

QUAD 405

POWER AMPLIFIER

Service Data

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Keith Snook modifications	Click here

CIRCUIT DESCRIPTION

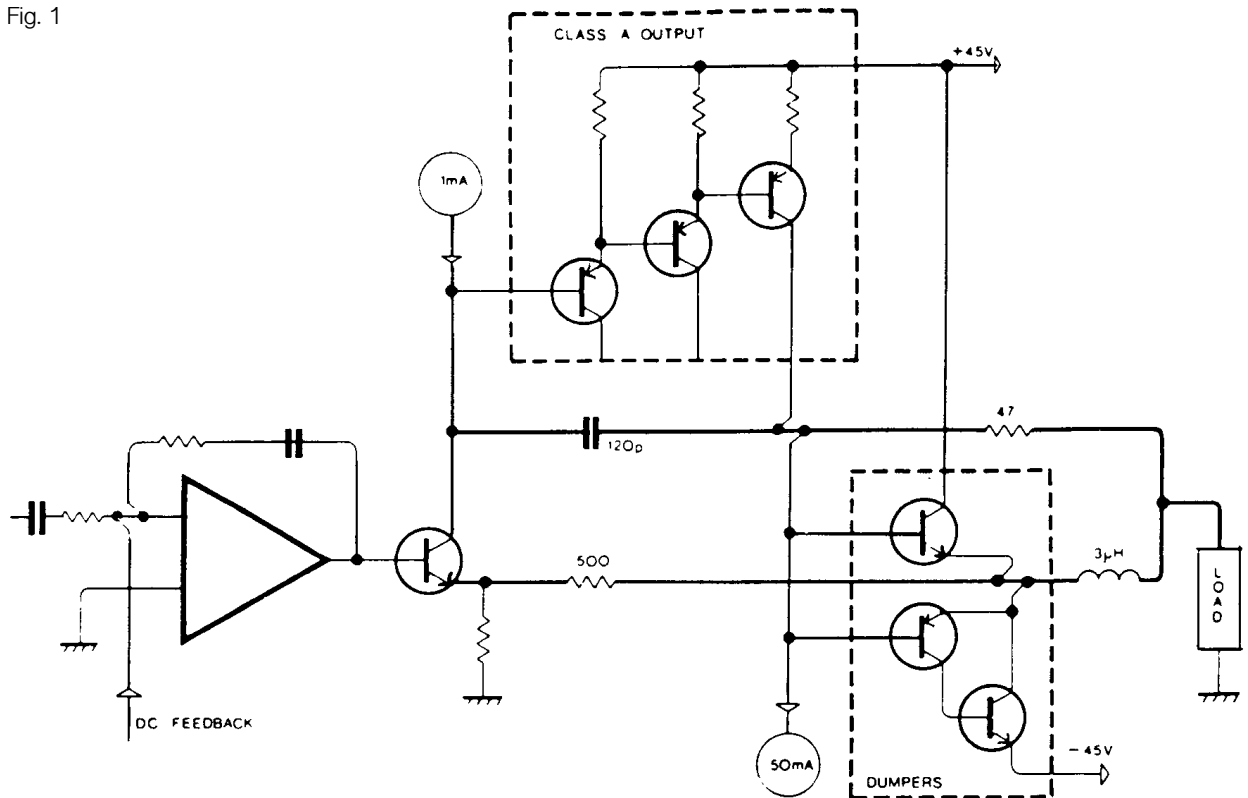
The QUAD 405 is a two channel power amplifier primarily intended for use in high quality sound reproducing systems. The amplifier is usually used with QUAD control units though other signal sources can readily be accommodated.

The amplifier uses a current dumping output circuit, a QUAD invention which eliminates many of the problems associated with transistor amplifiers, and covered by patents in several countries.

In a current dumping amplifier there is in effect both a low powered very high quality amplifier and a high powered heavy duty amplifier. The low power amplifier controls the loudspeakers at all times, calling upon the high power section to provide most of the muscle. The small amplifier is so arranged - it carries an error signal - that provided the larger power transistors (the dumpers) get within the target area of the required output current it will fill in the remainder accurately and completely. The reproduced quality is solely dependent on the small amplifier which because of its low power can be made very good indeed.

Problems of crossover, crossover distortion, quiescent current adjustment, thermal tracking, transistor matching, all disappear. There are no internal adjustments or alignments and the choice of power transistor types is less restrictive.

Fig. 1

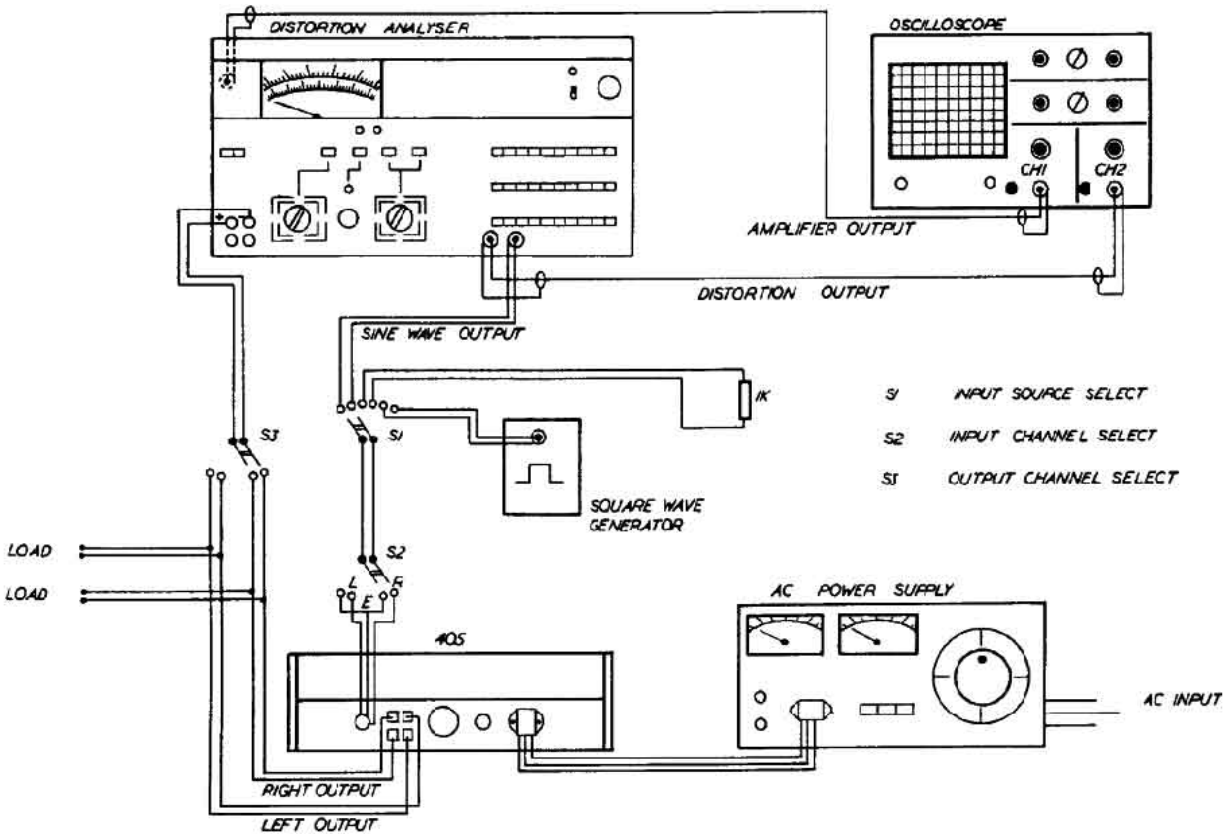


Simplified Schematic of QUAD 405 Amplifier showing Class A, Dumpers and Bridge Components.

TEST EQUIPMENT

Sound Technology Distortion Analyser 1700A (ST1700A)
Dual Beam Oscilloscope
4Ω and 8Ω load of 100W dissipation
1Ω load of 25W dissipation
2.5 kHz Square Wave Generator
Input Sensitivity Indicator (0 to 1V RMS)
AVOmeter (or similar multimeter)
0 to 12V d.c. power supply
Variac a.c. power supply

Fig. 2 illustrates a simple switching circuit which may assist if much testing is anticipated.



SUGGESTED SWITCHING ARRANGEMENT FOR TESTING QUAD 405

Fig. 2

Before testing, the cover of the 405 should be removed.

DISCONNECTING CLAMP CIRCUITS

When servicing a 405 fitted with a clamp circuit, it may be necessary to bypass this circuit.

For 405s fitted with amplifier boards M12368, this may be done by removing the push-on connectors carrying the brown wires from the amplifier boards, and connecting the loads between the black output terminals and the output terminals on the amplifier boards.

For 405s fitted with amplifier boards type M12565, it will be necessary to remove the side panels to gain access to the printed copper side of the amplifier boards. The three screws securing each side panel should be removed, the panel may then be slid outwards from the amplifier. If the solder is removed from the link pad shown in Fig. 18 (A), the clamp circuit will become disconnected.

Care should be taken to ensure that when testing is completed, the link pad is re-soldered.

AMPLIFIER CIRCUIT TESTING M 12368 - M 12565

the following test procedure is with reference to a 240V amplifier with no voltage limiters.

Select:

Controls	Y1 - 0.5V/cm d.c. coupled Y2 - 0.1V/cm d.c. coupled Timebase 0.2 ms/cm
ST 1700A-	Volts/power 100W RMS Distortion Ratio 0.01% 80kHz and 400kHz filters both in Frequency 1kHz Low Distortion Osc. level minimum
Connections	Load 8Ω S1 Sine Wave (ST1700A) S2 Left Input S3 Left Output

If the Amplifier fails any of the following tests, refer to the appropriate part of the fault finding section, page 6.

1. Check inside the amplifier for obvious faults such as burnt components, blown internal fuses etc.
Each of the following checks should be repeated on the other channel.
2. Apply the **a.c. Supply Volts** whilst observing the current consumption which should not exceed 0.12A.
3. Increase the **oscillator level** to 0.5V RMS ± 0.5 dB. the output should be 100W with no sign of clipping.
4. Select **set level** and adjust meter deflection for zero. Select **distortion** which should be less than 0.01%
Select **volts/power**, decrease the **applied frequency** to 100Hz, remove **400Hz** filter and adjust **oscilloscope timebase** to 2ms/cm. Set level, select distortion which should be less than 0.01%. Select **volts/power**, increase the **applied frequency** to 3kHz, select **400Hz** filter and adjust **timebase** to 50 μ s/cm. Select **distortion** which should again be less than 0.01%.
5. Select **volts/power**, increase **applied frequency** to 10kHz and adjust **timebase** to 20 μ s/cm. Adjust **oscillator level** so that output is 100W. Set level then select **distortion** which should be less than 0.05%.
6. Select **volts/power**, increase **applied frequency** to 20kHz and adjust the **timebase** to 10 μ s/cm. Reduce **output level** to 80W. Set level and measure **distortion** which should be less than 0.1%.
7. Select **volts/power** and decrease frequency to 1kHz. Adjust **oscillator level** so that output is 100W and adjust **timebase** to 0.2ms/cm. The following checks are to monitor the low frequency roll off of the 405. Select **30Hz** and the output level should fall by approximately 0.3dB. Select **20Hz** and the output level should fall by approximately 1dB. Select **10Hz** and the output level should fall by 7dB \pm 1.5dB.
8. Increase **frequency** to 1kHz. For 405s with amplifier boards type M 12368 insert 1.8k Ω voltage limiting resistors into the mini sockets on each amplifier board. For 405s with amplifier boards type M 12565-3 insert a link into these sockets. The output waveform should indicate clipping. Reduce the oscillator level until the clipping just disappears at which point the output level should be 20V RMS \pm 1V. Remove voltage limiters, and adjust **oscillator level** for 100W output.
9. Select **volts/power** and **square wave** input, (S1). Adjust **timebase** to 0.1ms/cm. Remove **load** and note the difference in the waveform with load and no load. there should be a slight difference in gain (10mV) but no overshoot. Reconnect the 8 Ω load.
10. The following checks should be carried out with no input signal and the input to the amplifier board loaded by a 1k Ω resistor, (S1). Remove **400Hz** filter and select **noise** which should be better than -93dB unweighted.
11. Select **volts/power**, **400Hz** filter and **sine wave** input at a **frequency** of 1kHz and adjust **oscillator level** for 100W output. Select **1 Ω load**. the output should clip equally on both halves of the waveform as shown in Fig. 11.
12. Select **4 Ω load**, output level should be 70W just prior to clipping.
13. **CLAMP CIRCUIT TESTING**

In order to test the clamp circuit, the circuit should first be disconnected from its amplifier board, as described on page 4.

For 405s fitted with amplifier boards M 12368 apply **6V d.c.** across the output terminals of the relevant channel with an ammeter in circuit.

For 405s fitted with amplifier boards M 12565 a wire should be soldered across the back of the amplifier board as shown in Fig. 18(B). 6V d.c. should be applied between this wire and the black output terminal of the relevant channel, with an ammeter in circuit.

In both cases the current should not exceed 0.5mA. Reverse the polarity of the supply and repeat the test.

The test should then be carried out on the other channel.

The complete test should then be repeated using a 12V d.c. supply with a 10 Ω resistor in series, when the current should be approximately 1A.

FAULT FINDING

The following information may assist in locating faults occurring on the amplifier boards of a 405. In each case only the faulty channel of the 405 is driven, as in the test procedure. The input should be a sine wave of 0.5V RMS and the output should be applied to an 8Ω load unless otherwise stated. The numbers refer to the relevant test check.

*Board type M12368 only **Board type M12565 only.

