

QUAD 405

POWER AMPLIFIER

Service Data

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| Keith Snook modifications | Click here |

CIRCUIT DESCRIPTION

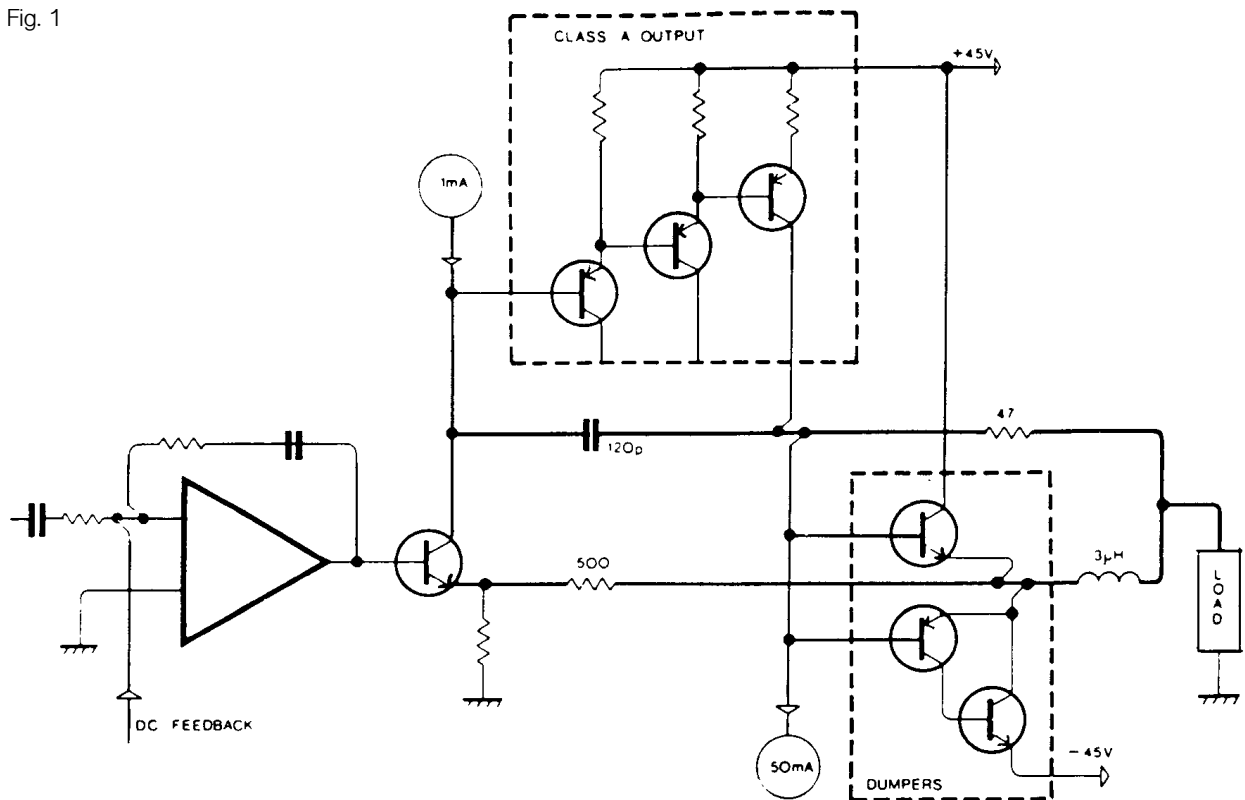
The QUAD 405 is a two channel power amplifier primarily intended for use in high quality sound reproducing systems. The amplifier is usually used with QUAD control units though other signal sources can readily be accommodated.

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 (ST 1700A)

Dual Beam Oscilloscope

4Ω and 8Ω load of 100W dissipation

1Ω load of 25W dissipation

2.5 kHz Square Wave Generator

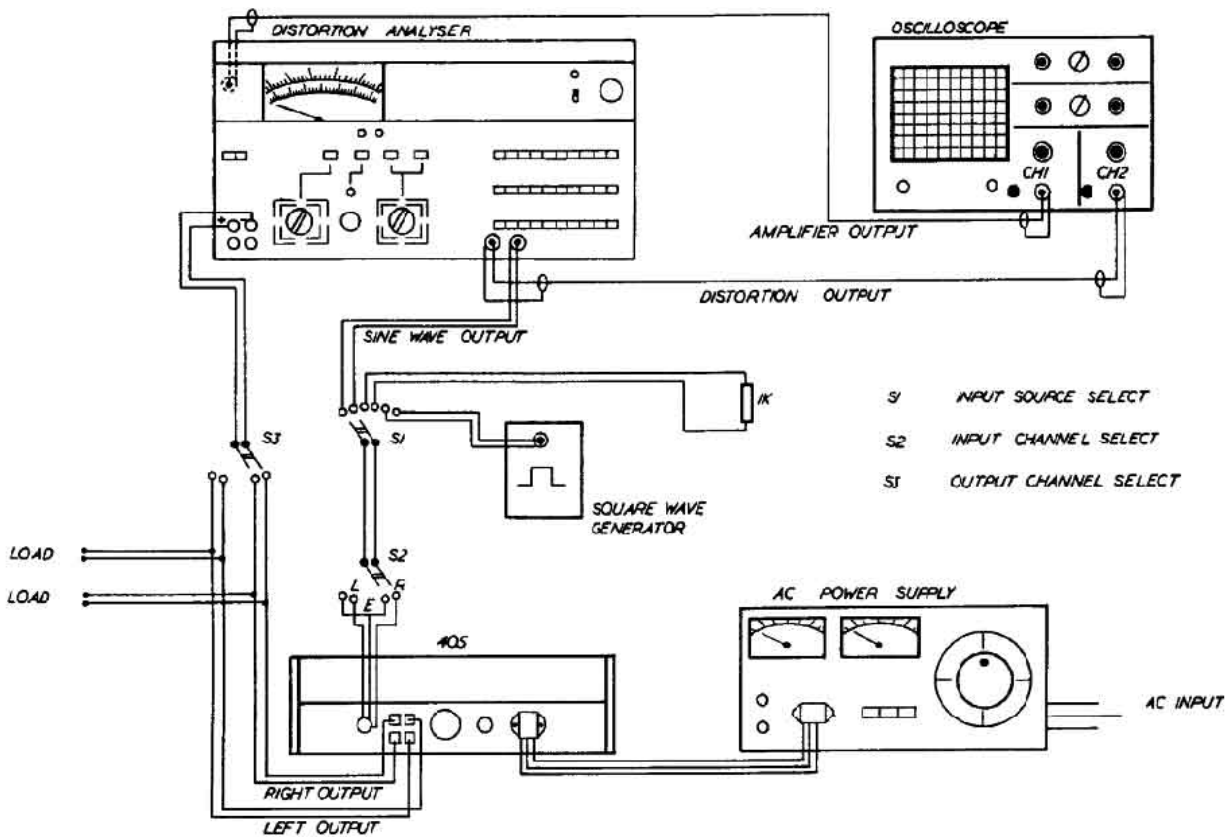
Input Sensitivity Indicator (0 to 1V RMS)

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 SI 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 50μs/cm. Select **distortion** which should again be less than 0.01%.
5. Select **volts/power**, increase **applied frequency** to 10kHz and adjust **timebase** to 20μs/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 10μs/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 ± 1.5 dB.
8. Increase **frequency** to 1kHz. For 405s with amplifier boards type M 12368 insert 1.8kΩ 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 ± 1 V. Remove voltage 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 8Ω load.
10. The following checks should be carried out with no input signal and the input to the amplifier board loaded by a 1kΩ 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 **1Ω load**. the output should clip equally on both halves of the waveform as shown in Fig. 11.
12. Select **4Ω 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 10Ω 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 |

