SECTION 505

STABILISED POWER SUPPLIER PS2/505

505.1 Introduction

The Power Supplier PS2/505, intended for use with the Cut/Fade Amplifier AM1/508, is designed to supply 300 milliamperes at −14 volts and 200 milliamperes at +9 volts. These supplies have a common terminal which is not connected to the frame of the chassis. The 14-volt stabilising is effected with a series regulator using a fraction of the output voltage to produce opposed-sense correction of output-voltage changes. A shunt regulator establishes the 9-volt supply and is dependent on the 14-volt circuit, as explained under 505.3.

The unit is constructed on a type CH1/12A chassis, on the rear bracket of which are fuses and a mains-transformer tapping selector to suit input voltages between 200 and 250 volts. All other components are mounted on a printed-wiring board; the chassis indexing-pin numbers are 5 and 9.

505.2 General Specification

Full-load outputs	300 mA at −14 volts (with less than 0·2 mV of 100-c/s ripple) and 200 mA at 9 volts (with less than 0·05 mV of 100-c/s ripple).
Full-load power consumption	6 watts.
Output resistances	16 milli-ohms (14-volt section). 65 milli-ohms (9-volt section).
Permitted mains bump	15 per cent.
Maximum ambient temperature	45 degrees C.
Weight	2·5 lb.

505.3 Application Feature

Overall operation of the supplier merits special consideration because the method of stabilising has an important bearing on the use of the unit. The basic arrangement given in Fig. A shows the main (series) regulator with an over-riding control of both supplies, but operated with a reference voltage taken from the 14-volt output. The shunt regulator has the subsidiary function of stabilising the 9-volt supply and, as shown subsequently, must carry adequate current to ensure satisfactory operation. As a consequence the load current of the 14-volt source has to be greater than that from the 9-volt source.

Fig. A shows a current I_L flowing through R_a and R_b, these representing suitable loads for the 9-volt and 14-volt outputs respectively. Assume

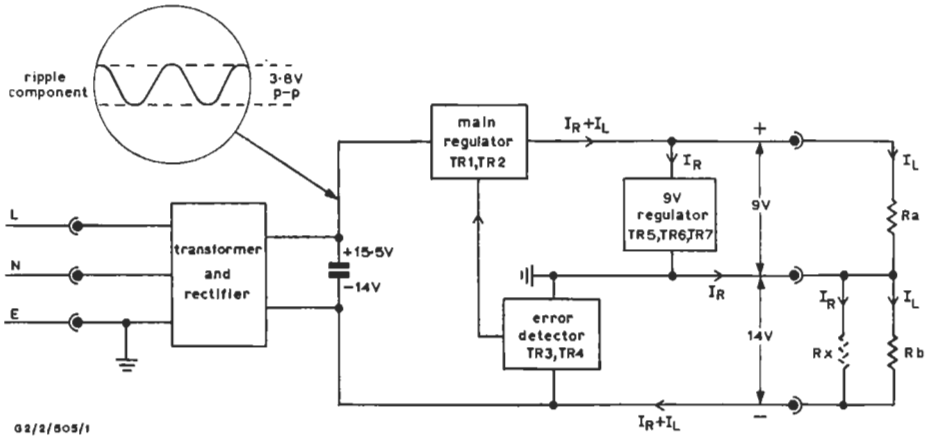


Fig. A. PS2/505 Supplier: Schematic of Unit with External Loading

for the present that there is no R_X. With the given condition the shunt regulator does not need to contribute current since I_R is zero. The series regulator carries the common load current I_L. If the value of R_a decreases, the shunt regulator is now incapable of providing current to keep the 9-volt output at the original voltage. The series regulator is responsive only to changes on the 14-volt output.

To maintain the 9-volt output while meeting this increased demand, the shunt regulator must work with a current above zero. For this purpose a resistor (R_X) could be placed across the 14-volt output, or alternatively the current could be taken as part of that flowing through R_b. It follows that the load current at 14 volts must be larger than the current drawn from the 9-volt output.

In practice the required excess is approximately 30 milliamperes. For the specified application, with one AM1/508 amplifier, the natural excess current at 14 volts is about 25 milliamperes. When the supplier is used with the Split Screen Switch Unit PA18/509, a resistor corresponding to R_X is fitted across the 14-volt output to provide the appropriate amount of artificial loading.

