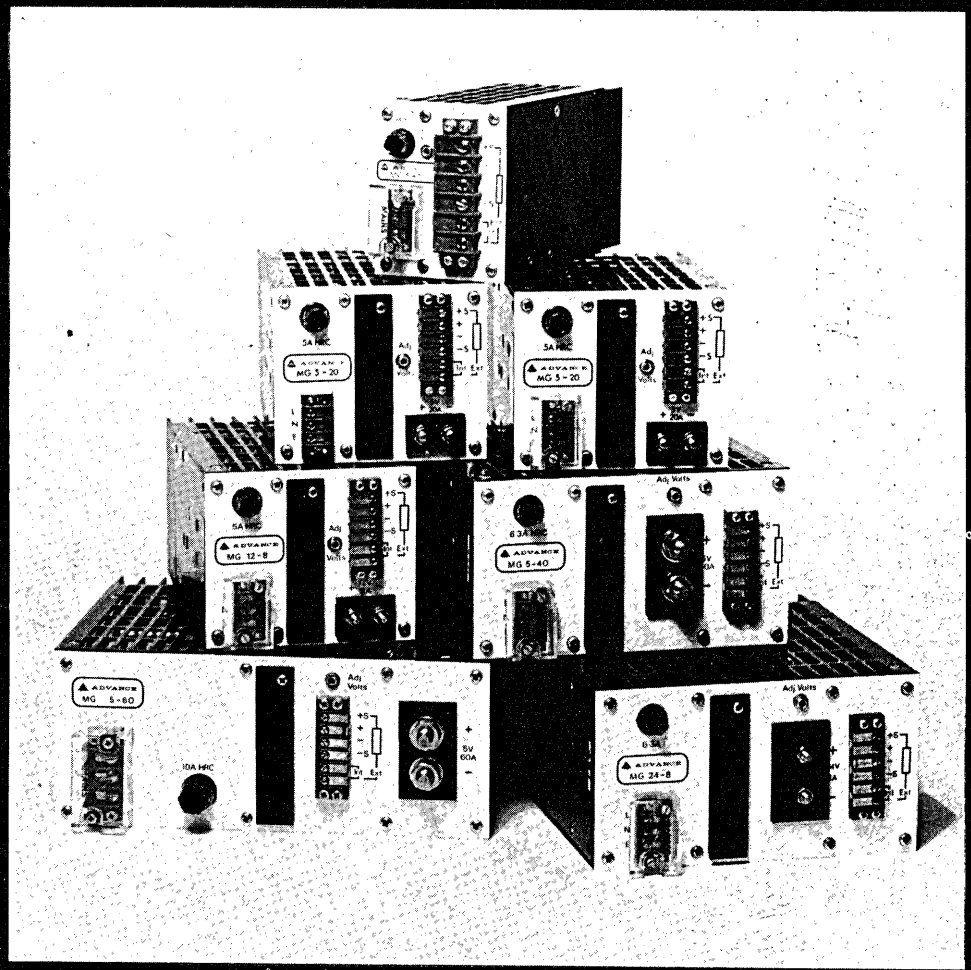
# The Advance MG Power Supply Handbook



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## Introduction

The Advance MG family of power supplies is a range of very compact units employing direct-off-line switching techniques in order to reduce physical dimensions to a minimum.

The range is produced in four different power levels, i.e., 50 watts, 100 watts, 200 watts and 300 watts. At each of these power levels, units are available with various combinations of output voltage and current.

The output voltage is adjustable by ±5% on all units by means of a screwdriver adjustment on the front panel. Facilities are provided for local or remote sensing and for voltage programming by means of an externally connected resistor.

Constant current protection is provided against overloads or short circuits.

Overvoltage protection by means of automatic control circuit shut-down is provided on all units.

Particular attention has been paid during the design stage to the problems of interference caused by the switching action of the power supply circuits. In this respect sample units have met the requirements of VDE 0875, curve 'N', and BS800, part 3.

## Specification

| *Type No.* | *MG 5–10* | *MG 5–20* | *MG 5–40* | *MG 5–60* | *MG 5–60A* | *MG 12–8* | *MG 15–7* | *MG 15–14* | *MG 24–4* | *MG 24–8* | *MG 24–12* | *MG 24–12A* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Input Voltage** +10% −20% 45–440Hz | 115V to 120V or 220V to 240V * | 220V or 240V by tap change | | | 115V or 120V by tap change * | 220V to 240V | | | | | | 115V to 120V * |
| **Output Voltage** | 5 | 5 | 5 | 5 | 5 | 12 | 15 | 15 | 24 | 24 | 24 | 24 |
| **Output Current** | 10 | 20 | 40 | 60 | 60 | 8 | 7 | 14 | 4 | 8 | 12 | 12 |
| **Case Style** | A | B | C | D | D | B | B | C | B | C | D | D |
| **Overvoltage Protection** | Set between 120–130% | | | | | Set between 115–125% | Set between 110–120% | | | | | |
| **Efficiency** | >65% | >70% | | | | | | | | | | |
| **Power Densities** | 0.9W/Cu.In. | Better than 1W/Cu.In. (65W/1000Cm³) | | | | | | | | | | |

* *Units MG5–10, MG5–60A and MG24–12A can also be used at input voltages in the range 100V to 115V within the limitations of the output characteristic curve Fig. 1.*

*Note:* Output voltages are adjustable ±5% by front panel potentiometer.

**Output Voltage Regulation**
0.1% maximum for a worst case combination of 0–100% load change and ±10% line change.

**Ripple**
10mV r.m.s.
50mV pk.-pk.
(30MHz bandwidth)

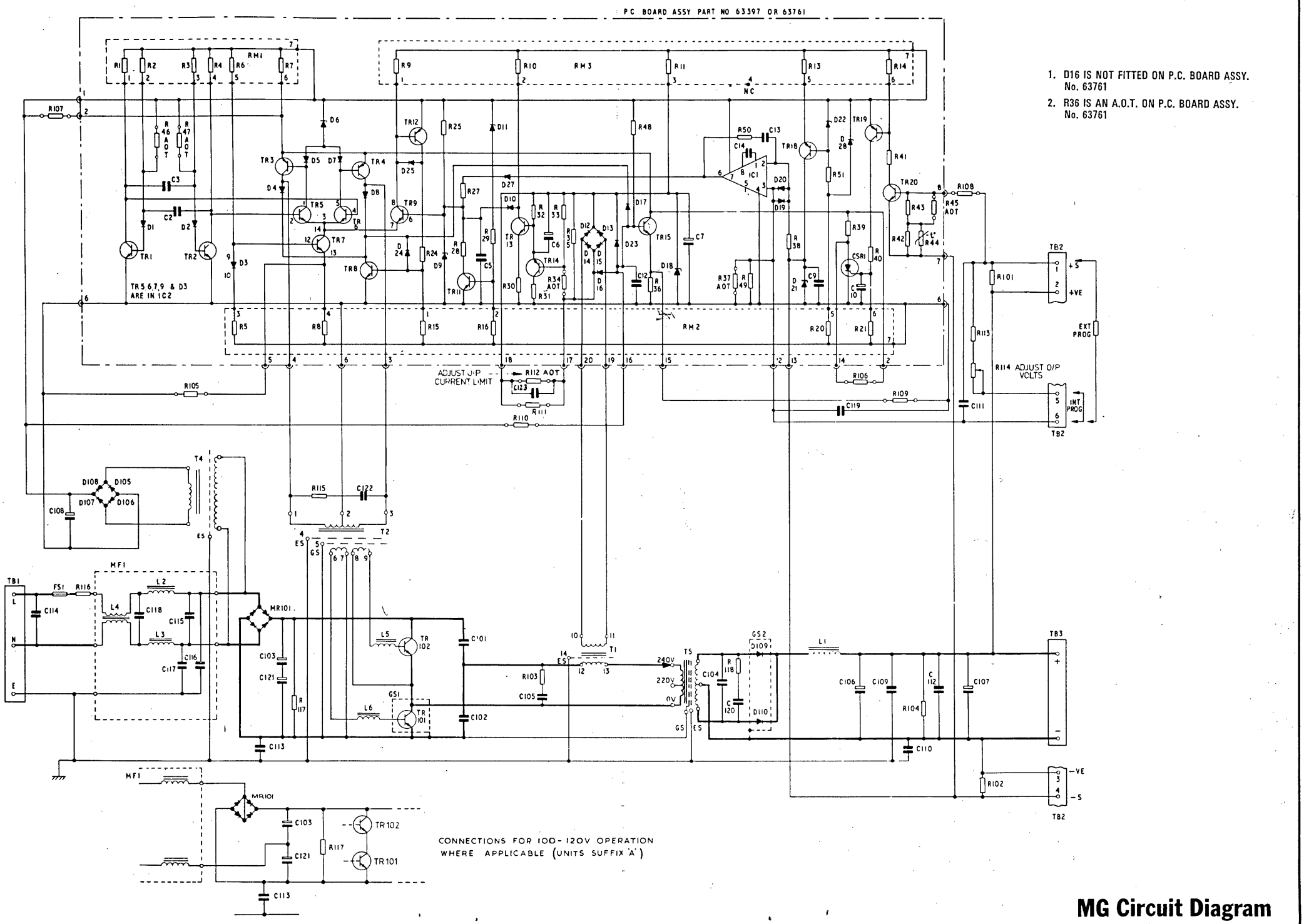
**Temperature Co-efficient**
±0.01%/°C.

