Chapter 34

OVERVOLTAGE UNIT, ROTAX, TYPE U4001

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LEADING PARTICULARS

Overvoltage unit, Type U4001	*Ref. No. 5UC/6574*
Generator voltage	81 *to* 104*V*, 165 *to* 500 *c/s*
Operating voltage	28*V d.c. and* 112*V d.c.*
M.V. trip voltage (no load)	140*V d.c.*
L.V. trip voltage (no load)	35*V d.c.*
Quick response trip voltage (no load)	175 *to* 185*V a.c.*
Overall dimensions—	
Length (including cover screws)	7·532 *in.*
Width (including mounting feet)	6·5 *in.*

Introduction

1. The U4001 overvoltage unit is intended for use with the a.c. generator, Type 154 (Rotax N0603), the carbon pile regulator unit, Type ZA6405/1 and the transformer-rectifier unit, Type U3102. It provides protection for an input from the generator of 81 to 104 volts at 165 to 500 c/s, and outputs of 112 and 28 volts d.c.

DESCRIPTION

2. The unit, shown in fig. 1, incorporates two magnetic amplifiers with infinite gain characteristics, designed to operate relays which have a trigger action. A single reference, operating from the 28-volt busbar, is used for both amplifiers. A fast response circuit is included as a protection against very high voltages and load sharing facilities provided for use with two or more systems.

3. The arrangement of the components is shown in fig. 2 and 3. The variable resistors which can be adjusted to control the d.c. input to the magnetic amplifiers can be reached by removing the base cover plate. The reference barretter is located immediately beneath the resistors R3 and R6 shown in fig. 2. The components are mounted in a pressed metal case which has apertures in the main cover plate to provide ventilation and cooling. The terminals are fitted on a single block, attached to one side of the case, and the fixing holes drilled through metal strips, which are fitted to the two side plates forming an integral part of the case.

Operation

4. Reference should be made to fig. 4. Two magnetic amplifiers are used in the unit, TD1 to protect the 112-volt circuits and TD2 to protect the 28-volt circuits. The d.c. signals pass from the 112-volt and 28-volt busbars to the winding C3-C4 on the corresponding magnetic amplifiers. A 28-volt signal from the busbar is fed through the reference barretter L1 to provide the bias signal on the winding A3-A4 of each amplifier. The voltage of the signal is allowed to rise until it equals that of the bias; in this condition the amplifier operates, closes the relay contacts and disconnects the generator. A tertiary winding, C1-C2, on each amplifier provides a slight delay to ensure that transient overvoltages do not cause the amplifiers to operate. The input transformer TR1 is designed to prevent voltages surge from saturating the magnetic amplifiers when the transformer-rectifier unit is first switched on. As an additional surge protection, the voltage is fed back negatively from the 112-volt busbar to the winding A1-A2 of each amplifier. This feedback voltage assists the bias voltage and prevents the amplifiers from operating.