505.4 Circuit Description (Fig. 505.1)

Fig. 505.1 shows the circuit in which a bridge rectifier, D1-D4, is used to obtain a single d.c. supply, floating because there is no frame connection. The rectifier output of approximately 29 volts is applied through the main regulator to obtain the accurate 23 volts required for the two outputs.

The direct means of main regulation is TR1, driven by TR2 which is preceded by a two-stage amplifier formed of TR3 and TR4. The emitter of TR4 is held at a constant positive voltage by its connection through zener diode D5 to the 14-volt negative rail. The base is connected to RV1 in a voltage-divider across the 14-volt output, thereby allowing for pre-setting adjustment of the voltage which is compared with the reference voltage on the emitter. Although it has one more transistor than usual, with TR3 providing phase inversion as well as amplification, the control system acts to correct output-voltage changes in a manner essentially similar to that of series regulators in various suppliers described in this Instruction. Details are obtainable from, for example, the information applying to the PS2/9 supplier.

The 9-volt regulator has TR5-TR7 in a typical three-transistor configuration for series stabilising, but adapted in this instance to the shunting function by including R14 to give protection by limiting the current which can flow through it. TR5 operates with the emitter held at the reference voltage on the junction of R7 and zener diode D6, and the compared voltage applied to the base from RV2 in a voltage-divider across the 9-volt output. With reference to a setting-up value, the regulator draws more current in the event of an output-voltage rise, and less if the voltage falls.

RV2 enables the exact voltage produced from the 9-volt output to be determined, RV1 serving similarly in the 14-volt circuit. C7 forms part of the TR7 collector load and determines the frequency response of the stabilising loop. The equivalent in the 14-volt section is C5, in connection with TR1. Note that if either capacitor decreases seriously in value, the associated regulator will probably become unstable due to the rise in loop gain.

505.5 Test Procedure

The required test apparatus is:

Avometer, Model 8.
Two 47-ohm resistors, tolerance 5 per cent (Painton P.301A).
Oscilloscope (with a vertical sensitivity of 5 mV/cm).
Amplifier (Philips type GM 4754).

1. Check that the supply lead is connected to the 240-volt and 0-volt tags, and also that the electrostatic screen and transformer secondary are correctly connected. Ensure that the unit is fitted with 150-mA fuses.
2. Plug the unit into a Cable Termination Panel PN3A/2, with normal mains wiring.

Note: For safety the PN3A/2 should be fitted with chassis guides, as these ensure that the dowel pin is not accidentally inserted into the live socket of the 15-way connector. A Designs Department drawing (reference DB.15552) gives details of the chassis-guide construction.

3. Connect one 47-ohm resistor between pins 4 (commoned with pins 5, 6 and 7 as the 14-volt negative terminal) and 12 (commoned with pins 13, 14 and 15 as the 0-volt terminal). Between this 0-volt terminal and pin 8 (commoned with pins 9, 10 and 11 as the 9-volt positive terminal) connect the other 47-ohm resistor.

Note: For convenience the resistors can be mounted externally on the PN3A/2 by means of terminals. Valid testing of the supplier requires the full-loading condition, met with resistors of the stated value.

4. After checking that they are not linked already, make a temporary connection between the 0-volt output terminal and the frame.
5. Connect the 240-volt mains supply. Measure the voltage at the 14-volt output. Vary RV1 to ascertain the range of voltage available and finally leave it set for 14 volts. Repeat this operation on the 9-volt supply, varying RV1 and eventually adopting the setting giving 9 volts.
6. Use the Avometer to measure the voltage between the 0-volt output terminal and the positive end of the C1, C2 combination. The reading should be 15·5 volts $\pm$ 1 volt. Ripple voltage as measured between the same points should be less than 5 volts p-p.
7. Use the amplifier and oscilloscope to measure the hum appearing on each supply. The hum should be less than 200 micro-volts on the 14-volt supply, and less than 50 micro-volts for the 9-volt supply.
8. Conclude testing by seeing that the temporary connection referred to under 4 is removed.

