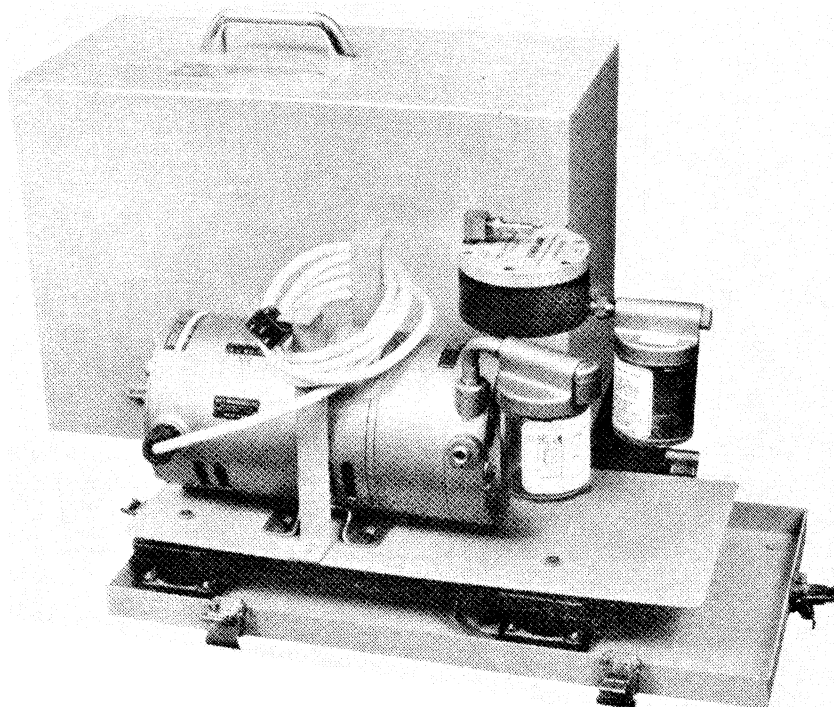
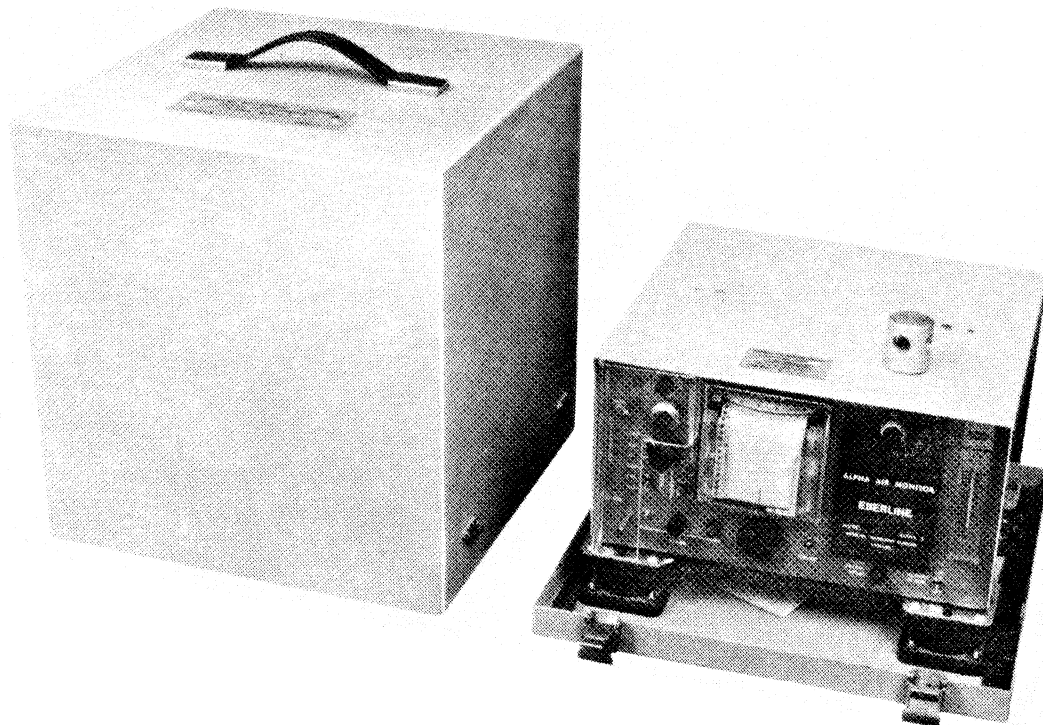


EBERLINE ALPHA 3 AIR SAMPLING MONITOR  
AND TYPE RAP1 PUMP



# MONITOR AIR SAMPLING (EBERLINE ALPHA 3)

## AND PUMP TYPE RAPI

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## WARNINGS

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

MAKE SURE YOU KNOW THE SAFETY PRECAUTIONS AND FIRST AID INSTRUCTIONS BEFORE YOU USE A HAZARDOUS SUBSTANCE

READ THE LABEL ON THE CONTAINER IN WHICH THE SUBSTANCE IS SUPPLIED

READ THE DATA SHEET APPLICABLE TO THE SUBSTANCE

OBEY THE LOCAL ORDERS AND INSTRUCTIONS

### WARNINGS

(1) RADIOACTIVITY. ALL RADIOACTIVE SUBSTANCES ARE HARMFUL IF HANDLED CARELESSLY. PERSONNEL MUST OBSERVE THE SAFETY PRECAUTIONS DETAILED IN JSP 392.

(2) LETHAL VOLTAGE. VOLTAGES IN EXCESS OF 30V RMS OR 50V DC CAN BE LETHAL AND ARE PRESENT IN THIS EQUIPMENT. REFER TO JSP 375 ISSUE 2 OR DEF STAN 61-15 ISSUE 3.

(3) TOXIN. CADMIUM IS CONTAINED IN THE RETAINING BRACKET OF THE DETECTOR, THE DETECTOR AMPLIFIER BOARD AND IN THE MOUNTING OF THE RELAY ON THE BRACKET. CADMIUM DOES NOT PRESENT A HAZARD IN NORMAL USE, BUT MAY DO SO IF:

(I) DUST IS RELEASED AS A RESULT OF DAMAGE, GRINDING, DRILLING OR FILING.

(II) FUMES ARE RELEASED AS A RESULT OF EXCESSIVE HEATING, WELDING, OR SIMILAR OPERATIONS.

SAFETY PRECAUTIONS TO BE OBSERVED WHEN HANDLING THIS MATERIAL ARE DETAILED IN AP 100B-10 ORDER 1804.

(4) EXPLOSIVE HAZARD. PUMP TYPE RAP 1 MUST NOT BE USED TO PUMP COMBUSTIBLE LIQUIDS.

## LEADING PARTICULARS

MONITOR AIR SAMPLING . . . . .	6Z/6665-99-659-5813 (Ref. No. 6Z/6595813)
CARRYING CASE . . . . .	6Z/6665-99-664-2457 (Ref. No. 6Z/6642457)
PUMP TYPE RAP 1 . . . . .	6Z/4320-99-659-5814 (Ref. No. 6Z/6595814)
CARRYING CASE . . . . .	6Z/6665-99-664-2458 (Ref. No. 6Z/6642458)

### DIMENSIONS

#### Monitor Air Sampling + Case

Height . . . . .	21 cm (8.25 in.)
Length . . . . .	31 cm (12.25 in.)
Depth . . . . .	31 cm (12.25 in.)
Weight . . . . .	6.6 kg (14.50 lbs)

#### Pump Type RAP 1 + Case

Height . . . . .	25.4 cm (10 in.)
Length . . . . .	44.5 cm (17.5 in.)
Depth . . . . .	17.8 cm (7 in.)
Weight . . . . .	13.6 kg (30 lbs)

### DETECTOR

Silicon - Diffused type (cleanable) with 490 mm<sup>2</sup> (0.75 inch<sup>2</sup>) area.

### FILTER

25 mm (1 inch) diameter. Whatman type GF/A.

### COUNTING EFFICIENCY

Approximately 50% of 2  $\pi$  (Pi) with wide window from plated 25 mm (1 inch) Pu<sup>239</sup> source in holder.

### BACKGROUND

The natural background level will vary with the location. Therefore, because of the unacceptable time taken to achieve steady state conditions when setting up the background level % 'SUBTRACTION' control the current policy is to pre-set the control for maximum subtraction.

### AMPLIFIER

Charge - sensitive input allowing very high sensitivity with excellent noise rejection. This is followed by a d.c. coupled amplifier with fed-back for stability and control. The overall sensitivity is adjustable by an internal gain control.

### THRESHOLD

Adjustable, by a calibrated ten turn control mounted on the front panel. Adjustable within the range of 0 to 1.0 volt (0.10 MeV energy equivalent).

### WINDOW

Adjustable, by a calibrated ten turn control mounted on the front panel. Adjustable within the range of 0 to 1.0 volt (0.10 MeV energy equivalent), always constant above the threshold. Another front panel control allows the window to be disabled and a gross count to be obtained.



### SUBTRACT WINDOW

An adjustable internal ten turn control located on the Pulse Height Analyser (PHA) Readout Circuit Board, always constant above the window. 100 millivolts equals 1 MeV.

### READOUT

Recorder 0 to 1.0 mA full scale linear readout. Ranges selected by front panel control of 0-50, 0-500 or 0-5000 CPM. (Counts per minute).

### ALARM

Alarm point adjustable from 0 to 100% full scale alarm setting point is read directly on the recorder by interrupting the CPM reading. A red alarm light and an audible alarm are provided on the front panel. A set of external alarm relay contacts (common, normally open, normally closed) are provided on the rear panel. However the contacts are not used.

### AIR INTAKE

Screen protected cap with four (4) ports approximately 1 inch open area.

### TEMPERATURE

Operational from -7°C (20°F) to 55°C (130°F). Total change in system gain is less than  $\pm 5\%$ .

### FAILURE ALARM

If no counts are obtainable in approximately 30 seconds or the power fails, the counting light extinguishes and the failure alarm relay changes state, the contacts are rated at 3 amps 30V d.c., but are not used.

### SUBTRACTION CIRCUIT

Maximum, greater than 60% of pulses in subtraction window. Minimum, approximately 10% of pulses in subtraction window.

### RESPONSE TIME

Set by two position switch on front panel, FAST or SLOW.

- |      |  |
|------|--|
| FAST | Approximately 30 seconds (used during repair and routine servicings).                        |
| SLOW | Approximately 180 seconds. Measured to 90% of final reading. (Used for monitoring purposes). |

## VACUUM SYSTEMS

### REGULATED PUMP SYSTEM

An external pump system such as the Eberline Model RAP 1 (NSN 4320-99-659-5814) is recommended.

## S.I. RADIOLOGICAL UNITS AND THEIR CONVERSION TO EXISTING UNITS

### INTERNATIONAL SYSTEM OF UNITS

1. The International System (SI) units are a set of units for use in all branches of science. The General Conference on Weights and Measures acting on the recommendation of the International Commission on Radiation Units and Measurements (ICRU) has adopted special unit names for SI units in connection with radioactivity.
  - 1.1 The SI unit of activity is the becquerel (symbol Bq) equal to one nuclear transformation per second  $3.7 \times 10^{10}$  becquerels equal 1 curie (Ci) exactly.
  - 1.2 The SI unit of absorbed dose is the gray (symbol Gy) equal to one joule/kilogram (J/kg). 1 gray equals 100 rads exactly.
  - 1.3 The SI unit of dose equivalent is the joule/kilogram (J/kg). It is proposed by the International Commission on Radiological Protection (ICRP) that this unit be named sievert (symbol Sv). 1 sievert equals 100 rems exactly.
  - 1.4 The SI unit of exposure is the coulomb/kilogram (C/kg). No special name has been adopted for this unit as its use is expected to decrease. 1 coulomb/kilogram is 3876 roentgens.

### PREFIXES FOR SI UNITS

2. There is a set of prefixes to be used with SI units. These include the following:

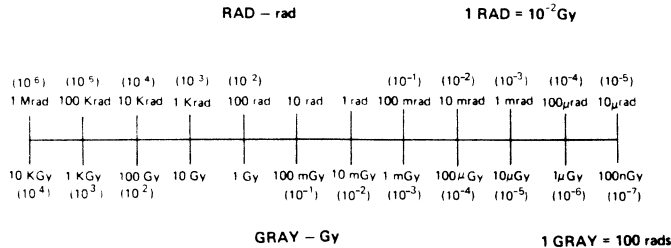
factor	prefix	symbol	factor	prefix	symbol
$10^{18}$	exa	E	$10^3$	milli	m
$10^{15}$	peta	P	$10^{-6}$	micro	$\mu$
$10^{12}$	tera	T	$10^{-9}$	nano	n
$10^9$	giga	G	$10^{-12}$	pico	p
$10^6$	mega	M	$10^{-15}$	femto	f
$10^3$	kilo	k	$10^{-18}$	atto	a

thus  $1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq} = 37 \text{ gigabecquerels (GBq)}$

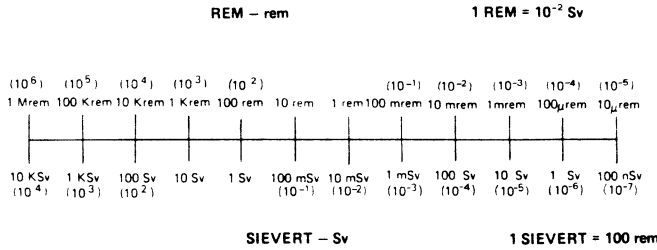
### RELATIONSHIPS BETWEEN SI UNITS AND NON SI UNITS

3.	physical quantity	SI units	non SI units	relationship
	activity	becquerel (Bq) 1 becquerel = 1/s	curie (Ci)	$1 \text{ Bq} = 2.70 \times 10^{-11} \text{ Ci}$ $= 27.0 \text{ pCi}$ $1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq}$ $= 37 \text{ GBq}$
	absorbed dose	gray (Gy) 1 Gy = 1 J/kg	rad (rad)	$1 \text{ Gy} = 100 \text{ rads}$ $1 \text{ rad} = 0.01 \text{ Gy}$ $= 10 \text{ mGy}$
	dose equivalent	sievert (Sv) 1 Sv = 1 J/kg	rem	$1 \text{ Sv} = 100 \text{ rems}$ $1 \text{ rem} = 0.01 \text{ Sv}$ $= 10 \text{ mSv}$
	exposure	coulomb/kilogram (C/kg)		$1 \text{ C/kg} = 3876 \text{ R}$ $= 3.876 \text{ kR}$ $1 \text{ R} = 2.58 \times 10^{-4} \text{ C/kg}$ $= 258 \mu\text{C/kg}$

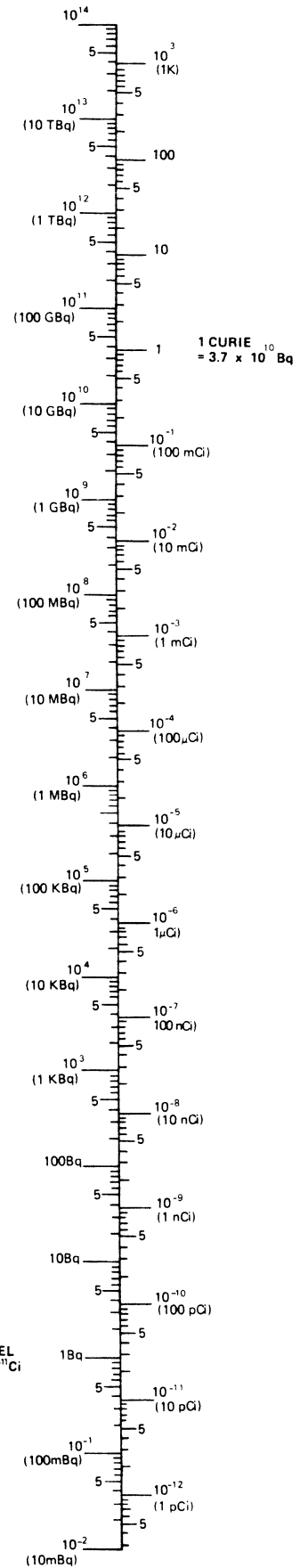
# RADIOLOGICAL UNIT CONVERSION CHART



## RAD-GRAY



## REM-SIEVERT



**1 CURIE** = 3.7 x 10<sup>10</sup> Bq

**1 BEQUEREL**  
= 2.7 x 10<sup>-11</sup> Ci

## BEQUEREL-CURIE

# MONITOR AIR SAMPLING (EBERLINE ALPHA 3)

## AND PUMP TYPE RAP1

### Chapter 1

#### DESCRIPTION

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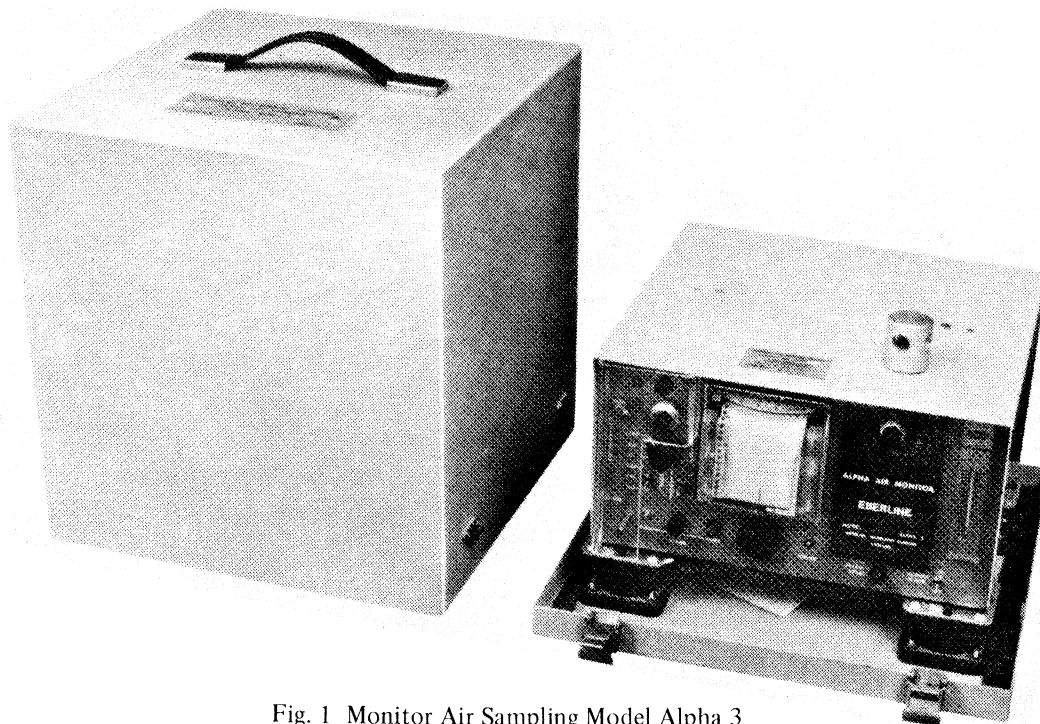


Fig. 1 Monitor Air Sampling Model Alpha 3

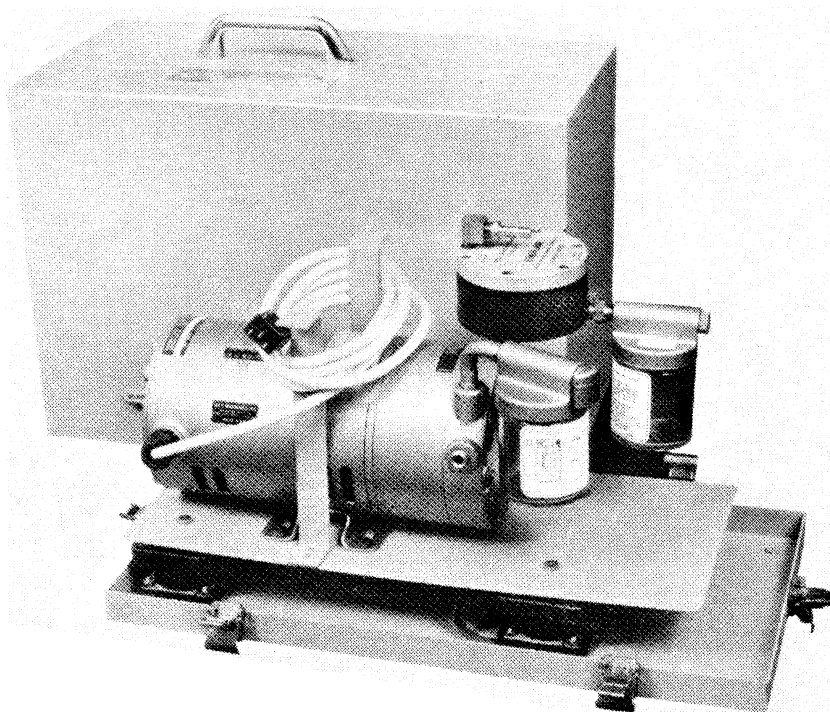


Fig. 2 Pump Type RAP 1

## INTRODUCTION

### Purpose

1. The monitor provides a solid state detector and a pulse height analyser for the detection of Alpha in air particles of a specific energy and the rejection of other energies. This greatly increases the sensitivity because of the rejection of Radon-Thoron daughters. For instance, 4 Maximum Permissible Concentrated (MPC) hours of  $\text{Pu}^{239}$  can be detected with an average Radon-Thoron background.

## CIRCUIT SUMMARY

Note . . .

Reference to figure 3 should be made when using the following summary.

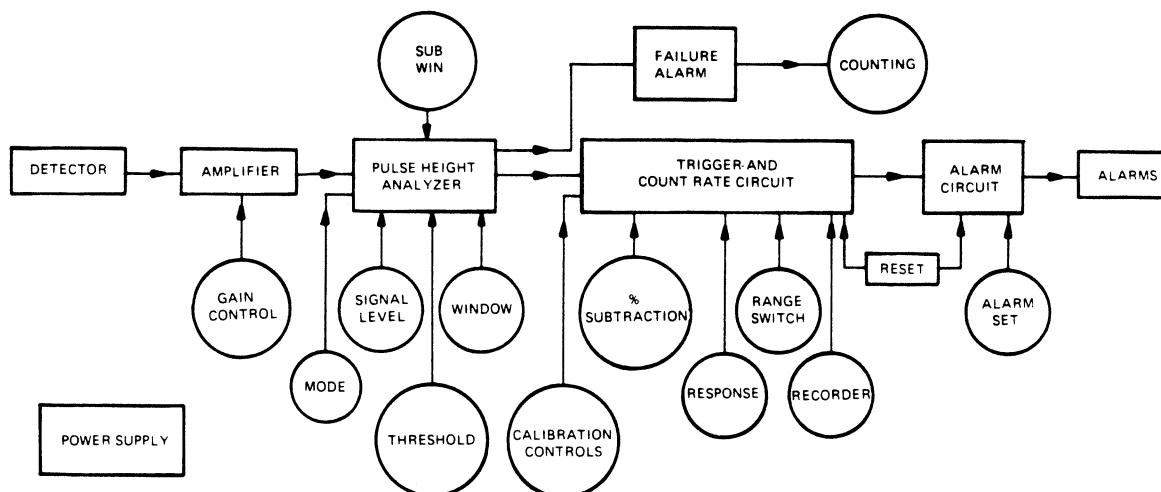


Fig. 3 System Block Diagram

### Detector

2. The monitor employs a solid state detector. The advantage of a solid state detector is that it has good resolution to Alpha particles whilst showing low sensitivity to Beta and Gamma radiations.

Note . . .

The resolution of the monitor is highly dependent on the type of filter paper used to collect the air sample. The RAF uses Whatman GF/A filter papers (see fig. 4).

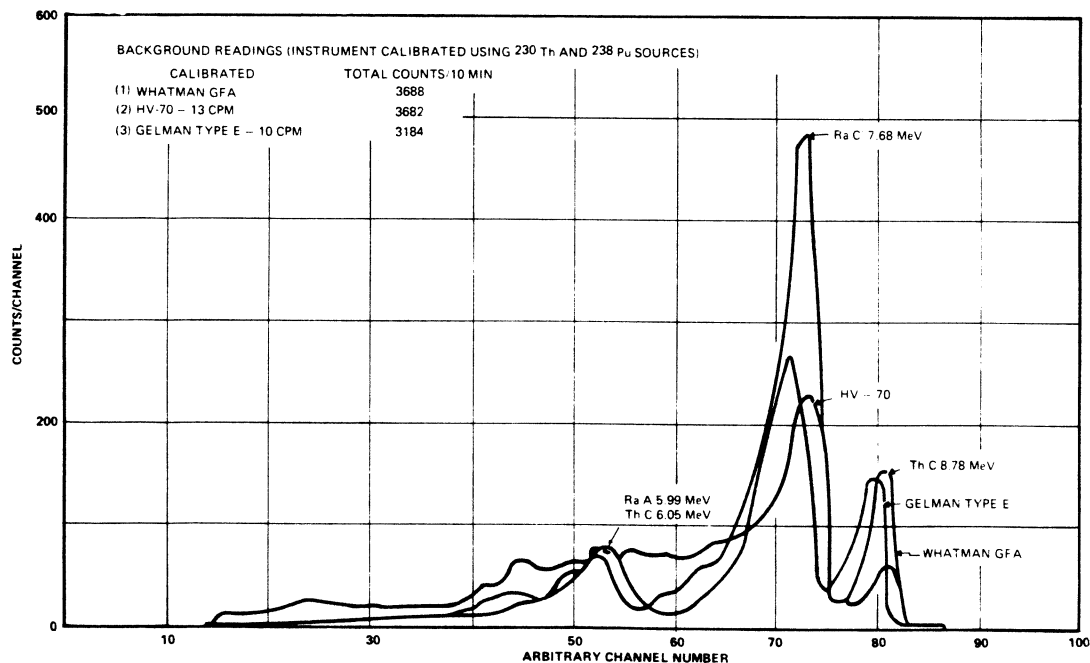


Fig. 4 Effect on Resolution of various filter papers

### Count rate

3. The count rate is read on the front panel recorder which has 3 (three) switch selectable ranges of '50', '500' and '5000' Counts Per Minute (CPM) full scale. The response time is controlled by a two position switch, providing a 'FAST' response for calibration, or a 'SLOW' response for minimum meter fluctuation during monitoring. The operating modes of 'GROSS' count, pulse height analyzing (PHA), or 'PHA' with background subtraction 'PHA-SUB' are selectable by a switch on the front panel.

### Background subtraction

4. The background subtraction circuitry employs a separate adjustable window so that the Radium A peak may be used to determine the amount of subtraction required. The use of a separate window for subtraction provides a stable reading during rapidly changing Radon concentrations.

### High level alarm

5. The high level alarm trip point is displayed on the recorder when a button is pushed and is adjustable over the recorder range by the front panel control. When actuated, alarms are indicated both visually and aurally on the front panel. An internal relay provides for a remote alarm indication, but this facility is not used in the RAF. The aural alarm may be switched off if not desired.

### Failure warning

6. A failure warning circuit will provide a visual indication in the absence of a signal at the detector. If a signal is not present the 'counting' light will be extinguished. An internal relay provides for an external alarm. An airflow alarm circuit is also provided to warn the operator that the airflow has decreased below approximately 25 LPM.

### Calibration and maintenance

7. The calibration controls are accessible through the front panel allowing calibration to be completed without disassembly. Calibration is to be performed in accordance with the appropriate chapter of the topic -5F of this publication. For routine maintenance the cover is easily removed exposing all the internal parts. Reference should be made to the Chapter 3 of the Topic -1 of this publication when carrying out routine maintenance and for guides to fault finding and component location.

### Filter head and Vacuum Assemblies

8. The standard filter head is 25mm (1 inch) diameter filter. The monitor is used with an external air pump model RAP 1 which is connected to the monitor by six feet of plastic tubing. An airflow indicator on the front of the monitor will indicate air flows from 10 to 100 litres per minute (LPM).

## THEORY OF OPERATION

Note . . .

Reference to figures 9, 10 & 11 should be made when using the following description.

### DETECTOR

9. When Alpha particles bombard the detector, they enter the depletion layer of a reverse biased diode junction. Whilst the particles are in the depletion layer, they give up energy by causing ion pairs to be created. One ion pair is created by each 3.23 MeV of energy given up by the Alpha particle.

10. Because of the high electric field in the depletion layer, as soon as the ion pairs are created they are swept out of the depletion layer and the total resultant charge is applied to the preamplifier input Q101 and Q102 via plug P101 and C106.

## AMPLIFIER CIRCUIT BOARD

### Preamplifier

11. Transistors Q101 and Q102 form a charge sensitive preamplifier whose output is proportional to the charge input from the detector. The feedback capacitor C101 determines the sensitivity of this circuit. A constant current source CR102 sets Q101 bias current and, due to its high impedance, provides a very high voltage gain from Q101. Transistor Q102 is an emitter follower which provides a low impedance output from the pre-amplifier to the main amplifier transistors Q103 through Q107, integrated circuit A101 and transistor Q108.

### Main amplifier

12. Transistors Q103 to Q107 form a D.C. coupled amplifier with feedback provided by R110 and R102 to control and stabilize the bias condition. This gain is controlled by a feedback loop from the emitter of Q107 through R109 to the emitter of Q103. The resistance of R108 (Gain Control) forms a voltage divider with R109 to determine the gain.

13. The output from Q107 is fed via C107 and R120 to the inverting input of A101. A101 is a single ended operational amplifier which has a gain of 10:1. The output of A101 is applied to Q108 an emitter follower via C108. The output of the emitter follower is applied via C109 and J101 to the Pulse Height Analysing Readout Board (PHA Board). This output consists of +ve pulses when test source 6Z/6642456 is used. The pulses are approximately 0.7 volt in amplitude and 4 $\mu$ s in duration.

14. Regulated power supplies for the preamplifier board are provided by CR101 which is a 15V voltage regulator supplying the operational amplifier (A101) and the emitter follower (Q108). A102 is a 5V regulator supplying the voltage for transistors Q101 to Q107.

15. S101 breaks the detector voltage circuit to prevent spurious alarms when the filter paper is changed.

## PULSE HEIGHT ANALYSER (PHA) CIRCUIT BOARD

Note: 1. Parts of this unit use logic circuits and are described using positive logic, ie, a high positive level is referred to as a logic 1 and a low or zero level is referred to as a logic 0.

Note: 2. Reference should be made to figure 5 for idealised pulse waveforms, and to fig. 6 for the complete schematic diagram.

16. The input signal from the amplifier board is fed via the SIGNAL LEVEL control (RI), which sets the amplitude of the input. The d.c. level is set by the THRESHOLD control (RII) and the controlled input is fed to 3 signal comparators. The comparators are contained in an i.c. A1, which is connected as a quad comparator. The function of each comparator is as follows:

Ala pins 4, 5, 2.	Threshold comparator.
Alb pins 6, 7, 1.	Main window comparator.
Alc pins 8, 9, 14.	Subtraction window comparator.
Ald pins 10, 11, 13.	Alarm comparator (see para. 27)

17. Each comparator is fed with the controlled input signal and a separate d.c. level. The levels and the threshold voltage are all derived from a potential divider chain R13, R9, R10, R11, R12 connected between the +5v and 0v lines. When the signal at the comparator input rises above the control d.c. level, the comparator output falls from logic 1 to logic 0.

### THRESHOLD COMPARATOR AND GROSS MODE

18. Comparator Ala will produce a negative pulse output when pulses from the signal level control exceed the difference between the control bias on pin 4 and the reference bias held at 2v on pin 5. The control bias is adjustable between +1v and +2v by the THRESHOLD control RII.

Note: The ratio of turns to voltage output of RII is 0.1v per turn. The THRESHOLD control dial is offset by 0.7 of a turn to compensate for alpha energy lost in the airspace between the filter and the detector face. See fig. 5.



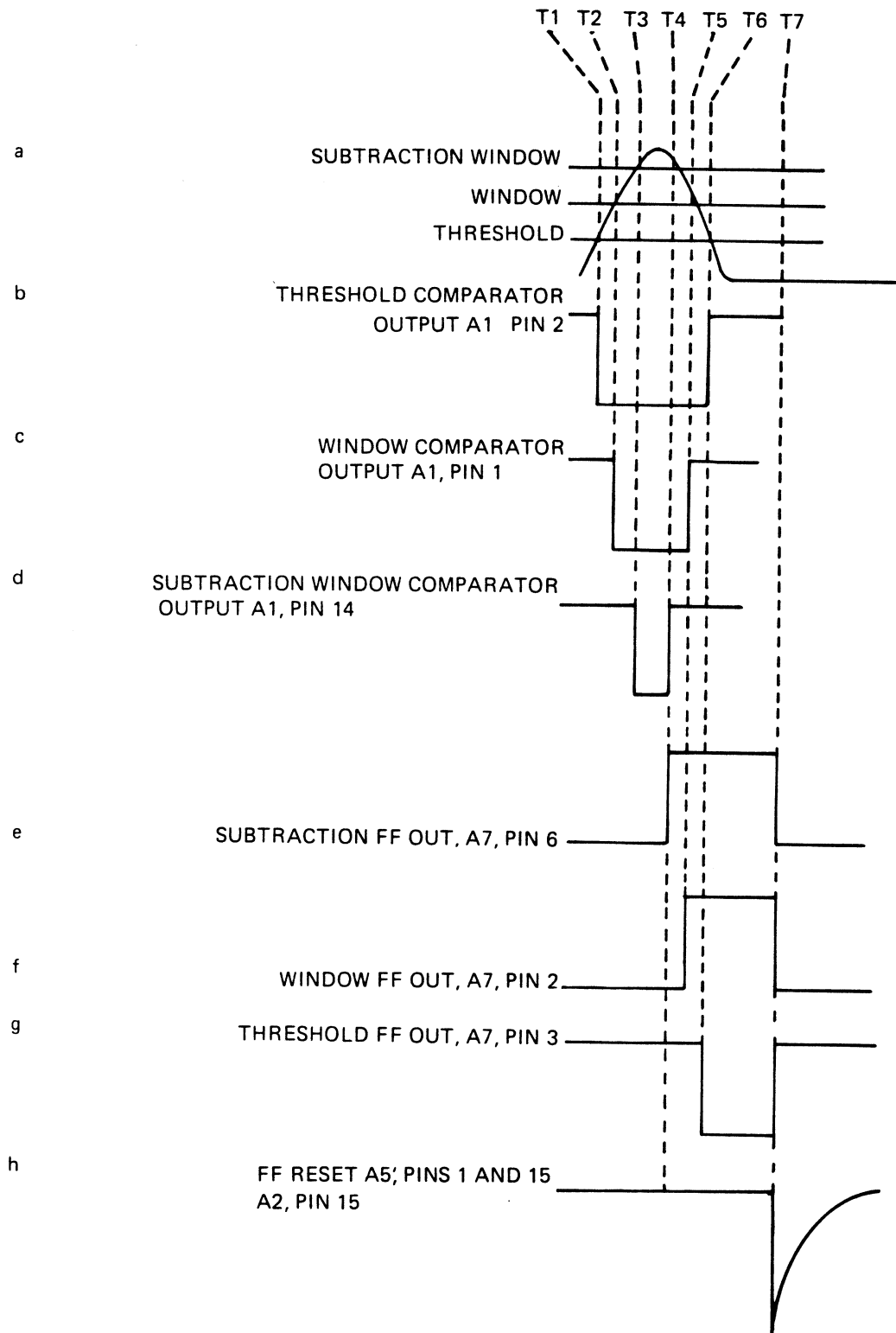


Fig. 5 Pulse Timing in Discriminator circuit

For example, if the threshold control is set to 5.7 the control bias will be 1.5v, the difference between pin 5 and pin 4 is  $2v - 1.5v = 0.5v$ , therefore only input pulses which exceed 0.5v will produce an output pulse at pin 2.

19. The pulse from A1a is fed to the clock input of A5b. Both J and K inputs are connected to a logic 1, ie, A5b is connected as a toggle. The positive going lagging edge at the clock input will cause the Q and  $\bar{Q}$  outputs to reverse. The (now) negative output from A5b pin 9 is fed to the NOR gate A7a pin 3. With the MODE SELECTOR switch in the GROSS position, A5a is inhibited (J and K at logic 0) and the permanent logic 0 at A7a pin 2 enables A7a. The pulse on A7a pin 3 is passed through A7a and is seen as a positive pulse at A7a pin 1.