Effect	Cause
1. R33 Burnt R37 Burnt R41 Burnt R39 Burnt R38 Burnt	Collector-Base Tr10 o/c L1 o/c (solder joints) L3 o/c (solder joints) R20 or R21 o/c D5 or D6 o/c
2. High Current □ *□ **□ Draws high current which drops to 0.1A□ after approx 2 seconds□	Tr2 o/c, Tr3 o/c, Tr7 o/c Tr9 s/c Tr10 s/c, R7 o/c C8 s/c C3 s/c D2 o/c R8 o/c R14 o/c
3. No increase in a.c. supply current for increase in signal□ Signal is unstable and clips□ 100W output for 0.3V input□ Waveform trace as in Fig. 3□ Waveform trace as in Fig. 4□ Approximately 4W output□	R3 o/c, C1 o/c, R31 o/c R6 o/c R20 or R21 o/c Tr8 o/c, Tr6 s/c, R36 o/c, R30 o/c, C10 s/c L2 o/c (solder joints) R16 o/c
4. Second Harmonic Distortion□ Second Harmonic Distortion especially at 100Hz□ and on o/c load Third Harmonic Distortion especially at 100Hz□ Third Harmonic Distortion□ Hum and Noise□ Hum*□ Waveform trace as in Fig. 5*□ Waveform trace as in Fig. 6*□ Waveform trace as in Fig. 7□ Waveform trace as in Fig. 8*□ Waveform trace as in Fig. 9□	IC1, Tr1, Tr2, Tr3, Tr4, R5, R6, R17, R18, R22, C1 C2, C7, C8 R5 L2, R3, R6, R16, R20, R21, C3 C5 o/c R37 o/c Tr3 s/c R23 o/c, R5 o/c □ □ R33 s/c R8 o/c C5 s/c, R15 o/c, Tr1 o/c
6. Distortion at 20kHz□	D5 or D6 s/c,
8. Limiting resistor R11 has no effect□	R10 s/c
9. Square Wave trace as in Fig. 10□	C6 o/c
10. Noise especially at 100Hz□ Noise with large spikes□ Noise□	R5 Tr1 R12, R3, R4, Tr2, IC1 (change to topology!)
11. Current limiting check with 1Ω load Waveform trace as in Fig. 12□ Waveform trace as in Fig. 13□ Waveform trace as in Fig. 14□ Waveform trace as in Fig. 8□	R29 o/c, R28 s/c, R25 o/c D3 s/c, R27 o/c, R24 o/c, R26 s/c Tr6 o/c C11 s/c Tr5 o/c
13. Draws high current with 6V d.c. supply□	T2 s/c

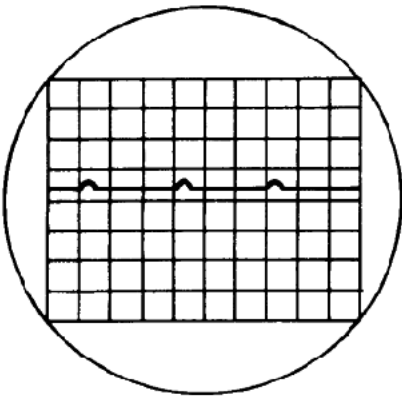


Fig. 3

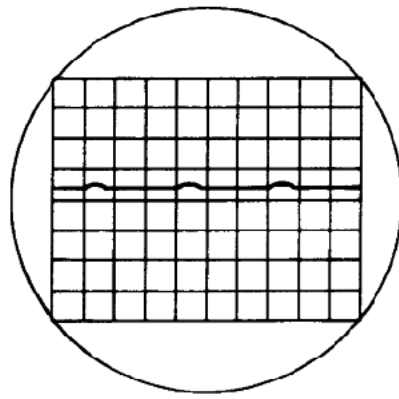


Fig. 4

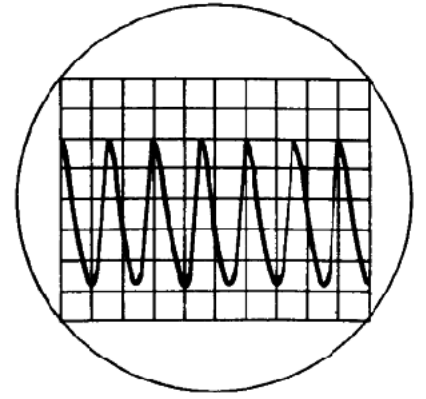


Fig. 5

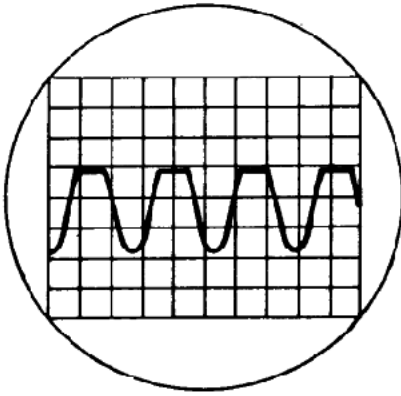


Fig. 6

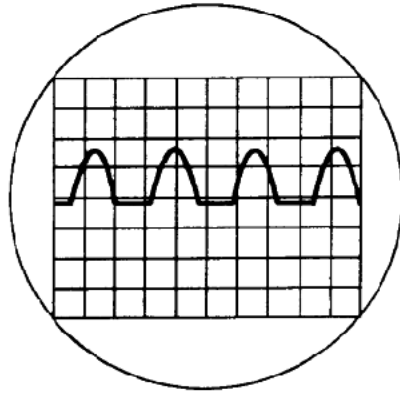


Fig. 7

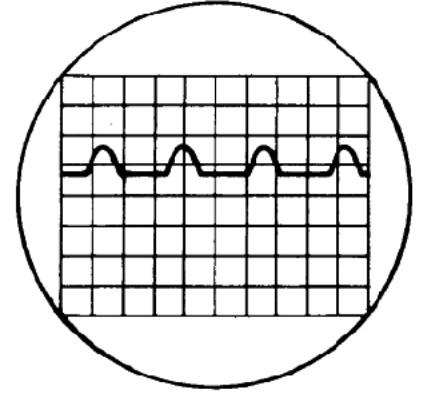


Fig. 8

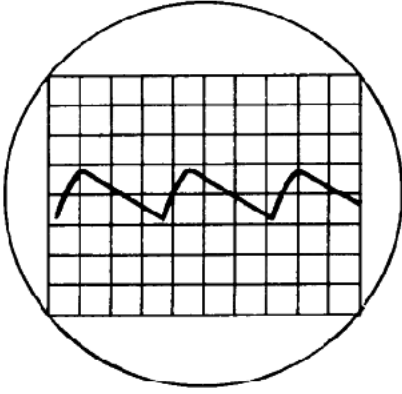


Fig. 9

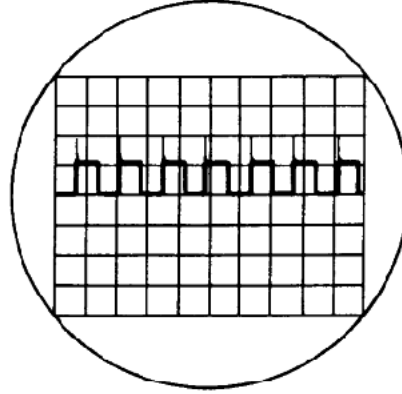


Fig. 10

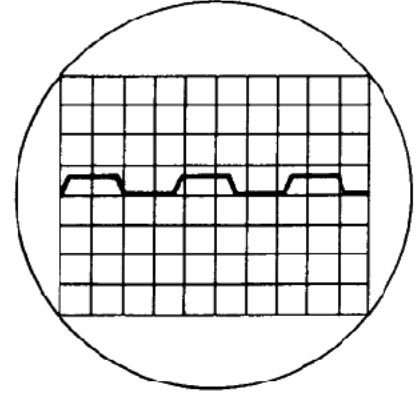


Fig. 11

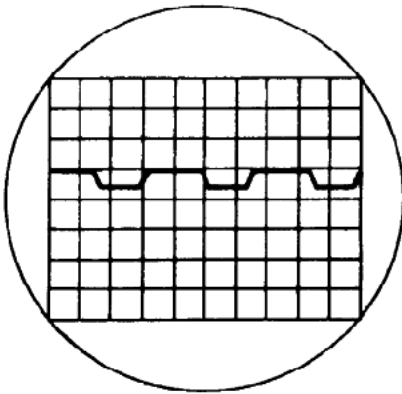


Fig. 12

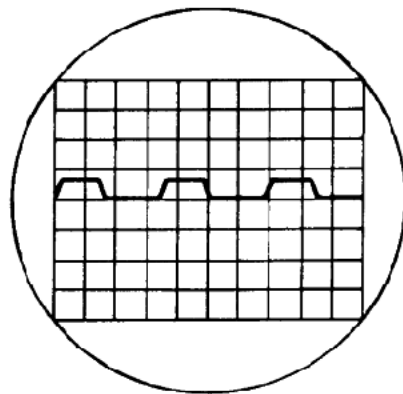


Fig. 13

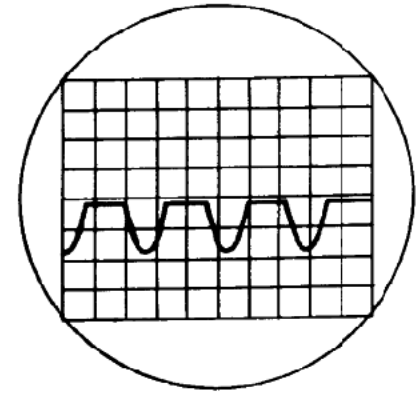


Fig. 14

MODIFICATIONS TO PRINTED CIRCUIT BOARDS.

- **Amplifier Board M 12368 iss.5** originally fitted. □ □ □ □ Circuit diagram iss. 2.
- 1.□ **Amplifier board M 12368 iss.6**
 - Copper track layout modified - component layout unchanged.
- 2.□ **Amplifier board M 12368 iss.7** □ □ □ □ □ □ Circuit diagram iss. 3.
 - R4 changed from 10k to 22k
 - R5 changed from 10k to 4k7
 - R9 changed from 180Ω to 220Ω
 - R19 (3k3) removed (combined with R23)
 - R23 changed from 3k3 to 1k2
 - C9 (330pF) removed (would be in parallel with C11)
 - C18 47nF fitted to -ve supply after FS2 - see circuit diagram
 - FS1 and FS2 effectively changed places
 - R2 changed from 2.2Ω to 10Ω
 - Copper track width reduced□
- 3.(a)□ **Amplifier board M 12368 iss.9** introduced at serial number 9000.□ □ □ □ Circuit diagram iss. 4.
 - R41 22Ω added
 - L3 6.9μH added
 - C15 0.1μF added
 - C16 0.1μF added
 - C18 (47nF) removed
 - C19 1nF fitted between base and collector of Tr10 ([not recommended if stable without](#))
 - Copper track width reduced
 - Also at s/n 9000 a clamp circuit, on PCB M12400, was mounted on the output terminal (Fig. 15).
 - This detects excessive d.c. offset at the output and short circuits, blowing the internal 4A fuses FS1 and/or FS2 to protect the loudspeaker.
- 3.(b)□ The following component changes were made at serial number 29000.□□ □ □ □ □ Circuit diagram iss. 5.
 - R10 changed from 1k to 1k8
 - R27 changed from 8k2 to 15k
 - R29 changed from 8k2 to 15k
 - R35 changed from 0.08Ω to 0.091Ω
 - R36 changed from 0.08Ω to 0.091Ω
 - D1 changed from LR120C to LR150C (op-amp voltage increased from 12V to 15V)
 - D2 changed from LR120C to LR150C (op-amp voltage increased from 12V to 15V)
- 4.□ **Amplifier board M 12368 iss.10**
 - Identical to M12368 iss. 9 except copper pads for power transistors modified for production.
- 5.□ **Amplifier board M 12565 iss.3** Introduced at serial number 59001.□ □ □ □ Circuit diagram iss. 6.
 - Other QUAD 405s with this PCB fitted were serial numbers 57301 to 57600 inc.
 - This board incorporates the clamp circuit and the ESL voltage limiter is now a link
- 6.□ **Amplifier board M 12565 iss.5** (QUAD 405-2 PCB). □ □ □ □ Circuit diagram iss. 7.
 - Was fitted at serial number 62500 but with a 405 name plate until serial number 65000.
 - See page 12 for 405-2 PCB changes.

Alternatives

Transistors - on PCB M12368 iss. 5, 6 & 7 BDY77 or BDY74 may have been used for Tr9 and Tr10.

BDY77 is a suitable replacement for both but beware - **faster transistors may cause instability.**

On M12368 iss. 9 & 10 and M12565 iss. 3 Transistors Tr9 and Tr10 may be 2SD424, 17556 or 2SD676 and are interchangeable.

Tr2 - BC682, ZTX304, BCX32 and BC546B are interchangeable.

Tr3, Tr4 - E5458, ZTX504 and BC556B are interchangeable.

Tr7, Tr8 - 40872 or 2SA740 are interchangeable.

LED - LP1 - HP5082-4850, Exciton XC5053, Toshiba TLR114A (or any modern LED with R40 adjusted).

CLAMP CIRCUIT

Introduced co-incident with amplifier PCB M12368 iss. 9 at serial number 9001. All 405s with serial numbers 9000 and under being returned for service, should be fitted with a clamp board as shown below. At serial number 59001 the clamp circuit was fitted as an integral part of the amplifier board M12565 iss. 3. The function of this circuit is to monitor the d.c. component of the output. In the event of a component failure which causes excessive d.c. voltage, the circuit will short circuit the amplifier output and thus protect the speakers.

REPLACING THE CLAMP BOARD

If it is necessary to replace a clamp board the following instructions should be followed:

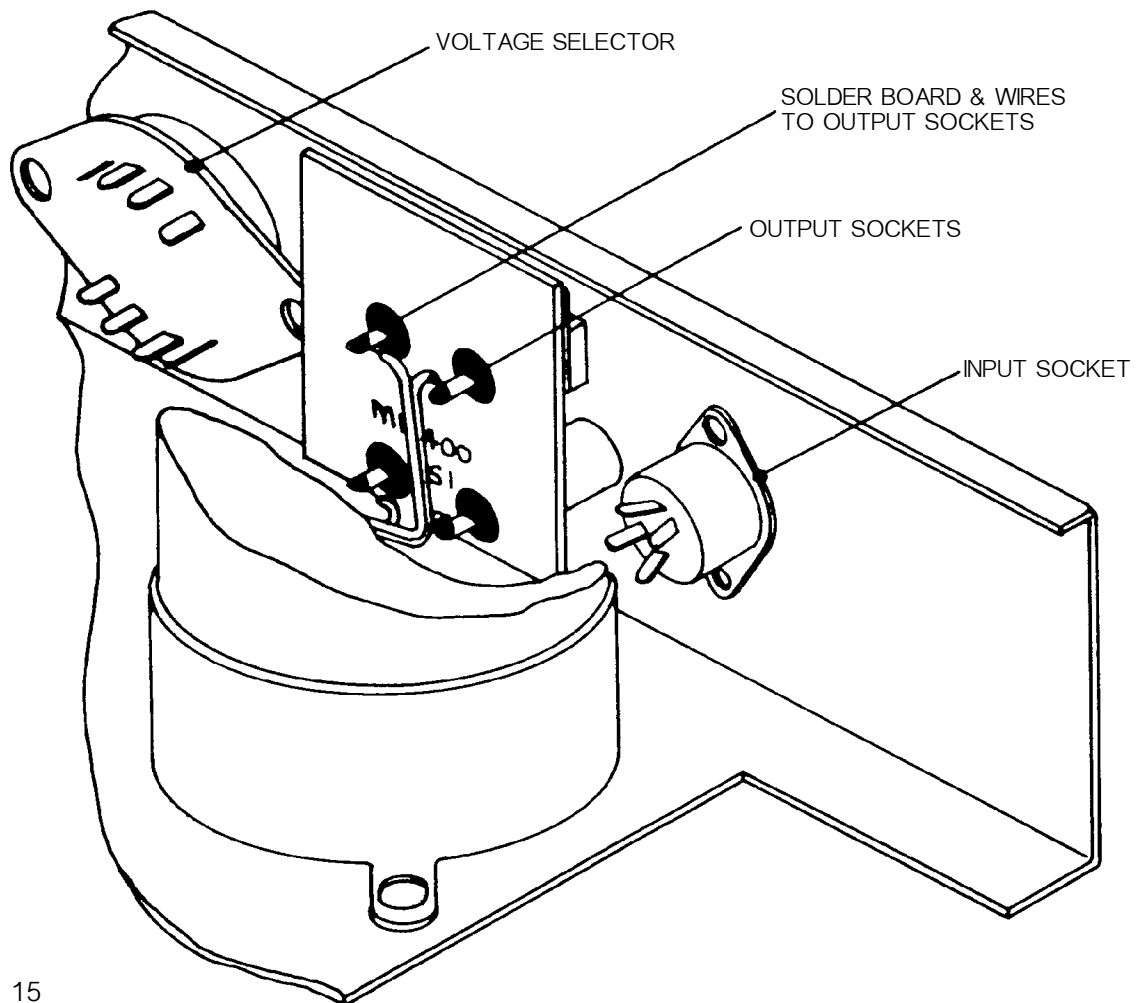


Fig. 15

1. Disconnect the wiring to the right channel circuit board and fold it back onto the transformer. Loosen the clamp holding the electrolytic capacitor next to the output terminals, and lift the capacitor out of the way.
2. Disconnect the leads to the output sockets, place the clamp board over the output connectors and re-solder. It is advisable to tin the output connector tags before positioning the clamp board. This makes soldering easier.
- Replace the capacitor and reconnect the tags to the right channel amplifier board.