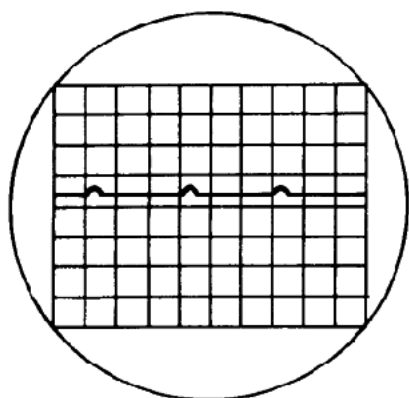


Fig. 3

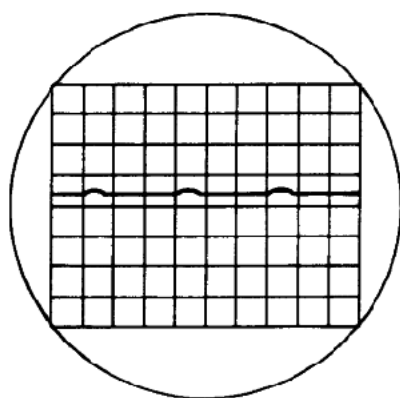


Fig. 4

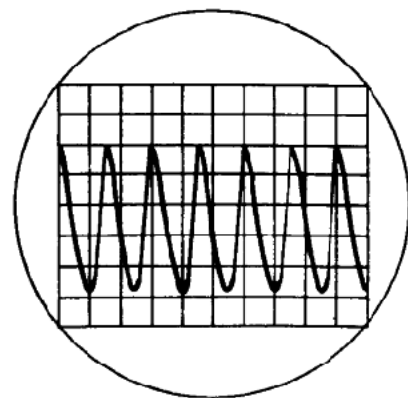


Fig. 5

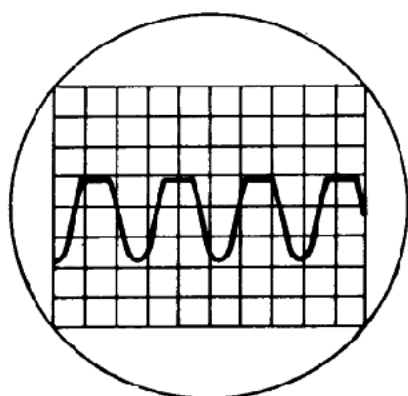


Fig. 6

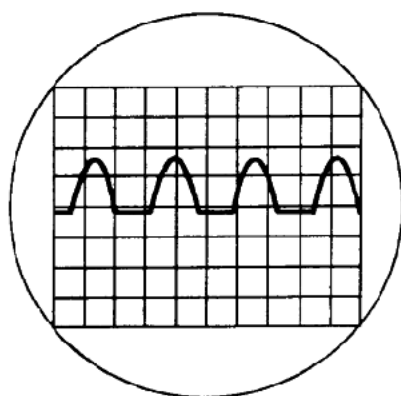


Fig. 7

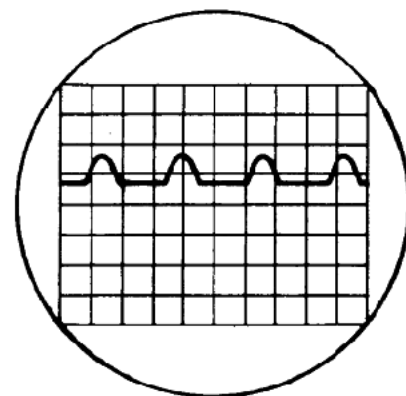


Fig. 8

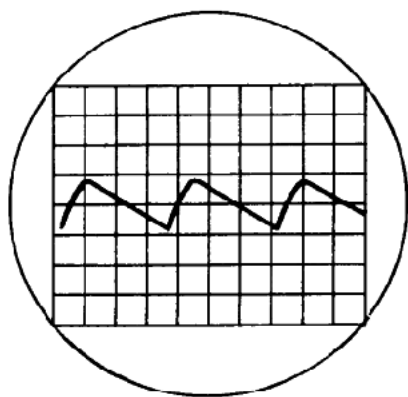


Fig. 9

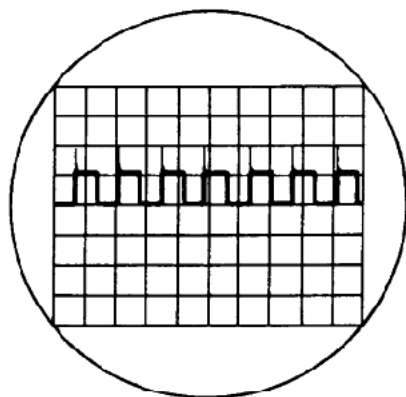


Fig. 10

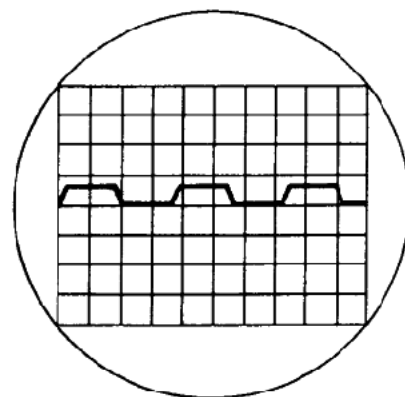


Fig. 11

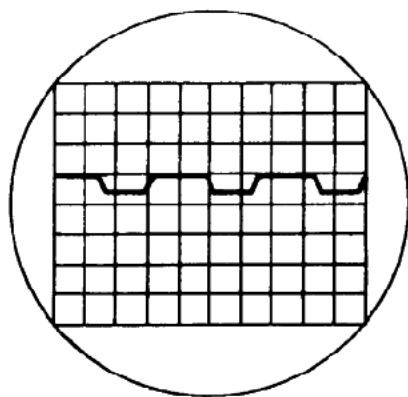


Fig. 12

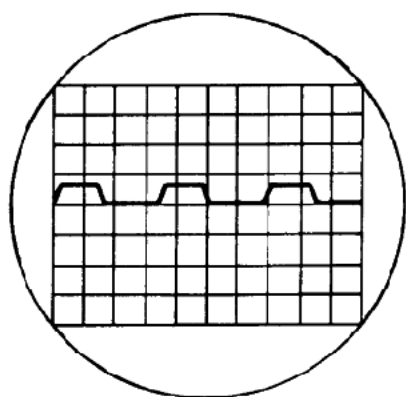


Fig. 13

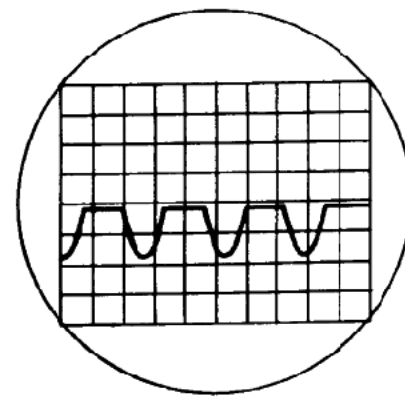


Fig. 14

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 M 12400, 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 M 12368 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 M 12368 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 M 12368 iss. 9 & 10 and M 12565 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 M 12368 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 M 12565 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:

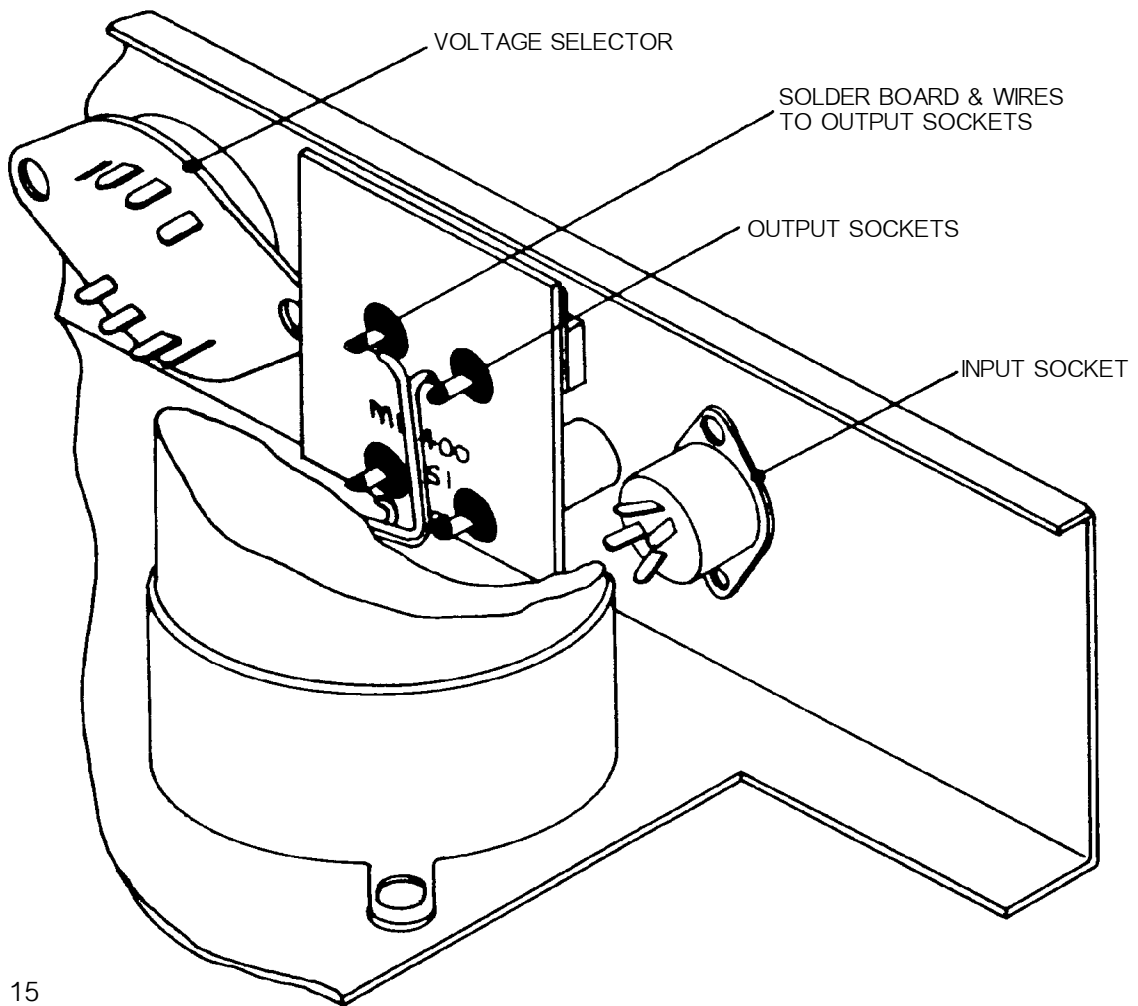


Fig. 15

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)

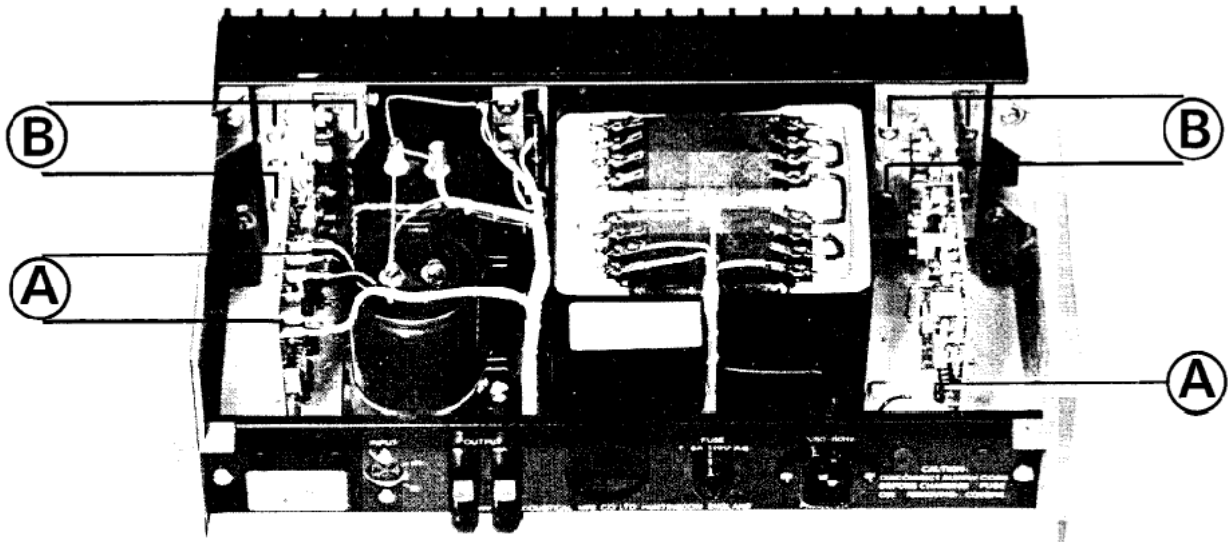


Fig. 16

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 R18 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 chasis by R2 to avoid hum loop when using mains earth. |

