CPL
IC28	900149785N	HD146818
IC29	900149850E	8259A
Transistors		
TRI	9001496695	PSA13
TR2, TR3	9001498375	BC182L

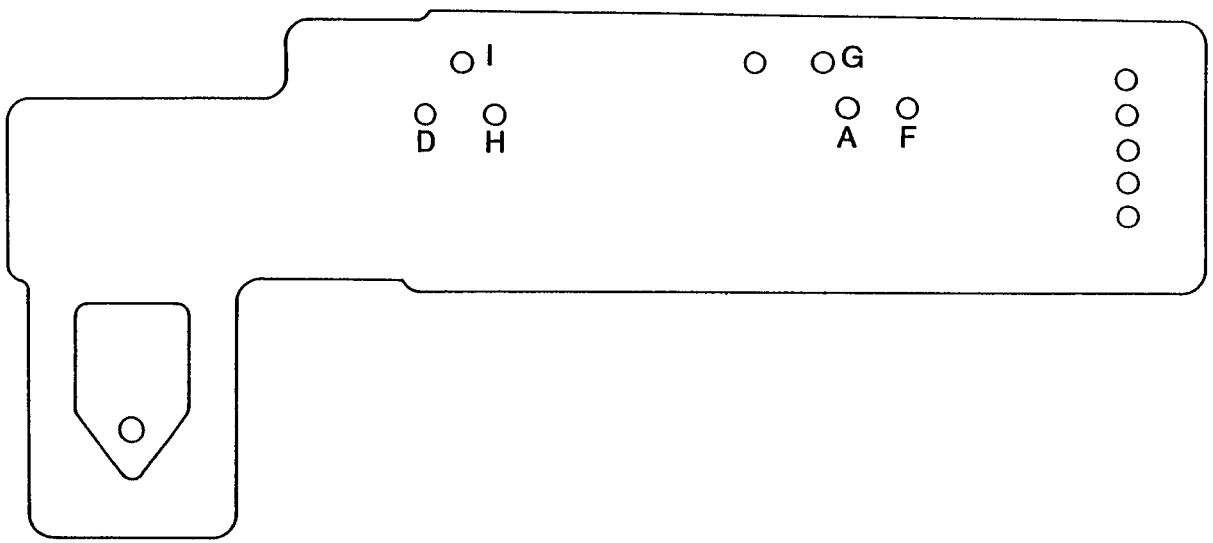
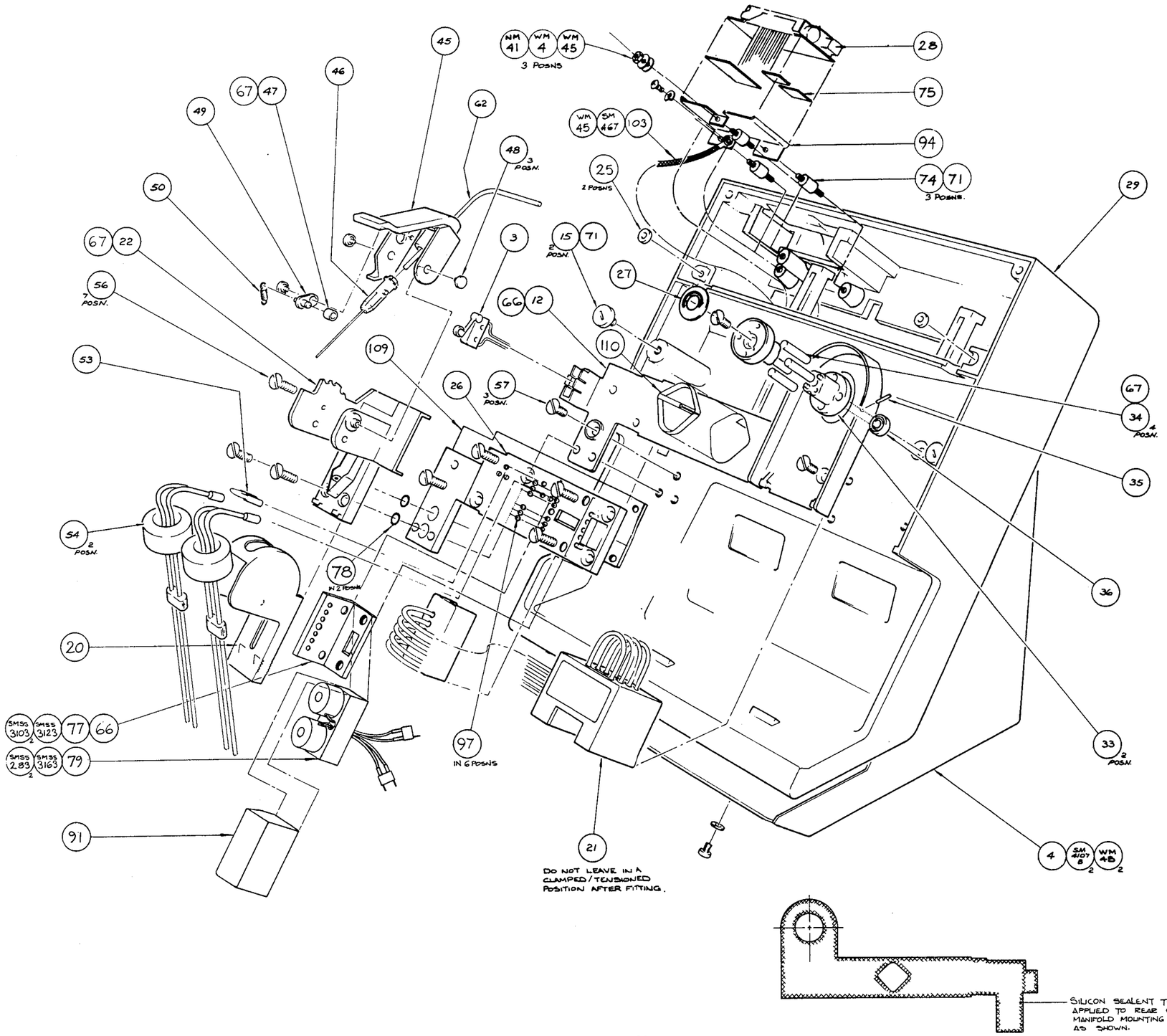


Figure 6 - Manifold showing tubing ports


NM 41 WM 4 WM 45
3 POSNS
45
46
67 47
49
62
48 3 POSN.
50
67 22
56 7 POSN.
53
109
26
57 3 POSN.
3
66 12
15 71 2 POSN.
25 2 POSNS
27
1
110
28
75
WM 45 SM 467 103
94
74 71 3 POSNS.
29
67
34 4 POSN.
35
36
33 2 POSN.
4 SM 4107 B 2 WM 4B 2
54 2 POSN.
78 IN 2 POSNS
20
SMSS 3103 2 SMSS 3123 77 66
SMSS 2.83 2 SMSS 3163 79
91
97 IN 6 POSNS
21
DO NOT LEAVE IN A CLAMPED/TENSIONED POSITION AFTER FITTING.

SILICON SEALENT TO BE APPLIED TO REAR OF MANIFOLD MOUNTING PLATE AS SHOWN.

FIG 4.