CLAMP CIRCUIT ALTERNATIVES

- T1 - 2N4992 or BS08A-03
- T2 - Sc141B or TIC226B or RCA T2800

CONVERSION OF 405 TO A MONO 180W AMPLIFIER

To carry out the conversion, the modification kit Q410MOD should first be obtained.

- 1.□ Remove the 405 cover and base plate.
- 2.□ Unplug the AMP connectors from the right-hand channel PCB (right-hand side when viewed from front).
- 3.□ Release the clip securing the rear 10,000 μ F capacitor (C 14) and lay the capacitor over the right-hand PCB.
□
- 4.□ Unsolder the 4 leads from the output terminals.
□ For 405s fitted with PCBs M 12368 (serial numbers below 59000) remove the clamp board M 14200.
□ To disconnect the clamp circuit on 405s fitted with PCBs M 12565 (serial numbers above 59000) remove both
□ of the side panels. The solder should then be removed from the link pads shown as "A" in fig. 18.
- 5.□ Remove the output terminals and replace those for the right-hand channel with the sockets provided, Red at the
□ top. Fit the blanking grommets provided in the vacant holes.
- 6.□ Fit the new printed circuit clamp board to the output sockets and reconnect the output leads. Brown/Red to the
□ pin marked R, Brown/White to the pin marked L and both Green leads to the pin next to L.
- 7.□ Remove the 4 pin DIN socket and unsolder the leads from it.
- 8.□ Connect these leads to the new input board, White to L and Red to R and the screens to the two E tags.
- 9.□ Fit the new input socket and board.
- 10.□ Refit C 14 and the AMP connector to the right-hand PCB.
- 11.□ Remove the output leads Brown/White from left-hand PCB and Brown/Red from right-hand PCB.
- 12.□ Connect a 4-8 Ω speaker between the output tags of these two PCBs.
- 13.□ Switch on the 405, inject a signal of approximately 100mV at 1kHz at the input socket (left and right pins are
□ now common). Remove the blanking grommet adjacent to the input socket and adjust the pre-set potentiometer
□ through this hole for a null in the signal from the speaker, increase the input signal level as required for final setting.
- 14.□ Switch off remove signal input, disconnect the loudspeaker, reconnect the output leads, refit blanking grommet
□ and all covers.□

REMOVING THE AMPLIFIER MODULES

1. Note the colour coding for reconnection and remove the push-on AMP connectors A.
2. Undo the four fixing screws B, for each module.
3. Remove the heatsink grease from the face of the aluminium T-section and retain for use when re-fitting.
□ (not recommended after years of service - use new heat sink compound or sheet material)

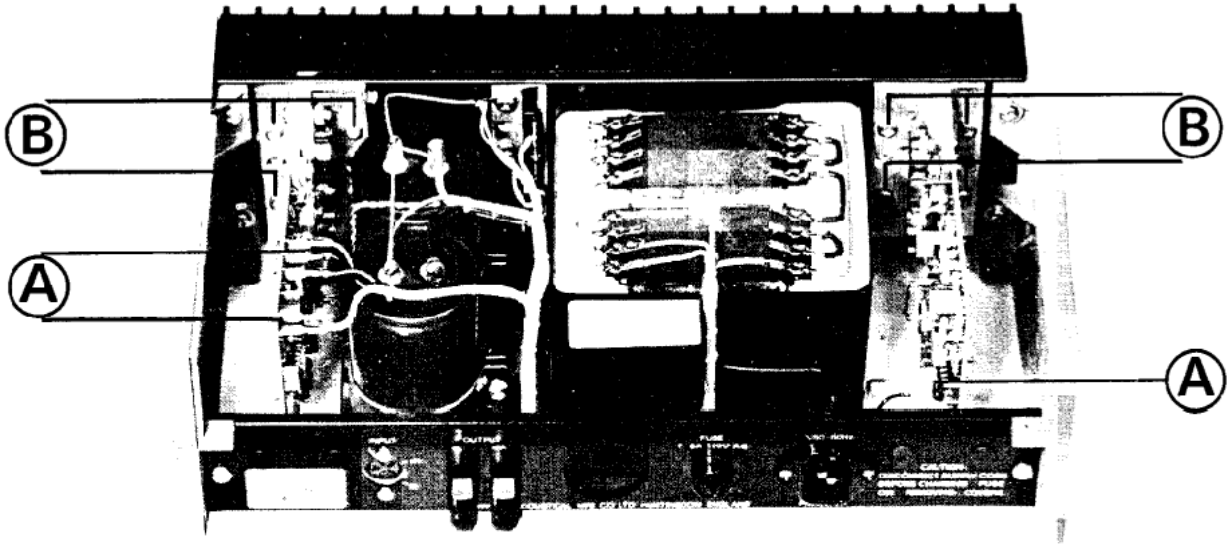


Fig. 16

REPLACING THE QUAD 405 TRANSFORMER

1. Disconnect the a.c. supply and remove top cover (2 M4 screws) and bottom plate (4 M4 screws).
2. Note the connections and then unsolder the external wiring to the a.c. supply transformer.
3. Remove the two retaining screws through the large centre holes of each T-section heat-sink then release the amplifier boards by removing the other 4 screws on each. These 12 screws fasten into tapped strips located in slots in the rear of the finned heat-sink sections, which now become free of the front plate.
4. Release the transformer by undoing 4 screws through the front plate and 2 through the bottom plate.
5. Reverse the procedure with the new transformer.

Note: It should not be necessary to remove the push-on AMP connectors from the amplifier PCBs.

QUAD 405-2

The original 405 provided 100 Watts per channel into load impedances between 4.5Ω and 8 Ω. To meet the need of 4Ω and 8Ω loudspeakers whose impedance falls below 4.5Ω, the 405-2 was introduced in January 1983 at serial number 65000, but the 405 modules had already been fitted from serial number 62500 onwards. Many earlier amplifiers have also since been converted to 405-2 by owners and dealers replacing the modules.

The 405-2 has a more sophisticated current limiter circuit based on a thick-film assembly N1/N2 permitting full output into loads between 3Ω and 10Ω, and upto 50W into 1.5Ω loads, provided the output transistors will not be hazarded by doing so. (see Fig. 17). As with earlier 405 models after serial number 59001, the output stage clamp circuit is incorporated in the main module boards and a shorting link used for the voltage limiter.

The first 405-2 circuit diagram was 12333 iss. 7 and the PCB reference M12565 iss. 5.

Subsequent modifications were:

Date	Serial Number	PCB 12565 issue	Circuit Diagram 12333 iss.	Changes
May 83	66700	6	8	C20 (4n7) added to avoid mild instability when switching off. D13 added in series with D5 to correct response at 20kHz. R44 added to maintain unconditional stability.
July 83	67950	6	8	Output terminals replaced by 4mm sockets.
Aug 84	72501	7	9	Tr4 changed to BC556B and R 18 omitted replacing both Tr3 and Tr4.
Dec 85	83000	7	-	Voltage selector omitted.
Feb 86	85000	7	10	New mains input connector incorporating fuse-holder DIN input replaced by phono sockets. Signal earth isolated from chassis by R2 to avoid hum loop when using mains earth.

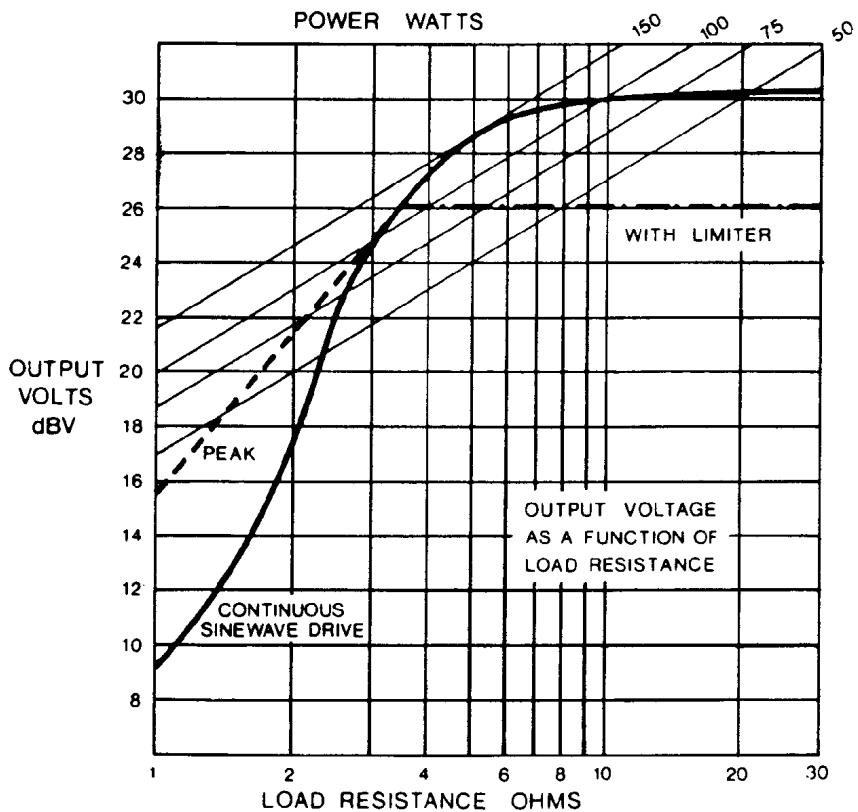


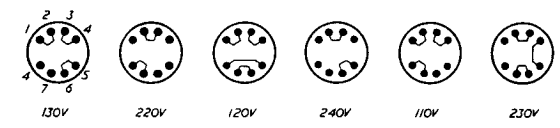
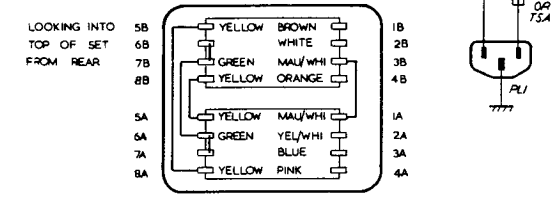
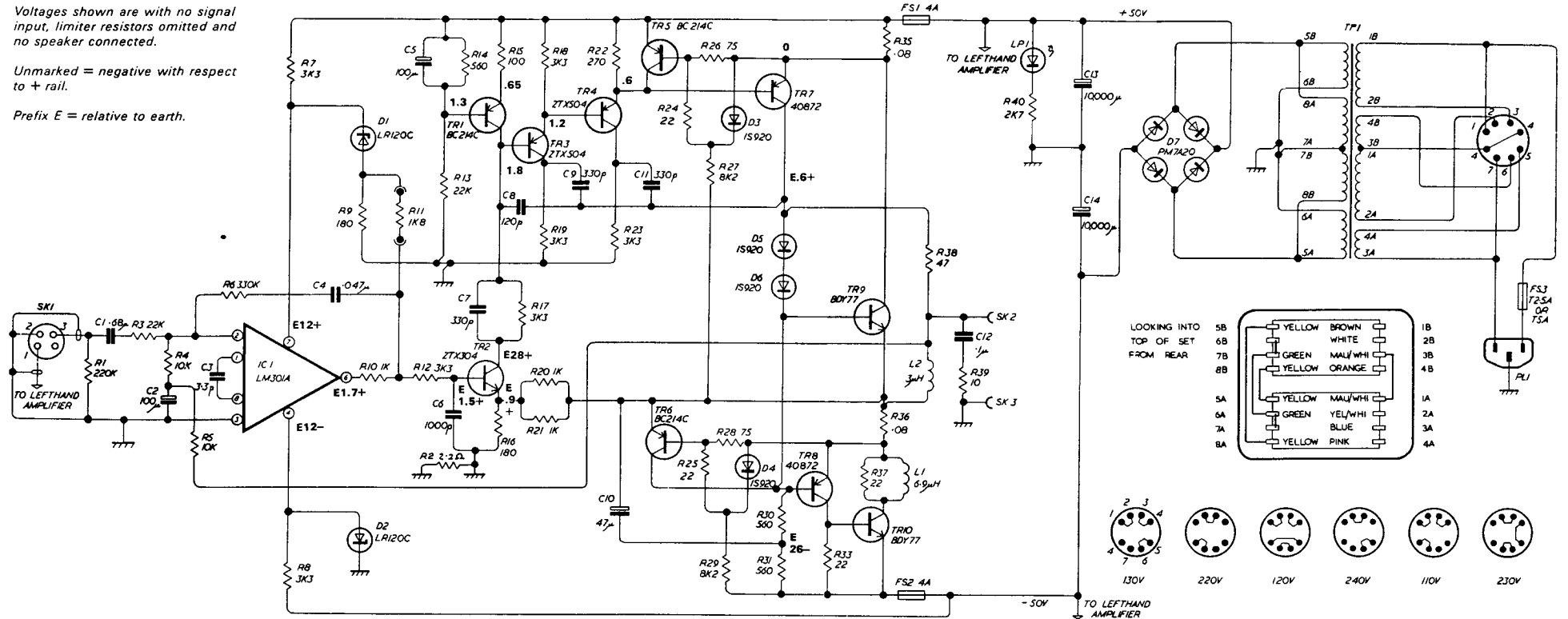
Fig. 17

BOARD NUMBER M12368 ISS 5 AND 6

Voltages shown are with no signal input, limiter resistors omitted and no speaker connected.

Unmarked = negative with respect to + rail.

Prefix E = relative to earth.



