Portable Dose Ratemeter
PDR3/Sv

Portable Dose Ratemeter PDR3/Sv

This Manual was prepared for Serial Numbers : - 186 - 265

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A THORN EMI company

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1. INTRODUCTION

The PDR3 Sv is a portable wide range gamma survey monitor, using an internal geiger tube and ratemeter. The unit displays dose equivalent rate in terms of microseiverts per hour. Since however there has yet to be defined by ICRU a practical unit of dose equivalent, the unit has been calibrated in exposure on the basis that 100R = 1Sv as suggested by the PTB and BCRU*.

To simplify the text of this manual the term dose rate is used for dose equivalent rate and dose for dose equivalent throughout. The unit is intended to measure for deep tissue dose equivalence only.

The doserate range covered is from 50μSv/h to 500m Sv/h and is displayed on the log-scaled panel meter. An integrated dose may also be displayed on a linear scale by means of a biased switch. Audible/visual alarms occur at three fixed dose levels. The audible alarm may be reset.

* BCRU - BJR 1982 Vol 55 p 375 - 377

PTB - Mitteilungen 90 4/80

2. SPECIFICATION

2.1 CONSTRUCTION

The unit is housed in a case of tough cream plastic, with an R.A.F. Blue/Grey handle and cream labels. This strong material combines light weight with easy cleaning and decontamination and high abrasive resistance.

The overall dimensions are :-

Length	241mm
Width	120mm
Height	146mm (including handle)
Weight	1.6kg

Batteries

The unit has two leak-proof U2 cells (IEC R20)

The battery life is not less than 100 hours (assuming audible alarm operates briefly).

2.2 DOSERATE

Doserate Range

50μSv/h to 500m Sv/h in 5 decades, on a 70mm scale.

Doserate Accuracy (662 KeV)

± 20% at 20°C
< 20% change over temperature range +20° C to +60°C
< 20% change over temperature range +20° C to -10°C

Saturation

Full scale deflection on doserate scale from 500m Sv/h up to at least 10^2 Sv/h.

Beta Response

≤ 0.02 of the dose rate due to beta energies of less than 2.2MeV.

Angular Dependence

< 30% at 622 KeV.

Energy Response

± 25% 80 KeV to 3 MeV.

Meter Response Times (Doserate Scale)

These are the 90% response times for a factor of 10 change in actual doserate.

Increasing Rate

5μSv/h to 50μSv/h 11 secs
50μSv/h to 500μSv/h 6 secs
500μSv/h to 5m Sv/h 3 sec
5m Sv/h to 50m Sv/h 3 sec
50m Sv/h to 500m Sv/h 3 sec

Decreasing Rate

50μSv/h to 5μSv/h 80 secs
500μSv/h to 50μS/h 22 secs
5m Sv/h to 500μSv/h 4 secs
50m Sv/h to 50m Sv/h 3 secs
500m Sv/h to 50m Sv/h 3 secs

2.3 INTEGRATED DOSE

Integrated Dose Range

0 - 40m Sv for dose rates upto 500m Sv/h.

Integrated Dose Accuracy (622 KeV)

Within 10% at 20° C

Alarms at 5.7mSv

Red L.E.D. (Slow Flash)
Audible alarm (can be reset)

At 23mSv

Red L.E.D. (Fast Flash)
Audible alarm (can be reset)

At 46m Sv

Red L.E.D. (on)
Audible alarm (can be reset)

Battery Low Condition

Audible alarm (can be inhibited but not reset).

NOTE The audible alarm rapidly drains the batteries and resetting is therefore advisable.

CONTROLS

BATT-OFF-ON	Three position locking lever switch.
DOSE	Momentary Contact Toggle (integrated dose against spring bias)
MUTE	Push button (resets audible alarm)

3. INSTALLATION

3.1 BATTERY INSERTION

The instrument is normally provided with the batteries in a separate package. To insert the batteries, loosen the four handle retaining screws and remove the handle, which covers the battery compartment.

The new batteries must be fitted in the correct way, as shown by the diagram moulded in the bottom of the compartment.

3.2 CHANGING BATTERIES

Proceed as above, except that the existing batteries must be removed by pulling upwards on the tabs provided.

4. OPERATION

Before switching on ensure that the mechanical zero of the meter corresponds to the first mark on the lower scale; adjust the screw on the meter case if necessary.

Set switch to BATT. position to ensure that the meter reads within the BATT. section. If it reads less than this, the batteries must be changed. There is a delay of several seconds after turning on before the unit is fully operational.

If the unit is turned off and on rapidly, the audible alarm may be induced, and this must be reset by the RESET button. The doserate is normally displayed; this is on the black scale.

An integrated dose facility is also available in the unit and this is displayed, on the red scale by selecting it on the DOSE switch. This is a biased switch, and so it must be held in position for a continous display, on the red scale, for integrated dose.

The integrating dose alarm facility is operative from time of switch on, and when the dose received reaches a total of 5.7m Seiverts an alarm will occur. The L.E.D. will flash at a slow rate and there will be an audible warning; the latter may be reset.

When the integrated dose reaches 23m Seiverts, a second alarm will occur. The L.E.D. will flash at a fast rate and there will be an audible warning; the latter may be reset.

When the integrate dose reaches 46m Seiverts a third alarm will occur. The L.E.D. will stay full on and an audible warning will occur; the latter may again be reset.

An audible alarm will also occur in a low battery condition. This however, may not be reset, but may be inhibited by keeping a finger on the MUTE button.

One could continue under these circumstances to use the instrument for a short period, if considered desirable. In this case the inhibition of the alarm by pressing the reset button must be continued.

The integrated dose is reset to zero each time the unit is turned on. A timed dose may therefore be made by turning the unit off, waiting several seconds then turning the unit on for the desired time. The dose may be read by selecting the integrated dose scale with the biased toggle switch, the dose integration cannot however, be stopped.

When the integrated dose has reached 46 Seiverts, the integration will stop until the unit is turned off, when the integrated dose returns to zero.

After turning on the unit, it should be checked that the integrated dose starts at zero.

Operation in pulsed fields such as that due to accelerators may give significant errors and advice should be sought from Nuclear Enterprises before using this instrument to measure such fields.

The instrument should also not be used to measure fields due to low energy x-rays either from radioactive materials or x-ray generators.