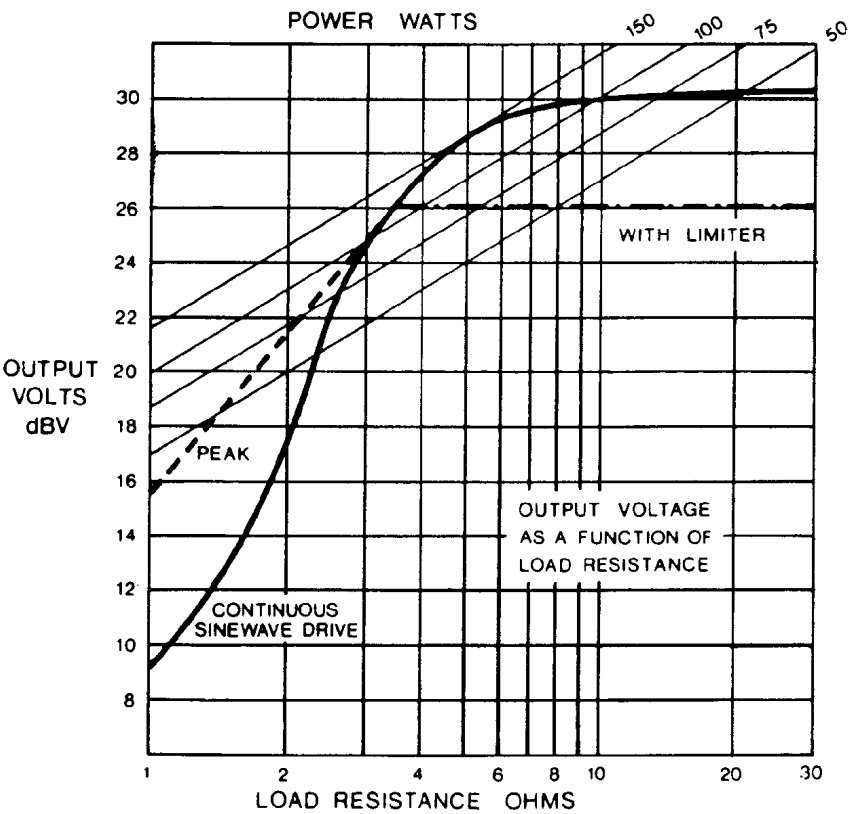


Fig. 17

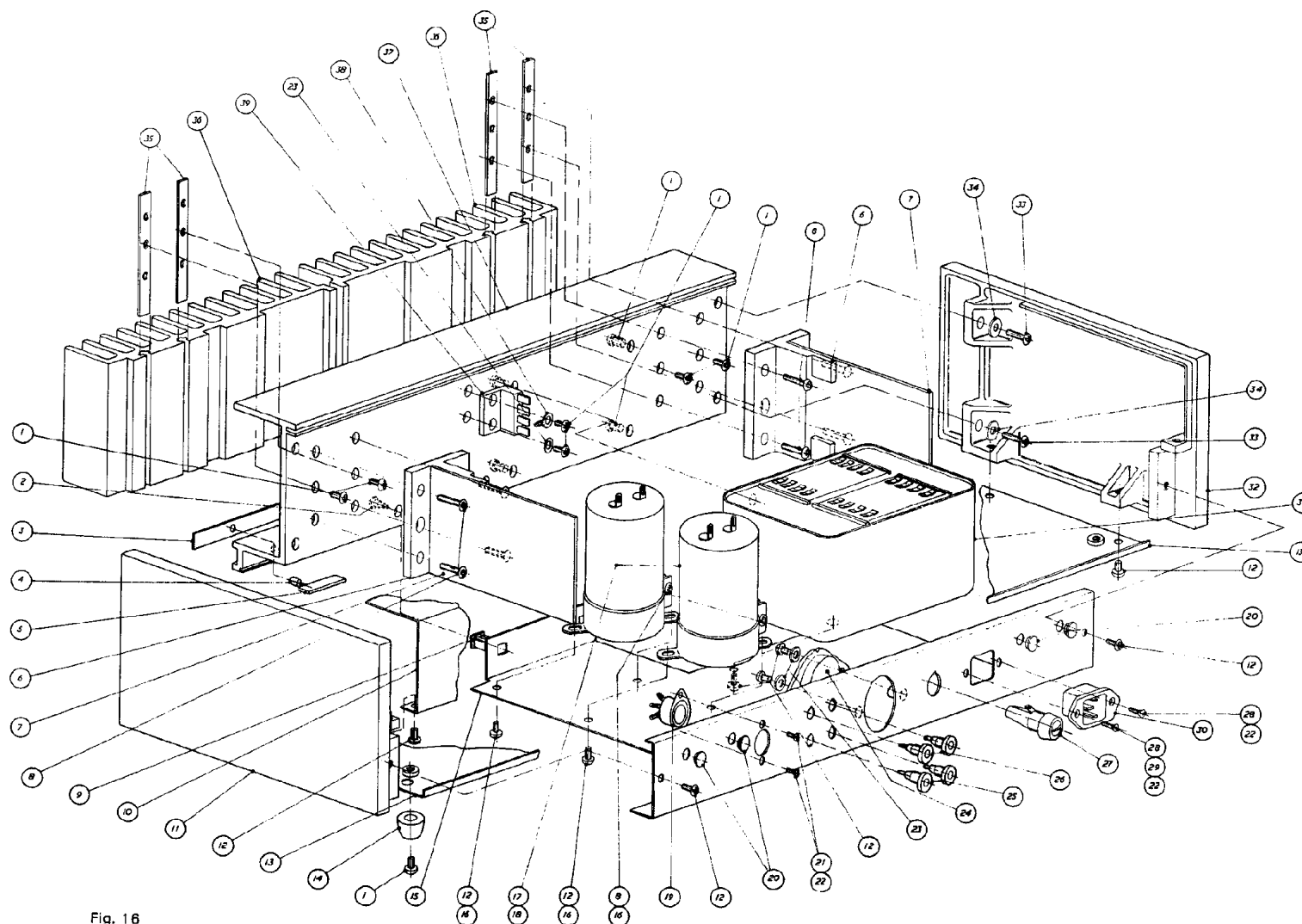


Fig. 16

Assembly Diagram.

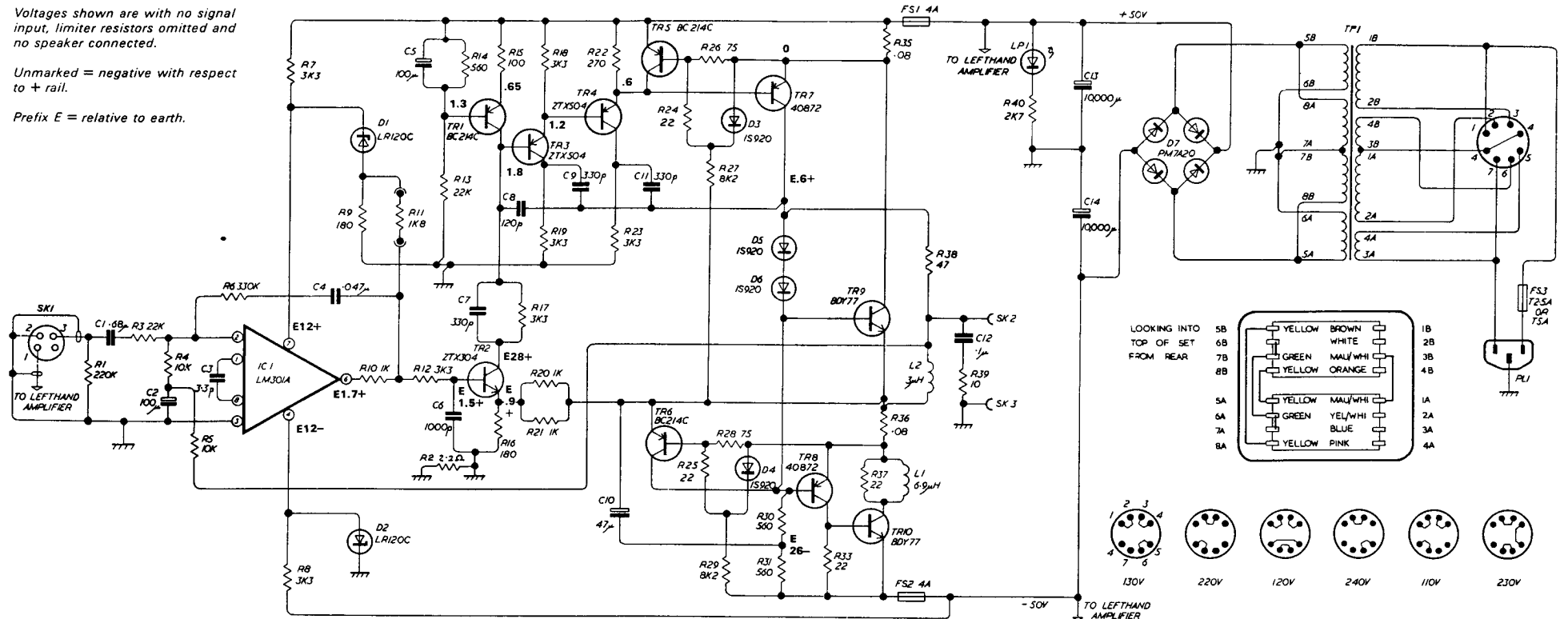
| No | Drawing No | Description | Stock No |
|-----|------------|----------------------------------|----------|
| 1 | | SCREW M4 X 8 mm POSDRIV | |
| 2 | | SCREW M4 X 5 mm POSDRIV | |
| 3 | A3/1234 | POWER PLATE | |
| 4 | | LED HEATLET PACKARD | |
| 5 | A4/1237 | PRINTED WIRING BOARD | |
| 6 | A3/1234 | AMPLIFIER MOUNTING BRACKET | |
| 7 | A3/1235 | PRINTED WIRING BOARD | |
| 8 | | SCREW M4 X 8 mm POSDRIV | |
| 9 | | LOCKW NUT 17x 1.5x 0.5mm-10 | |
| 10 | A4/1237 | COVER | |
| 11 | A1/1233 | RIGHT HAND END COVER | |
| 12 | | SCREW M4 X 8 mm POSDRIV | |
| 13 | A4/1235 | BASE PLATE | |
| 14 | | FOOT COP 5x5x5mm | |
| 15 | A1/1235 | CHASSIS | |
| 16 | | NUT M4 FULL HEX | |
| 17 | | CAPACITOR 1000µ 63V ERIE | |
| 18 | | CAPACITOR CLIP 5mm x 5mm | |
| 19 | | SOCKET | AT-1 |
| 20 | | SOLD GARNISH 10x10x 10mm | |
| 21 | | SCREW M4 X 8 mm POSDRIV | |
| 22 | | NUT M4 FULL HEX | |
| 23 | | WASHER M4 | |
| 24 | | VOLUME SELECTOR 7/1-001 | |
| 25 | | OUTPUT SOCKET BEL LINEBOARD 5T/0 | |
| 26 | | OUTPUT SOCKET BEL LINEBOARD 5T/0 | |
| 27 | | FLUSHHOLDER BLACK 12x12x12 | |
| 28 | | SCREW M4 X 8 mm POSDRIV | |
| 29 | | SOLDER TIE M4 TUCKER T888 | |
| 30 | | MARKING PLUG OTTO HEL 488-2 | |
| 31 | A3/1235 | TRANSFORMER | |
| 32 | A1/1235 | LEFT HAND END COVER | |
| 33 | | SCREW M4 X 8 mm POSDRIV | |
| 34 | | WASHER M4 12mm O/D | |
| 35 | A4/1235 | HEAT SINK FIXING STRIP | |
| 36 | A3/1235 | HEAT SINK | |
| 37 | A4/1235 | FRONT PANEL | |
| 38 | | SOLDER TIE M4 TUCKER T888 | |
| 39 | | AMPLIFIER M41 PWTAB 2 | |
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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 | R2R200S |
| 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 | R22R0J1 |
| R25 | 22 | ± 10% | Resistor | R22R0J1 |
| 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 | R22R0J1 |
| R35 | 0.08 | | Resistor Acoustical DRG A4/12383 | RR081JY |
| R36 | 0.08 | | Resistor Acoustical DRG A4/12383 | RR081JY |
| R37 | 22 | ± 10% | Resistor | R22R0J1 |
| R38 | 47 | ± 5% | Resistor | R47RJ1 |
| R39 | 10 | ± 10% | Resistor | R10RJ1 |
| R40 | 2K7 | | Resistor 1.6W | R2K70RJ1 |
| C1 | 0.68μ | | Capacitor 100V | C680NKS |
| C2 | 100μ | ± 10% | Capacitor 3V | C100UME |
| C3 | 3.3P | ± 20% | Capacitor | C3P30KJ |
| C4 | 0.047μ | | Capacitor 250V | C47N0JS |
| 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 |

