CHANNEL AMPLIFIER
TYPE 4073/00
(Part No. 844073/00)

INSTRUCTION AND MAINTENANCE MANUAL

Supplied for use with
Equipment Serial No(s)

Made on Order No. 19/5088

Customer's Order No. 3170

IAG

PYE T.V.T. LTD.
CAMBRIDGE
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CONTENTS

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SECTION 1 - INTRODUCTION

This amplifier will fulfil the functions of a microphone, line or group amplifier in an audio installation. The characteristics of the amplifier design make it suitable for handling signals at microphone level, or for sending signals to line.

The amplifier is arranged in two sections, the two sections may be cascaded directly (with the input section terminated in 600 ohms) or via remote fader control.

Provision has been made to reduce the current consumption of the amplifier in cases where maximum output is not required.

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SECTION 2 - SPECIFICATION

INPUT SECTION

Input Impedance (Measured at 60 c/s, 1 kc/s and 8 kc/s)

600 ohms ±10%. ±j20%

Alternative input transformers are available

Input Isolation	Greater than 50 dB
Gain	45 dB ± 1 dB (variable)
Frequency Response	60 c/s to 8 kc/s ±0•1 dB 30 c/s to 15 kc/s ±0•5 dB
Output Isolation	Greater than 50 dB
Distortion	Less than 1% at an output level of +10 dBm

OUTPUT SECTION

Input Impedance (Measured at 60 c/s, 1 kc/s and 8 kc/s)

Greater than 10k ohms ± j2k ohms

Input Isolation	Greater than 50 dB
Gain	35 dB ± 0•5 dB
Frequency Response	60 c/s to 8 kc/s ±0•1 dB 30 c/s to 15 kc/s ±0•5 dB
Distortion	Less than 1% at an output level of +24 dBm
Output Isolation	Greater than 50 dB

Output Impedance (Measured at 60 c/s to 8 kc/s)

Less than 30 ohms ± j7•5 ohms

COMPLETE UNIT

Maximum Gain	80 dB ± 1 dB
Noise	(measured as specified by B.B.C.) Without Filter -127 dBm With Filter (400 c/s to 10 kc/s) -131 dBm
Distortion	Less than 1% at an output level of +24 dBm

Frequency Response

60 c/s to 8 kc/s ±0.2 dB
30 c/s to 15 kc/s ±1 dB

Supply Requirements

300 mA at 16V for an output level of +24 dBm
100 mA at 16V for an output level of 0 dBm

Maximum Output Level

+24 dBm

Approximate Overall Dimensions

Height	3 inches	(7½ cm)
Width	3 inches	(7½ cm)
Depth	9¼ inches	(23½ cm)

Approximate Weight

2½ lb (1·1 kg)

SECTION 3 - INSTALLATION AND OPERATION

3.1 PREPARATION

If the unit is to be used as an addition to an existing installation proceed as follows.

(a) Fix the receptacle plate (plus any additional screens which may be necessary) and wire the connector in accordance with instructions contained in the appendix 'Unit Mounting and Wiring Techniques'.

(b) Determine the output level required from the amplifier (see Section 2), and insert or omit the link on the mating connector as required:

(i) if a low output (i.e. at a level below 0 dBm) is required pins 5 and 13 should be unconnected, but

(ii) if a high output is required pins 5 and 13 should be joined together, or

(iii) if any intermediate output is required a suitable resistor should be connected between the pins.

(c) Check that the B+ voltage is 16V (± 1V)

(d) Check that the fuse is well home in its clip.

(e) Switch off the power supply before inserting the unit.

NOTE: If a group of amplifiers is to be inserted forced cooling is advisable.

For explanation of certain points see the appendix "Maintenance Precautions on Semiconductor Units".

3.2 INSERTION

To insert the unit, grasp the handle, and press the unit into the frame until the catch engages. Apply a slight pull to ensure the unit is securely located in position.

When it becomes necessary to remove the unit, grasp the handle so as to lift up the small catch. The unit may then be pulled out.

3.3 CONTROLS

There are two controls, both are mounted on the front panel, they are:

(a) a toggle switch labelled High/Low, and

(b) a rotary control labelled LEVEL.

When the toggle switch is in the LOW position the signal is attenuated by 20 dB. When the switch is in the HIGH position no attenuation of the signal takes place.

The LEVEL control provides for a variation in gain within the limits of ±25 dB.

3.4 SETTING-UP

If the unit is to be used as a channel amplifier the controls should be set to give the required output to the following apparatus.

If the unit is to be used as a line amplifier, the required amplifier gain should be determined, and ensuringthat the amplifier's working is within its maximum input and output limits, the controls should be set accordingly.

The minimum and maximum gain conditions are:

Toggle Switch in 'LOW'	position	35 - 60 dB
" " " 'HIGH'	"	55 - 80 dB

SECTION 4 - TECHNICAL DESCRIPTION

4.1 INPUT SECTION

The input signal is passed via the input transformer T1 into the switched potential divider R1, R2 and R3. The 'High/Low' settings of the switch give a zero, or a 20 dB attenuation to the signal.

From the potential divider the signal is fed into the base of VT1, the first of a pair of low-noise silicon transistors arranged in a super-alpha configuration. This arrangement provides a wide dynamic range and a low distortion content, together with a low noise content distributed throughout the audio spectrum rather than the low-frequency noise more usually experienced with transistor amplifiers.

The signal passes from VT2 to the common-emitter stage VT3. Base bias stabilisation is effected by potential dividers R10 and R11, with the forward bias (base-emitter) controlled by the voltage developed across R13, the emitter stabilising resistor. This bias voltage opposes any d.c. change in collector current, and stabilises the d.c. conditions for the stage over a wide range of temperature and component changes.

The d.c. supply to the input stage is stabilised by the zener diode MR1 and the resistor R4.

Negative feedback is applied between the collector of VT3 and the emitter of VT2 via the LEVEL control R14. This increases the input impedance in step with a reduction in gain. A phase-reversing stage (VT14) is connected in the feedback path between the emitter of VT2 and the base of VT1. This ensures that the feedback applied to VT1 is negative and out of phase. The second feedback loop reduces the input impedance as gain is reduced. The result of feedback applied by the method employed is that the input impedance remains substantially constant at all settings of the LEVEL control. The feedback applied to the input stage also gives an improved noise figure.