**Output Impedance**
100mΩ at 100KHz.

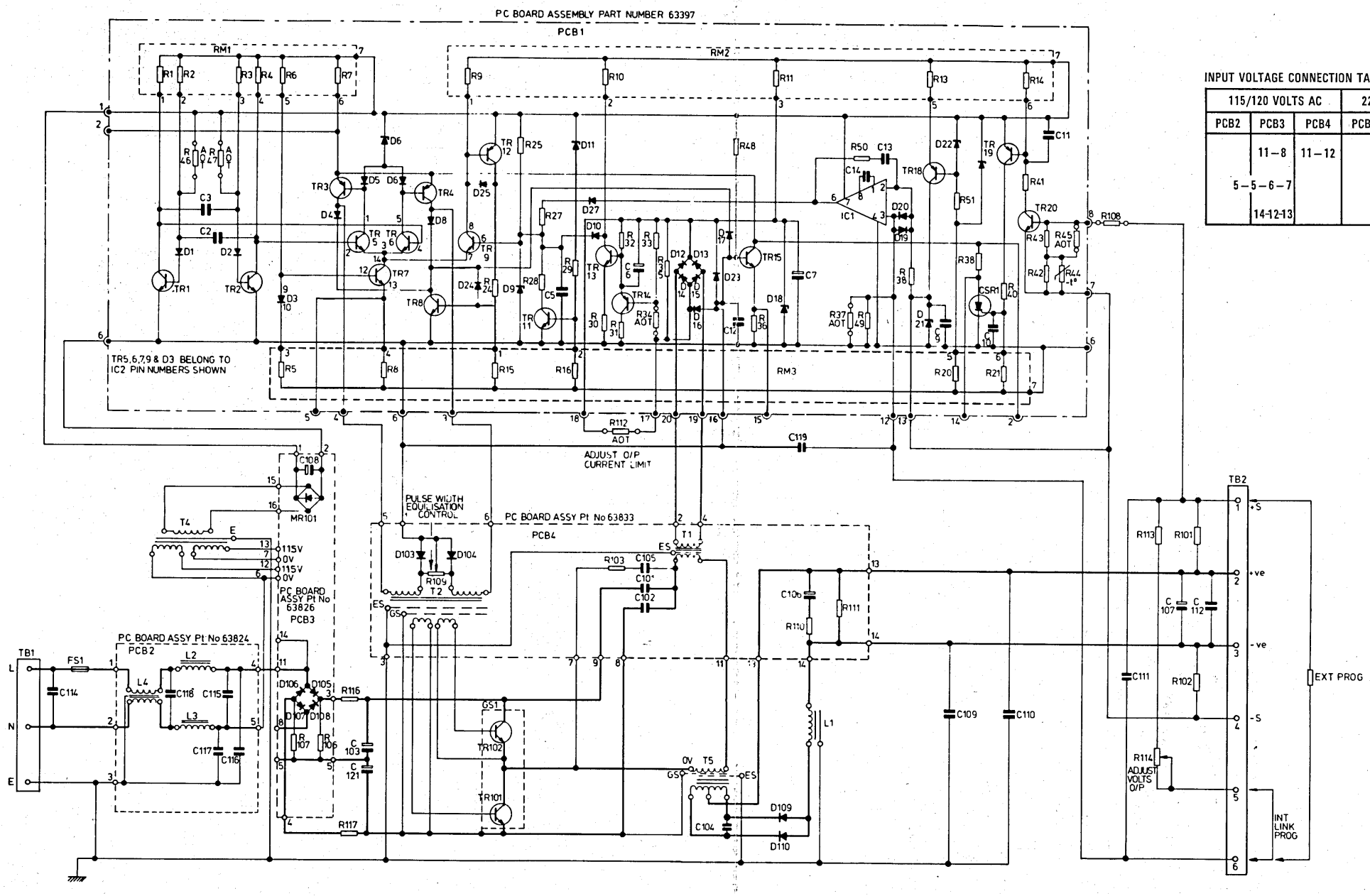
**Overload Protection**
Constant current, set at 110% ±5% full load.

**Temperature Range**
−10°C to +70°C derating from 50°C at 2½%/°C.

**Series and Parallel Operation**
No limit on parallel operation.
Series operation to a maximum total voltage of 250V.




# MG Circuit Diagram




INPUT VOLTAGE CONNECTION TABLE

| 115/120 VOLTS AC | | | 220/240 VOLTS AC | | |
|---|---|---|---|---|---|
| PCB2 | PCB3 | PCB4 | PCB2 | PCB3 | PCB4 |
| | 11–8 | 11–12 | | 5–8–6 | 11–12 |
| 5–5–6–7 | | | | 7–12 | |
| | 14-12-13 | | | 14–13 | |

**Adjustment procedure for R109.**

With the unit working in an overload condition (i.e. with the output voltage having dropped by about 10% from nominal) adjust R109 to give maximum output current.

## MG 5-10 Circuit Diagram

### Remote Sensing
Available from front panel, total voltage drop in the output leads should not exceed 5V max. in each lead. See output characteristic curves, Figs. 1 and 2, for limitations.

### Remote Programming
Output voltage may be programmed from 1V upwards by insertion of a programming resistor on front panel. Programming resistance 1000Ω /V ±0.5%.

### Output Hold-Up
Output maintained for the duration of a missing mains cycle at maximum output current and –10% mains input when the unit is operating at up to 105% output voltage rating.

### Remote switch off
Output may be reduced to zero by connecting short-circuit between 1 and 6 of programme terminal block.

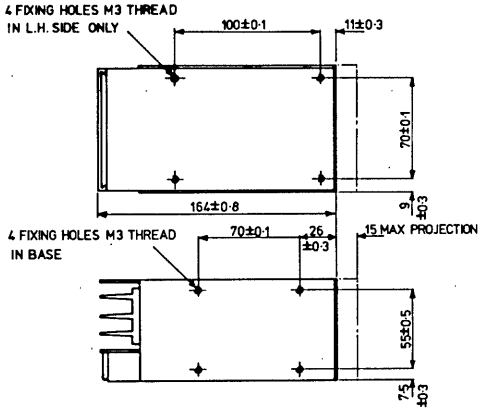
### Insulation
Between AC input and output terminals and case connected together tested to 2.1KV peak for one minute.
Between DC output and case ±250V DC continuous, tested to 500V DC for one minute.

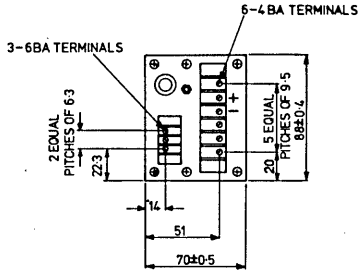
### Switch-on Time
Output will reach specification within 4 cycles of 50 or 60 Hz mains.

### Transient Response
For step load changes of 10–100% or 100–10%, voltage deviations are typically 350mV and output voltage returns to within the regulation band in approximately 4mS.

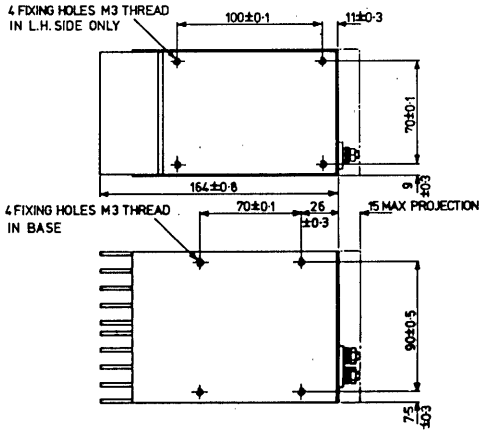
### Mechanical Standard
B.S.4318 preferred metric dimensions and Isometric screws are used.

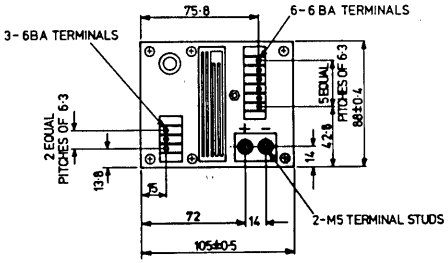
## Dimensions



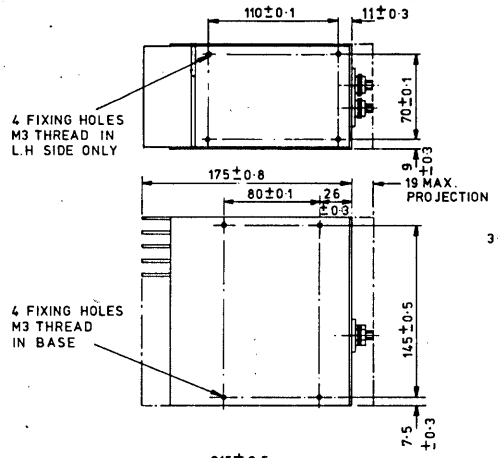



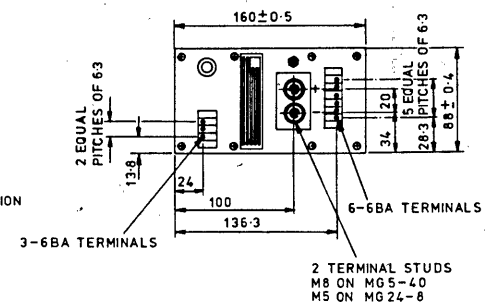

CASE STYLE A
Weight 1·2Kg



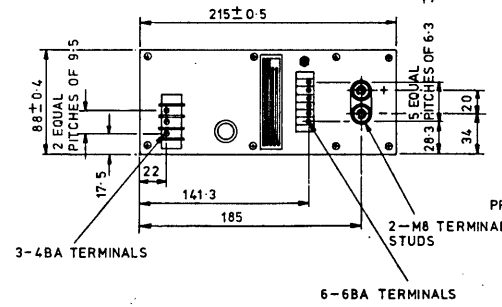



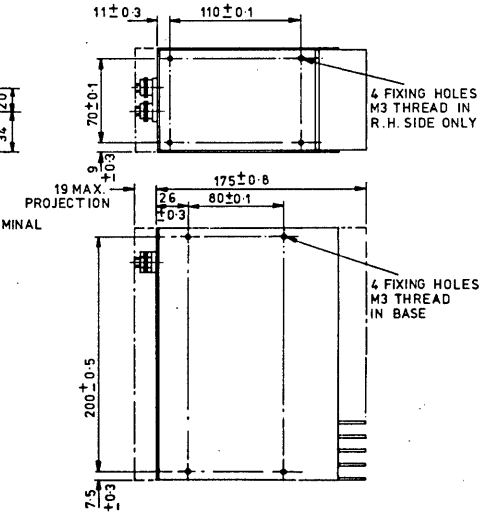

CASE STYLE B
Weight 2·0Kg




CASE STYLE C
Weight 3·4 Kg




CASE STYLE D
Weight 4·5Kg

## Guarantee and service facilities

This instrument is guaranteed for a period of five years from its delivery to the purchaser covering the replacement of defective parts other than fuses.

We maintain comprehensive after sales facilities and the instrument can, if necessary, be returned to our factory for servicing. The Type and Serial Number of the instrument should always be quoted, together with full details of any fault and the service required. The Service Department can also provide maintenance and repair information by telephone or letter.

Equipment returned to us for servicing must be adequately packed preferably in the special box supplied, and shipped with the transportation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be put in hand without delay and charged unless other instructions are received.

OUR SALES, SERVICE AND ENGINEERING DEPARTMENTS ARE READY TO ASSIST YOU AT ALL TIMES.