NUCLEAR ENTERPRISES LTD - CIRCUIT COMPONENTS LIST

```
A---------------  PDR3R
|
|  B------------  PDR3G
|  |
|  |  C---------  PDR3SV
|  |  |
|  |  |
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CCT REF	A	B	C	PART/DRAWING NUMBER	DESCRIPTION	VENDOR CODE
					RESISTORS	
R1	*	*	*	408860LB	R-M01/5 470R 2% 1/4W	COSTAN
R2	*	*	*	414986LF	RV-CR1/3B 2K0 10% 0.5W	COSTAN
R3	*	*	*	408864LB	R-M01/5 680R 2% 1/4W	COSTAN
R4	*	*	*	408900LB	R-M01/5 22K 2% 1/4W	COSTAN
R5	*	*	*	408896LB	R-M01/5 15K 2% 1/4W	COSTAN
R6	*	*	*	408908LB	R-M01/5 47K 2% 1/4W	COSTAN
R7	*	*	*	680851LB	R-MG1/3 68M 5% 1.0W	COSTAN
R8	*	*	*	410954LA	R-C1/2 3M3 5% 1/2W	COSTAN
R9	*	*	*	408940LB	R-M01/5 1M0 2% 1/4W	COSTAN
R10	*	*	*	408908LB	R-M01/5 47K 2% 1/4W	COSTAN
R11	*	*	*	408868LB	R-M01/5 1K0 2% 1/4W	COSTAN
R12	*	*	*	408868LB	R-M01/5 1K0 2% 1/4W	COSTAN
R13	*	*	*	408910LB	R-M01/5 56K 2% 1/4W	COSTAN
R14	*	*	*	408916LB	R-M01/5 100K 2% 1/4W	COSTAN
R15	*	*	*	408922LB	R-M01/5 180K 2% 1/4W	COSTAN
R16	*	*	*	408908LB	R-M01/5 47K 2% 1/4W	COSTAN
R17	*	*	*	408900LB	R-M01/5 22K 2% 1/4W	COSTAN
R18	*	*	*	408860LB	R-M01/5 470R 2% 1/4W	COSTAN
R19	*	*	*	408916LB	R-M01/5 100K 2% 1/4W	COSTAN
R20	*	*	*	415717LF	RV-CR1/3B 10K 10% 0.5W	COSTAN
R21	*	*	*	408848LB	R-M01/5 150R 2% 1/4W	COSTAN
R22	*	*	*	408932LB	R-M01/5 470K 2% 1/4W	COSTAN
R23	*	*	*	408876LB	R-M01/5 2K2 2% 1/4W	COSTAN
R24	*	*	*	408932LB	R-M01/5 470K 2% 1/4W	COSTAN
R25	*	*	*	408882LB	R-M01/5 3K9 2% 1/4W	COSTAN
R26	*	*	*	408864LB	R-M01/5 680R 2% 1/4W	COSTAN
R27	*	*	*	667506LB	R-MF1/2/50 33K 1% 1/4W	COSTAN
R28	*	*	*	670206LB	R-MF1/2/50 75K 1% 1/4W	COSTAN
R29	*	*	*	672306LB	R-MF1/2/50 150K 1% 1/4W	COSTAN
R30	*	*	*	674406LB	R-MF1/2/50 300K 1% 1/4W	COSTAN
R31	*	*	*	676506LB	R-MF1/2/50 620K 1% 1/4W	COSTAN
R32	*	*	*	408892LB	R-M01/5 10K 2% 1/4W	COSTAN
R33	*	*	*	678631LB	R-MF1/3/50 1M2 1% 1/2W	COSTAN
R34	*	*	*	680502LB	R-MF1/3/50 2M4 1% 1/2W	COSTAN
R35	*	*	*	680553LB	RESISTOR MF 3M3 1% 1W 50PPM H2	HOLSEL
R36	*	*	*	680582LB	RESISTOR MF 3M9 1% 1W 50PPM H2	HOLSEL
R37	*	*	*	680582LB	RESISTOR MF 3M9 1% 1W 50PPM H2	HOLSEL
R38	*	*	*	680582LB	RESISTOR MF 3M9 1% 1W 50PPM H2	HOLSEL
R39	*	*	*	417264LF	RV-CR1/3B 500K 10% 0.5W	COSTAN
R40	*	*	*	680582LB	RESISTOR MF 3M9 1% 1W 50PPM H2	HOLSEL
R41	*	*	*	408932LB	R-M01/5 470K 2% 1/4W	COSTAN
R42	*	*	*	416751LF	RV-CR1/3B 200K 10% 0.5W	COSTAN
R43	*	*	*	408932LB	R-M01/5 470K 2% 1/4W	COSTAN
R44	*	*	*	408830LB	R-M01/5 27R 2% 1/4W	COSTAN
R45	*	*	*	408916LB	R-M01/5 100K 2% 1/4W	COSTAN

NUCLEAR ENTERPRISES LTD - CIRCUIT COMPONENTS LIST

A---------- PDR3R
|
| B---------- PDR3G
| |
| | C--------- PDR3SV
| | |
| | |

CCT REF	A	B	C	PART/DRAWING NUMBER	DESCRIPTION	VENDOR CODE
R46	*	*	*	408868LB	R-MO1/5 1KO 2% 1/4W	COSTAN
R47	*	*	*	676506LB	R-MF1/2/50 620K 1% 1/4W	COSTAN
R48	*	*	*	410996LA	R-C1/2 10M 5% 1/2W	COSTAN
R49	*	*	*	680403LB	R-MG1/2 2M2 5% 1/2W	COSTAN