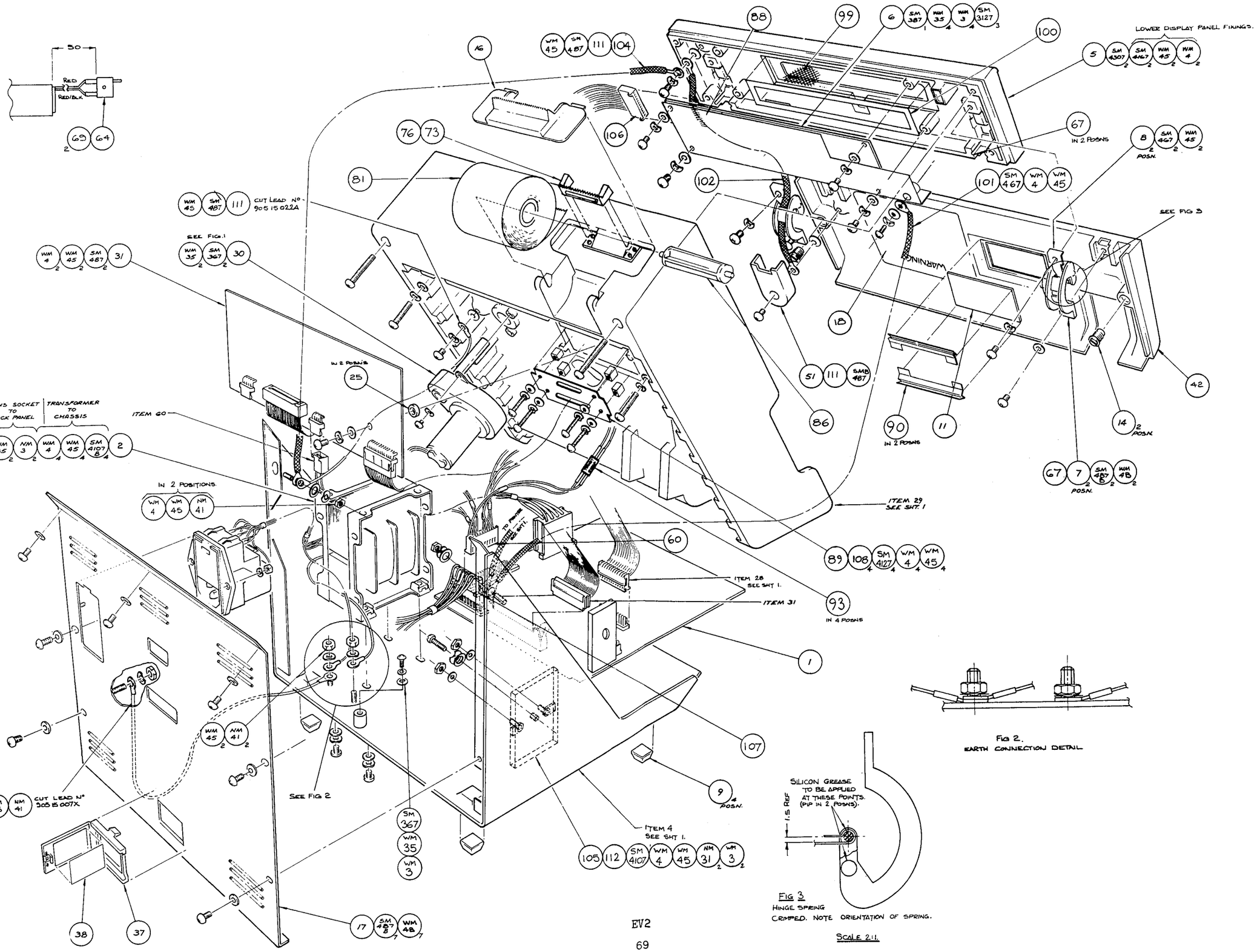
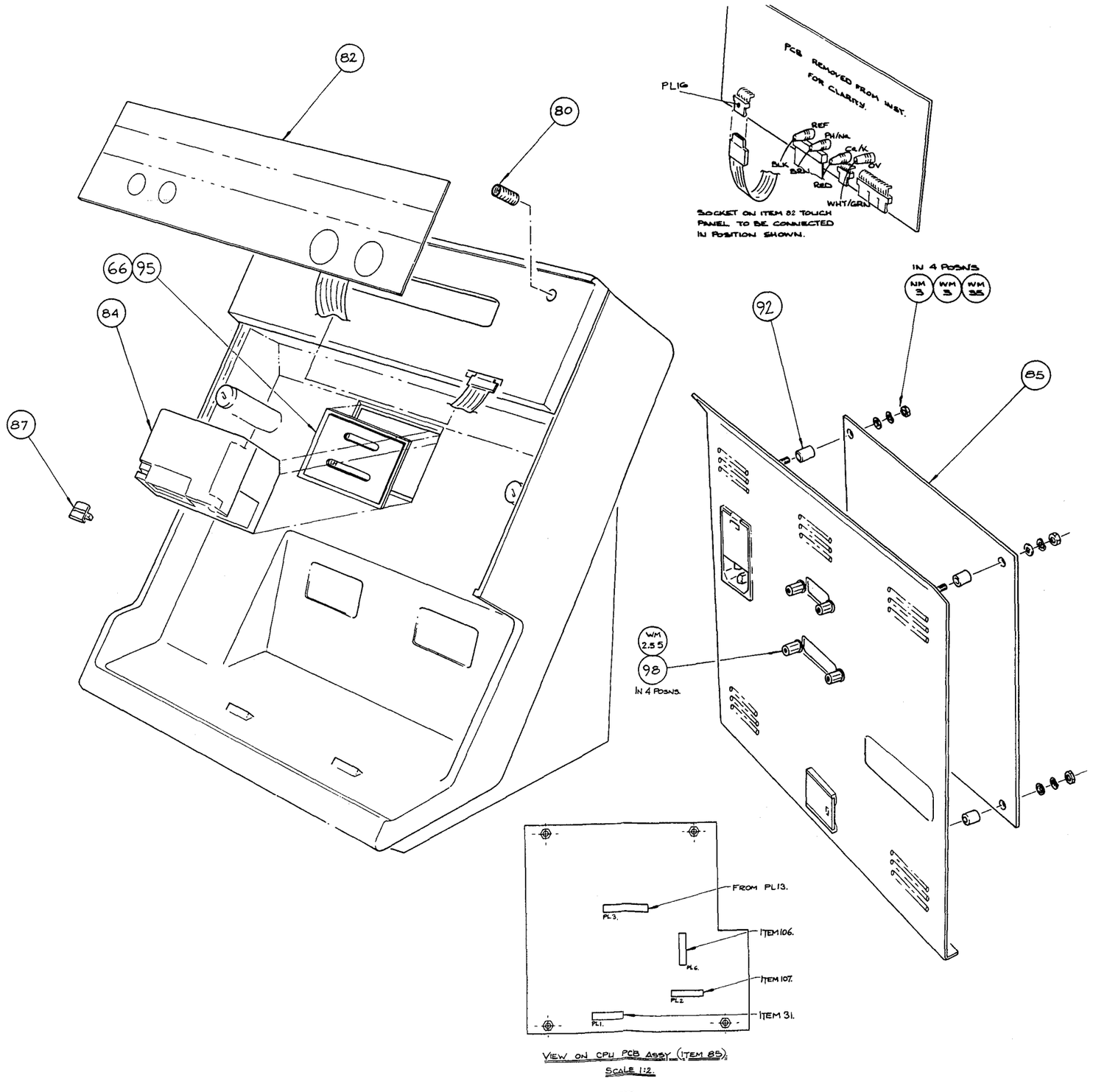


FIG 2.
EARTH CONNECTION DETAIL

FIG 3
HINGE SPRING CRIMPED. NOTE ORIENTATION OF SPRING.

SCALE 2:1.



VIEW ON CPU PCB ASSY (ITEM 85).
SCALE 1:2.

614 MAIN ASSEMBLY PARTS LIST/SPARES CROSS REFERENCE

ITEM	DESCRIPTION	SPARES NO. OR PART NO.	OTHER ITEMS INCLUDED	COMMENT
1	PSU PCB ASSEMBLY	478677		
2	TRANSFORMER ASSEMBLY	90416032A		
3	MICROSWITCH	478623	93	
4	CHASSIS F & C	61405006K		
5	DISPLAY COVER F & C	90416033X	82	
6	DISPLAY MODULE	478656		
7	HINGE ARM	90407004P		
8	SPRING	90407005A		
9	RUBBER FOOT	00130010K		
10	NO ITEM 10			
11	WINDOW	90416031P	14,18,42,90	
12	MANIFOLD MOUNTING PLATE	478657		
13	NO ITEM 13			
14	MAGNETIC CATCH	SEE ITEM 11		
15	COUNTER PLATE	SEE ITEM 29		
16	PRINTER COVER	478694		
17	BACK PANEL F & C	61405004M		
18	WARNING LABEL	00178978F		
19	NO ITEM 19			
20	WEIR COVER	478633		
21	PUMP TUBE CASSETTE	478639		
22	COVER, PROBE MOUNTING	478829	78	
23	NO ITEM 23			
24	NO ITEM 24			
25	SCREW, RETAINING	SEE ITEM 31		INC.IN 478830
26	MANIFOLD PERSPEX	478841	78,109	
27	ROTOR LABLE	478664	33,34,35	
28	PRINTER ASSEMBLY	478661	75	
29	BULKHEAD MOULDING F & C	90416038K	15,73	
30	MOTOR/GEARBOX	478666	36,64,69,93	
31	AMPLIFIER PCB ASSEMBLY	478679		
32	NO ITEM 32			
33	ROTOR CAGE	SEE ITEM 27		
34	PUMP ROLLER	SEE ITEM 27		
35	DOWEL PIN	SEE ITEM 27		
36	SHAFT SEAL	SEE ITEM 30		
37	INSPECTION COVER	90405010F		
38	STATUS INDICATOR DOOR LABEL	00187122L		
39	NO ITEM 39			
40	NO ITEM 40			
41	NO ITEM 41			
42	ELECTRODE COVER F & C	SEE ITEM 11		
43	NO ITEM 43			
44	NO ITEM 44			
45	PROBE LEVER	478654	48,50	

ITEM	DESCRIPTION	SPARES NO. OR PART NO.	OTHER ITEMS INCLUDED	COMMENT
46	PROBE MOULDING	478634	62	
47	CAM ROLLER	90410017M		
48	RETAINING PIN	SEE ITEM 45		
49	INDEX ARM	90410019P		
50	RETURN SPRING	SEE ITEM 45		
51	WIRE COVER	90405018A		
52	NO ITEM 52			
53	LINK TUBE	478653	54	
54	TUBE ASSEMBLY	SEE ITEM 53		
55	NO ITEM 55			
56	NYLON SCREWS			INC.IN 478830
57	NYLON SCREWS			INC.IN 478830
58	NO ITEM 58			
59	NO ITEM 59			
60	MAIN CABLEFORM	478833		
61	NO ITEM 61			
62	ANALYSIS TUBE	SEE ITEM 46		
63	NO ITEM 63			
64	2-WAY CONNECTOR	SEE ITEM 30		
65	NO ITEM 65			
66	MARINE SEALANT	478831		
67	SILICON GREASE	478949		
68	NO ITEM 68			
69	INSULATION SLEEVING	SEE ITEM 30		
70	NO ITEM 70			
71	LOCTITE	00173240N		
72	NO ITEM 72			
73	PAPER TEARER	SEE ITEM 29		
74	ANTIVIBRATION MOUNT	00108748N		
75	GASKET	SEE ITEM 28		
76	PERMABOND ADHESIVE	00173299K		
77	NR SOLENOID I/F	478842	79,97,93	
78	'O' RING	SEE ITEM 22,26		
79	NR SOLENOID ASSEMBLY	SEE ITEM 77		
80	SPRING COMPRESSION	SEE ITEM 82		
81	PRINTER ROLL	478638		
82	TOUCH PANEL	90416034E	80	
83	NO ITEM 83			
84	ELECTRODE BLOCK ASSEMBLY	478828	89,95,108	
85	CPU PCB ASSEMBLY	478678		
86	PAPER ROLL DOWEL	478624		
87	TUBE LOCATOR	90511023E		
88	DISPLAY SCREEN	61405016M		
89	GASKET PLATE	SEE ITEM 84		
90	WINDOW CLIP	SEE ITEM 11		
91	SOLENOID COVER	478775		
92	NYLON SPACER	00101137F		
93	TRANSIT STRAP LABEL	SEE ITEMS 3,30 77		

ITEM	DESCRIPTION	SPARES NO. OR PART NO.	OTHER ITEMS INCLUDED	COMMENT
94	PRINTER TRAY	61405022K		
95	BLOCK GASKET	SEE ITEM 84		
96	NO ITEM 96			
97	'O' RING	SEE ITEM 77		
98	SPACER, STUD	00101138H		
99	DISPLAY MESH	61405018P		
100	MESH GASKET	61405019A		
101	SCREENED CABLE	61405025N		
102	SCREENED CABLE	61405026P		
103	SCREENED CABLE	61405027A		
104	SCREENED CABLE	61405028X		
105	HEATSINK	61405017N		
106	DISPLAY CABLEFORM	478832		
107	POWER CABLEFORM	478834		
108	NO ITEM 108			
109	MANIFOLD GASKET	SEE ITEM 26		
110	MOUNTING PLATE PLUG	478825		
111	GROUNDING WASHER	61405031L		
112	HEATSINK COMPOUND	00149208N		
113	BULKHEAD LABEL	00178921M		
114	BULKHEAD LABEL	00178920L		