**Advance Electronics Limited**
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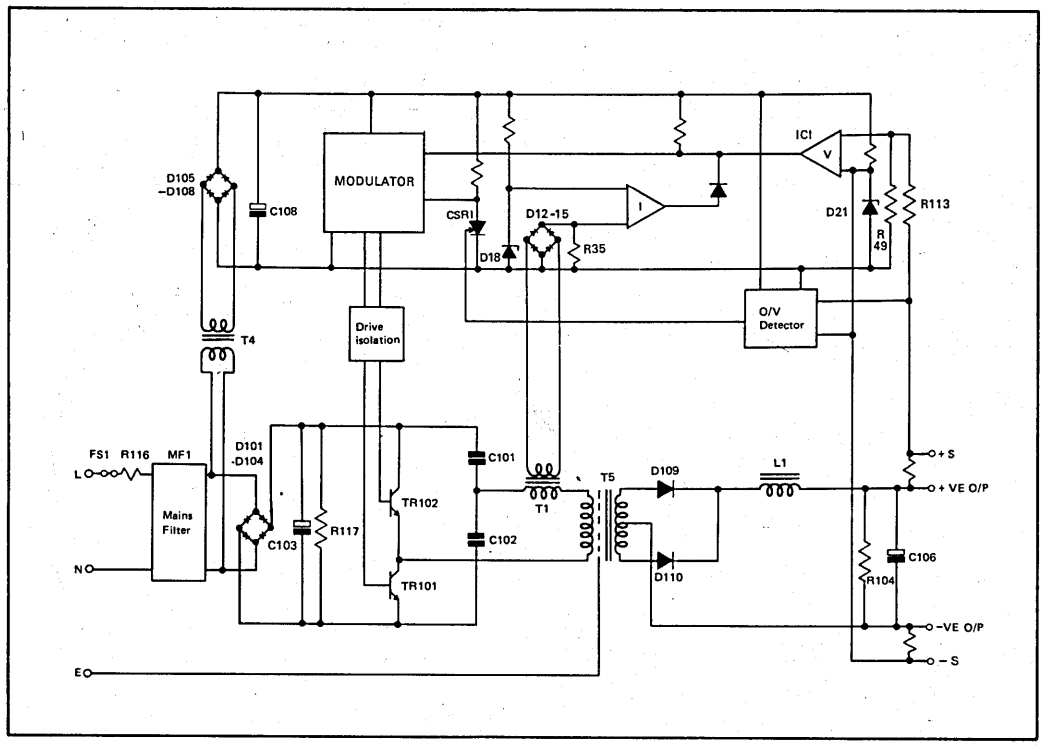



*Fig. 4*

## Voltage control circuit

The output voltage, as sensed at the terminals +S and –S, is fed via the potential divider R113, R49 to the input of the operational amplifier IC1. Here it is compared with the internally generated reference voltage appearing across D21. The amplified error signal at the output of the amplifier is then fed to the modulator. The function of this circuit is to produce two trains of antiphase current pulses of controlled and equal durations, these durations being controlled by the level of the input to the modulator from the error amplifier.

The current pulses are fed to the bases of the inverter transistors TR101, TR102, in such a manner as to cause the transistors to conduct alternately with a period of non conduction, or dwell, in the intervening periods. The voltage waveform thereby impressed on the primary of transformer T5 is stepped down and rectified by D109, D110 to produce a voltage whose D.C. content is a function of the width of the current pulses produced by the modulator and hence of the output of the voltage error amplifier.

The rectified secondary voltage waveform is then filtered by L1, C106, to remove the A.C. content.

## Current control circuit

Overcurrent protection is provided by sensing the A.C. current pulses flowing in the primary of the inverter transformer. (The amplitude of this current is proportional to the magnitude of the D.C. output current.) The A.C. current is transformed by T1 and rectified by the small signal rectifier D12–15. The resulting train of unidirectional current pulses is fed into resistor R35 to produce a voltage waveform. The amplitude of this waveform is compared with the internally generated reference voltage appearing across D18, by the peak-detecting amplifier I. When the amplitude of these pulses reaches a predetermined level, the overcurrent amplifier operates so as to feed a signal into the modulator which overrides the voltage control signal and causes the modulator pulse widths to reduce, thus reducing the output voltage and keeping the output current controlled to the maximum safe level.

## Overvoltage circuit

The output voltage of the unit is monitored at the sense terminals +S and –S and fed to the input of the O/V detector by means of a potential divider. If a fault occurs in either the power supply or its external voltage-sense wiring such that an output overvoltage appears, the O/V detector operates and fires the small signal thyristor CSR1. This has the effect of disabling the modulator so that no drive current pulses are available and the output voltage decays to zero. The power supply will remain at zero until the mains supply is switched off and re-applied.

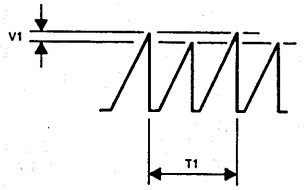
# Maintenance

The plug-in control boards used in the MG units are available as spare parts together with an extension board for use as a servicing aid.

1. Control Board Advance Part No. 63397 (50, 100 and 300 watt units)
2. Control Board Advance Part No. 63761 (200 watt units)
3. Extension Board Advance Part No. 64268

## Setting up procedure for board assembly 63397 & 63761.

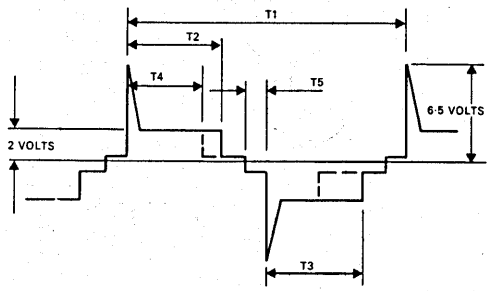
1 Measuring between Pins 3 and 9, the following waveform should be observed.




Adjust R47 to give a time T1 of 36μS.

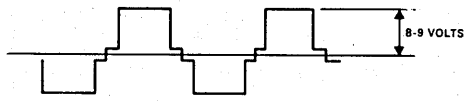
2 Adjust R46 so as to equalize the amplitude of alternate peaks of the waveform, i.e., to minimise the difference voltage V1. When this test has been carried out, time T1 should have reduced to 30μS – 0μS + 1μS.

3 Now monitoring between pins 1 and 2, the following waveform should be observed. (Display set to $Y_1 + Y_2$, $Y_1$ inverted.)




4 Adjust R37 so that T2 and T3 are reduced to T4 which is 7.5μS.

5 Adjust R34 so that T2 and T3 just begin to reduce. At this point the waveform will look as below for Part No. 63397. (For Part No. 63761 waveform will be similar to that in test 3.)

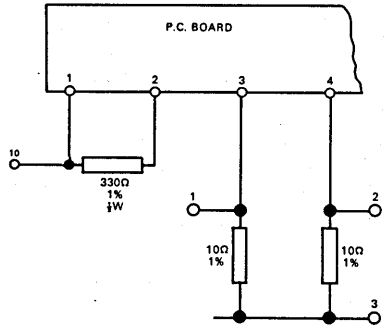



6 Adjust R45 so that the waveform is clamped to zero under an overvoltage signal.

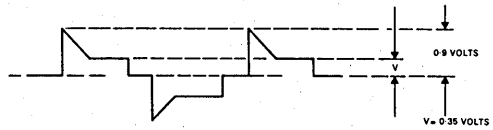
7 Switch the auxiliary voltage from 10.0 volts to 17.5 volts and check that only T2 and T3 reduce in time.

8 Check that T5 does not exceed 1μS during any of the above tests.

9 Extra test for P.C. Assy. 63761

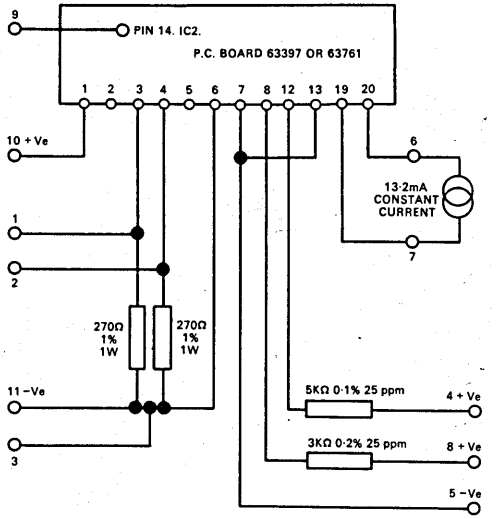



The following waveform should be observed.




Adjust R36 until V = 0.35 Volts.
Fit the nearest E24 range resistor above the measured value of R36.

## Board test circuit (Board No. 63397 & 63761)




*Note:*

Pins 9 + 11 supplied during test 2 (4 to 8 volts, variable)

Pins 4 + 5 supplied during test 4 (5 volts ± 2mV at 10mA)

Pins 6 + 7 supplied during test 5 (13.2mA +0 –0.1mA Constant I)

Pins 8 + 5 supplied during test 6 (6.75 volts ±0.10 volt at 30mA)