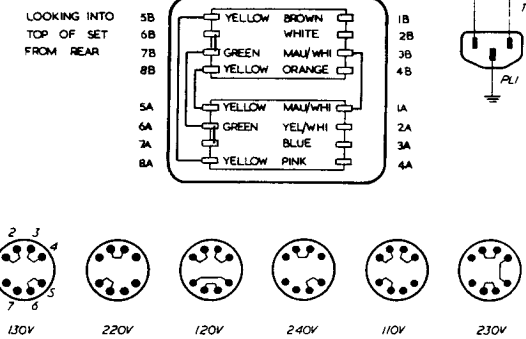
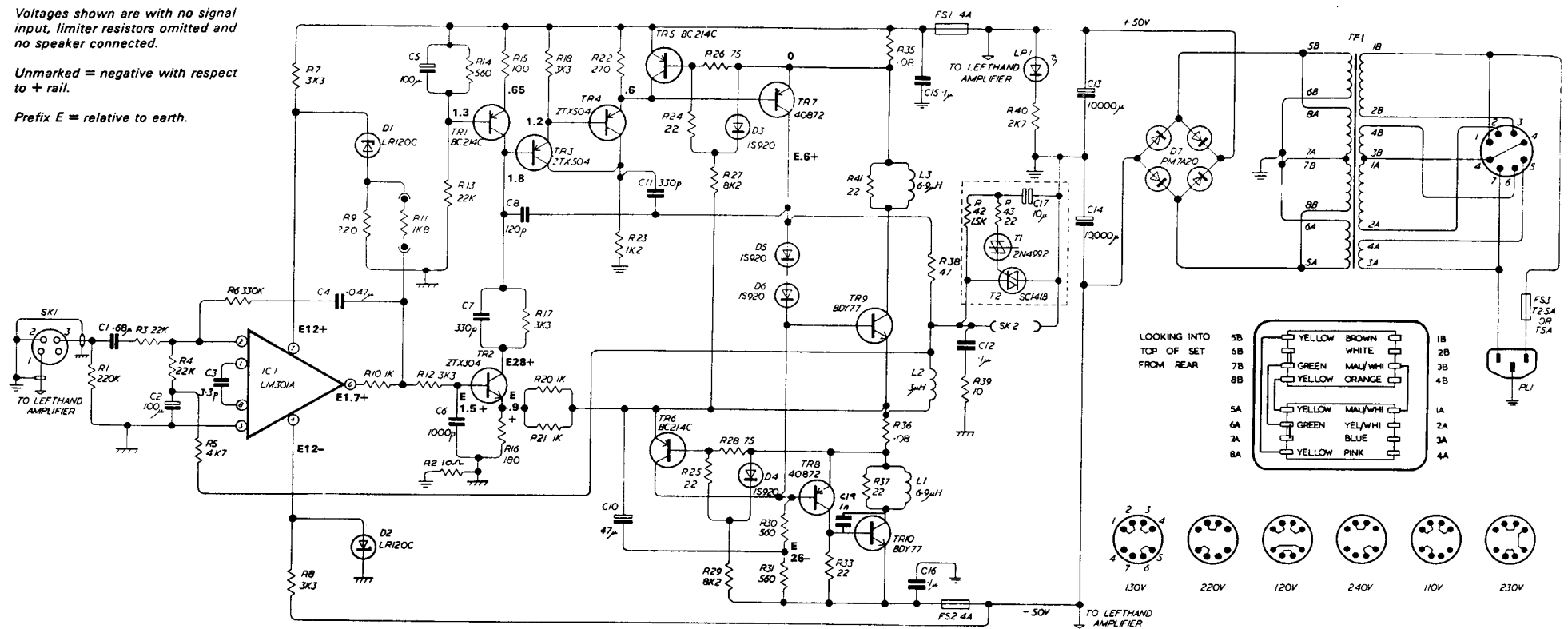
| No. | Value | Tol | Reference | Stock No. |
|------|---------|-------|-------------------------------------|-----------|
| C12 | 0.1μ | | Capacitor 250V | C100NKC |
| C13 | 10,000μ | | Capacitor 63V | C10KUTA |
| C14 | 10,000μ | | Capacitor 63V | C10KUTA |
| TR1 | | | Transistor BC214C | DBC214C |
| 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 80Y74 or 80Y77 | D80Y77Q |
| TR10 | | | Transistor 80Y74 or 80Y77 | D80Y77Q |
| 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 |

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 | 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 | 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 | R560RJ5 |
| R31 | 560 | ± 10% | Resistor 2.5W | R560RJ5 |
| R32 | 22 | ± 10% | Resistor | R22R0J1 |
| R33 | 22 | ± 10% | Resistor | R22R0J1 |
| R34 | 0.08 | | Resistor | RR081JY |
| R35 | 0.08 | | Resistor Acoustical DRWG A4/12383 | RR081JY |
| R36 | 0.08 | | Resistor | 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 |
| C1 | 0.68μ | | Capacitor 100V | C680NKS |
| 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 |