614 INTERCONNECTION TABLE

SCHEDULE 1 - TOUCH PANEL TO AMPLIFIER BOARD

Touch Panel Switch	Amplifier Board (PL12)
Switch Return	Pin 1
Sam No. Reset	Pin 2
Paper Feed	Pin 3
'Yes' key	Pin 4
'No' key	Pin 5

SCHEDULE 2 - AMPLIFIER BOARD TO CPU BOARD

Amplifier Board (PL13)	Function	CPU Board (PL3)
1	Analogue 0V	1
2	Analogue Signal O/P	2
3	Signal 0V	3
4	Offset Signal I/P	4
5	Analogue 0V	5
6	1.23V Reference	6
7	Analogue 0V	7
8	Analogue +6V	8
9	Analogue -6V	9
10	Digital +5V	10
11	Digital 0V	11
12	'Yes' Key	12
13	'No' Key	13
14	Sam No Reset	14
15	Paper Feed	15
16	Mux Select D0	16
17	Mux Select D1	17
18	Mux Select D2	18
19	Channel Select	19
20	Ca/K Gain Select	20

SCHEDULE 3 - AMPLIFIER BOARD TO ELECTRODE BLOCK

Amplifier Board (PL14)	Function	Electrode Block
1	Sample Detector 2 I/P	Sample Detector 2
2	0V	Sample Detector 2
3	Sample Detector 2 LED O/P	Sample Detector 2
4	Analogue 0V	Sample Detector 2
5	Thermistor	Thermistor
6	0V	Sample Detector 1
7	Sample Detector 1 I/P	Sample Detector 1
8	Sample Detector 1 LED O/P	Sample Detector 1
9	Thermistor	Thermistor
10	Analogue 0V	Sample Detector 1
11		
12		

REF	(X3)	Ref Electrode I/P	Black wire
pH/Na	(X1)	pH/Na Electrode I/P	Brown or white wire
Ca/K	(X4)	Ca/K Electrode I/P	Red wire
Ground	(X2)	Screen	White/green wire

SCHEDULE 4 - AMPLIFIER BOARD TO POWER BOARD

Amplifier Board (PL15)	Function	Power Board (PL9)
1	Heater Control	1
2	Heater (-12V)	11

SECTION 5 - POWER BOARD TO TRANSFORMER ASSEMBLY

Power Board (PL7)	Function	Transformer Assy (Wire Colour)
1	10V AC (+5V)	Violet
2	20V AC (+12V)	Black
3	20V AC (+12V)	Black
4	10V AC (+5V)	Violet
5	N/C	
6	N/C	
7	Ground	Green/yellow
8	N/C	
9	N/C	
10	10V AC (-12V)	Grey
11	10V AC (-12V)	Grey
12	N/C	

SCHEDULE 6 - POWER BOARD TO PRINTER

Power Board (PL8)	Function	Printer
1	Resdet	1
2	Digital 0V	2
3	Printer 0V	3
4	Motor Drive	4
5	Printer +5V	5
6	Solenoid Drive	6
7	Solenoid Drive	7
8	Solenoid Drive	8
9	Solenoid Drive	9
10	Digital 0V	10
11	Tacho Sense	11
12	N/C	

SCHEDULE 7 - POWER BOARD TO uSWITCH/SOLENOIDS/MOTOR/HWARE

Power Board (PL9)	Function	Destination/Wire Colour
1	See Schedule 4	
2	Upper Solenoid	Black
3	uSwitch	White/Green
4	Upper Solenoid	White
5	Lower Solenoid	White/Black
6	Lower Solenoid	Black/White
7	N/C	
8	Motor Drive (+ve)	Black
9	Motor Drive (-ve)	Red
10	N/C	
11	See Schedule 4	
12	uSwitch	White/Green

SCHEDULE 8 - POWER BOARD TO CPU BOARD (SIGNALS)

Power Board (PL10)	Function	CPU Board (PL1)
1	Power Reset	1
2	Mains Power Status	2
3	Printer Power Status	3
4	Motor On/Off	4
5	Motor Speed	5
6	Upper Solenoid Control	6
7	Lower Solenoid Control	7
8	Ram/Rtc Deselect	8
9	Heater Control	9
10	Inreg Indicator	10
11	Alarm Control	11
12	Printer Solenoid Control	12
13	Printer Solenoid Control	13
14	Printer Solenoid Control	14
15	Printer Solenoid Control	15
16	Printer Sense	16
17	Resdet	17
18	Printer Motor Control	18
19	uSwitch	19
20	Motor on Indicator	20

SCHEDULE 9 - POWER BOARD TO CPU BOARD (POWER)

Power Board (PL11)	Function	CPU Board (PLR)
1	+5V Digital	1
2	Digital 0V	2
3	Analogue +6V	3
4	Analogue -6V	4
5	Analogue 0V	5
6	+ 12V	6
7	- 12V	7

8	VBack	8
9	+5V Digital	9
10	Digital 0V	10
11	Digital 0V	11
12	Digital 0V	12

SCHEDULE 10 - CPU BOARD TO DISPLAY

CPU Board (PL6)	Function	Display
1	Digital 0V	1
2	+5V Digital	2
3	Data Bit 0	3
4	Data Bit 1	4
5	Data Bit 2	5
6	Data Bit 3	6
7	Data Bit 4	7
8	Data Bit 5	8
9	Data Bit 6	9
10	Data Bit 7	10
11	Data Strobe	11
12	Busy	12

SCHEDULE 11 - DATA OUTPUT SOCKET

CPU Board SK4	Function
2	RS232 TX Data O/P
3	RS232 RX Data O/P
4	RTS
6	DSR
7	Signal Ground
8	20mA TX -ve
9	20mA TX +ve
10	20mA RX -ve
11	20mA RX +ve
14	+12V
18	-12V
24	Security Key Pull-up
25	+5V Digital

SCHEDULE 12 - PERIPHERALS CONTROL SOCKET

CPU Board SK5	Function
5	Probe Up Status
6	Probe Down Status
7	Last Sample Flag Status
9	+5V Digital
12	Sampler Motor Drive
13	0V Digital
14	On/Off Line Status
15	Stat Key Status

appendix A

APPENDIX A CONTENTS

1 BLOOD SAMPLE SEQUENCE

Initiated when "Yes" is pressed in answer to "PROBE IN SAMPLE?"

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate sample	1.78	OFF	OFF	Leading edge Triggers SD1
2	Display "RETURN PROBE"	OFF	OFF	OFF	Probe returned
3	Move sample through block	1.78	OFF	OFF	Trailing edge triggers SD1
4	Measure sample	OFF	OFF	OFF	End of measure sequence
5	Flush sequence	See Table 8			

2 URINE SAMPLE SEQUENCE (also applies to urine slope)

Initiated when "Yes" pressed in answer to "PROBE IN UR SAMPLE?"

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate sample	1.78	OFF	OFF	Leading edge triggers SD1
2	Move sample quickly	5.52	OFF	OFF	After 8 seconds
3	Display "RETURN PROBE"	OFF	OFF	OFF	Probe returned
4	Move sample through block	1.78	OFF	OFF	Trailing edge triggers SD1
5	Measure sample	OFF	OFF	OFF	End of measure sequence
6	Flush sequence	See Table 8			

3 CALIBRATION SEQUENCE

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution	8.50	OFF	ON	After 0.5 secs
2	Aspirate solution	8.50	ON	OFF	After 2.0 secs
3	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
4	Pause	OFF	OFF	OFF	After 3.0 secs
5	Aspirate solution	4.00	OFF	OFF	After 4.0 secs
6	Aspirate cal solution	1.78	ON	OFF	Leading edge triggers SD1
7	Move cal through block	1.78	OFF	OFF	Trailing edge triggers SD1
8	Measure cal solution and update	OFF	OFF	OFF	End of cal measure sequence
9	Flush sequence	See Table 8			

4 SLOPE SEQUENCE

Initiated automatically during 2 point standardisation

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution	8.50	OFF	ON	After 1.0 secs
2	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
3	Aspirate slope	1.78	OFF	ON	Leading edge triggers SD2
4	Aspirate slope	1.78	OFF	ON	2 secs
5	Measure slope solution and update	OFF	OFF	OFF	End of slope measure sequence
6	Flush sequence	See Table 8			

5 DEPROTEINIZE/CONDITION SEQUENCE

Initiated by pressing "Yes" to "PROBE IN SOLN C?" (OR D)

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution Aspirate solution	8.50 1.78	OFF OFF	OFF OFF	After 7.5 secs (DEPRO) BD2 Triggers (COND)
2	Check solution	OFF	OFF	OFF	Solution in place
3	Pause	OFF	OFF	OFF	5 minutes or pressing "No"
4	Flush sequence	See Table 8			

6 PRIME AND DRAIN SEQUENCE

Initiated by pressing "Yes" to "PRIME?" or "DRAIN?"