| | MG 5 – 10 | | | MG 5 – 20 | | | MG 5 – 40 | | | MG 5 – 60 | | | MG 5 – 60A | | | MG 12 – 8 | | | MG 15 – 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ckt. Ref. | Description | Qty. | Part No. | Description | Qty. | Part No. | Description | Qty. | Part No. | Description | Qty. | Part No. | Description | Qty. | Part No. | Description | Qty. | Part No. | Description | Qty. | Part No. |
| R101 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| R102 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| R103 | RESISTOR M.O. 470R 2% ¼W | 1 | 26739 | RESISTOR W.W. 100R 5% 6W | 1 | 1240 | RESISTOR W.W. 100R 5% 6W | 1 | 1240 | RESISTOR W.W. 33R 5% 6W | 1 | 2277 | RESISTOR W.W. 33R 5% 6W | 1 | 2277 | RESISTOR W.W. 100R 5% 6W | 1 | 1240 | RESISTOR W.W. 100R 5% 6W | 1 | 1240 |
| R104 | NOT USED | | | RESISTOR W.W. 10R 5% 6W | 1 | 19803 | RESISTOR W.W. 8R2 5% 6W | 1 | 19795 | RESISTOR W.W. 4R7 5% 6W | 1 | 19792 | RESISTOR W.W. 4R7 5% 6W | 1 | 19792 | RESISTOR W.W. 12OR 5% 6W | 1 | 3264 | RESISTOR W.W. 15OR 5% 6W | 1 | 19085 |
| R105 | NOT USED | | | NOT USED | | | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | RESISTOR M.O. 100R 2% ¼W | 1 | 26747 | NOT USED | | | NOT USED | | |
| R106 | RESISTOR M.O. 220K 2% ¼W | 1 | 28830 | NOT USED | | | RESISTOR M.O. 27R 2% ¼W | 1 | 28774 | RESISTOR M.O. 39R 2% ¼W | 1 | 28775 | RESISTOR M.O. 39R 2% ¼W | 1 | 28775 | NOT USED | | | NOT USED | | |
| R107 | RESISTOR M.O. 220K 2% ¼W | 1 | 28830 | NOT USED | | | RESISTOR M.O. 33R 2% ¼W | 1 | 26749 | RESISTOR M.O. 33R 2% ¼W | 1 | 26749 | RESISTOR M.O. 33R 2% ¼W | 1 | 26749 | NOT USED | | | NOT USED | | |
| R108 | RESISTOR M.O. 2K7 2% ¼W | 1 | 26728 | RESISTOR M.O. 2K7 2% ¼W | 1 | 26278 | RESISTOR M.O. 2K7 2% ¼W | 1 | 26728 | RESISTOR M.O. 2K7 2% ¼W | 1 | 26728 | RESISTOR M.O. 2K7 2% ¼W | 1 | 26728 | RESISTOR M.O. 6K8 2% ¼W | 1 | 28796 | RESISTOR M.O. 8K2 2% ¼W | 1 | 28798 |
| R109 | POTENTIOMETER 200R 20% ¼W | 1 | 53916 | NOT USED | | | NOT USED | | | RESISTOR M.O. 82R 2% ¼W | 1 | 28781 | RESISTOR M.O. 82R 2% ¼W | 1 | 28781 | NOT USED | | | NOT USED | | |
| R110 | RESISTOR WIRE 30m 00% 000W | 1 | 63859 | NOT USED | | | RESISTOR M.O. 5K6 2% ¼W | 1 | 22483 | RESISTOR M.O. 1K2 2% ¼W | 1 | 26734 | RESISTOR M.O. 1K2 2% ¼W | 1 | 26734 | NOT USED | | | NOT USED | | |
| R111 | RESISTOR C.C. 47R 5% 1W | 1 | 4038 | NOT USED | | | RESISTOR M.O. 430R 2% ¼W | 1 | 26752 | RESISTOR M.O. 560R 2% ¼W | 1 | 26737 | RESISTOR M.O. 560R 2% ¼W | 1 | 26737 | NOT USED | | | NOT USED | | |
| R112 | RESISTOR M.O. 2% ¼W | 1 | A.O.T. | RESISTOR M.O. 2% ¼W | 1 | A.O.T. | RESISTOR M.O. 2% ¼W | 1 | A.O.T. | RESISTOR M.O. 2% ¼W | 1 | A.O.T. | RESISTOR M.O. 2% ¼W | 1 | A.O.T. | RESISTOR M.O. 2% ¼W | 1 | A.O.T | RESISTOR M.O. 2% ¼W | 1 | A.O.T. |
| R113 | RESISTOR M.F. 4K5 1% ¼W | 1 | 52949 | RESISTOR M.F. 4K5 1% ¼W | 1 | 52949 | RESISTOR M.F. 4K5 1% ¼W | 1 | 52949 | RESISTOR M.F. 4K5 1% ¼W | 1 | 52949 | RESISTOR M.F. 4K5 1% ¼W | 1 | 52949 | RESISTOR M.F. 11K 1% ¼W | 1 | 53413 | RESISTOR M.F. 14K 1% ¼W | 1 | 53416 |
| R114 | CONTROL POT. 1K0 10% 1W | 1 | 52925 | CONTROL POT. 1K0 10% 1W | 1 | 52925 | CONTROL POT. 1K0 10% 1W | 1 | 52925 | CONTROL POT. 1K0 10% 1W | 1 | 52925 | CONTROL POT. 1K0 10% 1W | 1 | 52925 | CONTROL POT. 2K0 10% 1W | 1 | 52944 | CONTROL POT. 2K0 10% 1W | 1 | 52944 |
| R115 | NOT USED | | | NOT USED | | | RESISTOR C.C. 10R 5% ¼W | 2 | 21793 | NOT USED | | | NOT USED | | | NOT USED | | | NOT USED | | |
| R116 | RESISTOR W.W. 2R7 5% 2W | 1 | 54015 | RESISTOR W.W. 1R0 10% 3W | 1 | 53613 | RESISTOR W.W. 3R9 10% 2W OR<br>RESISTOR W.W. 3R9 10% 2W OR<br>RESISTOR W.W. 1R8 5% 4W | 4<br>4<br>2 | 53597<br>53598<br>53599 | NOT USED | | | NOT USED | | | RESISTOR W.W. 1R0 10% 3W | 1 | 53613 | RESISTOR W.W. 1R0 10% 3W | 1 | 53613 |
| R117 | RESISTOR W.W. 2R7 5% 2W | 1 | 54015 | RESISTOR M.O. 470K 2% ¼W | 1 | 27574 | RESISTOR C.C. 560K 10% ¼W | 1 | 4409 | RESISTOR C.C. 68K 5% ¼W | 2 | 18572 | RESISTOR C.C. 68K 5% ¼W | 2 | 18572 | RESISTOR M.O. 470K 2% ¼W | 1 | 27574 | RESISTOR M.O. 470K 2% ¼W | 1 | 27574 |
| R118 | | | | NOT USED | | | NOT USED | | | RESISTOR C.C. 10R 5% ¼W | 2 | 21793 | RESISTOR C.C. 10R 5% ¼W | 2 | 21793 | NOT USED | | | NOT USED | | |
| C101 | CAP. POLYESTER 220n 250v | 1 | 53758 | CAP. POLYESTER 470n 250v | 1 | 52886 | CAP. POLYESTER 1µ0 250v | 1 | 51121 | CAP. POLYESTER 1µ5 250v | 1 | 53278 | CAP. POLYESTER 1µ5 250v | 1 | 53278 | CAP. POLYESTER 470n 250v | 1 | 52886 | CAP. POLYESTER 470n 250v | 1 | 52886 |
| C102 | CAP. POLYESTER 220n 250v | 1 | 53758 | CAP. POLYESTER 470n 250v | 1 | 52886 | CAP. POLYESTER 1µ0 250v | 1 | 51121 | CAP. POLYESTER 1µ5 250v | 1 | 53278 | CAP. POLYESTER 1µ5 250v | 1 | 53278 | CAP. POLYESTER 470n 250v | 1 | 52886 | CAP. POLYESTER 470n 250v | 1 | 52886 |
| C103 | CAP. EL. 250µ 200v | 1 | 53756 | CAP. EL. 200µ 400v | 1 | 52881 | CAP. EL. 470µ 400v | 1 | 52914 | CAP. EL. 1m4 200v | 1 | 53097 | CAP. EL. 1m4 200v | 1 | 53097 | CAP. EL. 200µ 400v | 1 | 52881 | CAP. EL. 200µ 400v | 1 | 52881 |
| C104 | CAP. POLYESTER 10n 400v | 1 | 781 | CAP. CERAMIC 10n 250v | 1 | 22395 | CAP. CERAMIC 10n 250v | 1 | 22395 | CAP. POLYESTER 10n 400v | 1 | 781 | CAP. POLYESTER 10n 400v | 1 | 781 | CAP. POLYESTER 4n7 400v | 1 | 776 | CAP. CERAMIC 1n0 500v | 1 | 22387 |
| C105 | CAP. POLYESTER 470p 400v | 1 | 53757 | CAP. POLYESTER 1n0 400v | 1 | 769 | CAP. POLYESTER 2n2 400v | 1 | 53090 | CAP. POLYESTER 3n3 400v | 1 | 774 | CAP. POLYESTER 3n3 400v | 1 | 774 | CAP. POLYESTER 1n0 400v | | 769 | CAP. POLYESTER 1n0 400v | 1 | 769 |
| C106 | CAP. EL. 470µ 6·3v | 10 | 32164 | CAP. EL. 2 x 16m5 6·3v, OR<br>CAP. EL. 33m 6·3v OR 10v | 1 | 52882<br>53882 | CAP. EL. 2 x 16m5, 6·3v, OR<br>CAP. EL. 33m 6·3v OR 10v | 2 | 52882<br>53882 | CAP. EL. 2 x 23m5 6·3v | 2 | 52961 | CAP. EL. 2 x 23m5 6·3v | 1 | 52961 | CAP. EL. 2 x 7m5 16v | 1 | 52784 | CAP. EL. 2 x 5m0 25v | 1 | 52867 |
| C107 | CAP. TANT. 10µ 25v | 1 | 52937 | NOT USED | | | CAP. CERAMIC 100n 30v | 1 | 19647 | CAP. TANT. 33µ 10v | 1 | 52936 | CAP. TANT. 33µ 10v | 1 | 52936 | CAP. TANT. 10µ 35v | 1 | 53106 | CAP. TANT. 10µ 35v | 1 | 53106 |
| C108 | CAP. EL. 470µ 25v | 1 | 32185 | CAP. EL 470µ 25v | 1 | 32185 | CAP. EL. 470µ 25v | 2 | 32185 | CAP. EL. 1m0 25v | 1 | 32186 | CAP. EL. 1m0 25v | 1 | 32186 | CAP. EL. 470µ 25v | 1 | 32185 | CAP. EL. 470µ 25v | 1 | 32185 |
| C109 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 |
| C110 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 | CAP. CERAMIC 5n6 500v | 1 | 22394 |
| C111 | CAP. POLYESTER 100n 160v | 1 | 804 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 47n 250v | 1 | 31375 | CAP. POLYESTER 47n 250v | 1 | 31375 |
| C112 | CAP. CERAMIC 100n 30v | 1 | 19647 | CAP. CERAMIC 100n 30v | 1 | 19647 | CAP. CERAMIC 100n 30v | 1 | 19647 | CAP. CERAMIC 100n 30v | 2 | 19647 | CAP. CERAMIC 100n 30v | 2 | 19647 | CAP. CERAMIC 100n 30v | 1 | 19647 | CAP. CERAMIC 100n 30v | 1 | 19647 |
| C113 | NOT USED | | | CAP. CERAMIC 5n0 3Kv | 1 | 1514 | CAP. CERAMIC 5n0 3Kv | 1 | 1514 | CAP. CERAMIC 5n0 3Kv | 1 | 1514 | CAP. CERAMIC 5n0 3kv | 1 | 1514 | CAP. CERAMIC 5n0 3kv | 1 | 1514 | CAP. CERAMIC 5n0 3Kv | 1 | 1514 |
