MODIFYING ASR40NZ POWER SUPPLY
FOR OTHER DC OUTPUTS.

This power supply was a basic 24V 65 A unit designed to run 24V military radio,s The output was adjustable in 1 V steps from 27 to 32 V dc.Incorporated in the voltage control system was an overvoltage protection system designed to trip at 5 V above each switch setting.

VOLTAGE CONTROL.To access the Voltage control remove the top cover,the range switch is located at the rear in front of the Printed circuit board.THe screw driver adjusted switch sets both the output Voltage and the trip point.

MODIFICATIONS TO OBTAIN LOWER VOLTAGES.

The Voltage programming was set at 1000 Ohms per Volt in the original design.This was determined by the value of R22 on the circuit board in series with a 500 Ohm trimmer at the bottom right hand side of the PCB.With R22 at 2.2k Ohms and the trimmer at the right setting the output Voltage was set by a chain of 1% 1K resistors R1 to R7 in series with R8 and R9 15K + 10K.Thus the total chain added up to 32K.

To obtain say 12 V output the chain must add up to 12K ,assuming that the chain was set to 32 V ie 32K then to bring the output down to 12V the value of the chain must be 12k Ohm ,this requires a parallel resistor of 19.2k

Locate the purple wire going to the bottom segment of the switch,wire a 19.2k resistor from the junction of the wire and the switch and connect the other end of the resistor to -S or the negative output terminal of the power supply.The best thing is to wire a 25K pot from the purple wire to _ S and adjust the pot to get 12V output.

MODIFICATION TO MAKE POWER SUPPLY CONTINUOUSLY VARIABLE.

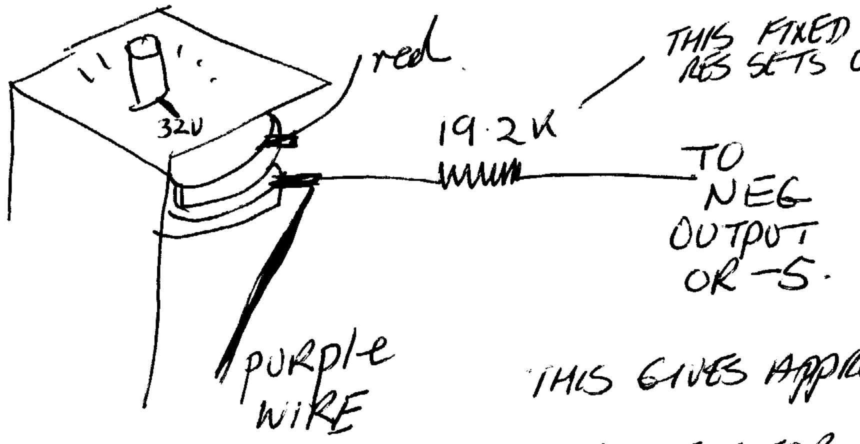
The first method with a 25K pot will not allow full adjustment from 0 to 32V. A better way is to use a 50 K linear pot.First remove the circuit board, locate the 2.2K resistor R22 marked on the Pcb.Replace this with a 3.9K resistor.Disconnect the purple wire from the switch.Warning make sure the power supply is disconnected.

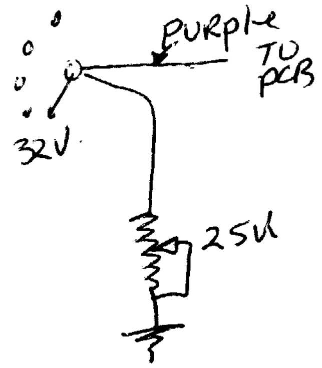
Connect the free end of the purple wire to one end of the 50 K pot,connect the slider to -S or neg output terminal.Plug circuit board back in.Set switch to 32 V. Turn power supply on.You should be able to vary the output from 0 to approx 30V. To trim to full scale adjust the 500 Ohm trimmer on the bottom of the PCB Fig 9.

To reduce residual noise connect a high quality 63V 4.7mFd capacitor across the pot,with the neg end connected to the NEG output or -S.This pot can be located on the front panel of the power supply if the leads are twisted.