### RESET CIRCUIT

20. Following an input that clocks A5b, a positive edge is fed from A5b pin 10. After a time determined by R18 and C5, A7c operates, its output falling from logic 1 to logic 0. This edge is fed back to the reset input of A5b (and to the reset inputs of A5a and A2b see para. 26) This resets A5b, completing the pulse being fed from A5b through A7a to the counting circuits.

### PHA MODE

21. When PHA mode is selected the circuits of the window control R10, window comparator A1b and A5a must be considered. Moving the MODE SWITCH S1 from the Gross position removes the logic 0 on A5a pins 2 and 3 and the stage will toggle if clocked.

22. The inputs to A1b consist of the controlled signal input at A1b pin 6 and a reference d.c. input from the window control R10 on A1b pin 7. Two conditions are possible:

- a. Input signal insufficient to operate window comparator A1b. Under these conditions A5a will not be clocked, A7a pin 2 remains at logic 0 and pulses from A5b pin 9 are passed through A7a to the counting circuit.
- b. Input signal overcomes the control d.c. from the window control and A1b operates. The lagging positive edge of the pulse from A1b pin 1 clocks A5a. A5 pin 6 goes to a logic 1 inhibiting A7a and there is no input to the counting circuit. A5a is reset by a temporary logic 0 on A5a pin 1 from A7c.

23. It will be noted from fig. 5a that the board input pulse is approximately triangular in shape, and the positive going lagging edges of the comparator output pulses (fig. 5b, c and d) are used to clock the J.Ks. This ensures that A7a pin 2 goes to a logic 1, inhibiting the gate A7a before A7a pin 3 goes to logic 0 due to the pulse from A5b. Therefore, when using PHA mode, only pulses that cause A1a to operate but do not cause A1b to operate are fed to the counting circuit. With respect to the front panel controls, only pulses that are between the THRESHOLD control setting and the WINDOW control setting will be counted.

### THE COUNTING CIRCUIT

24. Positive pulses from A7a are passed to A3a pin 1. A3a and b and associated circuitry form a monostable multivibrator, the output being positive pulses. These cause Q9 and Q10 to conduct and the integrating capacitors C10 and C11 to charge. The value of the charge current is determined by Q10 circuit and the time for which the current will flow is set by the recovery time of the multivibrator. With the XI range selected (ie. 0-50 cpm indicated) the recovery time is relatively long. With the x 100 range chosen (0-5000 cpm indicated) the recovery time is short and more pulses are required to obtain F.S.D. Resistors R21, 22 and 23 are used to calibrate the input of the indicator.

25. The integrator response time is controlled by C10 and R28 when the RESPONSE switch is in the 'FAST' position, and by C10 and 11 with R2 when 'SLOW' response is selected. The voltage developed across the capacitors is fed via voltage follower A4 to the pen recorder and radiation alarm circuits.

## SUBTRACTION WINDOW COMPARATOR AND SUBTRACTION CIRCUIT

26. Alc, A2b and A7b operate in a similar manner to the window circuits Alb, A5a and A7a. Only pulses above the WINDOW reference d.c. level but below the SUBTRACTION WINDOW level from R13 are felt at the output of A7b pin 4. These pulses are fed to A3c, A3d and associated circuitry which form a monostable multivibrator. The output pulse is one of 3 predetermined values, as selected by the range switch, it is negative going and is fed via Q17 to Q18. The gain of Q18 stage is controlled by R46, the PERCENTAGE SUBTRACTION control, which varies the actual amount of subtraction from 10% to 60% of the counts occurring in the subtraction window. When the MODE switch SI is put to PHA SUB, the monitor operates as for PHA, except that the output of Q18 is felt on the integrating capacitors C10 and C11. Since this pulse is negative, ie. the opposite polarity to the output of Q10, the charge on C10 and C11 is reduced, which minimises the unwanted effect of radon and thoron daughters in the area of interest.

## THE RADIATION ALARM CIRCUIT

27. a. **Setting.** A d.c. level from the SET ALARM control R32 is fed through emitter follower Q11. When the PUSH TO SET ALARM button S4 is depressed the set alarm reading is indicated on the recorder. R32 may be adjusted to set the alarm at any point between 0 and FSD.
- b. **Operation.** The output of Q11 is permanently connected to Ald pin 11 as a reference input. Ald pin 10 is fed with the integrated d.c. level from A4 pin 6. When this level exceeds the reference, Ald pin 13 falls from logic 1 to logic 0, triggering discrete bistable Q12/13. Q12 switches on, the radiation alarm light DSI illuminates and the alarm squaler DS2 sounds. The squaler may be silenced by operating the AUDIBLE ALARM ON/OFF switch. Relay K201 is also energised although the contacts are not used.
- c. **Resetting.** The alarm is reset by operating the RESET button, S5, for a few seconds. Q16 is switched off and Q14 and Q15 are turned hard on. The current through Q15 discharges C10 and C11, returning the recorder reading to zero and restoring the output of Ald to a logic 1. The fall in voltage at Q14 collector is felt at Q13 base, resetting the bistable Q12/13 and deactivating the alarm light DSI, the squaler DS2 and relay K201.

## FAILURE ALARM

28. The failure alarm consists of: A8a and b, Q2, Q26 and associated circuitry. The input to the failure alarm circuit is taken from the output of the threshold JK A5b pin 9, so that all pulses above the threshold level are applied to the failure circuit. A8a is connected as a monostable multivibrator, its pulse width being set by R6 and C4. The output of the multivibrator is used to discharge capacitor C3 by turning on transistor Q2. As long as C3 is kept discharged the output of A8b pin 9 is high and Q26 is ON. When Q26 is on, the counting light DS3 is illuminated and the failure relay K1 is energised.

29. If no pulses are received from A5b, C3 is allowed to charge. When the voltage on C3 exceeds  $\frac{2}{3}$  of  $V_{cc}$  the output of A8b pin 9 goes low and Q26 is turned off. This causes the counting light DS3 to extinguish and the failure relay K1 to de-energise. The contacts of relay K1 are not used. It takes approximately 30 secs from the time of the last pulse from A5b to activate the alarm. As normally there are a few hundred counts per minute of radon activity occurring the counting light should always be on, and relay K1 energised, if the activity is being counted. If d.c. power fails DS3 will extinguish and indicate a failure condition, K1 will also de-energise.

## NO FLOW ALARM

30. The monitor operates at an air flow of 30 litres per minute (LPM) through the detector. This is set on pump RAP 1 and is checked using the flow meter on the front panel of the monitor. With the equipment switched on and the air flow set, the FLOW ALARM RESET button is depressed. This energises relay FAR 1. Contacts of the relay hold the relay energised and keep the flow alarm light off. Should the airflow fall to  $25 \text{ LPM} \pm 3 \text{ LPM}$  the flow switch opens, relay FAR 1 de-energises and the flow alarm light is illuminated.

## POWER SUPPLY CIRCUIT BOARD

31. Power to the PHA (Pulse Height Analyser) Board is regulated by A6 and CR6. A6 is a +ve 5 volts regulator and supplies the PHA circuit. Zener diode CR6 supplies the -ve 5.3 volts for the circuit. CR3 provide +ve 3.6 volts nominal, for A3 and Q18.

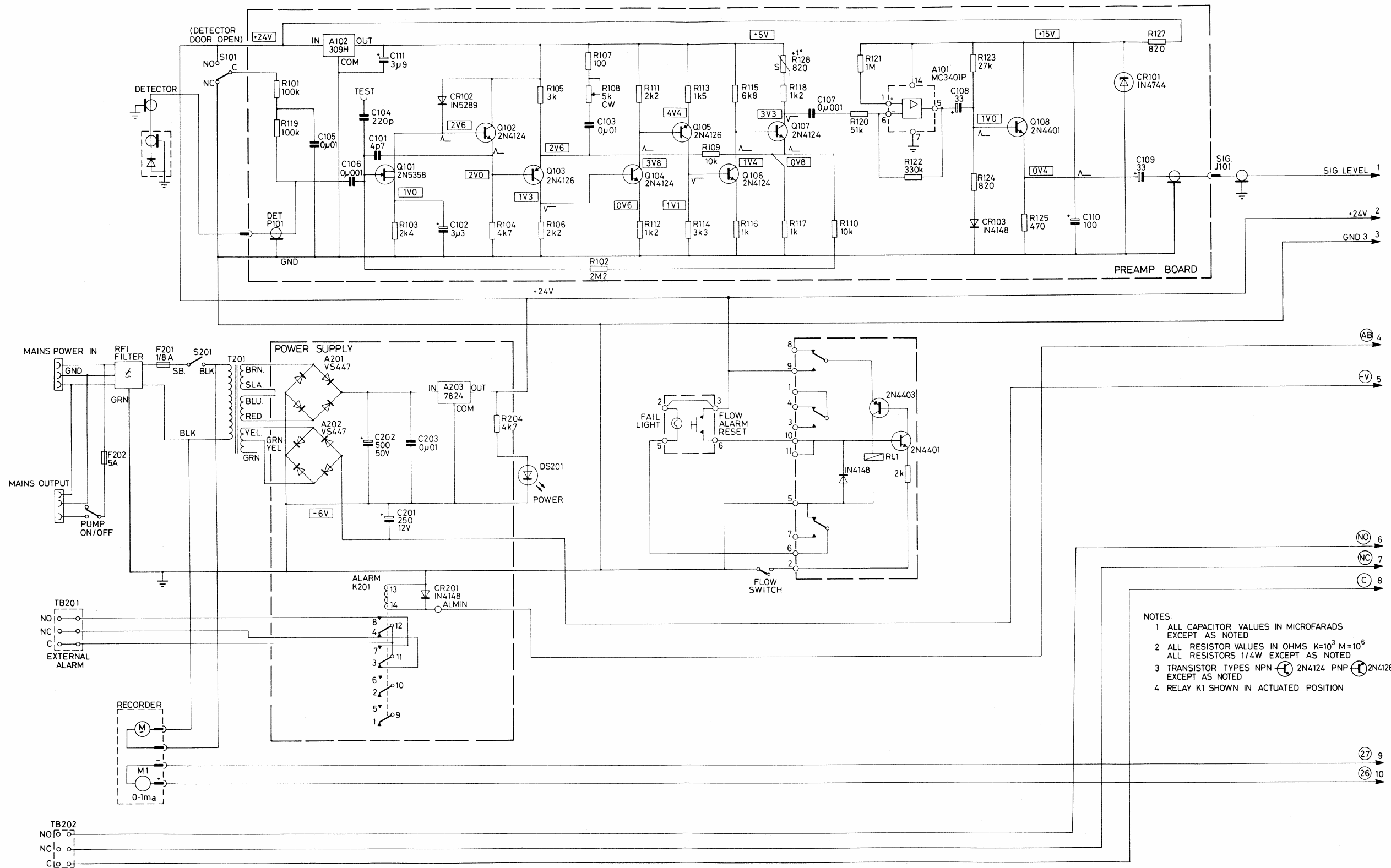
## Power supplies

32. The power supplies consist of transformer T201, bridge rectifiers, A201, A202 and integrated circuit A203. Two of T201's 12 volt windings are connected in series and they, along with A201, A203 and C202 form the +ve 24 volt Power Supply. A201 is a full wave rectifier, C202 is used as a DC filter and A203 is a 24 volt voltage regulator. R204 and DS201 are used as an indicator circuit and DS201 is illuminated when the DC voltage is on.
33. T201 centre-tapped winding, together with A202 and C201 form the -ve 6 volt supply. A202 is a full wave rectifier and C201 is the DC filter.

## GENERAL

### PUMP TYPE RAP1

34. The pump type RAP 1 consists of an oil-less vacuum pump with regulator for use with the air monitor where a constant air flow is required. The regulator holds a constant pressure drop across an in-line orifice by varying a bypass valve into the pump. This system allows the pump to work at a minimum drop head at all times so that it runs cooler, this extends the lifetime of the pump.
35. The relatively small size and light weight make the unit easily portable and the oil-less pump requires no lubrication. The vanes are carbon-graphite, self-sealing and adjusting to maintain a like-new efficiency.
36. It should be noted that when pressure varies, the flow rate through an orifice, with a constant pressure drop, varies approximately as the square root of the ratio of the absolute pressure. Thus, if paper loading causes a pressure drop to one half the original, the flow referred to atmosphere will decrease to 0.7 of the original. The orifice is adjustable, allowing flow rate adjustment from near zero up to the maximum capacity of the pump which is approximately 100 LPM.



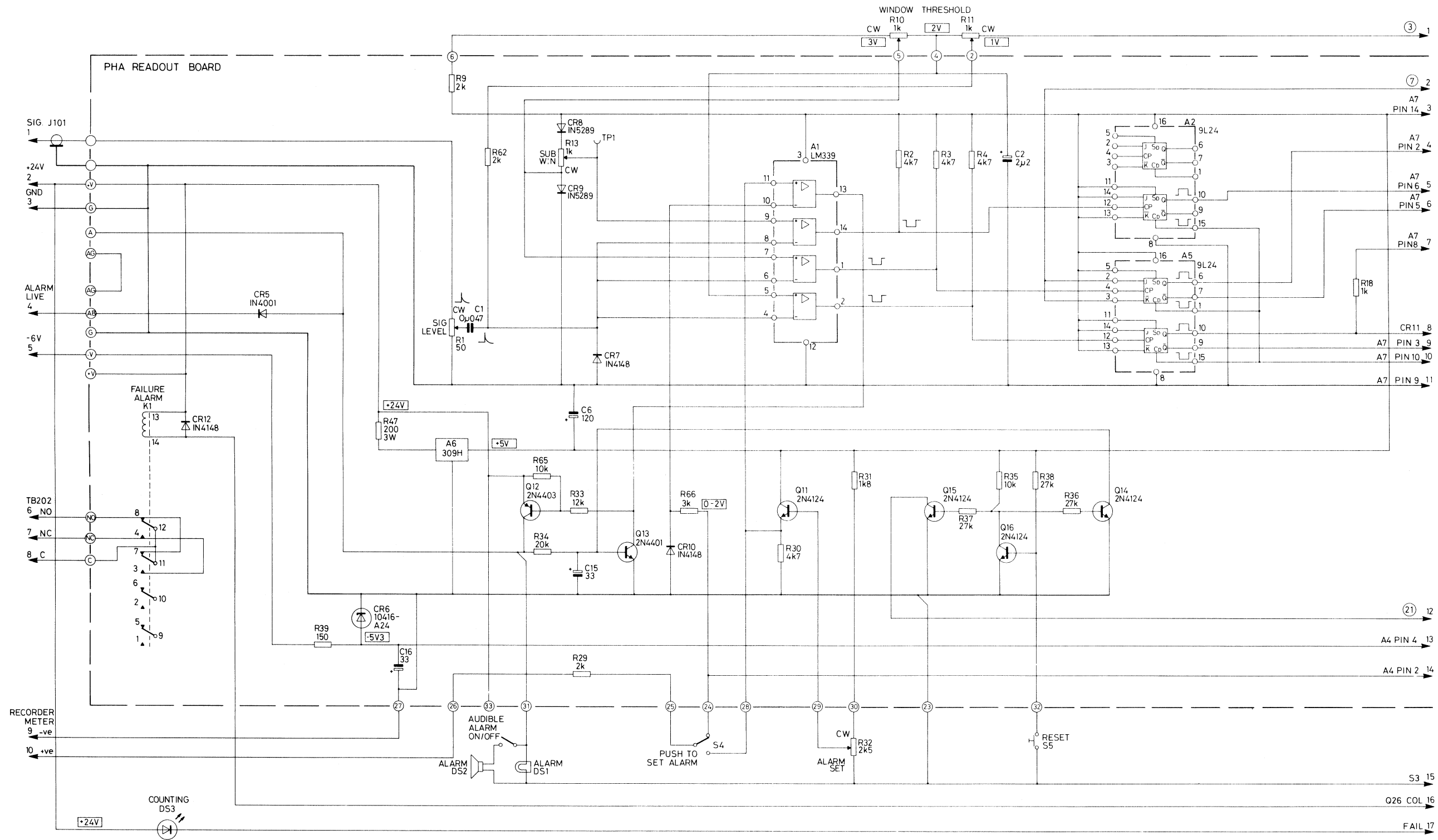
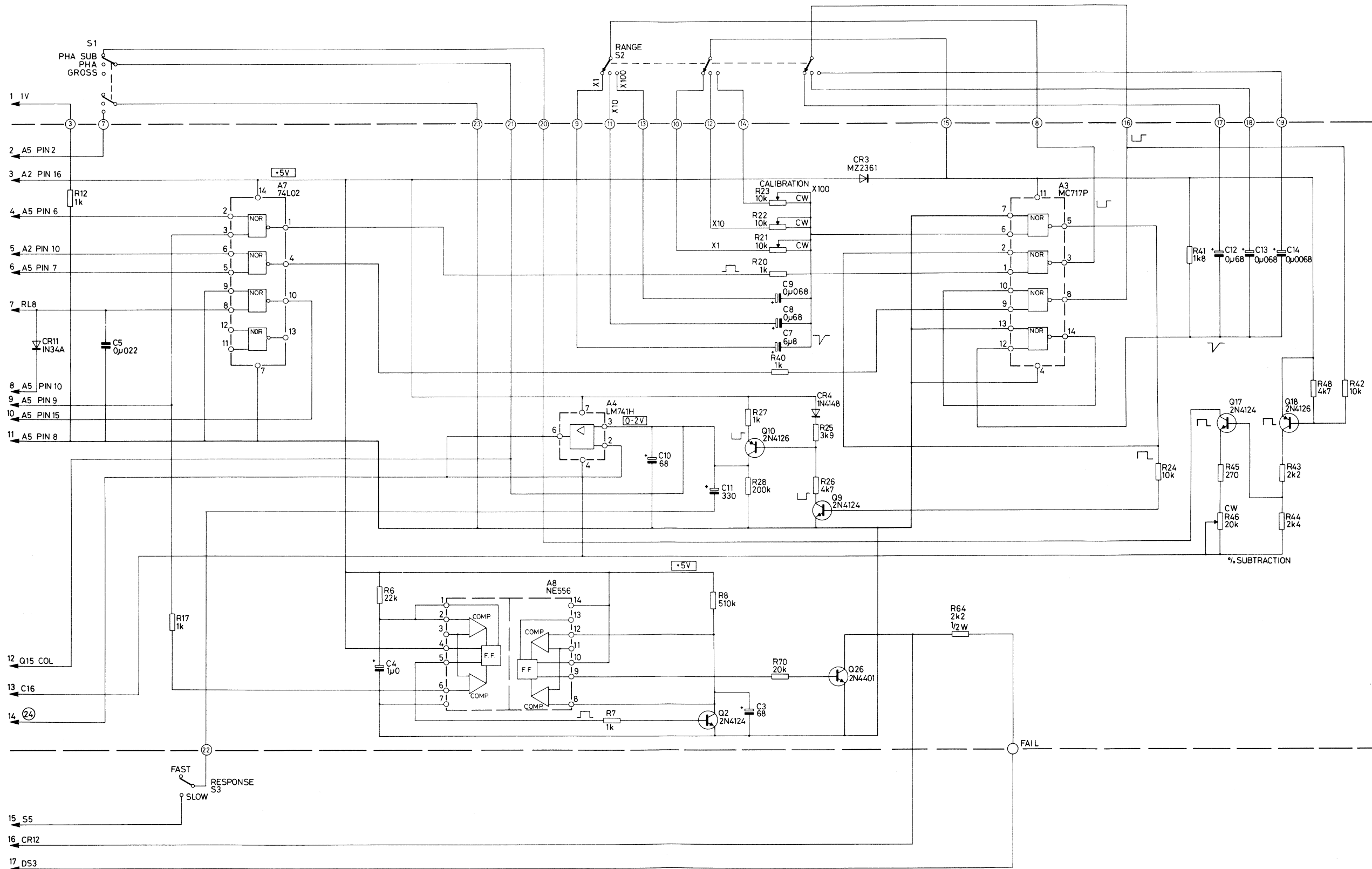


Fig. 6  
 Chap. 1  
 Page 12

Monitor Air Sampling Alpha 3 Circuit Diagram (Part B)



Monitor Air Sampling Alpha 3 Circuit Diagram (Part C)

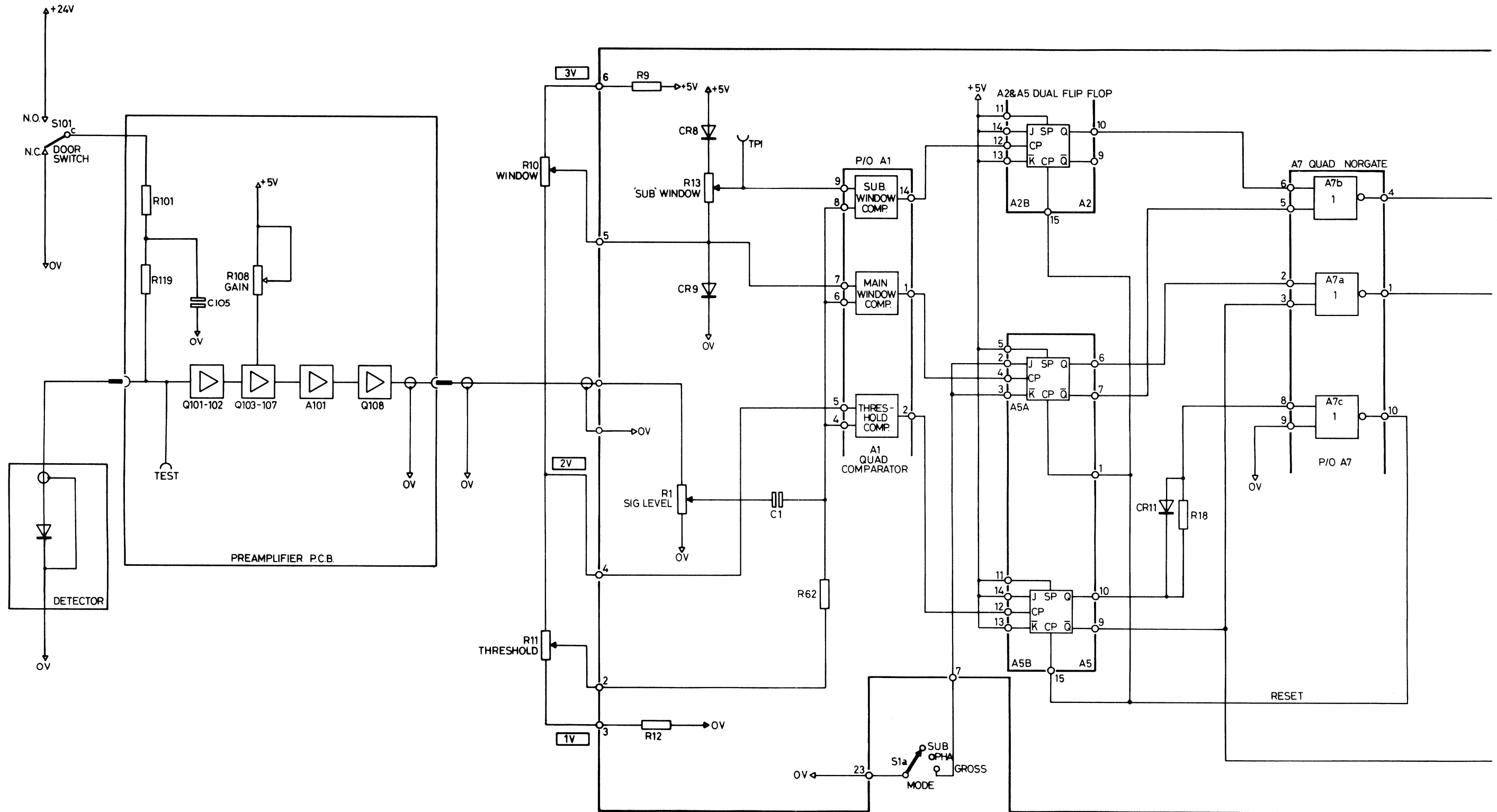
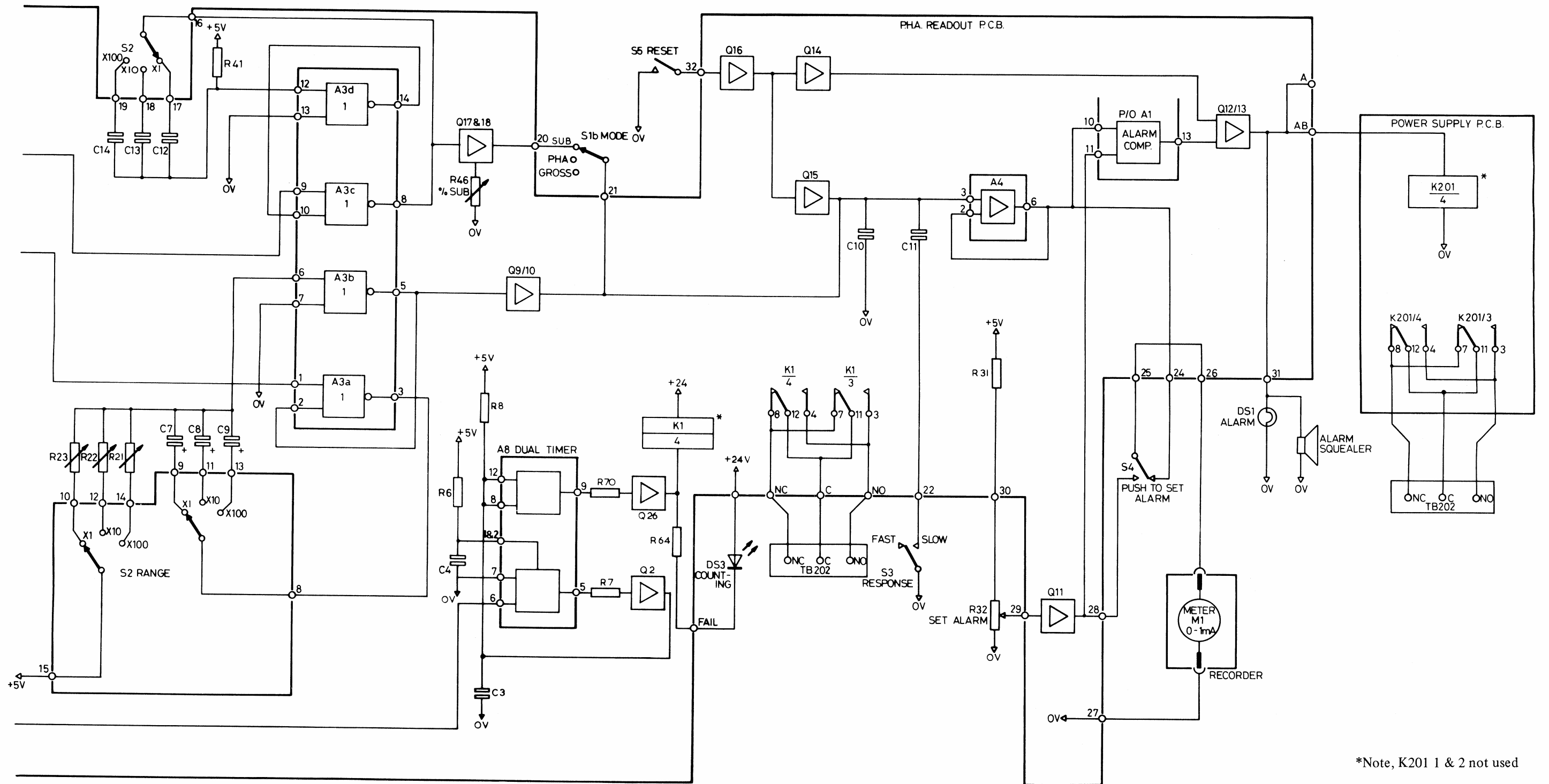


Fig. 7  
 Chap 1  
 Page 14

Signal chain diagram (Part A)





\*Note, K1 1 & 2 not used

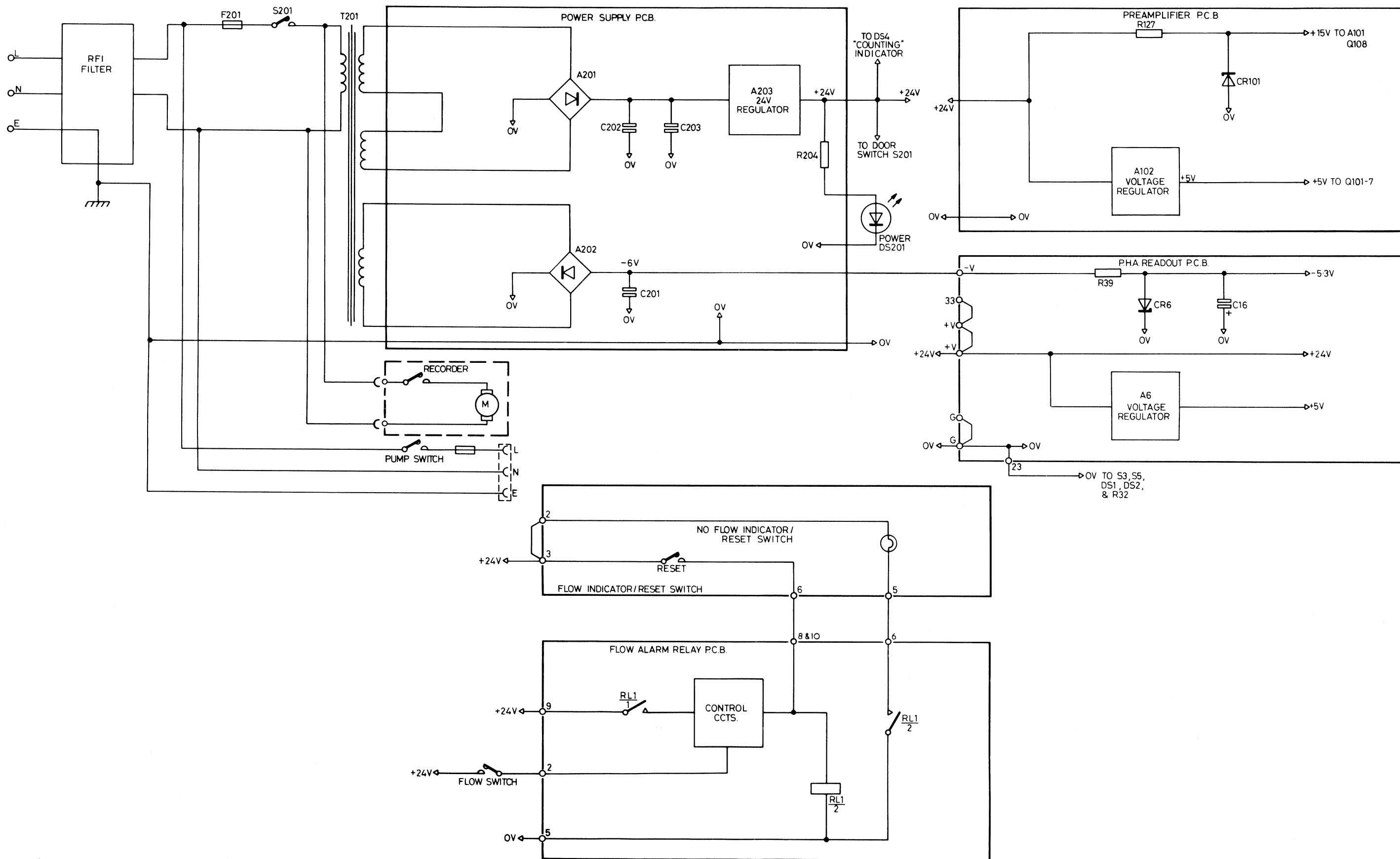


Fig. 8  
 Chap. 1  
 Page 16

Power supply signal chain diagram

MONITOR AIR SAMPLING (EBERLINE ALPHA 3)

AND PUMP TYPE RAP1

Chapter 2

PREPARATION FOR USE AND OPERATING INSTRUCTIONS

Para.

	USING THE MONITOR
1	General
	DESCRIPTION OF CONTROLS AND CONNECTIONS
2	Front Panel
3	Rear Panel controls and connections
4	Internal controls
5	Effect of controls
	PREPARATION FOR USE
10	Sequence of operations
11	Before Use Operational Checks
12	Setting the Subtraction Percentage
13	Setting the Airflow Rate
14	After Use Servicing

Fig.

Page

1	Front Panel Controls . . . . .	2
2	Rear Panel Controls and Connectors . . . . .	3
3	Internal Controls . . . . .	4
4	Pulse Height Spectrums Pu <sup>239</sup> showing effect of window. . . . .	5
5	Typical Pulse Height Spectrums . . . . .	7
6	Pump Type RAP 1 Air Flow Adjustment . . . . .	8

USING THE MONITOR

GENERAL

1. The following should be observed when using the monitor:
  - 1.1 EFFICIENCY:— The efficiency of the system should be checked often to ensure proper operation.
  - 1.2 FILTER PAPER:— The filter paper should be changed daily or more frequently depending on local conditions (Chap. 3 para 15).
  - 1.3 AIR FLOW:— The air flow rate should be checked as often as possible to verify a constant air flow in the system.
  - 1.4 CHART RECORDER PAPER:— The chart recorder should be checked regularly whilst monitoring is in progress to ensure that sufficient paper remains to complete the required monitoring period. To change the paper refer to Chap. 4 para. 12. (Note :- the paper rolls are to be replaced by qualified personnel only).

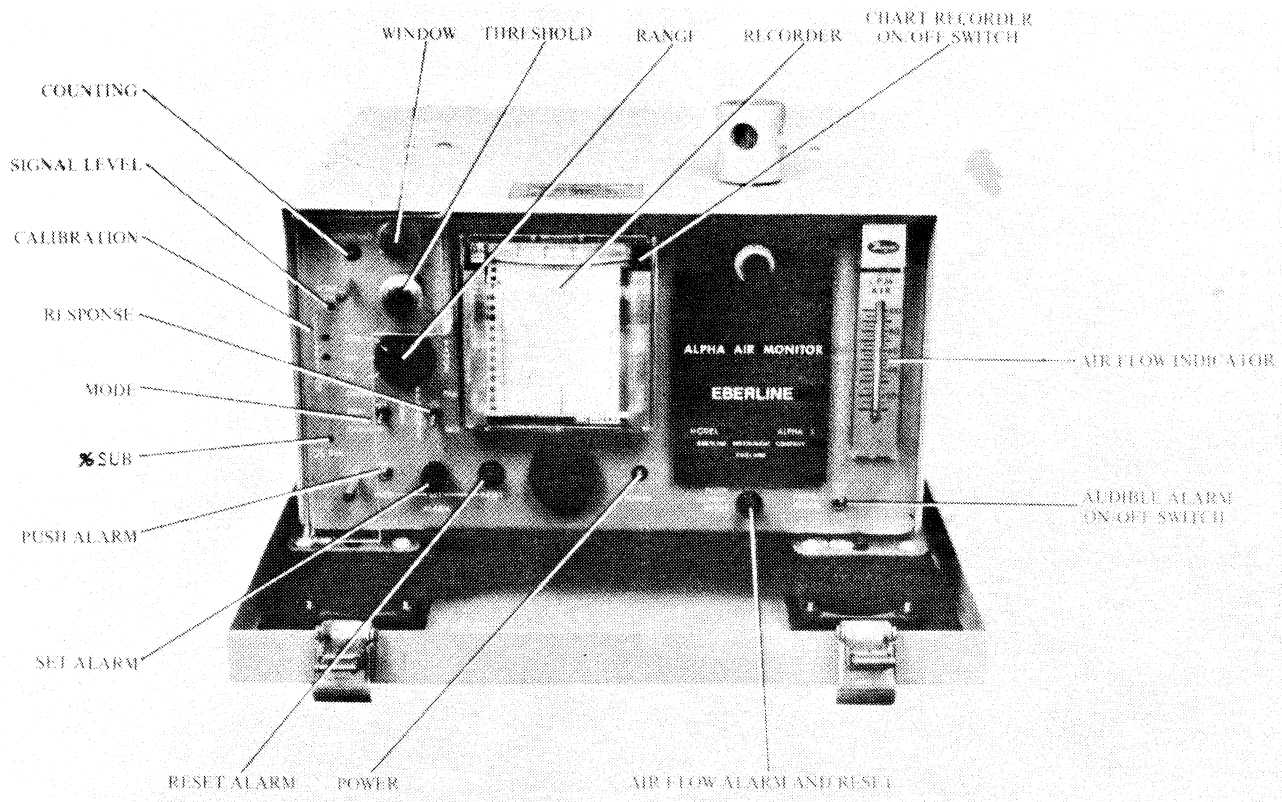


Fig. 1 Front Panel Controls

## DESCRIPTION OF CONTROLS AND CONNECTIONS

### Front panel controls

2. Figure 1 shows the location of all of the front panel controls and should be used when examining the following description of the controls and their purpose.