| C114 | CAP. POLYESTER 4n7 250v | 1 | 53099 | CAP. POLYESTER 4n7 250v | 1 | 53046 | CAP. POLYESTER 10n 250v | 1 | 53102 | CAP. POLYESTER 10n 250v | 1 | 53102 | CAP. POLYESTER 10n 250v | 1 | 53102 | CAP. POLYESTER 4n7 250v | 1 | 53046 | CAP. POLYESTER 4n7 250v | 1 | 53046 |
| C115 | CAP. POLYESTER 47n 250v | 1 | 53100 | NOT USED | | | NOT USED | | | CAP. POLYESTER 47n 250v | 1 | 53100 | CAP. POLYESTER 47n 250v | 1 | 53100 | NOT USED | | | NOT USED | | |
| C116 | CAP. POLYESTER 4n7 250v | 1 | 53099 | NOT USED | | | NOT USED | | | CAP. POLYESTER 4n7 250v | 1 | 53099 | CAP. POLYESTER 10n 250v | 1 | 53102 | NOT USED | | | NOT USED | | |
| C117 | CAP. POLYESTER 4n7 250v | 1 | 53099 | NOT USED | | | NOT USED | | | CAP. POLYESTER 4n7 250v | 1 | 53099 | CAP. POLYESTER 10n 250v | 1 | 53102 | NOT USED | | | NOT USED | | |
| C118 | CAP. POLYESTER 33n 250v | 1 | 53101 | NOT USED | | | NOT USED | | | CAP. POLYESTER 33n 250v | 1 | 53101 | CAP. POLYESTER 33n 250v | 1 | 53101 | NOT USED | | | NOT USED | | |
| C119 | CAP. POLYESTER 100n 160v | 1 | 804 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 | CAP. POLYESTER 100n 160v | 1 | 31377 |
| C120 | NOT USED | | | NOT USED | | | NOT USED | | | CAP. CERAMIC 10n 250v | 2 | 22395 | CAP. CERAMIC 10n 250v | 2 | 22395 | NOT USED | | | NOT USED | | |
| C121 | CAP. EL. 250µ 200v | 1 | 53756 | NOT USED | | | NOT USED | | | CAP. EL. 1m4 200v | 1 | 53097 | CAP. EL. 1m4 200v | 1 | 53097 | NOT USED | | | NOT USED | | |
| C122 | NOT USED | | | NOT USED | | | CAP. CERAMIC 1n0 500v | 1 | 22387 | NOT USED | | | NOT USED | | | NOT USED | | | NOT USED | | |
| C123 | NOT USED | | | NOT USED | | | NOT USED | | | NOT USED | | | NOT USED | | | NOT USED | | | NOT USED | | |
| D101 | NOT USED | | | RECTIFIER BRIDGE S8MB9 | 1 | 53229 | RECTIFIER BRIDGE S8MB9 | 1 | 53229 | DIODE MR756 | 1 | 53098 | DIODE MR756 | 1 | 53098 | RECTIFIER BRIDGE S8MB9 | 1 | 53229 | RECTIFIER BRIDGE S8MB9 | 1 | 53229 |
| D102 | NOT USED | | | | | | | | | DIODE MR756 | 1 | 53098 | DIODE MR756 | 1 | 53098 | | | | | | |
| D103 | DIODE IN4148 | 1 | 23802 | | | | | | | DIODE MR756 | 1 | 53098 | DIODE MR756 | 1 | 53098 | | | | | | |
| D104 | DIODE IN4148 | 1 | 23802 | | | | | | | DIODE MR756 | 1 | 53098 | DIODE MR756 | 1 | 53098 | | | | | | |
| D105 | DIODE IN4007 | 1 | 52337 | DIODE IN4003 | 1 | 23462 | DIODE IN 4003 | 1 | 23462 | RECTIFIER BRIDGE W02 | 1 | 19725 | RECTIFIER BRIDGE W02 | 1 | 19725 | DIODE IN4003 | 1 | 23462 | DIODE IN4003 | 1 | 23462 |
| D106 | DIODE IN4007 | 1 | 52337 | DIODE IN4003 | 1 | 23462 | DIODE IN 4003 | 1 | 23462 | | | | | | | DIODE IN4003 | 1 | 23462 | DIODE IN4003 | 1 | 23462 |
| D107 | DIODE IN4007 | 1 | 52337 | DIODE IN4003 | 1 | 23462 | DIODE IN 4003 | 1 | 23462 | | | | | | | DIODE IN4003 | 1 | 23462 | DIODE IN4003 | 1 | 23462 |
| D108 | DIODE IN4007 | 1 | 52337 | DIODE IN4003 | 1 | 23462 | DIODE IN 4003 | 1 | 23462 | | | | | | | DIODE IN4003 | 1 | 23462 | DIODE IN4003 | 1 | 23462 |
| D109 | DIODE EF150N6, OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 | DIODE MBR4020 P/F | 1 | 52885 | DIODE SELECTED MBR4020 P/F | 1 | 63545 | DIODE SELECTED MBR4020 P/F | 2 | 63545 | DIODE SELECTED MBR4020 P/F | 2 | 63545 | DIODE EF150N6 'OR'<br>DIODE BYX61-200 | 1 | 52946<br>53810 | DIODE EF150N6 OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 |
| D110 | DIODE EF150N6, OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 | DIODE MBR4020 P/F | 1 | 52885 | DIODE SELECTED MBR4020 P/F | 1 | 63545 | DIODE SELECTED MBR4020 P/F | 2 | 63545 | DIODE SELECTED MBR4020 P/F | 2 | 63545 | DIODE EF150N6 'OR'<br>DIODE BYX61-200 | 1 | 52946<br>53810 | DIODE EF150N6 OR<br>DIODE BYX 61-200 | 1 | 52946<br>53810 |
| MR101 | RECTIFIER BRIDGE W02 | 1 | 19725 | | | | | | | | | | | | | | | | | | |
| TR101<br>TR102 | TRANSISTOR MATCHED PAIR | 1 | 63828 | MATCHED PAIR BDY93<br>OR BDY 28 AD | 1 | 62165 | MATCHED PAIR MST1092<br>OR BDY28AD | 1 | 62119 | MATCHED PAIR SVT350-5 | 1 | 62094 | MATCHED PAIR SVT 350-5 | 1 | 62094 | MATCHED PAIR BDY93<br>OR BDY 28AD | 1 | 62165 | MATCHED PAIR BDY 93<br>OR BDY 28 AD | 1 | 62165 |
| L1 | CHOKE OUTPUT | 1 | 63831 | CHOKE OUTPUT | 1 | 61176 | CHOKE OUTPUT | 1 | 61327 | CHOKE OUTPUT | 1 | 61595 | CHOKE OUTPUT | 1 | 61595 | CHOKE OUTPUT | 1 | 61542 | CHOKE OUTPUT | 1 | 61542 |
| L2 | CHOKE SYMMETRIC | 1 | 63836 | NOT USED | | | NOT USED | | | CHOKE SYMMETRIC | 1 | 62074 | CHOKE SYMMETRIC | 1 | 62074 | NOT USED | | | NOT USED | | |
| L3 | CHOKE SYMMETRIC | 1 | 63836 | NOT USED | | | NOT USED | | | CHOKE SYMMETRIC | 1 | 62074 | CHOKE SYMMETRIC | 1 | 62187 | NOT USED | | | NOT USED | | |
| L4 | CHOKE ASSYMETRIC | 1 | 63837 | NOT USED | | | NOT USED | | | CHOKE ASYMMETRIC | 1 | 62075 | CHOKE ASYMMETRIC | 1 | 62188 | NOT USED | | | NOT USED | | |
| L5 | NOT USED | | | NOT USED | | | NOT USED | | | FERRITE RING | 1 | 53315 | FERRITE RING | 1 | 53315 | NOT USED | | | NOT USED | | |
| L6 | NOT USED | | | NOT USED | | | NOT USED | | | FERRITE RING | 1 | 53315 | FERRITE RING | 1 | 53315 | | | | | | |
| | P.C. BOARD ASSY. | | 63397 | P.C. BOARD ASSY. | 1 | 63397 | P.C. BOARD ASSY. | 1 | 63761 | P.C. BOARD ASSY. | 1 | 63397 | P.C. BOARD ASSY. | 1 | 63397 | P.C. BOARD ASSY. | 1 | 63397 | P.C. BOARD ASSY. | 1 | 63397 |
| MF1 | NOT USED | | | MAINS FILTER | 1 | 52935 | MAINS FILTER | 1 | 52974 | NOT USED | | | NOT USED | | | MAINS FILTER | 1 | 52935 | MAINS FILTER | 1 | 52935 |
| T1 | TRANSFORMER – CURRENT SENSE | 1 | 63841 | TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61545 | TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 | TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 | TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 | TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61545 | TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61545 |
| T2 | TRANSFORMER – DRIVE | 1 | 63840 | | | | | | | | | | | | | | | | | | |
| T4 | TRANSFORMER – AUXILIARY | 1 | 64267 | TRANSFORMER – AUXILIARY | 1 | 64275 | TRANSFORMER – AUXILIARY | 1 | 64276 | TRANSFORMER – AUXILIARY | 1 | 64276 | TRANSFORMER – AUXILIARY | 1 | 64276 | TRANSFORMER – AUXILIARY | 1 | 64275 | TRANSFORMER – AUXILIARY | 1 | 64275 |
| T5 | TRANSFORMER – OUTPUT | 1 | 63830 | TRANSFORMER – OUPUT | 1 | 61177 | TRANSFORMER – OUTPUT | 1 | 61324 | TRANSFORMER – OUTPUT | 1 | 61590 | TRANSFORMER – OUTPUT | 1 | 61590 | TRANSFORMER – OUTPUT | 1 | 61544 | TRANSFORMER – OUTPUT | 1 | 62327 |
| GS1 | GUARD SHIELD – TRANSISTOR | 1 | 63843 | GUARD SHIELD – TRANSISTOR | 1 | 61172 | GUARD SHIELD – TRANSISTOR | 1 | 61172 | GUARD SHIELD – TRANSISTOR | 1 | 61172 | GUARD SHIELD – TRANSISTOR | 1 | 61172 | GUARD SHIELD – TRANSISTOR | 1 | 61172 | GUARD SHIELD – TRANSISTOR | 1 | 61172 |
| GS2 | NOT USED | | | GUARD SHIELD – DIODE | 1 | 61171 | GUARD SHIELD – DIODE | 1 | 61171 | GUARD SHIELD – DIODE | 1 | 61171 | GUARD SHIELD – DIODE | 1 | 61171 | GUARD SHIELD – DIODE | 1 | 52966 | GUARD SHIELD – DIODE | 1 | 52966 |
| FS1 | FUSE 2·5A CERAMIC 5 x 20mm | 1 | 53788 | FUSE 5amp CERAMIC 5 x 20 mm | 1 | 52877 | FUSE 6·3amp CERAMIC 5 x 20mm | 1 | 52990 | FUSE 10amp CERAMIC SIZE '0' | 1 | 4227 | FUSE 10amp CERAMIC SIZE '0' | 1 | 4227 | FUSE 5amp CERAMIC 5 x 20mm | 1 | 52877 | FUSE 5amp CERAMIC 5 x 20mm | 1 | 52877 |