Simple FIXED VOLTAGE OPERATION

RANGE SELECTOR SWITCH SET TO 32V

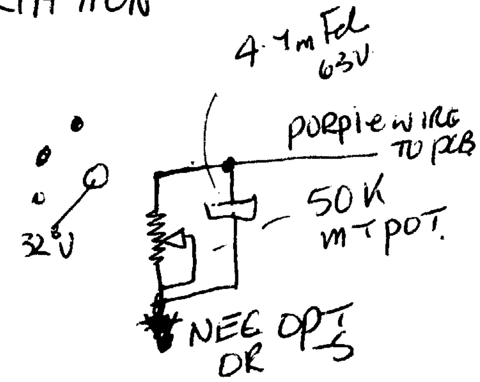


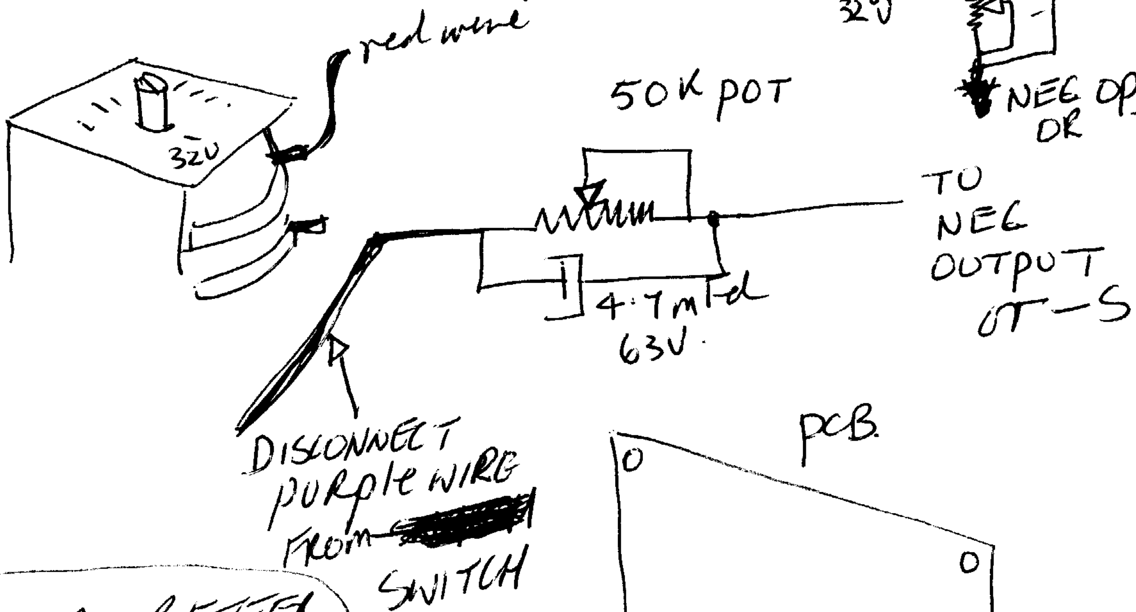


THIS GIVES APPROX 12V OPT.

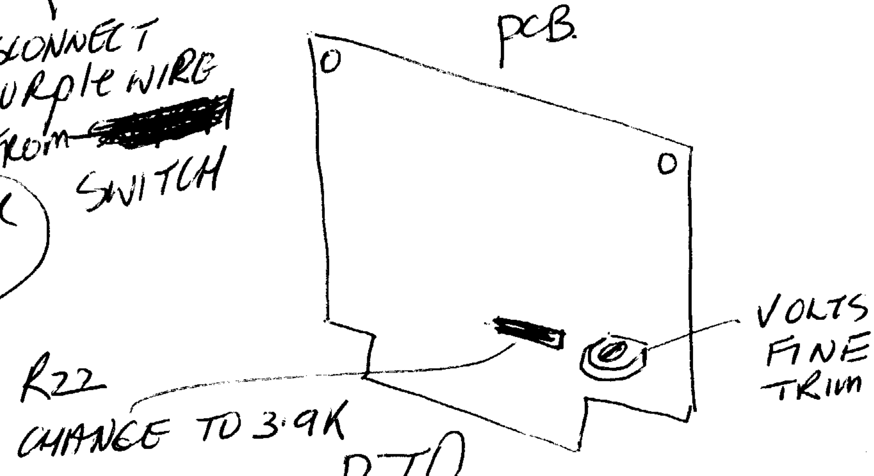
YOU CAN MAKE THE 19.2K RESISTOR A 25K POT & ADJUST TO GET 12V.

FOR CONTINUEOUS VOLTAGE VARIATION LINEAR UP TO 32V. MAX.
SET SWITCH TO 32V. FOR V TRIP AT 35V





THIS IS A BETTER WAY THAN ABOVE METHOD.



