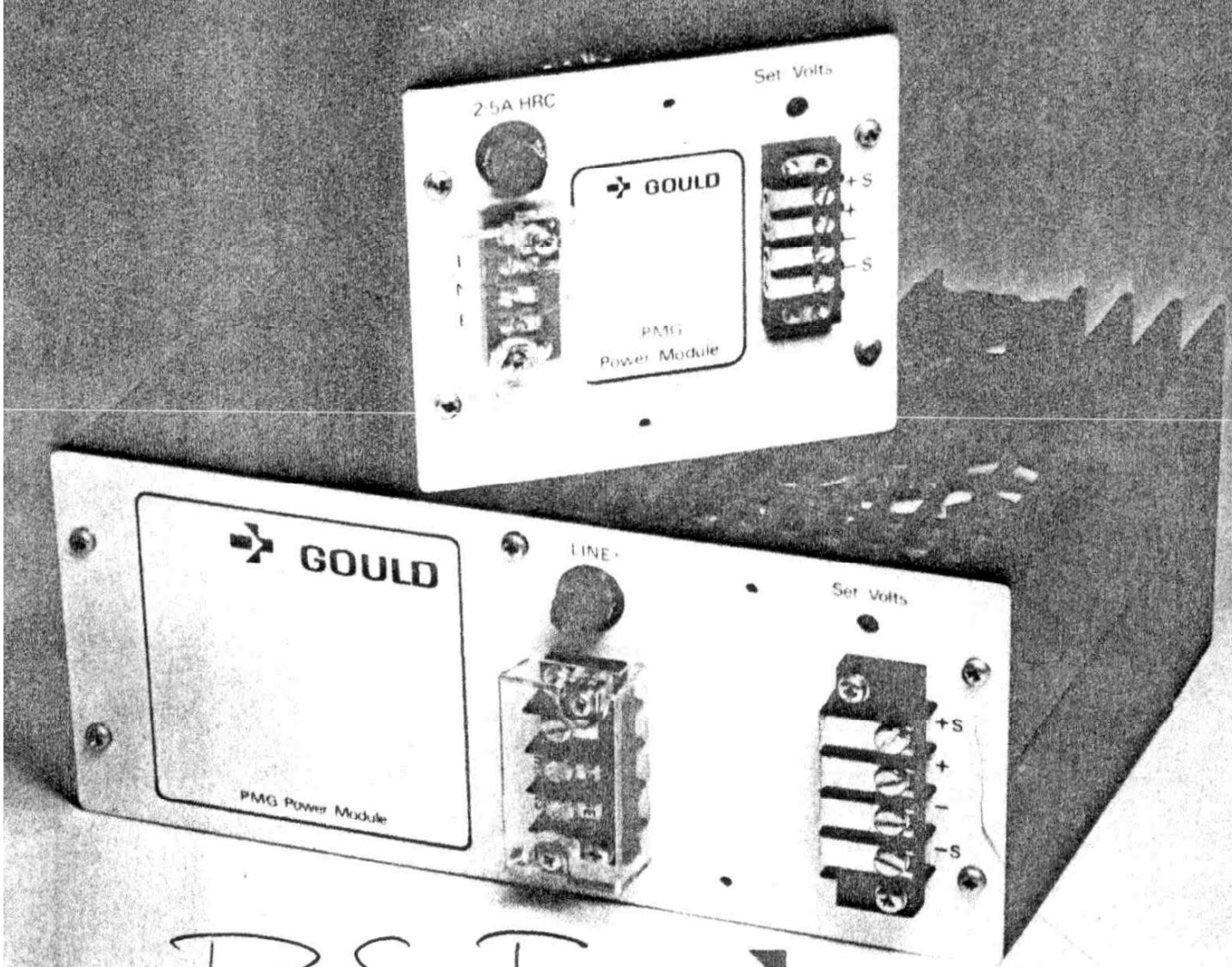
PMG Series Power Supplies Handbook



RST

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Introduction

The Gould PMG series is a range of regulator controlled stabilised DC power supplies. Various combinations of current and voltage are available with both single and dual outputs. Two standard case sizes cover the complete range, making the units size compatible with the Gould MG range of direct-off-line switching power supplies.