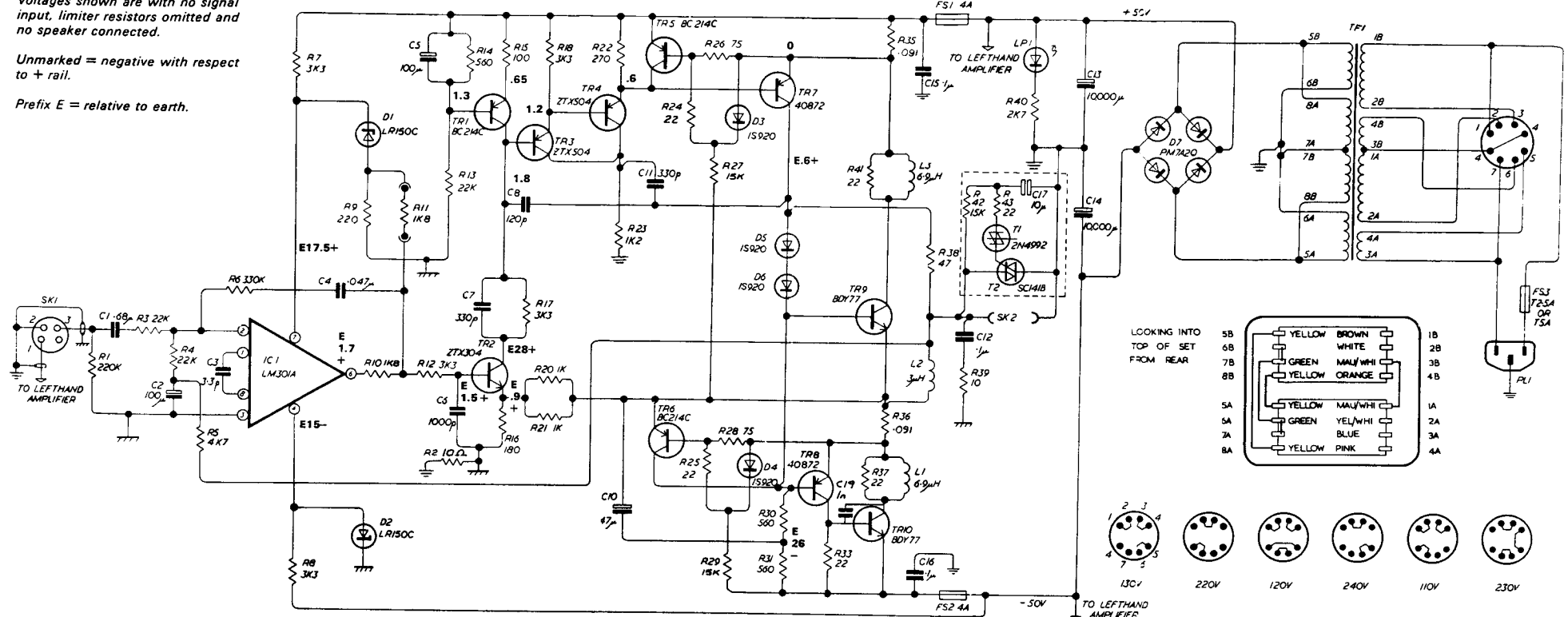
| No. | Value | Tol | Reference | Stock No. |
|------|---------|-----|--------------------------------------|-----------|
| C9 | | | Capacitor 40V | C47U02B |
| C10 | 47μ | | Capacitor | C330PKJ |
| C11 | 330P | | Capacitor | C100NKC |
| C12 | 0.1μ | | Capacitor 250V | C100NKC |
| C13 | 10.000μ | | Capacitor 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 |
| 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 2SD678 or 17556 | D17556X |
| TR10 | | | Transistor 2SD424 or 2SD678 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 |
| IC1 | | | LM301A | DML301A |
| L1 | 6.9μH | ± 20% | Inductor ANCO TC1/85 | L12406A |
| L2 | 3μH | ± 5% | 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 | UM02A5DA |
| | T5A | | 110-130V | UM05ADA |
| LP1 | | | Hewlett Packard 5082-4850 Red | BL5053P |
| TF1 | | | Acoustical DRG A3/12382 | L12382A |

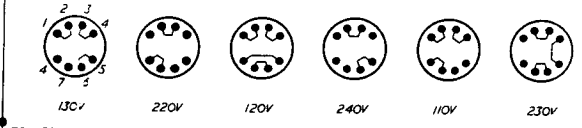
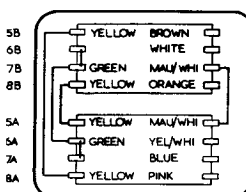
Voltages shown are with no signal input, limiter resistors omitted and no speaker connected.

Unmarked = negative with respect to + rail.

Prefix E = relative to earth.



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| 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 | R220R0J1 |
| R10 | 1K8 | ± 10% | Resistor | R1K80J1 |
| R11 | 1K8 | ± 10% | Resistor | R1K80J1 |
| R12 | 3K3 | ± 10% | Resistor | R3K30J1 |
| R13 | 22K | ± 2% | Resistor | R22K0J1 |
| R14 | 560 | ± 10% | Resistor | R560R0J1 |
| R15 | 100 | ± 10% | Resistor | R100R0J1 |
| R16 | 180 | ± 2% | Resistor | R180R0J1 |
| 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 | R270R0J1 |
| 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 |
| C1 | 0.68μ | | Capacitor 100V | C680NKS |
| C2 | 100μ | ± 10% | Capacitor 3V | C100UME |
| C3 | 3.3P | ± 20% | Capacitor | C3P30KJ |
| C4 | 0.047μ | | Capacitor 250V | C47N0JS |
| C5 | 100μ | | Capacitor 6V | C100UZ8 |
| 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 |
| 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 2SD676 or 17556 | D17556X |
| TR10 | | | Transistor 2SD424 or 2SD676 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 | DPM7A2Q |
| IC1 | | | LM301A | DML301A |
| L1 | 6.9μH | ± 20% | Inductor ANCO TC1/65 | L12406A |
| L2 | 3μH | ± 5% | Inductor ANCO 440/D | L12405A |
| L3 | 6.9μH | ± 20% | Inductor ANCO TC1/65 | L12406A |
| 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 |

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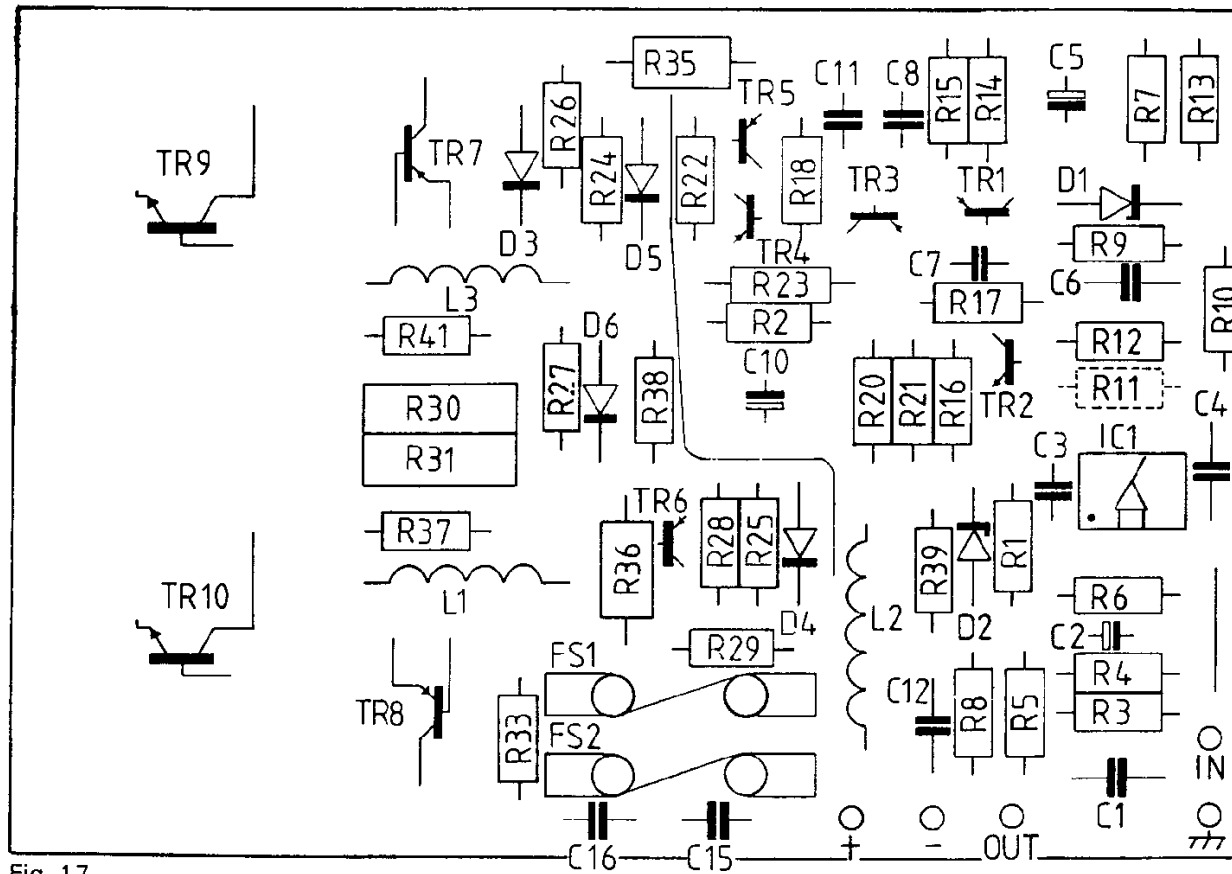
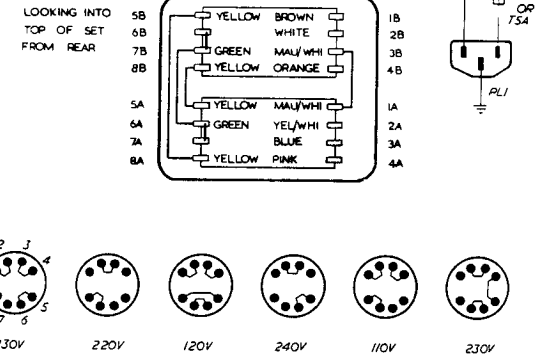
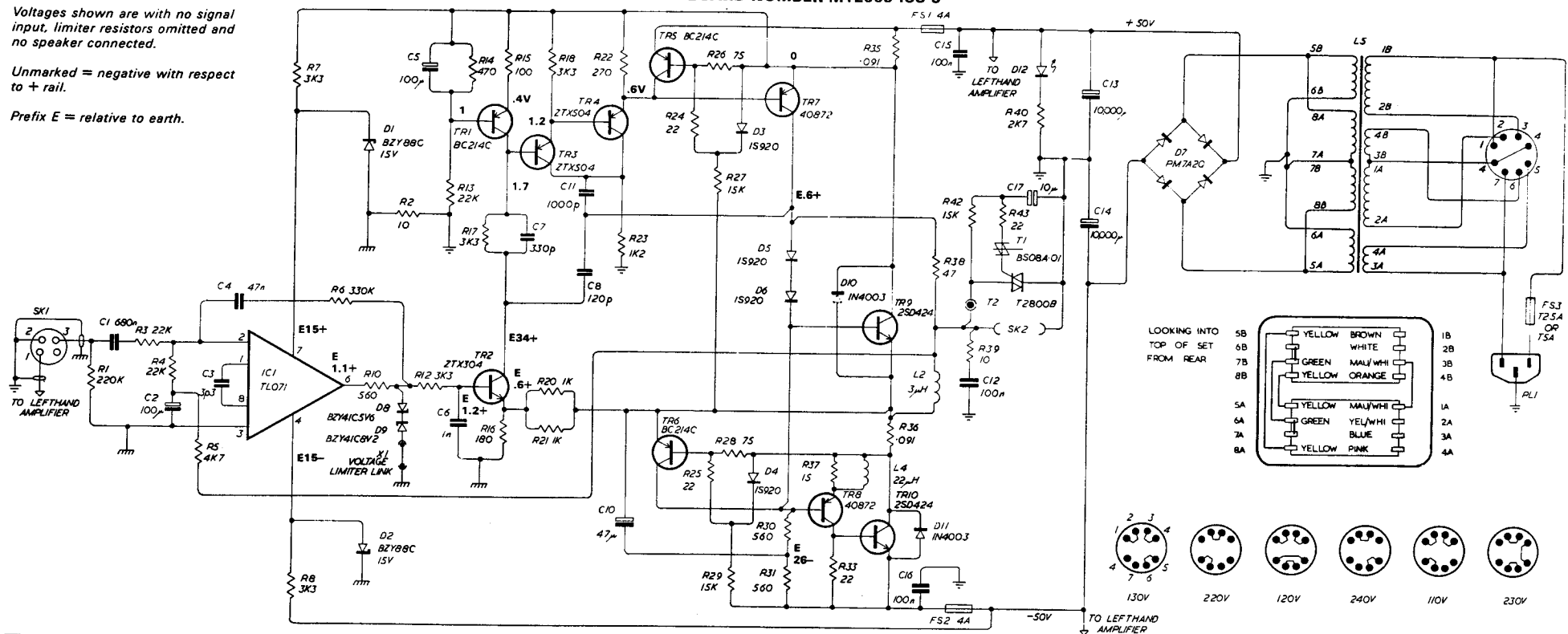