VT4 and VT5 are connected in a collector-lifted stage with the signal being fed from one end of R22 into the base of VT5, the signal on the emitter of VT5 appears at the opposite end of R22, and the amplitude of the signals appearing at the base and emitter of VT5 is the same; it can therefore be said that R22 acts as an infinite impedance. This gives VT4 a high impedance and therefore a high stage gain off-setting the reduction in gain due to the application of negative feed-back over these two stages (VT4 and VT5).

Compensation for any high-frequency loss due to stray capacity is provided by the network C8 and R17. The capacitor C12, connected between the base of VT5 and B+ reduces that part of the high-frequency response which is above the audio spectrum.

The output from VT5, the common-collector stage, is coupled by C13 (the d.c. blocking capacitor) to the section output transformer (T2).

4.2 OUTPUT SECTION

The section input transformer (T3) feeds a push-pull common-emitter stage (VT6 and VT7) via two series resistors (R27 and R28).

In order to bring to optimum the drive conditions for the next stage, the output impedance of the stage VT6 and VT7 is reduced by shunt resistors R30 and R31 between the base and collector of each transistor.

VT8 and VT9 form a common-emitter stage, and feedback is applied to both emitters of the stage from the tertiary winding of the output transformer T4. The correct amount of feedback is obtained by the ratio of R56 and R57 to R40 and R41, the two capacitors C26 and C27 maintaining the correct phase shift at all frequencies.

The accurate balance of the output transistors VT12 and VT13 is important, and an automatic balancing circuit, which works as follows, is incorporated:-

If, for instance, the emitter of VT12 is negative with respect to the emitter of VT13, the base of VT10 (to which it is connected) will be more negative. This will make the collector of VT10 more positive, and as the collector of VT10 is connected to the base of VT12, the base of VT12 will be made more positive, thus making the emitter less negative. The emitters of VT10 and VT11 are connected together and therefore the transistors have very close base voltages. This ensures that the emitter voltages of VT12 and VT13 are closely related, and the currents are almost the same.

The two capacitors (C19 and C20), connected between the bases and collectors of the balancing transistors, reduce the a.c. gain of these transistors to unity.

C22 and C23, connected between the collectors and bases of the output transistors, reduce the loop gain of those frequencies which are above the audio spectrum.

The minimum collector load impedance at which the output stage can operate, i.e. when the external load resistance is disconnected, is fixed by the resistor R55 across the amplifier output.

C14 (on the input section), and C24 (on the output section) are the output isolation capacitors. These are 'select on test' capacitors, and to maintain the correct output isolation of the amplifier if renewal of either (or both) of these becomes necessary, proceed as instructed in Section 5.4.1.

4.3 RATING AND COOLING

All components, including transistors, are operated well within their maximum ratings. Extreme ambient temperatures have been considered and a wide ambient range is acceptable to the unit. Cooling of the transistors is assisted by the dissipation coefficient of the heat sink, and the unit as a whole is cooled by air convection.

In this connection attention is drawn to the appendix 'Maintenance Precautions on Semiconductor Units'.

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SECTION 5 - MAINTENANCE AND FAULT FINDING

WARNING: Before commencing any checking, fault finding, or other maintenance work, see the appendix "Maintenance Precautions on Semiconductor Units".

5.1 ACCESS TO COMPONENTS

To obtain access to components inside the unit lay the unit on a flat surface, unscrew the ribbed posts at the rear of the unit, remove the screws at the front end of the members which held the ribbed posts, loosen the hinge screws at the base of the unit to prevent them binding, and carefully hinge out the sides of the unit. To prevent strain on the cableform the sides should be hinged onto some flat surface.

5.2 VOLTAGE AND CURRENT ANALYSIS

(See warning given at the head of this section).

Fault location on the unit will be facilitated by making checks at the circuit points shown in the following table. The figures given are those measured on a typical unit, and measured figures may be found to vary slightly from one unit to another. Deviations from the figures given are not necessarily indicative of faults in the unit, but if there are wide divergencies, and the supply voltage is found to be within tolerance, investigation should be made.

CONDITIONS

All voltage readings on the unit are taken with respect to the positive rail, under no-signal conditions, using a meter having a sensitivity of 20000 ohms per volt, and on the meter range quoted.

The 'High/Low' switch is set to 'High', the 'LEVEL' control fully clockwise, and pins 5 and 13 on the external connector are connected together.

The B- voltage is 16V
The B- current is 272mA

The abbreviations used in the table are:

e = emitter b = base c = collector

Circuit	Location	Meter Range	Measurement Volts
VT1	e	2·5	1
	b	2·5	0·1
	c	10	5·5
VT2	e	2·5	0·9
	b	2·5	1
	c	10	5·5

Circuit	Location	Meter Range	Measurement Volts
VT3	e	2·5	1
	b	2·5	1
	c	10	4·3
VT4	e	10	3·8
	b	10	3·9
	c	25	10
VT5	e	10	10
	b	25	10
	c	25	15
VT6	e	2·5	0·7
	b	2·5	0·9
	c	10	4
VT7	e	2·5	0·7
	b	2·5	0·9
	c	10	4
VT8	e	2·5	0·3
	b	2·5	0·4
	c	10	10
VT9	e	2·5	0·4
	b	2·5	0·4
	c	10	10
VT10	e	2·5	0·9
	b	2·5	1
	c	2·5	1·5
VT11	e	2·5	0·9
	b	2·5	1
	c	2·5	1·5
VT12	e	2·5	1
	b	2·5	1·3
	c	25	16
VT13	e	2·5	1
	b	2·5	1·3
	c	25	16
VT14	e	2·5	2
	b	2·5	2
	c	10	6
V_{B-}			16
I_{B-}	High current condition		272 mA

5.3 RESISTANCE OF WINDINGS

NOTE: Values are ±10%

Transformer T4

Pins	1 - 2	2 ohms
"	2 - 3	2 "
"	5 - 9	25 "
"	9 - 6	25 "
"	7 - 8	10 "

5.3.1 High Permeability Cored Transformers

Warning

D.C resistance measuring devices and continuity checking equipment, e.g. Avometers, should not be used for checking the resistance or continuity of certain transformer windings. The reason for this and the treatment to be given if d.c. is accidently used are dealt with in the appendix "Demagnetising of High Permeability Cores" bound in with this manual.