The output voltage of each unit is adjustable by approximately ±0·4V from nominal by means of a screwdriver adjustment accessible through the front panel. In the case of dual outputs units, the single adjustment controls both outputs.

Remote sensing facilities are available to enable a constant voltage to be maintained at a point remote from the power supply, and each unit is protected against overload and short circuit conditions.

Overvoltage protection is available, supplied as standard on 5V units and as an option on other units in the range.

Specification

Input Voltage
110 — 120 — 220 — 240±10% 48 — 400Hz

Case Size 1	*PMG5-5*	*PMG12-2·7*	*PMG15-2·2*	*PMG24-1·5*	*PMGD15-1·2**
Output voltage	5V	12V	15V	24V	±15V
Output current	5A	2·7A	2·2A	1·5A	1·2A

Case Size 2	*PMG5-10*	*PMG12-5·5*	*PMG15-4·5*	*PMG24-3*	*PMGD15-2·5**
Output voltage	5V	12V	15V	24V	±15V
Output current	10A	5·5A	4·5A	3A	2·5A

Output voltage adjustable by ± ½V by front panel potentiometer.

* May be set to ±12V. See circuit diagram.

Load Regulation
0·1% max for no load-full load change

Line Regulation
±0·1% max. for ±10% AC line variation

Tracking (Dual Units)
Within 1%

Ripple & Noise
2mV pk-pk max at full load

Temperature Range
−10°C to +50°C ambient

Temperature Co-efficient
±0·02%/°C

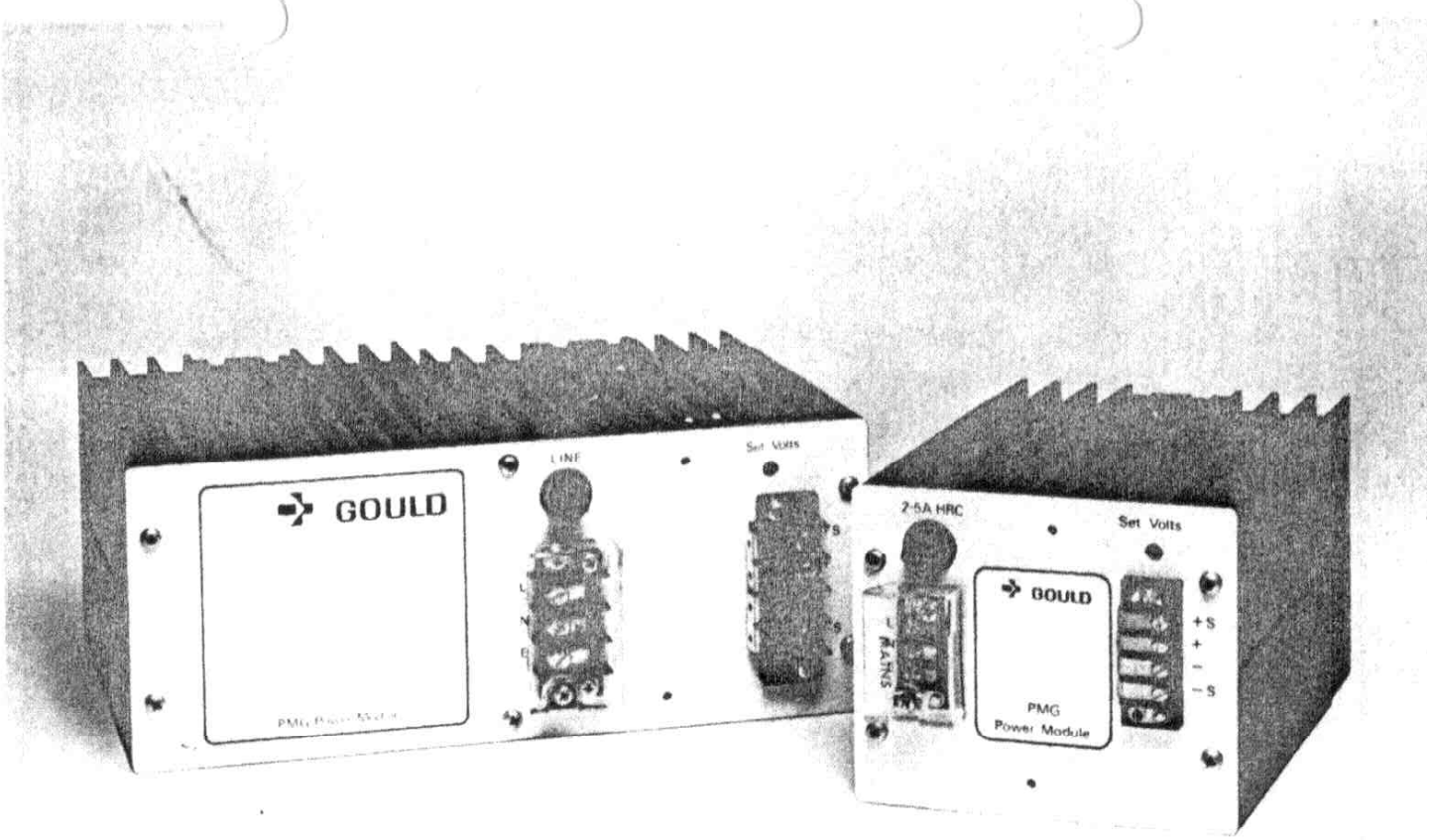
Output Impedance
0·25Ω max at 100kHz

Overload Protection
Auto-resetting re-entrant overcurrent protection set to approx 120% of full load current.

Overvoltage Protection
Fitted as standard on 5V units. Set between 120% and 130% of rated output voltage. Available on other units by the external addition of an OVP-05 unit.

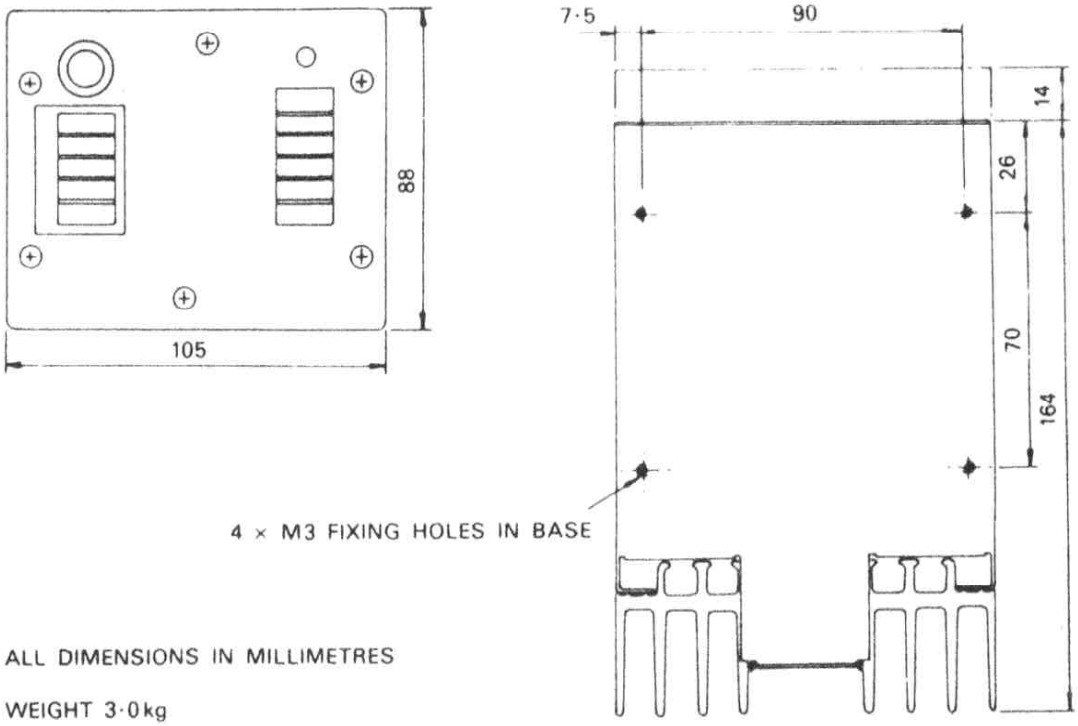
Remote Sensing
Provision is made for remote voltage sensing to eliminate the effects of lead resistance on voltage regulation.

Insulation
Floating output must not exceed ±250V DC from ground. Proof tested at 500V DC for 1 minute. AC input terminals to output terminals and case connected together proof tested at 2KV rms for 1 minute.