- 2.1 AIR FLOW INDICATOR: – Displays the rate of air through the monitor.
- 2.2 RECORDER: – Provides a permanent record of CPM over a set time period. Meter at top of recorder shows instantaneous CPM reading, the chart recorder can be switched off by switch indicated in fig. 1.
- 2.3 RANGE: – Provides for selection of 0-50, 0-500 or 0-5000 CPM scale reading on the recorder.
- 2.4 THRESHOLD: – A ten turn calibrated dial potentiometer for setting and changing the base line of Alpha energies to be counted (0-10 MeV energy equivalent).
- 2.5 WINDOW: – A ten turn calibrated dial potentiometer used for setting and changing the range of Alpha energies to be counted and is always constant above the threshold (0-10 MeV energy equivalent).
- 2.6 CALIBRATION: – These controls are set during calibration and allow the recorder full scale readings to be adjusted as necessary in the three ranges.
- 2.7 SIGNAL LEVEL: – Adjusts the signal level from the amplifier to the Pulse Height Analyser (PHA) circuit board for correct amplitude, and is set during calibration.
- 2.8 MODE: – Selects the mode of operating either:
  - (a) GROSS: all pulses above the threshold level are counted
  - (b) PHA: all pulses above the threshold level and below the window level are counted
  - (c) PHA-SUB: as PHA but a subtraction is made. The basis of the subtraction is the activity above the window level and below the sub window level (background count)

- 2.9 RESPONSE:- Selects FAST (approximately 30 seconds) or SLOW (approximately 180 seconds) to be selected for the recorder readout. The FAST position being used for calibration only.
- 2.10 SET ALARM:- Allows adjustment of the alarm point as displayed on the recorder.
- 2.11 PUSH ALARM:- Allows the alarm point to be displayed on the recorder.
- 2.12 RESET ALARM:- Visually indicates an alarm condition and when depressed resets the alarm and returns the indicator on the recorder to zero.
- 2.13 COUNTING:- Illuminated when the monitor is operating normally. Extinguishes when counting ceases.
- 2.14 POWER:- Illuminated when the internal DC supplies are activated.
- 2.15 AIR FLOW ALARM AND RESET:- Allows 'NO FLOW' alarm to be reset when air flow has been re-established after failure, and illuminates when 'NO FLOW' alarm is activated.
- 2.16 % SUB:- An adjustable ten turn potentiometer which is used to adjust the percentage of the count rate in the subtraction window that is subtracted from the recorder reading. It is used to counter-act the naturally occurring count due to background radioactivity, and will be set to maximum subtraction during 6 monthly servicing.
- 2.17 AUDIBLE ALARM ON/OFF:- Allows the alarm to be switched off.

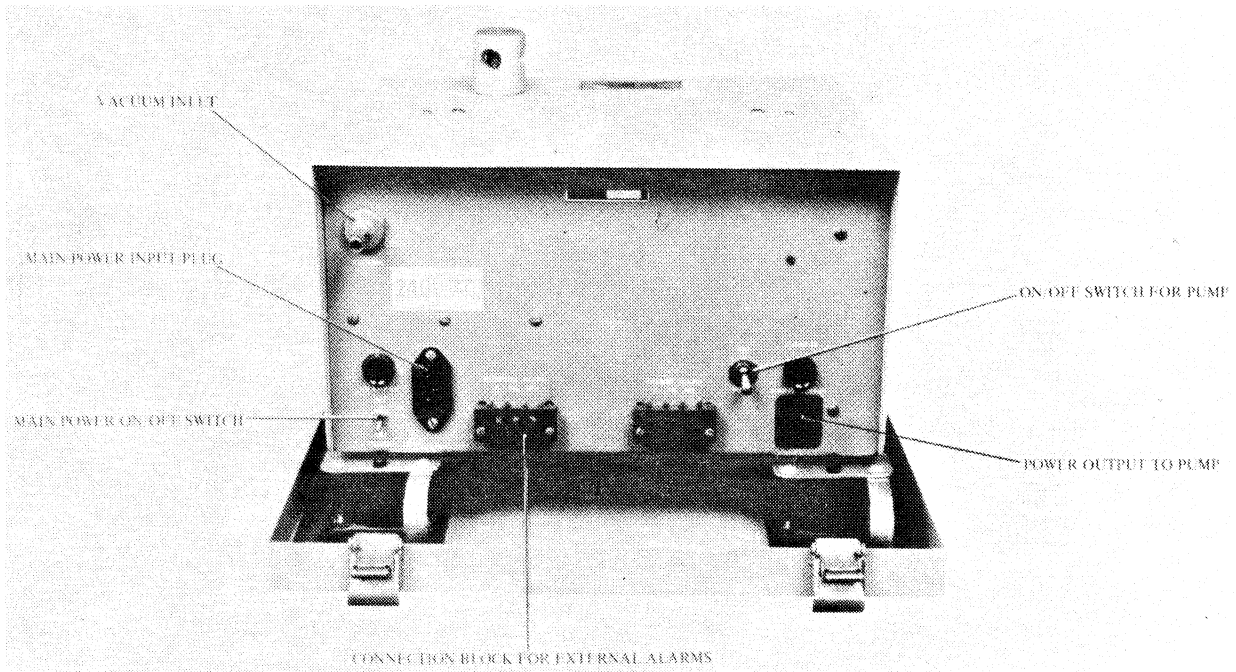


Fig. 2 Rear Panel controls and connections

Rear panel controls and connections

- 3. Refer to fig. 2. Rear Panels controls and connections.
- 3.1 Monitor mains power supply :
  - 3.1.1 ON/OFF switch (Note: this switch does not control the pump power supply).
  - 3.1.2 Input plug
  - 3.1.3 Fuse FS1. Immediately above ON/OFF switch

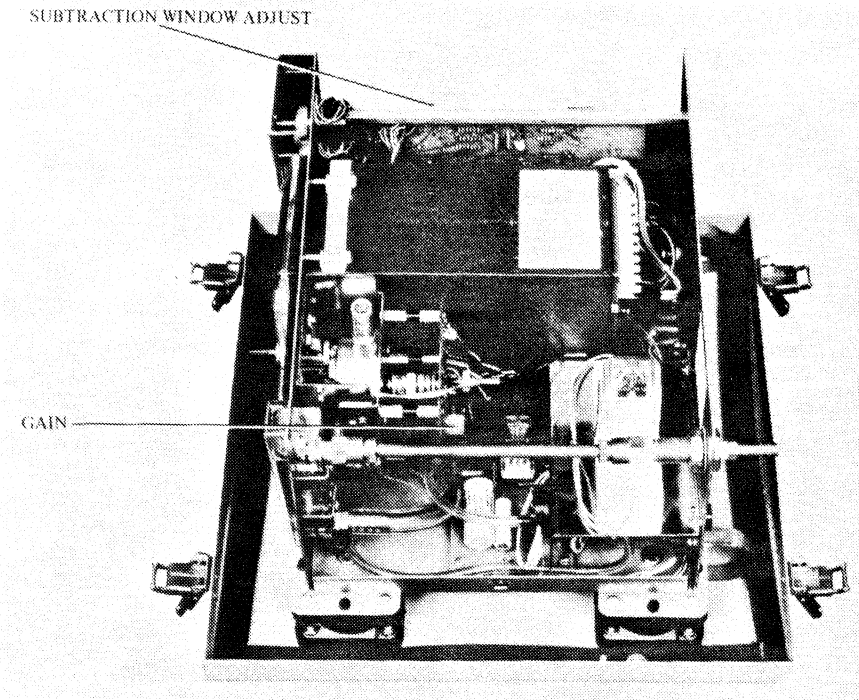


Fig. 3 Internal Controls

- 3.2 Pump power supply:
  - 3.2.1 ON/OFF switch
  - 3.2.2 Power supply socket
  - 3.2.3 Pump fuse (adjacent to pump ON/OFF switch)
- 3.3 Connector block for external alarms (not used by the RAF)
- 3.4 Vacuum inlet connector

#### Internal controls

- 4. The location of the internal controls are shown in fig. 3
  - 4.1 GAIN:- This control is used during calibration to set/adjust the overall gain of the amplifier.
  - 4.2 SUBTRACTION WINDOW ADJUST:- An adjustable ten turn potentiometer which is used to set the desired window width for the subtraction circuit.

#### EFFECT OF CONTROLS (figs. 4 & 5)

- 5. The 'THRESHOLD' and 'WINDOW' adjustments of the ALPHA-3 correspond to a channel number on Figure 5. The optimum setting for  $\text{Pu}^{239}$ , for example, would be a 'THRESHOLD' setting equivalent to channel 4.65 and a 'WINDOW' setting equivalent to 10 channels in width, which would extend to channel 56.5. With these settings, the ALPHA-3 would count at least 90% of the  $\text{Pu}^{239}$  counts and reject everything outside these limits.
- 6. However, some of the counts from the radon-thoron daughter spectrum do fall within channels 46.5 to 56.5 and will be counted. In Figure 5, these represent approximately 2% of the total radon-thoron activity. The actual percentage of the total radon-thoron activity which is counted depends on the 'THRESHOLD' and 'WINDOW' settings and on the relative abundance of the various daughters.

7. The relative abundance of the RaA, RaC', ThC and ThC' depend, naturally, on their relative abundance in the air and their equilibrium condition. This also depends on how long the sample has been collating. The short half life RaA (3 min.) will reach equilibrium on the paper quite rapidly, while the RaC will take longer due to its longer apparent half life (approx. 30 min.). Likewise, the ThC and ThC1 continue to build up and will not reach equilibrium for many hours because of longer apparent half life (10.6 hours). Figure 5 shows pulse height spectra from various sources taken on a multichannel analyser connected into the ALPHA-3 at the amplifier output. The lower three are taken from plated sources placed in the sample holder of the ALPHA-3. The upper curve is from a filter paper after 25 LPM of air has been pulled for 16 hours.

8. Typically, with the controls set as described above, the ALPHA-3 will count 2% of the total radon-thoron activity with the majority of the counts coming from the RaA peak. Rejection of activity outside the THRESHOLD and WINDOW limits set as above, will increase the detection sensitivity to Pu<sup>239</sup> by a factor of 50 or so over that of a conventional gross counting instrument.

9. The background subtraction circuit can reduce the effect of the radon-thoron daughters even further. This circuit measures the count rate of the events rejected by the upper discriminator (and occurring in the subtraction window), takes an adjustable percentage of this count rate and subtracts it from the meter reading. Alphas with energies slightly above the upper threshold of the main window (RaA, for example) are the ones most likely to scatter down and be counted in the main channel and so the subtraction window uses only those energies to determine the amount of subtraction applied to the main count rate. It ignores the higher energies which, if included, would cause subtraction errors during random level changes.

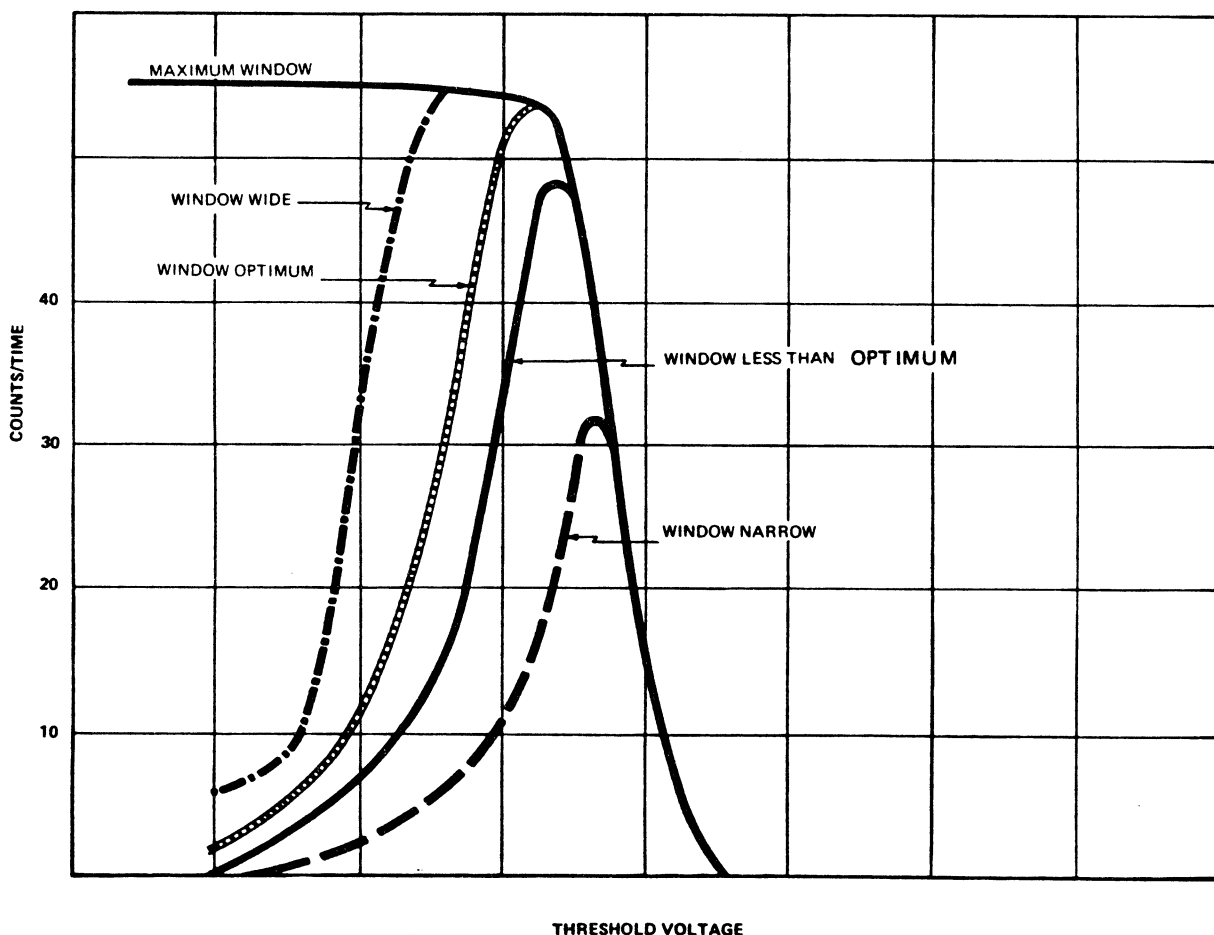


Fig. 4 Pulse Height Spectrums of Pu<sup>239</sup> showing effect of windows

## PREPARATION FOR USE

### SEQUENCE OF OPERATIONS

10. The following sequence of operation is recommended when preparing the monitor for use.
  - 10.1 Ensure monitor main power switch is set to 'OFF' and connect the 3 wire 250V a.c. supply.
  - 10.2 Connect the vacuum tube to the monitor rear panel and connect the Pump power lead to the socket provided on the rear panel.
  - 10.3 Set the main power switch and the pump power switch to 'ON'.

Note . . .

When using the pump RAP 1 (NSN 4320-99-659-5814) the airflow rate is adjusted by the control on the RAP1 pump. See figure 6 and is to be set for a rate of 30 LPM as indicated on the monitor.

- 10.4 Carry out before use operational check. (See para. 11)
- 10.5 Ensure the WINDOW control is set to 1.0 and the threshold to 5.15.
- 10.6 Set the percentage subtraction required (See para. 13)
- 10.7 Change the filter paper (See chap. 3)
- 10.8 The monitor is now ready for use.

### BEFORE USE OPERATIONAL CHECKS

WARNING. . .

ALL RADIOACTIVE SUBSTANCES ARE HARMFUL IF HANDLED CARELESSLY, PERSONNEL ARE TO OBSERVE THE SAFETY PRECAUTIONS DETAILED IN JSP 392

11. The before use Servicing is detailed in the Topic -5F, Chapter 2.

### Setting the subtraction percentage

12. Notes . . .

1. Due to the unacceptable time taken to achieve a steady state subtraction the %SUB control is set for maximum subtraction. Both the '%SUB' and 'SUB-WIN' controls are pre-set during 6 monthly servicings.
2. See para. 2 for location and operation of the '%SUB' control.
3. This para. has been included for information purposes only.



- 12.1 Check that the 'THRESHOLD' is set at 5.15 and 'WINDOW' at 1.0 before the subtraction percentage can be set.
- 12.2 The SUBtraction WINDOW width must be set for the isotope to be used for the subtraction (i.e. Ra A). For this each 100mV above the window voltage equals 1 MeV.
- 12.3 Place a clean filter in the monitor filter holder, turn on the monitor and start the air flow and allow to run until equilibrium is reached (not less than 2 hours).

Note . . .

The air must not contain particles of isotope of interest.

- 12.4 Switch on the SUBtraction and adjust the control for a reading as near zero as possible.

Note . . .

Statistical fluctuation of the needle is normal and necessitates observing the meter long enough to be certain of the reading.

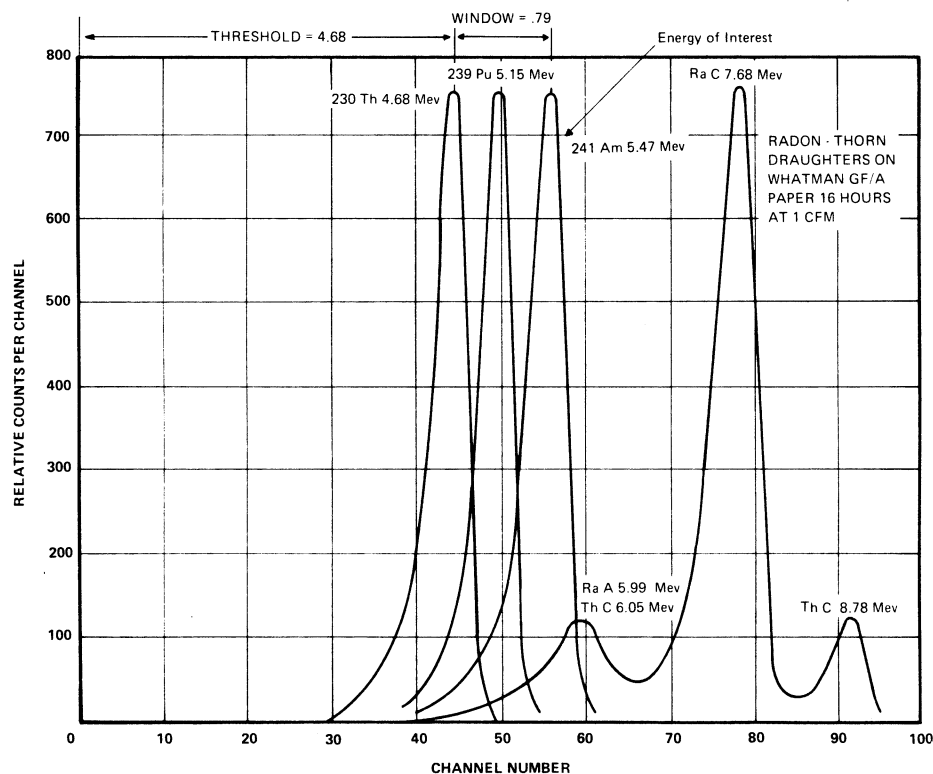


Fig. 5 Typical Pulse Height Spectrums

### Setting the air flow rate

13. Adjustment of the airflow through the monitor may be achieved by using a screw at the rear of the pump regulator (fig. 6) whilst observing the flowrate indicator on the front of the monitor.

### After Use Servicing

14. The after use servicing required is detailed in the Topic -5F, Chapter 3.

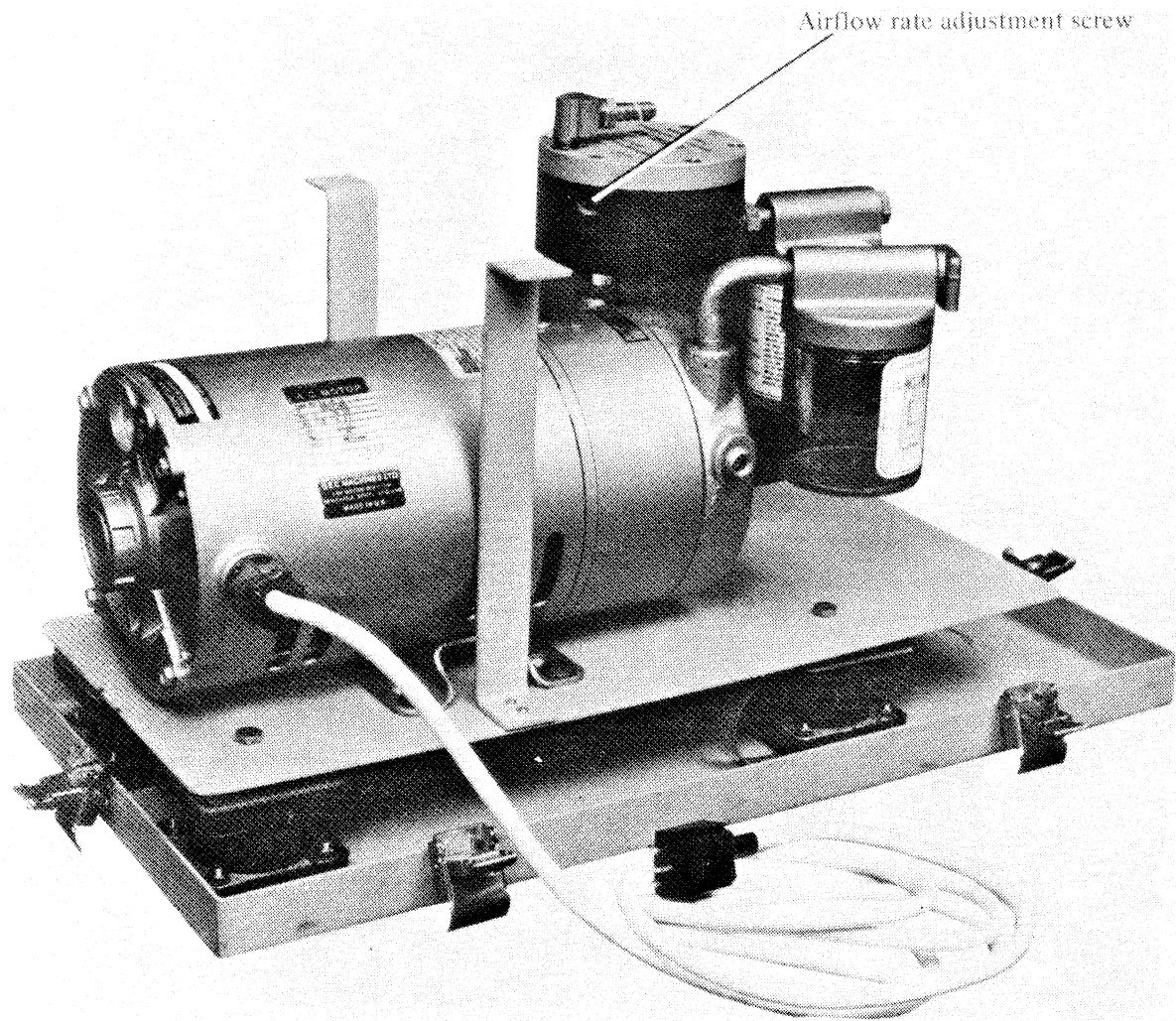


Fig. 6 Pump type RAP 1 airflow adjustment

**MONITOR AIR SAMPLING (EBERLINE ALPHA 3)  
AND  
PUMP TYPE RAP 1**

**Chapter 3**

**SERVICING**

**CONTENTS**

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3	After Use Servicing
4	One Monthly Servicing
5	Acceptance and Six Monthly Servicing
6	List of Test Equipment
	<b>ASSEMBLY AND DISASSEMBLY</b>
7	Removal of the Cover Piece
9	Printed Circuit Boards
10	Detector
	<b>FAULT ISOLATION</b>
11	General
12	Component Locations
13	Standing Voltage Check
14	Filter Change
	<b>PUMP TYPE RAP 1</b>
15	General
16	Starting
17	Flushing
18	Recommended Solvents
19	Filters
20	Loss of Vacuum
21	Fits and Clearances

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5	Filter holder . . . . .	7

## WARNINGS . . .

- (1) ALL RADIO ACTIVE SUBSTANCES ARE HARMFUL IF HANDLED CARELESSLY  
PERSONNEL ARE TO OBSERVE THE SAFETY PRECAUTIONS DETAILED IN JSP 392
- (2) VOLTAGES IN EXCESS OF 30V R.M.S. OR 50V D.C. CAN BE LETHAL AND ARE PRESENT IN  
THIS INSTRUMENT.
- (3) CADMIUM IS PRESENT IN THE RETAINING BRACKET OF THE DETECTOR AND DETECTOR  
AMPLIFIER BOARD AND IT IS ALSO PRESENT IN THE MOUNTING OF THE RELAY ON THAT  
BRACKET. THE SAFETY PRECAUTIONS AND HANDLING INSTRUCTIONS TO BE OBSERVED,  
WHEN HANDLING CADMIUM ARE DETAILED IN AP 100B-01, ORDER 1703.

## SERVICING INFORMATION

### GENERAL

1. The servicing information contained in this chapter is supplementary to the mandatory servicing instructions in the Topic -5F element of this publication. It is intended to facilitate the operations specified in the -5F schedules by means of additional information, and to provide details of non-routine servicing which is not covered in the -5F element, e.g fault diagnosis and the servicing or replacement of parts considered likely to become faulty.

### Before Use Servicing

2. This servicing is to be carried out by user units in accordance with the policy detailed in AP 110A-01, leaflet 386. The procedure for this servicing is detailed in Chapter 2 of the -5F instructions.

### After Use Servicing

3. This servicing is to be carried out by user units in accordance with the policy detailed in AP 110A-01, leaflet 386. The procedure for this servicing is detailed in Chapter 3 of the -5F instructions.

### One Monthly Servicing

4. This servicing is to be carried out by user units in accordance with the policy detailed in AP 110A-01, leaflet 386. The procedure for this servicing is detailed in Chapter 4 of the -5F instructions.

### Acceptance and Six Monthly Servicing

5. Servicings which involve removal of the monitor cover or dismantling of the pump are only to be performed by suitably qualified tradesmen as detailed in AP 100A-01, leaflet 386. The locations at which this servicing is to be performed will be detailed by each Command Headquarters in accordance with the policy detailed in the aforementioned leaflet and amplified as necessary by the MOD Wpn/Eng 3 (RAF) Policy letter. The procedure for this servicing is detailed in Chapter 6 of the -5F instructions.

### List of Test Equipment

6. The full list of test equipment required for the routine servicing is listed in the appropriate -5F instructions.

## ASSEMBLY AND DISASSEMBLY

### CAUTIONS . . .

- (1) If the detector face is scratched, or if the detector is subjected to shock loading, it can be permanently damaged. Extreme care must be exercised when handling the detector.
- (2) The detector has contacts which are ultra-sonically bonded and can be pulled loose if excessively strained. Avoid pulling or exerting undue strain on the detector leads.
- (3) The detector may be cleaned with methanol (63G/6810-99-220-0945) and then dried by an air blast. However, the use of solvents containing fluoride ion should be avoided as these are liable to cause damage to the detector surface and adversely affect the detector performance.

### Removal of the Monitor Cover

7. The cover may be removed as follows:—
  - 1.1 Remove the air intake cap
  - 1.2 Remove the two retaining screws situated centrally on the lower edges of the side panels.
  - 1.3 Slightly prise apart the cover side panels and remove the cover.
8. Re-fitting the cover is reverse of the removal instructions.

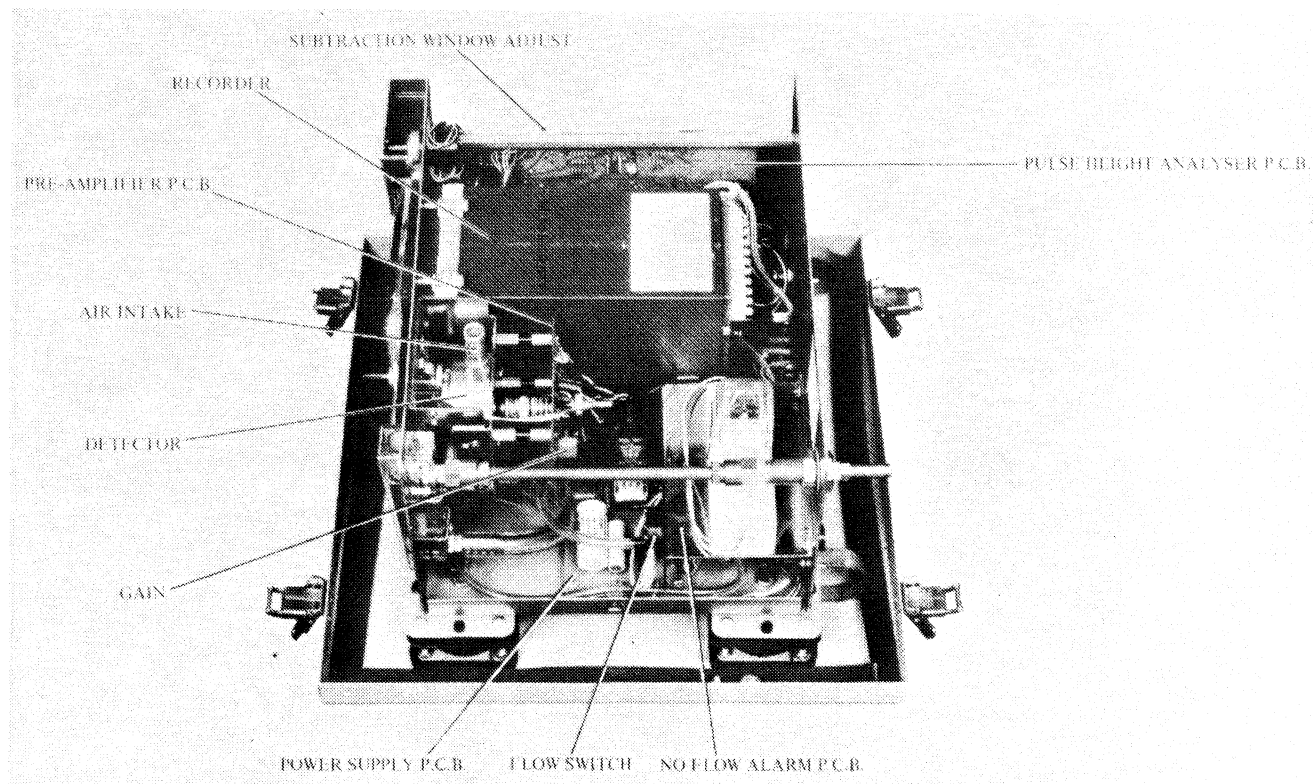


Fig. 1 Internal view of air monitor with cover removed.

## Printed Circuit Boards

9. The printed circuit boards remain in situ for normal calibration and maintenance. However, should the boards need to be removed this is easily accomplished by removing the individual securing screws and lifting the board away from the supporting pillars.

## Detector

10. The detector may be removed as follows:—

- 10.1 Remove cover (para. 7)
- 10.2 Remove amplifier printed circuit board (para. 9)
- 10.3 Open the hinged door on the front panel.
- 10.4 Remove the two screws from the rear of the detector housing.
- 10.5 Remove the detector housing from the chassis.
- 10.6 Remove the detector from its housing by sliding the detector out of the rear side.

11. The fitting of a detector is the reverse of the above procedure.

## FAULT ISOLATION

### GENERAL

12. To check the monitor a pulse generator may be used. Many voltages are supplied on the circuit diagram Chapter 1, Fig. 9 as an aid to isolating failures. Standard fault finding techniques should be used. After repair the monitor is to be tested in accordance with Chapter 6 of the -5F instructions.