The transformers in this unit to which the warning applies are listed below, together with the inductance of the windings and the frequency and voltage at which it is measured, the r.m.s. demagnetising voltage, and the pins to which this voltage is to be applied.

Circuit Ref.	Inductance/Frequency	Demagnetising Volts	Pins
T1 Primary	10.4 H at 0.2V 50c/s	10	1.3
T2 Primary	10.4 H at 0.2V 50c/s	10	1.3
T3 Primary	135 H at 0.5V 50c/s	30	1.3

5.4 TESTING

NOTE: Before testing consult the appendix "Maintenance Precautions on Semiconductor Units".

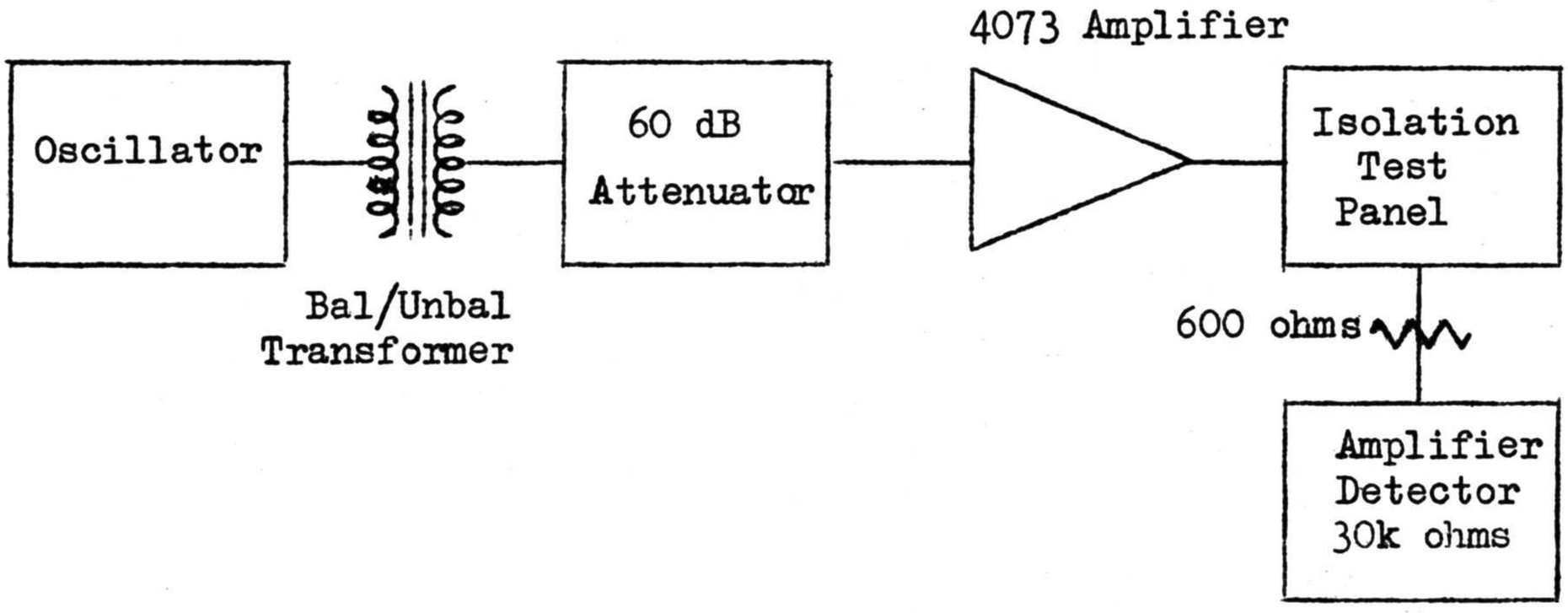
If testing of performance features is necessary because of accidents or failure of major components:

(a) Ensure that the accuracy of the test equipment is adequate for the results expected.

(b) Ensure that the test power supplies are suitable, and

(c) ensure that good quality balance to unbalance transformers are used to match input and output impedances of the unit to the test gear.

5.4.1 Test for Output Isolation



Set up the test equipment as indicated, and proceed as follows:

Set the attenuator to the gain of the amplifier (4073).

Adjust the oscillator to give a reading of 0 dBm on the amplifier detector.

Remove the plug from the input jack, and insert into the test jack of the isolation test panel.