No.	Value	Tol	Reference	Stock No.
R1	220K	± 10%	Resistor	R220KJ1
R2	2.2	± 5%	Resistor	R2R20DS
R3	22K	± 5%	Resistor	R22K0J1
R4	10K	± 10%	Resistor	R10K0J1
R5	10K	± 10%	Resistor	R10K0J1
R6	330K	± 5%	Resistor	R330KJ1
R7	3K3	± 10%	Resistor	R3K30J1
R8	3K3	± 10%	Resistor	R3K30J1
R9	180	± 5%	Resistor	R180RJ1
R10	1K	± 5%	Resistor	R1K00J1
R11	1K8	± 10%	Resistor	R1K80J1
R12	3K3	± 10%	Resistor	R3K30J1
R13	22K	± 5%	Resistor	R22K0J1
R14	580	± 10%	Resistor	R580RJ1
R15	100	± 10%	Resistor	R100RJ1
R16	180	± 5%	Resistor	R180RJ1
R17	3K3	± 10%	Resistor	R3K30J1
R18	3K3	± 10%	Resistor	R3K30J1
R19	3K3	± 10%	Resistor	R3K30J1
R20	1K	± 5%	Resistor	R1K00J1
R21	1K	± 5%	Resistor	R1K00J1
R22	270	± 10%	Resistor	R270RJ1
R23	3K3	± 10%	Resistor	R3K30J1
R24	22	± 10%	Resistor	R22RJ1
R25	22	± 10%	Resistor	R22RJ1
R26	75	± 5%	Resistor	R75RJ1

No.	Value	Tol	Reference	Stock No.
R27	8K2	± 5%	Resistor	R8K2RJ1
R28	75	± 5%	Resistor	R75RJ1
R29	8K2	± 5%	Resistor	R8K2RJ1
R30	580	± 10%	Resistor 2.5W	R580RJS
R31	580	± 10%	Resistor 2.5W	R580RJS
R33	22	± 10%	Resistor	R22RJ1
R35	0.08		Resistor Acoustical DRG A4/12383	RR091JY
R36	0.08		Resistor Acoustical DRG A4/12383	RR091JY
R37	22	± 10%	Resistor	R22RJ1
R38	47	± 5%	Resistor	R47RJ1
R39	10	± 10%	Resistor	R10RJ1
R40	2K7		Resistor 1.6W	R2K70JR
C1	0.88µ		Capacitor 100V	C680NKS
C2	100µ	± 10%	Capacitor 3V	C100UME
C3	3.3P	± 20%	Capacitor	C3P30KJ
C4	0.047µ		Capacitor 250V	C47NQSJ
C5	100µ		Capacitor 6V	C100UZB
C6	1000P		Capacitor 400V	C1N00KK
C7	330P	± 20%	Capacitor	C330PKJ
C8	120P	± 5%	Capacitor	C120PJ1
C9	330P	± 20%	Capacitor	C330PKJ
C10	47µ		Capacitor 40V	C47U0ZB
C11	330P		Capacitor	C330PKJ

No.	Value	Tol	Reference	Stock No.
C12	0.1µ		Capacitor 250V	C100NKC
C13	10,000µ		Capacitor 63V	C10KUTA
C14	10,000µ		Capacitor 63V	C10KUTA
TR1			Transistor BC214C	DBC214C
TR2			Transistor BC882 or ZTX304 or BCX32	DZTX304
TR3			Transistor E5458 or ZTX504	DZTX504
TR4			Transistor E5458 or ZTX504	DZTX504
TR5			Transistor BC214C	DBC214C
TR6			Transistor BC214C	DBC214C
TR7			Transistor 40872 or 2SA740	D40872X
TR8			Transistor 40872 or 2SA740	D40872X
TR9			Transistor BDY74 or BDY77	DBDY77Q
TR10			Transistor BDY74 or BDY77	DBDY77Q
D1			Zener Diode LR120C	DZ12VAA
D2			Zener Diode LR120C	DZ12VAA
D3			Diode IS920	DIS920B
D4			Diode IS920	DIS920B
D5			Diode IS920	DIS920B
D6			Diode IS920	DIS920B
D7			Bridge Rectifier	DPM7A20
IC1			LM301A	DML301A
L1	6.9µH	± 20%	Inductor ANCO TC1/65	L12408A

No.	Value	Tol	Reference	Stock No.
L2	3µH	± 5%	Inductor ANCO 440/D	L12405A
FS1	4A			UM04AQA
FS2	4A			UM04AQA
FS3	T2.5A		220-240V	UM2A5DA
	T5A		110-130V	UM05ADA
LP1			Hewlett Packard 5082-4850 Red	BL5053R
TF1			Acoustical DRG A3/12362	L12362A

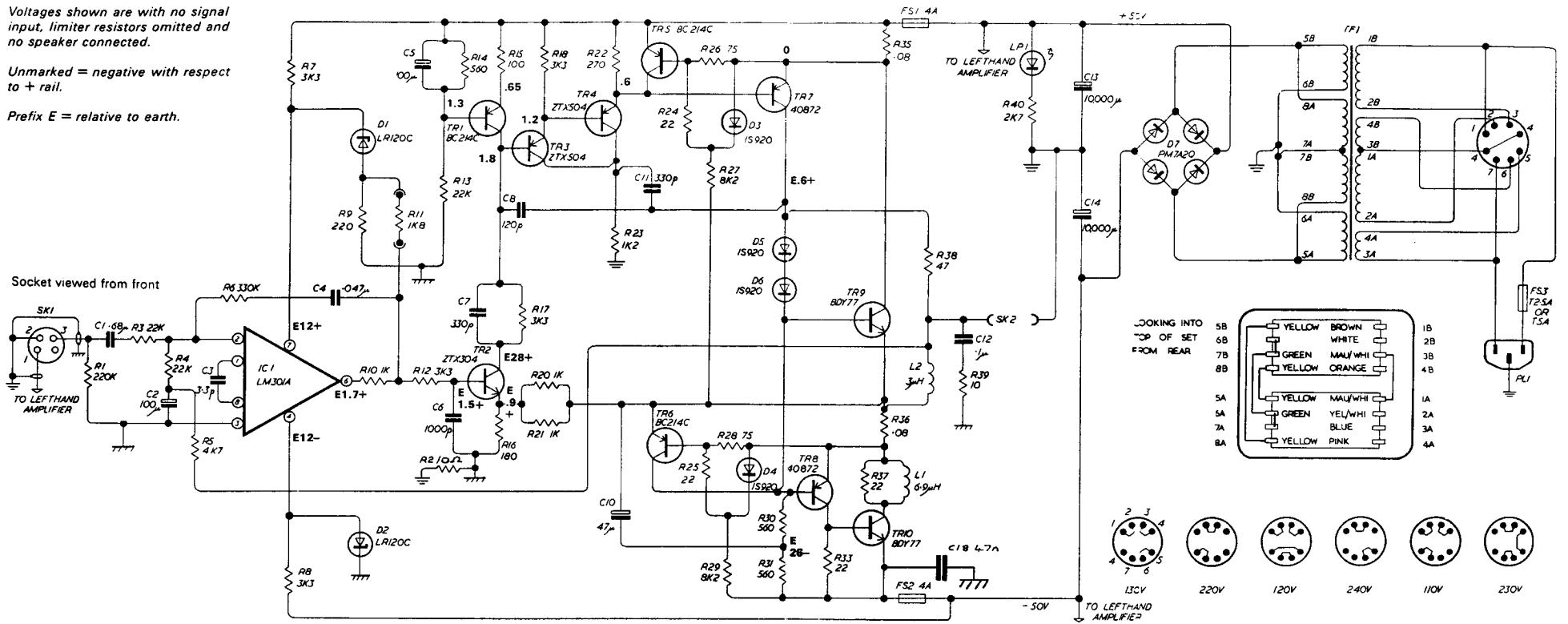
BOARD NUMBER M12368 ISS 7

Voltages shown are with no signal input, limiter resistors omitted and no speaker connected.

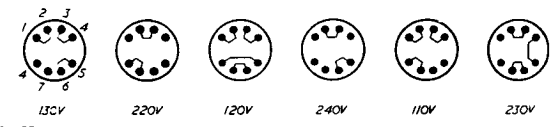
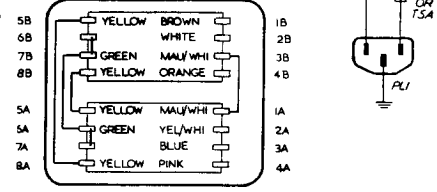
Unmarked = negative with respect to + rail.

Prefix E = relative to earth.

Socket viewed from front



LOOKING INTO TOP OF SET FROM REAR



No.	Value	Tol	Reference	Stock No.
R1	220K	± 10%	Resistor	R220KJ1
R2	10	± 5%	Resistor	R10R0J1
R3	22K	± 2%	Resistor	R22K0J1
R4	22K	± 2%	Resistor	R22K0J1
R5	4.7K	± 10%	Resistor	R4K70J1
R6	330K	± 5%	Resistor	R330KJ1
R7	3K3	± 10%	Resistor	R3K30J1
R8	3K3	± 10%	Resistor	R3K30J1
R9	220	± 5%	Resistor	R220RJ1
R10	1K	± 2%	Resistor	R1K00J1
R11	1K8	± 10%	Resistor	R1K80J1
R12	3K3	± 10%	Resistor	R3K30J1
R13	22K	± 2%	Resistor	R22K0J1
R14	560	± 10%	Resistor	R560RJ1
R15	100	± 10%	Resistor	R100RJ1
R16	180	± 2%	Resistor	R180RJ1
R17	3K3	± 10%	Resistor	R3K30J1
R18	3K3	± 10%	Resistor	R3K30J1
R19				
R20	1K	± 2%	Resistor	R1K00J1
R21	1K	± 2%	Resistor	R1K00J1
R22	270	± 10%	Resistor	R270RJ1
R23	1K2	± 10%	Resistor 1.6W	R1K20JR
R24	22	± 10%	Resistor	R22R0J1
R25	22	± 10%	Resistor	R22R0J1
R26	75	± 5%	Resistor	R75R0J1

No.	Value	Tol	Reference	Stock No.
R27	8K2	± 5%	Resistor	R8K20J1
R28	75	± 5%	Resistor	R75R0J1
R29	8K2	± 5%	Resistor	R8K20J1
R30	560	± 10%	Resistor 2.5W	R560RJ1
R31	560	± 10%	Resistor 2.5W	R560RJS
R33	22	± 10%	Resistor	R22R0J1
R35	0.08		Resistor Acoustical DRG.44/12383	RR091JY
R36	0.08		Resistor Acoustical DRG.44/12383	RR091JY
R37	22	± 10%	Resistor	R22R0J1
R38	47	± 5%	Resistor	R47R0J1
R39	10	± 10%	Resistor	R10R0J1
R40	2K7		Resistor 1.6W	R2K70JR
C1	0.88µ		Capacitor 100V	C880NKS
C2	100µ	± 10%	Capacitor 3V	C100UME
C3	3.3P	± 20%	Capacitor	C3P30KJ
C4	0.047µ		Capacitor 250V	C47N0JS
C5	100µ	± 10%	Capacitor 6V	C100U2B
C6	1000P		Capacitor 400V	C1N00KK
C7	330P	± 20%	Capacitor	C330PKJ
C8	120P	± 5%	Capacitor	C120PJ1
C9				
C10	47µ		Capacitor 40V	C47U0ZB
C11	330P		Capacitor	C330PKJ

No.	Value	Tol	Reference	Stock No.
C12	0.1µ		Capacitor 250V	C100NKC
C13	10,000µ		Capacitor 63V	C10KUTA
C14	10,000µ		Capacitor 63V	C10KUTA
C18	0.047µ		Capacitor	C47N0J1
TR1			Transistor BC214C	DBC214C
TR2			Transistor BC882 or ZTX304 or BCX32	DZTX304
TR3			Transistor E5458 or ZTX504	DZTX504
TR4			Transistor E5458 or ZTX504	DZTX504
TR5			Transistor BC214C	DBC214C
TR6			Transistor BC214C	DBC214C
TR7			Transistor 40872 or 2SA740	D40872X
TR8			Transistor 40872 or 2SA740	D40872X
TR9			Transistor BDY74 or BDY77	DBDY77Q
TR10			Transistor BDY74 or BDY77	DBDY77Q
D1			Zener Diode LR120C	DZ12VAA
D2			Zener Diode LR120C	DZ12VAA
D3			Diode IS920	DIS920B
D4			Diode IS920	DIS920B
D5			Diode IS920	DIS920B
D6			Diode IS920	DIS920B
D7			Bridge Rectifier	DPM7A2Q
IC1			LM301A	DML301A

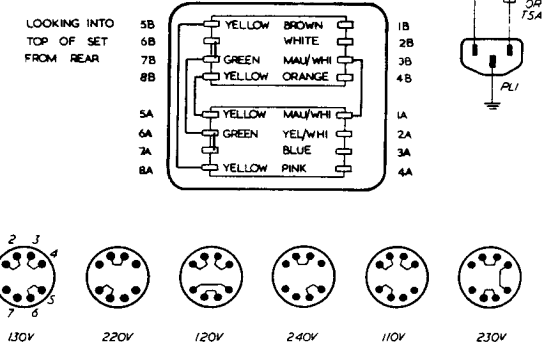
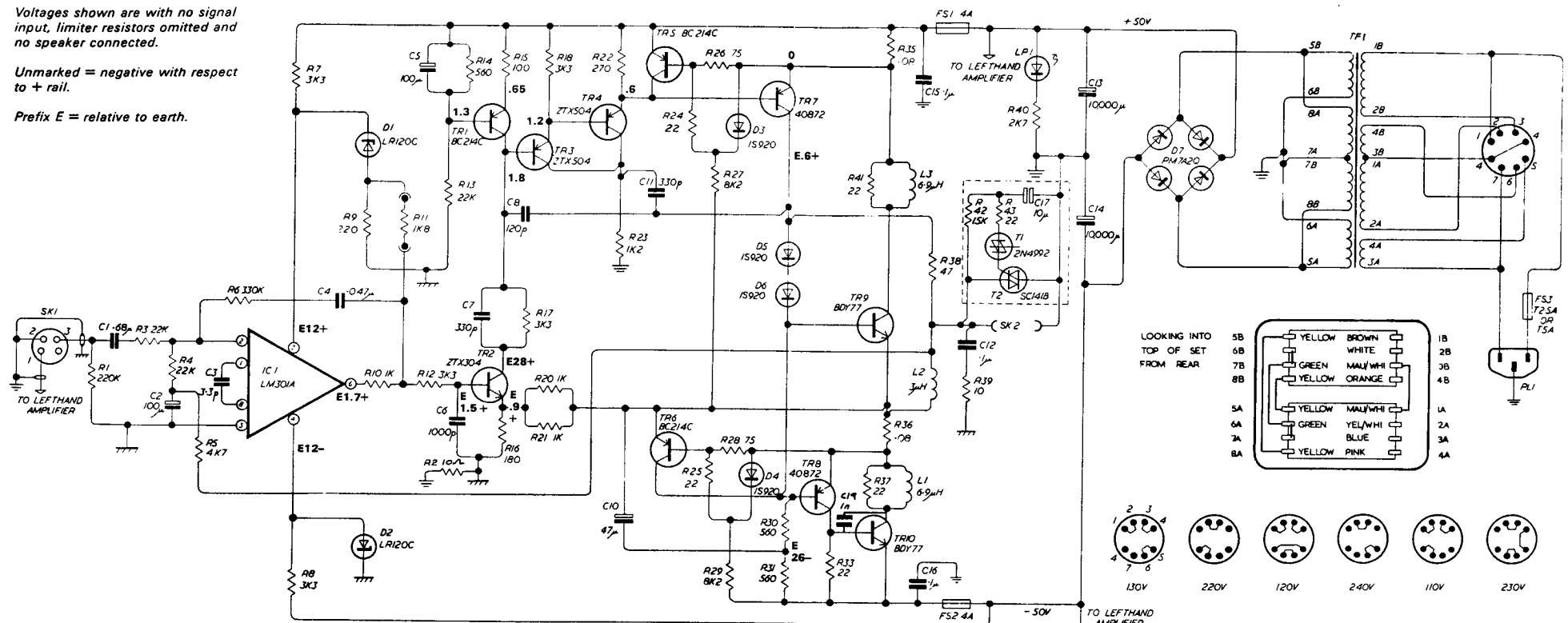
No.	Value	Tol	Reference	Stock No.
L1	6.9µH	± 20%	Inductor ANCO TC1/65	L12406A
L2	3µH	± 5%	Inductor ANCO 440/D	L12405A
FS1	4A			UM04AQA
FS2	4A			UM04AQA
FS3	T2.5A	220-240V		UM2A5DA
	T5A	110-130V		UM05ADA
LP1			Hewlett Packard 5082-4850 Red	BL5053R
TF1			Acoustical DRG A3/12362	L12362A

BOARD NUMBER M12368 ISS 9

Voltagess shown are with no signal input, limiter resistors omitted and no speaker connected.

Unmarked = negative with respect to + rail.

Prefix E = relative to earth.