R50	*	*	*	416751LF	RV-CR1/3B 200K 10% 0.5W	COSTAN
R51	*	*	*	408932LB	R-MO1/5 470K 2% 1/4W	COSTAN
R52	*	*	*	408940LB	R-MO1/5 1MO 2% 1/4W	COSTAN
R53	*	*	*	659706LB	R-MF1/2/50 2K7 1% 1/4W	COSTAN
R54	*	*	*	408884LB	R-MO1/5 4K7 2% 1/4W	COSTAN
R55	*	*	*	408892LB	R-MO1/5 10K 2% 1/4W	COSTAN
R56	*	*	*	408848LB	R-MO1/5 150R 2% 1/4W	COSTAN
R57	*	*	*	408894LB	R-MO1/5 12K 2% 1/4W	COSTAN
R58	*	*	*	408864LB	R-MO1/5 680R 2% 1/4W	COSTAN
R59	*	*	*	408856LB	R-MO1/5 330R 2% 1/4W	COSTAN
R60	*	*	*	408876LB	R-MO1/5 2K2 2% 1/4W	COSTAN
R61	*	*	*	408884LB	R-MO1/5 4K7 2% 1/4W	COSTAN
R62	*	*	*	417264LF	RV-CR1/3B 500K 10% 0.5W	COSTAN
R63	*	*	*	408926LB	R-MO1/5 270K 2% 1/4W	COSTAN
R64	*	*	*	408879LB	R-MO1/5 3KO 2% 1/4W	COSTAN
.						
.				CAPACITORS		
.						
C1	*	*	*	488507MD	C-STE 680UF 20% 6.3 TAP	ITTCOM
C2	*	*	*	486005MA	C-AE1 220UF -10+50% 35V	COSTAN
C3	*	*	*	465525MB	C-MPT2 0.022UF 20% 400V	COSTAN
C4	*	*	*	465525MB	C-MPT2 0.022UF 20% 400V	COSTAN
C5	*	*	*	465525MB	C-MPT2 0.022UF 20% 400V	COSTAN
C6	*	*	*	465525MB	C-MPT2 0.022UF 20% 400V	COSTAN
C7	*	*	*	470557MB	C-MPT2 0.15UF 20% 630V	COSTAN
C8	*	*	*	431303MC	CAP DCE 4.7PF 0.5PF 2KV HD09	ITTCOM
C9	*	*	*	486003MA	C-AE1 220UF -10+50% 16V	COSTAN
C10	*	*	*	463029MB	C-MPT2 0.01UF 20% 1KV	COSTAN
C11	*	*	*	471024MB	C-MPT2 0.22UF 10% 100V	COSTAN
C12	*	*	*	441008MB	C-PS1 100PF 2.5% 160V	COSTAN
C13	*	*	*	448702MC	C-MCE3 1000PF 10% 100V	COSTAN
C14	*	*	*	481004MA	C-AE1 22UF -10+50% 35V	COSTAN
C15	*	*	*	448651MC	C-MCE2 1000PF 5% 100V	COSTAN
C16	*	*	*	445101MC	C-MCE1 330PF 2% 100V	COSTAN
C17	*	*	*	435501MC	C-MCE1 15PF 2% 100V	COSTAN
C18	*	*	*	448954MB	CAP PS 1000PF 1% 160V 426	MULLRD
C19	*	*	*	467726MB	C-MPT2 0.033UF 2% 100V	COSTAN
C20	*	*	*	475416MB	C-MPT2 1.0UF 2% 100V	COSTAN
C21	*	*	*	470551MB	C-MPT2 0.15UF 20% 100V	COSTAN
C22	*	*	*	470551MB	C-MPT2 0.15UF 20% 100V	COSTAN
C23	*	*	*	476524MB	C-MPT2 2.2UF 10% 100V	COSTAN
C24	*	*	*	480551MB	C-MPT1 15UF 20% 63V	COSTAN
C25	*	*	*	445101MC	C-MCE1 330PF 2% 100V	COSTAN
C26	*	*	*	478002MA	C-AE1 4.7UF -10+50% 63V	COSTAN

NUCLEAR ENTERPRISES LTD - CIRCUIT COMPONENTS LIST

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A---------------  PDR3R
|
|  B------------  PDR3G
|  |
|  |  C---------  PDR3SV
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CCT REF	A	B	C	PART/DRAWING NUMBER	DESCRIPTION	VENDOR CODE
C27	*	*	*	445101MC	C-MCE1 330PF 2% 100V	COSTAN
C28	*	*	*	475010MB	C-MPT2 1.0UF 20% 100V	COSTAN
C29	*	*	*	449901MB	C-PS1 1800PF 2.5% 160V	COSTAN
C30	*	*	*	470021MB	C-MPT2 0.1UF 20% 100V	COSTAN
C31	*	*	*	486002MA	C-AE1 220UF -10+50% 10V	COSTAN
C32	*	*	*	435800MC	C-MCE1 18PF 2% 100V	COSTAN
C33	*	*	*	470081MC	C-MCE4 0.1UF -20+80% 50V	COSTAN
				DIODES		
D1	*	*	*	402291NC	DIODE/REF BZY88.C9V1	MULLRD
D2	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D3	*	*	*	402250NC	DIODE/REC BYX10	MULLRD
D4	*	*	*	402250NC	DIODE/REC BYX10	MULLRD