PTO

(76) Overload Indicator Lamp Switching Fig 23
When the power supply is overloaded, the output of current limit IC (c) goes low.

Transistor Q6 senses the change in the output of IC(c) and the collector of Q6 goes high.

This switches on Q7 which conducts. The overload LED is connected across terminals 11 and 12 and lights up indicating the fault.

Transistor Q8 is not used in this particular power supply. An LED connected across 8 and 9 will turn on when the power supply is operating under constant voltage operation.

Such an LED is wired under the printed circuit board socket to complete the circuit, but is not visible.

(77) Main Circuit Diagram Components Fig 24
Radio Interference Suppression
Interference suppression components are fitted on the AC input ie ERO F1740 delta capacitor. The positive and negative output terminals are RF grounded via C5 and C6.

Additional suppression at the cathodes of mains SCR1 and SCR2 is provided by C7.

The main and auxiliary transformers are fitted with earthed interwinding shields.

The level of conducted and radiated interference is very low. To maintain this, the top cover must always be securely screwed in place.

(78) Main Circuit Diagram Protection Fig 24
The series pass regulators are protected against reverse voltage by diodes D4 D5.

These will conduct if for some reason the output voltage becomes higher than the input DC at the main filter capacitors.

This can happen if a sudden short circuit occurs in the pre-regulator output, or a high voltage is injected back into the power supply output terminals from a load.

Diode D6 conducts if the output polarity of the power supply becomes negative for any reason.

(79) Output Capacitors Main Circuit Fig 24
The main output capacitor C4 is a high value 22,000 MFD, this capacitor serves several purposes. Firstly the power supply regulator requires a very low AC output impedance otherwise violent oscillation would occur. The charge stored in the capacitor sustains the power supply output under conditions of very high transient load change speeds, which are too fast for even the series regulator to respond adequately to.

Finally this capacitor filters any residual ripple and spikes feed through the series regulator.

Capacitor C3 is ripple suppression filter across the voltage programming resistor chain.

PART 8 MAINTENANCE AND REPAIRS

(80) Routine Maintenance

Routine Maintenance consists of periodically checki the operation as described in section (32).

Checking that screws, bolts etc. have not become loose, cleaning out dust, checking cables.

The outside should only be rubbed or polished with a soft dry cloth. Do not use any solvents as some solvents can attack the paint and silk screen labelling.

Every six months or more frequently depending on use, remove the top lid and blow out any accummulation of dust with an air jet.

Do not remove the plug in printed circuit board unless a performance fault is indicated.

In the field, the air vent grills will accumulate dust, lint, pollen, which may cause clogging and partial reduction in cooling air flow. It is recommended that operators use a duster or small size paint brush as part of field equipment to keep the vents clear.

After a prolonged period in service the power supplies should be given a calibration and specification check, see sections (34) (35) (36), to ensure the equipment complies with the specifications.

(81) Repairs

Fault incidence in solid state equipment is generally very low, and in a sense this reliability often makes repairs more difficult due to lack of familiarity with equipment which rarely fails. Experience with solid state power supplies indicate that most faults are transistor and rectifier failures. The first approach to fault finding should be directed to these components rather than a theoritical analysis of circuit diagrams, which should come later if initial fault finding is not successful.

It is desirable to have a working power supply of the same type available to make comparisons against.

Also it is recommended that a few spare control circuit boards known to be in working order should be held at a maintenance base.

To ease semi-conductor fault finding, all regulator transistors and integrated circuits plug into sockets on the heat sinks or circuit boards. Indiscriminate changing of components, particularly on circuit boards should be avoided.

(82) Extender Boards

Calibrations should be carried out with the main control board PC1A plugged into its socket as access to the calibration trimmers is easy. However it is impossible to carry out fault diagnosis on this circuit board in its normal situation and an extender board must be used. The control circuit board is removed from its socket the extender board is plugged in, in its place and the control circuit board is placed in the socket on the extender board.

(82) Extender Boards Contd.

Occasionally problems are encountered when plugging in extender and circuit boards in that the pin clips on the sockets may not register accurately with the printed circuit plug tracks, this can result in faulty operation, see section (38).

(83) Test Equipment

The type of test equipment needed has been outlined in the sections of this manual dealing with specification testing and calibration.

Warning Oscilloscopes should be operated from isolation transformers as certain tests, ie checking gate signals on SCR's involve operating the oscilloscope cabinet above earth potential.

A variac is essential for fault finding.