Fig. 17

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 | R10RJ1 |
| R3 | 22K | ± 2% | Resistor | R22KOG1 |
| R4 | 22K | ± 2% | Resistor | R22KOG1 |
| R5 | 4K7 | | Resistor | R4K7OJ1 |
| R6 | 330K | ± 2% | Resistor | R330KG1 |
| R7 | 3K3 | | Resistor | R3K3OJ1 |
| R8 | 3K3 | | Resistor | R3K3OJ1 |
| R10 | 560 | | Resistor | R560RJ1 |
| R12 | 3K3 | | Resistor | R3K3OJ1 |
| R13 | 22K | ± 2% | Resistor | R22KOG1 |
| R14 | 470 | | Resistor | R470RJ1 |
| R15 | 100 | | Resistor | R100RJ1 |
| R16 | 180 | ± 2% | Resistor | R180RG1 |
| R17 | 3K3 | | Resistor | R3K3OJ1 |
| R18 | 3K3 | | Resistor | R3K3OJ1 |
| R20 | 1K | ± 2% | Resistor | R1K0OG1 |
| R21 | 1K | ± 2% | Resistor | R1K0OG1 |
| R22 | 270 | | Resistor | R270RJ1 |
| R23 | 1K2 | | Resistor | R1K2OJR |
| R24 | 22 | | Resistor | R22ROJ1 |
| R25 | 22 | | Resistor | R22ROJ1 |
| R26 | 75 | | Resistor | R75RJ1 |

| No. | Value | Tol | Reference | Stock No. |
|---------------------------------------|-------|-----|-----------|-----------|
| R27 | 15K | | Resistor | R15K0J1 |
| R28 | 75 | | Resistor | R75ROJ1 |
| R29 | 15K | | Resistor | R15K0J1 |
| R30 | 560 | | Resistor | R560RJ1 |
| R31 | 560 | | Resistor | R560RJ1 |
| R33 | 22 | | Resistor | R22ROJ1 |
| R35 | .091 | | Resistor | RR091JY |
| R36 | .091 | | Resistor | RR091JY |
| R37 | 15 | | Resistor | R15ROJ1 |
| R38 | 47 | | Resistor | R47ROJ1 |
| R39 | 10 | | Resistor | R10ROJ1 |
| R40 | 2K7 | | Resistor | R2K7OJR |
| R42 | 15K | | Resistor | R15K0J1 |
| R43 | 22 | | Resistor | R22ROJ1 |
| All Resistors ± 5% except where shown | | | | |
| C1 | 880n | | Capacitor | C880NKS |
| C2 | 100μ | | Capacitor | C100UKT |
| C3 | 3p3 | | Capacitor | C3P3OC1 |
| C4 | 47n | | Capacitor | C47N0J1 |
| C5 | 100μ | | Capacitor | C100U2B |
| C6 | 1n | | Capacitor | C1N00KK |
| C7 | 330p | | Capacitor | C330PKJ |

| 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 | D2TX304 |
| TR3 | | | Transistor 2TX504 | D2TX504 |
| TR4 | | | Transistor 2TX504 | D2TX504 |
| 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 8508A-01 or 2N4992 | D8508AA |
| T2 | | | TRIAC T2800B | DT2800B |
| D1 | | | Zener Diode BZY88C 15V | DZ15VAA |

| No. | Value | Tol | Reference | Stock No. |
|-----|-------|------|--|-----------|
| D2 | | | Zener Diode BZY88C 15V | DZ15VAA |
| D3 | | | Diode 1S920T8 | D1S920B |
| D4 | | | Diode 1S920T8 | D1S920B |
| D5 | | | Diode 1S920T8 | D1S920B |
| D6 | | | Diode 1S920T8 | D1S920B |
| D7 | | | Bridge Rectifier PM7A2Q | DPM7A2Q |
| D8 | | | Zener Diode 82V41C8V2 | DZ8V2AA |
| D9 | | | Zener Diode 82V41C5V6 | DZ5V6AA |
| D10 | | | Diode 1N4003 | D1N4003 |
| D11 | | | Diode 1N4003 | D1N4003 |
| D12 | | | LED XC5053R | BL5053R |
| IC1 | | | Int. Circuit TL071, ME5534, LM351, LM301 | DO71CPX |
| L2 | 3μH | ± 5% | Choke | LT2405A |
| L4 | 22μH | | Choke | LSC1022 |
| L5 | | | Transformer | LT2362A |
| 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

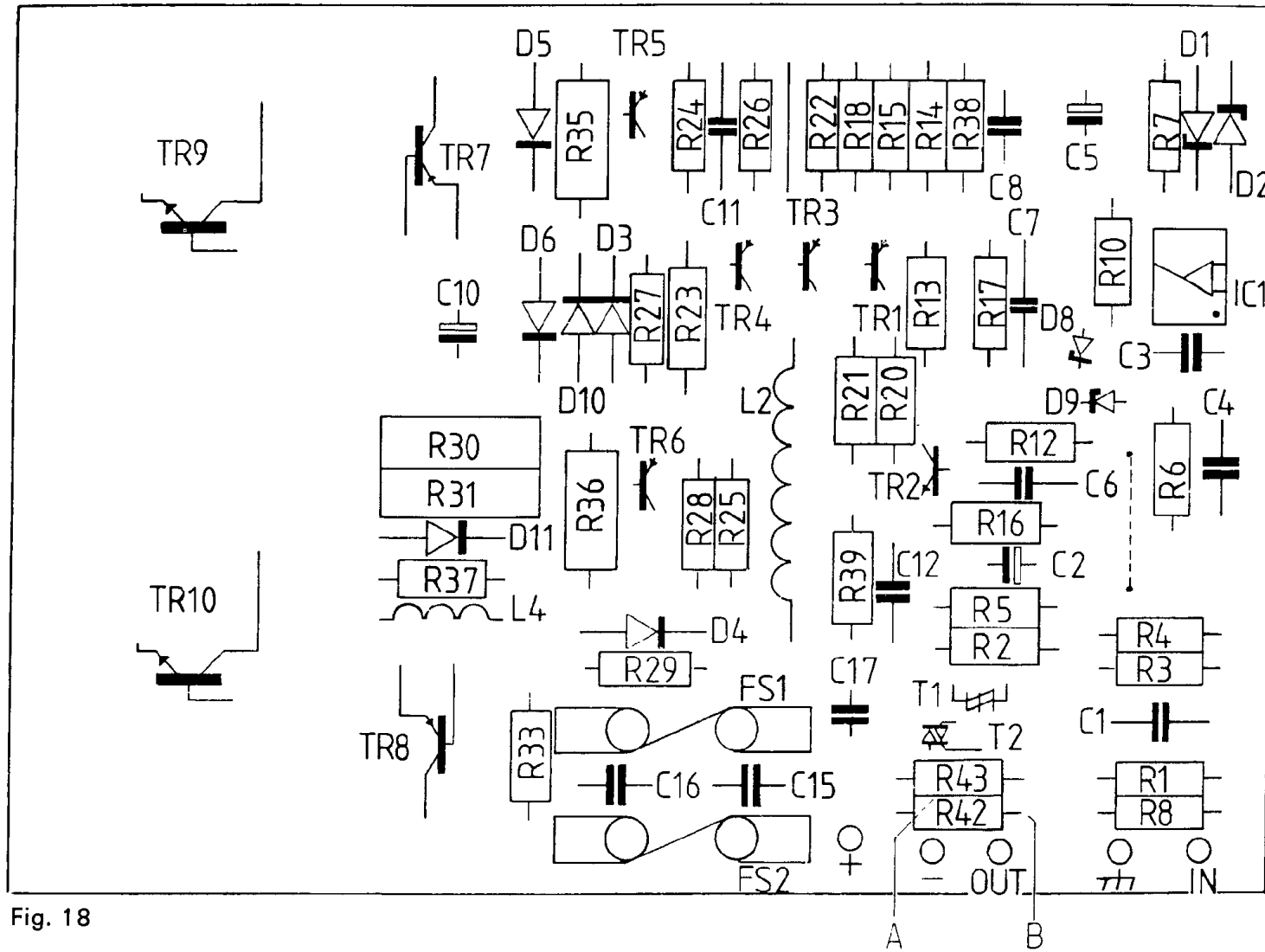
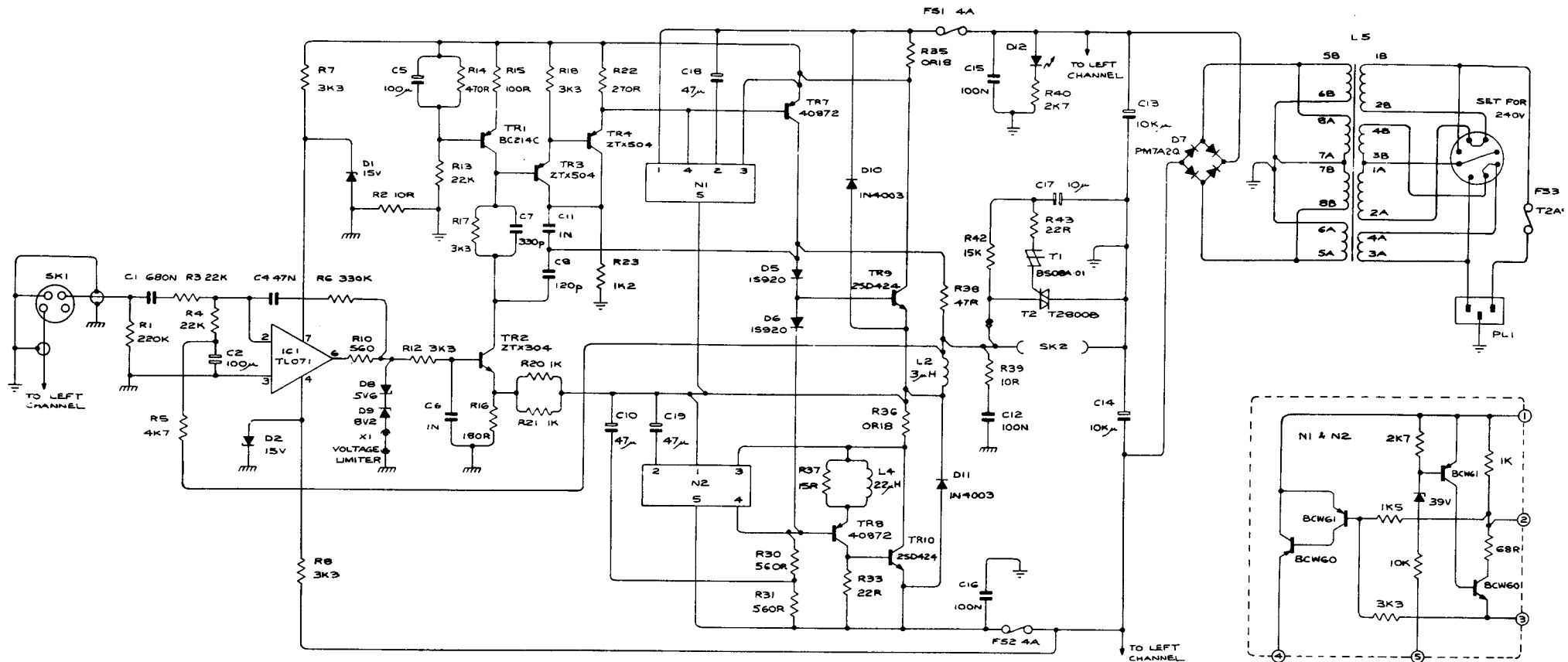