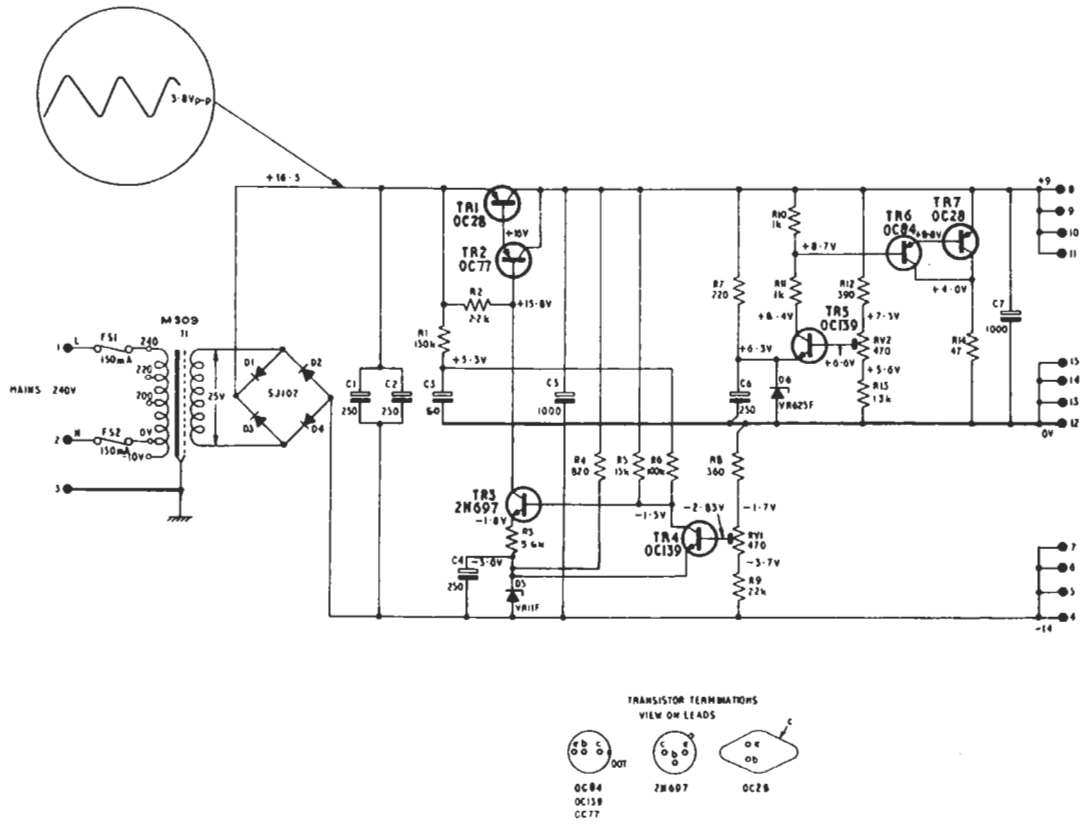
505.6 Maintenance

Bench servicing is recommended, using a single test connector made from a PN3A/2 fitted with terminals to which the dummy loads can be connected; see notes below items 2 and 3 in the preceding sequence for testing.

Output voltages should be adjusted with the unit either (a) loaded suitably to the condition for its normal use, or (b) as specified under 505.5. The regulation is such that the supplier ought not to require readjustment when it is changed from one application to another.

WJP/1165

FIG.505.1



COMP	TYPE	TOLERANCE PER CENT	COMP	TYPE	TOLERANCE PER CENT
C1	HUNT MEF45T 50V		R6	ERIE 109	2
C2	HUNT MEF45T 50V		R7	ERIE 109	2
C3	T.C.C. CE43/AN1 6V		R8	ERIE 109	2
C4	U.C.C. SC584/6LS 12V		R9	ERIE 109	2
C5	T.C.C. CE422CN1 25V		R10	ERIE 109	2
C6	U.C.C. SC584/6LS 12V		R11	ERIE 109	2
C7	T.C.C. CE90BN1 12V		R12	ERIE 109	2
			R13	ERIE 109	2
R1	ERIE 109	2	R14	PAINTON MV1A	5
R2	ERIE 109	2			
R3	ERIE 109	2	RV1	PLESSEY 404/1/00142/470	
R4	ERIE 109	2	RV2	PLESSEY 404/1/00142/470	
R5	ERIE 109	2			

STABILISED POWER SUPPLIER PS2/505: CIRCUIT