(84) Diagnosis, Continuous Overvoltage Tripping

The most likely cause for this fault is a shorted series pass regulator transistor.

Measure the resistance between the positive terminal of the filter capacitor and the positive output terminal of the power supply, if it is zero in both directions disconnect the series regulator heat sinks in turn and try to isolate which heat sink has the fault.

The fault could be a transistor or one of the protection diodes D4 or D5.

If there are no shorts in the pass regulator, check the setting of the output voltage switch if it is 28V for instance, connect a variac to the power supply AC input. Connect an accurate D.C. voltmeter to the test terminals.

Turn the variac to zero output.

Switch on the power supply, use an insulated screw driver to hold in the contactor and slowly turn up the variac. (Note do not have any load connected).

Observe the voltmeter reading rise, when the output reading on the voltmeter reaches 28V note if the output ceases to rise with further increase in variac output, if it stops at 28V this would indicate that the regulator is working properly. However if the output continues to rise, there is some fault on the regulator PCB. At 31V the O/V trip relay should click over.

Reduce the variac back to zero (still holding the contactor in) in order to latch off the O/V relay and bring the variac up to obtain just below 28V output.

Connect a voltmeter between TP1 and the ref TP3 in the circuit board, the reference voltage reading should be between + 2.4 to 2.5V.

If the reading is about + 5V, the reference diode LM336 is faulty and this is the cause of the overvoltage.

Another cause of overvoltage, is an open circuit in the voltage programming resistor chain. Check the resistance between pin 17 of the circuit board and the negative output terminal. The resistance should be 28,000 Ohms for 28V output. If the reading is much higher or open circuit check the cause of the fault.

(84) CONTINUOUS OV TRIPPING

Continuous Overvoltage Tripping Cont

If none of these procedures clear the overvoltage trip, due to lack of regulation, a more detailed anaysis of the circuit board in necessary. It is preferable to do cross measurements against another working power supply, to help diagnosis.

If overvoltage trip off occurs before the output reaches the regulation setting, the fault will be in the overvoltage protection circuitry.

(85) Diagnosis, Under Voltage

If the undervoltage is constant at a fixed value with and without load, the setting of the voltage range switch could be too low. Another cause could be a low reference voltage, or leaky capacitor C3 shunting the programming resistor chain.

If the undervoltage occurs only when load is connected check the current limit control setting has not altered, the over load LED will light up if this is happening.

Incorrect setting of the overload trip control RV4 will produce falling regulation.

One cause of falling regulation on a heavy load is loss of firing pulses at the gate of one of the thyristors.

An isolated oscilloscope should be connected in turn to each SCR to check presence of waveforms similar to Fig 18, waveforms 6 and 7. A lack of firing pulse on an SCR will produce half wave rectification and low pre-regulator output on load. This can be confirmed by checking the ripple waveform across the filter capacitor if the peaks occur every 20m Sec instead of at 10m Sec intervals the circuit is half waving.

A common cause of firing pulse loss at one SCR is an incorrectly plugged in control current board.

If the differential is set too low say under 3V. there will not be sufficient input to the series regulator for it to function correctly.

Other causes of falling regulation would be circuit board faults in the pre-regulator or series regulator integrated circuits. Check + and - supply voltage values on PC1A between TP1 to TP2 for + 15V and TP1 to TP7 for -12V.

(86) Faulty Pre-Regulator Operation.

This may not always cause any observable effect on the output voltage at the load terminals. If overheating is present, the pre-regulator differential may be too high, producing excessive dissipation in the pass transistors. A dangerous situation can occur if the pre-regulator turns full on, as the voltage rating of the filter capacitors will be exceeded.

This fault must be diagnosed using a variac to prevent the pre-reg output exceeding 50V.

Investigate the following points, Z3 shorted C7 leaky, incorrect setting of RV4, failure of Q5 causing Q4 to oscillate continuously and turning the SCRs on continuously, a fault in section d of the LM324 quad operational amplifier causing its output to stay low, a defective 555 Timer IC.

(86) Faulty Pre-Regulator Operation Contd.

Erratic pre-regulator operation can be caused by loss of zero-crossing pulses, problems in the firing pulse circuits.

(87) Continuous Circuit Breaker Tripping

Connect a long extension lead to the AC input to eliminate possibility of transformer switch on inrush. If tripping still occurs, disconnect blue wires leading from transformer secondary to the rectifier assembly. If tripping continues suspect a fault in the mains transformer.