No.	Value	Tol	Reference	Stock No.
R1	220K	± 10%	Resistor	R220KJ1
R2	10	± 5%	Resistor	R10R0J1
R3	22K	± 2%	Resistor	R22K0J1
R4	22K	± 2%	Resistor	R22K0J1
R5	4.7K	± 10%	Resistor	R4K70J1
R6	330K	± 2%	Resistor	R330KJ1
R7	3K3	± 10%	Resistor	R3K30J1
R8	3K3	± 10%	Resistor	R3K30J1
R9	220	± 5%	Resistor	R220RJ1
R10	1K	± 2%	Resistor	R1K00J1
R11	1K8	± 10%	Resistor	R1K80J1
R12	3K3	± 10%	Resistor	R3K30J1
R13	22K	± 2%	Resistor	R22K0J1
R14	560	± 10%	Resistor	R560RJ1
R15	100	± 10%	Resistor	R100RJ1
R16	180	± 2%	Resistor	R180RJ1
R17	3K3	± 10%	Resistor	R3K30J1
R18	3K3	± 10%	Resistor	R3K30J1
R19				
R20	1K	± 2%	Resistor	R1K00J1
R21	1K	± 2%	Resistor	R1K00J1
R22	270	± 10%	Resistor	R270RJ1
R23	1K2	± 10%	Resistor 1.6W	R1K20JR
R24	22	± 10%	Resistor	R22R0J1
R25	22	± 10%	Resistor	R22R0J1
R26	75	± 5%	Resistor	R75R0J1

No.	Value	Tol	Reference	Stock No.
R27	8K2	± 5%	Resistor	R8K20J1
R28	75	± 5%	Resistor	R75R0J1
R29	8K2	± 5%	Resistor	R8K20J1
R30	560	± 10%	Resistor 2.5W	R560RJS
R31	560	± 10%	Resistor 2.5W	R560RJS
R32				
R33	22	± 10%	Resistor	R22R0J1
R34				
R35	0.08		Resistor	RR081JY
R36	0.08		Resistor Acoustical DRWG A4/12383	RR081JY
R37	22	± 10%	Resistor	R22R0J1
R38	47	± 5%	Resistor	R47R0J1
R39	10	± 10%	Resistor	R10R0J1
R40	2K7		Resistor 1.6W	R2K70JR
R41	22	± 10%	Resistor	R22R0J1
R42	15K	± 10%	Resistor	R15K0J1
R43	22	± 10%	Resistor	R22R0J1
R44				
C1	0.68µ		Capacitor 100V	CB80NKS
C2	100µ	± 10%	Capacitor 3V	C100UME
C3	3.3P	± 20%	Capacitor	C3P30KJ
C4	0.047µ		Capacitor 250V	C47N0JS
C5	100µ		Capacitor 6V	C100U2B
C6	1.000P		Capacitor 400V	C1N00KK
C7	330P	± 20%	Capacitor	C330PKJ
C8	120P	± 5%	Capacitor	C120PJ1

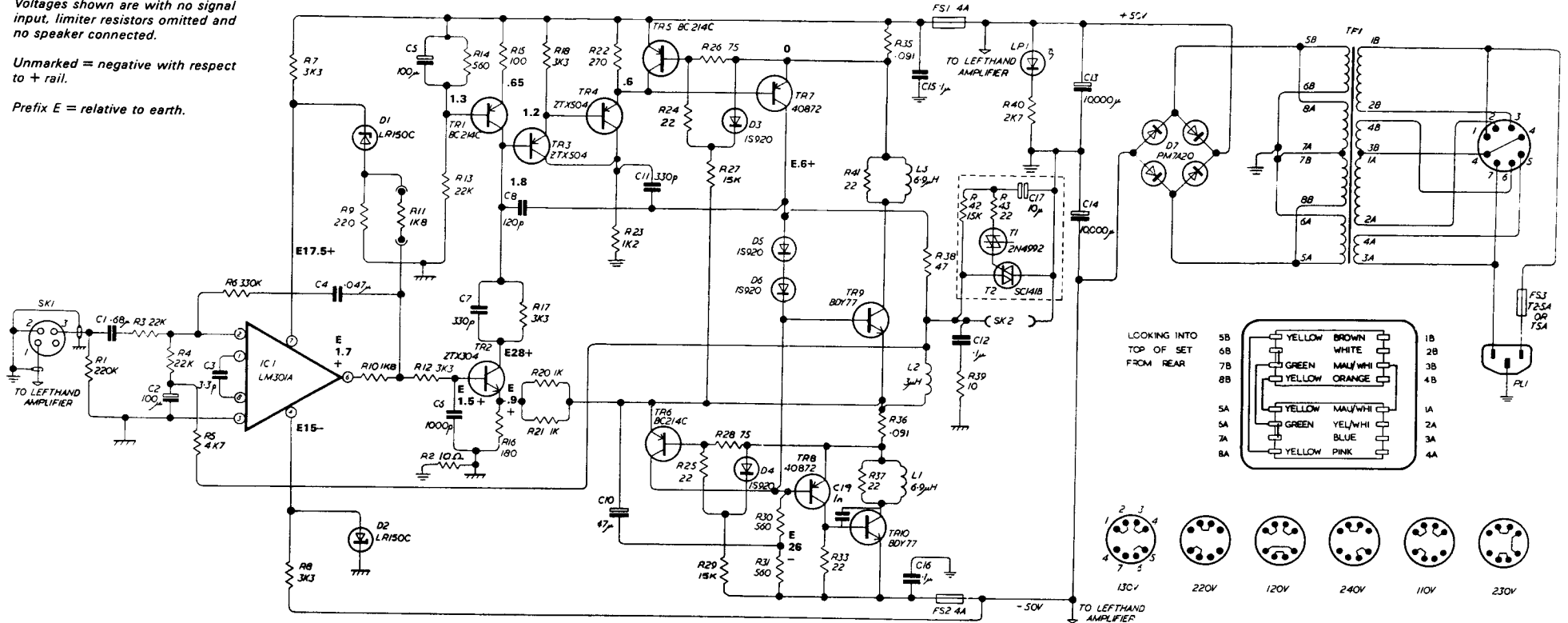
No.	Value	Tol	Reference	Stock No.
C9				
C10	47µ		Capacitor 40V	C47U02B
C11	330P		Capacitor	C330PKJ
C12	0.1µ		Capacitor 250V	C100NKC
C13	10.000µ		Capacitor 83V	C10KUTA
C14	10.000µ		Capacitor 83V	C10KUTA
C15	0.1µ		Capacitor 100V	C100NKS
C16	0.1µ		Capacitor 100V	C100NKS
C17	10µ		Capacitor 40V	C10U02R
C18				
C19	1000P		Capacitor	C1N00SA
C20				
TR1			Transistor BC214C	DBC214C
TR2			Transistor BC682 or ZTX304 or BCX32	DZTX304
TR3			Transistor E5458 or ZTX504	DZTX504
TR4			Transistor E5458 or ZTX504	DZTX504
TR5			Transistor BC214C	DBC214C
TR6			Transistor BC214C	DBC214C
TR7			Transistor 40872 or 2SA740	D40872X
TR8			Transistor 40872 or 2SA740	D40872X
TR9			Transistor 2SD424 or 2SD876 or 17556	D17556X
TR10			Transistor 2SD424 or 2SD876 or 17556	D17556X
T1			DIAC 2N4982 or 8S08A-03	DBS08AA
T2			TRIAC SC1418 or T1C2268 or T2800	DT2800B

No.	Value	Tol	Reference	Stock No.
D1			Zener Diode LR120C	DZ12VAA
D2			Zener Diode LR120C	DZ12VAA
D3			Diode IS920	DIS920B
D4			Diode IS920	DIS920B
D5			Diode IS920	DIS920B
D6			Diode IS920	DIS920B
D7			Bridge Rectifier	DFM7A2Q
D8				
IC1			LM301A	DML301A
L1	6.9µH	± 20%	Inductor ANCO TC1/85	L12406A
L2	3µH	± 8%	Inductor ANCO 440/D	L12405A
L3	6.9µH	± 20%	Inductor ANCO TC1/85	L12406A
FS1	4A			UM04AQA
FS2	4A			UM04AQA
FS3	T2.5A		220-240V	UM2A5DA
FS4			110-130V	UM05ADA
LP1			Hewlett Packard 5082-4850 Red	BL5053R
TF1			Acoustical DRG A3/12382	L12382A

Voltages shown are with no signal input. Limiter resistors omitted and no speaker connected.

Unmarked = negative with respect to + rail.

Prefix E = relative to earth.



No.	Value	Tol	Reference	Stock No.
R1	220K	± 10%	Resistor	R220KJ1
R2	10	± 5%	Resistor	R10R0J1
R3	22K	± 2%	Resistor	R22K0J1
R4	22K	± 2%	Resistor	R22K0J1
R5	4.7K	± 10%	Resistor	R4K70J1
R6	330K	± 2%	Resistor	R330KJ1
R7	3K3	± 10%	Resistor	R3K30J1
R8	3K3	± 10%	Resistor	R3K30J1
R9	220	± 5%	Resistor	R220RJ1
R10	1K8	± 10%	Resistor	R1K80J1
R11	1K8	± 10%	Resistor	R1K80J1
R12	3K3	± 10%	Resistor	R3K30J1
R13	22K	± 2%	Resistor	R22K0J1
R14	560	± 10%	Resistor	R560RJ1
R15	100	± 10%	Resistor	R100RJ1
R16	180	± 2%	Resistor	R180RJ1
R17	3K3	± 10%	Resistor	R3K30J1
R18	3K3	± 10%	Resistor	R3K30J1
R19				
R20	1K	± 2%	Resistor	R1K00J1
R21	1K	± 2%	Resistor	R1K00J1
R22	270	± 10%	Resistor	R270RJ1
R23	1K2	± 10%	Resistor 1.6W	R1K20JR
R24	22	± 10%	Resistor	R22R0J1
R25	22	± 10%	Resistor	R22R0J1
R26	75	± 5%	Resistor	R75R0J1

No.	Value	Tol	Reference	Stock No.
R27	15K	± 5%	Resistor	R15K0J1
R28	75	± 5%	Resistor	R75R0J1
R29	15K	± 5%	Resistor	R15K0J1
R30	560	± 10%	Resistor 2.5W	R560RJS
R31	560	± 10%	Resistor 2.5W	R560RJS
R33	22	± 10%	Resistor	R22R0J1
R35	0.091		Resistor	RR091JY
R36	0.091		Resistor	RR091JY
R37	22	± 10%	Resistor	R22R0J1
R38	47	± 5%	Resistor	R47R0J1
R39	10	± 10%	Resistor	R10R0J1
R40	2K7		Resistor 1.6W	R2K70JR
R41	22	± 10%	Resistor	R22R0J1
R42	15K	± 10%	Resistor	R15K0J1
R43	22	± 10%	Resistor	R22R0J1
R44	22	± 10%	Resistor	R22R0J1
C1	0.68µ		Capacitor 100V	C880NKS
C2	100µ	± 10%	Capacitor 3V	C100UME
C3	3.3P	± 20%	Capacitor	C3P30KJ
C4	0.047µ		Capacitor 250V	C47N0JS
C5	100µ		Capacitor 6V	C100U2B
C6	1000P		Capacitor 400V	C1N00KK
C7	330P	± 20%	Capacitor	C330PKJ
C8	120P	± 5%	Capacitor	C120PJ1

No.	Value	Tol	Reference	Stock No.
C9				
C10	47µ		Capacitor 40V	C47L0ZB
C11	330P		Capacitor	C330PKJ
C12	0.1µ		Capacitor 250V	C100NKC
C13	10,000µ		Capacitor 63V	C10KUTA
C14	10,000µ		Capacitor 63V	C10KUTA
C15	0.1µ		Capacitor 100V	C100NKS
C16	0.1µ		Capacitor 100V	C100NKS
C17	10µ		Capacitor 40V	C10U0ZR
C19	1000P		Capacitor	C1N00SA
L1	6.9µH	± 20%	Inductor ANCO TC1/65	L12405A
L2	3µH	± 5%	Inductor ANCO 440/D	L12405A
L3	6.9µH	± 20%	Inductor ANCO TC1/65	L12405A
TR1			Transistor BC214C	D8C214C
TR2			Transistor BC682 or ZTX304 or BCX32	DZTX304
TR3			Transistor E5458 or ZTX504	DZTX504
TR4			Transistor E5458 or ZTX504	DZTX504
TR5			Transistor BC214C	D8C214C
TR6			Transistor BC214C	D8C214C
TR7			Transistor 40872 or 2SA740	D40872X
TR8			Transistor 40872 or 2SA740	D40872X
TR9			Transistor 2SD424 or 2SD076 or 17556	D17556X
TR10			Transistor 2SD424 or 2SD076 or 17556	D17556X
T1			DIAC 2N4992 or 8S08A-03	D8S08AA
T2			TRIAC SC1418 or T1C2268 or T2800	DT2800B

No.	Value	Tol	Reference	Stock No.
D1			Zener Diode LR150C	DZ15VAA
D2			Zener Diode LR150C	DZ15VAA
D3			Diode IS920	DIS920B
D4			Diode IS920	DIS920B
D5			Diode IS920	DIS920B
D6			Diode IS920	DIS920B
D7			Bridge Rectifier	DDPM7A2Q
IC1			LM301A	DML301A
L1	6.9µH	± 20%	Inductor ANCO TC1/65	L12405A
L2	3µH	± 5%	Inductor ANCO 440/D	L12405A
L3	6.9µH	± 20%	Inductor ANCO TC1/65	L12405A
FS1	4A			UM04AQA
FS2	4A			UM04AQA
FS3	T2.5A		220-240V	UM2A5DA
	T8A		110-130V	UM05ADA
LP1			Hewlett Packard 5082-4850 Red	BL5053R
TF1			Acoustical DRG A3/1236Z	L12362A