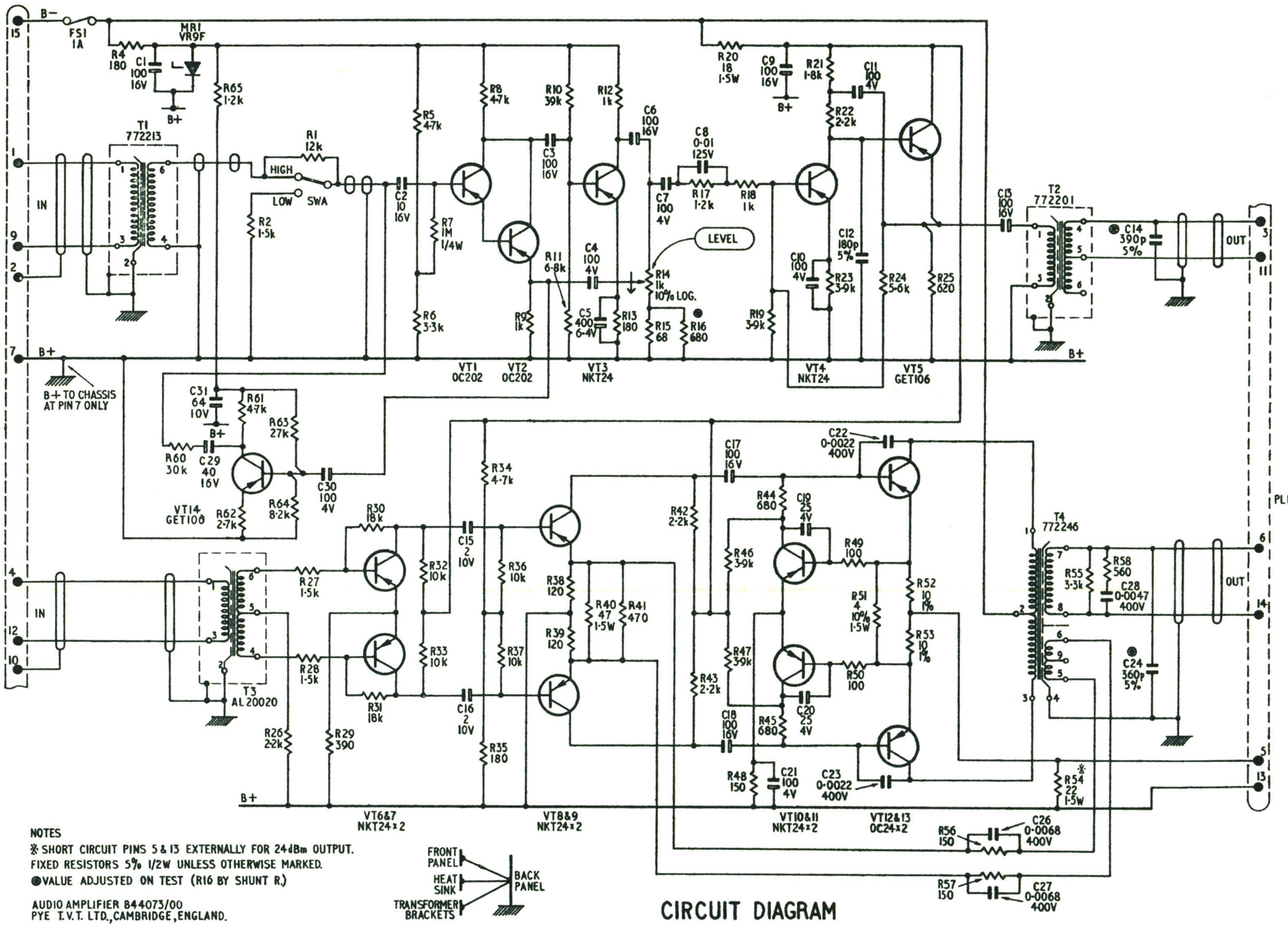
Note the new reading on the amplifier detector.

The isolation figure = the difference between the two figures.

PARTS LIST
FOR
CHANNEL AMPLIFIER
TYPE 4073/00

Item				Pye Part No.	Manufacturer	Type
6.1 RESISTORS						
4	ohms	±10%	1½W	678365	Painton	MV1A
10	"	±1%	½"	NC10066	"	93
18	"	±5%	1½"	PE18059	"	MV1A
22	"	"	"	678383	"	"
39	"	"	"	PE39059	"	"
47	"	"	"	PE47059	"	"
68	"	"	½W	PE68067	Electrosil	CJ20
100	"	"	"	PE10167	"	"
120	"	"	"	PE12167	"	"
150	"	"	"	PE15167	"	"
180	"	"	"	PE18167	"	"
390	"	"	"	PE39167	"	"
470	"	"	"	PE47167	"	"
560	"	"	"	PE56167	"	"
680	"	"	"	PE68167	"	"
1k	"	"	"	PE10267	"	"
1·2k	"	"	"	PE12267	"	"
1·5k	"	"	"	PE15267	"	"
1·8k	"	"	"	PE18267	"	"
2·2k	"	"	"	PE22267	"	"
2·7k	"	"	"	PE27267	"	"
3·3k	"	"	"	PE33267	"	"
3·9k	"	"	"	PE39267	"	"
4·7k	"	"	"	PE47267	"	"
5·6k	"	"	"	PE56267	"	"
6·8k	"	"	"	PE68267	"	"
10k	"	"	"	PE10367	"	"
12k	"	"	"	PE12367	"	"
18k	"	"	"	PE18367	"	"
27k	"	"	"	PE27367	"	"
30k	"	"	"	PE30367	"	"
33k	"	"	"	PE33367	"	"
1M	"	"	2	PE10569	"	CJ42
1k	"	Log. Pot.	1	PL02514	Plessey	E Log
6.2 CAPACITORS						
180pF		±5%	400V	665003	Dubilier	Sm 22
360pF		±10%	350V	661005	"	"
390pF		"	"	664993	"	"
2200pF		"	400	653615	Mullard	C296AC/A2K2
4700pF		"	"	653617	"	C296AC/A4K7
6800pF		"	"	653618	"	C296AC/A6K8

Item			Pye Part No.	Manufacturer	Type
2µF	-10+50	10 V	680302	Mullard	C426AN/D2
25 "	"	4 "	680310	"	C426AM/B25
40 "	"	16 "	680303	"	C426AM/E40
100 "	"	4 "	680316	"	C426AM/B100
100 "	"	16 "	680307	"	C426AM/E100
400 "	"	6·4	PS44000	"	C426AM/F6·4
6.3 TRANSFORMERS					
T1			772213	Pye	B8906
T2			772201	"	B8846
T3			AL20020	"	B9142
T4			772246	"	B9066
6.4 SEMICONDUCTORS					
Transistor			865359	Mullard	OC24
"			FV07006	Brush	OC702
"			865570	Newmarker Transistors	NKT24
"			865337	G.E.C.	GET106
Zener Diode			FV09004	B.T.H.	VR9F
6.5 MISCELLANEOUS					
Fuse	1A		700488	Belling Lee	L1055/1
Plug	16-way		724101	Amphenol	26-159-16
Switch	2-pole changeover		BJ21055	N.S.F.	8373/K6



NOTES

※ SHORT CIRCUIT PINS 5 & 13 EXTERNALLY FOR 24dBm OUTPUT.
FIXED RESISTORS 5% 1/2W UNLESS OTHERWISE MARKED.
● VALUE ADJUSTED ON TEST (R16 BY SHUNT R.)

AUDIO AMPLIFIER 844073/00
PYE T.V.T. LTD., CAMBRIDGE, ENGLAND.