### Component Locations

13. Refer to figures 2, 3 and 4 for test point and component locations.

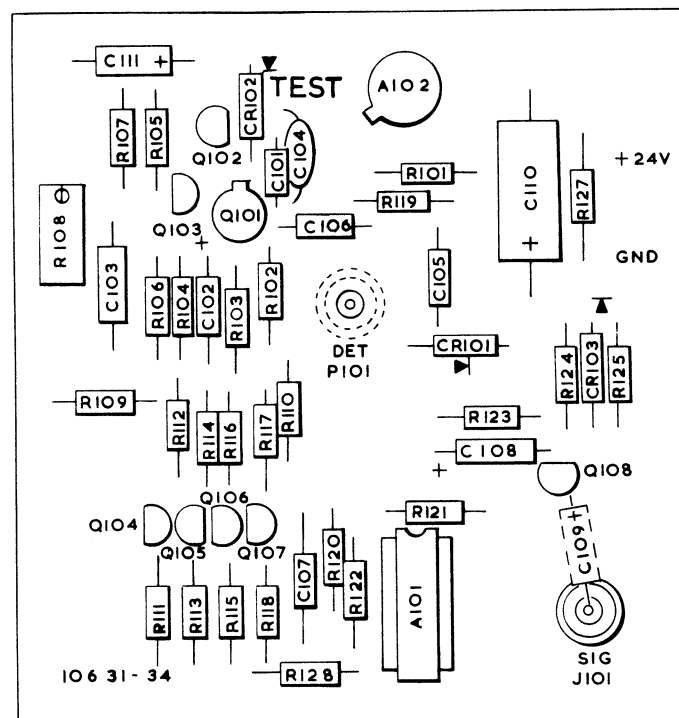


Fig. 2 Pre-Amplifier PCB, component location

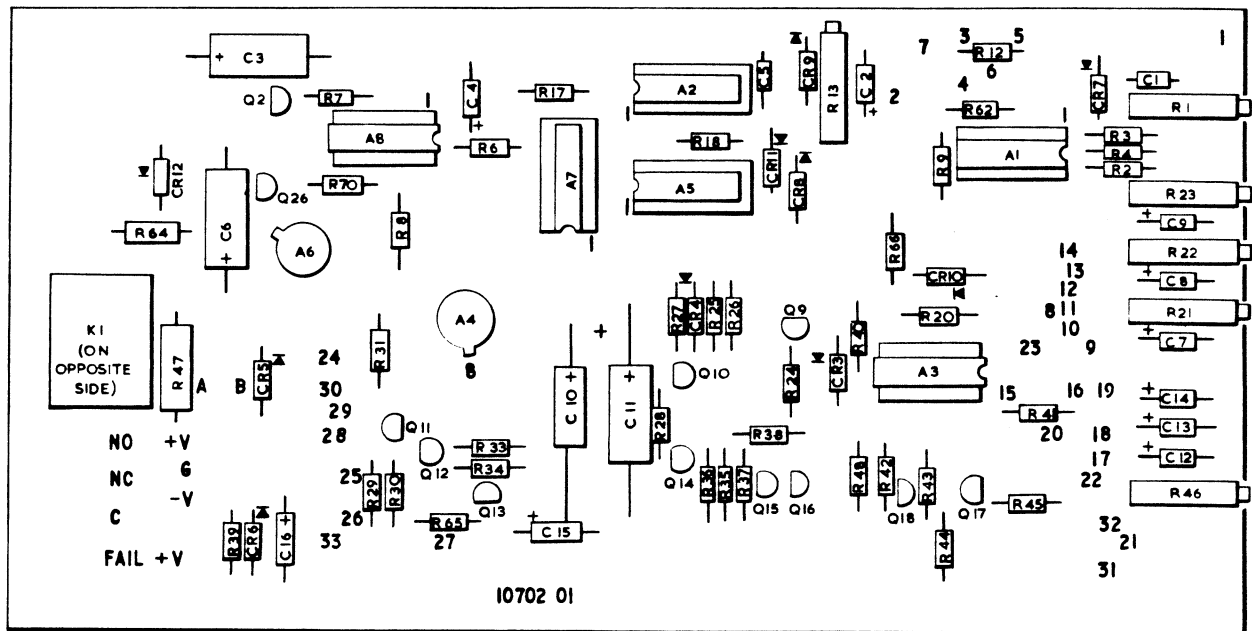


Fig. 3 Pulse Height Analyser PCB component location

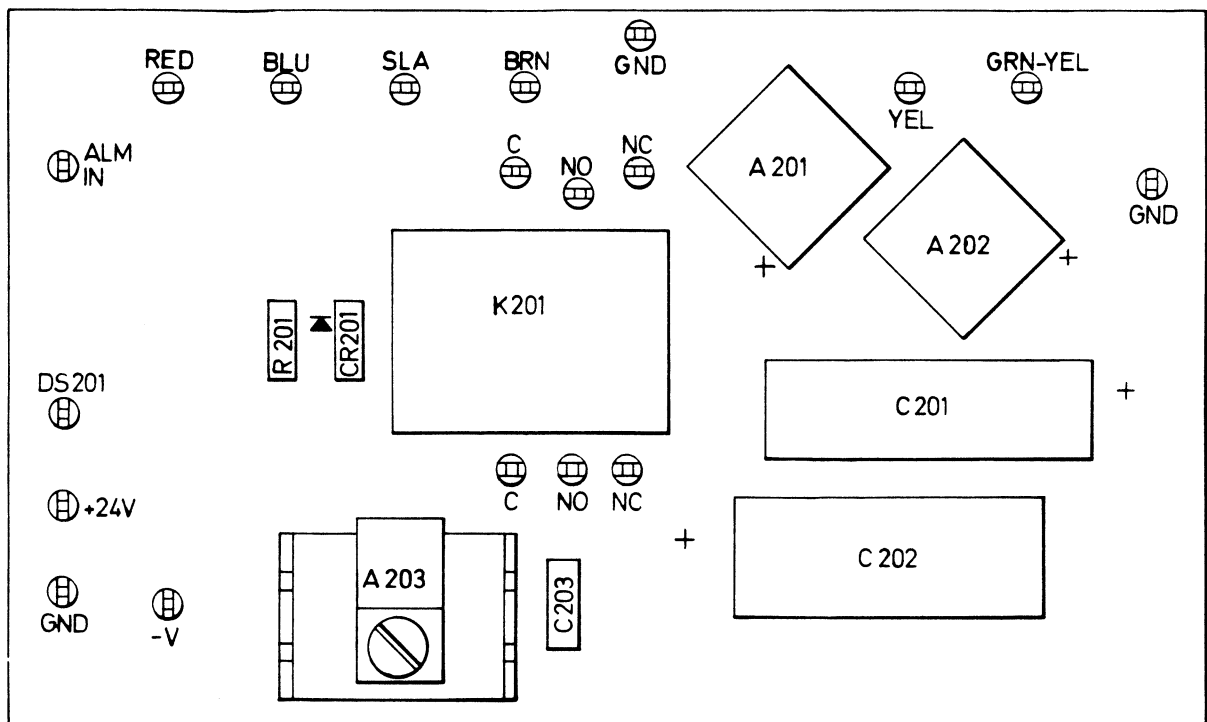


Fig. 4 Power supply PCB component location

## Standing Voltage Checks

14. Before carrying out a complete servicing the standing voltages should be checked as detailed below:—

- 14.1 Connect the monitor to the 240V a.c. supply and set the 'ON/OFF' switch to 'ON'.
- 14.2 On the POWER SUPPLY PCB check the following voltages for conformity with the specified tolerances.
  - 14.2.1 The +24 volts at the 24V terminal shall be between 22.8V and 25.2V
  - 14.2.2 The -ve volts at the -ve terminal of C201 shall be approximately -9 volts.
- 14.3 On the PHA-READOUT PCB, check the following for conformity with the specified tolerances.
  - 14.3.1 The +5 volts at the junction of C6 and R31 shall be between 4.6 and 5.4 volts.
  - 14.3.2 The -ve 5.3 volts at the -ve terminal of C16 shall be between -ve 3.00 and 5.6 volts.
- 14.4 On the AMPLIFIER PCB check the following voltages for conformity with the specified tolerances.
  - 14.4.1 The +5 volts, at the junction of C111 and R128 shall be between 4.6 and 5.4 volts.
  - 14.4.2 The +15 volts at the junction of R127 and CR101 shall be between 14.25 and 15.75 volts.
  - 14.4.3 Measure the voltage on the emitter of Q107 it should be between 0.6 and 1 volt. If voltage indicated is correct, proceed with the complete servicing. If not, check the listed voltages in para. 14.4.4 and correct as necessary.
  - 14.4.4

Q101	Source	0.85 – 1.18 volts
Q101	Drain	2.33 – 2.90 volts
Q102	Emitter	1.63 – 2.30 volts
Q103	Emitter	2.33 – 2.90 volts
Q103	Collector	1.15 – 1.46 volts
Q104	Emitter	0.55 – 0.76 volts
Q104	Collector	3.62 – 3.92 volts
Q105	Emitter	4.22 – 4.52 volts
Q106	Collector	1.05 – 1.78 volts
Q107	Emitter	0.45 – 1.08 volts

### Filter change

15. It is recommended that the filter paper is changed daily or more frequently depending on local conditions if the monitor is in constant use. In other applications, the filter should be changed as directed in the -5F element of this manual. The filter may be changed as follows:—

- 15.1 Turn the sample holder securing the knob FULLY counter clockwise (CCW).

Note . . .

It is necessary to turn the securing knob fully CCW as the securing mechanism will then be correctly aligned for closing the sample holder when necessary.

- 15.2 Carefully open the sample holder door.
- 15.3 Remove the filter paper retainer and inspect the sealing ring on inside of retainer, taking care not to touch the filter paper with the hands.
- 15.4 Remove the filter paper using a pair of tweezers and dispose of in accordance with local instructions.
- 15.5 Fit a clean filter paper and replace the sample holder ring. Care must be exercised during this last action as damage to the internal sealing O' ring may occur.
- 15.6 Close the sample holder door, and turn the securing knob fully clockwise (CW).



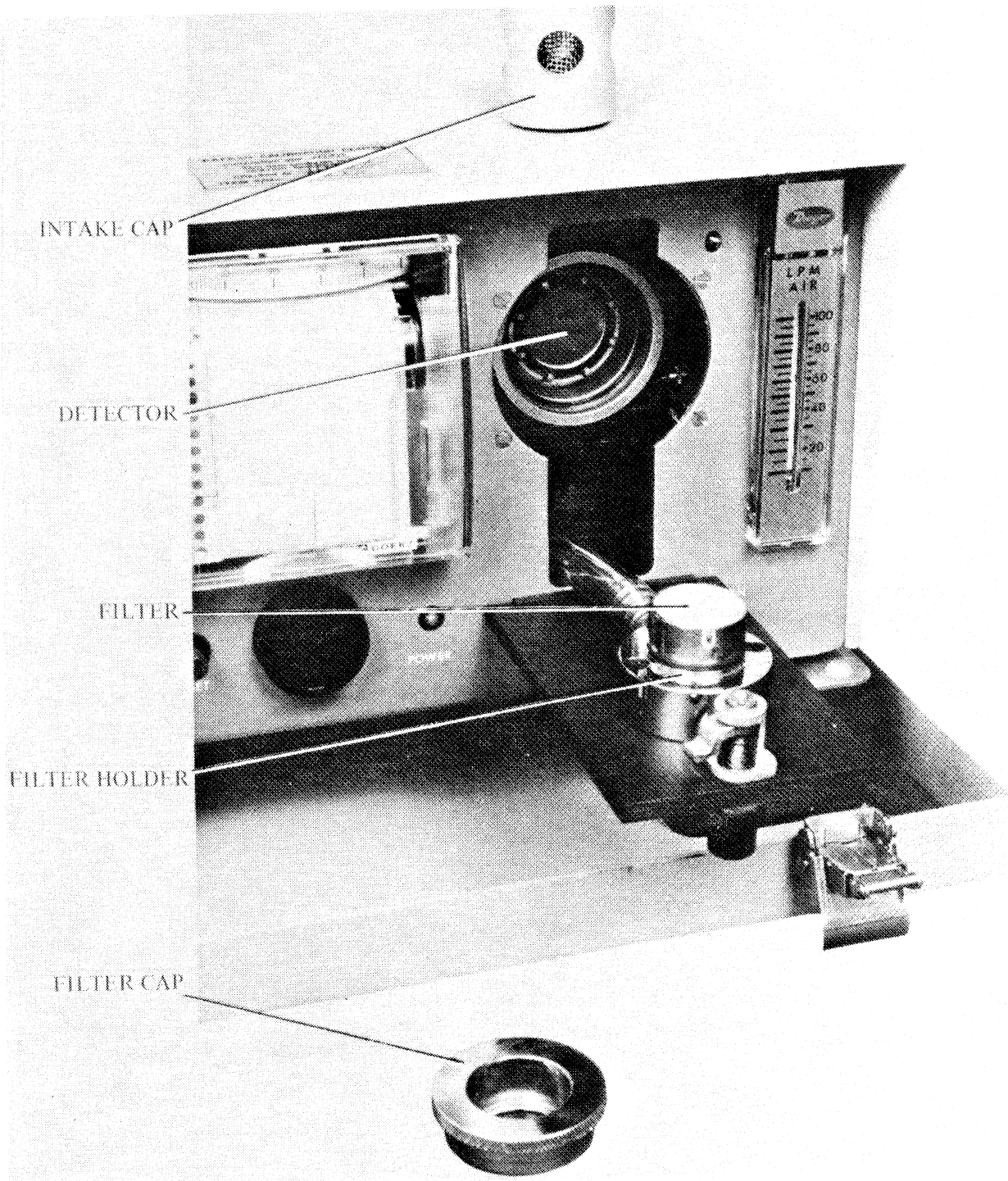


Fig. 5 Filter holder

## PUMP TYPE RAP 1

### WARNINGS . . .

TO PREVENT EXPLOSIVE HAZARD DO NOT PUMP COMBUSTIBLE LIQUIDS OR VAPOUR WITH THIS PUMP

### CAUTIONS . . .

- (1) Do not lubricate this dry 'oil less' air pump. The carbon vanes and grease packed motor bearings require no lubrication.
- (2) Do not run the pump in the transit case as the thermal cut-out will operate prematurely.

### General

16. The pump type RAP 1 is designed to give a long and trouble free life, very little maintenance being required. However, the following points to basic maintenance and operating procedures are supplemental to the -5F instructions.

### Starting

17. If the motor fails to start or hums, disconnect it from the mains supply and ensure that the current rating shown on the nameplate is available at the supply point. Examine the plug and switch for signs of deterioration and damage and repair as necessary. If the pump is extremely cold, allow the pump temperature to rise to room temperature before starting the motor.

### Flushing

18. Should excessive dirt, foreign particles, moisture or oil be permitted to enter the pump, the vanes will act sluggishly or may even break. Flushing the pump should rectify these situations. In order to flush the pump, remove the filter, the regulator and silencer assemblies and introduce several teaspoons of solvent into the pump **WHILE THE PUMP IS RUNNING**. Repeat the flushing procedure, and if this does not rectify the situation, removal of the end plate for further examination will be necessary. Periodic flushing is recommended.

### Recommended Solvents

### WARNING . . .

DO NOT USE KEROSENE.

19. The following solvents are recommended for use during flushing operations of the pump; Loctite Safety Solvent, Inhibisol Safety Solvent and Dow Chemical Chlorothane.

### Filters

20. Dirty filters can restrict air flow if not corrected, could lead to possible motor over-loading, and early pump failure. The filters should be checked periodically and cleaned when necessary. The filters may be cleaned in the following manner. Remove the felts and wash the filter in an approved solvent (para. 19). The filters can then be dried with an air blast, or shaken dry if necessary.

### Loss of Vacuum

### CAUTIONS . . .

Do not remove the rotor or loosen any motor thru-bolts.

21. If flushing does not eliminate the problem, remove the six bolts holding the end plate and the four vanes, and check the vanes and pump for excessive wear and damage, replace worn or damaged part as necessary

## Fits and Clearances

22. If after flushing the pump fails to produce the proper vacuum or pressure, the vanes could be worn or the top clearance between the motor and the body may have increased to greater than 0.015'. A light metallic clanging could mean that the motor and the body are touching. The top clearance may be adjusted by 'LIGHTLY' tapping on the pump body (either top or bottom depending on whether the clearance is too large or small). The motor should be turned while setting the clearance to assure that all points on the motor clear the body. Total end clearance for both ends of the motor will vary from 0.0035' to 0.0045'.

Chapter 4  
**CHART RECORDER**  
 Contents

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- 11    Access to the chart drive and recording mechanism
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## LEADING PARTICULARS

Type . . . . .	Chopper Bar with inkless trace
Range . . . . .	0-600 m/a
Chopping rate . . . . .	3 secs
Recording . . . . .	Accuracy 1.5%
Chart drive . . . . .	Synchronous motor
Movement type . . . . .	Ligament suspended moving coil
Power supply . . . . .	AC 230 – 250 volts 3VA
Size . . . . .	90mm x 90mm x 210mm. Panel mounted

## DESCRIPTION

### GENERAL

1. The chart recorder is contained in a sheet steel case finished in light grey hammer enamel. The front of the instrument is protected by a clear rimless perspex cover, and is mounted centrally on the front panel of the monitor. The recorder consists of two main units, the measuring unit and the chart drive unit.

### Measuring unit

2. This consists of a frame which is made up of two plates and a terminal board which is also the backplate of the instrument. The measuring unit scale and chart drive motor are secured to this frame, which also carries the guide rails by which the chart drive is located. The measuring unit also contains the range, printed circuit board (PCB).

### Scale

3. The scale is slightly curved and designed such that the pointer moves in the same plane as the scale, thereby practically eliminating parallax error. An integral perspex shield protects the pointer when the front cover is removed.

### Chart drive unit

4. The chart is driven by a synchronous motor mounted centrally within the mainframe. The motor drives the chopper bar cam to produce a constant chopper rate of once every 3 secs. The chart paper is driven via a 6.1 gearbox which enables the selection of two recording speeds 20 or 120 mm/h. The chart is fed from the free feed spool via the guide and sprocket wheels at the top of the chart plate. There is provision for manual advancement of the paper via the serrated wheel at the upper left side of the chart guide. The paper is fed to the take up spool which is driven by the motor and gearbox. The On/Off switch at the side of the chart plate provides a mechanical and electrical interlock for removal of the chart drive mechanism.

5. The chart drive mechanism can be easily withdrawn from the case and swung downwards which facilitates the replacement of the chart. A lever located in the top right hand corner of the instrument when operated releases the chart drive mechanism from the main body of the recorder and automatically operates a microswitch to stop the chart drive and chopper mechanism at the same time lifting the chopper bar clear of the pointer so that damage to the pointer is prevented when the mechanism is withdrawn.

## RECORDING

6. Recording is achieved by means of a pressure sensitive wax coated paper chart producing a black trace. The pointer, under pressure of the chopper bar, removes a layer of wax thus leaving a black dot on the chart, successive dots thus producing a continuous trace. If the chart speed is high in relation to the chopping rate, a continuous trace may not be formed. The chopper bar is operated by the synchronous motor via a cam wheel and during the period that the bar is raised, the pointer is free to take up a position in accordance with the input. The chopping rate is once every 3 seconds. See fig. 1.

### Meter unit

7. The meter unit is a moving coil type employing a taut ligament suspension and a fully aged magnetic system. The F.S.D. of 600 mA DC is determined by the value of components fitted to the scaling P.C.B. located at the rear of the main frame.

### FRONT PANEL CONTROLS

8. The front of the recorder consists of a clear rimless perspex cover which has projections which fit into slots in the bottom rim of the metal case, the top of the cover being secured by a spring clip. If so desired, the recorder may be protected against unauthorised opening by the insertion of a wire through the holes in the right hand top edge. The wire can then be sealed.

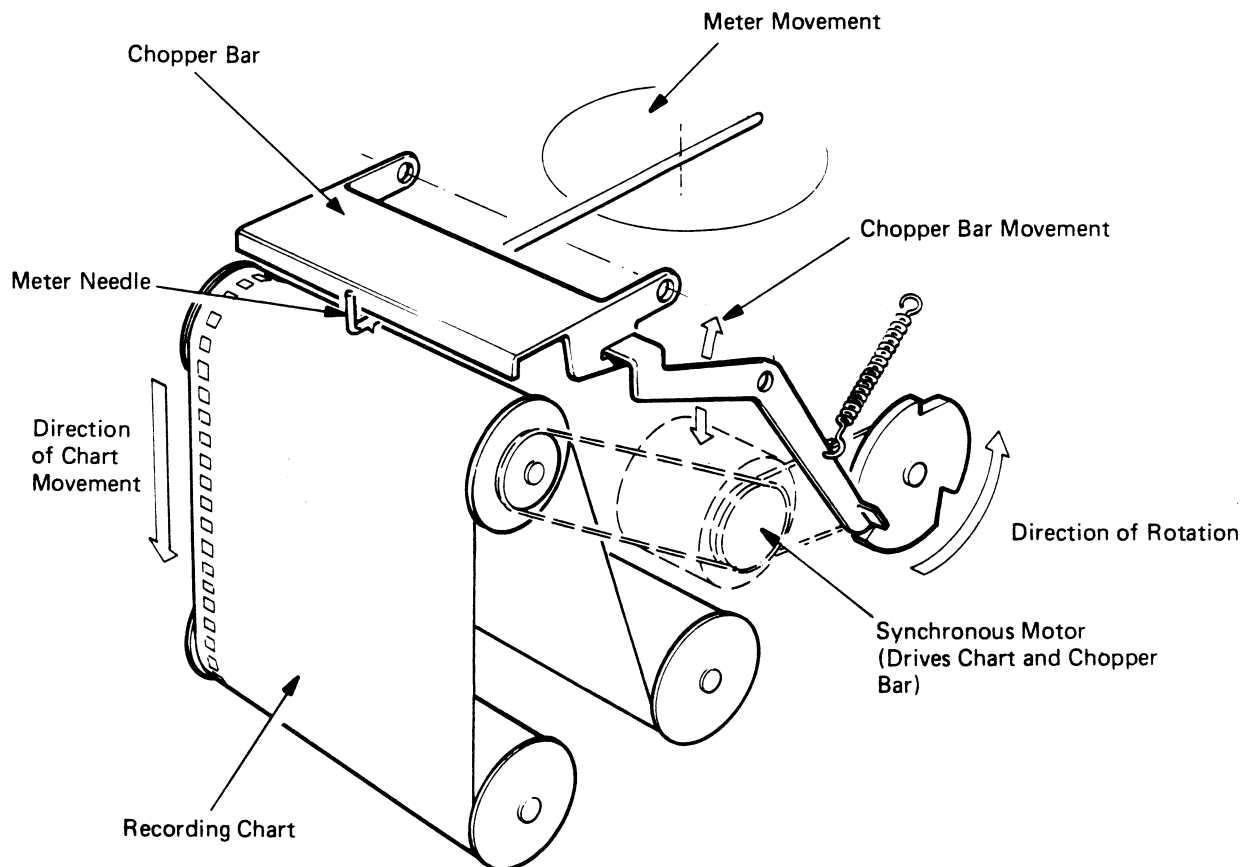
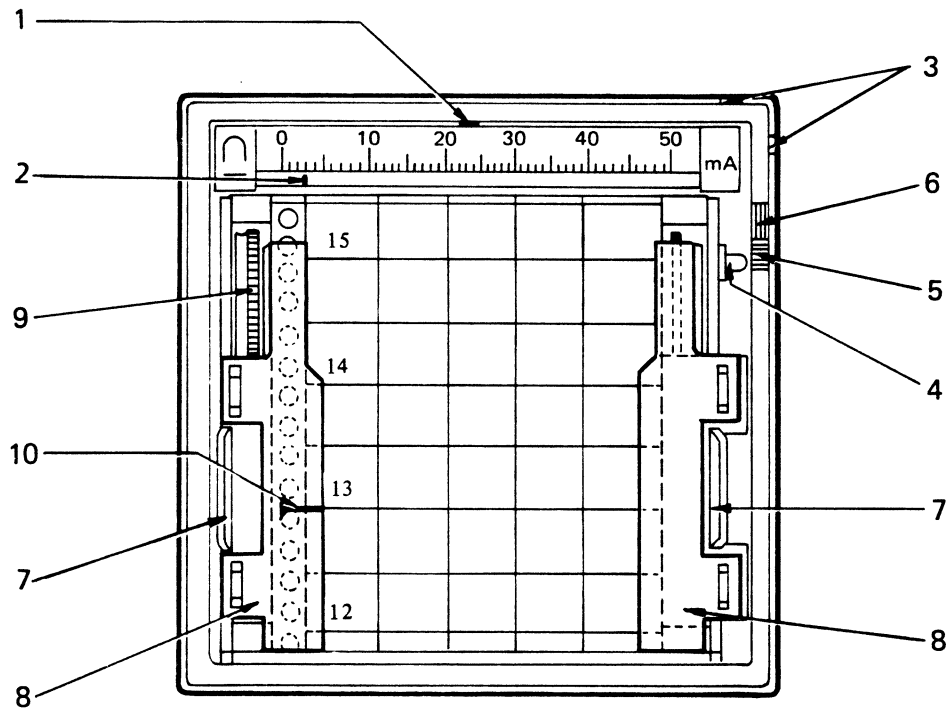


Fig. 1 CHART RECORDER ACTION (DIAGRAMMATIC)



**Fig. 2 RECORDER FRONT (TIME OF RECORDING 16:00 HRS)**

9. Refer to fig. 2. The front panel controls are as follows:—

- 1: Pointer set zero lever
- 2: Pointer
- 3: Holes to secure against unauthorised opening
- 4: Lever to operate the switch and to lock the chart drive unit
- 5: Green tab: Chart drive motor switches on, chart drive unit locked
- 6: Red tab: Chart drive motor switched off, chart drive unlocked, Chopper bar 'UP'
- 7: Grips for removing chart drive unit
- 8: Hinged chart guides
- 9: Knurled edge of chart drive roller
- 10: Timing mark (60mm distance)

#### Removal and refitting of the front cover

10. To open the recorder, grip the ribbed areas on either side of the cover, pull gently forward and lift out. To refit the cover, hold the cover slightly inclined, place the lower edge in the bottom rim of the case so that the projections fit into the slots and clip the cover in place by exerting slight pressure at the top of the cover.

#### Access to the chart drive and recording mechanism

11. Refer to fig. 2. When the front cover is removed (para. 10) the locking lever (4) which also actuates a microswitch in the mains circuit to the synchronous motor becomes accessible. In the lower position marked by a green tab (5) the chart motor is switched on and locked into the case. In the upper position indicated by the red tab (6) the motor is switched off, the chopper bar is locked in the up position so that the pointer (2) is free and the chart drive unit is released. The drive unit can then be pulled forward by the two grips (7). The chart can be changed and/or the chart drive speed altered.

## Fitting a new chart

12. Refer to figs. 2 and 3. Open the recorder as described in paras. 10 and 11, the chart drive can now be swung downwards to give access to the chart feed spool (12) and the take up spool (19). These are positioned by means of spindles fitted into slots (13) & (20) and by spring clips (11) & (18). To replace a chart roll press the feed spool (12) slightly upwards and lift it out of the slots ensuring that the chart drive unit has been swung down for ease of access. Remove the expended chart tube, and push a new roll of chart into the spool (perforated edge towards the flange) which is then placed back in the slots with the flange to the left hand side and pressed downwards until locked. Pull about 20 cm (8 in.) in preparation for inserting the V-shaped end of the chart into the take up spool (19). The chart drive unit is now moved to the horizontal position, and the take up spool (19) is removed by gripping it from below, exerting slight forward and downwards pressure removing the spool from slot (20). When the right hand flange has been pulled clear of the spindle, the used chart can be removed. Refit the flange and push the V-shaped end of the new chart into the slot of the take up spool (19). Wind a few turns onto the spool with the face of the chart inwards, the flange and cog wheel should be to the left. Open the chart guides (8), and place the chart over the chopping roller (15), chart drive roller and guide roller (9) inserting the take up spool (19) into its slots (20) gently exerting upward pressure until the roller is locked in position. Return the chart guides (8) to their normal position and check that the chart perforations are correctly located on the drive roller sprockets. Return the chart drive unit into the case locking it into position with the lever (4) in the green (5) position. To set the start time, see para. 13.

## Setting the chart time

13. By using the knurled rim (9) on the upper left hand side of the chart roller the chart can be moved manually. On the left hand side chart guide there is a mark (10) (see fig. 2) at a distance of 60 mm from the recording edge. If the recording chart is to be aligned with the time of day the chart must be moved by use of the knurled rim so that the timing which is 60 mm in advance of the required time, is aligned with the mark, e.g. for a paper speed of 20 mm/h time of day less 3 hours.

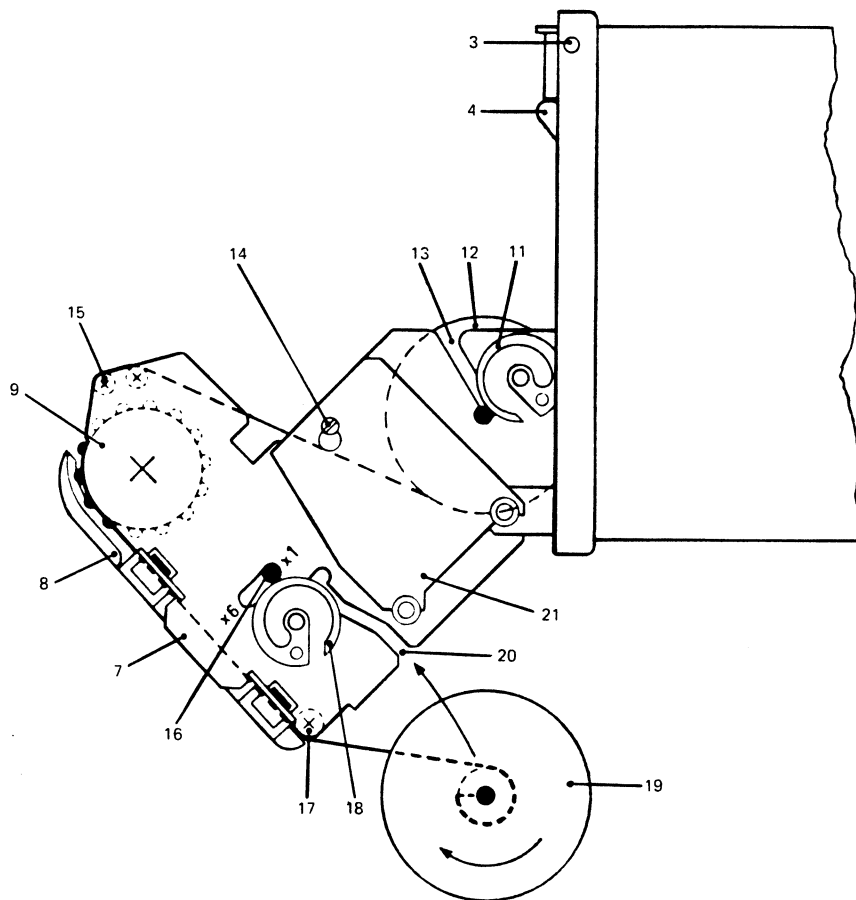


Fig. 3 Fitting a new chart (component location)



### Pointer zero adjustment

14. Should it become necessary to reset the meter zero position, this can be achieved by use of the set zero lever (1). The recording chart should be in position and the input should be switched on.

### Changing the chart speed (see fig. 3)

15. The recorder is normally operated at a chart speed of 20 mm/h, however during servicing and calibration the speed used is 120 mm/h. To select the higher speed open the recorder as described in paras. 10 and 11. Set the speed change lever (16) on the right hand side of the chart drive unit to the X6 position. Return the chart drive unit to the case and proceed with the necessary work. After completion of the repair/calibration, the speed change lever (16) is to be returned to the XI (20 mm/h) position.

## MAINTENANCE

### GENERAL

16. The recorder has been designed to give long and trouble free service and requires practically no routine maintenance. However, it is recommended that after protracted periods of use, the chart drive roller bearings should be lubricated with a resinless oil, the scale chopper bar and pointer should be cleaned with a fine brush to remove any wax deposits, the front cover and plastic shield should be cleaned with a damp soft cloth in order to avoid the build up of a static charge.

17. This chapter contains instructions for dis-assembly, assembly and adjustment as far as they are required for the replacement of defective components. A list of components that are likely to become faulty by wear and tear and other external influences can be found in the topic (-3) element of this publication.

### Removal of cover

### CAUTION . . .

All input connections must be disconnected before the recorder is dis-assembled.

18. The cover may be removed by unscrewing the two slotted nuts at the rear of the instrument. The main frame can then be withdrawn giving access to all the interior parts.

### METER MOVEMENT REPLACEMENT

Note . . .

The meter movement is housed in a separate plastic housing.

19. To replace a defective meter movement proceed as follows:—

- 19.1 Remove instrument cover para. 3.
- 19.2 Locate and remove the movement cover.
- 19.3 Loosen the two (2) scale plate screws and detach the scale plate and its base plate.
- 19.4 Tilt up the chopper bar by approx. 90°, and lift it out of its bearings by lateral displacement.
- 19.5 Note the electrical connections to the movement and disconnect the wires.
- 19.6 Remove the movement securing screws and lift out the movement.
- 19.7 Fit the replacement movement and secure in position using the screws removed at para. 19.6. Apply a small quantity of locking varnish to screw leads.
- 19.8 Reconnect the wires removed at para. 19.5.
- 19.9 Refit the chopper bar into its bearings.
- 19.10 Refit the scale plate and its base plate and secure in position, treat heads of screws with locking varnish.
- 19.11 Refit movement cover.

20. After the fitting of a new meter movement or when the mechanical integrity is in doubt, the adjustments detailed in paras. 21 to 24 inclusive should be performed.

## MECHANICAL ADJUSTMENTS

### Adjustment of movement centre with respect to the scale arc

21. Proceed as follows:—
  - 21.1 Raise the chopper bar and secure in raised position.
  - 21.2 Shift the movement along the longitudinal axis of the instrument until the pointer tip is in line with the scale plane when the pointer is in the mid scale position.
  - 21.3 Adjust as necessary the pointers lateral position to the scale using the four fixing screws of the movement cover plate (see fig. 4).
  - 21.4 Check that the pointer moves parallel to the scale arc and if necessary, re-adjust the lateral position of the movement (see fig. 4).
  - 21.5 Release and lower the chopper bar.

### Adjustment of pointer height

22. Proceed as follows:—

The height of the pointer shall be  $0.5 \text{ mm} \pm 0.1 \text{ mm}$  from the lower edge of the scale, (see figure 5). and not less than 1 mm between positioning of the slotted nuts fitting the meter movement compartment to the carrier plate. Move the pointer across the lateral range of movement to ensure that the distance between pointer and scale, and pointer and recording roller remains constant. (see figure 4).

### Adjustment of Scale

23. With the chart drive running set the pointer to the zero line of the chart. Any error appearing is to be averaged out by laterally moving the scale. The difference between the recording chart zero and the scale zero must not exceed 0.5%.
24. After all adjustments have been carried out, ensure that all screws loosened have been locked in position with varnish.

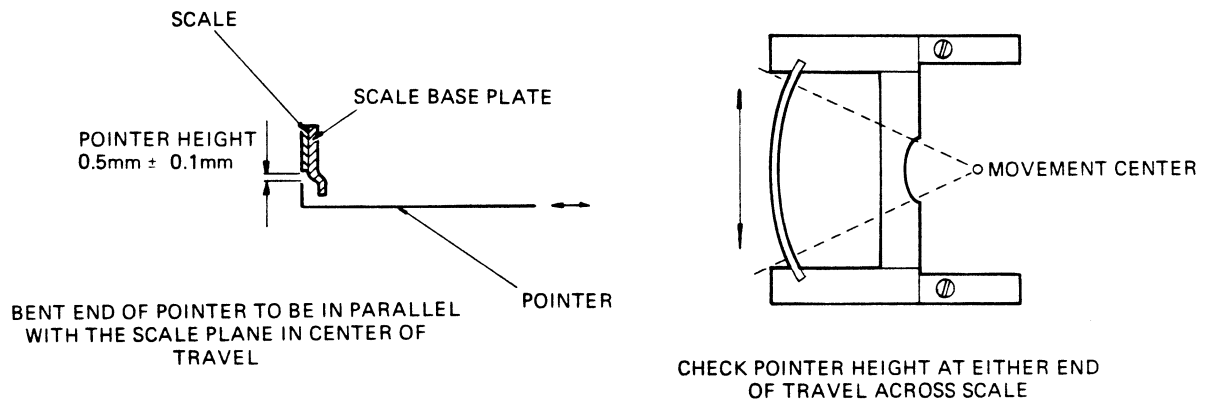
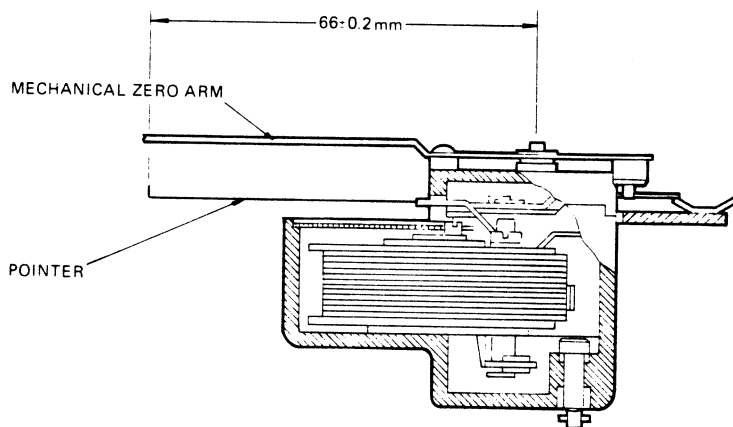


Fig. 4 Pointer adjustment

## Replacement of movement pointer

25. Proceed as follows:—

- 25.1 Remove the movement (para. 19).
- 25.2 Warm up the pointer bridge with heating needle and extract defective pointer together with insulating tube.
- 25.3 Remove all traces of adhesive from the outside of the pointer bridge (fig. 5).
- 25.4 Degrease the insulating tube of the new pointer, smear on adhesive from the back end to about half the length of the insulating tape and insert it into the preheated pointer bridge. Align the  $66 \pm 0.2$  mm.



ADJUSTMENT OF POINTER LENGTH

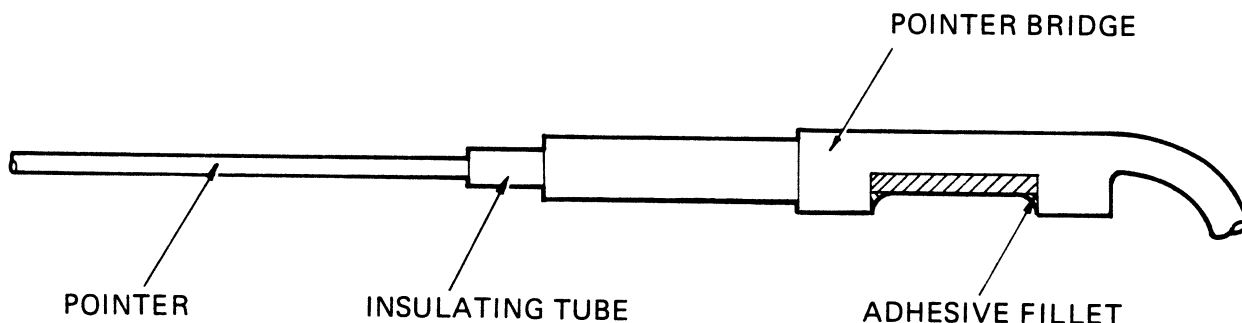


Fig. 5 Replacement of pointer

- 25.5 Fill up pointer bridge with adhesive and allow to harden at room temperature.
- 25.6 Check the balance and correct if necessary.
- 25.7 Refit to recorder and carry out adjustments as necessary (para. 21 through para. 24).