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution	8.50	OFF	ON	After 30 secs (Prime) After 45 secs (Drain)
2	Pause	OFF	OFF	OFF	After 1 sec
3	Aspirate solution	8.50	ON	OFF	After 30 secs (Prime) After 45 secs (Drain)
4	Aspirate solution	8.50	OFF	OFF	After 2 secs

7 WET SEQUENCE

Initiated automatically (periodic 10 minute basis)

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Run pump	6.00	OFF	OFF	After 0.5 secs
2	Aspirate solution	6.00	OFF	ON	After 0.5 secs
3	Aspirate solution	3.25	ON	OFF	After 2.0 secs
4	Aspirate solution	3.25	OFF	OFF	After 2.0 secs
5	Aspirate solution	3.25	ON	OFF	After 2.0 secs
6	Aspirate solution	3.25	OFF	OFF	After 2.0 secs
7	Pause	OFF	OFF	OFF	After 3.0 secs
8	Aspirate solution	4.00	OFF	OFF	After 4.0 secs

8 FLUSH SEQUENCE

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Run pump	6.00	OFF	OFF	After 0.5 secs
2	Aspirate solution	6.00	OFF	ON	After 0.5 secs
3	Aspirate solution	8.50	ON	OFF	After 2.0 secs
4	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
5	Aspirate solution	8.50	ON	OFF	After 2.0 secs
6	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
7	Pause	OFF	OFF	OFF	After 3.0 secs
8	Aspirate solution	4.00	OFF	OFF	After 4.0 secs