CIRCUIT DIAGRAM

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MAINTENANCE PRECAUTIONS

FOR

SEMICONDUCTOR UNITS

NOTE: Non-observance can lead to destruction of semiconductors.

SECTION 1. GENERAL ELECTRICAL PRECAUTIONS

1.1 CONTINUITY CHECKING

When using any type of meter to check continuity, it is essential to remember that some give a voltage which is sufficient to destroy certain low voltage semiconductors. This is most likely if the polarity of the test voltage is applied incorrectly. Therefore:

(a) Check the polarity of the test meter voltage.
(b) Check the voltage level and see that this is within the rating of the semiconductors.
(c) When checking wiring external to a unit, it is safer to unplug the unit (or units) whenever possible.
When it is required to check resistors, capacitors and other components it must be remembered that if these components are across the whole, or part, of a semiconductor device, the device itself may affect test meter readings. It is necessary in these cases to disconnect one end of the component being checked.
(d) When the potential at the test meter terminals exceeds the semiconductor ratings it will be advisable to disconnect one end of every component which it is necessary to check - but see also 1.2. below.

1.2 SOLDERING

When soldering is undertaken in semiconductor circuits, poor insulation on the iron can give a sufficient level of a.c. leakage to permanently damage semiconductors. It is advisable therefore to make a quick check with a meter between the bit of the iron and the circuit earth. Note: on some units this may not be the chassis. If a potential is present take one of the following steps:

(a) Repair earth on the iron, or get another.
(b) Remove unit's earth by unplugging where possible.
(c) Remove unit's earth by disconnecting temporarily, say at an equipment plug or terminal block.
(d) Fit a switch in the 'live' lead to the iron, and switch off before bit touches the components or wiring.
(e) Use a low voltage iron or one which can be earthed to the equipment (not to the main's earth).

Remember, these precautions also apply when soldering cableform wiring external to the unit.

Never solder with the B+ switched ON. This can lead to disastrous short circuits, e.g. across emitter resistor.

All semiconductors are temperature sensitive, even without the power ON. Therefore;

When soldering use a thermal shunt, e.g. long nosed cool pliers or similar shunt, between the iron and the device.

1.3 VOLTAGE ANALYSIS

When making a voltage analysis be more than normally careful to prevent undesired short circuits by test prods. These can ruin a transistor e.g. if across base and B-, or across emitter resistor. Crocodile clips are a very common cause of accidental short circuits.

1.4 DISCONNECTING SEMICONDUCTOR UNITS

Because high level transients can damage many types of semiconductor always switch off the power supplies before removing the unit or unplugging it. Even if transients are known to be of no importance it is still possible in unplugging to break say a bias line before the B+ and hence give rise to damage.

1.5 TEST POWER SUPPLIES

Where units of an equipment can be unplugged and removed from a rack or console, it is always preferable to use a jumper lead so that the unit may be plugged in to its normal power supply. Check the polarity on the jumper lead (see also 2.5). Where test power supplies must be used observe the following:

(a) Use a power unit with similar characteristics to the one in the equipment e.g. with low ripple, high stabilisation, transient suppression, etc.
(b) Set d.c. supply to nominal ±1V, or better, so that results are meaningful.
(c) Always check polarity before connecting any test supply.
(d) Heavy gauge wire is essential for low impedance B+ supplies, say 23/·0076.

1.6 TEST EQUIPMENT

It should be remembered that items of test equipment often contain capacitors which may be charged as a result of some previous test. This charge may be sufficient to damage semiconductors in the item under test. Therefore:

(a) Always connect test equipment earth wires first to the unit under test, then touch the other connecting lead to earth before connecting it into the unit to be tested.
(b) Observe this kind of precaution with capacitors, whether these are used for test purpose or as replacements, i.e. check that they are discharged.

Signal Generators, especially l.f.types, quite frequently give voltages which far exceed the semiconductor rating. Therefore:

Before connecting this class of instrument into a semiconductor circuit the output should be turned down to minimum and care taken that the output is not subsequently turned up above a safe level.

1.7 SEMICONDUCTOR POWER UNITS

Special components are usual in these units; all are low voltage items. Some are intolerant of overloads. Therefore in all maintenance and servicing operations ensure that incorrect conditions are not introduced e.g. if the mains transformer or its taps have to be changed the connections should be carefully checked to ensure that excess voltage is not applied.

1.8 HIGH VALUE CAPACITORS

High capacity condensers are common on all semiconductor units. Since semiconductor devices are intolerant of large transients, be careful not to charge or discharge high value capacitors through them, e.g. by short circuits when power has been recently applied, or by replacing a capacitor when the B+ is on.

Never discharge the many thousand µF condensers by short circuits in the unit.

1.9 EARTHING

On no account should the earthing system of multi-unit audio installations, video installations, or any others be altered. On transistorised equipment this is more than normally important due to the use of low impedance supplies and the risk of introducing hum and other forms of interference into low signal circuits. The unit circuit earth is not necessarily connected to the mains earth or chassis. Any added B+(earth) wiring should always be in very heavy cable (See 1.5 d.)

This prohibition applies equally to paths for lamp, relay and other similar circuit supplies which are kept separate from signal paths. In this case high ripple (or plain a.c.) voltage may be fed into the signal earth. The resulting earth currents can then be picked up in low level signal circuits and amplified.

1.10 TRANSISTOR TESTING

It is always advisable to use a test item designed specifically for testing semiconductors, since any other item may give misleading results, and may also damage the semiconductor device.

SECTION 2. MECHANICAL PRECAUTIONS

2.1 PAINT

The black paint covering on certain semiconductors is there to stop light from reaching the junction which is sensitive to electromagnetic radiation including regions centred on the frequency of visible light. In fitting and handling, this paint must not be damaged.

2.2 SEMICONDUCTOR LEADS

When replacing, or disconnecting for test, the lead should not be bent closer than 1·5mm with respect to the body since any bending closer than this may damage the seal.

2.3 POWER SEMICONDUCTORS

When replacing power semiconductors the mica insulating washers (if used) must not be damaged; nor may any other material be substituted since this will affect adversely the transfer of heat from the case to the heat sink.