## MG 15 – 14

| Description | Qty. | Part No. |
|---|---|---|
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR W.W. 100R 5% 6W | 1 | 1240 |
| RESISTOR W.W. 120R 5% 6W | 1 | 3264 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 27R 2% ¼W | 1 | 28774 |
| RESISTOR M.O. 33R 2% ¼W | 1 | 26749 |
| RESISTOR M.O. 8K2 2% ¼W | 1 | 28798 |
| NOT USED | | |
| RESISTOR M.O. 5K6 2% ¼W | 1 | 22483 |
| RESISTOR M.O. 430R 2% ¼W | 1 | 26752 |
| RESISTOR M.O. 2% ¼W | 1 | A.O.T. |
| RESISTOR M.F. 14K 1% ¼W | 1 | 53416 |
| CONTROL POT. 2K0 10% 1W | 1 | 52944 |
| RESISTOR C.C. 10R 5% ¼W | 2 | 21793 |
| RESISTOR W.W. 3R9 10% 2W OR<br>RESISTOR W.W. 3R9 10% 2W OR<br>RESISTOR W.W. 1R8 5% 4W | 4<br>4<br>2 | 53597<br>53598<br>53599 |
| RESISTOR C.C. 560K 10% ¼W | 1 | 4409 |
| NOT USED | | |
| CAP. POLYESTER 1µ0 250v | 1 | 51121 |
| CAP. POLYESTER 1µ0 250v | 1 | 51121 |
| CAP. EL. 470µ 400v | 1 | 52914 |
| CAP. POLYESTER 1n0 400v | 1 | 769 |
| CAP. POLYESTER 2n2 400v | 1 | 53090 |
| CAP. EL. 2 x 5m0 25v | 2 | 52867 |
| CAP. TANT. 10µ 35v | 1 | 53106 |
| CAP. EL. 470µ 25v | 2 | 32185 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. POLYESTER 22n 160v | 1 | 31373 |
| CAP. CERAMIC 100n 30v | 1 | 19647 |
| CAP. CERAMIC 5n0 3Kv | 1 | 1514 |
| CAP. POLYESTER 4n7 250v | 1 | 53046 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| CAP. POLYESTER 100n 160v | 1 | 31377 |
| NOT USED | | |
| NOT USED | | |
| CAP. CERAMIC 1n0 500v | 1 | 22387 |
| NOT USED | | |
| RECTIFIER BRIDGE S8MB9 | 1 | 53229 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE EF150N12 OR<br>DIODE BYX61-200 | 1 | 53184<br>53810 |
| DIODE EF150N12 OR<br>DIODE BYX 61-200 | 1 | 53184<br>53810 |
| MATCHED PAIR MST 1092<br>OR BDY 28AD | 1 | 62119 |
| CHOKE OUTPUT | 1 | 63484 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| P.C. BOARD ASSY. | 1 | 63761 |
| MAINS FILTER | 1 | 52974 |
| TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 |
| TRANSFORMER – AUXILIARY | 1 | 64276 |
| TRANSFORMER – OUTPUT | 1 | 63483 |
| GUARD SHIELD – TRANSISTOR | 1 | 61172 |
| GUARD SHIELD – DIODE | 1 | 52966 |
| FUSE 6·3amp CERAMIC 5 x 20mm | 1 | 52990 |

## MG 24 – 4

| Description | Qty. | Part No. |
|---|---|---|
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR W.W. 100R 5% 6W | 1 | 1240 |
| RESISTOR W.W. 470R 5% 6W | 1 | 231 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| RESISTOR M.F. 13K5 2% ¼W | 1 | 52994 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| RESISTOR M.O. 2% ¼W | 1 | A.O.T. |
| RESISTOR M.F. 21K5 1% ¼W | 1 | 53424 |
| CONTROL POT. 5K0 10% 1W | 1 | 52945 |
| NOT USED | | |
| RESISTOR W.W. 1R0 10% 3W | 1 | 53613 |
| NOT USED | | |
| RESISTOR M.O. 470K 2% ¼W | 1 | 27574 |
| NOT USED | | |
| CAP. POLYESTER 470n 250v | 1 | 52886 |
| CAP. POLYESTER 470n 250v | 1 | 52886 |
| CAP. EL. 200µ 400v | 1 | 52881 |
| CAP. CERAMIC 1n0 500v | 1 | 22387 |
| CAP. POLYESTER 1n0 400v | 1 | 769 |
| CAP. EL. 2 x 3m4 40v | 1 | 52870 |
| CAP. TANT. 10µ 35v | 1 | 53106 |
| CAP. EL. 470µ 25v | 1 | 32185 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. POLYESTER 22n | 1 | 31373 |
| CAP. CERAMIC 100n 30v | 1 | 19647 |
| CAP. CERAMIC 5n0 3Kv | 1 | 1514 |
| CAP. POLYESTER 4n7 250v | 1 | 53046 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| CAP. POLYESTER 100n 160v | 1 | 31377 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| RECTIFIER BRIDGE S8MB9 | 1 | 53229 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE EF150N6 OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 |
| DIODE EF150N6 OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 |
| MATCHED PAIR BDY93<br>OR BDY 28AD | 1 | 62165 |
| CHOKE OUTPUT | 1 | 61553 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| P.C. BOARD ASSY. | 1 | 63397 |
| MAINS FILTER | 1 | 52935 |
| TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61545 |
| TRANSFORMER – AUXILIARY | 1 | 64275 |
| TRANSFORMER – OUTPUT | 1 | 61555 |
| GUARD SHIELD – TRANSISTOR | 1 | 61172 |
| GUARD SHIELD – DIODE | 1 | 52966 |
| FUSE 5amp CERAMIC 5 x 20mm | 1 | 52877 |

## MG 24 – 8

| Description | Qty. | Part No. |
|---|---|---|
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR W.W. 100R 5% 6W | 1 | 1240 |
| RESISTOR W.W. 270R 5% 6W | 1 | 19641 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 27R 2% ¼W | 1 | 28774 |
| RESISTOR M.O. 33R 2% ¼W | 1 | 26749 |
| RESISTOR M.O. 13K5 2% ¼W | 1 | 52994 |
| NOT USED | | |
| RESISTOR M.O. 5K6 2% ¼W | 1 | 22483 |
| RESISTOR M.O. 430R 2% ¼W | 1 | 26752 |
| RESISTOR M.O. 2% ¼W | 1 | A.O.T. |
| RESISTOR M.F. 21K5 1% ¼W | 1 | 53424 |
| CONTROL POT. 5K0 10% 1W | 1 | 52945 |
| RESISTOR C.C. 10R 5% ¼W | 2 | 21793 |
| RESISTOR W.W. 3R9 10% 2W OR<br>RESISTOR W.W. 3R9 10% 2W OR<br>RESISTOR W.W. 1R8 5% 4W | 4<br>4<br>2 | 53597<br>53598<br>53599 |
| RESISTOR C.C. 560K 10% ¼W | 1 | 4409 |
| NOT USED | | |
| CAP. POLYESTER 1µ0 250v | 1 | 51121 |
| CAP. POLYESTER 1µ0 250v | 1 | 51121 |
| CAP. EL. 470µ 400v | 1 | 52914 |
| CAP. POLYESTER 1n0 400v | 1 | 769 |
| CAP. POLYESTER 2n2 400v | 1 | 53090 |
| CAP. EL. 2 x 3m4 40v | 2 | 52870 |
| CAP. TANT. 10µ 35v | 1 | 53106 |
| CAP. EL. 470µ 25v | 2 | 32185 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. CERAMIC 22n 250v | 1 | 31373 |
| CAP. CERAMIC 100n 30v | 1 | 19647 |
| CAP. CERAMIC 5n0 3Kv | 1 | 1514 |
| CAP. POLYESTER 10n 250v | 1 | 53102 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| CAP. POLYESTER 100n 160v | 1 | 31377 |
| NOT USED | | |
| NOT USED | | |
| CAP. CERAMIC 1n0 500v | 1 | 22387 |
| NOT USED | | |
| RECTIFIER BRIDGE S8MB9 | 1 | 53229 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE IN4003 | 1 | 23462 |
| DIODE EF150N6 OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 |
| DIODE EF150N6 OR<br>DIODE BYX61-200 | 1 | 52946<br>53810 |
| MATCHED PAIR MST1092<br>OR BDY28AD | 1 | 62119 |
| CHOKE OUTPUT | 1 | 61694 |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| NOT USED | | |
| P.C. BOARD ASSY. | 1 | 63761 |
| MAINS FILTER | 1 | 52974 |
| TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 |
| TRANSFORMER – AUXILIARY | 1 | 64276 |
| TRANSFORMER – OUTPUT | 1 | 61693 |
| GUARD SHIELD – TRANSISTOR | 1 | 61172 |
| GUARD SHIELD – DIODE | 1 | 52966 |
| FUSE 6·3amp CERAMIC 5 x 20mm | 1 | 52990 |

## MG 24 – 12

| Description | Qty. | Part No. |
|---|---|---|
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR W.W. 33R 5% 6W | 1 | 2277 |
| RESISTOR W.W. 180R 5% 6W | 1 | 2210 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 39R 2% ¼W | 1 | 28775 |
| RESISTOR M.O. 33R 2% ¼W | 1 | 26749 |
| RESISTOR M.F. 13K5 2% ¼W | 1 | 52994 |
| RESISTOR M.O. 82R 2% ¼W | 1 | 28781 |
| RESISTOR M.O. 1K2 2% ¼W | 1 | 26734 |
| RESISTOR M.O. 560R 2% ¼W | 1 | 26737 |
| RESISTOR M.O. 2% ¼W | 1 | A.O.T. |
| RESISTOR M.F. 21K5 1% ¼W | 1 | 53424 |
| CONTROL POT. 5K0 10% 1W | 1 | 52945 |
| NOT USED | | |
| NOT USED | | |
| RESISTOR C.C. 68K 5% ¼W | 2 | 18572 |
| RESISTOR C.C. 10R 5% ¼W | 2 | 21793 |
| CAP. POLYESTER 1µ5 250v | 1 | 53278 |
| CAP. POLYESTER 1µ5 250v | 1 | 53278 |
| CAP. EL. 1m4 200v | 1 | 53097 |
| CAP. POLYESTER 1n0 400v | 1 | 769 |
| CAP. POLYESTER 3n3 400v | 1 | 774 |
| CAP. EL. 2 x 5m0 40v | 1 | 52871 |
| CAP. TANT. 10µ 35v | 1 | 53106 |
| CAP. EL. 1m0 25v | 1 | 32186 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. POLYESTER 22n 160v | 1 | 788 |
| CAP. CERAMIC 100n 30v | 2 | 19647 |
| CAP. CERAMIC 5n0 3Kv | 1 | 1514 |
| CAP. POLYESTER 10n 250v | 1 | 53102 |
| CAP. POLYESTER 47n 250v | 1 | 53100 |
| CAP. POLYESTER 4n7 250v | 1 | 53099 |
| CAP. POLYESTER 4n7 250v | 1 | 53099 |
| CAP. POLYESTER 33n 250v | 1 | 53101 |
| CAP. POLYESTER 100n 160v | 1 | 31377 |
| CAP. POLYESTER 1n0 400v | 1 | 769 |
| CAP. EL. 1m4 200v | 1 | 53097 |
| NOT USED | | |
| CAP. CERAMIC 1n5 500v | 1 | 22388 |
| DIODE MR756 | 1 | 53098 |
| DIODE MR756 | 1 | 53098 |
| DIODE MR756 | 1 | 53098 |
| DIODE MR756 | 1 | 53098 |
| RECTIFIER BRIDGE WO2 | 1 | 19725 |
| DIODE EF150N12 OR<br>DIODE BYX61-200 | 1 | 53184<br>53810 |
| DIODE EF150N12 OR<br>DIODE BYX61-200 | 1 | 53184<br>53810 |
| MATCHED PAIR SVT350-5 | 1 | 62094 |
| CHOKE OUTPUT | 1 | 62635 |
| CHOKE SYMMETRIC | 1 | 62074 |
| CHOKE SYMMETRIC | 1 | 62074 |
| CHOKE ASYMMETRIC | 1 | 62075 |
| FERRITE RING | 1 | 53315 |
| FERRITE RING | 1 | 53315 |
| P.C. BOARD ASSY. | 1 | 63397 |
| NOT USED | | |
| TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 |
| TRANSFORMER – AUXILIARY | 1 | 64276 |
| TRANSFORMER – OUTPUT | 1 | 61590 |
| GUARD SHIELD – TRANSISTOR | 1 | 61172 |
| GUARD SHIELD – DIODE | 1 | 61171 |
| FUSE 10amp CERAMIC SIZE '0' | 1 | 4227 |