IC8 pin 3

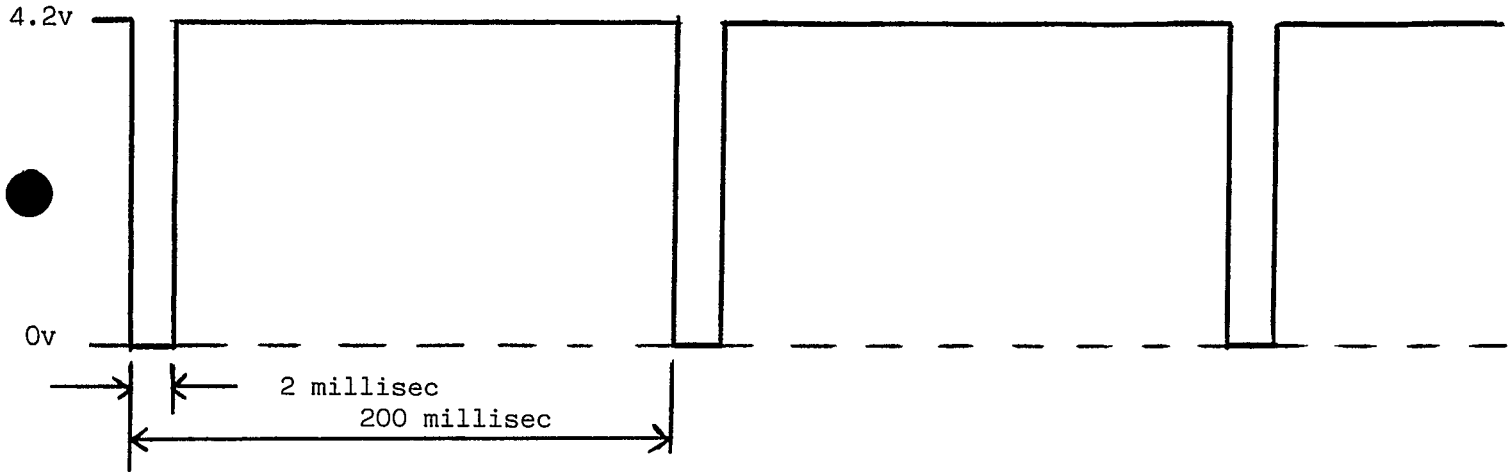


FIGURE 1

IC7 pin 30

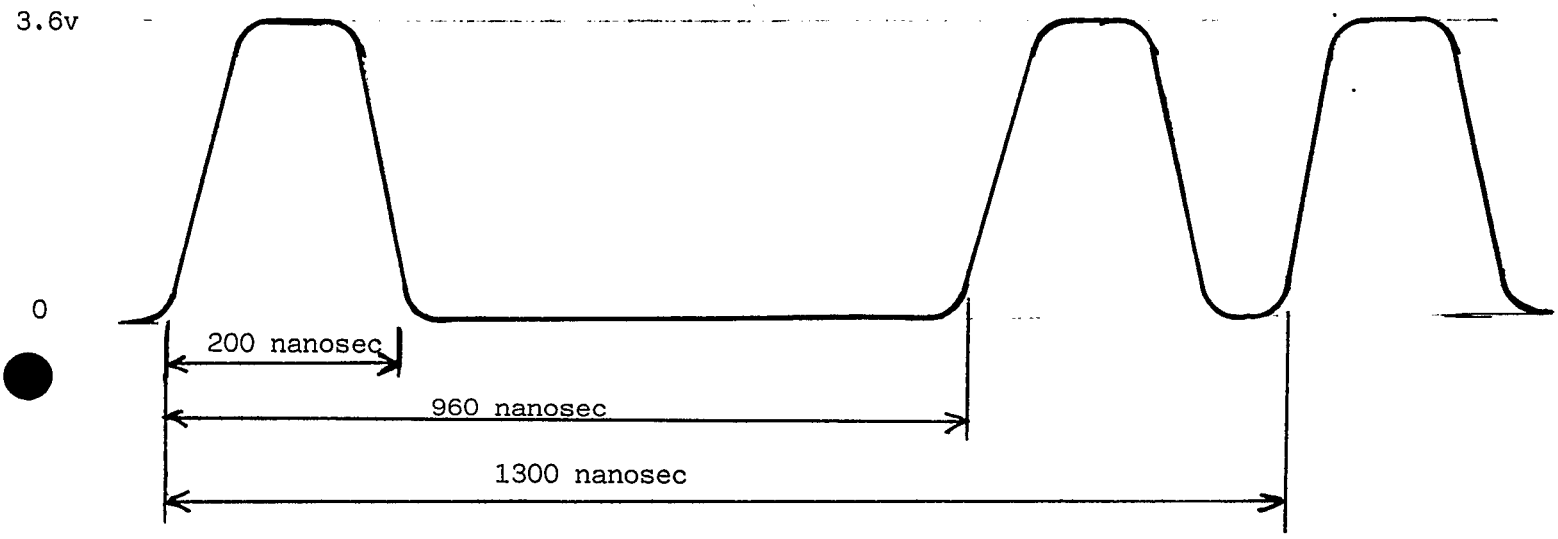


FIGURE 2

IC7 pin 37

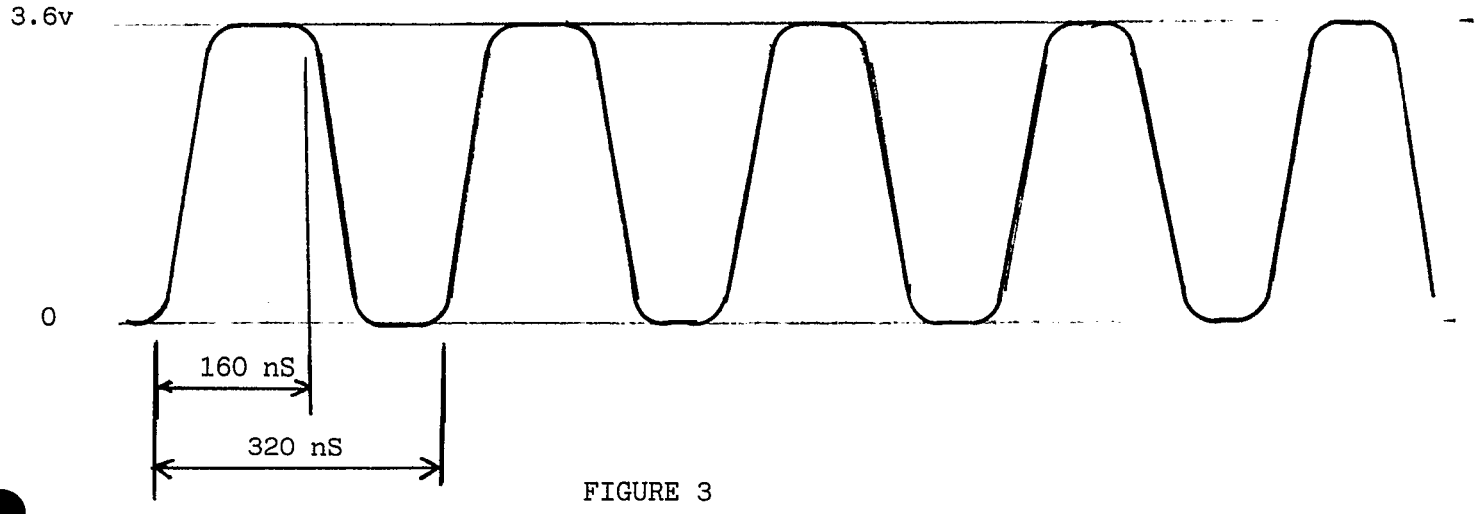


FIGURE 3

IC19 pin 22

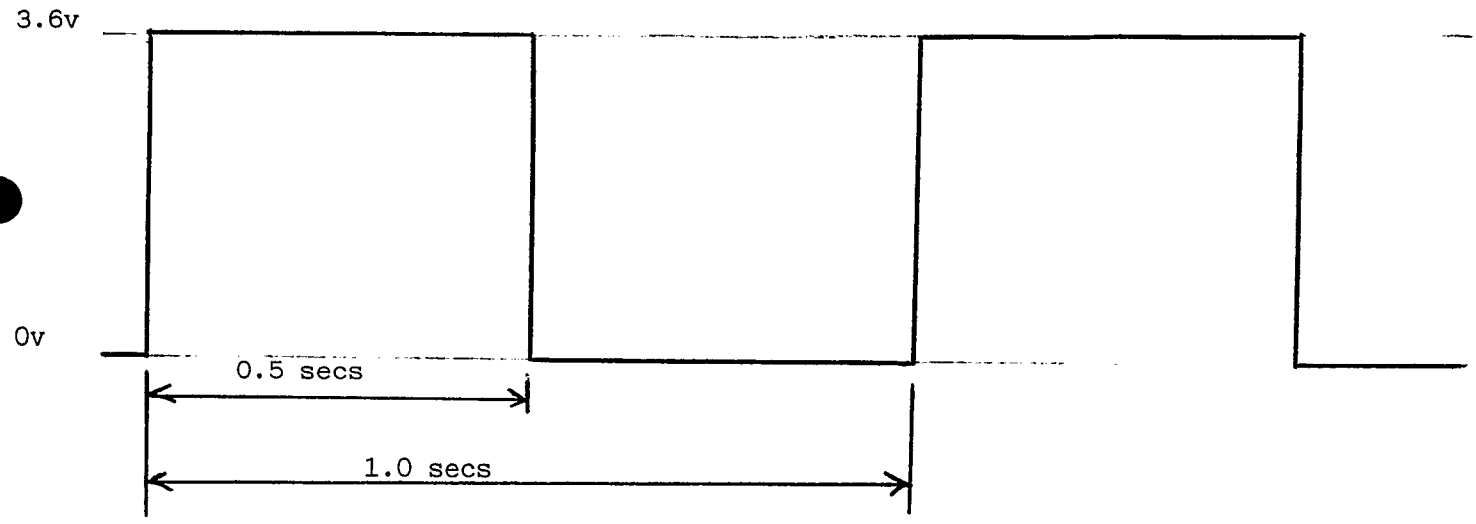


FIGURE 4

IC8 pin 23

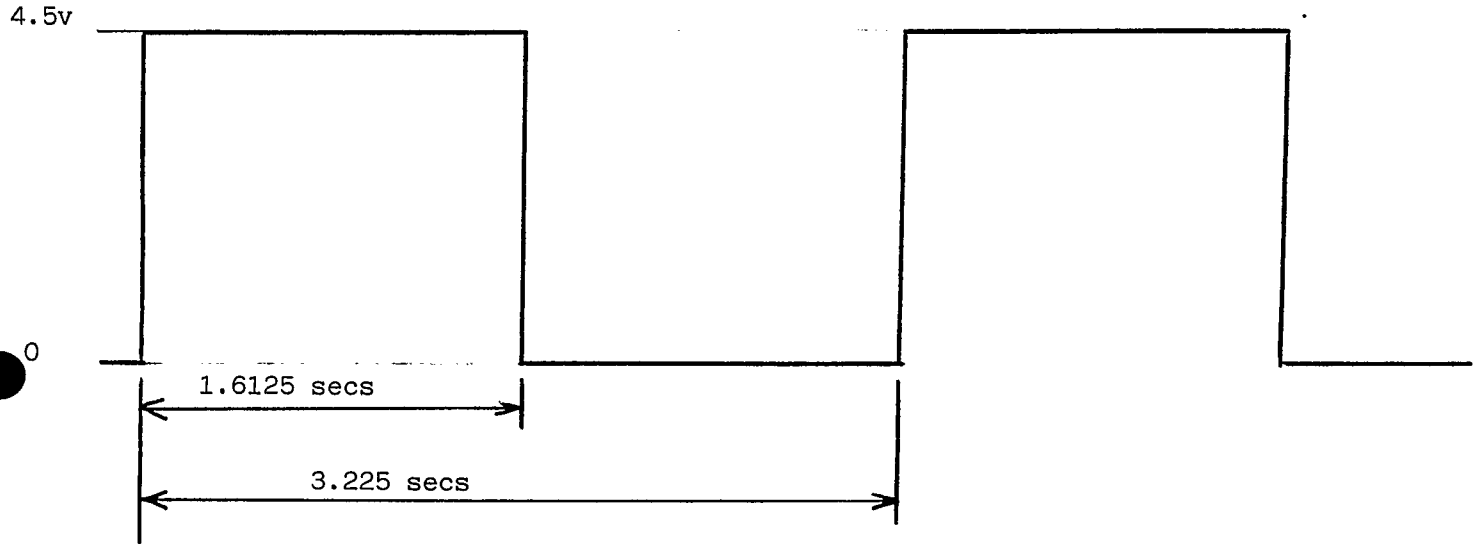


FIGURE 5

IC10 pin 11