D5	*	*	*	402250NC	DIODE/REC BYX10	MULLRD
D6	*	*	*	402250NC	DIODE/REC BYX10	MULLRD
D7	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D8	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D9	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D10	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D11	*	*	*	402284NC	DIODE/REF BZY88.C4V7	MULLRD
D12	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D13	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D14	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D15	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D16	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D17	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D18	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D19	*	*	*	403011NC	DIODE/GEN ZS150	FERAEL
D20	*	*	*	A35903/A	PAD100 TO N.E. SPEC	------
D21	*	*	*	A35903/A	PAD100 TO N.E. SPEC	------
D22	*	*	*	A35903/A	PAD100 TO N.E. SPEC	------
D23	*	*	*	A35903/A	PAD100 TO N.E. SPEC	------
D24	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D25	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D26	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
D27	*	*	*	403181NC	DIODE/REC 1N4001	TEXASI
D28	*	*	*	403074NC	DIODE/GEN 1N914	MULLRD
				TRANSISTORS		
TR1	*	*	*	401677NB	TR/PNP ZTX502L	FERAEL
TR2	*	*	*	401678NB	TR/PNP ZTX550L	FERAEL
TR3	*	*	*	401677NB	TR/PNP ZTX502L	FERAEL
TR4	*	*	*	NOT USED		------
TR5	*	*	*	401674NB	TR/PNP ZTX510L	FERAEL
TR6	*	*	*	401677NB	TR/PNP ZTX502L	FERAEL
TR7	*	*	*	401676NB	TR/NPN ZTX107L	FERAEL

NUCLEAR ENTERPRISES LTD - CIRCUIT COMPONENTS LIST

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A--------------  PDR3R
|
|  B-----------  PDR3G
|  |
|  |  C---------  PDR3SV
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|  |  |
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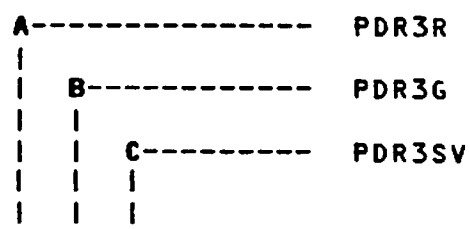
CCT REF	A	B	C	PART/DRAWING NUMBER	DESCRIPTION	VENDOR CODE
TR8	*	*	*	401676NB	TR/NPN ZTX107L	FERAEL
TR9	*	*	*	401678NB	TR/PNP ZTX550L	FERAEL
TR10	*	*	*	401677NB	TR/PNP ZTX502L	FERAEL
				VALVES		
V1	*	*	*	5223/1A	G.M. TUBE & SHIELD ASSEMBLY	------
				INTEGRATED CIRCUITS		
IC1	*	*	*	400809PB	IC/DIG CD4001AE OR UBE	RCACOR
IC2	*	*	*	400811PB	IC/DIG CD4025AE OR UBE	RCACOR
IC3	*	*	*	400809PB	IC/DIG CD4001AE OR UBE	RCACOR
IC4	*	*	*	400462PB	IC/DIG CD4013AE	RCACOR
IC5	*	*	*	400810PB	IC/DIG CD4020AE	RCACOR
IC6	*	*	*	400812PB	IC/DIG CD4089BE	RCACOR
IC7	*	*	*	400810PB	IC/DIG CD4020AE	RCACOR
IC8	*	*	*	400806PA	IC/LIN UA776TC	FAIRCH
IC9	*	*	*	400462PB	IC/DIG CD4013AE	RCACOR
IC10	*	*	*	401601PA	IC/LIN CA3080	RCACOR
				TRANSFORMERS		
T1	*	*	*	C32033/A	TRANSFORMER	------
				SWITCHES		
S1	*	*	*	405013KG	SW/TOG 3PDT 7307-K-ZQ	CAKSWT
S2	*	*	*	405240KG	SW/PB (MOM) BK 1213/C	GUECHR
S3	*	*	*	405016KG	SW/TOG SPDT RED CAP 7108-KZQ	CAKSWT
				LAMPS		
LP1	*	*	*	407836ND	LED RED(R) 5082-4860	HEWLET