## MG 24 – 12A

| Description | Qty. | Part No. |
|---|---|---|
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR W.W. 33R 5% 6W | 1 | 2277 |
| RESISTOR W.W. 180R 5% 6W | 1 | 2210 |
| RESISTOR M.O. 100R 2% ¼W | 1 | 26747 |
| RESISTOR M.O. 39R 2% ¼W | 1 | 28775 |
| RESISTOR M.O. 33R 2% ¼W | 1 | 26749 |
| RESISTOR M.F. 13K5 2% ¼W | 1 | 52994 |
| RESISTOR M.O. 82R 2% ¼W | 1 | 28781 |
| RESISTOR M.O. 1K2 2% ¼W | 1 | 26734 |
| RESISTOR M.O. 560R 2% ¼W | 1 | 26737 |
| RESISTOR M.O. 2% ¼W | 1 | A.O.T. |
| RESISTOR M.F. 21K5 1% ¼W | 1 | 53424 |
| CONTROL POT. 5K0 10% 1W | 1 | 52945 |
| NOT USED | | |
| NOT USED | | |
| RESISTOR C.C. 68K 5% ¼W | 2 | 18572 |
| RESISTOR C.C. 10R 5% ¼W | 2 | 21793 |
| CAP. POLYESTER 1µ5 250v | 1 | 53278 |
| CAP. POLYESTER 1µ5 250v | 1 | 53278 |
| CAP. EL. 1m4 200v | 1 | 53097 |
| CAP. POLYESTER 1n0 250v | 1 | 769 |
| CAP. POLYESTER 3n3 400v | 1 | 774 |
| CAP. EL. 2 x 5m0 40v | 1 | 52871 |
| CAP. TANT. 10µ 35v | 1 | 53106 |
| CAP. EL. 1m0 25v | 1 | 32186 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. CERAMIC 5n6 500v | 1 | 22394 |
| CAP. POLYESTER 22n 160v | 1 | 788 |
| CAP. CERAMIC 100n 30v | 2 | 19647 |
| CAP. CERAMIC 5n0 3Kv | 1 | 1514 |
| CAP. POLYESTER 10n 250v | 1 | 53102 |
| CAP. POLYESTER 47n 250v | 1 | 53100 |
| CAP. POLYESTER 10n 250v | 1 | 53102 |
| CAP. POLYESTER 33n 250v | 1 | 53101 |
| CAP. POLYESTER 100n 160v | 1 | 31377 |
| CAP. POLYESTER 1n0 400v | 1 | 769 |
| CAP. POLYESTER 1n0 400v | 1 | 53097 |
| NOT USED | | |
| CAP. CERAMIC 1n5 500v | 1 | 22388 |
| DIODE MR756 | 1 | 53098 |
| DIODE MR756 | 1 | 53098 |
| DIODE MR756 | 1 | 53098 |
| DIODE MR756 | 1 | 53098 |
| RECTIFIER BRIDGE WO2 | 1 | 19725 |
| DIODE EF150N12 OR<br>DIODE BYX61-200 | 1 | 53184<br>53810 |
| DIODE EF150N12 OR<br>DIODE BYX61-200 | 1 | 53184<br>53810 |
| MATCHED PAIR SVT350-5 | 1 | 62094 |
| CHOKE OUTPUT | 1 | 62635 |
| CHOKE SYMMETRIC | 1 | 62187 |
| CHOKE SYMMETRIC | 1 | 62187 |
| CHOKE ASSYMETRIC | 1 | 62188 |
| FERRITE RING | 1 | 53315 |
| FERRITE RING | 1 | 53315 |
| P.C. BOARD ASSY. | 1 | 63397 |
| NOT USED | | |
| TRANSFORMER – CURRENT SENSE<br>TRANSFORMER – DRIVE | 1 | 61591 |
| TRANSFORMER – AUXILIARY | 1 | 64276 |
| TRANSFORMER – OUTPUT | 1 | 61590 |
| GUARD SHIELD – TRANSISTOR | 1 | 61172 |
| GUARD SHIELD – DIODE | 1 | 61171 |
| FUSE 10amp CERAMIC SIZE '0' | 1 | 4227 |

## P.C. BOARD ASSY. 63397 AND 63761.

| Ct. Ref. | Description | Qty. | Part No. |
|---|---|---|---|
| R1 | RESISTOR 3K9 5% | | |
| R2 | RESISTOR 6K8 5% | | |
| R3 | RESISTOR 6K8 5% (RESISTOR | | |
| R4 | RESISTOR 3K9 5% MODULE | 1 | 63478 |
| R6 | RESISTOR 12K 5% RM1 | | |
| R7 | RESISTOR 100R 5% | | |
| R9 | RESISTOR 1K0 5% | | |
| R10 | RESISTOR 2K7 5% (RESISTOR | | |
| R11 | RESISTOR 2K2 5% MODULE | 1 | 63400 |
| R13 | RESISTOR 330R 5% RM3 | | |
| R14 | RESISTOR 1K0 5% | | |
| R5 | RESISTOR 390R 5% | | |
| R8 | RESISTOR 100R 5% (RESISTOR | | |
| R15 | RESISTOR 220R 5% MODULE | 1 | 63399 |
| R16 | RESISTOR 1K0 5% RM2 | | |
| R20 | RESISTOR 820R 5% | | |
| R21 | RESISTOR 220R 5% | | |
| R24 | RESISTOR M.O. 680R 2% ¼W | 1 | 22484 |
| R25 | RESISTOR M.O. 47K 5% ¼W | 1 | 53624 |
| R27 | RESISTOR M.O. 1K0 5% ¼W | 1 | 28593 |
| R28 | RESISTOR M.O. 4K7 5% ¼W | 1 | 52122 |
| R29 | RESISTOR M.O. 2K7 5% ¼W | 1 | 52121 |
| R30 | RESISTOR M.O. 150R 5% ¼W | 1 | 28605 |
| R31 | RESISTOR M.O. 10R 5% ¼W | 1 | 28588 |
| R32 | RESISTOR M.O. 22K 5% ¼W | 1 | 53623 |
| R33 | RESISTOR M.O. 5K6 5% ¼W | 1 | 28603 |
| R34 | RESISTOR M.O. 5% ¼W | 1 | A.O.T. |
| R35 | RESISTOR M.O. 510R 5% ¼W | 1 | 53621 |
| R37 | RESISTOR M.O. 5% ¼W | 1 | A.O.T. |
| R38 | RESISTOR M.O. 1K5 5% ¼W | 1 | 25903 |
| R39 | RESISTOR M.O. 120R 2% ¼W | 1 | 26746 |
| R40 | RESISTOR M.O. 2K2 5% ¼W | 1 | 28607 |
| R41 | RESISTOR M.O. 3K3 5% ¼W | 1 | 53622 |
| R42 | RESISTOR M.O. 220R 5% ¼W | 1 | 28600 |
| R43 | RESISTOR M.O. 300R 5% ¼W | 1 | 28611 |
| R44 | THERMISTOR 220R 10% | 1 | 50786 |
| R45 | RESISTOR M.O. 5% ¼W | 1 | A.O.T. |
| R46 | RESISTOR M.O. 5% ¼W | 1 | A.O.T. |
| R47 | RESISTOR M.O. 5% ¼W | 1 | A.O.T. |
| R48 | RESISTOR M.O. 5K6 5% ¼W | 1 | 28603 |
| R49 | RESISTOR M.F. 6K8 1% ¼W | 1 | 52950 |
| R50 | RESISTOR M.O. 180K 5% ¼W | 1 | 53625 |
| R51 | RESISTOR M.O. 2K7 5% ¼W | 1 | 52121 |
| C2 | CAP. POLYSTY' 6n8 30v | 1 | 52939 |
| C3 | CAP. POLYSTY' 6n8 30v | 1 | 52939 |
| C5 | CAP. POLYESTER 22n 250v<br>OR CAP. POLYESTER 22n 400v | 1 | 53620 |
| C6 | CAP. TANT. 10µ 10v | 1 | 52938 |
| C7 | CAP. TANT. 33µ 10v | 1 | 52936 |
| C9 | CAP. CERAMIC 100n 10v OR<br>CAP. CERAMIC 47n 12v | 1 | 51093<br>19657 |
| C10 | CAP. TANT. 220n 35v | 1 | 53784 |
| C12 | CAP. CERAMIC 1n5 500v | 1 | 22388 |
| C13 | CAP. CERAMIC 100n 10v OR<br>CAP. CERAMIC 47n 12v | 1 | 51093<br>19657 |
| C14 | CAP. CERAMIC 27p 500v | 1 | 22369 |
| D1 | DIODE IN4148 | 1 | 23802 |
| D2 | DIODE IN4148 | 1 | 23802 |
| D4 | DIODE IN4148 | 1 | 23802 |