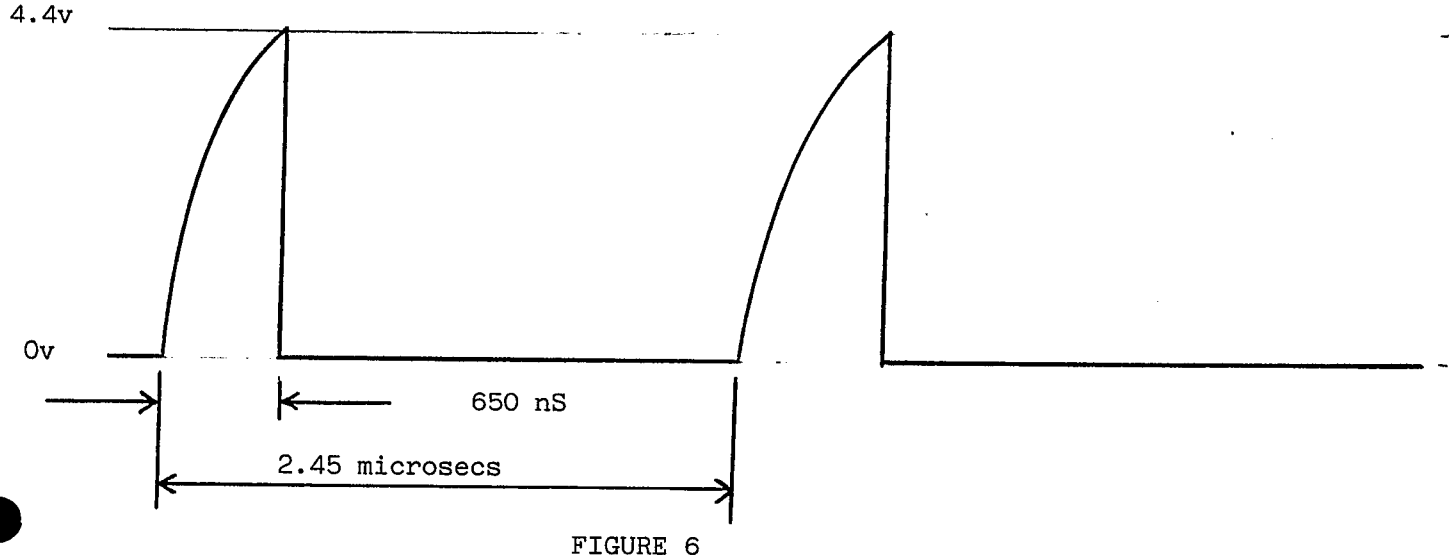


FIGURE 6

IC7 pin 7

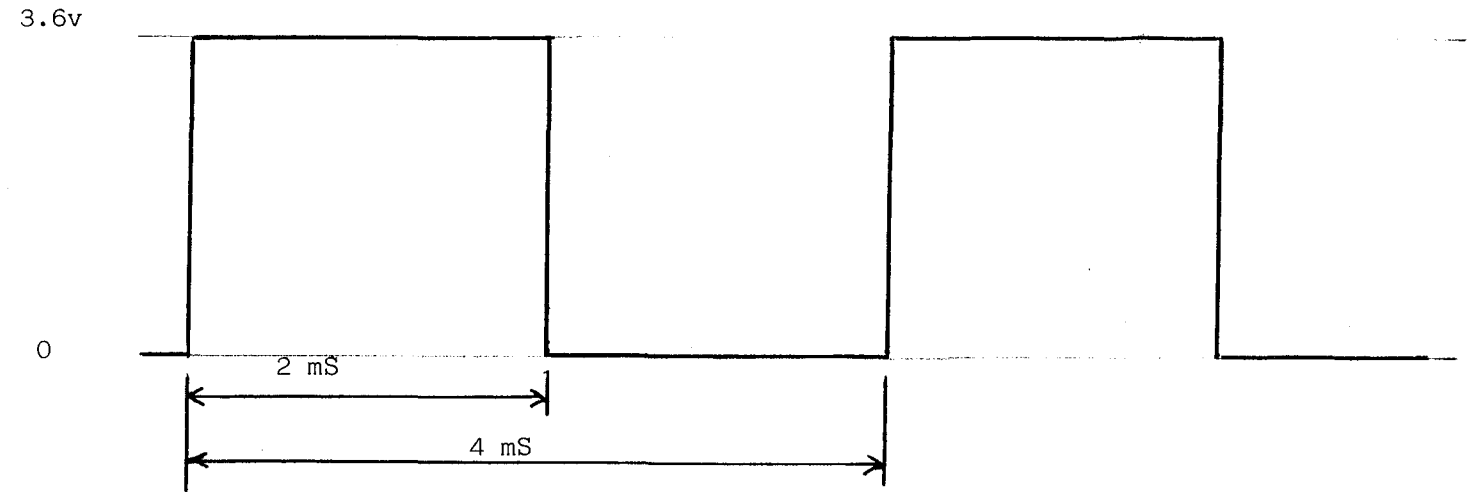


FIGURE 7

IC28 pin 23

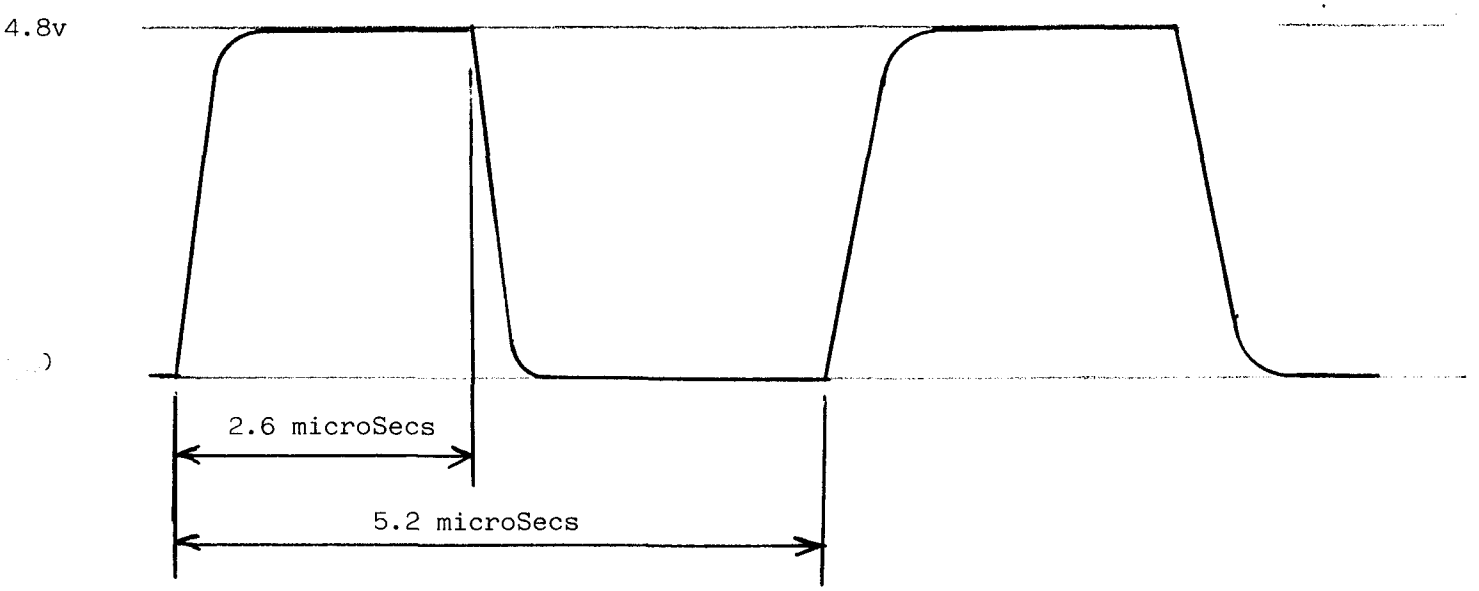


FIGURE 8

Notes All times and voltages shown are typical only
All integrated circuit pin references are with respect to Figure 5B - CPU Board in the service manual