A smear of silicone grease on the washer serves to prevent sticking and also to make a more intimate heat bond to the sink. No other type of grease should be used.

Fixings on power semiconductors should be well tightened since this again affects heat transfer.

With some devices the metal case may be connected to an internal electrode. In these cases care must be taken not to allow the case to touch the chassis, other components, or any nearby tags.

2.4 HEAT SINKS

On no account should the black matt finish be removed from heat sinks (or fins) since this can affect the power handling capacity by an amount varying up to as much as 30% depending on the type of component.

On many small semiconductors a clip is used to increase the power dissipation. Make sure, therefore, that when a device is replaced the same size of clip is used and that this makes close contact with the case.

2.5 FORCED COOLING

Where forced cooling is provided this must not be obstructed since this can affect the power handling capacity by as much as 200% or higher.

When servicing on a test bench, or on jumper leads, the equipment air supply should be simulated or damage may result.

SECTION 3 - STORAGE

3.1 R.F.RADIATION

When units or components are stored this should not be near any high-power r.f. radiation e.g. from transmitters, test installations, etc. Radiation of this type is harmful, especially in the 'S' and 'X-Band'.

3.2 RADIO-ACTIVE EFFECTS

Semiconductors are affected adversely by various radio-active radiations e.g. X-rays, gamma rays and neutrons. Keep them away from any quantity of radio-active valves e.g. T.R.cells and some gas tubes since these contain radio-active materials.

3.3 TEMPERATURE

Although temperature ranges for semiconductors are continually increasing it is still good practice to keep all stocks away from hot radiators etc. and equally, not to permit stocks to accidentally reach very low temperature conditions.

3.4 MAGNETS

Semiconductors should not be stored close to very strong magnets. There is no permanent effect on the semi-conductor material, but part of the device, i.e. the case, may become permanently magnetised and the field from this will then change the performance of the semi-conductor.

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UNIT MOUNTING AND WIRING TECHNIQUES

1. GENERAL

Plug-in units are housed in special frames which can accept different sizes of units (in mixed sizes) and can also provide individual unit screening facilities.

2. FIXING THE FRAME

Some frames are supplied permanently fixed into consoles, others are loose items for bolting into racks. When fixing the frame into any rack observe the following:

(a) Use the fibre washers (supplied with the fixing screws) so as to protect the paint on the front member of the frame.

(b) Do not obstruct the ventilation holes in the top and bottom plates of the frame.

(c) Units generating large amounts of heat should not be positioned immediately beneath the frame.

3. FIXING THE SCREENS

The types of screening plates available can fit into the frame so as to divide it vertically and horizontally as required, i.e. to give a mixture of compartment sizes. Fit these as follows:

(a) Insert vertical screens first by dropping the lugs into the slots provided in the frame and then by slightly bowing the screen allow the other lugs to spring into the opposite slots.

(b) Insert the horizontal screens in the same manner but with the lugs entering the slots in the vertical screens.

4. RECEPTACLE PLATE ASSEMBLY

When units are supplied to fit into the frame a back plate (appropriate to the size of the compartment) is supplied loose. This is complete with fixings and with the unit mating connector already in position. When fitting the plate observe the following:

(a) Ensure that the plate is mounted so as to give the correct pin alignment of the mating connector.

(b) Do not tighten the mating connector fixings; "floating" is deliberate to ensure easy alignment of the unit connector and the mating component.

5. WIRING CONNECTORS

WARNING If the particular unit being installed contains semi-conductors it should not be plugged in during the soldering operation. Similarly other units already in the equipment should be

unplugged if these contain semiconductors, but see the section entitled "Maintenance Precautions on Semiconductor Units".

When soldering new leads ensure attention to the following:

(a) Use stranded wire for all connections. Stiff wire will cancel the floating action of the connector and will be liable to fracture.

(b) Do not tightly stretch the leads, but leave just sufficient slack to reconnect if the lead should be accidentally broken away.

(c) Do not permit solder to run back along the conductor strands; this spoils the insulant and creates a danger of breakage at some later date.

(d) Programme leads (input and output) should be insulated, screened twin. Expose no more than approximately $\frac{1}{2}$ inch of lead from the screening braid in order to avoid unwanted pick-up. The screening on the output leads should not be finished in a pigtail; trim and cover with a sleeve. The screening on the output signal leads should be earthed at the remote end of the audio cable, NOT to a mains earth.

(e) The screening pigtail of the input leads must go to the signal earth (normally B+ or the B+ busbar). Keep it short and sleeve it to prevent short circuits.

(f) Leads from B+ and B- should not be of smaller gauge than 14/.0076, preferably with thick wall insulation. The heavy gauge is needed in this application because of the low impedance of the power supply. This impedance must not be increased otherwise the stability of the power supply may suffer. For leads longer than 1 yard (1 m) the use of 23/.0076 is strongly advised.

6. DUMMY UNITS AND PANELS

If a frame is being installed then it should be remembered that different sizes of dummy units and back panels are available to fill vacant compartments in the frame. Where forced cooling is present in a rack (or console) these dummy units with their back panels serve not only to ensure a good presentation but also to ensure that the path of the cooling air stream is not diverted in a wasteful manner. On semi-conductor equipments this is of more than normal importance.

7. PARTS LIST

Rack Mounting Frame (19" rack)	749087
Vertical Screen	435629
Horizontal Screen	435630

APPENDIX

DE-MAGNETISATION OF HIGH PERMEABILITY CORES

1. GENERAL

The long term effects arising from the physical maltreatment of Mumetal and other high permeability materials are widely known. Effects which arise as a result of high d.c. current when applied in associated windings either continuously or in surges are not so well known. Increasing use of high permeability materials in transformers, record/playback heads, and other wound assemblies, coupled with the steady increase in remanence figures as new materials become available, make the need for care in one-time simple checking operations more than ever necessary. Fortunately, the precaution to be taken normally only applies when some fault has developed, and it is necessary to check such things as continuity and / or resistance in part of a circuit that includes transformers which have not been designed to carry d.c. current.