Fig. 18



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
R22K0G1
R4K70J1
R330KG1
R3K30J1
R3K30J1
R560RJ1
R3K30J1
R22K0G1
R470RJ1
R100RJ1
R180RG1
R3K30J1
R3K30J1
R1K00G1
R1K00G1
R270RJ1
R1K20JR
R560RJ1
R560RJ1
R22RJ1
R0R18JC
R0R18JC
R15RJ1

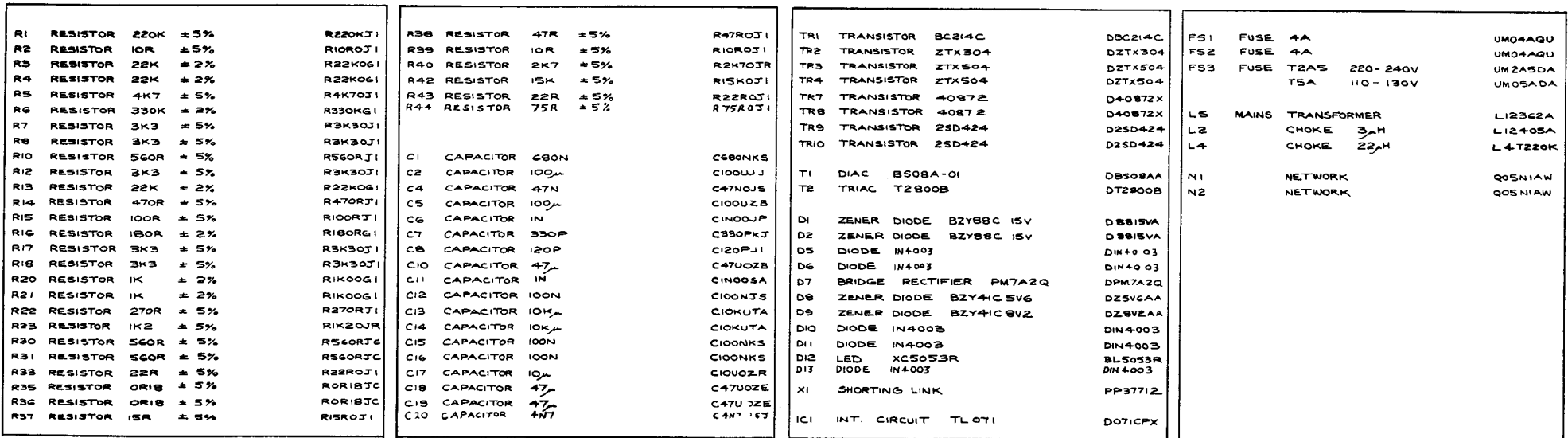
R38 RESISTOR 47R ± 5%
R39 RESISTOR 10R ± 5%
R40 RESISTOR 2K7 ± 5%
R42 RESISTOR 15K ± 5%
R43 RESISTOR 22R ± 5%
C1 CAPACITOR 680N
C2 CAPACITOR 100µ
C4 CAPACITOR 47N
C5 CAPACITOR 100µ
C6 CAPACITOR 1N
C7 CAPACITOR 330P
C8 CAPACITOR 120P
C10 CAPACITOR 47µ
C11 CAPACITOR 1N
C12 CAPACITOR 100N
C13 CAPACITOR 10Kµ
C14 CAPACITOR 10Kµ
C15 CAPACITOR 100µ
C16 CAPACITOR 100N
C17 CAPACITOR 10µ
C18 CAPACITOR 47µ
C19 CAPACITOR 47µ

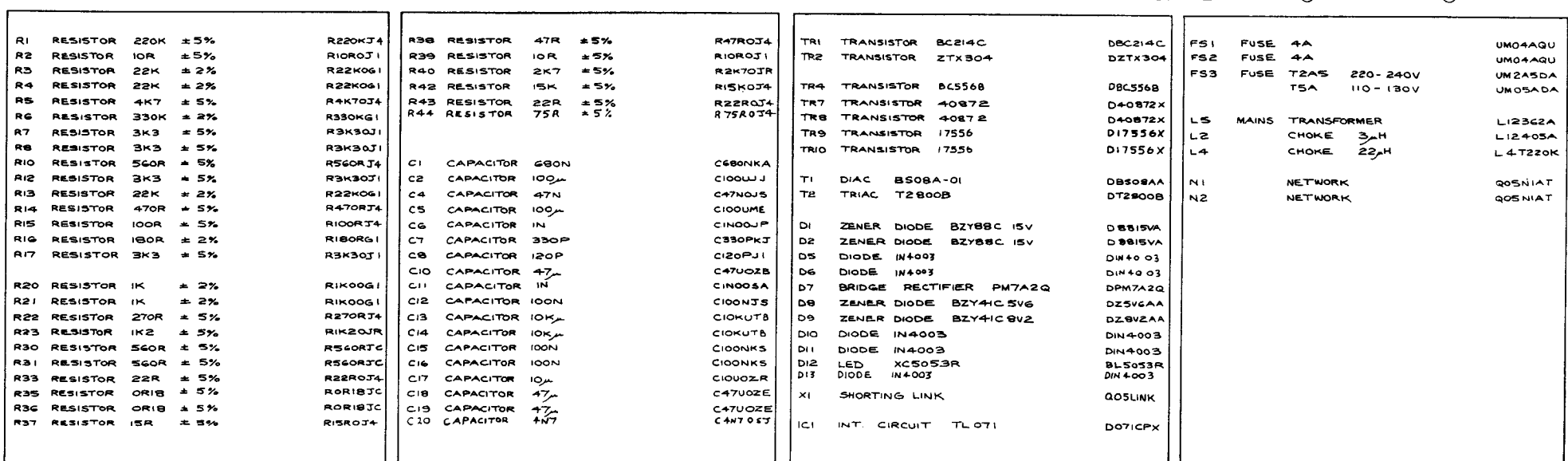
R47RJ1
R10R0J1
R2K70JR
R15K0J1
R22RJ1
C680NKS
C100WJ
C47N0J5
C100U2B
C100U2P
C330PKJ
C120PJ1
C47U02B
C100U3A
C100NJS
C10KUTA
C10KUTA
C100NKS
C100NKS
C100U2R
C47U02E
C47U02E