Dimensions

CASE SIZE 1



ALL DIMENSIONS IN MILLIMETRES

WEIGHT 3·0kg

CASE SIZE 2

ALL DIMENSIONS IN MILLIMETRES

WEIGHT 5·0kg

Guarantee and service facilities

This power supply 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 power supply can, if necessary, be returned to our factory for servicing. The Type and Serial Number of the power supply 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 power supplies arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the power supply, 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.

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Operatio.

AC Supply

PMG units are normally supplied ready wired for use on 240V AC supply. To set the unit for operation on other supply voltages the following procedure should be adopted.

(1) Units housed in Size 1 Case

Release the top cover by taking out the two front panel top screws, the two heatsink top screws and the heatsink cover plate top screw. Slacken the two front panel bottom screws to allow panel to tilt forward slightly. The cover may now be lifted from the unit. The supply voltage taps will be found on the right hand side mounted on the transformer winding, and should be wired in accordance with the diagrams below.

Replace the cover by reversing the above procedure, taking care not to foul the cableform when locating the cover.

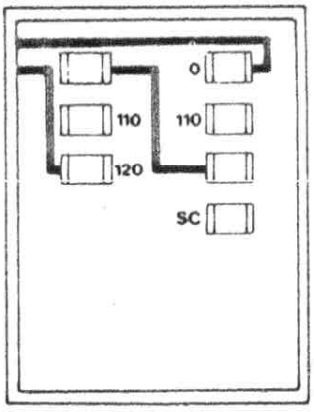
(2) Units housed in Size 2 Case

Release the top cover by taking out the three front panel top screws, the four heatsink top screws and the two heatsink cover plate top screws. Slacken the three front panel bottom screws to allow panel to tilt forward slightly. The cover may now be lifted from the unit. The supply voltage taps will be found on the left hand side, mounted on the transformer winding, and should be wired in accordance with the diagrams below.

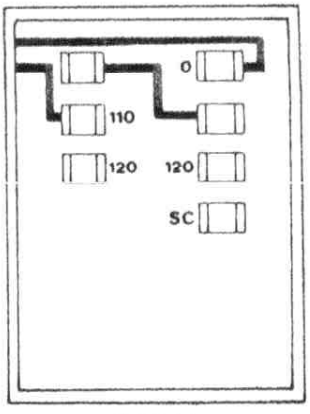
Replace the cover by reversing the above procedure, taking care not to foul the cableform when locating the cover.

The AC supply to the unit should be wired to the left hand terminal block on the front panel. Remove the safety cover by unscrewing its two retaining screws, connect the supply as indicated on the adjacent panel markings and replace the safety cover.