BOARD NUMBER M12368 ISS 9 AND 10

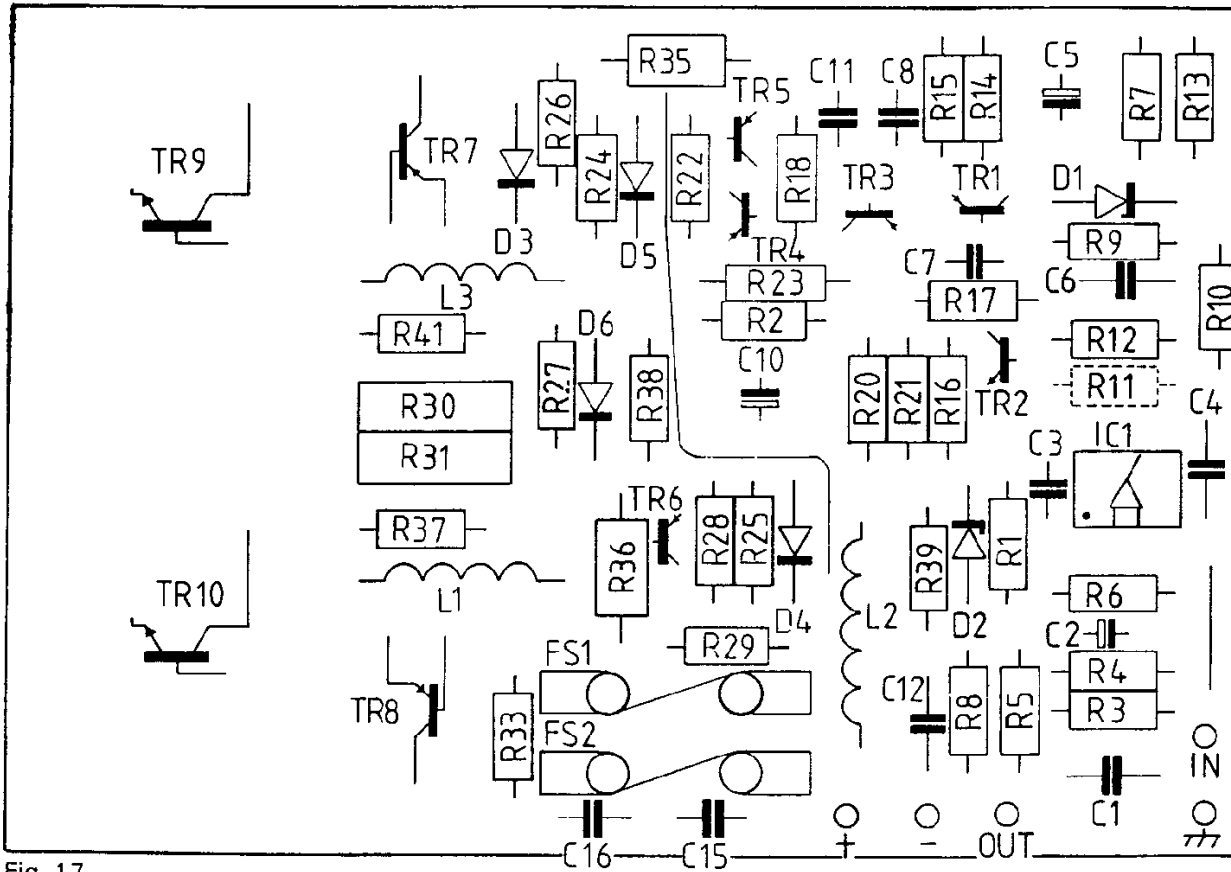


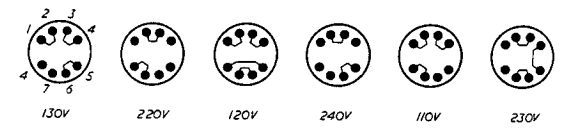
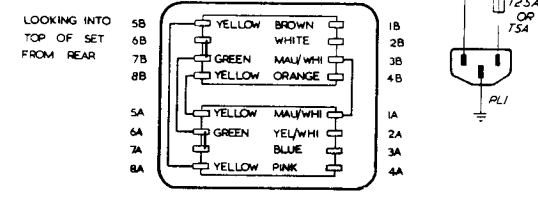
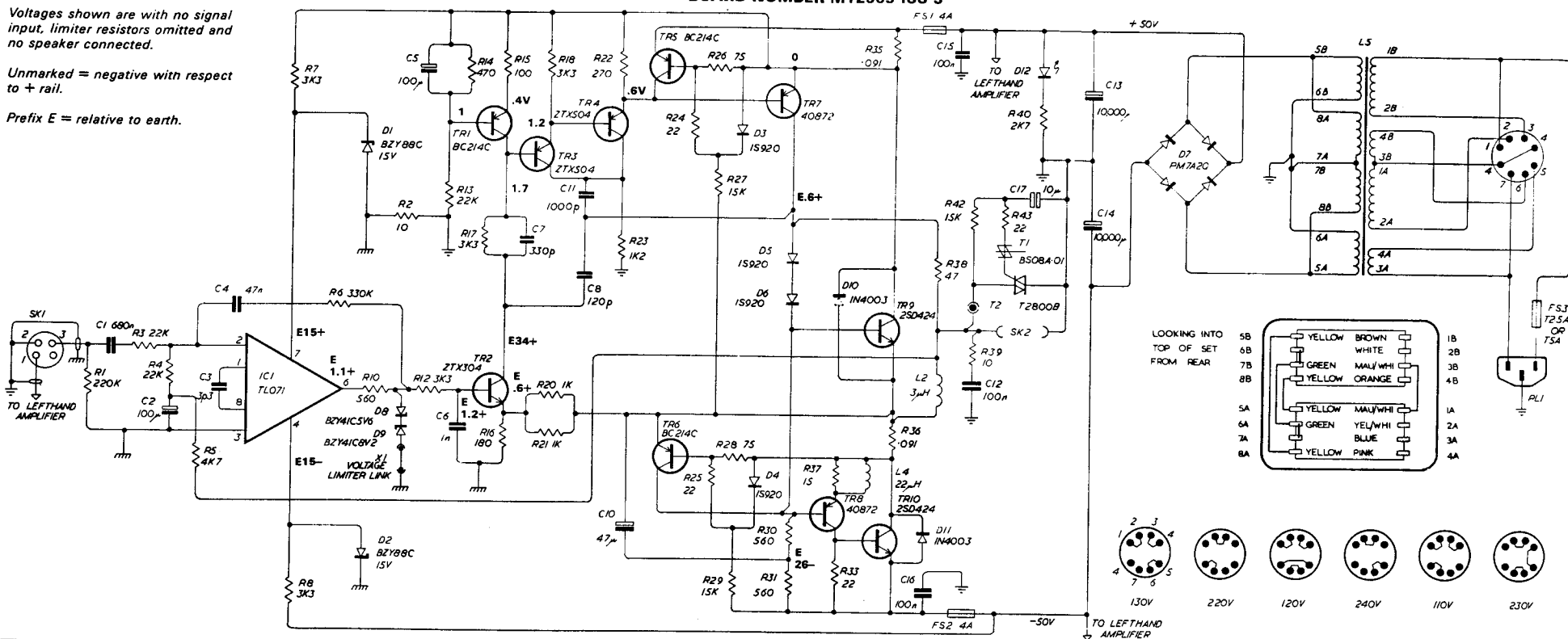
Fig. 17

BOARD NUMBER M12565 ISS 3

Voltages shown are with no signal input, limiter resistors omitted and no speaker connected.

Unmarked = negative with respect to + rail.

Prefix E = relative to earth.



No.	Value	Tol	Reference	Stock No.
R1	220K		Resistor	R220KJ1
R2	10		Resistor	R10RQJ1
R3	22K	± 2%	Resistor	R22KOG1
R4	22K	± 2%	Resistor	R22KOG1
R5	4K7		Resistor	R4K7QJ1
R6	330K	± 2%	Resistor	R330KG1
R7	3K3		Resistor	R3K3QJ1
R8	3K3		Resistor	R3K3QJ1
R10	560		Resistor	R560RJ1
R12	3K3		Resistor	R3K3QJ1
R13	22K	± 2%	Resistor	R22KOG1
R14	470		Resistor	R470RJ1
R15	100		Resistor	R100RJ1
R16	180	± 2%	Resistor	R180RG1
R17	3K3		Resistor	R3K3QJ1
R18	3K3		Resistor	R3K3QJ1
R20	1K	± 2%	Resistor	R1K00G1
R21	1K	± 2%	Resistor	R1K00G1
R22	270		Resistor	R270RJ1
R23	1K2		Resistor	R1K20JR
R24	22		Resistor	R22RQJ1
R26	22		Resistor	R22RQJ1
R28	75		Resistor	R75RQJ1
R29	15K		Resistor	R15KQJ1
R30	560		Resistor	R560RJS
R31	560		Resistor	R560RJS
R33	22		Resistor	R22RQJ1
R35	.091		Resistor	RR091JY
R36	.091		Resistor	RR091JY
R37	15		Resistor	R15RQJ1
R38	47		Resistor	R47RQJ1
R39	10		Resistor	R10RQJ1
R40	2K7		Resistor	R2K70JR
R42	15K		Resistor	R15KQJ1
R43	22		Resistor	R22RQJ1
All Resistors ± 5% except where shown				
C1	880n		Capacitor	C880NKS
C2	100µ		Capacitor	C100UKT
C3	3p3		Capacitor	C3P30C1
C4	47n		Capacitor	C47NQS
C5	100µ		Capacitor	C100U2B
C6	1n		Capacitor	C1N00KK
C7	330p		Capacitor	C330PKJ
C8	120p		Capacitor	C120PJ1
C10	47µ		Capacitor	C47U02B
C11	1000p		Capacitor	C1K0PKJ
C12	100N		Capacitor	C100NJS
C13	10.000µ		Capacitor	C10KUTA
C14	10.000µ		Capacitor	C10KUTA
C15	100N		Capacitor	C100NKS
C16	100N		Capacitor	C100NKS
C17	10µ		Capacitor	C10U02R
TR1			Transistor BC 214C	DBC214C
TR2			Transistor 2TX304	DZTX304
TR3			Transistor 2TX504	DZTX504
TR4			Transistor 2TX504	DZTX504
TR5			Transistor BC214C	DBC214C
TR6			Transistor BC214C	DBC214C
TR7			Transistor 40872	D40872X
TR8			Transistor 40872	D40872X
TR9			Transistor 17556 or 2SD424	D17556X
TR10			Transistor 17556 or 2SD424	D17556X
T1			DIAC B508A-01 or 2N4992	DBS08AA
T2			TRIAC T2800B	DT2800B
D1			Zener Diode BZY88C 15V	DZ15VAA

No.	Value	Tol	Reference	Stock No.
D2			Zener Diode BZY88C 15V	DZ15VAA
D3			Diode 1S920TB	D1S920B
D4			Diode 1S920TB	D1S920B
D5			Diode 1S920TB	D1S920B
D6			Diode 1S920TB	D1S920B
D7			Bridge Rectifier PM7A2Q	DDPM7A2Q
D8			Zener Diode BZV41C8V2	DZ8V2AA
D9			Zener Diode BZV41C5V6	DZ5V6AA
D10			Diode 1N4003	D1N4003
D11			Diode 1N4003	D1N4003
D12			LED XC5053R	BL5053R
IC1			Int. Circuit TL071, ME5534, LM351, LM301	DD071CPX
L2	3µH	± 5%	Choke	L12405A
LA	22µH		Choke	LSC1022
L5			Transformer	L12362A
FS1	4A		Fuse	UM04AQJ
FS2	4A		Fuse	UM04AQJ
FS3	T2A5		Fuse 220-240V	UM2A5DA
	T5A		Fuse 110-130V	UM05ADA
X1			Link	PP37712

No.	Value	Tol	Reference	Stock No.
C8	120p		Capacitor	C120PJ1
C10	47µ		Capacitor	C47U02B
C11	1000p		Capacitor	C1K0PKJ
C12	100N		Capacitor	C100NJS
C13	10.000µ		Capacitor	C10KUTA
C14	10.000µ		Capacitor	C10KUTA
C15	100N		Capacitor	C100NKS
C16	100N		Capacitor	C100NKS
C17	10µ		Capacitor	C10U02R
TR1			Transistor BC 214C	DBC214C
TR2			Transistor 2TX304	DZTX304
TR3			Transistor 2TX504	DZTX504
TR4			Transistor 2TX504	DZTX504
TR5			Transistor BC214C	DBC214C
TR6			Transistor BC214C	DBC214C
TR7			Transistor 40872	D40872X
TR8			Transistor 40872	D40872X
TR9			Transistor 17556 or 2SD424	D17556X
TR10			Transistor 17556 or 2SD424	D17556X
T1			DIAC B508A-01 or 2N4992	DBS08AA
T2			TRIAC T2800B	DT2800B
D1			Zener Diode BZY88C 15V	DZ15VAA

No.	Value	Tol	Reference	Stock No.
D2			Zener Diode BZY88C 15V	DZ15VAA
D3			Diode 1S920TB	D1S920B
D4			Diode 1S920TB	D1S920B
D5			Diode 1S920TB	D1S920B
D6			Diode 1S920TB	D1S920B
D7			Bridge Rectifier PM7A2Q	DDPM7A2Q
D8			Zener Diode BZV41C8V2	DZ8V2AA
D9			Zener Diode BZV41C5V6	DZ5V6AA
D10			Diode 1N4003	D1N4003
D11			Diode 1N4003	D1N4003
D12			LED XC5053R	BL5053R
IC1			Int. Circuit TL071, ME5534, LM351, LM301	DD071CPX
L2	3µH	± 5%	Choke	L12405A
LA	22µH		Choke	LSC1022
L5			Transformer	L12362A
FS1	4A		Fuse	UM04AQJ
FS2	4A		Fuse	UM04AQJ
FS3	T2A5		Fuse 220-240V	UM2A5DA
	T5A		Fuse 110-130V	UM05ADA
X1			Link	PP37712

BOARD NUMBER M12565 ISS 3

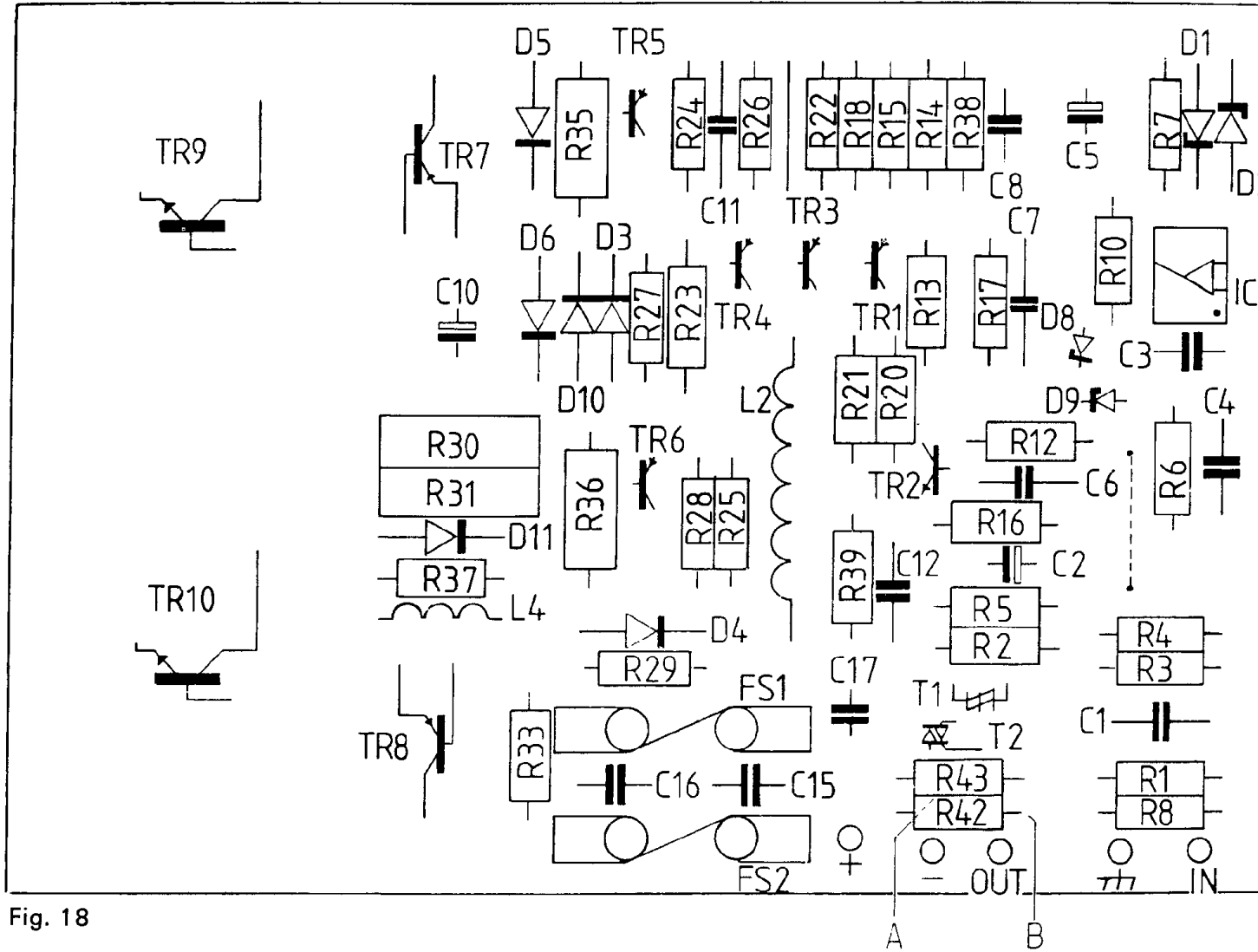
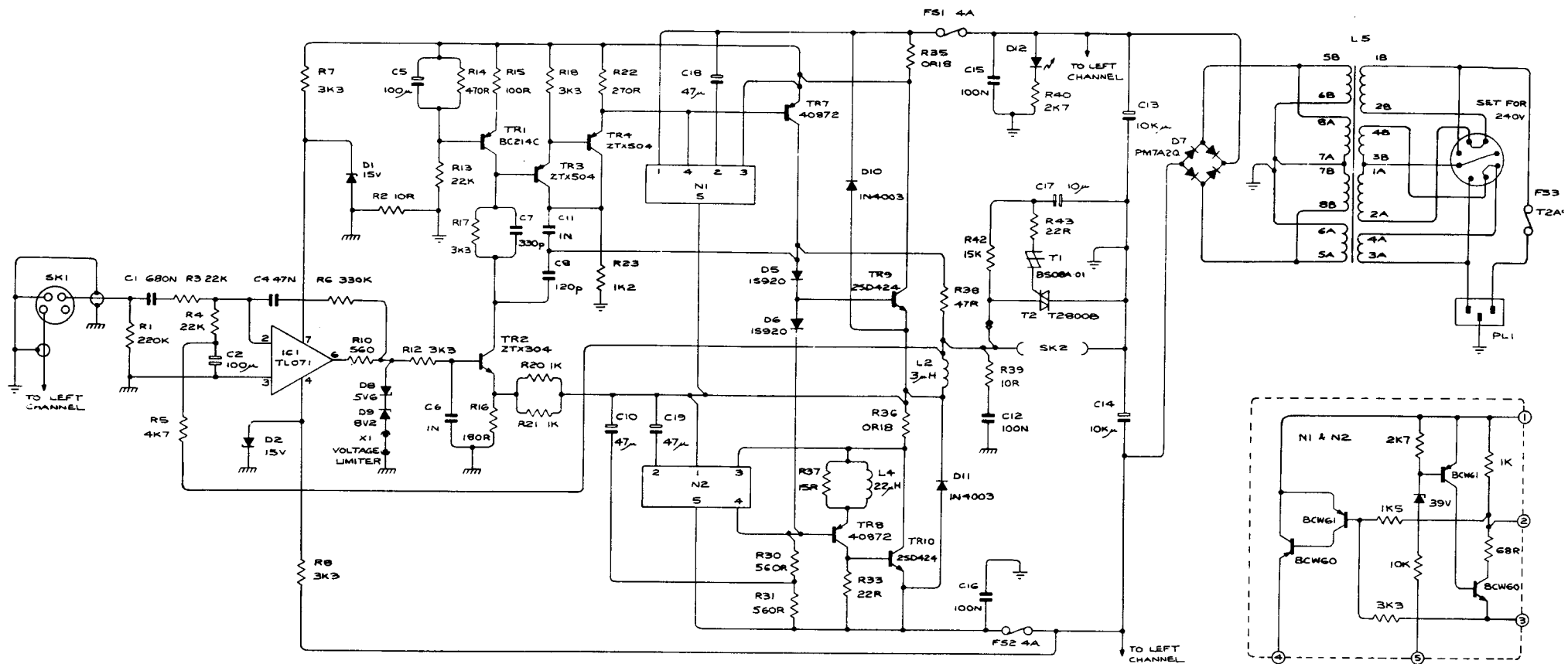