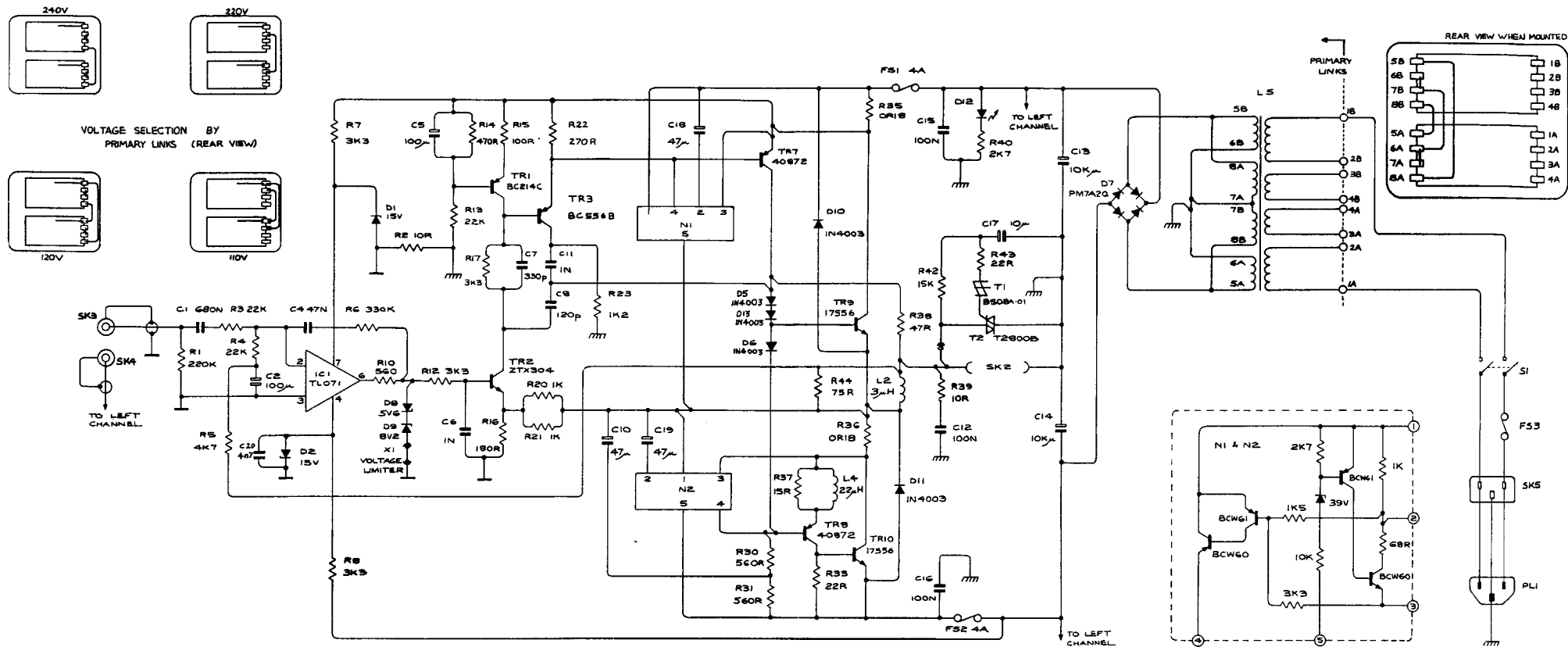
TR1 TRANSISTOR BC214C
TR2 TRANSISTOR ZTX304
TR3 TRANSISTOR ZTX504
TR4 TRANSISTOR ZTX504
TR7 TRANSISTOR 40872
TR8 TRANSISTOR 40872
TR9 TRANSISTOR 2SD424
TR10 TRANSISTOR 2SD424
T1 DIAC BS08A-01
T2 TRIAC T2800B
D1 ZENER DIODE BZY88C 15V
D2 ZENER DIODE BZY88C 15V
D5 DIODE 1S920
D6 DIODE 1S920
D7 BRIDGE RECTIFIER PM7A2Q
D8 ZENER DIODE BZY41C 5V6
D9 ZENER DIODE BZY41C 9V2
D10 DIODE IN4003
D11 DIODE IN4003
D12 LED XC5053R
X1 SHORTING LINK
IC1 INT CIRCUIT TL071

DBC214C
DZTX304
DZTX504
DZTX504
D40872X
D40872X
D2SD424
D2SD424
DBS08AA
DT2800B
DBZ88C
DBZ88C
DIS920B
DIS920B
DPM7A2Q
DZ5V6AA
DZ9V2AA
DIN4003
DIN4003
BL5053R
PP37712
D07ICPX

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







| | | | | | | | |
|-----------------------------|------------------------------|-----------------------|---------|-----------------------|---------|------------------------|---------|
| R1 RESISTOR 220K ± 5% | R220KJ4 | R39 RESISTOR 47R ± 5% | R47R0J4 | TR1 TRANSISTOR BC214C | DBC214C | F51 FUSE 4A | UM04AGU |
| R2 RESISTOR 10R ± 5% | R10R0J1 | R39 RESISTOR 10R ± 5% | R10R0J1 | TR2 TRANSISTOR 2TX304 | DBC214C | F52 FUSE 4A | UM04AGU |
| R3 RESISTOR 22K ± 2% | R22K061 | R40 RESISTOR 2K7 ± 5% | R2K70J4 | TR3 TRANSISTOR BC556B | DBC556B | F53 FUSE T2A5 220-240V | UM2A5DA |
| R4 RESISTOR 22K ± 2% | R22K061 | R42 RESISTOR 15K ± 5% | R15K0J4 | TR7 TRANSISTOR 40672 | D40672X | T5A 110-130V | UM05ADA |
| R5 RESISTOR 4K7 ± 5% | R4K70J4 | R43 RESISTOR 22R ± 5% | R22R0J4 | TR8 TRANSISTOR 40672 | D40672X | | |
| R6 RESISTOR 330K ± 5% | R330KQ1 | R44 RESISTOR 75R ± 5% | R75R0J4 | TR9 TRANSISTOR 17556 | D17556X | | |
| R7 RESISTOR 3K3 ± 5% | R3K30J1 | | | TR10 TRANSISTOR 17556 | D17556X | | |
| R8 RESISTOR 3K3 ± 5% | R3K30J1 | | | | | | |
| R9 RESISTOR 560R ± 5% | R560RJ4 | | | | | | |
| R10 RESISTOR 3K3 ± 5% | R3K30J1 | | | | | | |
| R11 RESISTOR 3K3 ± 5% | R3K30J1 | | | | | | |
| R12 RESISTOR 3K3 ± 5% | R3K30J1 | | | | | | |
| R13 RESISTOR 22K ± 2% | R22K061 | | | | | | |
| R14 RESISTOR 470R ± 5% | R470RJ4 | | | | | | |
| R15 RESISTOR 100R ± 5% | R100RJ4 | | | | | | |
| R16 RESISTOR 100R ± 2% | R100RJ4 | | | | | | |
| R17 RESISTOR 3K3 ± 5% | R3K30J1 | | | | | | |
| R20 RESISTOR 1K ± 2% | R1K00G1 | | | | | | |
| R21 RESISTOR 1K ± 2% | R1K00G1 | | | | | | |
| R22 RESISTOR 270R ± 5% | R270RJ4 | | | | | | |
| R23 RESISTOR 1K2 ± 5% | R1K20J4 | | | | | | |
| R30 RESISTOR 560R ± 5% | R560RJ4 | | | | | | |
| R31 RESISTOR 560R ± 5% | R560RJ4 | | | | | | |
| R33 RESISTOR 22R ± 5% | R22R0J4 | | | | | | |
| R35 RESISTOR 0R18 ± 5% | R0R18J4 | | | | | | |
| R36 RESISTOR 0R18 ± 5% | R0R18J4 | | | | | | |
| R37 RESISTOR 15R ± 5% | R15R0J4 | | | | | | |
| C1 CAPACITOR 680N | C680NKA | | | | | | |
| C2 CAPACITOR 100µ | C100µJ | | | | | | |
| C4 CAPACITOR 47N | C47N0J5 | | | | | | |
| C5 CAPACITOR 100µ | C100µME | | | | | | |
| C6 CAPACITOR 1N | C1000µP | | | | | | |
| C7 CAPACITOR 330P | C330PKJ | | | | | | |
| C8 CAPACITOR 120P | C120PJ1 | | | | | | |
| C10 CAPACITOR 47µ | C47µ0Z5 | | | | | | |
| C11 CAPACITOR 1N | C1000µA | | | | | | |
| C12 CAPACITOR 100N | C100NJS | | | | | | |
| C13 CAPACITOR 10K | C10KUT8 | | | | | | |
| C14 CAPACITOR 10K | C10KUT8 | | | | | | |
| C15 CAPACITOR 100N | C100NKS | | | | | | |
| C16 CAPACITOR 100N | C100NKS | | | | | | |
| C17 CAPACITOR 10µ | C10µ0Z4 | | | | | | |
| C18 CAPACITOR 47µ | C47µ0ZE | | | | | | |
| C19 CAPACITOR 47µ | C47µ0ZE | | | | | | |
| C20 CAPACITOR 47N | C47N0J7 | | | | | | |
| D1 ZENER DIODE BZY88C 15V | D8815VA | | | | | | |
| D2 ZENER DIODE BZY88C 15V | D8815VA | | | | | | |
| D5 DIODE 1N4003 | DIN4003 | | | | | | |
| D6 DIODE 1N4003 | DIN4003 | | | | | | |
| D7 BRIDGE RECTIFIER PM7A2Q | DPM7A2Q | | | | | | |
| D8 ZENER DIODE BZY44C 5V6 | D25V6AA | | | | | | |
| D9 ZENER DIODE BZY44C 5V6 | D25V6AA | | | | | | |
| D10 DIODE 1N4003 | DIN4003 | | | | | | |
| D11 DIODE 1N4003 | DIN4003 | | | | | | |
| D12 LED XC5053R | DL5053R | | | | | | |
| D13 DIODE 1N4003 | DIN4003 | | | | | | |
| X1 SHORTING LINK | Q05LINK | | | | | | |
| IC1 INT. CIRCUIT TL071 | DO71CPX | | | | | | |
| L5 MAINS TRANSFORMER | L12362A | | | | | | |
| L2 CHOKE 3µH | L12405A | | | | | | |
| L4 CHOKE 22µH | L4T220K | | | | | | |
| N1 NETWORK | Q05NIAT | | | | | | |
| N2 NETWORK | Q05NIAT | | | | | | |
| PL1 AC. POWER IN/FUSEHOLDER | PPM12AA | | | | | | |
| S1 SWITCH | S405OFF | | | | | | |
| SK2 OUTPUT SOCKETS | RED P5R514C BLACK P5B514C | | | | | | |
| SK3 INPUT RIGHT | P5PHON2 | | | | | | |
| SK4 INPUT LEFT | P5PHON9 | | | | | | |
| SK5 AC. POWER OUTLET SOCKET | P5P695S | | | | | | |