				WARNING DEVICES		
WD1	*	*	*	407758KM	LOUDSPEAKER 2" TP50	NORMRS
				BATTERIES		
B1	*	*	*	503050KJ	BATTERY 1.5V HP2	EVREDY
B2	*	*	*	503050KJ	BATTERY 1.5V HP2	EVREDY

NUCLEAR ENTERPRISES LTD - CIRCUIT COMPONENTS LIST



CCT REF	A	B	C	PART/DRAWING NUMBER	DESCRIPTION	VENDOR CODE
				METERS		
ME1	*			C32035	METER	------
ME1		*		C34926	METER	------
ME1			*	C35566	METER	------

5. CIRCUIT DESCRIPTION

A Circuit Diagram is enclosed (E31856).

For a block diagram see figure 1. This shows the circuit blocks in the same relative position as they occur in the circuit diagram.

5.1 POWER SUPPLY

TR2 oscillates due to the positive feedback between the primary and feedback windings of T1. When TR2 is on, the magnetizing current increases until it is limited by the base drive of TR2, when TR2 comes out of saturation and its collector voltage falls. The positive feedback ensures that TR2 switches off hard, and the magnetizing current is dumped into C2.

Overall negative feedback to stabilise the output voltage, is provided by controlling the base dirve of TR2 via TR1 and D1.

The secondary voltage on T1 is peak rectified, doubled and filtered. It supplies the geiger tube via the current limiting resistor R8. C8 provides a by-pass for the signal.

5.2 DISCRIMINATOR

The signal is ac, coupled to the discriminator IC10 by C10, which also provides the eht isolation. C12 is a charge collection capacitor. R12, R11 and R15 set a nominal threshold of 130mV for the discriminator while R15 also provides positive feedback to ensure a Schmitt action.

5.3 LOGARITHMIC RATEMETER

The circuit converts the pulse rate (e.g. at TP1) to a current at the input to IC8 and the current is proportional to the logarithm of the pulse rate.

D11, TR7, TR5 and associated components provide pulses of constant amplitude for the four diode pump circuits. Each pump circuit produces a dc level on the appropriate source capacitor i.e., C21 to C24. As the input rate increases, the voltage on the source capacitor increases, and so the charge acquired (i.e., output current) becomes logarithmic over a certain range. By using four circuits with large and equal ratios between the feed capacitors, the logarithmic relationship is extended to at least five decades, to within a few percent.

5.4 INTEGRATED DOSE

The pulses from the input discriminator are also fed to the integrated dose section. These pulses are prescaled, to determine the alarm thresholds, by IC6 and IC7 and are passed on to IC5 which gives a binary output. These operate through a binary

weighted resistor network R27 to R34 which generates a current proportional to the binary output of IC5. A proportion of this current, controlled by the f.s.d. potentiometer R42, passes through R42 to the amplifier IC8, when the integrated dose is selected by the switch S3 being depressed.