Fig. 18

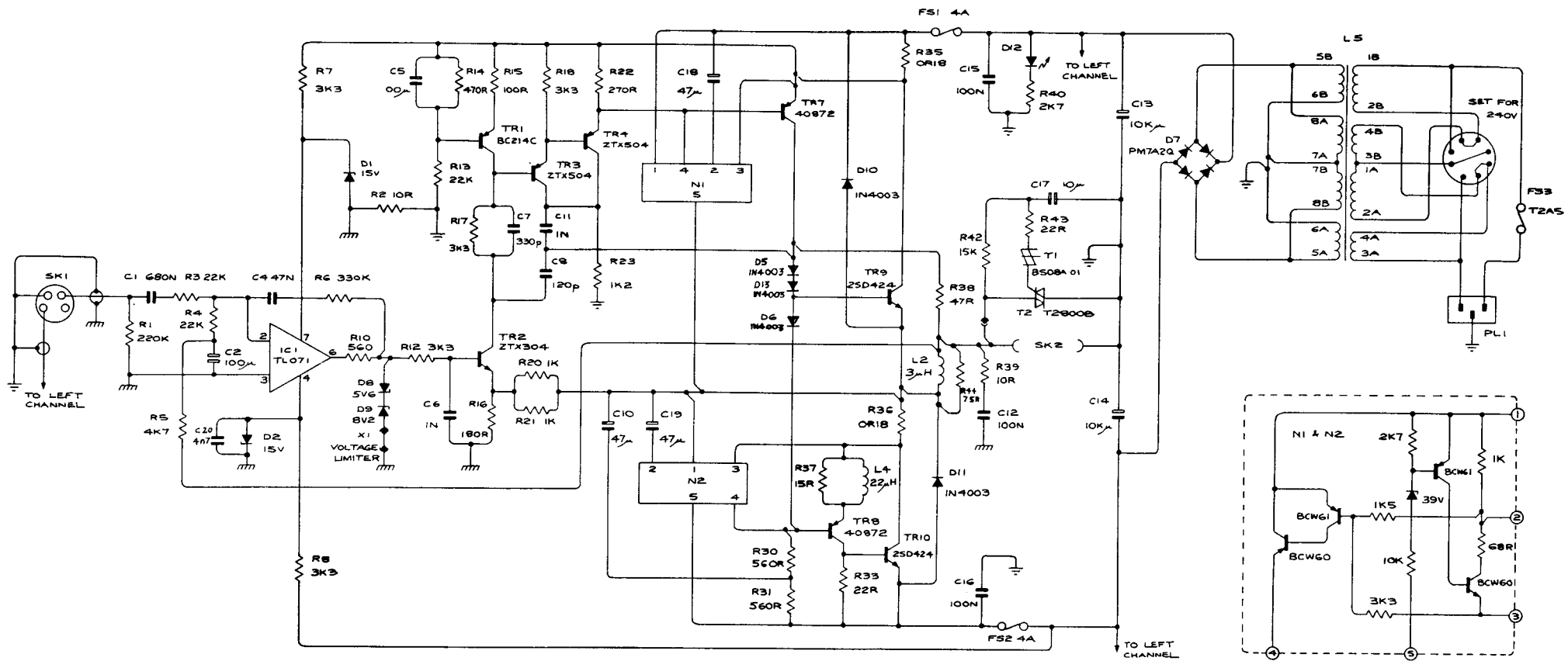


R1	RESISTOR	220K	± 5%
R2	RESISTOR	10R	± 5%
R3	RESISTOR	22K	± 2%
R4	RESISTOR	22K	± 2%
R5	RESISTOR	4K7	± 5%
R6	RESISTOR	330K	± 2%
R7	RESISTOR	3K3	± 5%
R8	RESISTOR	3K3	± 5%
R10	RESISTOR	560R	± 5%
R12	RESISTOR	3K3	± 5%
R13	RESISTOR	22K	± 2%
R14	RESISTOR	470R	± 5%
R15	RESISTOR	100R	± 5%
R16	RESISTOR	180R	± 2%
R17	RESISTOR	3K3	± 5%
R18	RESISTOR	3K3	± 5%
R20	RESISTOR	1K	± 2%
R21	RESISTOR	1K	± 2%
R22	RESISTOR	270R	± 5%
R23	RESISTOR	1K2	± 5%
R30	RESISTOR	560R	± 5%
R31	RESISTOR	560R	± 5%
R33	RESISTOR	22R	± 5%
R35	RESISTOR	0R18	± 5%
R36	RESISTOR	0R18	± 5%
R37	RESISTOR	15R	± 5%
R220KJ1			
R10R0J1			
R22K0G1			
R4K70J1			
R330K0G1			
R3K30J1			
R3K30J1			
R560RJ1			
R3K30J1			
R22K0G1			
R470RJ1			
R100RJ1			
R180R0G1			
R3K30J1			
R3K30J1			
R1K00G1			
R1K00G1			
R270RJ1			
R1K20JR			
R560RJC			
R560RJC			
R22R0J1			
R0R18JC			
R0R18JC			
R18R0J1			

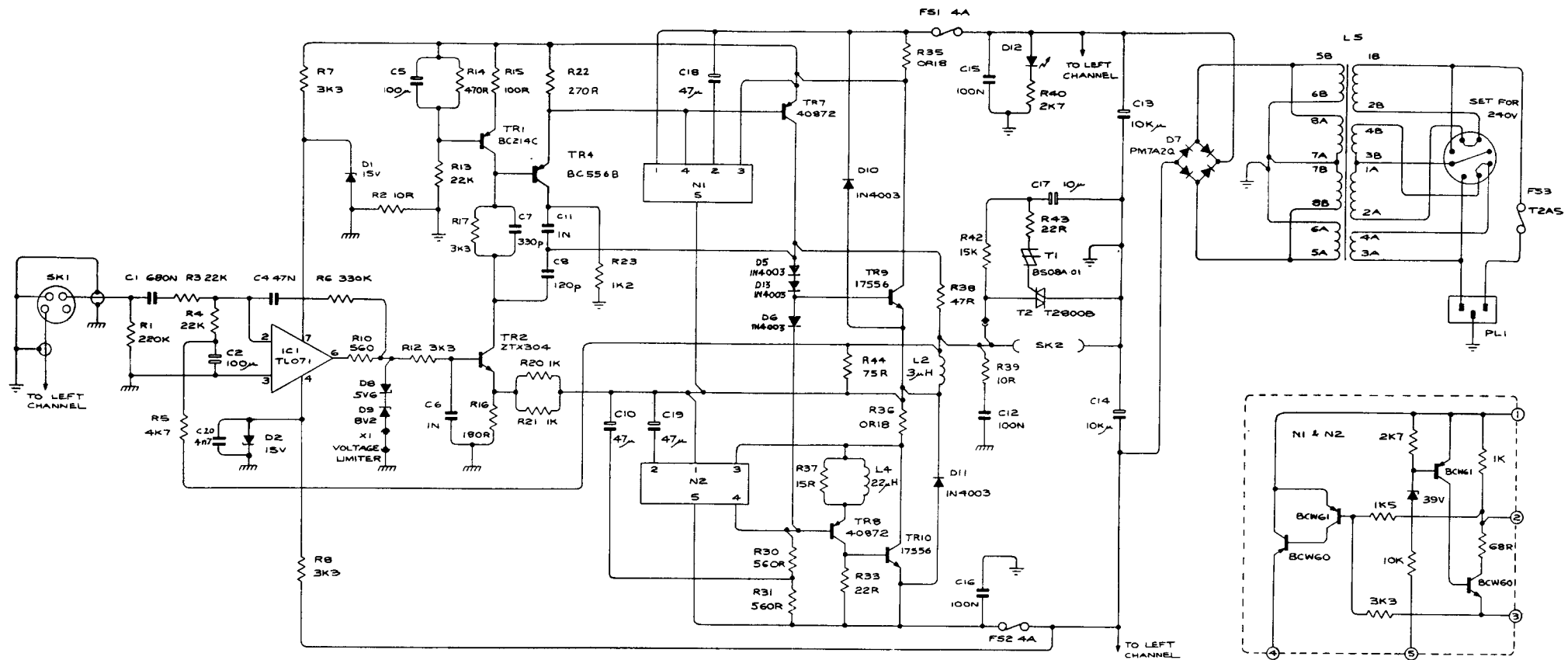
R38	RESISTOR	47R	± 5%
R39	RESISTOR	10R	± 5%
R40	RESISTOR	2K7	± 5%
R42	RESISTOR	15K	± 5%
R43	RESISTOR	22R	± 5%
R47R0J1			
R10R0J1			
R2K70R			
R15K0J1			
R22R0J1			
C1	CAPACITOR	680N	
C2	CAPACITOR	100µ	
C4	CAPACITOR	47N	
C5	CAPACITOR	100µ	
C6	CAPACITOR	1N	
C7	CAPACITOR	330P	
C8	CAPACITOR	120P	
C10	CAPACITOR	47µ	
C11	CAPACITOR	1N	
C12	CAPACITOR	100N	
C14	CAPACITOR	10Kµ	
C15	CAPACITOR	100N	
C16	CAPACITOR	100N	
C17	CAPACITOR	10µ	
C18	CAPACITOR	47µ	
C19	CAPACITOR	47µ	
C680NKS			
C100µJ			
C47N0J5			
C100µZB			
C1N00JP			
C330PFJ			
C120PJ1			
C47µ0ZB			
C1N00SA			
C100NJS			
C10KUTA			
C10KUTA			
C100NKS			
C100NKS			
C100µZR			
C47µ0ZE			
C47µ0ZE			

TR1	TRANSISTOR	BC214C	
TR2	TRANSISTOR	ZTX304	
TR3	TRANSISTOR	ZTX504	
TR4	TRANSISTOR	ZTX504	
TR7	TRANSISTOR	40872	
TR8	TRANSISTOR	40872	
TR9	TRANSISTOR	2SD424	
TR10	TRANSISTOR	2SD424	
D1	ZENER DIODE	BZY88C 15V	
D2	ZENER DIODE	BZY88C 15V	
D5	DIODE	1S920	
D6	DIODE	1S920	
D7	BRIDGE RECTIFIER	PM7A2Q	
D8	ZENER DIODE	BZY41C 5V6	
D9	ZENER DIODE	BZY41C 8V2	
D10	DIODE	1N4003	
D11	DIODE	1N4003	
D12	LED	XC5053R	
X1	SHORTING LINK		
IC1	INT CIRCUIT	TL071	
DBC214C			
DZTX304			
DZTX504			
DZTX504			
D40872X			
D40872X			
D2SD424			
D2SD424			
DB508AA			
DT2800B			
DB508AA			
DB508AA			
D1S920B			
D1S920B			
DZPM7A2Q			
DZ5V6AA			
DZ8V2AA			
D1N4003			
D1N4003			
BL5053R			
PP37712			
DO71CPX			

FS1	FUSE	4A	UM04AQU
FS2	FUSE	4A	UM04AQU
FS3	FUSE	T2A5 220-240V 15A 110-130V	UM2A5DA UM05ADA
L5	MAINS TRANSFORMER		L12362A
L2	CHOKE	3µH	L12405A
L4	CHOKE	22µH	L4T220K
N1	NETWORK		Q05N1AW
N2	NETWORK		Q05N1AW