Otherwise investigate for likely failure of D1, D2, SCR1, SCR2 or D3. Another cause would be breakdown of the filter capacitors.

Another possible cause is excessive AC input voltage, or low frequency mains input ie below 42 Hz.

Note half wave operation of the rectifier circuit due to a fault, can partly magnetise the core of the main transformer and agravate, inrush switch on tripping.

(88) Contactor Buzzing

Occasionally grit or dirt may collect between the poles of the contactor producing loud buzzing when it is operating.

(89) Replacing Circuit Board PC1A

Before replacing PC1A in its socket after service clean its contacts with a contact cleaner such as Servisol. Spray the socket with Servisal, after replacing the circuit board, check that both SCR gates have firing pulses present, and that the power supply functions correctly on load.

Carefully replace the spacers with the insulating bushes next to the circuit board at the top corners. Carry out any final calibration with the circuit board firmly secured in its socket.

(90) Series Pass Regulator Emitter Resistors

If a series regulator transistor shorts when the power supply is on load it is possible that the .08 Ohm resistor, see Fig 24, will burn out.

These resistors are made up from an 87mm length of 21 SWG constantan Resistance Wire.

The wire is coiled and soldered in position.

WINDING INFORMATION

Mains Transformer

Each leg wound as follows:

(1) Pri 201 Turns 2.36mm Lewkanex high temperature wir
(2) Electrostatic shield.
(3) Secondary, Four windings in one layer 56 turns 2.36
    Lewkanex high temperature wire.

The secondary windings are externally connected in parall 1.

Auxiliary Transformer

Bobbin wound.

(1) Pri 2729 turns .1mm copper wire.
(2) Shield.
(3) First Secondary 266-0-266 turns .22mm.
    leads yellow/brown CT/yellow
(4) Second Secondary 161 turns .22 copper wire.
    leads orange and white.

Choke

Wound 78 turns of 10 x 2.1mm glass braided copper
class H.
Butt packed gap 3mm.

PARTS LIST FOR MAIN DIAGRAM FIG. 24

Part	Part Description	Qty.	Type	Manf.	Supplier
C.B.	Circuit Breaker 20A	1	4201	N.Z. Insulators	National Elect. & Eng. Co.
Switch	On/Off Switch 60A	1	3/S	PDL Ind. Ltd., Chch.	" " "
Pilot	Neon Pilot Lamp Holder	1	PL1 Amber	Carrel & Carrel Ltd. AK	" " "
RY3C	Contactor 230V AC	1	LS 10-L15	Oliver Nilsen Ltd.	David Fraser Ltd. Auck.
RY4	Relay 12V DC	1	MY4	Omron, Japan	Teletherm Inst. Ltd. Auck.
B1/2	Blower Fans 220/230V	2	MX3A3	Rotron Inc, USA	Air-Spares NZ Ltd. Palm.Nth.
SCR1/2	Thyristor 200V 110A	2	C62B	General Electric USA	National Elect. & Eng. Co.
D1/2	Rectifier 200V 110A	2	MR1215SL	Motorola USA	Redfern Radio, Auckland.
D3	Rectifier 100V 35A	1	MDA3502	" "	" " "
D4/5	" 200V 3A	2	1N4141	RCA USA	AWA (NZ) Ltd.
D6	" 200V 6A	1	MR751	Motorola USA	Cema Electronics, or Redfern Radio, Auck.
Q1/11	Transistor NPN 100V 30A	11	2N3772	RCA USA	AWA (NZ) Ltd
C1/ab	Capacitor Electro 56K 50V	2	CEGW	Nippon Chemi-Con Japan	Channel Master (NZ) Ltd. Ak.
C7,C5,C6	" Polyester .047 1KV	3	KT1801	ERO	" " "
C4	Capacitor Electr. 22K 40V	1	CEEW	Nippon Chemi-Con Japan	" " "
C3	" " 4.7 63V	1	EB/CPF	RDE	" " "
C2	" Polyester .47 250V	1			" " "
C8	" Electro 100 50V	1	PC		" " "
C9	" Mylar 1MFd 50V	1			" " "
R1	Resistor WW 27 5W	1		Micron	David Reid Electronics Ltd.
R2/3	" " 100 16W	2	B83003	Philips	Philips Elect. Ind. NZ Ltd.
R4/14	"Carbon Film 100 .5W	11			Channel master (NZ) Ltd. Ak.
R15	Wire Shunt .004, 65A	1	ASR/40/NZ/R15	Redfern Radio	Redfern Radio, Auckland.
R16	Resistor WW 390, 16W	1		Micron	David Reid Electroncs Ltd.
LED 1/3	High Intens LED Amber	3	5082-4658	Hewlett Packard USA	Cema Electronics Ltd.
RV2	Wire Wnd Pot 500 2W	1	AW	I.R.H. Aust.	David Reid Electronics Ltd.
T1	Power Transformer	1	ASR/40/NZ/T1	Redfern Radio	Redfern Radio, Auckland
T2	Auxiliary Transformer	1	ASR/40/NZ/T2	" "	" " "
L1	Choke 65A	1	ASR/40/NZ/L1	" "	" " "
TR1/2	Terminal Screw 100A	2		ESEC	Redfern Radio, Auckland
PC1A	Printed Circuit PC1A	1	ASR/40/NZ/PC1A	Redfern Radio	" " "
PC2	Printed Circuit PC2	1	ASR/40/NZ/PC2	" "	" " "
TS	Thermal Switch 112°	1		MicroTherm	NZ Solenoid Co
RF Sup	Int. Suppr. ERO	1	L7	ERO	Channelma[illegible]
Neon	Pilot 230V Neon MES	1			Carrel & Carrel Ltd. Auck.