2. PRECAUTIONS

It is sometimes forgotten that simple d.c. operated instruments, such as Avometers when used on their resistance ranges for continuity or resistance checks can give quite high ampere-turn figures in the windings which they are used to check. In small modern transformers (and similar components) any such developed field strength has a small, compact mass of core material on which to act. When this small mass is composed of material with characteristics such as high permeability, fairly high remanence, and rather low magnetising force, the effect of the field can be quite marked. The effect shows itself in the overall component as a change of inductance. This will in turn affect the frequency response. The duration of the effect will depend upon a variety of factors but the really important point to remember is that in many cases only if corrective treatment is applied can the effect be cancelled. Therefore a simple rule should be observed that if:

(a) the unit's transformers are small,

(b) the circuit diagram shows that no d.c. flows in the windings,

then no d.c. operated device should be used for checking either continuity or resistance in the purely a.c. items. On such components as physically small output transformers it is normally sufficient to ensure that any d.c. current from test equipment does not exceed the current normally carried by the component.

3. CORRECTIVE TREATMENT

Since accidents are always possible a simple guide to demagnetising is set out in this section. It must be emphasised that since it is often impossible to gauge the extent of the damage caused by electrical maltreatment of wound components no guarantee of correction is implied by the provision of this information.

3.1 SUPPLIES

Normally any 50 c/s or 60 c/s supply is satisfactory. The r.m.s. demagnetising voltage is given in the maintenance section of unit manuals. Current rating of the supply is unlikely to present any problem. For most small input transformers in Audio units a range of a few hundred milliamps is sufficient. For large items a quick calculation based on the a.c. voltage plus the inductance quoted will provide the answer.

Whatever the source of a.c. voltage the waveform should be reasonably sinusoidal and free from harmonics and spikes. It should be remembered that highly inductive voltage regulators often provide a very poor waveform. Quality of the waveform is important since this will have a very considerable effect on the efficiency of the treatment.

3.2 METHOD

The procedure to be followed is set out below.

(a) Connect in series across the a.c. source a limiting resistor, and the full winding of a potentiometer of about 1000 ohms.

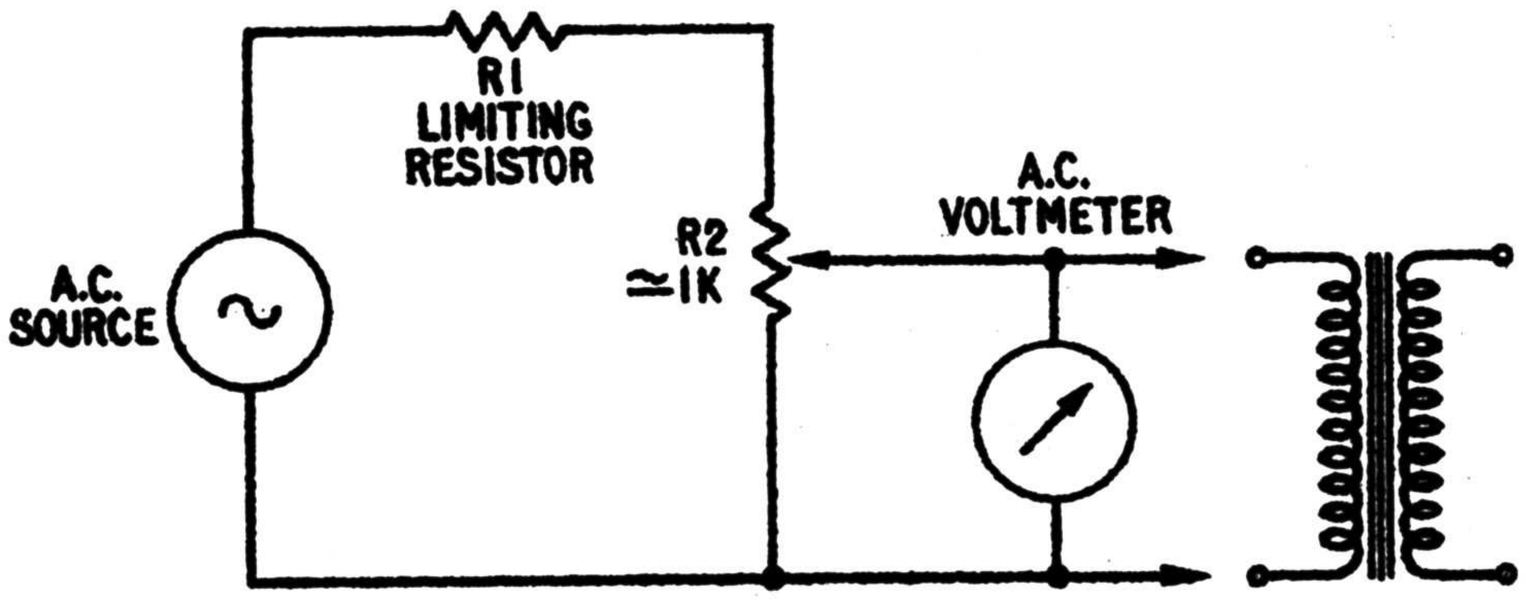

FIGURE 1

(b) Connect the component to be treated and an a.c. voltmeter across the slider of the potentiometer and its contact which is returned to the a.c. supply. Set the potentiometer to give zero volts to the component. (See Figure 1)

NOTE: If Avometers (or similar instruments) are used with a poor waveform the calibration will be in error and allowance must be made in accordance with the handbook supplied by the meter manufacturer.

(c) Switch on the a.c. supply and adjust the potentiometer to give the maximum r.m.s. voltage as shown in the unit manual.

NOTE: The limiting resistor in Figure 1 should be of such a value that if the slider of R1 should accidently be taken to the fullest extent of its travel, the voltage applied to the transformer will be only slightly in excess of the maximum specified.

(d) The voltage should now be gradually reduced to zero in about one minute, but note that the method of doing so is very important. As a rough guide it should be reduced so that a plot of voltage against time would give the well known exponential curve as of a condenser discharging through a fixed resistor. The point to remember is that the longest time is to be spent at the lowest voltages.

(e) If the waveform of the supply contains harmonics (or other departures from a true sine wave) the procedure may have to be repeated a few times.