## Adjustment of microswitch

26. The microswitch must be adjusted in such a way that it switches the chart drive on and off correctly, with the respective positions of the switch lever. The excess lift of the switch to be optimally used when in the 'ON' position.

Switch lever UP  
Switch lever DOWN

Chart drive 'OFF'  
Chart drive 'ON'

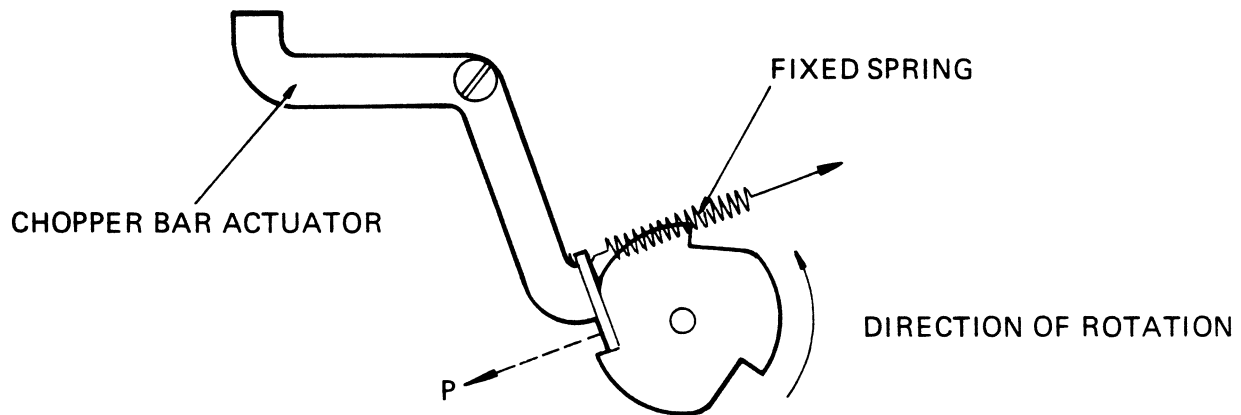
The lever must click in both positions without overcoming resistance.

### Adjustment of chopper bar

27. Fix the pointer in the zero position and ensure that the chopper bar is parallel to the recording roller; if not adjust as necessary by inserting shims under the scale carrier.

### Chopper bar actuator test

28. The force required to lift the striking lever off the cam wheel is to be measured at the bottom end of the resting face. It shall be between 60 - 80g (without the chopper bar mounted). The gliding surface of the cam must be properly lubricated. (See figure 6).



$P = 60 - 80 \text{ gm}$  (without chopper bar mounted)

Fig. 6 Chopper bar actuator test

### Re-fitting the case.

29. Before the case is re-fitted, check that the movement in the moulded case is in its proper position with respect to the movement carrier plate. The distance between the movement casing and the carrier plate must be approximately 1mm.

## PREFACE

1. Material issued for inclusion in this Topic 2, should be filed in the following order:-
  - 1.1 Preface (this page)
  - 1.2 General orders:  
These leaflets are identified by the letters 'GO' and should be filed in numerical order.
  - 1.3 Equipment modification list  
This list shows all MOD-approved modifications affecting the subject of this Topic 2, including those for which leaflets will not be issued. The list will be re-issued periodically. As modification leaflets are inserted, suitable entries should be recorded in the applicable columns of this list.
  - 1.4 Modification Leaflets  
Leaflets bear numbers allotted in sequence as the leaflets are sent to press and should be filed in numerical order.
2. When a complete leaflet or individual leaf is re-issued in amended form, the alterations are indicated by triangles, thus ► — — — ◄ to show where text has been changed.

MONITOR AIR SAMPLING (MODEL ALPHA 3)

and

PUMP TYPE RAP 1

EQUIPMENT MODIFICATION LIST

MOD. Mod. No.	Contractor Mod. No.	Mod.Plates Strike No.	Modification Title	Class	Leaflet No.

EQUIPMENT MODIFICATION LIST

## PREFACE

### Introduction

1. This Illustrated Parts Catalogue (IPC) is designed as an aid to the identification of component parts or assemblies of parts of the equipment and to provide the information necessary for the demanding of spares.
2. This IPC may list some or all of the parts comprising the equipment concerned but only those parts given a NATO Stock Number will normally be available as spares. Should there be a requirement for an item not assigned a number, demands may be submitted quoting the code number of publication, item number, figure reference and item name. Where a manufacturer's number is known, this should also be quoted.

### Quantities

3. The figure in the 'Number-off' column specifies the quantity used, in one off of the next higher assembly.

### Demands

4. Demands are to be submitted in accordance with current instructions contained in AP830, Vol 1 (7th Edn), part 2B, leaflet BAG7/1, 2nd Issue. For Test Equipment, the terms of AP3413, Vol 1, Part 1 must also be complied with.

### Modification state

5. When appropriate, a list at the front of each chapter or sub-chapter will indicate the modification numbers which have been incorporated in this IPC.

### Amendments

6. Amendments to this IPC will be published from time to time. They will be numbered consecutively and the 'Amendment Record' is to be completed for each amendment embodied.

### Abbreviations

7. See separate list at the end of preface.

### Annotations

8. AR..... in the 'number-off' column, indicates that the quantity is 'as required'.  
Cct Ref .. indicates circuit reference.  
Cos/Los .. indicates Class of Store and Line of Servicing.  
NI ..... in the Fig-item column, indicates item not illustrated.  
Ref ..... in the 'number-off' column, indicates item shown for reference purposes only.

SOT ..... in the item description column, indicates that component parameter is selected on test e.g. resistor ohmic value to be selected from a range of listed values.

Cal ..... in the left hand margin, indicates that in equipments subject to re-calibration, replacement of such items may make re-calibration of the equipment necessary prior to Service use.

### Indentation

9. Items are listed in a logical order of assembly/dis-assembly and are to show the relationship of the item using the 'Dot' system viz:-

#### MAIN ASSEMBLY

Attaching parts for main assembly

. FIRST LEVEL OF BREAKDOWN (sub-assembly or detail part of main assembly)

. Attaching parts for first level

.. SECOND LEVEL OF BREAKDOWN (sub-sub-assembly or detail part of sub-assembly)

.. Attaching parts for second level

... THIRD LEVEL OF BREAKDOWN (sub-sub-sub-assembly or detail part of sub-sub-assembly)

... Attaching parts for third level

#### Note to Royal Air Force users

10. a. Reporting of Unsatisfactory Features. Observations on and suggested amendments to this publication should be reported in accordance with AP100B-01 Order Nos. 0504/0575 to the Ministry of Defence AFD, SM21 (RAF) through Command Headquarters. Additionally, user formations may consider, after experience with the equipment concerned, that the information available at the time of printing of this publication could be revised. Points covered might include, for example:-

(i) Recommended alterations to lines of servicing.

(ii) Errors in item description and/or referencing.

(iii) Omission of an item or items.

b. Class of Store and Maintenance Code. In Chapter 2, against each item is shown the class of store, with the addition of a numeral viz: P1, L2, C3. The numeral indicates the lowest line of servicing at which the item is normally available as a spare except as in sub-para (c) below.



c. Detail part spares ranged for third line may be demanded for replacement at first or second line to meet specific repair tasks provided they can be fitted without the provision of third line tools and test equipment.

d. Class P stores are controlled by the appropriate Ministry of Defence Supply Management Branch and are not to be demanded unless specially authorised. Items in this class are normally exchanged on a one-for-one basis between the three lines of servicing for repair purposes.

e. Security Graded Equipment. Complete equipments, or any part thereof, having a security grading of Restricted or higher, are not to be disposed of to the public without the prior consent of the Ministry of Defence.

### Publications

11. a. Associated Air Publications.....

b. Queries relating to this publication should be forwarded to the Publication Management Authority quoting the Reference shown on the front cover, whose address is:-

Ministry of Defence (AFD)  
SM21(RAF)  
Block 3, Government Buildings  
St. George's Road  
Harrogate  
North Yorks  
HG2 9DB

1. Some of the items, or the materials listed in this publication are hazardous to health and/or safety and therefore require special handling. Other items, although not posing a hazard to health or safety, may be damaged unless specially handled.

2. Such items are identified in the text of Chapters 2 by adding, at the end of the Item Description, a triangle with the appropriate Warning number inside. Details of the particular hazards and/or handling requirements are listed below.

<u>3. WARNING NO.</u>	<u>HAZARD/HANDLING</u>
1	<u>BERYLLIUM/BERYLLIA</u> This item contains Beryllium/Beryllia which, under certain circumstances can give off toxic fumes or dust. Handle in accordance with AP119A-0513-1 Chapter 4-1.
2	<u>CADMIUM</u> This item contains cadmium which, when subjected to some processes or conditions, gives off toxic fumes and/or dust. Handle in accordance with AP100B-01. Order No. 1703.
3	<u>PTFE</u> This item contains PTFE which, when heated or machined, gives off toxic fumes or dust. Handle in accordance with AP110B-01. Order No.1703.
4	<u>MERCURY</u> This item contains mercury which is poisonous and corrosive. Handle in accordance with AP100B-01. Order No. 1701.
5	<u>RADIO ACTIVE MATERIAL</u> This item contains Radio Active Material. Handle, store and dispose in accordance with AP4687A, Vol 2.
6	<u>CATHODE RAY TUBE (CRT)</u> The risk of implosion is greatly increased if the CRT glass is scratched or scored. Handle in accordance with AP100B-01. Order No. 1801.
7	<u>CONFORMAL COATING</u> This item has a conformal coating. When worked, this coating may give off toxic fumes or dust. Handle in accordance with current instructions.*

WARNING NO.HAZARD/HANDLING

- 8            STATIC SENSITIVE DEVICE  
This item is static sensitive. To avoid it being damaged handle in accordance with BS5783\*.
- 9            MAGNET  
This item contains magnetic material which may require special handling, storage or despatch. Handle in accordance with JSP(F)395.
- 10          PINPOINT BEARINGS  
This item contains pinpoint bearings which may be damaged if left at rest in one position for prolonged periods. Exercise regularly in accordance with current instructions\*.
- 11          LITHIUM BATTERY  
This item contains Lithium and a variety of hazardous chemicals. If permitted to vent, can release an irritant gas or a corrosive substance and may be subject to spontaneous ignition. Handle, store and dispose of in accordance with DCI/GEN/3/84\*.
- 12          ASBESTOS/MAN MADE MINERAL FIBRES  
This item contains asbestos/man made mineral fibres. These substances, when machined or worked, can release dust which, if inhaled, is hazardous to health. Handle and dispose of in accordance with AP119A-0513-1 Chapters 3-1 and 3-2.
- 13          IONIZED OZONE  
This equipment utilises heat operated recording paper which gives off slightly toxic fumes. Use only as instructed\*.
- 14          POLYCHLORINATED BIPHENOLS  
This fluid used in capacitors and transformers can produce toxic fumes. Handle, store and dispose of in accordance with DCI/GEN 84/83\*.
- 15          VITON 'O' RING  
Viton is a fluoroelastomer i.e. it is a synthetic rubber-like material containing fluorine. It is commonly used for gaskets 'O' rings and seals of various kinds. Although VITON is the most well known fluoroelastomer there are others including those using trade names 'Fluorel' and 'Tecomoflon'. When used under their design conditions they are perfectly satisfactory and safe. However if exposed to a temperature of 400°C or higher, the material does not burn but decomposes, and one of the products formed is hydrofluoric acid. This acid is extremely corrosive and is almost impossible to remove once it contaminates the skin. Action in accordance with BR2000(20) Article 0812\*.

\* Wording will be amended to refer the user of this publication to the appropriate safety and/or engineering order when published.

ABBREVIATIONS

A .....	Ampere	BSP.Tr.,EXT	British Standard Pipe, Taper, External, Jointing Thread
A/A .....	Any acceptable		
aac .....	Automatic Amplitude Control	BSP.Tr.INT	British Standard Pipe, Taper, Internal, Jointing Thread
ac .....	Alternating current		
A/F .....	Across Flats	BSW .....	British Standard Whitworth Thread
A/F .....	Audio Frequency		
AFC .....	Automatic Frequency Control	Btu .....	British Thermal Unit
Ag .....	Silver	C .....	Capacitance
AGC .....	Automatic Gain Control	C .....	Celsius (Centigrade)
Al .....	Aluminium	c .....	Centi (one hundredth)
Al B .....	Aluminium Bronze	Ca .....	Calcium
AM .....	Amplitude Modulation	cap.hd .....	Capstan Head
AMC .....	Automatic Modulation Control	ccw .....	Counterclockwise
apc .....	Automatic Phase Control	Cd .....	Cadmium
Ar .....	Argon	ch hd .....	Cheese Head
As .....	Arsenic	CI .....	Cast Iron
asb .....	Asbestos	circ .....	Circumference
assy .....	Assembly	CL .....	Centre Line
ATC .....	Automatic Tuning Control	Cl .....	Chlorine
Au .....	Gold	Cm .....	Curium
avg .....	Average	Co .....	Cobalt
AWG .....	American Wire Gage	coeff .....	Coefficient
b .....	breadth	c of g .....	Centre of Gravity
BA .....	British Association Screw Thread	conc .....	Concentrated
Ba .....	Barium	cp .....	Candle Power
BDC .....	Bottom Dead Centre	Cr .....	Chromium
Be .....	Beryllium	cres .....	Corrosion Resistant Steel
bhp .....	Brake Horse Power	crt .....	Cathode Ray Tube
Bi .....	Bismuth	Cs .....	Caesium
br .....	brass	csk .....	Countersunk
BSF .....	British Standard Fine Thread	c/s .....	Cycles per Second (see also Hertz)
BSP.F .....	British Standard Pipe, Fastening Thread	C/sq m .....	Coulomb per Square Metre
BSP.L .....	British Standard Pipe, Longscrew Thread	CT .....	Centre Tapped
BSP.PL .....	British Standard Pipe, Parallel, Jointing Thread	c to c .....	Centre to Centre
		Cu .....	Copper
		cu .....	Cubic
		CV .....	Common Valve
		CW .....	Continuous Wave

CV .....	Common Valve	enam .....	Enamelled
CW .....	Continuous Wave	EP .....	Extreme Pressure
cw .....	Clockwise	eV .....	Electronvolt
c/w .....	Complete with	exp .....	Expansion
cwt .....	Hundredweight	ext .....	External
cwt .....	Hundredweight (long) (112 pounds avoirdupois)	F .....	Fahrenheit
d .....	Deci (one tenth)	F .....	Farad
da .....	Deca (ten)	f .....	Frequency
dB .....	Decibel	Fe .....	Iron
dBm .....	Decibel relative to one milliwatt	fil .....	Filament
dBV/m .....	Decibel relative to one volt metre	flex .....	Flexible
dBW .....	Decibel relative to one watt	fl oz (UK) .	Fluid Ounce (UK)
dc .....	Direct Current	fl oz (US) .	Fluid Ounce (US)
dcg .....	Decigram (1/10th gram)	FM .....	Frequency Modulation
deg .....	Degree	FSD .....	Full Scale Deflection
deg A .....	Degree Angstrom	fsk .....	Frequency-shift Keying
deg C .....	Degree Celsius	ft .....	Foot
deg F .....	Degree Fahrenheit	g .....	Acceleration due to gravity (local acceleration of free fall)
deg K .....	Degree Kelvin	G .....	Giga (one thousand million)
deg R .....	Degree Rankine	g .....	Gramme
DF .....	Direction Finding	Ga .....	Gallium
doz .....	Dozen	gal .....	Gallon
dp .....	Double-Pole	galv .....	Galvanised
dpdt .....	Double-Pole, Double- Throw	gc/s .....	Gigacycle per Second
dpst .....	Double-Pole, Single- Throw	Gd .....	Gadolinium
dsb .....	Double Sideband	Ge .....	Germanium
dt .....	Double-Throw	gr .....	Grain
dwg .....	Drawing	H .....	Hydrogen
dyn .....	Dyne	h .....	Hecto (one thousand)
e.g. ....	For Example	h .....	Height
EHF .....	Extrememely High Frequency	H .....	Henry
ehp .....	Effective Horse Power	h .....	High
eht .....	Extra High Tension	h .....	Hour
emf .....	Electrmotive Force	hd .....	Head
		He .....	Helium
		het .....	Heterodyne
		hex .....	Hexagon(al)

HSS	High Speed Steel	m	Metre
ht	High Tension	m	Milli (one thousandth)
HTP	High Test Peroxide	mA	Milliamperere
HTS	High Tensile Steel	mag	Magneto
Hz	Hertz (see also c/s)	max	Maxium
I	Iodine	mb	Millibar
id	Inside Diameter	Mc	Megacycle
IF	Intermediate Frequency	mcr	Maxium Continous Rating
ihp	Indicated Horse-power	MCW	Modulated Continuous Wave
In	Indium	mep	Mean Effective Pressure
in	Inch	Mc/s	Megacycle per second
int	Internal	MeV	Mega Electronvolt
int fr	Internally Frosted	mfg	Manufacturing
Ir	Iridium	mfr	Manufacturer
J	Joule	Mg	Magnesium
K	Potassium	min	Minimum
k	Kilo (one thousand)	min	Minute (time)
kc	Kilocycle	Mk	Mark
keV	Kilo Electronvolt	MKSA	Metre, Kilogramme, Second, Ampere (system of units)
kg	Kilogramme (mass)	ml	Millilitre
km	Kilometre	mm	Millimetre
Kr	Krypton	mmf	Magnetomotive Force
kV	Kilovolt	mm Hg	Millimetre of Mercury (conventional)
kVA	Kilovolt-Ampere	Mn	Manganese
kW	Kilowatt	Mn B	Manganese Bronze
l	Litre	mp	Melting Point
lb	Pound (avoirdupois) (mass)	MS	Mild Steel
lbf	Pound - force	M/S	Metre per Second
LF	Low Frequency	mtd	Mounted
lg	Length (long)	mtg	Mounting
lh	Left Hand	MTI	Moving Target Indicator
Li	Lithium	MTS	Metre, Tonne, Second (system of Units)
liq pt (US)	Liquid Pint (US)	n	Nano (one thousand-millionth)
Litz	Litzendraht (wire)	N	Newton
Lm	Lumen	N	Number of Turns
log	Logarithm (ic)	N	Nitrogen
Lu	Lutetium		
lx	Lux		
M	Mega (one million)		

N .....	Newton	PTFE .....	Polytetrafluoroethylene
N .....	Number of Turns	Pu .....	Plutonium
N .....	Nitrogen	PVC .....	Polyvinyl Chloride
N/A .....	Not Applicable	qt .....	Quart
Na .....	Sodium	qtr .....	Quarter
Nb .....	Niobium	qty.....	Quantity
NC .....	American Coarse Thread	R .....	Rontgen
Nd .....	Neodymium	Ra .....	Radium
Ne .....	Neon	rad .....	Radian
NEF .....	American National Extra Fine Thread	rad .....	Radius
neg .....	Negative	rad/s .....	Radian per Second
NF .....	American National Fine Thread	rd .....	Round
Ni .....	Nickel	RES .....	Resistance
NP .....	Nickel Plated	rev/min ....	Revolutions per Minute
Np .....	Neptunium	RF .....	Radio Frequency
O .....	Oxygen	Rh .....	Rhodium
o/a .....	Over-all	rh .....	Right Hand
od .....	Outside Diameter	rms .....	Root Mean Square
ohms/V .....	Ohms per Volt	S .....	Sulphur
oz .....	Ounce (avoirdupois)(mass)	s .....	Second(time)
P .....	Phosphorous	Sb .....	Antimony
p .....	Pico (one million- millionth)	SHF .....	Super High Frequency
Pb .....	Lead	Si .....	Silicon
pf .....	Power Factor	Sn .....	Tin
phos B .....	Phosphor Bronze	sol .....	Soluble
pkg .....	Package(d)	sp .....	Single-Pole
P/O .....	Part Of	spdt .....	Single-Pole, Double- Throw
PORM .....	Plus or Minus	spst .....	Single-Pole, Single- Throw
p-p .....	Peak to Peak	Sr .....	Strontium
ppp .....	Peak Pulse Power	ssb .....	Single Sideband
ppm .....	Part per Million	st .....	Single Throw
PRF .....	Pulse Recurrence Frequency	std .....	Standard
p/s .....	Pulse per Second	stp .....	Standard Temperature and Pressure
psi .....	Pound-Force per Square inch	SWG .....	Standard Wire Gauge
Pt .....	Platinum	SWL .....	Safe Working Load
pt .....	Pint	t .....	Tonne
		Ta .....	Tantalum
		TDC .....	Top Dead Centre

thk	Thick(ness)	Xe	Xenon
Ti	Titanium	yd	Yard
tn	Ton (long) (2240 pounds avoirdupois)	Zn	Zinc
tpi	Threads Per Inch	Zr	Zirconium
TS	Tensile Strength		
tub.	Tubular		
U	Uranium		
u	Micro (one millionth)		
uH	Microhenry		
UHF	Ultra High Frequency		
UNC	Unified Coarse Thread		
UNEF	Unified Extra Fine Thread		
UNF	Unified Fine Thread		
unmtd	Unmounted		
UNS	Unified Special Thread		
unthd	Unthreaded		
u-sec	Microsecond		
u/w	Used With		
V	Vanadium		
V	Volt		
vac	Vacuum		
VAr	Reactive Volt Ampere		
var	Variable		
VHF	Very High Frequency		
vol	Volume		
VSWR	Voltage Standing Wave Ratio		
vu	Volume Unit		
W	Watt		
W	Tungsten		
w	Width		
Wb	Weber		
Wh	Watt Hour		
Whit	Whitworth		
wkg	Working		
w/o	Without		
wp	Working Pressure		
wt	Weight		
X	Magnification		

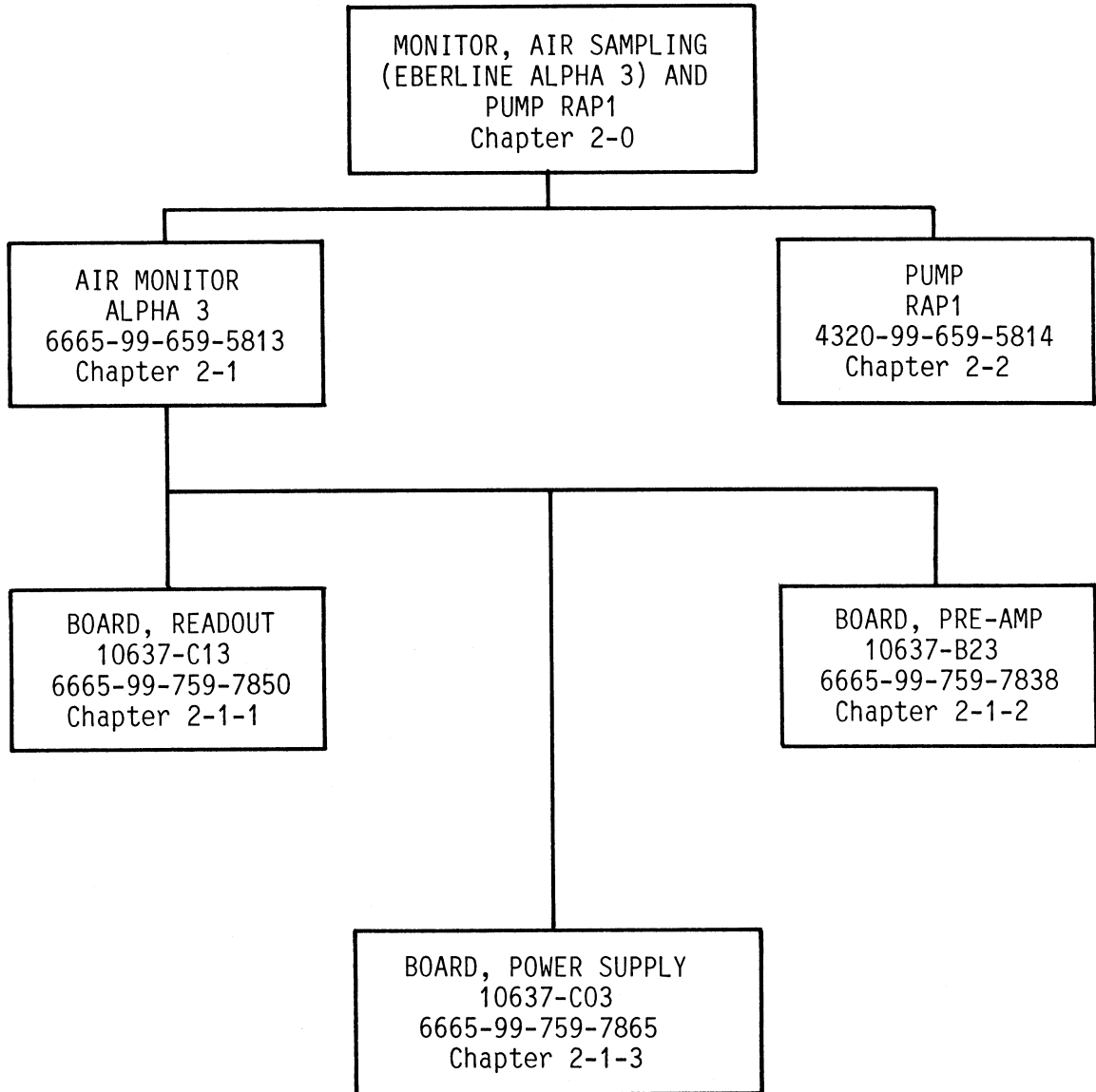


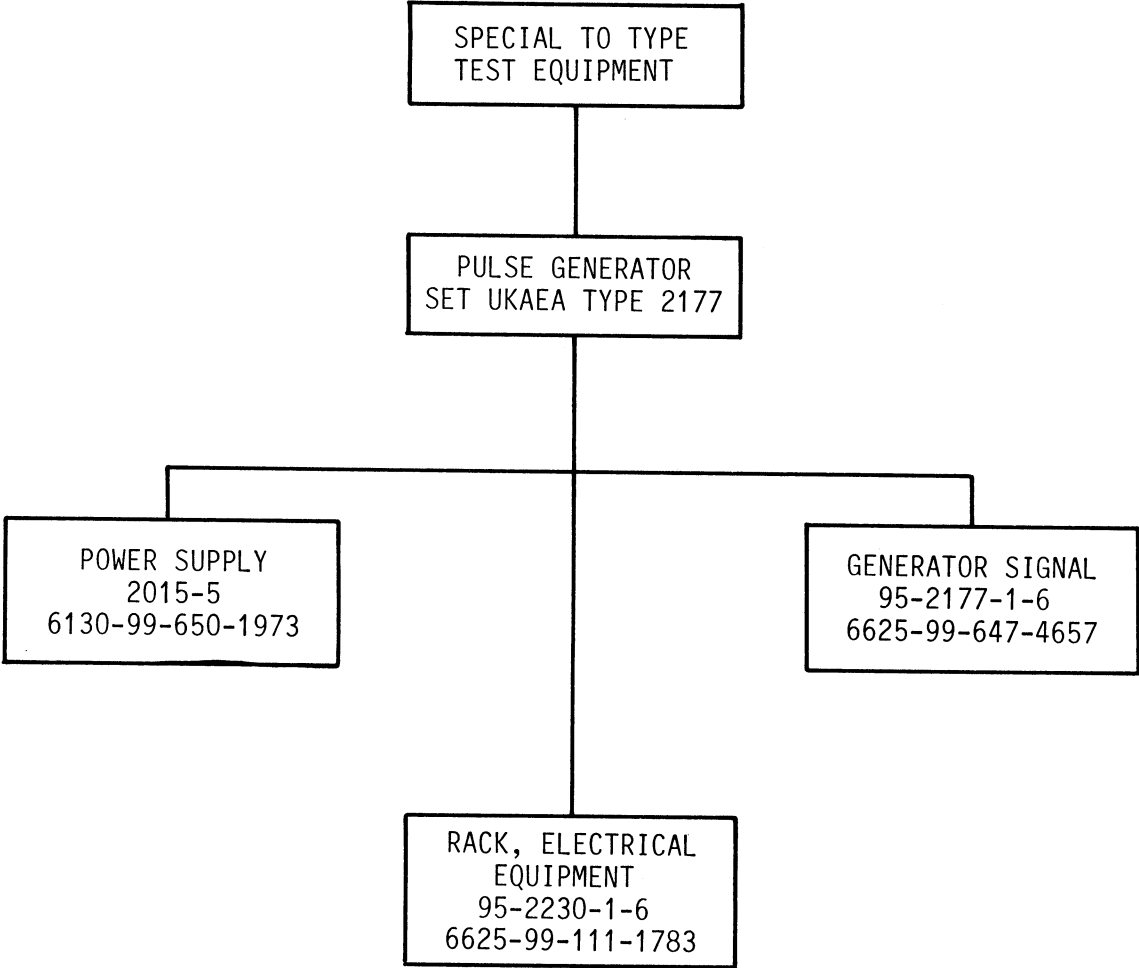
## Chapter 1

### INDEX OF ASSEMBLIES AND SUB ASSEMBLIES

NOTE:-

Unless otherwise stated, all drawing numbers quoted in this publication refer to:- Thermo-Electron Div of Eberline Corp (UK) or Eberline Instrument Corp (USA)





Item	Man. Code RN A RAF	NATO Stock No./ Catalogue No.	Item Name	Maker's Part No/ Drawing No.	Location in Chap 2 or Separate Sched. No.
1	6Z	6665-99-659-5813	AIR MONITOR	ALPHA 3 (10637-D16)	2-1
2	6Z	6665-99-759-7865	BOARD, POWER SUPPLY	10637-C03	2-1-3
3	6Z	6665-99-759-7838	BOARD, PRE-AMP	10637-B23	2-1-2
4	6Z	6665-99-759-7850	BOARD, READOUT	10637-C13	2-1-1
5		-	MONITOR, AIR SAMPLING (EBERLINE ALPHA 3) AND PUMP RAP1	-	2-0
6	6Z	4320-99-659-5814	PUMP  Note... STTE below is shown for information purposes only	RAP1	2-2
7		-	PULSE GENERATOR comprising:-	2177	-
8	6Z	6130-99-650-1973	POWER SUPPLY	UKAEA 2015-5	-
9	6Z	6625-99-647-4657	GENERATOR, SIGNAL	UKAEA 95-2177-1-6	-
10	6Z	6625-99-111-1783	RACK, ELECTRICAL EQUIPMENT	UKAEA 95-2230-1-6	-

Chapter 2-0

PARTS LIST

MONITOR, AIR SAMPLING (EBERLINE ALPHA 3) AND PUMP RAP1

(G.A. Drawing No.N/A)





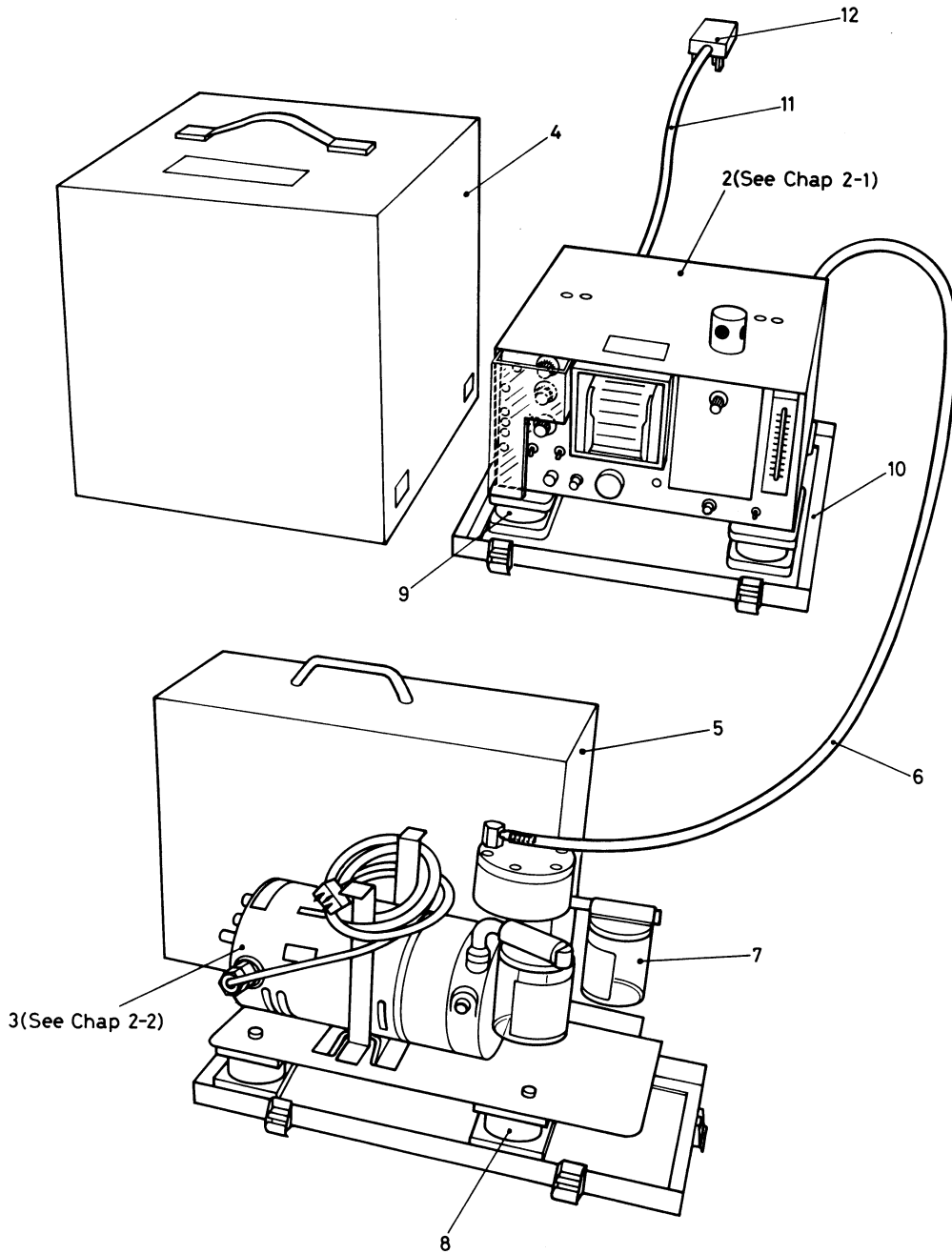


Fig 1 Monitor air sampling (Eberline Alpha 3) and pump RAP 1



Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-1		-	monitor, air sampling and pump (eberline alpha 3) and pump type RAP1		Ref
2		6665-99-659-5813	. AIR MONITOR (w/no flow alarm) Note... For spares details refer to Chapter 2-1		1
3		4320-99-659-5814	. PUMP (Regulated Air type) Note... For spares details refer to Chapter 2-2		1
4		6665-99-664-2457	. CASE, CONTROL-MONITOR		1
5		6665-99-664-2458	. CARRY CASE FOR REGULATED AIR PUMP		1
6		6665-99-759-7874	. HOSE 3/8in. id		6ft
7		6640-99-659-5817	. PAPER, FILTER glass microfibre; 25mm		10
8		5340-99-533-0285	. MOUNT, RESILIENT Note... Used with item 3	C2	4
9		5340-99-638-9806	. MOUNT, RESILIENT Note... Used with item 2	C2	4
10		4320-99-759-7878	. NEOPRENE 1/4in. thk Note... Used with items 4 & 5	C2	AR
11		6665-99-759-7873	. MAINS LEAD	C2	1
12		5935-99-940-1682	. . CONNECTOR, FREE, ELECTRICAL	C1	1