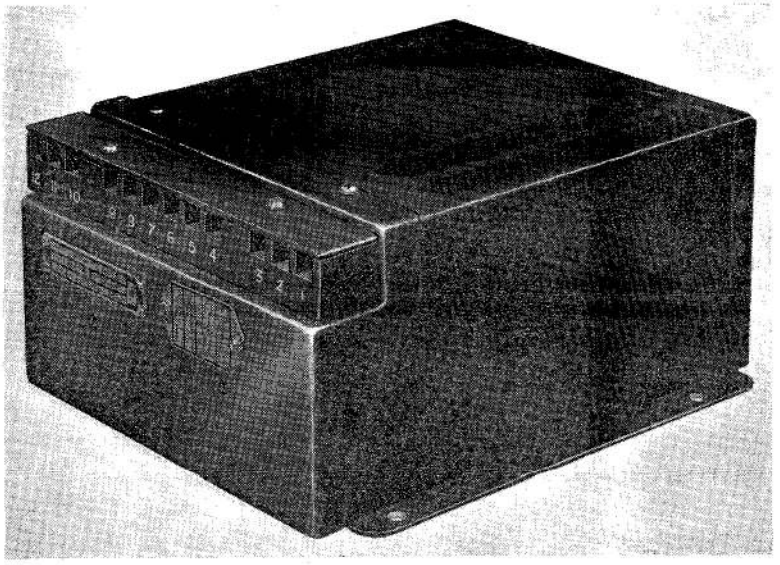


Fig. 1. General view of Type U4001

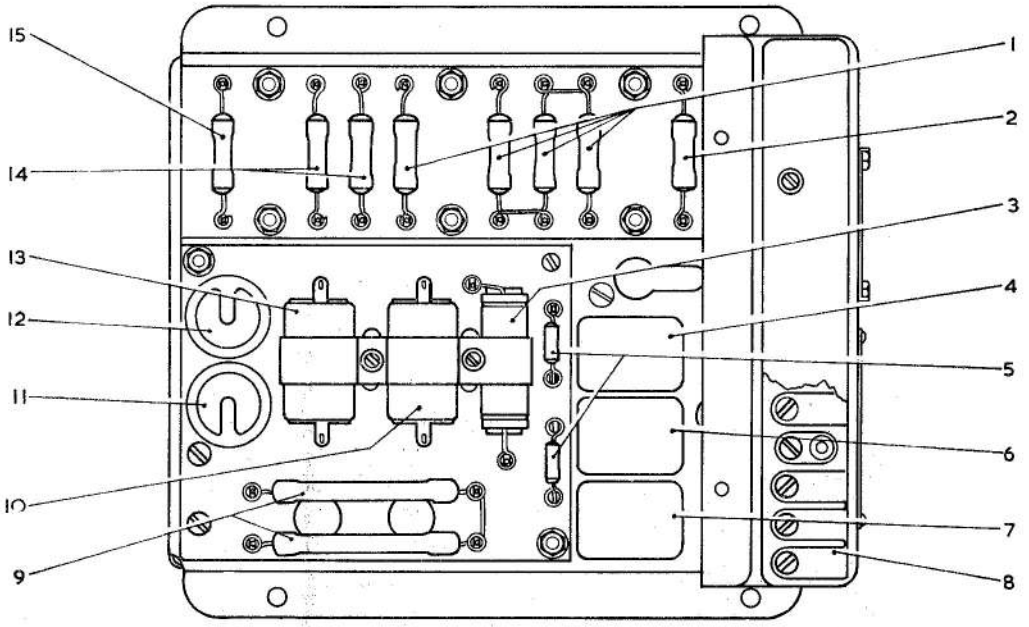
5. To provide protection against very high overvoltage a fast response circuit is incorporated. This circuit, which consists of a choke mounted in the case of the input transformer TR1, by-passes the magnetic amplifiers and overcomes the delay. The choke can be tapped for 210 volts, 215 volts, 220 volts or 225 volts and should be set to a value slightly in excess of the surge voltage measured when the transformer-rectifier is first switched on.

6. Two load sharing circuits, for M.V. and L.V, are included in the unit for use when two or more systems are employed. The circuits connect the magnetic amplifiers to the corresponding auxiliary regulating coil in the carbon pile. The two resistors, R2 and R4, develop voltages which are compared with those developed by the corresponding resistors in adjacent systems. When the voltages become unbalanced a current is fed to coil A5-A6 of the appropriate amplifier and the excitation of the relevant generator is automatically adjusted.

7. The 112-volt signal from the busbar to its associated magnetic amplifier can be varied by altering the connections of the resistors R14, R15 and by adjusting the variable resistor RV2. The 28-volt signal can be varied by adjusting RV1.