When the instrument is just switched on IC's 7 and 4 are reset by C14 and R22.

5.5 METER DRIVE

Normally current is passed to the amplifier IC8 from R35 to R38 in the diode pump section. This current is fed into the inverting input of the amplifier IC8, which gives an inverted operation, of approximately 1mA in R53 and full scale on the meter, for maximum doserate. If the integrated dose is selected however, the current is supplied by R42.

5.6 ALARMS AND ALARM LOGIC

Two pulse generators comprising IC3 and associated components are used to drive the loudspeaker and light emitting diode (L.E.D.).

The 500 Hz pulse generator provides the speaker tone and pulses the L.E.D. The 2 Hz pulse generator modulates the speaker tone and produces the flashing rate. The mark/space ratio of this pulse generator is approximately 25%, due to D25 and R52,this is to conserve power. The L.E.D. is also controlled by the signal from IC4 pin 12.

For doses below 5.7m Seiverts, IC4 pin 2 is high, causing a reset at IC4 pin 10 which causes IC4 pin 12 to be at a high logic level. This prevents the L.E.D. from being turned on.

At 5.7m Seiverts, IC4 is set by the high logic level at pin 6. This causes pin 2 to change to a low logic level. Pin 11 is now clocked by 2 Hz and a divided by two signals, occurs at pin 12 due to connections between pins 12 and 9. This enables a slow flash at the L.E.D.

At 23m Seivers, IC2 pin 8 is set by a high logic level. IC2 pin 12 remains at a low logic level enabling a fast flash at the L.E.D.

At 46m Seiverts, IC1 pin 12 is held at a high logic level which holds the L.E.D. full on and also inhibits IC6 at pin 10, thus maintaining the alarm condition.

For each of the alarm thresholds, a pulse is generated at IC2 pin 5. This causes the latch to switch, holding IC1 pin 4 at a high logic level and IC1 pin 10 at a low logic level. This enables the speaker.

Pressing the reset button will cause a high level at IC1 pin 6 which will reset the latch, such that IC1 pin 10 goes to a high logic level turning the speaker off.

5.7 BATTERY LOW ALARM

If the battery voltage drops to approximately 2 volts, then TR6 is turned off. This causes a low logic level at pins 1 and 2 of IC1, causing a high logic level at IC2 pin 3 of the latch which initiates an audible alarm.

5.8 G.M. OVERLOAD

At high doserates (greater than the meter f.s.d.) the geiger tube current increases but the average pulse height decreases, since the tube does not always fully recover between signals.

Eventually, the discriminator would not detect some pulses and the meter reading would fall back. This is prevented in the following way:-