FIGURE 9 FLUSH CYCLE

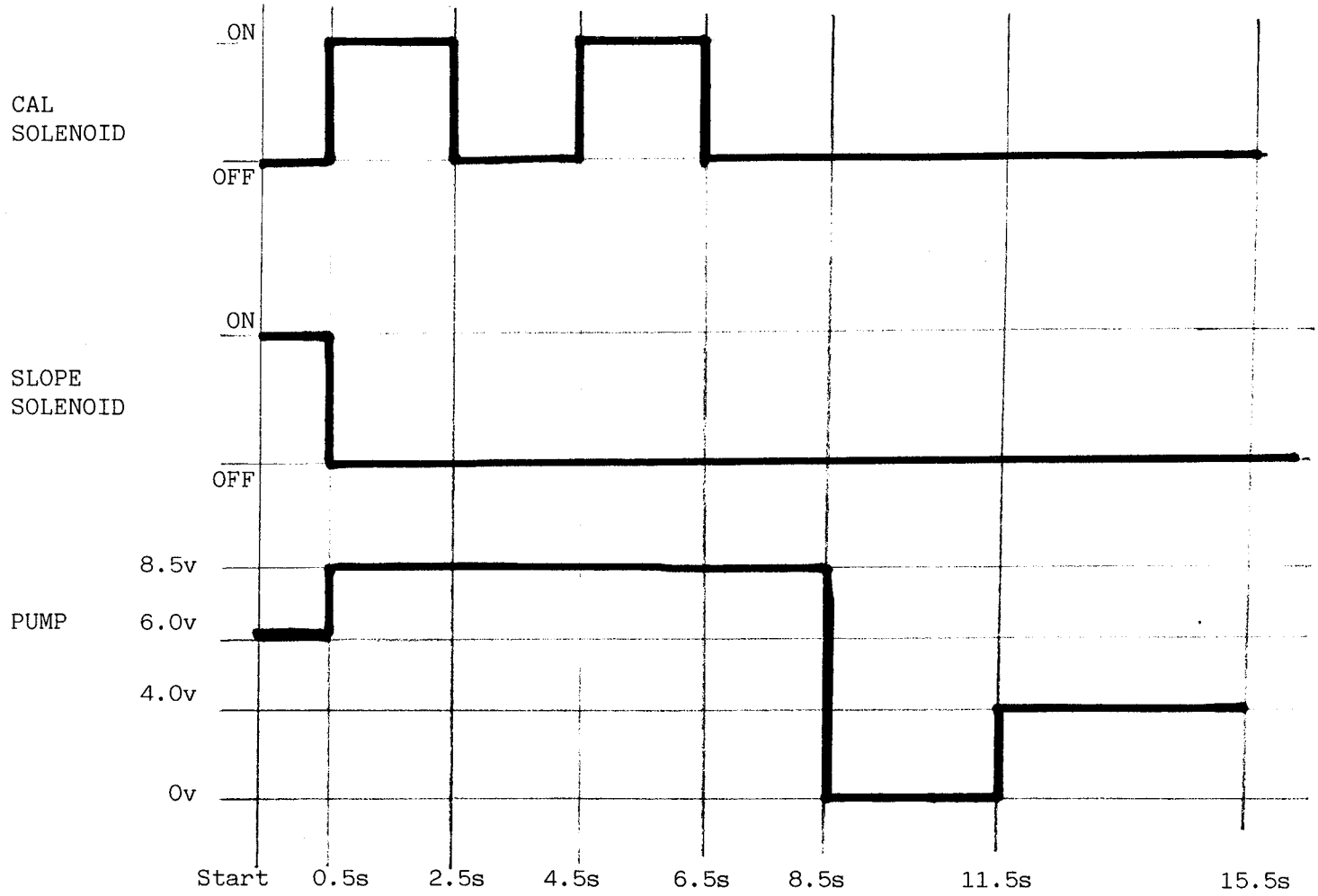


FIGURE 10 SAMPLE CYCLE

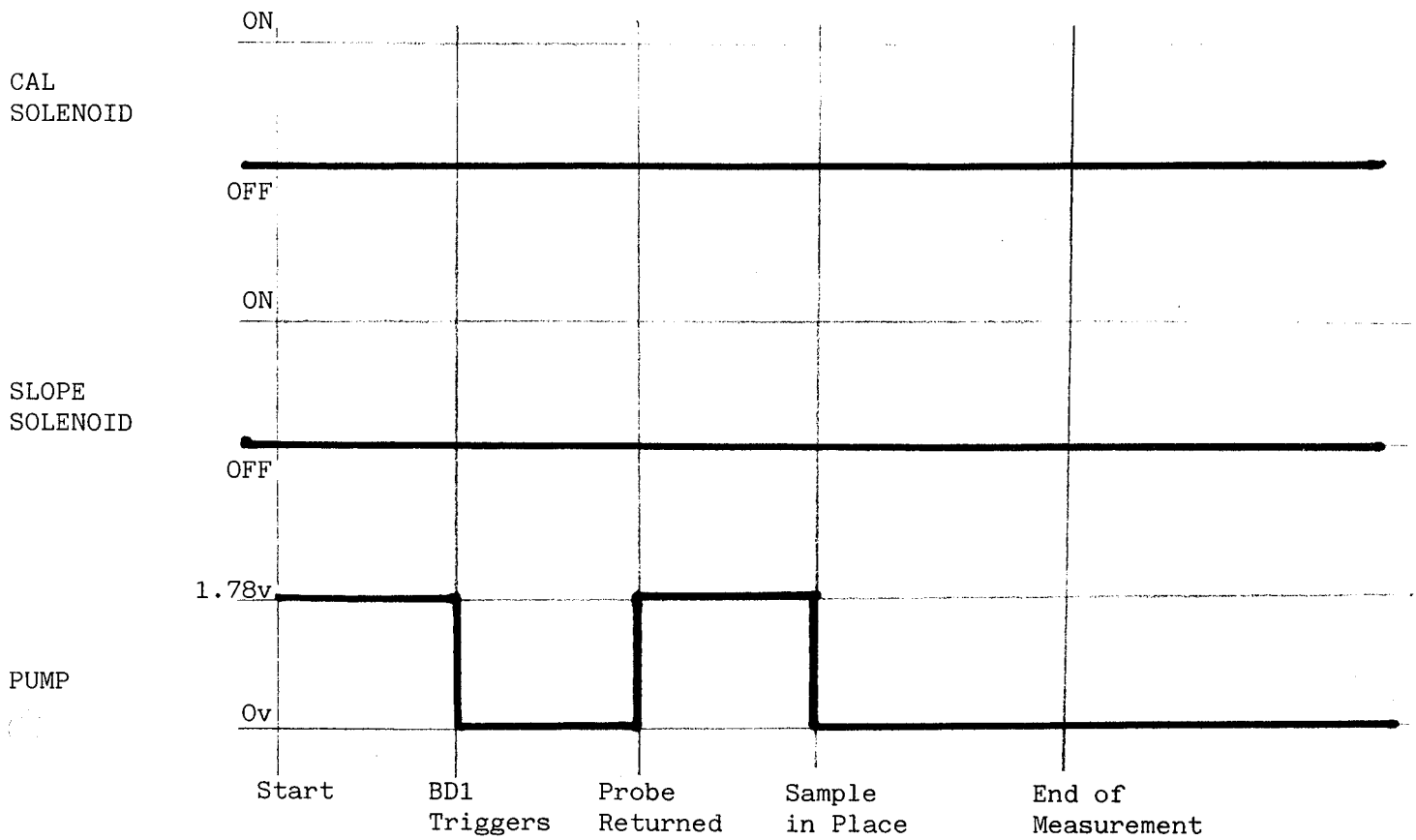


FIGURE 11

CALIBRATION SEQUENCE

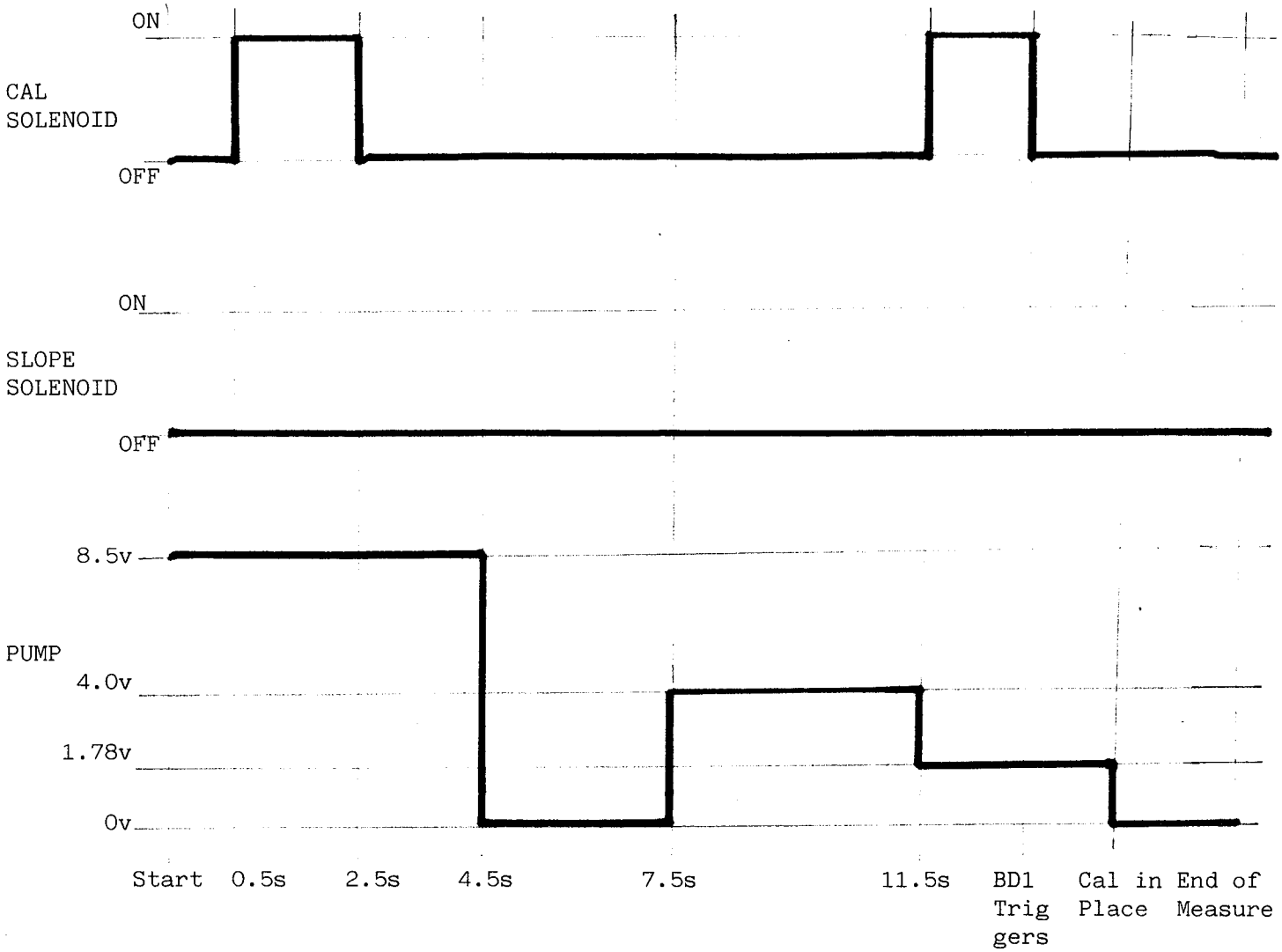


FIGURE 12

SLOPE SEQUENCE

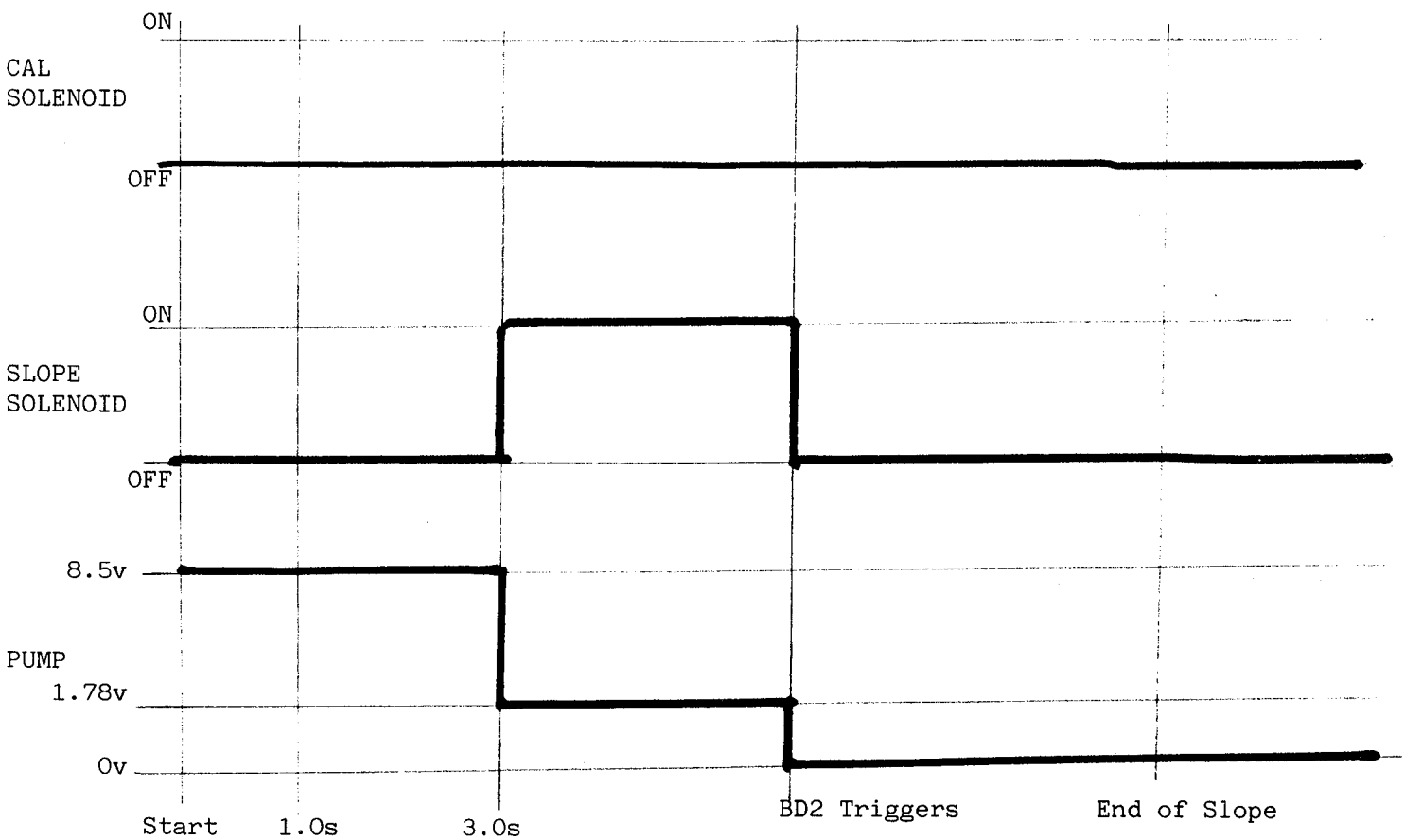


FIGURE 13 PRIME AND DRAIN SEQUENCE

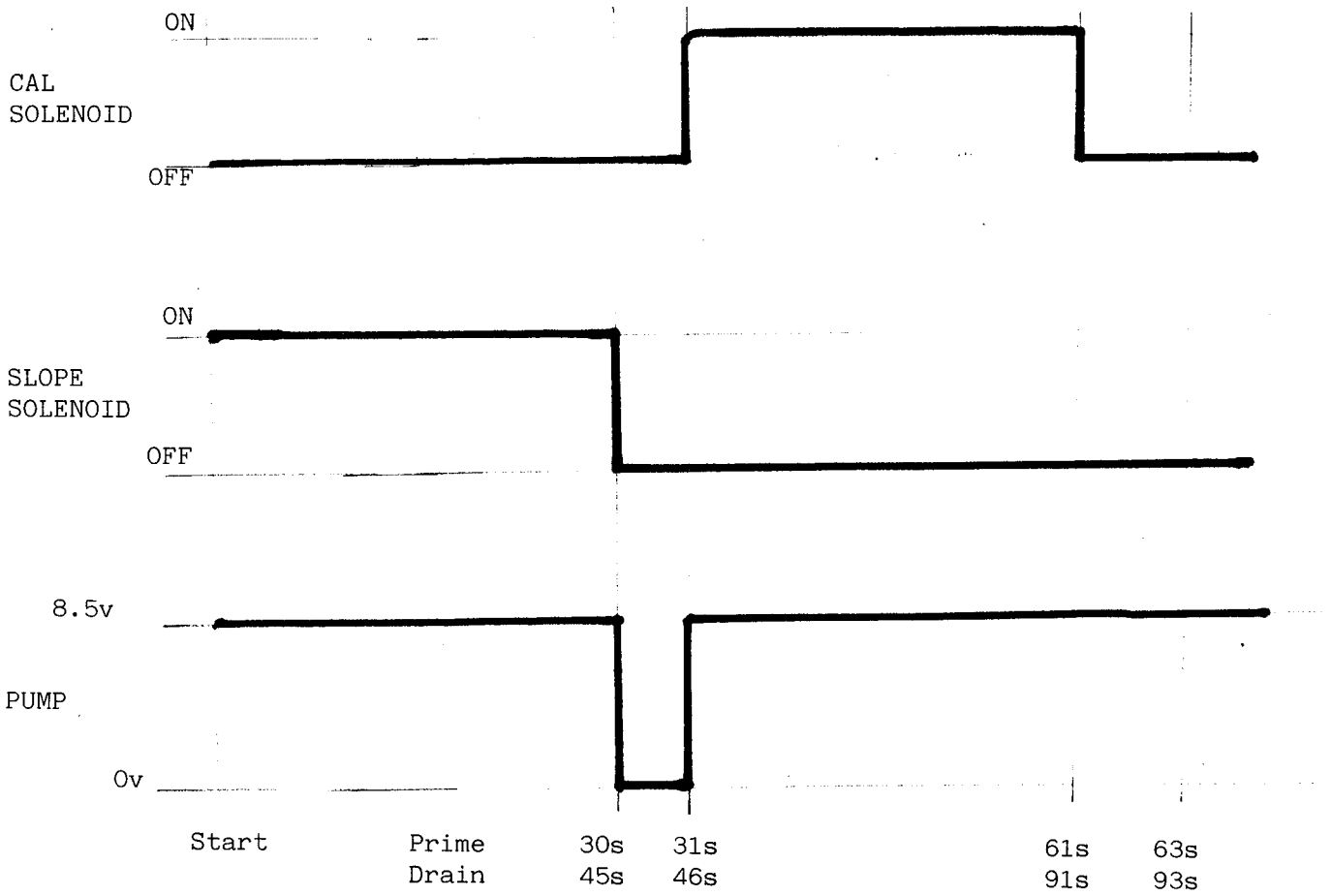


FIGURE 14 WET SEQUENCE

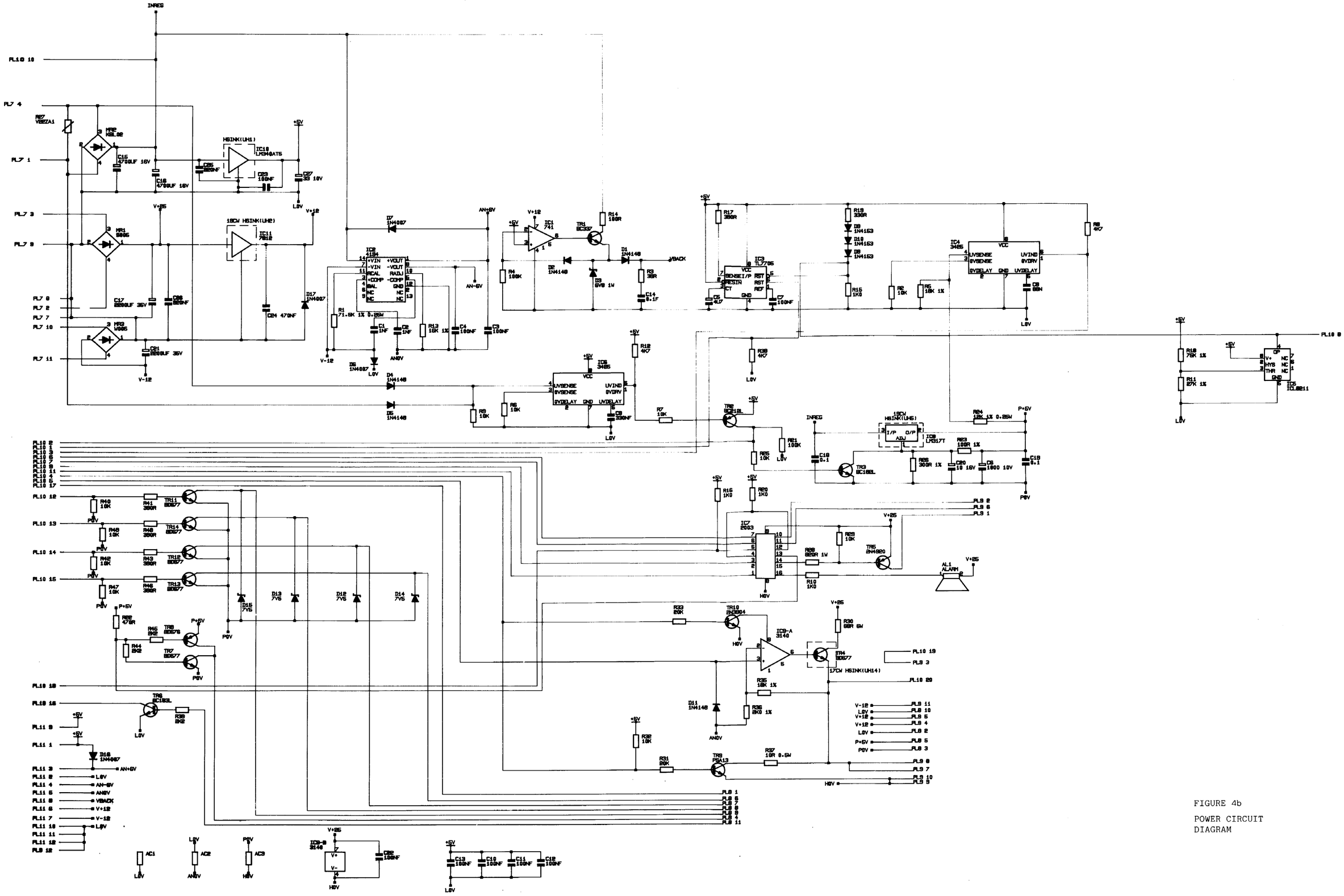


FIGURE 4b

POWER CIRCUIT DIAGRAM

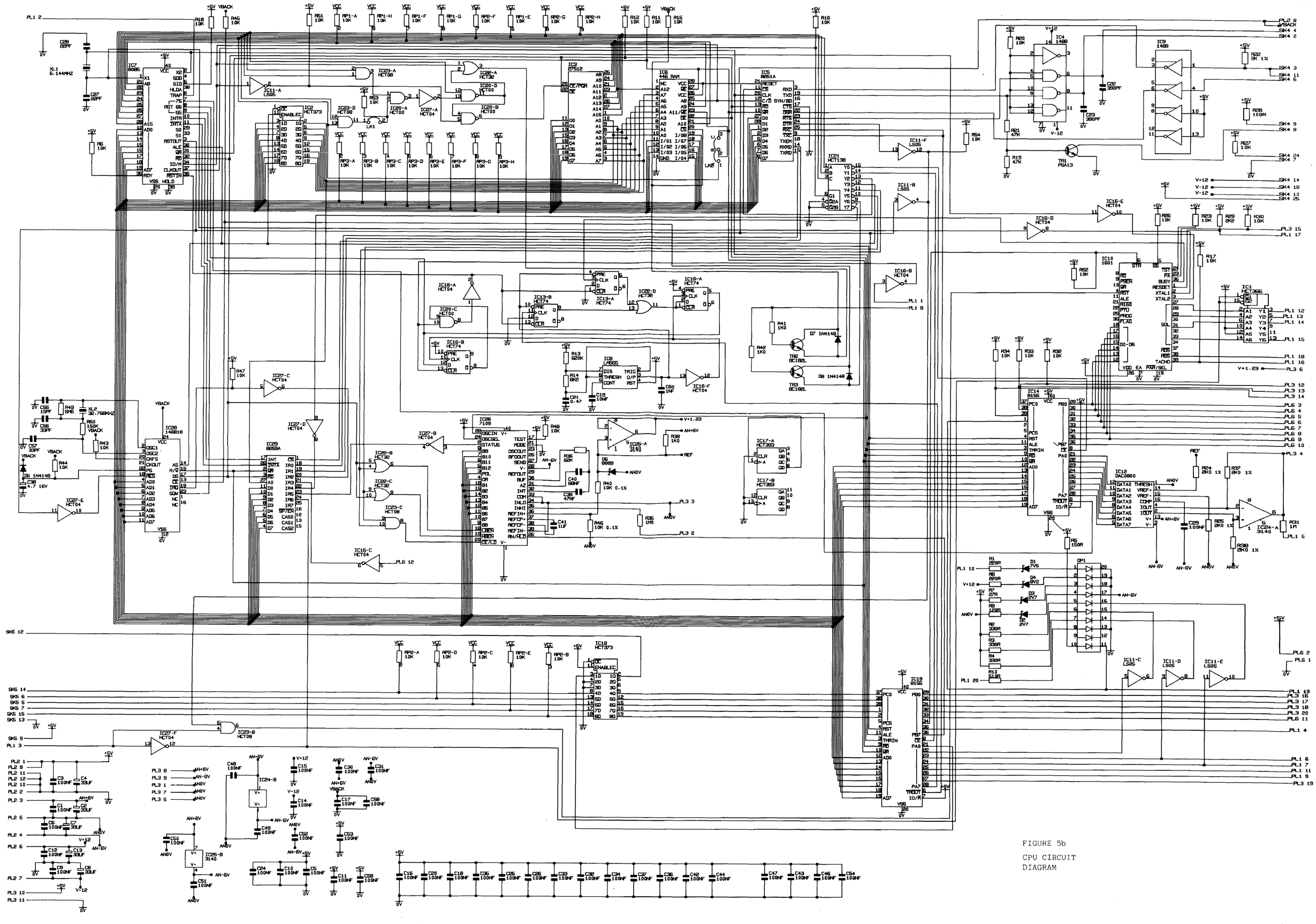


FIGURE 5b

CPU CIRCUIT
DIAGRAM

C1 100NF
C2 100NF
C24 100NF
C25 33 10V
C23 33 10V
C26 33 10V

X2 0V — AN0V

X1 Ph/Ns — IC3 AD645 — RG4 100K 0.25W — CB6 100PF 2.5% POLYST — R19 100K 1% — R4 100K 1% — R1 100K 1% — IC5-B 4053 — R5 100K 1% — IC1-A 3140 — R2 100K 1% — OVS — R3 4K75 1%

X3 REF — IC8 7611 — RG3 100K 0.25W — CB7 100PF 2.5% POLYST — R20 88K7 1% — PL14 5

R7 49K2 1% — C5 100NF — IC2-A 3140 — R6 6K49 1% — R9 6K49 1% — R8 3K3 — D3 1N4148 — D4 1N4148 — R10 10K — IC4-A 3140 — R11 3K — D5 1N4148 — D1 1N4148 — C9 100NF — IC5-C 4053 — R12 75K 1% — R13 49K2 1%