R1 RESISTOR 220K ± 5%	R220KJ1	R38 RESISTOR 47R ± 5%	R47R0J1	TR1 TRANSISTOR BC214C	DBC214C	FS1 FUSE 4A	UM04AGU
R2 RESISTOR 10R ± 5%	R10R0J1	R39 RESISTOR 10R ± 5%	R10R0J1	TR2 TRANSISTOR ZTX304	DZTX304	FS2 FUSE 4A	UM04AGU
R3 RESISTOR 22K ± 2%	R22K0G1	R40 RESISTOR 2K7 ± 5%	R2K70J1	TR3 TRANSISTOR ZTX504	DZTX504	FS3 FUSE T2A5 220-240V	UM2A5DA
R4 RESISTOR 22K ± 2%	R22K0G1	R42 RESISTOR 15K ± 5%	R15K0J1	TR4 TRANSISTOR ZTX504	DZTX504	T5A 110-130V	UM05ADA
R5 RESISTOR 4K7 ± 5%	R4K70J1	R43 RESISTOR 22R ± 5%	R22R0J1	TR7 TRANSISTOR 40872	D40872X		
R6 RESISTOR 330K ± 2%	R330K0G1	R44 RESISTOR 75R ± 5%	R75R0J1	TR8 TRANSISTOR 40872	D40872X	L5 MAINS TRANSFORMER	L12362A
R7 RESISTOR 3K3 ± 5%	R3K30J1			TR9 TRANSISTOR 2SD424	D2SD424X	CHOKE 3μH	L12405A
R8 RESISTOR 3K3 ± 5%	R3K30J1			TR10 TRANSISTOR 2SD424	D2SD424X	CHOKE 22μH	L4T220K
R10 RESISTOR 560R ± 5%	R560R0J1						
R12 RESISTOR 3K3 ± 5%	R3K30J1	C1 CAPACITOR 680N	C680NKS	T1 DIAC B508A-01	DB508AA		
R13 RESISTOR 22K ± 2%	R22K0G1	C2 CAPACITOR 100μ	C100UWJ	T2 TRIAC T2800B	DT2800B		
R14 RESISTOR 470R ± 5%	R470R0J1	C4 CAPACITOR 47N	C47N0JS				
R15 RESISTOR 100R ± 5%	R100R0J1	C5 CAPACITOR 470μ	C100U2B	D1 ZENER DIODE BZY88C 15V	DB8815VA		
R16 RESISTOR 180R ± 2%	R180R0G1	C6 CAPACITOR 1N	C1N00JF	D2 ZENER DIODE BZY88C 15V	DB8815VA		
R17 RESISTOR 3K3 ± 5%	R3K30J1	C7 CAPACITOR 330P	C330PJF	D5 DIODE IN4003	DIN4003		
R18 RESISTOR 3K3 ± 5%	R3K30J1	C8 CAPACITOR 120P	C120PJ1	D6 DIODE IN4003	DIN4003		
R20 RESISTOR 1K ± 2%	R1K00G1	C10 CAPACITOR 47μ	C47U02B	D7 BRIDGE RECTIFIER PM7A2Q	DPM7A2Q		
R21 RESISTOR 1K ± 2%	R1K00G1	C11 CAPACITOR 1N	C1N00SA	D8 ZENER DIODE BZY41C 5V6	DZ5V6AA		
R22 RESISTOR 270R ± 5%	R270R0J1	C12 CAPACITOR 100N	C100NJS	D9 ZENER DIODE BZY41C 8V2	DZ8V2AA		
R23 RESISTOR 1K2 ± 5%	R1K20J1	C13 CAPACITOR 10Kμ	C10KUTA	D10 DIODE IN4003	DIN4003		
R30 RESISTOR 560R ± 5%	R560R0J1	C14 CAPACITOR 10Kμ	C10KUTA	D11 DIODE IN4003	DIN4003		
R31 RESISTOR 560R ± 5%	R560R0J1	C15 CAPACITOR 100N	C100NKS	D12 LED XC5053R	BL5053R		
R33 RESISTOR 22R ± 5%	R22R0J1	C16 CAPACITOR 100N	C100NKS	D13 DIODE IN4003	DIN4003		
R35 RESISTOR 0R18 ± 5%	R0R18J1	C17 CAPACITOR 10μ	C10U02R	X1 SHORTING LINK	PP37712		
R36 RESISTOR 0R18 ± 5%	R0R18J1	C18 CAPACITOR 47μ	C47U02E	IC1 INT. CIRCUIT TL071	DO71CPX		
R37 RESISTOR 15R ± 5%	R15R0J1	C19 CAPACITOR 47μ	C47U02E				
		C20 CAPACITOR 4N7	C4N7167				



R1	RESISTOR	220K	± 5%	R220KJ4
R2	RESISTOR	10R	± 5%	R10R0J1
R3	RESISTOR	22K	± 2%	R22K0G1
R4	RESISTOR	22K	± 2%	R22K0G1
R5	RESISTOR	4K7	± 5%	R4K70J4
R6	RESISTOR	330K	± 2%	R330K01
R7	RESISTOR	3K3	± 5%	R3K30J1
R8	RESISTOR	3K3	± 5%	R3K30J1
R10	RESISTOR	560R	± 5%	R560RJ4
R12	RESISTOR	3K3	± 5%	R3K30J1
R13	RESISTOR	22K	± 2%	R22K0G1
R14	RESISTOR	470R	± 5%	R470RJ4
R15	RESISTOR	100R	± 5%	R100RJ4
R16	RESISTOR	180R	± 2%	R180RG1
R17	RESISTOR	3K3	± 5%	R3K30J1
R20	RESISTOR	1K	± 2%	RIK00G1
R21	RESISTOR	1K	± 2%	RIK00G1
R22	RESISTOR	270R	± 5%	R270RJ4
R23	RESISTOR	1K2	± 5%	RIK20JR
R30	RESISTOR	560R	± 5%	R560RTC
R31	RESISTOR	560R	± 5%	R560RTC
R33	RESISTOR	22R	± 5%	R22R0J4
R35	RESISTOR	OR18	± 5%	ROR1B7C
R36	RESISTOR	OR18	± 5%	ROR1B7C
R37	RESISTOR	15R	± 5%	R15R0J4

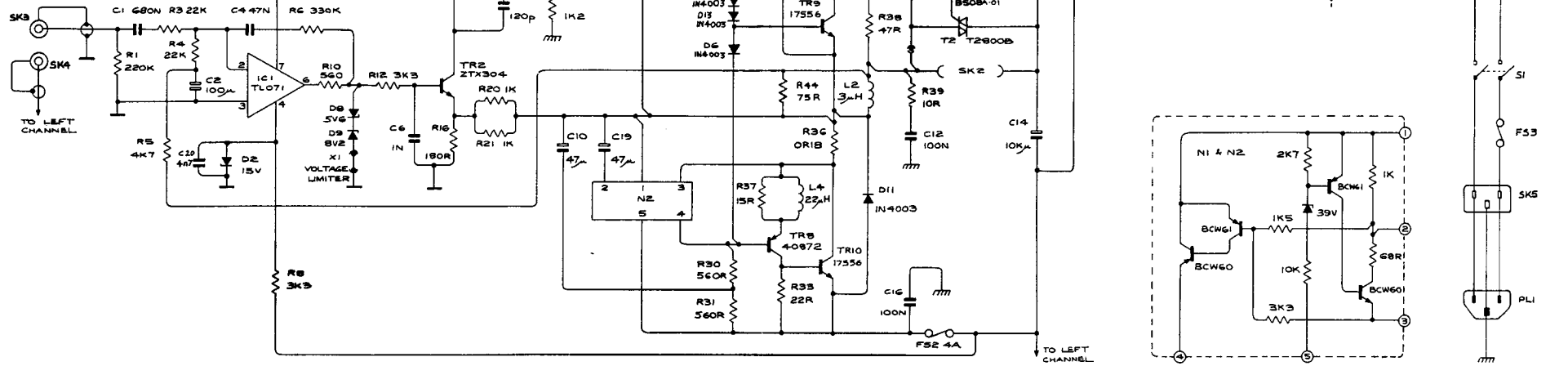
R38	RESISTOR	47R	± 5%	R47R0J4
R39	RESISTOR	10R	± 5%	R10R0J1
R40	RESISTOR	2K7	± 5%	R2K70JR
R42	RESISTOR	15K	± 5%	R15K0J4
R43	RESISTOR	22R	± 5%	R22R0J4
R44	RESISTOR	75R	± 5%	R75R0J4
C1	CAPACITOR	680N		C680NKA
C2	CAPACITOR	100µ		C100µJ
C4	CAPACITOR	47N		C47N0U5
C5	CAPACITOR	100µ		C100µME
C6	CAPACITOR	1N		C1N00µF
C7	CAPACITOR	330P		C330PKT
C8	CAPACITOR	120P		C120PJ1
C10	CAPACITOR	47µ		C47µO2B
C11	CAPACITOR	1N		C1N005A
C12	CAPACITOR	100N		C100NJ5
C13	CAPACITOR	10Kµ		C10KµT8
C14	CAPACITOR	10Kµ		C10KµT8
C15	CAPACITOR	100N		C100NK5
C16	CAPACITOR	100N		C100NK5
C17	CAPACITOR	10µ		C10µO2R
C18	CAPACITOR	47µ		C47µO2E
C19	CAPACITOR	47µ		C47µO2E
C20	CAPACITOR	47µ		C47µO2E

TR1	TRANSISTOR	BC214C	D8C214C
TR2	TRANSISTOR	ZTX304	DZTX304
TR4	TRANSISTOR	BC556B	D8C556B
TR7	TRANSISTOR	4087Z	D40872X
TR8	TRANSISTOR	4087Z	D40872X
TR9	TRANSISTOR	17556	D17556X
TR10	TRANSISTOR	17556	D17556X
T1	DIAC	B508A-01	D8508AA
T2	TRIAC	T2800B	DT2800B
D1	ZENER DIODE	BZY88C 15V	D8815VA
D2	ZENER DIODE	BZY88C 15V	D8815VA
D5	DIODE	1N4003	D1N4003
D6	DIODE	1N4003	D1N4003
D7	BRIDGE RECTIFIER	PM7A2Q	DPM7A2Q
D8	ZENER DIODE	BZY41C 5V6	DZ5V6AA
D9	ZENER DIODE	BZY41C 8V2	DZ8V2AA
D10	DIODE	1N4003	D1N4003
D11	DIODE	1N4003	D1N4003
D12	LED	XC5053R	BL5053R
D13	DIODE	1N4003	D1N4003
X1	SHORTING LINK		Q05LINK
IC1	INT. CIRCUIT	TL071	DO71CPX

FS1	FUSE	4A	UM04AQU
FS2	FUSE	4A	UM04AQU
FS3	FUSE	T2A5 220-240V T5A 110-130V	UM2A5DA UM05ADA
L5	MAINS TRANSFORMER		L12362A
L2	CHOKE	3µH	L12405A
L4	CHOKE	22µH	L4T220K
N1	NETWORK		Q05NIAT
N2	NETWORK		Q05NIAT



VOLTAGE SELECTION BY
PRIMARY LINKS (REAR VIEW)



R1	RESISTOR	220K	± 5%
R2	RESISTOR	10R	± 5%
R3	RESISTOR	22K	± 2%
R4	RESISTOR	22K	± 2%
R5	RESISTOR	4K7	± 5%
R6	RESISTOR	330K	± 2%
R7	RESISTOR	3K3	± 5%
R8	RESISTOR	3K3	± 5%
R9	RESISTOR	560R	± 5%
R10	RESISTOR	3K3	± 5%
R11	RESISTOR	22K	± 2%
R12	RESISTOR	470R	± 5%
R13	RESISTOR	100R	± 5%
R14	RESISTOR	100R	± 5%
R15	RESISTOR	100R	± 5%
R16	RESISTOR	180R	± 2%
R17	RESISTOR	3K3	± 5%
R18	RESISTOR	1K	± 2%
R19	RESISTOR	1K	± 2%
R20	RESISTOR	270R	± 5%
R21	RESISTOR	1K2	± 5%
R22	RESISTOR	270R	± 5%
R23	RESISTOR	1K2	± 5%
R24	RESISTOR	560R	± 5%
R25	RESISTOR	560R	± 5%
R26	RESISTOR	22R	± 5%
R27	RESISTOR	15R	± 5%

R220KJ4	R220KJ4	R36	RESISTOR	47R	± 5%
R10R0J1	R22K061	R39	RESISTOR	10R	± 5%
R22K061	R470RJ4	R40	RESISTOR	22K	± 5%
R470RJ4	R100RJ4	R42	RESISTOR	15K	± 5%
R100RJ4	R180R01	R43	RESISTOR	22R	± 5%
R180R01	R3K30J1	R44	RESISTOR	75R	± 5%
R3K30J1	R560RJ4	C1	CAPACITOR	680N	
R560RJ4	R3K30J1	C2	CAPACITOR	100µ	
R3K30J1	R22K061	C4	CAPACITOR	47N	
R22K061	R470RJ4	C5	CAPACITOR	100µ	
R470RJ4	R100RJ4	C6	CAPACITOR	1N	
R100RJ4	R180R01	C7	CAPACITOR	330P	
R180R01	R3K30J1	C8	CAPACITOR	120P	
R3K30J1	R1K00G1	C10	CAPACITOR	47µ	
R1K00G1	R1K00G1	C11	CAPACITOR	1N	
R1K00G1	R270RJ4	C12	CAPACITOR	100N	
R270RJ4	R1K00G1	C13	CAPACITOR	10K	
R1K00G1	R560RJ4	C14	CAPACITOR	10K	
R560RJ4	R22K061	C15	CAPACITOR	100N	
R22K061	R470RJ4	C16	CAPACITOR	100N	
R470RJ4	R180R01	C17	CAPACITOR	10µ	
R180R01	R270RJ4	C18	CAPACITOR	47µ	
R270RJ4	R180R01	C19	CAPACITOR	47µ	
R180R01	R180R01	C20	CAPACITOR	47N	

R470R0J4	TR1	TRANSISTOR	BC214C	DBC214C
R10R0J1	TR2	TRANSISTOR	2TX304	DZTX304
R2K70J4	TR3	TRANSISTOR	BC556B	DBC556B
R15K0J4	TR7	TRANSISTOR	40672	D40672X
R22R0J4	TR8	TRANSISTOR	40672	D40672X
R75R0J4	TR9	TRANSISTOR	17556	D17556X
C680NKA	T1	DIAC	BS08A-01	DBS08AA
C100µJ	T2	TRIAC	T2800B	DBT2800B
C47N0U5	D1	ZENER DIODE	BZY96C 15V	D6515VA
C100µME	D2	ZENER DIODE	BZY96C 15V	D6515VA
C100µPF	D5	DIODE	IN4003	DM4003
C890PKJ	D6	DIODE	IN4003	DM4003
C120PJ1	D7	BRIDGE RECTIFIER	PM7A20Q	DPM7A20Q
C47U0ZB	D8	ZENER DIODE	BZY41C 5V6	D25V6AA
C10006A	D9	ZENER DIODE	BZY41C 5V2	D25V2AA
C100NJS	D10	DIODE	IN4003	DM4003
C10KUTB	D11	DIODE	IN4003	DM4003
C100NK5	D12	LED	XC5053R	DL5053R
C100NK5	D13	DIODE	IN4003	DM4003
C100ZFR	X1	SHORTING LINK		Q05LINK
C47U0ZE	IC1	INT. CIRCUIT	TL071	DOT1CPX
C47U0ZE				
C47067				

FS1	FUSE	4A	UM04AGU
FS2	FUSE	4A	UM04AGU
FS3	FUSE	T2A5 220-240V T5A 110-130V	UM2A5DA UM05ADA
L5	MAINS TRANSFORMER		L12362A
L2	CHOKE	3µH	L12405A
L4	CHOKE	22µH	L4T220K
N1	NETWORK		Q05NIAT
N2	NETWORK		Q05NIAT
PL1	AC. POWER IN/FUSEHOLDER	PLUG	PPF12AA
S1	SWITCH		S4050FF
SK2	OUTPUT SOCKETS	RED BLACK	P5R514C P5B514C
SK3	INPUT RIGHT		P5PH0N2
SK4	INPUT LEFT		P5PH0N9
SK5	AC. POWER OUTLET SOCKET		P5P695S