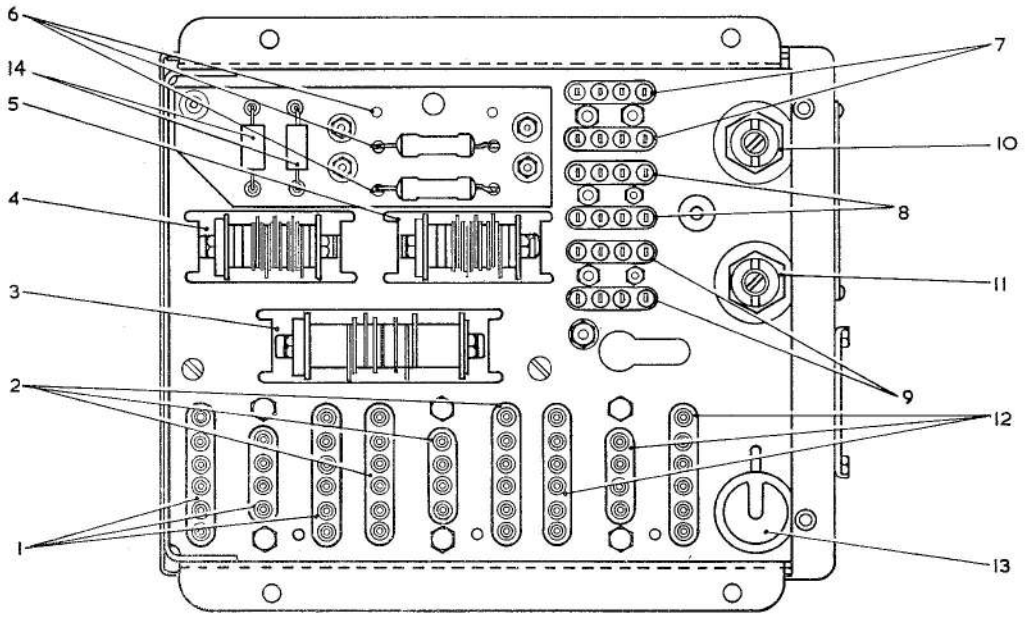
INSTALLATION

8. The unit should be mounted in a position that ensures the maximum air flow in the direction of the terminal block. The perforated top cover should be kept well clear of any obstruction and should not be closer than one inch to any adjacent surface. The unit should be fixed by four 2 B.A. bolts through the mounting holes which are 5·0 in. and 6·062 in. apart. Electrical connections should be made by means of the 4 B.A. screw and washer terminations.



1 R10, R11, R12, R13, FEEDBACK CIRCUIT
2 R1, INPUT TRANSFORMER CIRCUIT
3 C3, FAST RESPONSE CIRCUIT
4 RELAY RL1
5 R7, R8, FEEDBACK CIRCUIT
6 RELAY RL2
7 RELAY RL3
8 TERMINAL BLOCK
9 R3, R6, M.V. SIGNAL CIRCUIT
10 R4, L.V. LOAD SHARING CIRCUIT
11 C4, FEEDBACK CIRCUIT
12 C1, FEEDBACK CIRCUIT
13 R2, M.V. LOAD SHARING CIRCUIT
14 R9, R16, FAST RESPONSE CIRCUIT
15 R5, L.V. SIGNAL CIRCUIT

Fig. 2. View with main cover removed



1 TD1, MAGNETIC AMPLIFIER, M.V. CIRCUIT
2 TD2, MAGNETIC AMPLIFIER, L.V. CIRCUIT
3 MR3, RECTIFIER, FAST RESPONSE CIRCUIT
4 MR1, RECTIFIER, M.V. CIRCUIT
5 MR2, RECTIFIER, L.V. CIRCUIT
6 R14, R15 AND SHORT CIRCUIT, ADJUSTMENT OF M.V. CIRCUIT
7 RL3, FAST RESPONSE CIRCUIT
8 RL2, L.V. CIRCUIT
9 RL1, M.V. CIRCUIT
10 RV2, POTENTIOMETER, M.V. CIRCUIT
11 RV1, POTENTIOMETER, L.V. CIRCUIT
12 TR1, INPUT TRANSFORMER AND FAST RESPONSE CHOKE
13 C2, L.V. FEEDBACK
14 R17, R18, MR2 AND MR1 CIRCUITS

Fig. 3. View with base cover removed

SERVICING

9. Servicing is normally confined to ensuring that the unit is clean and free from damage. All external nuts and bolts should be checked for tightness. All connections should be checked to ensure security and the insulation of the connecting leads examined for signs of deterioration.

TABLE 1

Test equipment

L.V. voltmeter, 0-50V d.c.
M.V. voltmeter, 0-150V d.c.
A.C. voltmeter, 0-200V a.c.
Insulation resistance tester (500V)
Avometer, Model 7

The following supplies are required:—

L.V.	...	28-36V d.c.
M.V.	...	112-150V d.c.
A.C.	...	90-200V a.c., 400 c/s

Testing

10. All soldered connections should be carefully inspected for dry or high resistance joints. For the following tests, the equipment and supplies listed in Table 1 will be required.

Continuity tests

11. The following tests should be made between terminals on the block.

Terminals 1 and 2 should show approximately 1500 ohms.

Terminals 3 and 4 should show approximately 0·76 ohm.

Terminals 6 and 8 should show approximately 580 ohms.

Terminals 7 and 8 should show approximately 62 ohms.

Terminals 9 and 10 should show approxmately 1·6 ohms.

Terminals 5 and 6 should show approximately open circuit.

Terminals 11 and 12 should show approximately open circuit.

Insulation resistance tests

12. (1) Join terminals 1 and 2 with a common lead.