IC2 4051 — IN/OUT 6,15,1,2,4,12,13,14 — IN-H OUT/IN — A 11 — B 10 — C 9 — VSS 8 — Z 7 — VEE 8 — VDD 16 — AN-5V — AN+5V — 0V

+5V — R28 10K — R29 10K — R30 10K

PL13 10 — PL13 6 — PL13 1 — PL13 5 — PL13 7 — PL13 9 — PL13 8 — PL13 3 — PL14 2 — PL14 6 — PL13 11

V+1.23 — PL13 2 — PL13 16 — PL13 17 — PL13 18 — PL13 4

L1 — PL12 4 — PL13 12
L2 — PL12 5 — PL13 13
L3 — PL12 3 — PL13 15
L4 — PL12 2 — PL13 14
L5 — PL12 1 — 0V

R27 150R — PL14 8
R26 150R — PL14 3

R16 43K — R14 10K — R31 10K — PL13 20 — PL13 19

X4 Ca/K — IC10 AD645 — RG5 100K 0.25W — CB8 100PF 2.5% POLYST — R18 100K 1%

V+1.23 — R22 6K8 — IC7-A 3140 — PL14 1

V+1.23 — R21 6K8 — IC6-A 3140

PL14 7 — AN0V
PL14 4 — V+1.23
PL14 9 — AN0V
PL14 10

IC5-D 4053 — 0V — AN-5V

IC7-B 3140 — IC1-B 3140 — IC4-B 3140 — IC9-B 3140 — IC5-B 3140

C3 0.1 — C5 0.1 — C8 0.1 — C11 0.1 — C13 0.1 — C16 0.1 — C18 0.1 — C20 0.1 — C22 0.1 — C4 0.1 — C7 0.1 — C10 0.1 — C12 0.1 — C14 0.1 — C17 0.1 — C19 0.1 — C21 0.1

FIGURE 3b

AMPLIFIER
CISCUIT DIAG