> Pulses from the discriminator circuit are divided by two in IC9, the output appearing at pin 1. This drives a diode pump circuit C13, R13. The integrating time constant corresponds to a frequency greater than that of half of the maximum doserate. C13 is chosen so that the mean current pumped out of C11 is normally greater than the current supplied to C11 from the geiger tube.

When the discriminator output rate exceeds maximum doserate, the pumped current reduces because C13 is not fully charged between pulses. The voltage across R9 therefore increases until D23 conducts. Current begins to flow into the meter drive circuit, maintaining the meter at f.s.d.

6. MAINTENANCE

The only normal maintenance required is the periodic replacement of batteries (see under Installation).

If however, components have to be changed or the unit fails to function correctly, the following gives a brief indication of voltages, current and waveforms to be expected and the settings of the preset controls. Disconnect the geiger at pin 9, before commencing maintenance.

Before switching on ensure that the mechanical zero of the meter corresponds to the zero mark on the lower scale; adjust the screw on the meter bezel if necessary.

6.1 DC - DC CONVERTER AND EHT GENERATOR

Check that the -8V line lies between -8V and -10 volts.

Check that the -3V line lies between -2.5V and 4.5V.

With due caution as there is a HIGH VOLTAGE present, measure the potential at the junction of R6/R7 with equipment having an input impedance in excess of 100 MΩ. The potential at the junction should be between 500V and 600V. Adjust R2 until this reads 520V. The O/P impedance measured at this position. using a 10MΩ load resistor, should be less than 1.5M (typically 0.2 to 1M).

6.2 DISCRIMINATOR

Connect a pulse generator giving 100Hz negative pulse, 20μs duration to the junction of R11/R12 via a 220pF capacitor. Increase the amplitude of the pulses until the meter reads.

The necessary amplitude should be between 100 and 200mV.

6.3 R.M. DRIVE

Increase the pulse generator to approximately 14KHz and examine the pulse at D11 cathode with an attenuating probe (> 1M resistance, less than 10pF capacitance). They should comply with Figure 2.

6.4 LOG RATEMETER

With the pulse generator connected as described above, set the frequency to 1.46KHz and adjust R50 until there is a reading of 50m Seiverts/h.

Reduce the frequency to 1.46Hz. Allow time to settle. Adjust R39 until the meter reads 50μSeiverts/h.

These two procedures should be repeated until no further adjustment is required allowing time for each reading to settle before making any further adjustments.

6.5 INTEGRATED DOSE

Turn off the unit. Wait 5 seconds and then turn on the unit.
NOTE: The dose button must be held in place when taking subsequent readings.

The initial integrated dose reading should be 0 ± 1m Seivert.

With the pulse generator set to approximately 14KHz, the meter DOSE scale reading should increase by small steps every few seconds.