Chapter 2-1

PARTS LIST

AIR MONITOR  
6665-99-659-5813

(G.A. Drawing No.10637 D16)





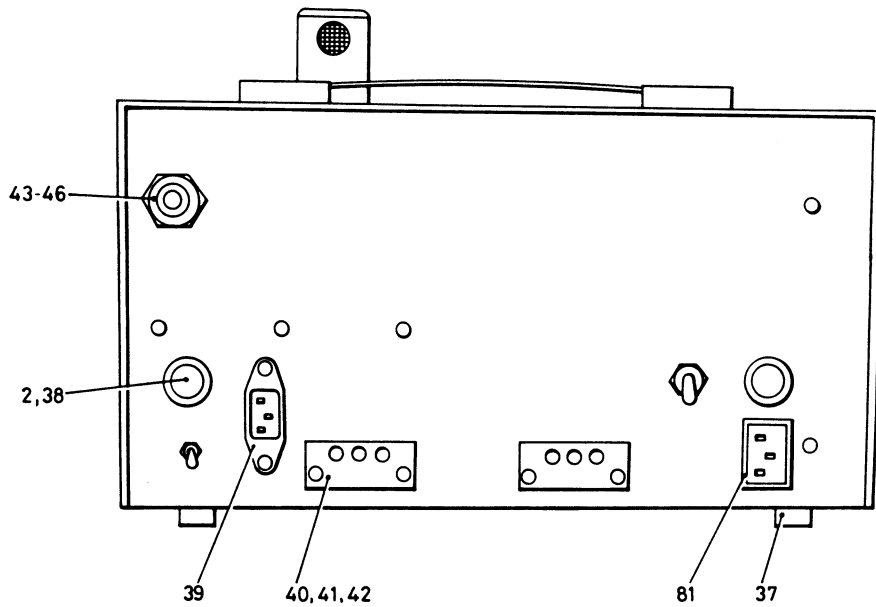
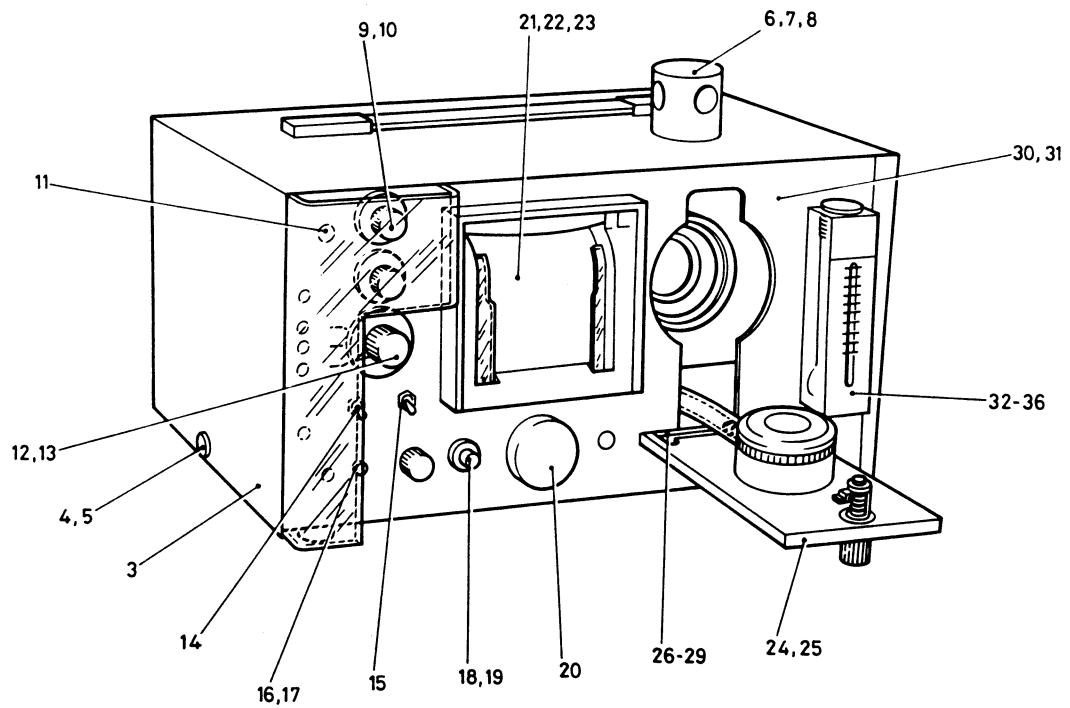


Fig 1 Air monitor

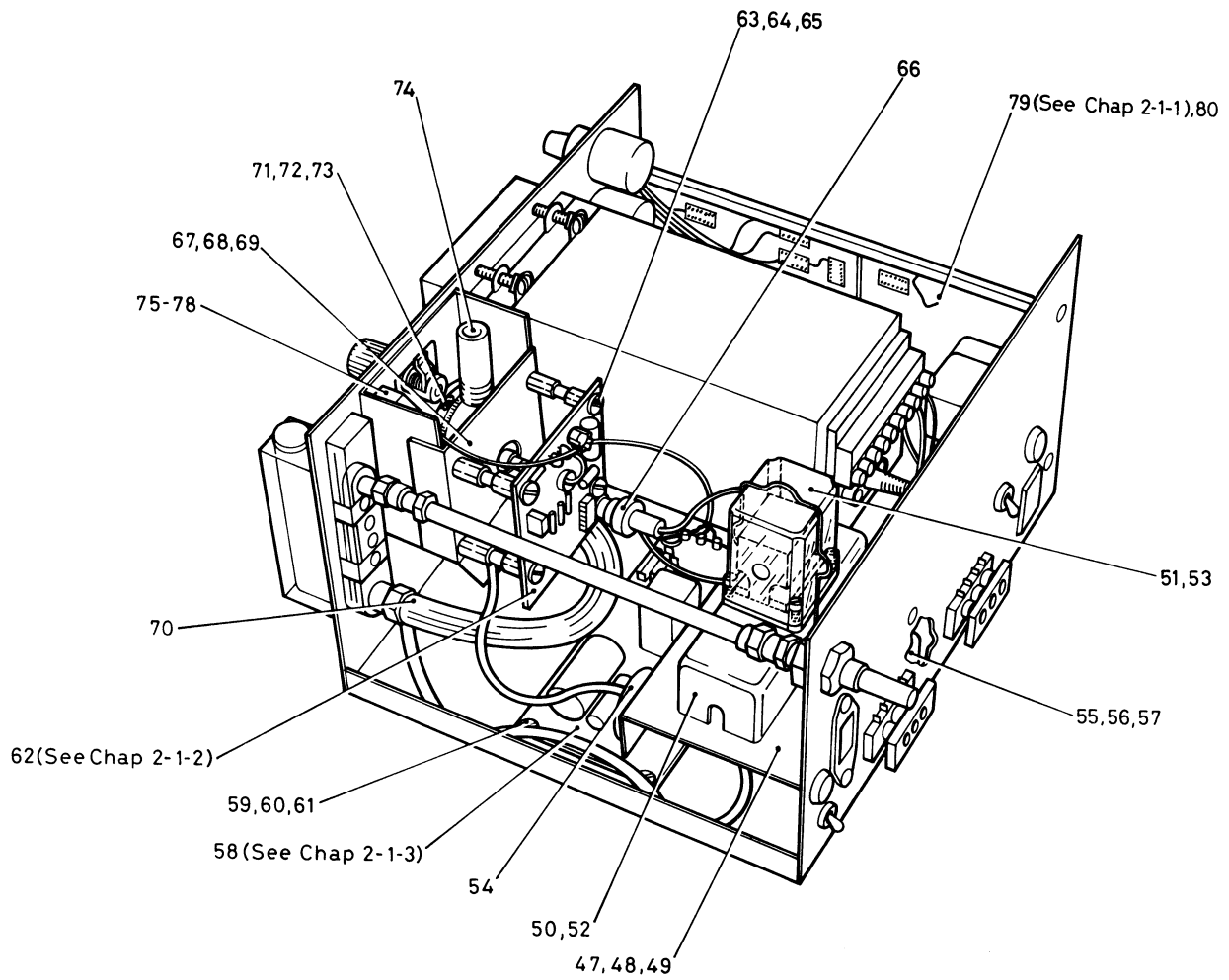


Fig 2

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-1		6665-99-659-5813	AIR MONITOR		Ref
2	F201	5920-00-284-9455	. FUSE LINK CARTRIDGE 125mA	C1	1
3		6665-99-253-6012	. COVER	C2	1
4		5305-99-759-7814	. SCREW, MACHINE	C2	2
5		5330-00-876-0086	. PACKING, PREFORMED	C2	2
6		6665-99-759-7826	. CAP, AIR INTAKE	C2	1
7		6665-99-759-7827	. SCREEN AIR INTAKE	C3	1
8			. RING, SEALING	C3	1
9		5355-99-112-2414	. DIAL, CONTROL	C2	2
10	R10 11	5905-99-529-3391	. RESISTOR, VARIABLE LINEAR PRECISION 1k $\pm$ 5%	C3	2
11	DS3 201	5961-00-261-7297	. LIGHT EMITTING DIODE	C3	2
12		5355-00-063-7912	. KNOB	C2	1
13	S2	5930-00-755-5929	. SWITCH, ROTARY	C3	1
14	S1	5930-99-110-6539	. SWITCH, TOGGLE	C3	1
15	S3 201	5930-00-902-4150	. SWITCH, TOGGLE	C3	2
16	S4	5930-00-729-8720	. SWITCH, PUSH	C3	1

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-17	R32	5905-00-581-1393	. RESISTOR, VARIABLE 2.5k $\pm$ 10%	C3	1
18	XDS1 5	5930-01-272-1431	. SWITCH, PUSH	C3	2
19	DS1	6240-00-763-7744	. LAMP, FILAMENT	C1	1
20	DS2	6350-00-102-4210	. BUZZER	C3	1
21			. RECORDER	C3	1
22		6665-99-766-0046	. . CHART ROLL	C1	1
23		NP	. . motor 312846300	C3	1 Ref
24		6665-99-253-6013	. DOOR	C3	1
25		5340-00-857-6217	. FASTENER, PAWL	C1	1
26		5340-99-759-7815	. HINGE	C3	1
27		5315-99-759-7816	. PIN (Hinge)	C3	1
28		5305-99-759-7817	. SCREW, MACHINE 4-40 UNC x 1/4in.	C3	2
29		5305-99-759-7818	. SCREW, SET socket hd; 4-40 UNC x 1/8in.	C3	2
30		5305-99-759-7819	. SCREW, MACHINE 0-80 UNC x 1/2in.	C3	1
31		5310-99-759-7820	. NUT, PLAIN, HEXAGON	C3	1
32		6680-01-314-3570	. METER, FLOW RATE, INDICATING	C3	1



Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-33		5310-99-759-7822	. SCREW, MACHINE 10-32 UNF x 5/16in.	C3	2
34		5310-99-759-7823	. WASHER, SELF-LOCKING 10 UNF	C3	2
35		-	. spacer 10546A38	-	1 Ref
36		-	. hose connector 5/16in. hose to 1/8 NPT	-	1 Ref
37		5340-99-759-7824	. BUMPER, FEET	C2	4
38 (1)	XF201	5920-00-709-1149	. FUSEHOLDER  OR	C3	1
38 (2)	XF201	5920-99-650-1876	. FUSEHOLDER	C3	1
39 NI		5935-99-653-8411	. CHASSIS PLUG WITH FILTER	C3	1
1-40		-	. cover, barrier strip 10546-A20	-	2 Ref
41		-	. barrier strip 3 way 14303-56	-	2 Ref
42		5305-99-759-7825	. SCREW, MACHINE 4-40 UNC x 3/4in.	C3	4
43		-	. hose barb 1/8in. hose KF0502PS	-	1 Ref
44		-	. bulkhead adaptor 1/8in. NPT	-	2 Ref
45		-	. adaptor pipe 5/16in. to 1/8in. NPT	-	2 Ref
46		6665-99-766-0047	. TUBING, PLASTICS 3mm id x 6mm od	C3	A/R

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
2-47		NP	. ac shield	-	1 Ref
48		5305-99-759-7830	. SCREW, MACHINE 4-40 UNC x 3/16in.	C3	3
49		5310-99-755-7868	. WASHER, SELF-LOCKING 4 UNC	C3	3
50		-	. no flow alarm board FAR1	-	Ref
51	R1	5945-99-653-7558	. . RELAY, ELECTROMAGNETIC	C3	1
52		6625-99-652-5629	. . COVER, RELAY TERMINALS	C3	1
53		5935-99-646-1994	. . SOCKET, RELAY	C3	1
54		5930-01-262-3507	. SWITCH, PRESSURE	C3	1
55	T201		. TRANSFORMER	C3	1
56		5305-99-759-7829	. SCREW, MACHINE 6-32 UNC x 5/16in.	C3	2
57		5310-99-759-7834	. NUT 6-32 UNC	C3	2
58		6665-99-759-7865	. BOARD, POWER SUPPLY  Note... For spares details refer to Chapter 2-1-3	C3	1
59		5305-99-759-7867	. SCREW 4-40 UNC x 5/16in.	C3	4
60		5310-99-759-7868	. LOCKWASHER 4 UNC	C3	4
61 (1)		5365-99-759-7866	. SPACER 4-40 UNC x 3/8in. lg  OR	C3	4
61 (2)		5310-00-021-7157	. NUT, PLAIN, ROUND	C3	4

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
2-62		6665-99-759-7838	. BOARD, PRE-AMP Note... For spares details refer to Chapter 2-1-2	C3	1
63		5305-99-759-7839	. SCREW 4-40 UNF x 1-1/8in.	C3	4
64		5310-99-759-7868	. LOCK WASHER 4 UN	C3	4
65		5310-00-963-9950	. NUT, PLAIN, HEXAGON 4-40 UNC x 1/2in.	C3	8
66		5995-99-199-4074	. CABLE ASSEMBLY, RADIO FREQUENCY		1
67		NP	. rear detector bracket 10631-C09	-	1 Ref
68		NP	. screw 4-40 UNC x 5/16in.	-	4 Ref
69		5310-99-759-7868	. LOCKWASHER 4 UNC	C3	4
70		6665-99-759-7831	. HOSE, DETECTOR	C3	1
71		6630-01-302-1894	. DETECTOR, AIR ELECTRONIC	C3	1
72		5305-99-759-7828	. SCREW 6-32 UNC x 5/16in.	C3	2
73			. SCREW 6-32 UNC x 9/16in.		2
74		NP	. air intake stack 10637-A10	-	1 Ref
75		5930-99-083-2414	. SWITCH (door interlock)		1
76		5305-99-102-0936	. SCREW, MACHINE 2-56 UNC x 1/2in.	C3	2

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
2-77		5310-99-759-7837	. WASHER 2 UN	C3	2
78		5310-99-759-7835	. NUT 2-56 UNC	C3	2
79		6665-99-759-7850	. BOARD READOUT  Note... For spares details refer to Chapter 2-1-1	C3	1
80		5305-99-759-7830	. SCREW 4-40 UNF x 5/16in.	C3	6
1-81		5935-99-801-9333	. CONNECTOR, FIXED, ELECTRICAL  Note... connects with item 2, Chapter 2-2	C3	1

Chapter 2-1-1

PARTS LIST

BOARD, READOUT  
6665-99-759-7850

# RECORD OF MODIFICATIONS INCORPORATED IN THIS CHAPTER

MOD. No.	Amdt. No.	MOD No.	Amdt. No.	MOD No.	Amdt. No.



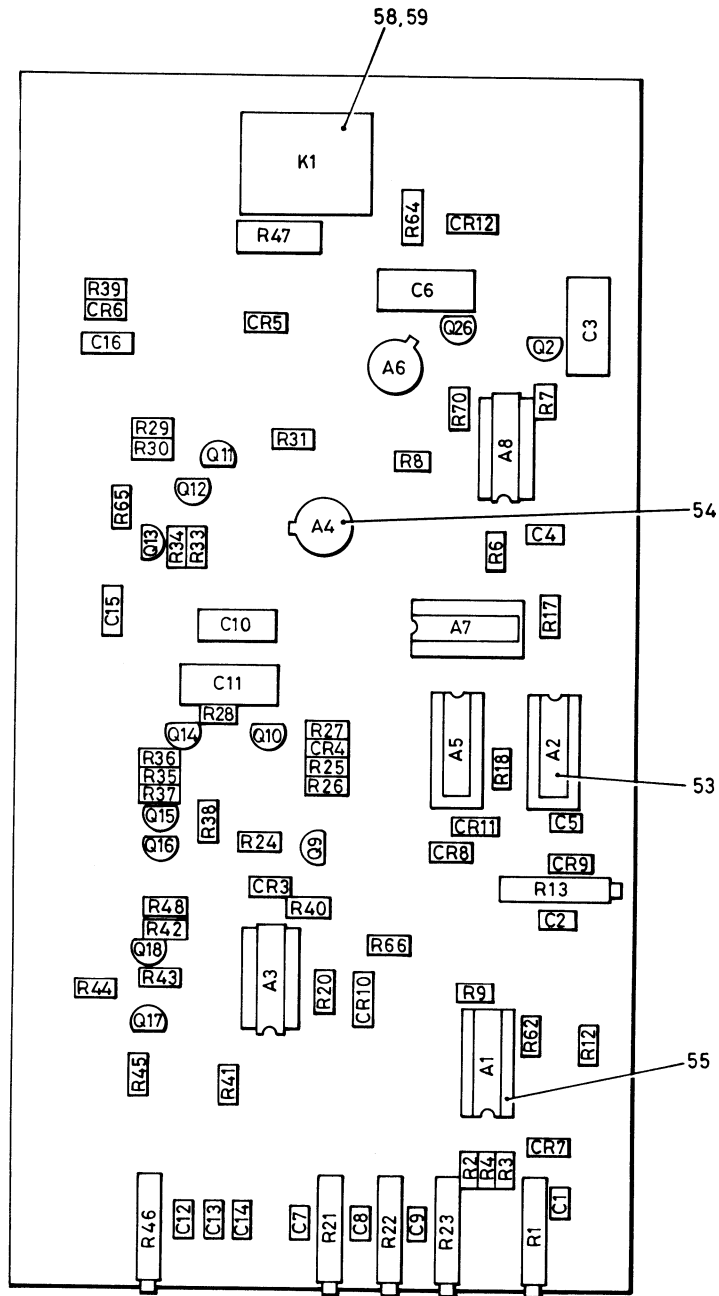


Fig 1 Board, readout



Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-1		6665-99-759-7850	BOARD, READOUT	C3	Ref
2	R1	5905-99-649-1174	. RESISTOR, VARIABLE 50 ohm, $\pm 10\%$ (SIG LEVEL)	C3	1
3	R2 3 4,	5905-00-752-3340	. RESISTOR, FIXED, COMPOSITION 4.7k, $\pm 10\%$ 26,30,48	C3	6
4	R6 43	5905-00-726-6433	. RESISTOR, FIXED, COMPOSITION 2.2k, $\pm 10\%$	C3	2
5	R7 12 17,	5905-00-752-3338	. RESISTOR, FIXED, COMPOSITION 1k, $\pm 10\%$ 18,20,27,40	C3	7
6	R8	5905-00-246-8690	. RESISTOR, FIXED, COMPOSITION 510k, $\pm 5\%$	C3	1
7	R9 29 62,	5905-00-686-3370	. RESISTOR, FIXED, COMPOSITION 2k, $\pm 5\%$ 70	C3	4
8	R13	5905-01-262-6717	. RESISTOR, VARIABLE 1k, $\pm 10\%$	C3	1
9	R21 22 23	5905-01-262-6718	. RESISTOR, VARIABLE 10k, $\pm 10\%$ (CAL X1,X10,X100)	C3	3
10	R24 35 65,	5905-00-816-8554	. RESISTOR, FIXED, COMPOSITION 10k, $\pm 10\%$ 42	C3	4
11	R25	5905-00-755-0795	. RESISTOR, FIXED, COMPOSITION 3.9k, $\pm 10\%$	C3	1
12	R28	5905-00-681-8821	. RESISTOR, FIXED, COMPOSITION 200k, $\pm 5\%$	C3	1
13	R31 41	5905-00-726-5346	. RESISTOR, FIXED, COMPOSITION 1.8k, $\pm 10\%$	C3	2
14	R33	5905-00-686-4529	. RESISTOR, FIXED, COMPOSITION 12k, $\pm 10\%$	C3	1

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ces/ Los	No. Off
1-15	R34	5905-00-686-3368	. RESISTOR, FIXED, COMPOSITION 20k, $\pm$ 5%	C3	1
16	R36 37 38	5905-00-752-3157	. RESISTOR, FIXED, COMPOSITION 27k, $\pm$ 10%	C3	3
17	R39	5905-00-752-3336	. RESISTOR, FIXED, COMPOSITION 150 ohm, $\pm$ 10%	C3	1
18	R44	5905-00-136-8406	. RESISTOR, FIXED, COMPOSITION 2.4k, $\pm$ 5%	C3	1
19	R45	5905-00-686-4525	. RESISTOR, FIXED, COMPOSITION 270 ohm, $\pm$ 10%	C3	1
20	R46	5905-01-092-9679	. POTENTIOMETER	C3	1
21	R47	5905-00-982-3337	. RESISTOR, FIXED, WIREWOUND 200 ohm, $\pm$ 5%	C3	1
22	R64	5905-00-171-2009	. RESISTOR, FIXED, COMPOSITION 2.2k, $\pm$ 10%	C3	1
23	R66	5905-00-682-4097	. RESISTOR, FIXED, COMPOSITION 3k, $\pm$ 10%	C3	1
24	C1	5910-01-048-7438	. CAPACITOR, FIXED, ELECTROLYTIC 0.047uF, $\pm$ 10%	C3	1
25	C2	5910-00-880-4165	. CAPACITOR, FIXED, ELECTROLYTIC 2.2uF, $\pm$ 10%	C3	1
26	C3 10	5910-99-759-7854	. CAPACITOR, FIXED, ELECTROLYTIC 68uF, $\pm$ 10%	C3	2
27	C4	5910-99-640-6213	. CAPACITOR, FIXED, ELECTROLYTIC 1uF, $\pm$ 10%	C3	2
28	C5	5910-00-782-1994	. CAPACITOR, FIXED, PLASTICS DIELECTRIC 0.022uF, $\pm$ 10%	C3	1
29	C6	5910-99-759-7856	. CAPACITOR, FIXED, ELECTROLYTIC 120uF, $\pm$ 10%	C3	1
30	C7	5910-99-759-7857	. CAPACITOR, FIXED, ELECTROLYTIC 6.8uF, $\pm$ 10%	C3	1

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-31	C8 12	5910-00-851-2090	. CAPACITOR, FIXED, ELECTROLYTIC 668pF, ± 10%	C3	2
32	C9 13	5910-00-752-4296	. CAPACITOR, FIXED, ELECTROLYTIC 0.068uF, ± 10%	C3	2
33	C11	5910-00-878-6691	. CAPACITOR, FIXED, ELECTROLYTIC 330uF, ± 10%	C3	2
34	C14	5910-99-759-7860	. CAPACITOR, FIXED, ELECTROLYTIC 6800pF, ± 10%	C3	1
35	C15 16	5910-00-722-4117	. CAPACITOR, FIXED, ELECTROLYTIC 33uF, ± 10%	C3	2
36	CR3	5961-00-224-3620	. SEMICONDUCTOR DEVICE, DIODE 1.4V	C3	1
37	CR4 7 10,	5961-99-118-0378	. SEMICONDUCTOR DEVICE, DIODE  12	C3	4
38	CR5	5961-99-118-0889	. SEMICONDUCTOR DEVICE, DIODE 50V	C3	1
39	CR6	5961-99-759-7861	. DIODE 5.3V	C3	1
40	CR8 9	5961-01-077-2738	. SEMICONDUCTOR DEVICE, DIODE 0.43mA	C3	1
41 (1)	CR11	5961-99-140-2096	. SEMICONDUCTOR  OR	C3	1
41 (2)	CR11	5960-99-000-3934	. VALVE, ELECTRONIC CV3934	C3	1
42 (1)	Q2 9 11,	5961-99-118-2209	. TRANSISTOR  14,15,16,17  OR	C3	7
42 (2)	Q2 9 11,	5961-00-422-3466	. TRANSISTOR  14,15,16,17	C3	7

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-43 (1)	Q10 18	5961-99-118-0682	. TRANSISTOR  OR	C3	2
43 (2)	Q10 18	5961-00-828-0723	. TRANSISTOR	C3	2
44	Q12	5961-00-124-0117	. TRANSISTOR	C3	1
45 (1)	Q13 26	5961-99-644-8132	. TRANSISTOR  OR	C3	1
45 (2)	Q13 26	5961-00-124-0113	. TRANSISTOR	C3	2
46	A1		. MICROCIRCUIT	C3	1
47	A2 5	5962-99-759-7851	. INTEGRATED CIRCUIT	C3	2
48	A3	5962-00-042-5428	. MICROCIRCUIT, DIGITAL	C3	1
49	A4	5962-00-276-7621	. MICROCIRCUIT, LINEAR	C3	1
50	A6	5962-00-272-9510	. MICROCIRCUIT, LINEAR	C3	1
51	A7	5962-00-257-9226	. MICROCIRCUIT, DIGITAL	C3	1
52 (1)	A8	5962-99-644-4049	. INTEGRATED CIRCUIT  OR	C3	1
52 (2)	A8	5962-01-041-2554	. INTEGRATED CIRCUIT	C3	1
53	XA2 5	-	. integrated circuit socket 16 pin Barnes 121-20/011-164	-	2 Ref
54	XA4	-	. integrated circuit socket 8 pin TRW 133-50-90-091	-	1 Ref

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-55	XA1 3 7 8	-	. integrated circuit socket 14 pin Barnes 121-20/011-144	-	4 Ref
56	K1	5945-99-140-6348	. RELAY, ELECTROMAGNETIC 24V dc coil  OR	C3	1
57	K1	5945-00-164-9883	. RELAY, ELECTROMAGNETIC	C3	1
58		-	. relay socket AMF 9KH2	-	1 Ref
59		5340-99-611-1638	. CLIP, RETAINING	C3	1

Chapter 2-1-2

PARTS LIST

BOARD, PRE-AMP  
6665-99-759-7838

(G.A. Drawing No.10637-B23)

**RECORD OF MODIFICATIONS  
INCORPORATED IN THIS CHAPTER**

MOD. No.	Amdt. No.	MOD No.	Amdt. No.	MOD No.	Amdt. No.





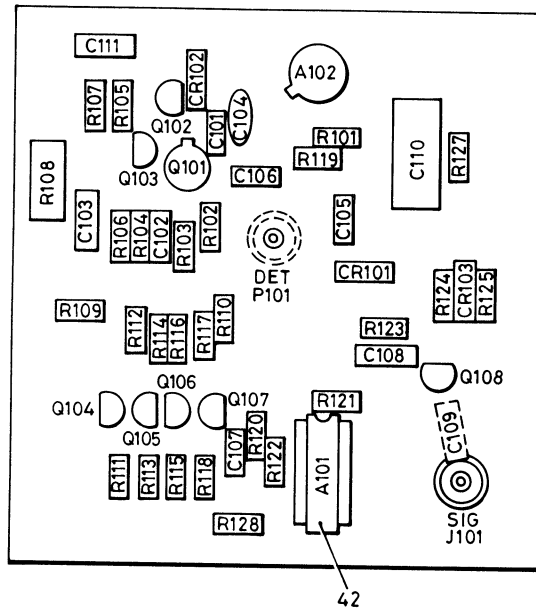


Fig 1 Board, pre-amp

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-1		6665-99-759-7838	. BOARD, PRE-AMP	C3	Ref
2	R101 119	5905-00-686-4530	. RESISTOR, FIXED, COMPOSITION 100k, $\pm 10\%$	C3	2
3	R102	5905-00-819-3361	. RESISTOR, FIXED, COMPOSITION 2.2M, $\pm 10\%$	C3	1
4	R103	5905-00-683-7724	. RESISTOR, FIXED, COMPOSITION 2.4k, $\pm 5\%$	C3	1
5	R104	5905-00-752-3340	. RESISTOR, FIXED, COMPOSITION 4.7k, $\pm 5\%$	C3	1
6	R105	5905-00-682-4097	. RESISTOR, FIXED 3k, $\pm 5\%$	C3	1
7	R106 111	5905-00-171-2009	. RESISTOR, FIXED, COMPOSITION 2.2k, $\pm 10\%$	C3	2
8	R107	5905-00-726-5340	. RESISTOR, FIXED, COMPOSITION 100 ohms, $\pm 10\%$	C3	1
9	R108	5905-00-607-9447	. RESISTOR, VARIABLE 5k, $\pm 5\%$	C3	1
10	R109 110	5905-00-816-8554	. RESISTOR, FIXED, COMPOSITION 10k, $\pm 10\%$	C3	2
11	R112 118	5905-00-752-3335	. RESISTOR, FIXED, COMPOSITION 1.2k, $\pm 10\%$	C3	2
12	R113	5905-00-726-5343	. RESISTOR, FIXED, COMPOSITION 1.5k, $\pm 10\%$	C3	1
13	R114	5905-00-686-4528	. RESISTOR, FIXED, COMPOSITION 3.3k, $\pm 10\%$	C3	1
14	R115	5905-00-811-0673	. RESISTOR, FIXED, COMPOSITION 6.8k, $\pm 10\%$	C3	1
15	R116 117	5905-00-752-3338	. RESISTOR, FIXED, COMPOSITION 1k, $\pm 10\%$	C3	2
16	R120	5905-00-682-4103	. RESISTOR, FIXED, COMPOSITION 51k, $\pm 5\%$	C3	1

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-17	R121	5905-00-681-8817	. RESISTOR, FIXED; COMPOSITION 1M, $\pm 10\%$	C3	1
18	R122	5905-00-686-3131	. RESISTOR, FIXED, COMPOSITION 330k, $\pm 10\%$	C3	1
19	R123	5905-00-752-3157	. RESISTOR, FIXED, COMPOSITION 27k, $\pm 10\%$	C3	1
20	R124 127	5905-00-755-0796	. RESISTOR, FIXED, COMPOSITION 820 ohms, $\pm 10\%$	C3	2
21	R125	5905-00-686-4526	. RESISTOR, FIXED, COMPOSITION 470 ohms, $\pm 10\%$	C3	1
22 (1)	R128 (RT128)	5905-99-648-8600	. RESISTOR, THERMAL 820 ohm, $\pm 5\%$ at 25 deg C  OR	C3	1
22 (2)	R128 (RT128)	5905-99-759-7858	. RESISTOR, THERMAL 820 ohm, $\pm 5\%$ at 25 deg C	C3	1
23	C101	5910-00-136-3728	. CAPACITOR, FIXED, CERAMIC DIELECTRIC 4.7pF, $\pm 0.5pF$	C3	1
24	C102	5910-00-777-6928	. CAPACITOR, FIXED, ELECTROLYTIC 3.3uF, $\pm 10\%$	C3	1
25	C103 105	5910-00-901-6106	. CAPACITOR, FIXED, PLASTICS DIELECTRIC 0.01uF, $\pm 10\%$	C3	2
26	C104	5910-00-666-6468	. CAPACITOR, FIXED, CERAMIC DIELECTRIC 220pF, $\pm 10\%$	C3	1
27	C106 107	5910-00-993-8305	. CAPACITOR, FIXED, PLASTICS DIELECTRIC 0.001uF, $\pm 10\%$	C3	1
28	C108 109	5910-00-784-7714	. CAPACITOR, FIXED, ELECTROLYTIC	C3	1
29	C110		. CAPACITOR, FIXED, ELECTROLYTIC	C3	1
30	C111	5910-00-902-1828	. CAPACITOR, FIXED, ELECTROLYTIC	C3	1

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-31	CR101	5961-99-141-8729	. DIODE	C3	1
32	CR102	5961-01-077-2738	. SEMICONDUCTOR DEVICE, DIODE	C3	1
33	CR103	5961-00-422-0814	. SEMICONDUCTOR DEVICE, DIODE	C3	1
34	Q101	5961-99-759-7849	. TRANSISTOR	C3	1
35	Q102 104 106	5961-99-118-2209	. TRANSISTOR  107	C3	4
36	Q103 105	5961-00-828-0723	. TRANSISTOR	C3	2
37	Q108	5961-00-124-0113	. TRANSISTOR	C3	1
38	A101	5962-00-361-8745	. MICROCIRCUIT	C3	1
39	A102	5962-00-272-9510	. MICROCIRCUIT, LINEAR	C3	1
40	J101	5935-99-943-7319	. SOCKET, ELECTRICAL (SIG)	C3	1
41	P101		. PLUG (DET)	C3	1
42		NP	. integrated circuit socket Barnes 121-20/011-144  Note... Used with A102	-	1 Ref

Chapter 2-1-3

PARTS LIST

BOARD, POWER SUPPLY  
6665-99-759-7865

(G.A. Drawing No.10637-C03)





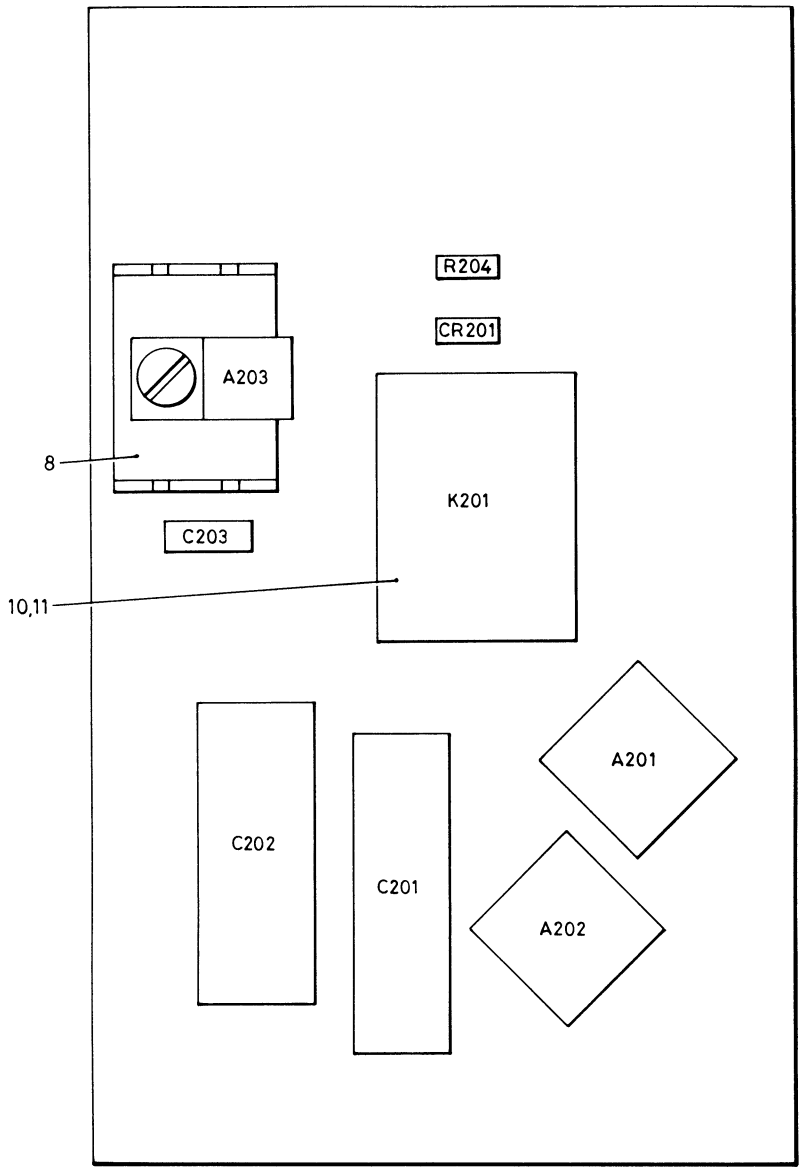


Fig 1 Board, power supply



Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-1		6665-99-759-7865	BOARD, POWER SUPPLY		Ref
2	C201	5910-00-825-2230	. CAPACITOR, FIXED, ELECTROLYTIC 250uF, 25V	C3	1
3	C202	5910-00-864-8354	. CAPACITOR, FIXED, ELECTROLYTIC 500uF, 50V	C3	1
4	C203	5910-00-993-8307	. CAPACITOR, FIXED, PLASTICS DIELECTRIC 0.01uF, 200V	C3	1
5	CR201	5961-99-118-0378	. SEMICONDUCTOR DEVICE, DIODE	C3	1
6	A201 202	5961-00-139-7625	. RECTIFIER, SEMICONDUCTOR DEVICE	C3	2
7	A203	5962-99-644-2398	. INTEGRATED CIRCUIT	C3	1
8		5999-01-025-7468	. HEAT SINK ELECTRICAL Note... Used with A203		1
9	K201	5945-99-140-6348	. RELAY, ELECTROMAGNETIC 24V dc coil	C3	1
10	XK201	NP	. relay socket AMF 9KH2	-	1 Ref
11		5340-99-611-1638	. CLIP, RETAINING	C3	1
12	R204	5905-00-752-3340	. RESISTOR, FIXED, COMPOSITION 4.7k, $\pm 10\%$	C3	1