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TREATMENT FOR ELECTRIC SHOCK

Human beings are rarely killed outright by electric shock and can, in most cases, be saved by immediate commencement of artificial respiration. Electric shock affects the nerves controlling the breathing and the action of the heart and unless prompt aid is given the victim may become unconscious and die. ALWAYS SEND FOR BUT NEVER WAIT FOR A DOCTOR.

Before touching the injured person, make sure that he is not in contact with a live conductor. If he is, break the circuit by opening the power switch - DO NOT TOUCH THE VICTIM WITH YOUR BARE HANDS. If it is not possible to switch off the current, use a piece of dry insulating material, such as wood, bakelite or rubber, to knock or push aside the conductor. Alternatively, pull the victim free using a leather belt or braces, protecting yourself still further by standing on a folded newspaper or a dry mackintosh.

HOLGER NIELSON METHOD OF ARTIFICIAL RESPIRATION

(1) Immediately the patient is released from electrical contact loosen his collar and any tight clothing as quickly as possible.

(2) Remove false teeth and sweets etc. from the patient's mouth and make sure that the tongue is free by giving two or three firm slaps with the flat of the hand between the shoulder blades.

(3) Lay the patient face downwards with the forehead resting on the fore arms so that the mouth and nose are kept clear of the ground (A).

(4) Kneel on one knee a little in front of and to the side of the patient's head so that the left foot is at the side of the patient's elbow. (A). The arms should slope forward so that the hands lie close together on the patient's shoulders with the wrists over the top of the shoulder blades. This is the starting position.

(i) Rock forward on outstretched arms until the arms are vertical above the patient's body (B). The pressure should be light and without force; the movement should take approximately 2 seconds.

(ii) Release the pressure by allowing the hands to slide quickly down the patient's arms to the elbows taking approximately $\frac{1}{2}$ a second (C). Then raise his arms and shoulders slightly, at the same time moving your body backwards (D), taking approximately 2 seconds.

(iii) Lower the patient's arms until they touch the ground (E), and return your hands to the original position on his shoulders and resume the position as before. Take approximately $\frac{1}{2}$ a second for this movement.

(5) Repeat the movements described in (i); (ii) and (iii) so that the complete cycle takes approximately six seconds. That is, about nine complete respirations per minute.

(6) Whilst artificial respiration is continued have someone else:-

(a) Loosen patient's clothing and keep him warm.

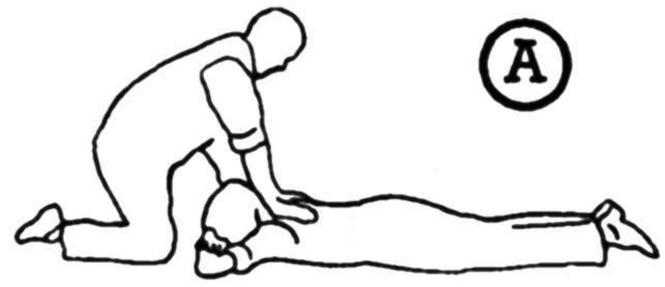
(b) Send for a doctor.

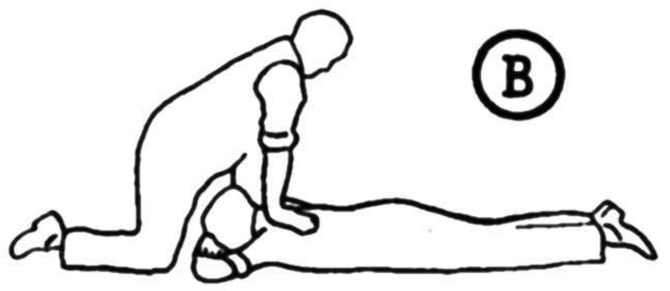
(c) Watch so that they can take over if prolonged treatment is necessary.

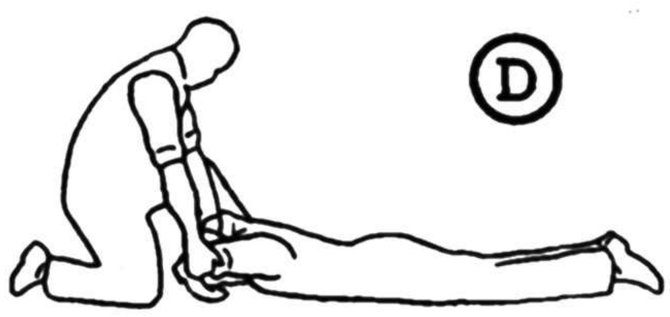
(7) Keep going for at least four hours even if there is no sign of recovery.

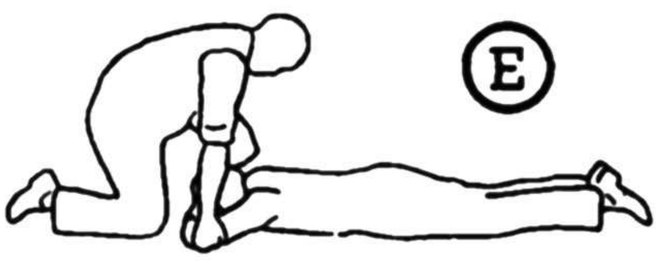
(8) Do not move the patient until he is breathing normally without assistance. There should be no hurry to move him after he has recovered.

(9) Do not give the patient oxygen or other stimulants unless ordered to by a doctor. When fully recovered the patient may be allowed to drink cold water with, if available, one teaspoonful of Sal Volatile to a glass. He may also be permitted to sniff smelling salts.









TREATMENT FOR BURNS

If as a result of electric shock the patient is suffering from burns, the following treatment should be given without hindrance to artificial respiration:-

(1) Remove the clothing near the affected part to enable the burn/s to be treated, taking care not to break any blisters that may have formed.

(2) Saturate the burn/s using a warm solution made up of one desertspoonful of bi-carbonate of soda and a pint of warm water. If bi-carbonate of soda is not available, use a teaspoonful of salt.

(3) Cover the burns with lint soaked in the above solution and apply a bandage taking care not to burst any blisters that may have formed.

(4) If a solution as above is not available cover the burns with a sterile dressing to exclude the air.

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