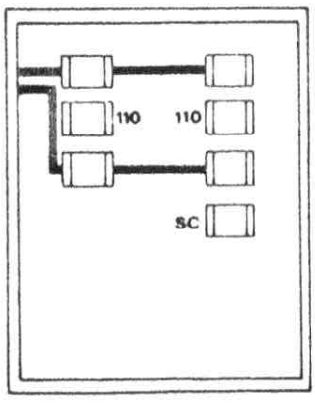
CASE SIZE 1



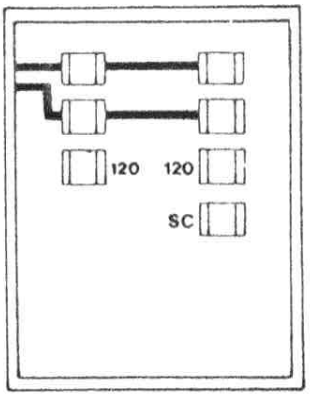
240V



220V

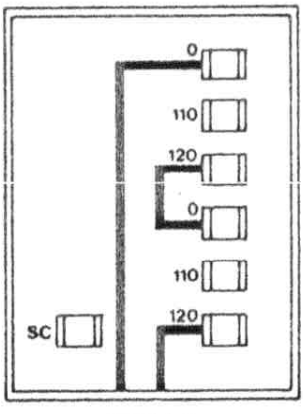


120V

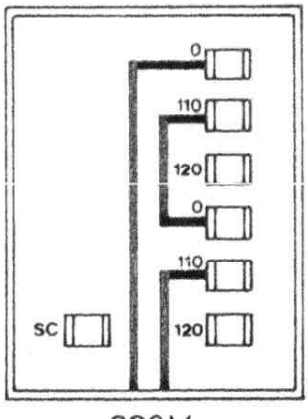


110V

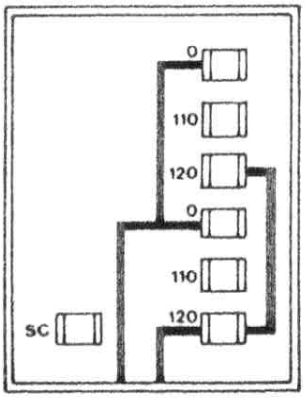
CASE SIZE 2



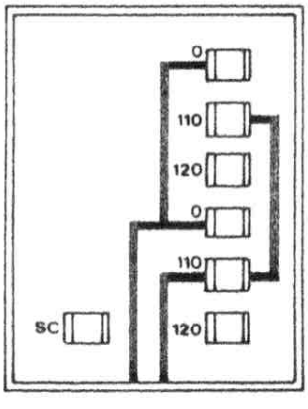
240V



220V



120V



110V

DC Output

Connections to the load, and for voltage sensing at the load if required, are made at the right hand terminal block.

Single Output Supplies

If remote sensing is not required, connections to the load are made between the + and − terminals. If remote sensing is required, the two metal links on the output terminal block should be removed, connections to the load made between the + and − terminals, and connection to the sensing points made between the +S and −S terminals.

Dual Output Supplies

If remote sensing is not required, connections to the loads are made between the + and − terminals, with the CT terminal connected to the common point of the load.

If remote sensing is required, the three metal links on the output terminal block should be removed, connection to the load made between the + and − terminals, with the CT terminal connected to the common point of the load, and connections to the sensing points made between the +S and −S terminals, with CTS terminal taken to the common sensing point of the load.

To set the output voltage, connect a DC voltmeter across the output terminals (local sensing) or across the load (remote sensing), apply mains supply to the unit and adjust the "Set Volts" control, located through a front panel hole, to give the required output voltage.

On dual output units, only one adjustment is provided, controlling the positive output, the negative output will be the same as the positive output by reason of the tracking facility of the supplies.

Circuit Description

The basic circuit is common to all units in the range, variations being those necessary to accommodate the different voltage and current ratings.

Basically, the supply consists of a power rectification and smoothing section, series regulator and a control section.

Rectification and Smoothing

5V Units

The output of transformer T101 is rectified by a two diode full wave rectifier, MR101, and smoothed by C101, with the transformer centre tapped for neutral.

Single output units other than 5V

The output of transformer T101 is rectified by a conventional bridge rectifier, MR101, and smoothed by C101.

Dual output Units

The output of the transformer is rectified by MR101 and smoothed by capacitors C101 and C103, this gives both a positive and negative supply w.r.t. the transformer centre tap.

Auxiliary Supplies

An auxiliary winding on the transformer is fed to a bridge rectifier comprising D1, D2, D3 and D4, the output of which is smoothed by C1 to provide the supply for the control circuit. The negative side of this supply is connected directly to the positive output of the power supply unit which enables the control circuit to float on top of the unit output voltage. All components for the auxiliary supply are mounted on the control PCB.

In dual output supplies the negative output control circuit derives its positive supply from the unregulated positive power line via R46 and is stabilised by Zener diode D42. Its negative supply is derived from the negative unregulated supply.

Voltage Control

(i) *General.* Voltage control is achieved by use of an integrated circuit voltage regulator, IC.1, whose output is fed to the series control elements TR101, TR102.

A much simplified circuit diagram of the integrated circuit is included in the main circuit diagram. The integrated circuit may be considered in three sections; a reference voltage source which provides a stable temperature compensated reference voltage at Pin 6 of the IC, a control amplifier that compares a reference voltage with a voltage directly dependent on the voltage appearing at the output of the supply, and an output stage which controls the series pass elements. This circuit is common to single output and the positive output of dual output supplies.

In dual output supplies, control of the negative output is achieved by the use of an integrated operational amplifier, IC41, which controls a series pass element.

(ii) *Circuit Description.* Resistors R1, R2 form a voltage divider between the reference voltage source and the positive sense line, whose junction is fed to one input of the control amplifier.