Chapter 2-2

PARTS LIST

PUMP (RAP1)  
4320-99-659-5814

(G.A. Drawing No.N/A)





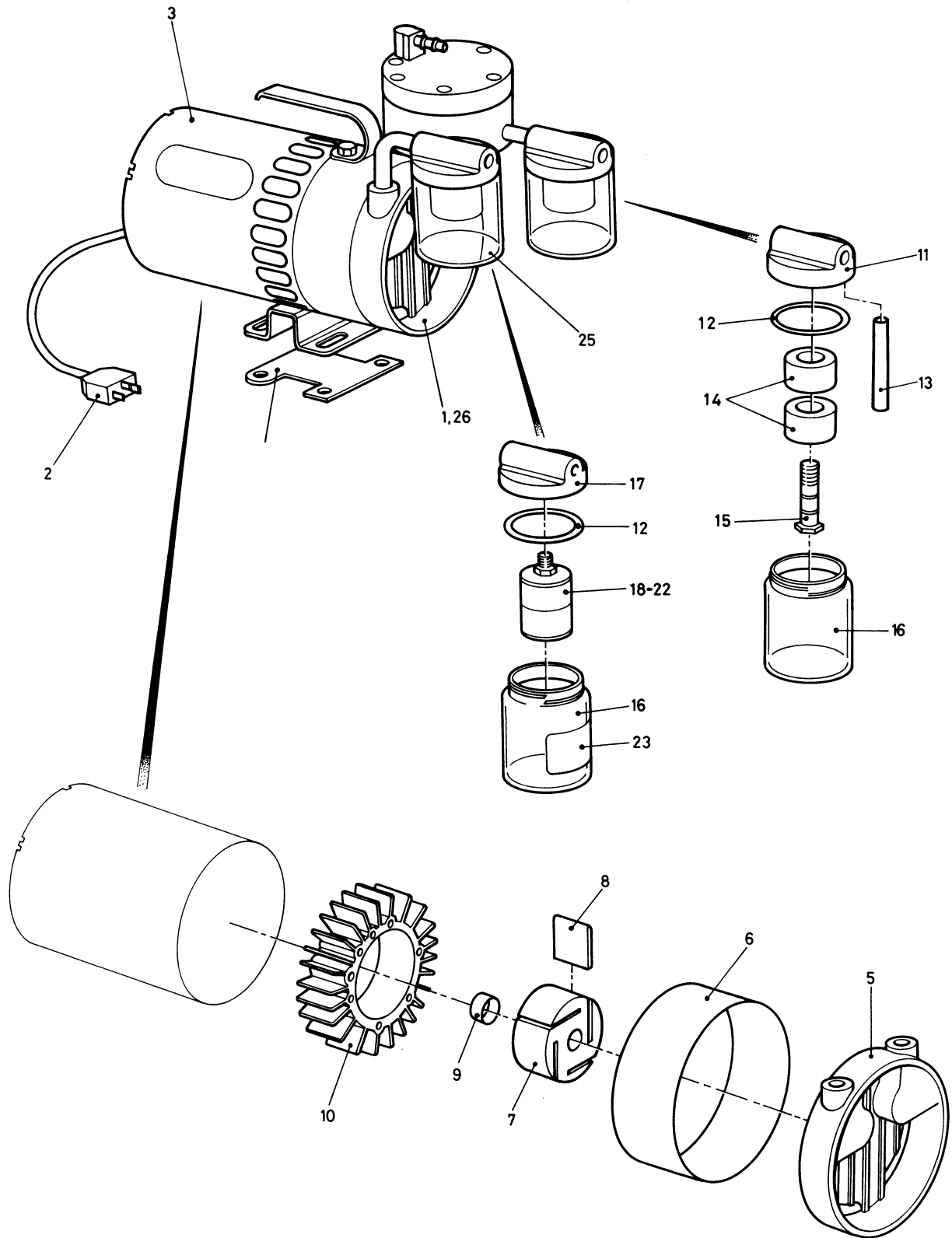


Fig 1 Pump  
(RAP1)

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/Los	No. Off
1-1		4320-99-659-5814	PUMP		Ref
2		5935-99-804-7580	. CONNECTOR, FREE, ELECTRICAL Note... connects with item 81, Chap 2-1	C2	1
3		-	. motor GEC BS2208/12 (D51242)	-	1 Ref
4		-	. foot support assy Gast AC136	-	1 Ref
5		-	. end plate Gast AF12	-	1 Ref
6		-	. shroud Gast AF111	-	1 Ref
7		-	. rotor Gast AF106B	-	1 Ref
8		4320-99-759-7883	. VANE	C2	4
9		-	. tolerance ring Gast AF105	-	1 Ref
10		-	. body Gast AF108	-	1 Ref
11		-	. cover and elbow assy Gast AV430	-	1 Ref
12		-	. cover gasket Gast B62A	-	2 Ref
13		-	. tube Gast B346A	-	1 Ref
14		5330-00-599-1301	. FELT, MECHANICAL	C2	2
15		4310-01-031-6683	. FELT, SUPPORT	C2	1
16		-	. jar Gast AA125A	-	2 Ref

Fig-Item	Cct Ref	NATO Stock No.	Item Name (For full description see Chapter 3)	Ccs/ Los	No. Off
1-17		-	. cover Gast AV402C	-	1 Ref
18		-	. filter felt assy Gast B343B	-	2 Ref
19		-	. . body Gast B347	-	1 Ref
20		4320-99-759-7882	. . FELT, MECHANICAL	C2	2
21		-	. . end cap Gast AA730	-	1 Ref
22		-	. . rivet stud Gast B378	-	1 Ref
23		-	. label, instruction Gast AB678	-	2 Ref
24 NI		4310-00-080-4241	. PARTS KIT, VACUUM Note... Comprises items 9,13,15 & 21	C2	1
1-25		4310-00-041-2750	. FILTER	C2	1
26		-	. pump Gast 0522V703 R25X		1 Ref

## Chapter 3

### INDEX OF RANGED SPARES BY NATO STOCK NUMBERS



Chapter 3

MANUFACTURER CODE TO MANUFACTURER NAME

CODE	NAME	CODE	NAME
F7691	TRW	83003	VARO CORP.
K0195	BSI	83330	H.H. SMITH INC
K0461	TEXAS INST.	85274	DWYER INST. CORP.
K0479	CEMENTATION-MUFFELITE (BARRY CONTROLS)	91737	ITT CANNON
K0718	BECKMAN	91929	HONEYWELL INC
K1796	ST&C	94173	MOTOROLA
K2504	RS COMPONENTS	94222	SOUTH CO
K5519	MOTOROLA	95146	ALCO SWITCH CORP.
K5835	SUHNER	96906	MIL STAN
K6659	FAIRCHILD	U0928	BULGIN
K6760	AMF INTERNATIONAL		
K7093	NATIONAL SEMICONDUCTOR		
K7766	BSI		
K7822	GEC		
K9093	WHATMAN BIOCHEMICALS		
S3323	WAYCOM SA		
U3038	THERMO ELECTRON		
00430	BARNES ENG CO		
01121	ALLEN-BRADLEY		
02660	BUNKER-RAMO CORP		
04596	EBERLINE INST. CORP.		
04713	MOTOROLA INC		
07688	JEDEC		
12040	SIGNETICS		
13103	THERMALLOY INC		
13499	COLLINS RADIO		
18324	SIGNETICS CORP		
24123	GAST MFG. CORP.		
27014	NATIONAL SEMICONDUCTORS		
29083	MONSANTO IND. CORP.		
49956	RAYTHEON INC		
56289	SPRAGUE		
56756	MICRO PNEUMATIC LOGIC		
71590	CENTRALAB DIV. OF GLOBE UNION		
72619	DIALIGHT CORP		
72982	ERIE TECHNOLOGY		
74868	AMPHENOL CORP.		
75915	LITTLE FUSE		
76055	MALLORY CONTROLS		
77342	AMF (AMERICAN MACHINE CO.)		
80063	US ARMY COMMS		
80131	EIA		
80183	SPRAGUE ELECTRIC		
80294	BOURNS INC.		
81349	MIL-SPEC		

NATO Stock No.	Item Name, Description and Maker's Part No./ Drawing No.	Chapter and Item No.
5310-00-021-7157	NUT, PLAIN, ROUND 83330 2371	2-1/61(2)
4310-00-041-2750	FILTER 24123 V425L	2-2/25
5305-00-063-7912	KNOB 49956 70-3-2	2-1/12
4310-00-080-4241	PARTS KIT, VACUUM 24123 K247	2-2/24
6350-00-102-4210	BUZZER 76055 SC628	2-1/20
5961-00-124-0113	TRANSISTOR 80131 2N4401 (04713 2N4401)	2-1-1/45(2) 2-1-2/37
5961-00-124-0117	TRANSISTOR 80131 2N4403 (04713 2N4403)	2-1-1/44
5910-00-136-3728	CAPACITOR 4.7pF, $\pm$ 0.5pF, 1kV dc wkg 56289 C030B102E4R7D	2-1-2/23
5905-00-136-8406	RESISTOR, FIXED, COMPOSITION 2.4k ohms, $\pm$ 5%; 1/4W 81349 RCR07G242JS	2-1-1/18
5961-00-139-7625	RECTIFIER, SEMICONDUCTOR 83003 VS447 +PAD	2-1-3/6
5945-00-164-9883	RELAY, ELECTROMAGNETIC 4 pole dt; 28V dc, 120V ac 3A; 650 ohm coil 77342 KHP17D11-24	2-1-1/57
5905-00-171-2009	RESISTOR, FIXED, COMPOSITION insulated; 2.2k ohms, $\pm$ 10%; 1/2W 81349 RC20GF222K	2-1-1/22 2-1-2/9
5961-00-224-3620	SEMICONDUCTOR DEVICE, DIODE 1.4V 04713 MZ2361	2-1-1/36
5905-00-246-8690	RESISTOR, FIXED, COMPOSITION 510k ohms, $\pm$ 5%; 1/4W 81349 RCR07G514JS	2-1-1/6

NATO Stock No.	Item Name, Description and Maker's Part No./ Drawing No.	Chapter and Item No.
5962-00-257-9226	MICROCIRCUIT, DIGITAL 81349 M38510-02701BCB	2-1-1/51
5961-00-261-7297	LIGHT EMITTING DIODE 29083 MV5021	2-1/11
5962-00-272-9510	MICROCIRCUIT, LINEAR 27014 LM309H	2-1-1/50 2-1-2/39
5962-00-276-7621	MICROCIRCUIT, LINEAR 27014 LM741H	2-1-1/49
5920-00-284-9455	FUSE LINK, CARTRIDGE glass body, 0.125 amp, 250V max, time delay rating 12 sec min at 200% load, 1.250in. lg, 0.250in. dia 81349 F02B250V1-8A	2-1/2
5962-00-361-8745	MICROCIRCUIT, LINEAR 94173 MC3401P	2-1-2/38
5961-00-422-0814	SEMICONDUCTOR DEVICE, DIODE K0461 1N4148	2-1-2/33
5961-00-422-3466	TRANSISTOR 04713 2N4124	2-1-1/42(2)
5905-00-581-1393	RESISTOR, VARIABLE composition; 2.500 ohms, $\pm 10\%$ ; 1/2W; single shaft, metal, rd, slotted, 0.031in. lg, 0.031in. w, 0.125in. dia, 3/8in. lg from mtg surface, normal torque 81349 RV6NAYSL252A	2-1/17
5330-00-599-1301	FELT, MECHANICAL 24123 B344A	2-2/14
5905-00-607-9447	RESISTOR, VARIABLE 5k ohms, $\pm 5\%$ ; 1W 80294 3255W-1-502	2-1-2/9
5910-00-666-6468	CAPACITOR, FIXED, CERAMIC 220pF, $\pm 10\%$ ; 100V dc 71590 DD221	2-1-2/26
5905-00-681-8817	RESISTOR, FIXED, COMPOSITION insulated; 1M ohm, $\pm 5\%$ ; 1/4W; 0.09in. od, 1/4in. lg 81349 RC07GF105J	2-1-2/17

NATO Stock No.	Item Name, Description and Maker's Part No./ Drawing No.	Chapter and Item No.
5905-00-681-8821	RESISTOR, FIXED, COMPOSITION insulated; 200k ohms, $\pm$ 5%; 1/4W 81349 RC07GF204J	2-1-1/12
5905-00-682-4097	RESISTOR, FIXED, COMPOSITION insulated; 3000 ohms, $\pm$ 5%; 1/4W 81349 RC07GF302J	2-1-1/23 2-1-2/6
5905-00-682-4103	RESISTOR, FIXED, COMPOSITION 51k ohms, $\pm$ 5%; 1/4W 81349 RC07GF513J	2-1-2/16
5905-00-683-7724	RESISTOR, FIXED, COMPOSITION 2.4k ohms, $\pm$ 5%; 1/4W 81349 RC07GF242J	2-1-2/4
5905-00-686-3131	RESISTOR, FIXED, COMPOSITION insulated, 330k ohms, $\pm$ 5%; 0.250W, 0.090in. dia, 0.250in. lg 81349 RC07GF334J	2-1-2/18
5905-00-686-3368	RESISTOR, FIXED, COMPOSITION 20k ohms, $\pm$ 5%; 1/4W 81349 RC07GF203J	2-1-1/15
5905-00-686-3370	RESISTOR, FIXED, COMPOSITION 2k ohms, $\pm$ 5%; 1/4W 81349 RC07GF202J	2-1-1/7
5905-00-686-4525	RESISTOR, FIXED, COMPOSITION encapsulated; 270 ohms, $\pm$ 10%; 1/4W 81349 RC07GF271K	2-1-1/19
5905-00-686-4526	RESISTOR, FIXED, COMPOSITION insulated; 470 ohms, $\pm$ 10%; 1/4W 81349 RC07GF471K	2-1-2/21
5905-00-686-4528	RESISTOR, FIXED, COMPOSITION insulated; 3.3k ohms, $\pm$ 10%; 1/4W 81349 RC07GF332K	2-1-2/3
5905-00-686-4529	RESISTOR, FIXED, COMPOSITION 12k ohms, $\pm$ 10%; 1/4W 81349 RC07GF123K	2-1-1/14
5905-00-686-4530	RESISTOR, FIXED, COMPOSITION insulated; 100k ohms, $\pm$ 10%; 1/4W 81349 RC07GF104K	2-1-2/2

NATO Stock No.	Item Name, Description and Maker's Part No./ Drawing No.	Chapter and Item No.
5920-00-709-1149	FUSEHOLDER, EXTRACTOR POST 75915 342012	2-1/38(1)
5910-00-722-4117	CAPACITOR, FIXED, ELECTROLYTIC 33uF, ± 10%; 10V 56289 150D336X9010B2	2-1-1/35
5905-00-726-5340	RESISTOR, FIXED, COMPOSITION insulated; 100 ohms, ± 10%; 1/4W 81349 RC07GF101K	2-1-2/8
5905-00-726-5343	RESISTOR, FIXED, COMPOSITION insulated; 1.5k, 10%, 1/4W 81349 RC07GF152K	2-1-2/12
5905-00-726-5346	RESISTOR, FIXED, COMPOSITION insulated; 1.8k ohms, ± 10%; 1/4W 81349 RC07GF182K	2-1-1/13
5905-99-726-6433	RESISTOR, FIXED, COMPOSITION 2.2k ohms, ± 10%; 1/4W 81349 RC07GF222K	2-1-1/4
5930-00-729-8720	SWITCH, PUSH 91929 1PB5	2-1/16
5905-00-752-3157	RESISTOR, FIXED, COMPOSITION insulated, 27,000 ohms total resistance, ± 10% tolerance, 1/4W power dissipation 13499 745-0800-000	2-1-1/16 2-1-2/19
5905-00-752-3335	RESISTOR, FIXED, COMPOSITION 1.2k; 10%; 1/4W 81349 RC07GF122K	2-1-2/11
5905-00-752-3336	RESISTOR, FIXED, COMPOSITION 150 ohms, ± 10%; 1/4W 81349 RC07GF151K	2-1-1/17
5905-00-752-3338	RESISTOR, FIXED, COMPOSITION 1k ohms, ± 10%; 1/4W 81349 RC07GF102K	2-1-1/5 2-1-2/15
5905-00-752-3340	RESISTOR, FIXED, COMPOSITION 4.7k ohms, ± 10%; 1/4W 81349 RC07GF472K	2-1-1/3 2-1-2/5 2-1-3/12

NATO Stock No.	Item Name, Description and Maker's Part No./ Drawing No.	Chapter and Item No.
5905-00-755-0795	RESISTOR, FIXED, COMPOSITION insulated; 3.9k ohms, $\pm 10\%$ ; 0.25W 81349 RC07GF392K	2-1-1/11
5905-00-755-0796	RESISTOR, FIXED, COMPOSITION 820 ohms, $\pm 10\%$ ; 1/4W 81349 RC07GF821K	2-1-2/20
5930-00-755-5929	SWITCH, ROTARY 71590 PA1006	2-1/13
6240-00-763-7744	LAMP, FILAMENT midget flanged T-1-3/4; 0.625in. o/a lg; 28V 81348 W-L-00111/7 (96906 MS25287-387)	2-1/19
5910-00-777-6928	CAPACITOR, FIXED, ELECTROLYTIC tantalum electrode; metal case; insulated; 3.3uF, $\pm 10\%$ ; 15V 56289 CS13BD335K	2-1-2/24
5910-00-782-1994	CAPACITOR, FIXED, ELECTROLYTIC 22000pF, $\pm 10\%$ ; 80V dc 56218 192P2239R8	2-1-1/28
5905-00-811-0673	RESISTOR, FIXED, COMPOSITION 81349 RC07GF682K	2-1-2/14
5905-00-816-8554	RESISTOR, FIXED, COMPOSITION 10k ohms, $\pm 10\%$ ; 1/2W 81349 RC07GF103K	2-1-1/10 2-1-2/10
5905-00-819-3361	RESISTOR, FIXED, COMPOSITION 2.200 megohms, $\pm 10\%$ ; 0.250W 81349 RC07GF225K	2-1-2/3
5910-00-825-2230	CAPACITOR, FIXED, ELECTROLYTIC 56289 TVA1208	2-1-3/2
5961-00-828-0723	TRANSISTOR 80131 2N4126	2-1-1/43(2) 2-1-2/36
5910-00-851-2090	CAPACITOR, FIXED, ELECTROLYTIC 688pF, $\pm 10\%$ ; 35V 56289 150D684X9035A2	2-1-1/31
▶ 5340-00-857-6217	FASTENER, PAWL 94222 48-10-401-10	2-1/25
5910-00-784-7714	CAPACITOR, FIXED, ELECTROLYTIC 33uF + 10%; 20V 81349 CS 13BC 336K	2-1-2/28

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5910-00-864-8354	CAPACITOR, FIXED, ELECTROLYTIC 500uF, - 10 + 150%; 50V dc 56289 TVA1315	2-1-3/3
5310-00-876-0086	PACKING, PREFORMED 94222 82-46-101-41	2-1/5
5910-00-878-6691	CAPACITOR, FIXED, ELECTROLYTIC tantalum electrode; solid type tub; metal case; insulated; 330uF, ± 10%, 6V dc wkg 56289 150D337X9006S2	2-1-1/33
5910-00-880-4165	CAPACITOR, FIXED, ELECTROLYTIC insulated; 2.2uF, ± 10%; 50V dc 81349 CS13BG225K	2-1-1/25
5910-00-901-6106	CAPACITOR, FIXED, PLASTIC DIELECTRIC foil film; 0.01uF, 80V dc, 10% 56289 192P1039R8	2-1-2/25
5910-00-902-1828	CAPACITOR, FIXED, ELECTROLYTIC 81349 CS13BC395K	2-1-2/30
5930-00-902-4150	SWITCH, TOGGLE 1 pole; dt; 50A max, 115V ac 95146 MST105D	2-1/15
5310-00-963-9950	NUT, PLAIN, HEXAGON no.4-40 by 1/2 lg 83330 2332	2-1/65
5905-00-982-3337	RESISTOR, FIXED 200 ohms, 3W 81349 RW69V201	2-1-1/21
5910-00-993-8305	CAPACITOR, FIXED, PLASTICS DIELECTRIC tub plastics case; 0.001uF, ± 10%; 200V dc wkg 56289 192P10292	2-1-2/27
5999-01-025-7468	HEAT SINK, ELECTRICAL 13103 6107B14	2-1-3/8
4310-01-031-6683	FELT, SUPPORT 24123 B345A	2-2/15
5962-01-041-2554	MICROCIRCUIT LINEAR 18324 NE556N	2-1-1/52(2)

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5910-01-048-7438	CAPACITOR, FIXED, PLASTICS DIELECTRIC .047uF, + 10%; 400V 56289 225P47394XD3	2-1-1/24
5961-01-077-2738	SEMICONDUCTOR DEVICE, DIODE 0.43mA 04713 JAN-TX1N5289	2-1-1/40 2-1-2/32
5905-01-092-9679	POTENTIOMETER 02660 3800P-203	2-1-1/20
5930-01-262-3507	SWITCH, PRESSURE 56756 MPL-501-20	2-1/54
5905-01-262-6717	RESISTOR, VARIABLE, WIREWOUND, NON PRECISION 74868 3800P-102	2-1-1/8
5905-01-262-6718	RESISTOR, VARIABLE, WIREWOUND, NON PRECISION 74868 3800P-103	2-1-1/9
5930-01-272-1431	SWITCH, PUSH 72619 922-1524-1571-525	2-1/18
▶ 6630-01-302-1894	DETECTOR, AIR ELECTRONIC solid state 04596 10637B22	2-1/71
6680-01-314-3570	METER, FLOW RATE, INDICATING 85274 RMA25	2-1/32
5960-99-000-3934	VALVE, ELECTRONIC 80131 1N34A	2-1-1/41(2)
5930-99-083-2414	SWITCH door, power interrupt 04596 10637-A11	2-1/75
5305-99-102-0936	SCREW, MACHINE UNC; steel; pan hd; slot drive; cadmium plated; no.2 by 1/2in. lg, class 2A thd K0195 BS3155	2-1/76
5930-99-110-6539	SWITCH, TOGGLE dpdt; 3 positions; 5A max; 115V ac; 5A max, 12V dc; S3323 MST 205P	2-1/14
5355-99-112-2414	DIAL, CONTROL knob type; 7/8in. dia by 31/32in. lg; primary scale engraved 0-100, secondary scale engraved 0-15 K0718 2606	2-1/9



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5961-99-118-0378	SEMICONDUCTOR DEVICE, DIODE silicon peak inverse voltage 100 volts K1796 1N4148	2-1-1/37 2-1-3/5
5961-99-118-0682	TRANSISTOR silicon; switching K5519 2N4126	2-1-1/43(1)
5961-99-118-0889	SEMICONDUCTOR DEVICE, DIODE silicon; 50V max peak inverse voltage; 1A max average forward current; JEDEC DO-41 package; -65 to + 175 deg C operating temperature range K0461 1N4001	2-1-1/38
5961-99-118-2209	TRANSISTOR K5519 2N4124	2-1-1/42(1) 2-1-2/35
5961-99-140-2096	SEMICONDUCTOR 72982 1N34A	2-1-1/41(1)
5945-99-140-6348	RELAY 77342 KHU17D11-24	2-1-1/56 2-1-3/9
5961-99-141-8729	DIODE 04713 1N4744	2-1-2/31
5995-99-199-4074	CABLE ASSEMBLY, RADIO FREQUENCY J10 to sig. input of PHA - readout board 04596 10637-A12	2-1/66
6665-99-253-6012	COVER aluminium alloy; 16 SWG thk; zinc chromate, painted beige; 310.8mm min lg, 294.0mm w; 172.0mm h U3038 203002	2-1/3
6665-99-253-6013	DOOR aluminium; black anodise; 123.8mm lg; 76.2mm w; 6.35mm thk; w/cut outs & holes; inscribed:- ALPHA AIR MONITOR EBERLINE MODEL ALPHA 3 U3038 2-219017	2-1/24
5905-99-529-3391	RESISTOR, VARIABLE, LINEAR PRECISION wirewound, 1k ohm, $\pm$ 5%; 2W K0718 MODEL 7276	2-1/10
5340-99-533-0285	MOUNT, RESILIENT metal/rubber; 2-1/2in. x 2-11/16in. x 2-11/16in. K0479 GB-2K1-BA-10	2-0/8

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5340-99-611-1638	CLIP, RETAINING cres; 1.11in. w; 1.46in. h, 0.035in. dia wire K6760 20C217 ISSUE 7	2-1-1/59 2-1-3/11
5340-99-638-9806	MOUNT RESILIENT aluminium/rubber; 2-11/16in. by 2-11/16in. by 2-1/2in. approx o/a dia K0479 GB2K1BA4	2-0/9
5910-99-640-6213	CAPACITOR, FIXED, ELECTROLYTIC 1 sect, metal case, 1uF, $\pm 10\%$ ; 50V dc wkg K4701 150D105X9050A	2-1-1/27
5962-99-644-2398	INTEGRATED CIRCUIT 04713 MC7824CT	2-1-3/7
5962-99-644-4049	INTEGRATED CIRCUIT 12040 NE556A	2-1-1/52(1)
5961-99-644-8132	TRANSISTOR 07688 2N4401	2-1-1/45(1)
5935-99-646-1994	SOCKET, RELAY 11 contact positions, 83mm lg, 36mm w, 20mm h K2504 401-712	2-1/53
5905-99-648-8600	RESISTOR, THERMAL 820 ohms at 25 deg C; $\pm 5\%$ ; 300mW; 125 deg C; + 0.7% per deg C; rod type K0461 TG1	2-1-2/22(1)
5905-99-649-1174	RESISTOR, VARIABLE 1 sect; film; 50 ohms; $\pm 10\%$ ; 1.25W at 25 deg C; 3/4W at 70 deg C; linear; rd; 3/32in. dia; 1/16in. lg; humidity proof K5743 3006P-1-500	2-1-1/2
5920-99-650-1876	FUSEHOLDER sealed; single way; 250V ac/dc; 10A; panel mounting K2504 412-015	2-1/38(2)
6625-99-652-5629	COVER, RELAY TERMINALS K2504 401-762	2-1/52

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5945-99-653-7558	RELAY, ELECTROMAGNETIC 3 pole changeover; normal duty, 475 ohms; 24V dc K2504 348-829	2-1/51
5935-99-653-8411	CHASSIS PLUG WITH FILTER 52.00mm lg, two 3.50mm dia mtg holes spaced 40.00mm c to c; 6A mains filter K2504 238-429	2-1/39
6665-99-659-5813	AIR MONITOR U3038 ALPHA3	2-0/2 2-1/1
4320-99-659-5814	PUMP U3038 RAP1	2-0/3 2-2/1
6640-99-659-5817	PAPER, FILTER glass microfibre; 25mm dia K9093 1820-025	2-0/7
6665-99-664-2457	CASE, CONTROL-MONITOR mild steel 0.048in. thk, 370mm w, 370mm lg, 400mm o/a h, spray paint epoxy stove enamel U3038 0-000003	2-0/4
6665-99-664-2458	CARRY CASE FOR REGULATED AIR PUMP mild steel 0.064in. thk, top cover, 0.080in. thk base, 407mm o/a h, 263mm w, 522mm lg, spray paint epoxy stove enamel U3038 0/000010/A	2-0/5
5305-99-759-7814	SCREW, BINDLE HEAD U3038 RAF005	2-1/4
5340-99-759-7815	HINGE U3038 10546-A11	2-1/26
5315-99-759-7816	PIN U3038 10546-A12	2-1/27
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5305-99-759-7818	SCREW, SET U3038 RAF007	2-1/29
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5310-99-759-7823	LOCKWASHER U3038 RAF011	2-1/34
5340-99-759-7824	BUMPER, FEET U3038 RAF003	2-1/37
5305-99-759-7825	SCREW U3038 RAF012	2-1/42
6665-99-759-7826	CAP, AIR INTAKE U3038 10546-A07	2-1/6
6665-99-759-7827	SCREEN, AIR INTAKE U3038 10546A08	2-1/7
5305-99-759-7828	SCREW U3038 RAF013	2-1/72
5305-99-759-7829	SCREW U3038 RAF014	2-1/56
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5305-99-759-7839	SCREW U3038 RAF021	2-1/63
5961-99-759-7849	TRANSISTOR silicon; N-channel; junction field-effect; 10MA forward gate current; 40V dc reverse gate- source voltage and drain gate voltage; 300MW dissipation; 0.230in. od K5519 2N5358	2-1-2/34
6665-99-759-7850	BOARD, READOUT U3038 10637-C13	2-1/79 2-1-1/1
5962-99-759-7851	INTEGRATED CIRCUIT K6659 9L24	2-1-1/47
5910-99-759-7854	CAPACITOR, FIXED, ELECTROLYTIC single section; metal; insulated; 68uF, $\pm 10\%$ ; 150V dc; tantalum; solid nonpolarized K4701 150D686X9015R2	2-1-1/26
5910-99-759-7856	CAPACITOR, FIXED, ELECTROLYTIC single section; metal; insulated; 120.00uF, $\pm 10\%$ ; 10V dc; tantalum; solid; nonpolarized K4701 150D127X0010R2	2-1-1/29
5910-99-759-7857	CAPACITOR, FIXED, ELECTROLYTIC single section; metal; insulated; 6.8uF; $\pm 10\%$ ; 6V dc; tantalum; solid nonpolarized K4701 150D685X9006A2	2-1-1/30
5905-99-759-7858	SENSITOR U3038 RAF004	2-1-2/22(2)
5910-99-759-7860	CAPACITOR, FIXED, ELECTROLYTIC 1 section; metal; insulated; 6800pF; $\pm 10\%$ ; 35V dc; tantalum; nonpolarized K4701 150D682X9035A2	2-1-1/34
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6665-99-759-7865	BOARD, POWER SUPPLY U3038 10637-C03	2-1/58 2-1-3/1
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6665-99-759-7874	HOSE U3038 19/105	2-0/6
4320-99-759-7878	NEOPRENE U3038 RAF028	2-0/10
4320-99-759-7882	FILTER FELT U3038 RAF032	2-2/20
4320-99-759-7883	VANE U3038 RAF033	2-2/8
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5935-99-804-7580	CONNECTOR, FREE, ELECTRICAL U0928 PX0770	2-2/2
5935-99-940-1682	CONNECTOR, FREE, ELECTRICAL free; resilient material; 3 pole; 13A, 250V ac; colour black K7766 BS1363	2-0/12
5935-99-943-7319	SOCKET, ELECTRICAL fixed; male shell; copper base alloy shell, silver plated; single pole; ac volts R.M.S. not rated; dc volts 500 max; 2.500Mc/s, 50 ohms K5835 UG-1094/Y	2-1-2/40
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10637C13	6665-99-759-7850
10637D16	6665-99-659-5813
150D105X9050A0	5910-99-640-6213
150D127X0010R2	5910-99-759-7856
150D336X9010A2	5910-00-722-4117 ▶
150D337X9006S	5910-00-878-6691
150D682X9035A2	5910-99-759-7860
150D684X9035A2	5910-00-851-2090
150D685X9006A2	5910-99-759-7857
150D686X9015R2	5910-99-759-7854
16/027	
▶ 1820-025	6665-99-659-5817 ◀
19/55	5935-99-759-7872
19/85	6665-99-759-7873
▶ 19/014	6665-99-766-0047 ◀
19/105	6665-99-759-7874
192P10292	5910-00-993-8305
192P1039R8	5910-00-901-6106
192P10392	5910-00-993-8307
192P2239R8	5910-00-782-1994
2-206	
2-219017	6665-99-253-6013
2N4124	5961-00-422-3466
2N4126	5961-00-828-0723
2N4401	5961-00-124-0113

Maker's Part No./ Drawing No.	NATO Stock No.
2N4403	5961-00-124-0117
2N5358	5961-99-759-7849
20C217	5340-99-611-1638
2015-5	6130-99-650-1973
203002	6665-99-253-6012
2103	6665-99-766-0046
225P47394XD3	5910-01-048-7438
228104/1mA/GS	
2332	5310-00-963-9950
2371	5310-00-021-7157
238-429	5935-99-653-8411
2606	5355-99-112-2414
300-2.5K+10%	5905-00-581-1393
3006P-1-500	5905-99-649-1174
312 7564 50	
313-125	5920-00-284-9455
3255W-1-502	5905-00-607-9447
342012	5920-00-709-1149
348-829	5945-99-653-7558
3800P-1-102	5905-01-262-6717
3800P-1-103	5905-01-262-6718
3800P-203	5905-01-092-9679
387	6240-00-763-7744
401-712	5935-99-646-1994
401-762	6625-99-652-5629
412-015	5920-99-650-1876
▶ 48-10-401-10	5340-00-857-6217 ◀
561CC0HBA102EE4R7D	5910-00-136-3728
6107B-14	5999-01-025-7468
70-3-2	5355-00-063-7912
7276	5905-99-529-3391
74L02	5962-00-257-9226
82-46-101-41	5330-00-876-0086
9L24	5962-99-759-7851
922-1524-1571-525	5930-01-272-1431
95-2177-1-6	6625-99-647-4657
95-2230-1-6	6625-99-111-1783

CHAPTER 2  
BEFORE USE SERVICING

EQUIPMENT AND TOOLS

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>QTY</u>
6515-99-210-7825	Tweezers, disposable	1
6Z/6642456	Source Radioactive (Plutonium)	1

MATERIALS

6Z/6595817	Paper, filter Type GF/A 3005	As required
NYR	Paper, chart recording	"

ASSOCIATED PUBLICATIONS

AP4687A, Vol 2	Radiation Safety, ionizing and non-ionizing radiation orders and instructions
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<u>ITEM NO.</u>	<u>ITEM</u>	<u>OPERATION</u>
	Note: If the equipment was switched off temporarily carry out the following operation at Item Nos. 1 to 5 only.	
1.	<u>Monitor power switch</u> (Monitor rear panel)	Set to ON.
2.	<u>ALARM RESET button</u>	(i) Press (ii) Release (iii) Check light is extinguished
3.	<u>Pump power switch</u> (Monitor rear panel)	(i) Set to ON (ii) Enter time on servicing form
4.	<u>FLOW ALARM RESET button</u>	(i) Check light is illuminated (ii) Press (iii) Release (iv) Check light is extinguished
5.	<u>Flowrate indicator</u>	Ensure a reading of 30 litres per minute (LPM) (check every hour).

ITEM NO.	ITEM	OPERATION
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The following is a complete Before Use Servicing and is to be carried out under the following circumstances:

- (i) On initial setting up of the equipment at the beginning of a deployment.
- (ii) If the equipment has to be re-sited during the deployment.
- (iii) If the operation of the equipment is suspect.