As the reading approaches 5.62 Seiverts, the L.E.D. should commence a slow flash and the audible alarm should sound. Stop the pulse generator quickly, mute the alarm and adjust R42 until the meter reads 5.6m Seiverts on the dose scale.

Continue the input from the pulse generator. As the meter DOSE scale reading approaches 23m Seivers, the L.E.D. should commence a fast flash and the audible alarm should sound. Stop the pulse generator quickly. The sound may be muted. R42 should be adjusted until the meter reads 23m Seivers on the DOSE scale.

Continue the input from the pulse generator. As the meter reading passes 40 m Seiverts, the L.E.D. should come full on and the audible alarm should sound (this may be muted). The meter reading should stop above 40m Seiverts.

Switch off the unit and wait 20 seconds. Switch on the unit and observe that the DOSE scale reading starts again from zero dose, ± 1m Seivert.

6.6 OVERLOAD CIRCUIT

With the pulse generator connected as described above, set the frequency to 14 KHz.

Set an AVO to the 3KV dc range and connect the positive lead to the junction of R6/R7 and connect the negative lead to pin 10.

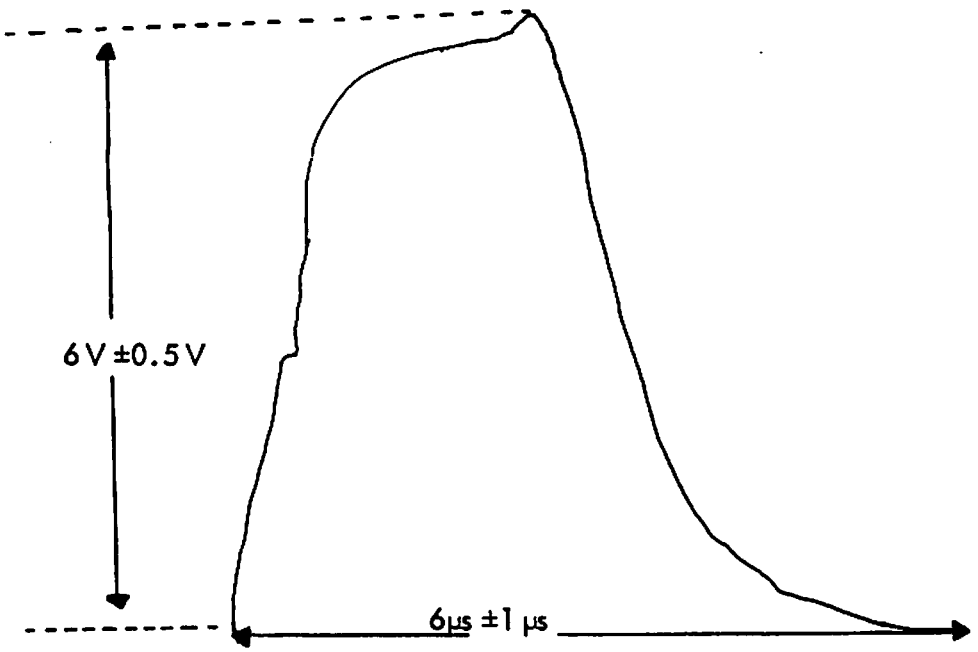
With due caution as there is a HIGH VOLTAGE present, switch on the unit.

The meter should show a full scale deflection.

Reduce the frequency of the pulse generator slowly and note that the reading reduces correspondingly and then begins to increase in value. The corresponding frequency should lie between 1100 and 500 Hz.

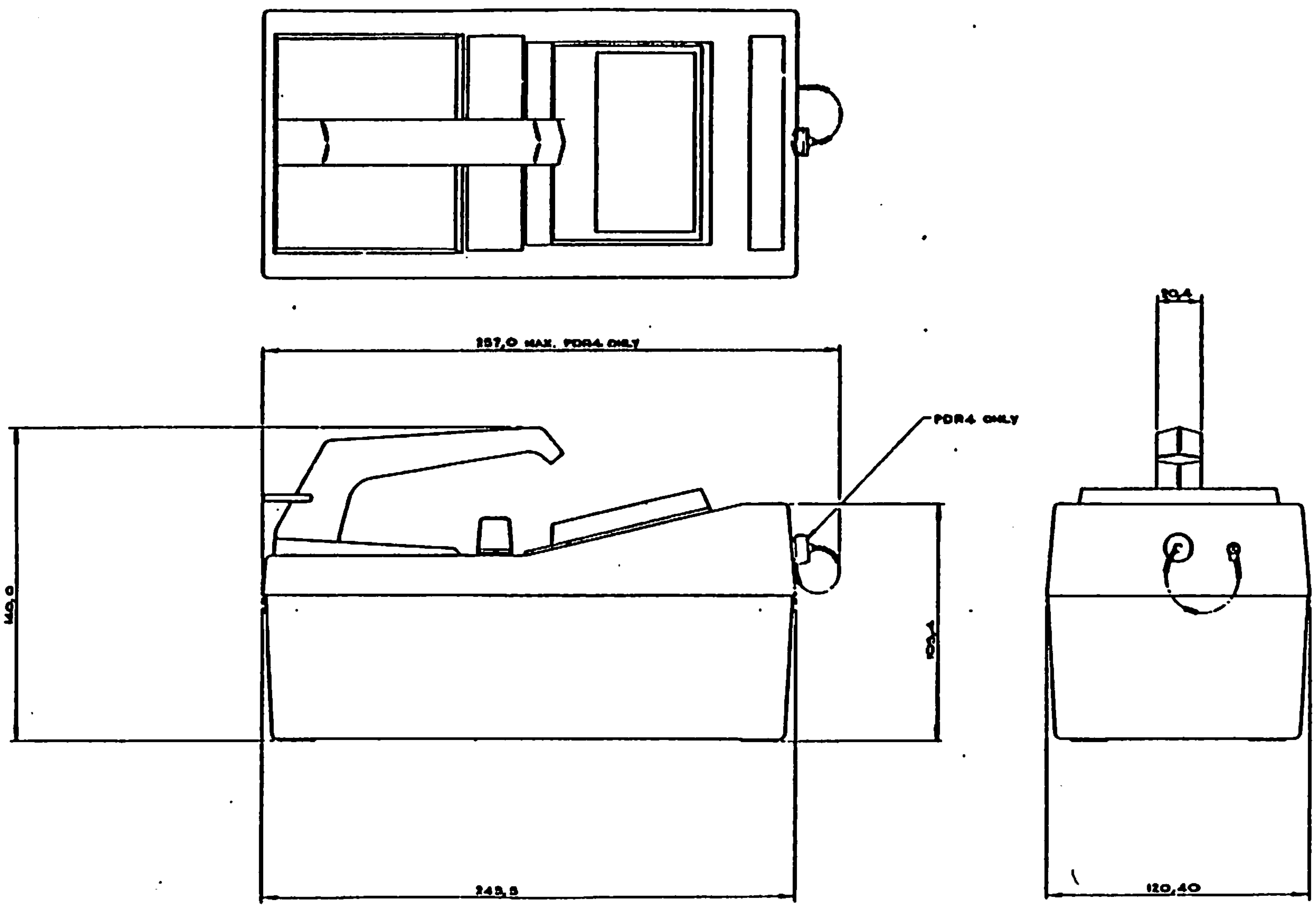
NOTE : The mechanical zero of the meter corresponds to the first mark on the lower scale.

7. ILLUSTRATIONS



WAVEFORM AT D11 CATHODE

FIG. 2.



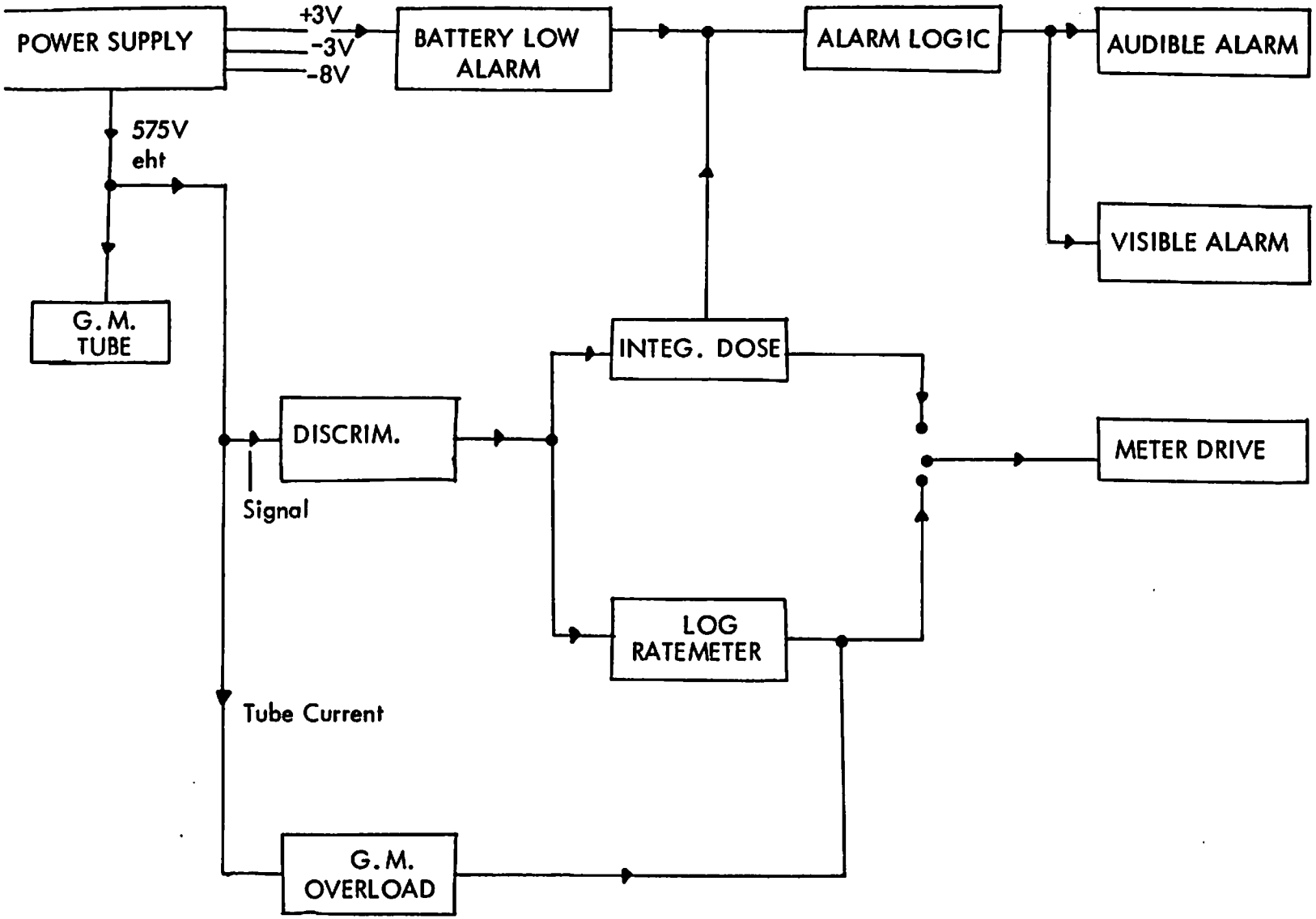
APPROX WEIGHT 1.8 Kg.

OVERALL DIMENSIONS
PORTABLE DOSERATE METER
TYPE PDR 1, 2, 3 & 4

DIMENSIONS IN MILLIMETRES

FULL SIZE

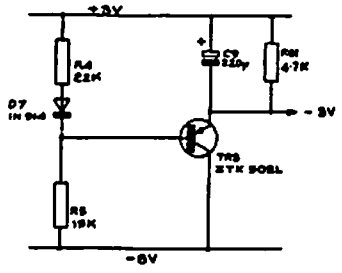
D33106

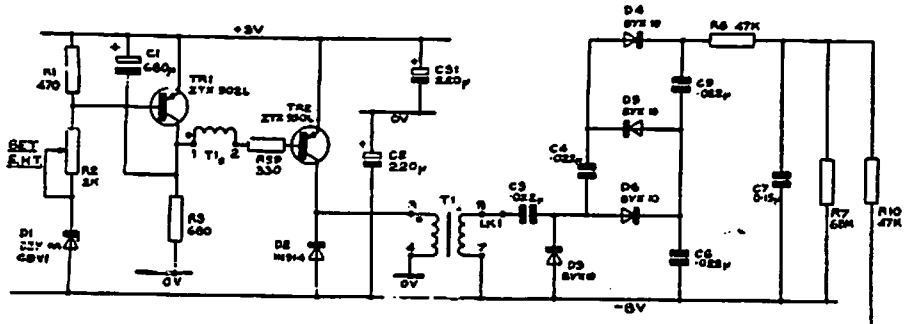


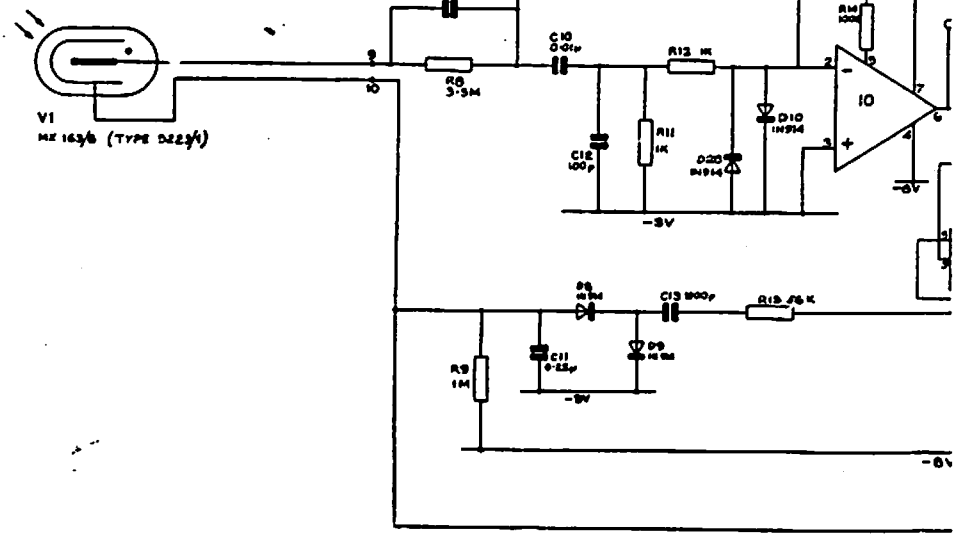
BLOCK DIAGRAM OF CIRCUIT LAYOUT PDR 3

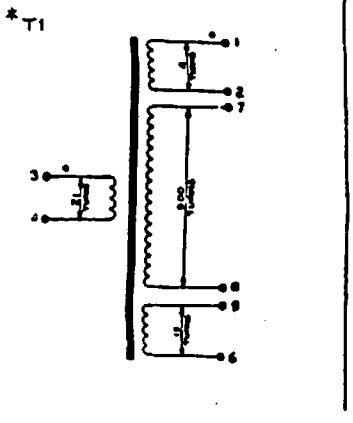
FIG. 1.

INTEGRATED CIRCUIT TABLE								
IC REF	TYPE Nº	POWER SUPPLIES GND 0V/-8V		VCC +3V	GRID REF.			
1	CD 4001 AE	7		14	C13	C16	C17	F19
2	CD 4025 AE	7		14	C16	F19	C19	
3	CD 4001 AE	7		14	E17	D17	D18	E18
4	CD 4013 AE	7		14	F15	F17		
5	CD 4020 AE	8		16	E13			
6	CD 4099 PE	8		16	E12			
7	CD 4020 AE	8		16	E13			
8	776 TC		4	7	H17			
9	CD 4013 AE		7	14	H12	J 11		
10	CA 3080		4	7	H10			



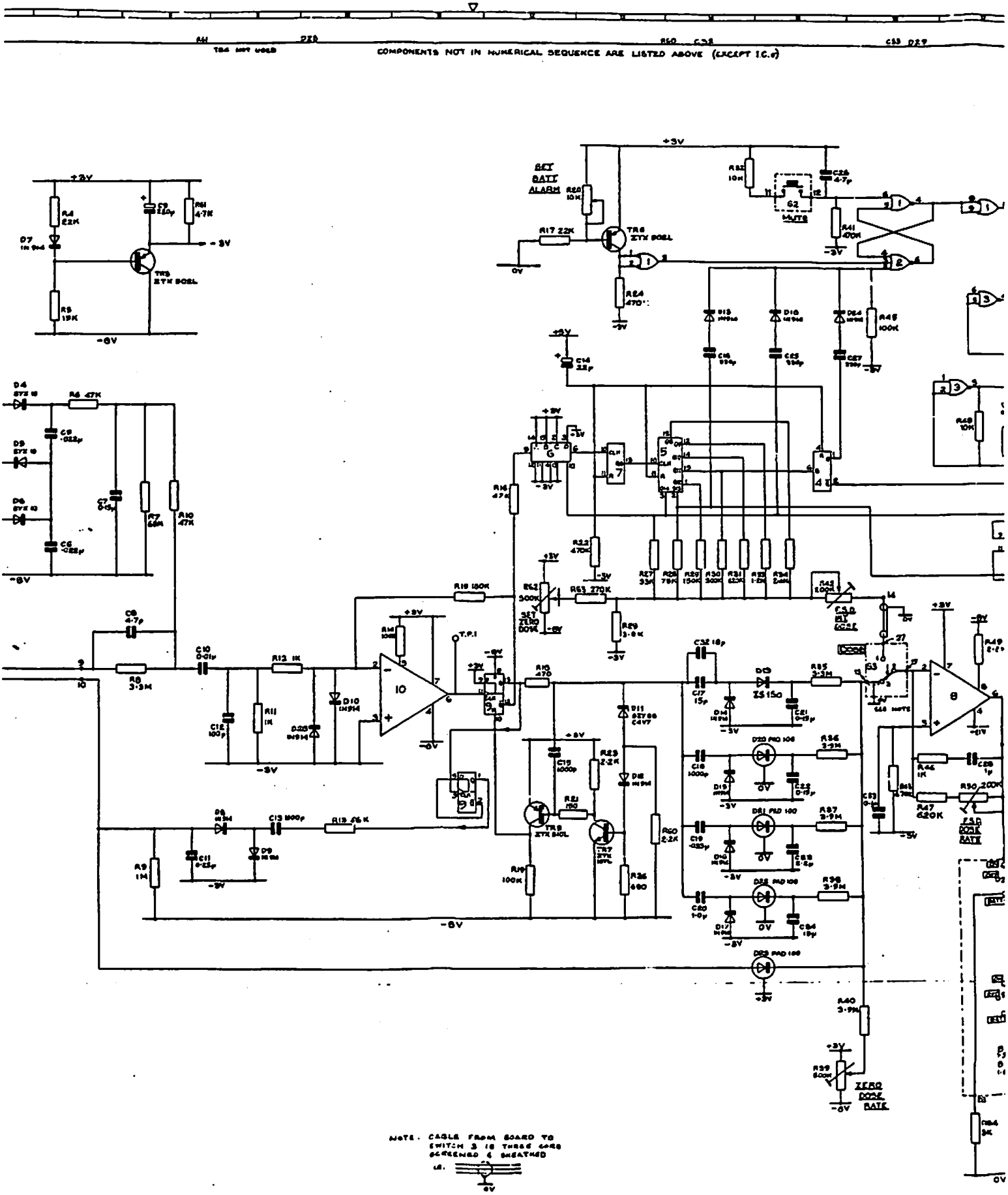






NOTE : CABLE SWITCH

MOD


COMPONENTS NOT IN NUMERICAL SEQUENCE ARE LISTED ABOVE (EXCEPT I.C.s)
+3V
-3V
-8V
0V
SET BATT ALARM
MUTE
ZERO DOSE RATE
SET ZERO DOSE RATE
NOTE: CABLE FROM BOARD TO SWITCH 3 IS THREE CORE SCREENED & SHEATHED

NUMERICAL SEQUENCE ARE LISTED ABOVE (EXCEPT I.C.s)