PARTS LIST FOR PC1A FIG23

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PARTS LIST FOR PC1A FIG 23.

Part	Part Description	Qty.	Type	Manf.	Supplier
CR13	Bridge Rect. 200V 1A	1	B60C1000W		Channel Master (NZ) Ltd. Ak.
CR1,2,3,6	Silicon Diode	4	BAX13	Philips	Philips Elect. Ind (NZ) Ltd.
CR4,5,7,8,9	Silicon Rect. 200V 1A	5	1N4004	RCA	AWA (NZ) Ltd.
10,11,12	" "	3	"	"	" "
Z1, 2	Zener 12V 400mW	2	BZX55C12	TFN	AWA (NZ) Ltd.
Z2	Precision Ref Diode	1	LM336Z	National Semi USA	Professional Electronics Lt
IC1	Quad Op Amp Int Circ	1	CA324G	RCA	AWA (NZ) Ltd.
IC5	Timer Int Circ	1	CA555CG	RCA	" "
IC6	Trans Array Int Circ	1	CA3083	"	" "
REG	Voltage Reg. 15V Int Circ	1	7815C	"	" "
Q1	Transistor NPN	1	40327	"	" "
Q2, 3	Transistor NPN	2	2N3053	"	" "
Q4	Transistor UJT	1	2N4871	Motorola	Cema Electronics Ltd.
T1, T2	Pulse Transformer	2	ASR/40/NZ/PC1A/T	Redfern Radio	Redfern Radio
C1	Capacitor Electro 220/63	1	Axial		Redfern Radio
C2	" " 100/16V	1	PCB		Channel Master (NZ) Ltd.
C3	" " 100/50V	1	"		" " "
C4	" Polyester .047 50V	1	PCB		" " "
C5	" " .1 50V	1	"		" " "
C6	" " 0056 50V	1	PCB		" " "
C7	" Tantalum 10MF. 35	1			Channel Master (NZ) Ltd.
C8	" " 2.2MF 35	1			" " "
C9	" " 22 16	1			" " "
C10	" Polyester .0056 50	1			" " "
RV1	Trimpot 500	1	IS	Murata	Redfern Radio, Auckland
RV3	" 10K	1		"	" " "
RV4	" 10K	1		"	" " "

MetalGlaze 2% Resistors ¼W. All IRH Type RG.
100 Ohm R41, 180 Ohm R38, 330 Ohm R24, R23, R48a. 680 Ohm R26, R28, 1K Ohm R16, R.17, R18, R21, R27, R29, R25, R30, R35, R36, R44, R46, R48, 1.5K R5, 2.2K R1, 2.7K R8, 3.9K R13, 4.7K R12, R34, 5.6K R31, R39, 8.2K R6, 10K R4, R7, R9, R37, R47, 18K R32, 27K R33, R40, 22K R45. 47K R43
100K R10, R11.

R42	Carbon Film Res. 1W. 560 Ohm		Channel Master (Nz) Ltd.

THE 500Ω CURRENT LIMIT POT AT REAR COULD BE TRANSFERED TO THE FRONT PANEL AS WIRED. TO MAKE A CONTINOUSLY ADJUSTABLE CONSTANT CURRENT/CONSTANT VOLTAGE POWER SUPPLY