6.	<u>Chapter 1</u>	)	Read
6.1	Safety precautions	)	
6.2	Servicing notes	)	
7.	<u>Monitor preparation</u>		
7.1	Monitor	)	(i) Remove from transit case (ii) Examine
7.2	Mains lead	)	
7.3	Monitor power switch (Monitor rear panel)		Ensure set to OFF.
7.4	WINDOW Control		Ensure set to 1.0.
7.5	THRESHOLD Control		Ensure set to 4.65.
7.6	RESPONSE switch		Ensure set to SLOW.
7.7	MODE switch		Ensure set to PHA-SUB.
7.8	RANGE switch		Set to x 100.
7.9	Monitor mains lead		(i) Connect to Monitor rear panel. (ii) Connect to mains power supply.
7.10	Mains power supply switch		Set to ON.
7.11	Monitor power switch		Set to ON (let Monitor warm up for 30 minutes before continuing).
8.	<u>Chart recorder checks</u>		
8.1	Recording paper		Ensure that a diagonal red line is not visible (See Note).
8.2	Recording paper speed		Check paper is moving downwards at approx 2cms per hour.
8.3	Recorder pointer		Check that it is marking the paper approx every 3 seconds.
Note: If a diagonal red line is visible the paper spool is to be replaced (by qualified personnel only).			
9.	<u>Counting and alarm checks</u>		
9.1	AUDIBLE ALARM ON OFF switch		Set to OFF.
9.2	ALARM PUSH button		Press in and hold
9.3	ALARM SET control		Adjust for a recorder scale reading of 15 (i.e. 1500 cpm)
9.4	ALARM PUSH button		Release
9.5	Filter paper access panel		(i) Unlock (rotate locking knob fully counter clockwise (ccw)). (ii) Lower panel.

ITEM NO.	ITEM	OPERATION
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Note: Under no circumstances is the detector mirror surface to be touched otherwise it may become contaminated or scratched.

9.6	Filter paper retainer	Pull to remove (hold panel firmly)
9.7	Filter paper	Remove and discard
9.8	Radioactive source (6Z/6642456)	(i) Remove from transit case (using tweezers) (ii) Check that serial number is the same as the one in the transit case. (iii) Place on sample holder face. (serial number downwards).
9.9	Filter paper retainer	Refit (hold panel firmly).
9.10	Filter paper access panel	(i) Ensure locking knob is fully ccw. (ii) Close (iii) Lock in position (rotate locking knob fully clockwise (cw) (iv) Check locked in position.

Note: If the panel is not locked in position repeat the operations in Item No. 9.10

9.11	COUNTING light	Check illuminated
9.12	ALARM RESET button	(i) Press (ii) Release (iii) Check button light extinguished
9.13	AUDIBLE ALARM switch	Set to ON
9.14	Alarm	Check operates when the scale pointer indicates 15 (i.e. 1500 cpm).
9.15	ALARM RESET button	Check button light is illuminated
9.16	AUDIBLE ALARM switch	Set to OFF.
9.17	Scale pointer	(i) Allow to stabilise (ii) Check that the reading lies between the limits given with the radioactive source (See Note)

Note: If the reading is outside the given limits the Monitor is to be run for a further 20 minutes. If the reading now lies within the limits the Monitor is serviceable. However, the Monitor accuracy is suspect if the reading is outside the given limits for a second time.

## 10. Monitor general

10.1	Filter paper access panel	(i) Unlock (ii) Lower
10.2	Filter paper source	Remove (hold panel firmly).
10.3	Radioactive source	(i) Remove (using tweezers). (ii) Replace in transit container.
10.4	Filter paper	Place new filter paper on sample holder face (using tweezers)
10.5	Filter paper retainer	Refit (hold panel firmly)
10.6	Filter panel access panel	(i) Ensure locking knob fully ccw. (ii) Close (iii) Lock in position (rotate locking knob fully cw ). (iv) Ensure panel is locked in position.

ITEM NO.	ITEM	OPERATION
10.7	RANGE switch	Set as directed by the Health Physics Section.
10.8	ALARM PUSH button	Press in and hold
10.9	ALARM SET control	Set alarm operating point as directed by the Health Physics Section.
10.10	ALARM PUSH button	Release
10.11	ALARM RESET button	(i) Press (ii) Release (iii) Check button light extinguishes
10.12	AUDIBLE ALARM switch	Set to ON.
11.	<u>Air pump and flow alarm checks</u>	
11.1	Air pump	(i) Remove from transit case (ii) Examine
11.2	Vacuum tube	(i) Remove from Monitor transit case (ii) Examine, especially for cleanliness (iii) Fit to pump regulator 'AIR IN' connection. (iv) Fit to Monitor rear panel (v) Ensure tight fit at both ends
11.3	Pump power switch (Monitor rear panel)	Ensure set to OFF.
11.4	Pump mains lead	Connect to Monitor rear panel
11.5	Pump power switch	(i) Set to ON (ii) Enter time on servicing form
11.6	Monitor flowrate indicator	Ensure indicated reading of 30 litres per minute (reading to be taken from centre line of indicator flow ball every hour the equipment is in use).
11.7	FLOW ALARM RESET button	(i) Check button light is illuminated (ii) Press (iii) Release (iv) Check light is extinguished
11.8	Pump power switch	Set to OFF
11.9	FLOW ALARM RESET button	Check button illuminates within 5 seconds of switching off.
11.10	Pump power switch	Set to ON.
11.11	FLOW ALARM RESET button	(i) Press (ii) Release (iii) Check button light extinguishes
12.	<u>Pump power switch</u>	Leave set to ON if Monitor and pump are required for immediate use.
13.	<u>Monitor power switch</u>	Leave set to ON 24 hours a day during the deployment (to stop condensation forming on the detector).
14.	<u>Servicing forms</u>	Sign.



CHAPTER 3

AFTER USE SERVICING

EQUIPMENT AND TOOLS

<u>REF. NO.</u>	<u>DESCRIPTION</u>	<u>QTY</u>
6515-99-2107825	Tweezers, disposable	1
6Z/6642456	Source, Radioactive (Plutonium)	1

MATERIALS

6Z/6595817	Paper, filter Type GF/A 3005	As required
NYR	Paper, Chart recording	"

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Radiation Safety, ionizing and non-ionizing  
radiation orders and instructions.

<u>ITEM No.</u>	<u>ITEM</u>	<u>OPERATION</u>
	Note: (i) After daily use carry out operations at Item Nos. 1 to 3 inclusive only.	
	(ii) At the termination of the deployment carry out the operations at Item Nos. 4 to 11 inclusive.	
1.	<u>Pump power switch</u> (Monitor rear panel )	(i) Set to OFF (ii) Enter time on servicing form
2.	<u>Monitor power switch</u>	) Leave set to ON 24 hours a day during the deployment to stop condensation forming on the detector.
3.	<u>Monitor mains power supply switch</u>	)

ITEM NO.	ITEM	OPERATION
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Note: Prior to carrying out the After Use Servicing, in full, ensure that the filter paper has been removed for monitoring.

4.	<u>Chapter 1</u>	) Read
4.1	Safety precautions	)
4.2	Servicing Notes	)
5.	<u>Pump RAP 1</u>	
5.1	Pump power switch (Monitor rear panel)	(i) Set to OFF (ii) Enter time on servicing form
5.2	Pump mains power lead	Disconnect from Monitor
6.	<u>Monitor preparation</u>	
6.1	WINDOW control	Ensure set to 1.0
6.2	THRESHOLD control	Ensure set to 4.65.
6.3	RESPONSE control	Ensure set to SLOW.
6.4	MODE switch	Ensure set to PHA-SUB
6.5	RANGE switch	Set to x 100
6.6	AUDIBLE ALARM switch	Set to OFF
6.7	Monitor mains lead	Ensure connected to mains power supply
6.8	Mains power switch	) Ensure set to ON
6.9	Monitor power switch	)
7.	<u>Counting and alarm checks</u>	
7.1	AUDIBLE ALARM ON OFF switch	Set to OFF
7.2	ALARM PUSH button	Press in and hold
7.3	ALARM SET control	Adjust for recorder scale reading of 15 (i.e. 1500 cpm).
7.4	ALARM PUSH button	Release
7.5	Filter paper access panel	(i) Unlock (rotate locking knob fully ccw) (ii) Lower

Note: Under no circumstances is the detector mirror surface to be touched otherwise it may become contaminated or scratched.

7.6	Filter paper retainer	Pull to remove (hold panel firmly)
7.7	Radioactive source (6Z/6642456)	(i) Remove from transit case (using tweezers) (ii) Check that serial number is the same as the one in the transit case. (iii) Place on sample holder face. (serial number downwards).
7.8	Filter paper retainer	Refit (hold panel firmly)
7.9	Filter paper access panel	(i) Ensure locking knob fully ccw. (ii) Close (iii) Lock in position (rotate locking knob fully cw) (iv) Ensure locked in position.

Note: If the panel is not locked in position repeat the operations at Item No. 7.9.

ITEM NO.	ITEM	OPERATION
7.10	COUNTING light	Check illuminated
7.11	ALARM RESET button	(i) Press (ii) Release (iii) Check button light extinguishes
7.12	AUDIBLE ALARM switch	Set to ON
7.13	Alarm	Check operates when scale pointer indicates 15 (i.e. 1500 cpm).
7.14	ALARM RESET button	Check button light is illuminated
7.15	AUDIBLE ALARM switch	Set to OFF
7.16	Scale Pointer	(i) Allow to stabilise (ii) Check that the reading lies between the limits given with the radioactive source. (See Note).

Note: If the reading is outside the given limits the Monitor is to be run for a further 20 minutes. If the reading now lies within the limits the Monitor is serviceable. However, the Monitor accuracy is suspect if the reading is outside the limits a second time.

#### 8. Filter paper renewal

8.1	Filter paper access panel	(i) Unlock (ii) Lower
8.2	Filter paper retainer	Remove (hold panel firmly).
8.3	Radioactive source	(i) Remove (using tweezers) (ii) Replace in transit case
8.4	Filter paper	Place new filter paper on sample holder face.
8.5	Filter paper retainer	Refit (hold panel firmly).
8.6	Filter paper access panel	(i) Ensure locking knob is fully ccw (ii) Close (iii) Lock in position (rotate locking knob fully cw) (iv) Ensure locked in position

#### 9. Air pump and flow alarm checks

9.1	Vacuum tube	(i) Ensure connected to Monitor (ii) Ensure connected to pump
9.2	Pump power switch (Monitor rear panel)	Ensure set to OFF
9.3	Pump mains power lead	Reconnect to Monitor rear panel
9.4	Pump power switch	Set to ON
9.5	FLOW ALARM RESET button	(i) Check button light is illuminated (ii) Press (iii) Release (iv) Check light extinguishes
9.6	Monitor flowrate indicator	Ensure a reading of 30 litres per minute (LPM)
9.7	Pump power switch	Set to OFF
9.8	FLOW ALARM RESET button	Ensure button light illuminates within 5 seconds of switching off
9.9	Pump power switch	Set to ON
9.10	FLOW ALARM RESET button	(i) Press (ii) Release (iii) Check button light extinguishes

ITEM NO.	ITEM	OPERATION
10.	<u>Monitor and pump general</u>	
10.1	Pump power switch	) (i) Set to OFF (ii) Record time on servicing form
10.2	Monitor power switch	)
10.3	Monitor mains power supply switch	)
10.4	Pump mains lead	Disconnect from Monitor
10.5	Monitor mains lead	(i) Disconnect from mains power supply (ii) Replace in Monitor transit case
10.6	Vacuum tube	(i) Disconnect from Monitor (ii) Disconnect from pump (iii) Replace in Monitor transit case
10.7	Monitor	) Replace in transit case
10.8	Pump	)
11.	<u>Servicing forms</u>	Sign

Chapter 4

ONE MONTHLY SERVICING

(To be carried out by the holder/user unit)

EQUIPMENT AND TOOLS

<u>REF NO.</u>	<u>DESCRIPTION</u>	<u>QTY</u>
6515-99-210-7825	Tweezers, disposable	1
6Z/6642456	Source, radioactive (Plutonium)	1

MATERIALS

6Z/6595817	Paper, filter type GF/A3005	As required
NYR	Paper, chart recording	As required

ASSOCIATED PUBLICATIONS

▶ JSP 392	Radiation Safety, ionizing and non-ionizing radiation orders and instructions.	◀
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<u>ITEM NO.</u>	<u>ITEM</u>	<u>OPERATION</u>
1.	<u>Chapter 1</u>	) Read
1.1	Safety precautions	)
1.2	Servicing notes	)
2.	<u>Before Use Servicing</u>	Carry out in full in accordance with Chapter 2 of this Topic-5F except for Item Nos. 12 and 13
3.	<u>Pump</u>	
3.1	Pump power switch	Set to OFF
3.2	Pump mains lead	Disconnect from Monitor
4.	<u>Monitor preparation</u>	
4.1	AUDIBLE ALARM switch	Set to OFF
4.2	Filter paper access panel	(i) Unlock (rotate locking knob fully counter-clockwise (ccw)). (ii) Lower panel

Note: Under no circumstances is the detector mirror surface to be touched otherwise it may become contaminated or scratched.

ITEM NO.	ITEM	OPERATION
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4.3	Radioactive source (6Z/6642456)	(i) Remove from transit case (using tweezers) (ii) Check that serial number is the same as the one in the transit case (iii) Place on sample holder face. (serial number downwards)
4.4	Filter paper retainer	Refit (hold panel firmly)
4.5	Filter paper access panel	(i) Ensure locking knob is fully ccw (ii) Close (iii) Lock in position (rotate locking knob fully clockwise (cw)) (iv) Ensure panel is locked in position.

Note: If the panel is not locked in position repeat the operations at Item No. 4.5

4.6	Chart recorder	Ensure printed trace stabilises within the cpm limits given with the source in use.
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Note (i) The Monitor is now to be run for a minimum of 8 hours to exercise the moving parts of the chart recorder.  
(ii) While the Monitor is running the following checks are to be carried out every 2 hours.

5.	<u>Monitor checks (every 2 hours)</u>	(Item Nos. 5.1 to 5.6 incl.)
5.1	ALARM RESET button	(i) Check button light is illuminated (ii) Press (iii) Release (iv) Check light extinguishes
5.2	AUDIBLE ALARM switch	Set to ON
5.3	Alarm	Check operates when scale pointer indicates 15 (i.e. 1500 cpm)
5.4	ALARM RESET button	Check button light is illuminated
5.5	AUDIBLE ALARM switch	Set to OFF
5.6	Chart recorder printout	Check trace remains within the cpm limits given with the source in use (except where an alarm check has been carried out)

Note: After 8 hours of Monitor operation carry out the following:-

6.	<u>Chapter 1 (of this Topic-5F)</u>	) Read
6.1	Safety precautions	)
6.2	Servicing notes	)
7.	<u>After Use Servicing</u>	Carry out in accordance with this Topic-5F, Chapter 3, Item Nos. 7.10 onwards.
8.	<u>Servicing Forms</u>	Sign as having completed the After Use Servicing.

Chapter 5

AIR PUMP RAP 1, (6Z/6595814)

100 hour SERVICING

To be carried out by the holder/user unit)

EQUIPMENT AND TOOLS

<u>REF NO.</u>	<u>DESCRIPTION</u>	<u>QTY</u>
-	-	-

MATERIALS

NYR	Filter, air (inlet)	As required
NYR	Filter, air (exhaust)	As required

ASSOCIATED PUBLICATIONS

► JSP 392      Radiation safety, ionizing and non-ionizing radiation orders and instructions.      ◀

<u>ITEM NO.</u>	<u>ITEM</u>	<u>OPERATION</u>
1.	<u>Chapter 1</u>	) Read
1.1	Safety precautions	)
1.2	Servicing notes	)

Note: If the pump is in operation set the pump power switch to OFF, enter running time on servicing form and commence the 100 hour servicing.

CAUTION: (i) If the pump was last used in an area which was not contaminated carry out the operations at Item Nos. 2 to 4 incl.  
(ii) If the pump was last used in a contaminated area carry out the operations at Item No. 5 onwards.

ITEM NO.	ITEM	OPERATION
2.	<u>Air Pump Servicing (uncontaminated pump)</u>	
2.1	Glass filter bowls (2 off)	(i) Remove (unscrew) (ii) Wash in clean water (iii) Shake out excess water (iv) Dry with a clean lint-free cloth
2.2	Air filters (2 off)	(i) Remove (ii) Examine or replace every 200 running hours.
Note: If filter replacement is not required carry out the following sub-ordinates (iii) to (vi) incl.		
	(iii) Wash in clean water	
	(iv) Shake to remove excess water	
	(v) Ensure as dry as possible before refitting	
	(vi) Refit	
2.3	Glass filter bowls (2 off)	Refit
3.	<u>Pump Power switch</u>	(i) Set to ON if the Monitor is required for immediate use (ii) Enter time on servicing form
4.	<u>Servicing form</u>	Sign
5.	<u>Air pump servicing (contaminated pump)</u>	
5.1	Glass filter bowls (2 off)	(i) Remove (unscrew) (ii) Wash in clean water (iii) Shake out excess water (iv) Dry with a clean lint-free cloth
Note: Contaminated waste is to be disposed of in accordance with (iaw) local orders and instructions		
5.2	Air filters (2 off)	(i) Remove (ii) Dispose of as contaminated waste iaw local orders and instructions (iii) Replace with new filters
5.3	Glass filter bowls (2 off)	Refit
6.	<u>Pump power switch</u>	(i) Set to ON if the Monitor is required for immediate use. (ii) Enter time on servicing form
7.	<u>Servicing form</u>	Sign



Chapter 6

ACCEPTANCE AND 6 MONTHLY SERVICING

EQUIPMENT AND TOOLS

<u>REF NO.</u>	<u>DESCRIPTION</u>	<u>QTY</u>
1C/9105851	Screwdriver, watchmakers	1
1C/9105875	Screwdriver, instrument	1
6515-99-2107825	Tweezers, disposable	1
10S/6207421	Generator, pulse (PG52)	1
10S/6518615	Multimeter, digital 7045	1
10S/1992562	Oscilloscope CT 531/3	1
6Z/6642456	Source, radioactive (Plutonium)	1
6Z/1111783	Shelf Unit	1
6Z/6474657	Power Unit	1
6Z/6501973	Pulse Generator	1
NYR	Allen Key 1mm	1

MATERIALS

6Z/6595817	Paper, filter GF/A 3005	As required
NYR	Paper, chart recording	As required

ASSOCIATED PUBLICATIONS

▶ JSP 392	Radiation safety, ionizing and non-ionizing radiation orders and instructions	◀
AP100B-01, Leaflet 1703	Specific precautions against cadmium dust	

ITEM NO.	ITEM	OPERATION
Note:	(i)	During the following servicing any adjustments made, to the counting circuits in particular, must be made with caution because of the time taken for the circuits to stabilise.
	(ii)	The Chart recorder drive may be switched off, if necessary, during the circuit adjustments.
1.	<u>Chapter 1</u>	) Read
1.1	Safety precautions	)
1.2	Servicing notes	)
2.	<u>Monitor general</u>	
2.1	Monitor	) (i) Remove from transit case (ii) Examine
2.2	Mains power lead	)
2.3	Chart recording paper	Ensure a diagonal red line is not visible
2.4	Air intake filter cap	(i) Remove (ii) Examine
2.5	Filter paper access panel	Ensure locked in position
2.6	Monitor case	Remove
2.7	Mains power lead	(i) Connect to Monitor (ii) Connect to mains power supply
2.8	Plastic cover (over controls)	Remove
2.9	AUDIBLE ALARM switch	Set to OFF
2.10	Mains power supply switch	) Set to ON
2.11	Monitor power switch	)
Note:		During the following chart recorder checks, at Item Nos. 2.12 and 2.13, the Monitor is to be left for 1 hour to allow the detecting circuits to warm up and stabilise.
2.12	Chart Recorder Pointer	Ensure Zeroed
2.13	Chart recorder marking circuit	Check that the scale pointer is marking the paper approximately every 3 seconds
2.14	Chart recorder paper speed	(i) Check that the paper is being driven downwards at approximately 2 cms per hour. (ii) Set drive switch to OFF (after 1 hour of equipment operation). (iii) Check that the paper has been marked on the zero line.
3.	<u>DC voltage checks</u>	
3.1	+24v check on the Power Supply Board (PSB)	(i) Connect digital multimeter (dmm): (a) Negative lead to chassis (b) Positive lead to the +24v o/p terminal on the PSB. (ii) Check that dmm reading is $+24v \pm 1.2v$
3.2	-ve 8v Check on the PSB	(i) Connect dmm: (a) Positive lead to chassis (b) Negative lead to rectifier side of C201. (ii) Check that dmm reading is $- 8v \pm 0.5v$ .

ITEM NO.	ITEM	OPERATION
3.3	-ve 5.3v check on the PHA- Readout Board (PRB)	(i) Connect dmm negative lead to the junction of R39 and C16 (ii) Check that dmm reading is $- 5.3v \pm 0.3v$
3.4	+5v check on the PRB	(i) Connect dmm: (a) negative lead to chassis (b) positive lead to the junction of C6 and R31 (ii) Check that dmm reading is $+5v \pm 0.4v$
3.5	+5v check on the Pre-Amplifier Board (PAB)	(i) Connect dmm positive lead to the + end of C111 (ii) Check that dmm reading is $+5v \pm 0.4v$
3.6	+ 0.8v check on the PAB	(i) Connect dmm positive lead to junction of R110 and emitter of Q107 (ii) Check that dmm reading is $0.8v \pm 0.2v$
4.	<u>Range calibration</u>	
4.1	RANGE switch	Set to x 100
4.2	MODE switch	Set to GROSS
4.3	THRESHOLD control	Set to 3.0
4.4	RESPONSE switch	Ensure set to FAST
4.5	Filter paper access panel	(i) Unlock (ii) Lower (leave lowered)
4.6	Pulse Generator PG 52	(i) Set output positive square wave to: (a) frequency = 66.6Hz (b) pulse width = $2\mu S$ (ii) Connect output of pulse width module to TRIG/CONT input of Harwell Pulse Generator 2177
4.7	Pulse Generator 2177	(i) Set to give positive pulse output synchronised to the PG 52 and set: (a) pulse width = $2\mu S$ (b) output amplitude = minimum (ii) Connect output to the TEST point on the PRE-AMP board (iii) Increase the output amplitude until monitor scale pointer indicates a steady reading.
4.8	x 100 calibration pot (RV 23)	Adjust for a recorder scale reading of 40 (i.e. 4000 cpm).
4.9	Pulse generator PG 52	Set to output frequency of 6.66Hz
4.10	Monitor RANGE switch	Set to x 10
4.11	x 10 calibration pot (RV 22)	Adjust for a recorder scale reading of 40 (i.e. 400 cpm).
4.12	Pulse generator PG 52	Set output frequency to 0.66Hz
4.13	Monitor RESPONSE switch	Set to SLOW
4.14	Monitor RANGE switch	Set to x 1
4.15	x 1 calibration pot (RV 21)	Adjust for recorder scale reading of 40 (i.e. 40 cpm)
4.16	Pulse Generator 2177	(i) Output amplitude set to minimum (ii) Disconnect from Monitor
5.	<u>Pre-amplifier gain check</u>	
5.1	RANGE switch	Set to x 100
5.2	MODE switch	Set to GROSS
5.3	Filter paper retainer	Remove (hold panel firmly)

ITEM No.	ITEM	OPERATION
5.4	Filter paper	(i) Remove (ii) Examine (iii) Discard as necessary
5.5	Radioactive source (6Z/6642456)	(i) Remove from transit case (using tweezers) (ii) Check that serial number is the same as the one in its transit case (iii) Place on sample holder face (serial number downwards)
5.6	Filter paper retainer	Refit (hold panel firmly)
5.7	Filter paper access panel	Lock in position
5.8	Oscilloscope	(i) Set to display input pulses of: (a) frequency approx 60HZ (b) amplitude = 0.7v (ii) Connect to the output of the Pre-Amp Board at the rear of Skt 101
5.9	Gain control (RV 108)	Adjust for a pulse amplitude on oscilloscope of 0.7v (average pulse heights)
5.10	Radioactive source	(i) Remove from Monitor (using tweezers) (ii) Replace in transit case
5.11	Filter paper access panel	Leave in lowered position
6.	<u>Signal level preparation</u>	
6.1	Pulse generator PG 52	Set output frequency to 66.6Hz
6.2	Pulse Generator 2177	(i) Connect output to TEST point on PRE-AM board (ii) Increase amplitude of output, from minimum, to obtain pulse height of 0.7v, as displayed on oscilloscope (iii) Note output amplitude selected
6.3	Oscilloscope	Disconnect
6.4	THRESHOLD control	Set to 5.35
<p>Note: The THRESHOLD control minimum setting is 0.7 and is offset to compensate for the energy loss in the air gap between the source and the detector.</p>		
6.5	RESPONSE switch	Set to FAST
6.6	SIGNAL LEVEL control	Adjust until pulses are just being counted by the Monitor chart recorder
7.	<u>THRESHOLD control check</u>	
7.1	Pulse Generator 2177	Set output amplitude to minimum.
7.2	THRESHOLD control	Set to 3.03
7.3	Pulse Generator 2177	(i) Increase output amplitude until pulses are just being counted on Monitor recorder (ii) Check pulse amplitude selected is $\frac{1}{2}$ that noted in Item No. 6.2 (iii) $\pm$ 5%

ITEM No.	ITEM	OPERATION
7.4	THRESHOLD control	Set to 10.0
7.5	Pulse Generator 2177	(i) Increase output amplitude until pulses are just being counted in Monitor recorder (ii) Check pulse amplitude selected is twice that noted in Item No. 6.2 (iii) $\pm 5\%$
8.	<u>WINDOW control check</u>	
8.1	MODE switch	Set to PHA
8.2	THRESHOLD control	Set to 2.0
8.3	WINDOW control	Set to 1.30
8.4	Pulse Generator 2177	(i) Set output amplitude to minimum (ii) Increase output amplitude until pulses are just being counted on Monitor recorder (iii) Note output amplitude selected (iv) Continue increasing the amplitude until pulse just stops being counted on Monitor recorder (v) Check pulse amplitude selected is twice that noted in Item No. 8.4 (iii) $\pm 10\%$
8.5	WINDOW control	Set to 3.90 (pulses will now be counted on Monitor recorder).
8.6	Pulse Generator 2177	(i) Increase output amplitude until pulses just stop being counted on Monitor recorder (ii) Check pulse amplitude selected is 4 times that noted in Item No. 8.4 (iii) $\pm 10\%$ (iii) Decrease output amplitude until pulses are being strongly counted on the Monitor received
8.7	Pulse Generator PG 52	Set output frequency to minimum
9.	<u>SUBTRACTION-WINDOW (SUB WIN) calibration</u>	
9.1	WINDOW control	Set to 1.00
9.2	Digital multimeter (dmm) (to measure 100mV DC)	(i) Connect negative lead to pin 5 on PHA-Readout Board (ii) Connect positive lead to TP-1 on PHA-Readout Board
9.3	SUB-WIN control (RV 13)	Adjust for a dmm reading of 100mV
10.	<u>Radiation alarm circuit check</u>	
10.1	ALARM PUSH button	Press in and hold
10.2	ALARM SET control	Adjust for a recorder scale reading of 40
10.3	ALARM PUSH button	Release
10.4	ALARM RESET button	(i) Press (ii) Release (iii) Check light is extinguished
10.5	AUDIBLE ALARM switch	Set to ON
10.6	Pulse Generator PG 52	Increase output frequency slowly until the audible alarm sounds
10.7	Monitor scale pointer	Check for a reading of 40

ITEM NO.	ITEM	OPERATION
10.8	ALARM RESET button	Check button light illuminates when alarm sounds
10.9	AUDIBLE ALARM switch	Set to OFF
10.10	Pulse generator output	Set frequency to minimum
10.11	ALARM PUSH button	Press in and hold
10.12	ALARM SET control	Adjust for recorder scale reading of 20
10.13	ALARM PUSH button	Release
10.14	ALARM RESET button	(i) Press (ii) Release (iii) Check button light extinguishes
10.15	AUDIBLE ALARM switch	Set to ON
10.16	Pulse generator output	Increase very slowly until the audible alarm sounds
10.17	Monitor scale pointer	Check for a reading of 20
10.18	ALARM RESET button	Check button light illuminates when alarm sounds
10.19	AUDIBLE ALARM switch	Set to OFF
10.20	Pulse generator	Disconnect from Monitor
11.	<u>Detection efficiency check</u>	
11.1	Radioactive source	(i) Remove from transit case (using tweezers) (ii) Check that serial number is the same as the one in its transit case (iii) Place on sample holder face. (serial number downwards)
11.2	Filter paper retainer	Refit (hold panel firmly)
11.3	Filter paper access panel	Lock in position
11.4	RANGE switch	Set to x 100
11.5	MODE switch	Set to GROSS
11.6	THRESHOLD control	Set to 3.0
11.7	SIGNAL LEVEL pot (RV1 on front panel)	Set fully clockwise
11.8	RESPONSE switch	Set to SLOW
11.9	Monitor scale pointer	(i) Allow to stabilise for about 5 minutes (ii) Check that the chart recorder reading is approximately 25% of the Disintegrations Per Minute (DPM) figure given with the radioactive source (iii) Note scale reading
11.10	THRESHOLD control	Set to 5.15
11.11	RESPONSE switch	Set to FAST
11.12	SIGNAL LEVEL pot	Adjust carefully for a chart recorder reading $\frac{1}{2}$ that noted in Item No. 11.9 (iii)
11.13	RESPONSE switch	Set to SLOW
11.14	Monitor scale pointer	(i) Allow to stabilise for about 5 minutes (ii) Check that the chart recorder reading is still $\frac{1}{2}$ that noted in Item No. 11.9 (iii)
11.15	Repeat Item Nos. 11.11 to 11.14 incl. until no further adjustment is necessary.	

Note: The following resolution check includes obtaining the maximum DPM reading possible by adjusting the THRESHOLD control and keeping the WINDOW setting at 0.10

ITEM NO.	ITEM	OPERATION
12.	<u>System resolution check</u>	
12.1	MODE switch	Set to PHA
12.2	WINDOW control	Set to 0.10
12.3	RESPONSE switch	Set to FAST
12.4	THRESHOLD control	(i) Set to 4.50 (ii) Rotate slowly clockwise (cw) until a maximum DPM reading is observed on the chart recorder (iii) Note THRESHOLD setting (i.e. THRESH for maxDPM) (iv) Continuing slowly rotating cw until the chart recorder reading is ½ that noted in (iii) (v) Note THRESHOLD setting (i.e. Upper THRESH) (vi) Rotate counter-clockwise (ccw) and continue past the setting of maximum DPM until the chart recorder reading is again ½ that noted in (iii) (vii) Note THRESHOLD setting (i.e. Lower THRESH)
12.5	Monitor	(i) Calculate the resolution (R) using the THRESHOLD settings noted in Item No. 11.5  $R = \frac{\text{Upper THRESH} - \text{Lower THRESH (5.15 (MeV))}}{\text{THRESH for max DPM}}$
13.	Counting light check	(ii) Check that Resolution is less than 500 KeV
13.1	THRESHOLD control	Set to 4.65
13.2	WINDOW control	Set to 1.00
13.3	Counting light	Ensure illuminated
13.4	Monitor scale pointer	Check that reading lies between the limits given with the source in use.
13.5	Filter paper access panel	(i) Unlock (ii) Lower
13.6	Filter paper retainer	Remove (hold panel firmly)
13.7	Radioactive source	(i) Remove from Monitor (using tweezers) (ii) Replace in transit case
13.8	Counting light	Check extinguishes within 60 seconds of the source being removed from the Monitor
14.	<u>Monitor airflow and FLOW ALARM check</u>	
14.1	Filter paper	(i) Examine (ii) Refit or replace as necessary
14.2	Filter paper retainer	Refit (hold panel firmly)
14.3	Filter paper access panel	Lock in position
14.4	Monitor air intake filter	Refit
14.5	Vacuum tube	(i) Connect to Monitor (ii) Connect to pump
14.6	Pump power switch (Monitor rear panel)	Ensure set to OFF (Down)

ITEM NO.	ITEM	OPERATION
14.7	Pump mains lead	Connect to Monitor rear panel
14.8	FLOW ALARM RESET button light	Check illuminated
14.9	Pump power switch	Set to ON
14.10	Monitor flowrate indicator	Ensure an airflow rate indication of 30 litres per minute (LPM)
14.11	Pump air regulator	Adjust as necessary for a flowrate indication of 30 LPM
14.12	FLOW ALARM RESET button	(i) Press (ii) Release (iii) Check button light is extinguished
14.13	Pump air regulator airflow screw	Adjust slowly to decrease airflow until the FLOW ALARM RESET button light illuminates
14.14	Flowrate indicator	Check flowrate is 25 LPM $\pm$ 3 LPM
Note: The following Item Nos. 14.15 to 14.18 are only applicable if Item NO.14.14 is not satisfied.		
14.15	Pump air regulator	Adjust for a flowrate indication of 30 LPM
14.16	FLOW ALARM RESET button	(i) Press (ii) Release (iii) Check button light is extinguished.
14.17	Airflow alarm switch	Adjust as necessary until the FLOW ALARM RESET button light illuminates at an airflow of 25 LPM + 3 LPM
Note: Rotating the airflow alarm switch screw counter-clockwise reduces the airflow rate at which the switch operates.		
14.18	Pump air regulator	Re-adjust for an indicated airflow of 30 LPM
14.19	FLOW ALARM RESET switch	(i) Press (ii) Release (iii) Check button light is extinguished
14.20	Pump power switch	Set to OFF
14.21	FLOW ALARM RESET button light	Check that it illuminates within 5 seconds of switching pump off
15.	<u>Monitor operational check (8 hours)</u>	
15.1	Filter paper access panel	(i) Unlock (ii) Lower
15.2	Filter paper retainer	(i) Remove (hold panel firmly)
15.3	Filter paper	(i) Remove (using tweezers) (ii) Examine (iii) Retain or discard as necessary
15.4	Radioactive source	(i) Remove from transit case (using tweezers) (ii) Check that serial number is the same as in its case (iii) Place on sample holder face. serial number downwards)
15.5	Filter paper retainer	Refit
15.6	Filter paper access panel	Lock in position
15.7	MODE switch	Set to PHA-SUB



ITEM NO.	ITEM	OPERATION
15.8	RESPONSE switch	Set to SLOW
15.9	THRESHOLD control	Set to 4.65
15.10	WINDOW control	Set to 1.0
15.11	% – SUB pot (front panel)	Set fully clockwise
15.12	Chart recorder	(i) Set paper drive switch to ON (ii) Allow scale pointer to stabilise for about 5 minutes (iii) Check that reading lies between the limits given with the source in use. (iv) Over a period of 8 hours check that the printed trace remained within the limits (v) Check that a diagonal red line is not visible on the paper
16.	<u>General</u>	
16.1	Filter paper access panel	(i) Unlock (ii) Lower
16.2	Filter paper retainer	Remove (hold panel firmly)
16.3	Radioactive source	(i) Remove (using tweezers) (ii) Replace in transit case as necessary
16.4	Filter paper	Refit or replace as necessary
16.5	Filter paper retainer	Refit (hold panel firmly)
16.6	Filter paper access panel	Lock in position
16.7	Monitor power switch	) Set to OFF
16.8	Mains power supply switch	)
16.9	Mains power lead	Disconnect from mains power supply
16.10	Pump mains power lead	Disconnect from Monitor
16.11	Vacuum tube	(i) Disconnect from Monitor (ii) Disconnect from pump
16.12	Plastic cover (over controls)	Refit
16.13	Monitor air filter	Remove
16.14	Monitor case	Refit
16.15	Monitor air filter	(i) Examine (ii) Refit
16.16	Monitor	) Replace in transit case
16.17	Pump	)
16.18	Mains lead	)
16.19	Vacuum tube	Replace in transit case
17.	<u>Servicing forms</u>	(i) Enter pump running time (during servicing) (ii) Sign