| Ct. Ref. | Description | Qty. | Part No. |
|---|---|---|---|
| D5 | DIODE IN4148 | 1 | 23802 |
| D6 | ZENER DIODE 3V3 | 1 | 33923 |
| D7 | DIODE IN4148 | 1 | 23802 |
| D8 | DIODE IN4148 | 1 | 23802 |
| D9 | ZENER DIODE 8V2 | 1 | 33933 |
| D10 | DIODE IN4148 | 1 | 23802 |
| D11 | ZENER DIODE 6V8 | 1 | 33931 |
| D12 | DIODE IN4148 | 1 | 23802 |
| D13 | DIODE IN4148 | 1 | 23802 |
| D14 | DIODE IN4148 | 1 | 23802 |
| D15 | DIODE IN4148 | 1 | 23802 |
| D17 | DIODE IN4148 | 1 | 23802 |
| D18 | ZENER DIODE 5V6 | 1 | 33929 |
| D19 | DIODE IN4148 | 1 | 23802 |
| D20 | DIODE IN4148 | 1 | 23802 |
| D21 | ZENER DIODE IN3497 | 1 | 29601 |
| D22 | ZENER DIODE 3V9 | 1 | 33925 |
| D23 | DIODE IN4148 | 1 | 23802 |
| D24 | DIODE AA143 | 1 | 52900 |
| D25 | DIODE AA143 | 1 | 52900 |
| D27 | DIODE IN4148 | 1 | 23802 |
| D28 | ZENER DIODE 6V8 | 1 | 33931 |
| TR1 | TRANSISTOR 2N2369 | 1 | 23307 |
| TR2 | TRANSISTOR 2N2369 | 1 | 23307 |
| TR3 | TRANSISTOR BFS96 OR<br>TRANSISTOR BSV49B OR<br>TRANSISTOR ZTX551 | 1 | 53626 |
| TR4 | TRANSISTOR BFS96 OR<br>TRANSISTOR BSV49B OR<br>TRANSISTOR ZTX551 | 1 | 53626 |
| TR8 | TRANSISTOR 2N2369 | 1 | 23307 |
| TR11 | TRANSISTOR BC108 | 1 | 26110 |
| TR12 | TRANSISTOR BCY70 | 1 | 23354 |
| TR13 | TRANSISTOR BC108 | 1 | 26110 |
| TR14 | TRANSISTOR BCY70 | 1 | 23354 |
| TR15 | TRANSISTOR BFY50 | 1 | 26112 |
| TR18 | TRANSISTOR BCY70 | 1 | 23354 |
| TR19 | TRANSISTOR BCY70 | 1 | 23354 |
| TR20 | TRANSISTOR BC108 | 1 | 26110 |
| (TR5) | | | |
| (TR6) | | | |
| (TR7) | TRANSISTOR ARRAY | | |
| (TR9) | CA 3086 | 1 | 52940 |
| (D3) | | | |
| IC2 | | | |
| IC1 | I.C., O.P.A. TYPE 748 C | 1 | 53549 |
| CSR1 | THYRISTOR 2N4146 | 1 | 52941 |
| | FOR P.C. BOARD ASSY. No. 63397 ADD: | | |
| R36 | RESISTOR M.O. 220R 5% ¼W | 1 | 28600 |
| D16 | DIODE IN4148 | 1 | 23802 |
| | FOR P.C. BOARD ASSY. No. 63761 ADD: | | |
| R36 | RESISTOR M.O. 5% ¼W | 1 | A.O.T. |

# Component Schedule

GOULD

Advance Electronics Limited –
Raynham Road, Bishop's Stortford, Hertfordshire,
England. Telephone: 0279 55166 Telex: 81510

# Operation

## Mains Connections

The AC supply input to the unit is connected to the terminal block on the left of the front panel. The terminals are marked L (line), N (neutral), E (earth). A transparent mains cover is provided.

## Mains tap-changing. (5V Units only)

Table 1 shows the mains input options available for the various units in the range and the required connections to the inverter transformer. In order to change the input voltage connections, the top or bottom covers must be removed to gain access to the appropriate components. In addition to changing the output transformer connections, the value of the fine-adjustment current limit resistor R112 must be changed. The values of the resistor appropriate to 220V and 240V operation are related by the equations,

$$R_x = \frac{14.8R_y}{16.3 + 3R_y} \quad \text{for MG5–20}$$

$$R_x = \frac{5.8R_y}{6.4 + 3R_y} \quad \text{for MG5–40, MG5–60 and MG5–60A}$$

where $R_x$ and $R_y$ are the values appropriate to all units operating at 115/220V and 120/240V respectively.

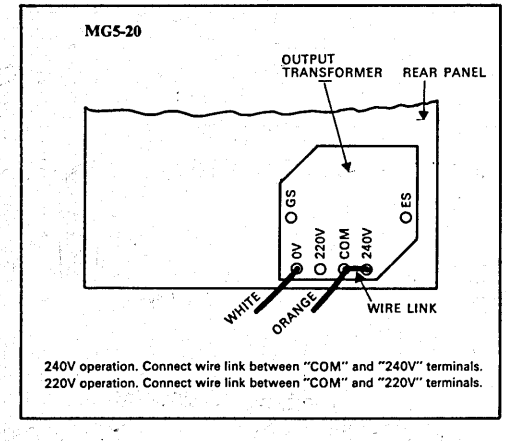
The location of R112 is as follows:—

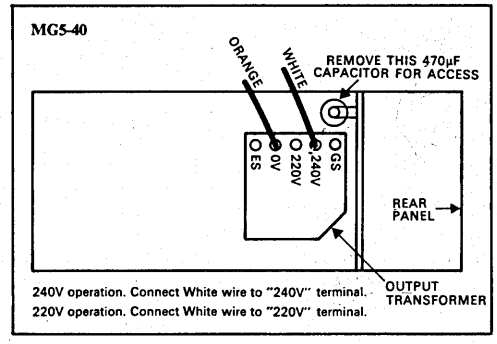
MG5–20 – Mounted on PTFE feed-throughs on the longitudinal centre panel at the bottom of the unit.

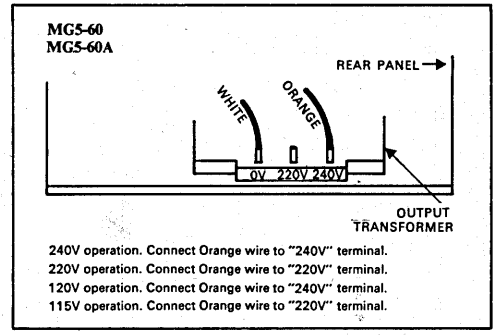
MG5–40 – Mounted on the auxiliary printed circuit card which runs longitudinally along the top of the unit, approximately at the centre-line.

MG5–60 and MG5–60A – On the auxiliary printed circuit board which mounts on the R.H. intermediate longitudinal panel at the top of the unit.

*N.B.* On the MG5–10 unit in addition to changing the input voltage connections, the input rectifier has to be changed from a bridge circuit to a doubler circuit by changing wire links. See the Circuit Diagram for the required information.




## Output Characteristics

An inherent advantage in the design concept of switching power supplies is that it is possible to trade off three fundamental aspects of the specification against each other.
These three aspects are:
1 Mains failure hold-up time.
2 Negative mains margin.
3 Output voltage (including lead voltage drop).
The MG series has been designed for a 28mS hold-up time at an output voltage of 105% of specification at –10% mains.

*Example*
Referring to the graphs: An MG5–20 operating on 220V nominal mains is required to provide 5V into a load with a 0.5V total lead drop, i.e. 110% voltage at the power supply terminals. Under these conditions the unit may be operated down to –8% mains with 28mS hold-up (whole cycle missing) or down to –16.5% mains with 18mS hold-up (half cycle missing).

## Output Connections

The output is available at the large studs on the front panel, the positive and negative terminals being identified + and – respectively. On the MG5–10 only the output is taken from the 6-way terminal block on the front panel. The wiring to the load should be such as to ensure that the lead voltage drop does not exceed the level determined from Fig. 1 or Fig. 2. Refer to Fig. 3 for the required size of cable.

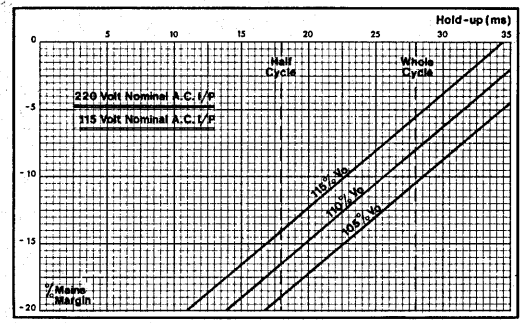



*Fig. 1*

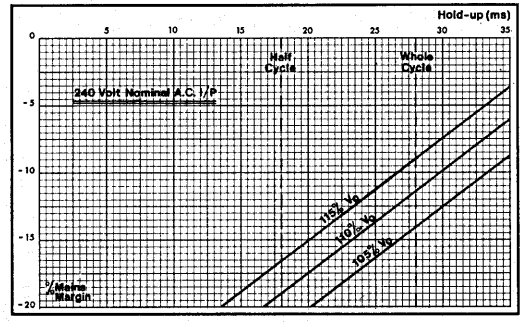



*Fig. 2*

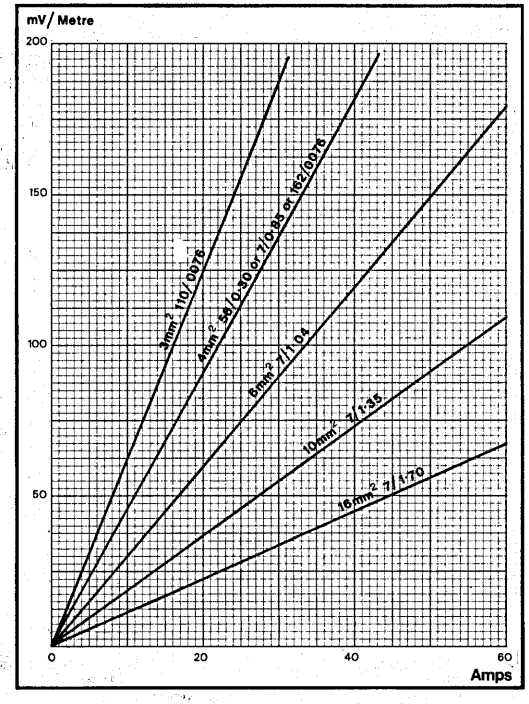



*Fig. 3*

## Remote Sensing

The remote sensing terminals are situated on the 6-way terminal block on the front panel. To operate the unit under remote sense conditions remove the links connecting +S to + and –S to –, and connect +S and –S to the points at which the regulated voltage is required.

## External Voltage Programming

The output voltage may be programmed remotely by removing the link marked "Int" on the 6-way terminal block and inserting a programming resistor between the lower terminal and +S.
Programming ratio 1000Ω /Volt ±0.5%.
*N.B.* Do not remove the link between +S and + unless remote sensing is being used.

## Mounting

Four M3 fixing holes are provided in the base of the unit and in one of the side panels. If it is necessary to mount the unit from the other side or from above the unit may be operated in the inverted position without limitation of any area of the specification.

## Cooling

The power supply is convection cooled and under normal operating conditions does not require forced air cooling. The unit should be mounted to allow the free passage of air to pass through the unit in a vertical direction. This is particularly important in the area of the heatsink. Units may be mounted adjacently without limitation.

# Circuit description

## General

The following is a generalised description of the operation of the MG circuit with reference to the block diagram of Fig. 4. Although the basic circuit is common to all units in the MG range, slight differences exist between individual units, and for this reason a complete detailed description of all units is not given here.

Basically, the circuit consists of a mains filter MF1 and full-wave rectifier D101–D104, followed by a reservoir capacitor C103. (For 115V units the rectifier is connected as a voltage doubler followed by a pair of series connected reservoir capacitors.) The resulting unstabilised D.C. voltage of approximately 350V is used as the power rail for a regulated D.C.–D.C. converter, operating at a frequency of 35KHz. The converter (TR101, TR102, C101, C102, T5) is of the half-bridge, pulse-width-modulated type. The output from the converter is rectified by the push-pull rectifier stage D109, D110, and smoothed by the low-pass filter L1, C106, to produce the output voltage.