R3, R14 and R4 form a divider chain between the reference voltage source and the negative sense line, and the junction of R3, R14 is fed to the other input of the control amplifier. D5 and D6 act as protection devices limiting the differential voltage input to the amplifier to a safe level, C2 provides loop stability, C3 acts as a filter across the voltage setting chain, C4 filters the series Zener diode and C5 filters the reference chain. The supply output voltage is determined by the value of R4 and R14, and any tendency to vary from this preset voltage is reflected as a differential voltage at the control amplifier inputs, causing the amplifier to vary the drive to the series pass elements and restore balance at its own input. R11 is adjusted to set the centre point of the voltage control potentiometer R14.

Negative Supply, dual output units

Tracking resistors R47, R48 form a potential divider between the positive and negative sense lines, the centre point of which is connected to the inverting input of the amplifier IC41. The non-inverting input of the amplifier is connected directly to the centre tap sense line, which acts as the voltage reference. D43 and D44 act as protection devices. The values of R47 and R48 are equal, therefore for the amplifier inputs to be balanced the voltage appearing across each of them must be equal. Any tendency for the output voltage to vary from its set level will be reflected as a differential input to the amplifier, causing the drive to the series regulator to vary sufficiently for balance to be restored. Similarly, if any change occurs at the positive output of the supply, thus varying the voltage across R47, and creating an imbalance at the amplifier inputs, the circuit will act to restore balance by making the voltage across R48 equal the voltage across R47. The negative output will therefore always track the positive output.

Current Control Circuit

The supply is protected from damage due to overload and short circuit conditions at its output by a re-entrant current limiting circuit.

A current flows through R5 and R6, producing a reference voltage across R6 which is proportional to the output voltage. As the load current is increased the voltage across R101, R102 plus the input voltage of TR101, TR102, exceeds that across R6 and D7, driving the current limit transistor in IC1, whose base is connected to Pin 2, into conduction, reducing the drive to the IC output transistor, and thus reducing the output voltage. As the load resistance tends towards a short circuit the voltage across R6 reduces, reducing further the available output current and giving a re-entrant voltage-current characteristic. R7 is adjusted to set the value of the maximum overload current, R12 is used to provide some current through R6 under short circuit conditions and increase the short circuit output current. It is omitted on the lower voltage units. D7 provides temperature compensation and is forward biased by the reference voltage via R13.

Negative Supply, dual output units

A current flows through resistors R43 and R45, producing a reference voltage at the emitter of TR41 proportional to the output voltage. Load current flows through resistor R103, producing a voltage proportional to the load current. If this voltage exceeds the reference voltage, TR41 is driven into conduction, reducing the drive to the IC output transistor in the positive regulator, thus reducing the positive output voltage. As the negative regulator tracks the output of the positive regulator, the negative output will reduce in sympathy. As the load resistance tends towards a short circuit, TR41 is driven harder into conduction, and the output voltage and current of both supplies will progressively reduce, giving a re-entrant voltage-current characteristic. R49 is adjusted to set the value of maximum overload current, and D41 provides temperature compensation for TR41. D45 acts as a speed-up facility when over-current conditions occur on the negative output whilst the positive output is unloaded.

Series Control Elements

The series control elements TR101, TR102, TR103, comprise darlington pairs housed in single T03 cases. On low power units one such device is used, whilst on the higher power units two devices in parallel are used. (See Parts List on circuit diagram for details of any particular supply.)

Overvoltage Protection

PMG5-5 and PMG5-10 units are fitted with internal overvoltage protection as standard. Other units have facilities for mounting Advance OVP-05 or OVP-10 overvoltage protection units externally (single output supplies only).

Circuit Operation

R28, R29 and R30/R31 form a potential divider across the output of the supply. R30 is a temperature compensating thermistor. If the voltage across the output terminals rises above a preset level TR22 is driven into conduction which turns on TR21 and provides gate drive for CSR21 which in turn fires CSR101. When CSR21 fires current is drawn from IC1 drive circuit via D21, removing drive from the series regulators. FS201 and FS202 act to protect T101 and MR101 in the event of an overvoltage being caused by a short circuit series element. R34 provides holding current for CSR21, D22 isolates R34/D21 junction from the unit output terminals.