(2) Join terminals 3 and 4 with a common lead.

(3) Join terminals 6, 7 and 8 with a common lead.

(4) Join terminals 9 and 10 with a common lead.

(5) Join terminals A1 and A2 on TR1, C2 on TD1 and C2 on TD2 with a common lead.

(6) Attach a lead to terminal 5.

(7) Connect all leads except (1) to the chassis and measure the resistance between (1) and case using a 500-volt insulation tester.

(8) Repeat the insulation resistance test between the chassis and the remaining leads in turn, with the other five common leads connected to the chassis.

In every case the insulation resistance should not be less than 5 megohms (R.A.F.) or 0·5 megohms (R.N.).

Overvoltage adjustment of M.V. circuit

13. (1) Set the supplies to the following values:—

M.V. supply to 112 volts.
L.V. supply to 28 volts.
A.C. supply to 90 volts.

(2) Connect the positive and negative of the M.V. supply to terminals 6 and 8 respectively.

(3) Connect the positive and negative of the L.V. supply to terminals 7 and 8 respectively.

(4) Connect the a.c. supply to terminals 1 and 2 through a two-way switch.

(5) Connect a 10-volt d.c. meter (Avo) across the operating coil of relay RL1 and switch on all supplies.

(6) Using RV2 and the resistors R14, R15 obtain a reading of approximately 1 volt in the meter, indicating that RL1 is not energized.

(7) Increase the M.V. supply to 140 volts and by adjusting R14, R15 and RV2 set the overvoltage circuit to trip at 140 volt.

Note . . .

Having set the overvoltage to trip at 140 *volts it may be necessary to reduce the M.V. to* 112 *volts and switch the a.c. supply off and on to de-energize RL*1.

Overvoltage adjustment of L.V. circuit

14. (1) With the circuit as in 13 (1) to (4), connect a 10-volt meter (Avo (across the operating coil of relay RL2 and adjust RV1 so that a reading of approximately 1 volt is obtained.

(2) With the L.V. supply at 35 volts, by adjusting RV1 set the overvoltage circuit to trip at 35 volts.

Overvoltage adjustment of fast response circuit

15. (1) Disconnect the L.V. and M.V. supplies from the unit and connect an ohmmeter across the contact tags of relay RL3, to obtain an indication of when the relay operates.

(2) Vary the tappings C1 to C4 on the transformer TR1 until the relay operates between 175 and 185 volts a.c.

Note . . .

Care should be taken to ensure that the a.c. supply voltage is not held in excess of 90 *volts longer than is necessary to obtain a spot check.*

TABLE 2

Circuit component details

Circuit Ref.	Description	Value	Rotax No.
TD1	Transductor		P7007
TD2	Transductor		P7007
TR1	Transformer and choke assembly		P8101
L1	Barretter		N124897-1
RL1	Relay		N113193
RL2	Relay		N113193
RL3	Relay		N113193
MR1	Rectifier		N133225
MR2	Rectifier		N133225
MR3	Rectifier		N137732/12
C1	Capacitor 70V	50 Mfd.	N140828
C2	Capacitor 70V	50 Mfd.	N140828
C3	Capacitor	0·5 Mfd.	N67200
C4	Capacitor 70V	50 Mfd.	N140828
RV1	Variable resistor	100 ohms	N114217
RV2	Variable resistor	100 ohms	N114217
R1	Resistor 3W	1·5 K ohms	N113591/53
R2	Resistor	0·76 ohms	N142826
R3	Resistor 6W	470 ohms	N113593/41
R4	Resistor	1·61 ohms	N142826-1
R5	Resistor 3W	200 ohms	N113591/32
R6	Resistor 6W	430 ohms	N113593/40
R7	Resistor 1·5W	4·7 K ohms	N113590/65
R8	Resistor 1·5W	4·7 K ohms	N113590/65
R9	Resistor 3W	240 ohms	N113591/34
R10	Resistor 3W	910 ohms	N113591/48
R11	Resistor 3W	910 ohms	N113591/48
R12	Resistor 3W	1·6 K ohms	N113591/54
R13	Resistor 3W	1·6 K ohms	N113591/54
R14	Resistor 3W	150 ohms	N113591/29
R15	Resistor 3W	150 ohms	N113591/29
R16	Resistor 3W	240 ohms	N113591/34
R17	Resistor 3W	620 ohms	N113591/44
R18	Resistor 3W	620 ohms	N113591/44

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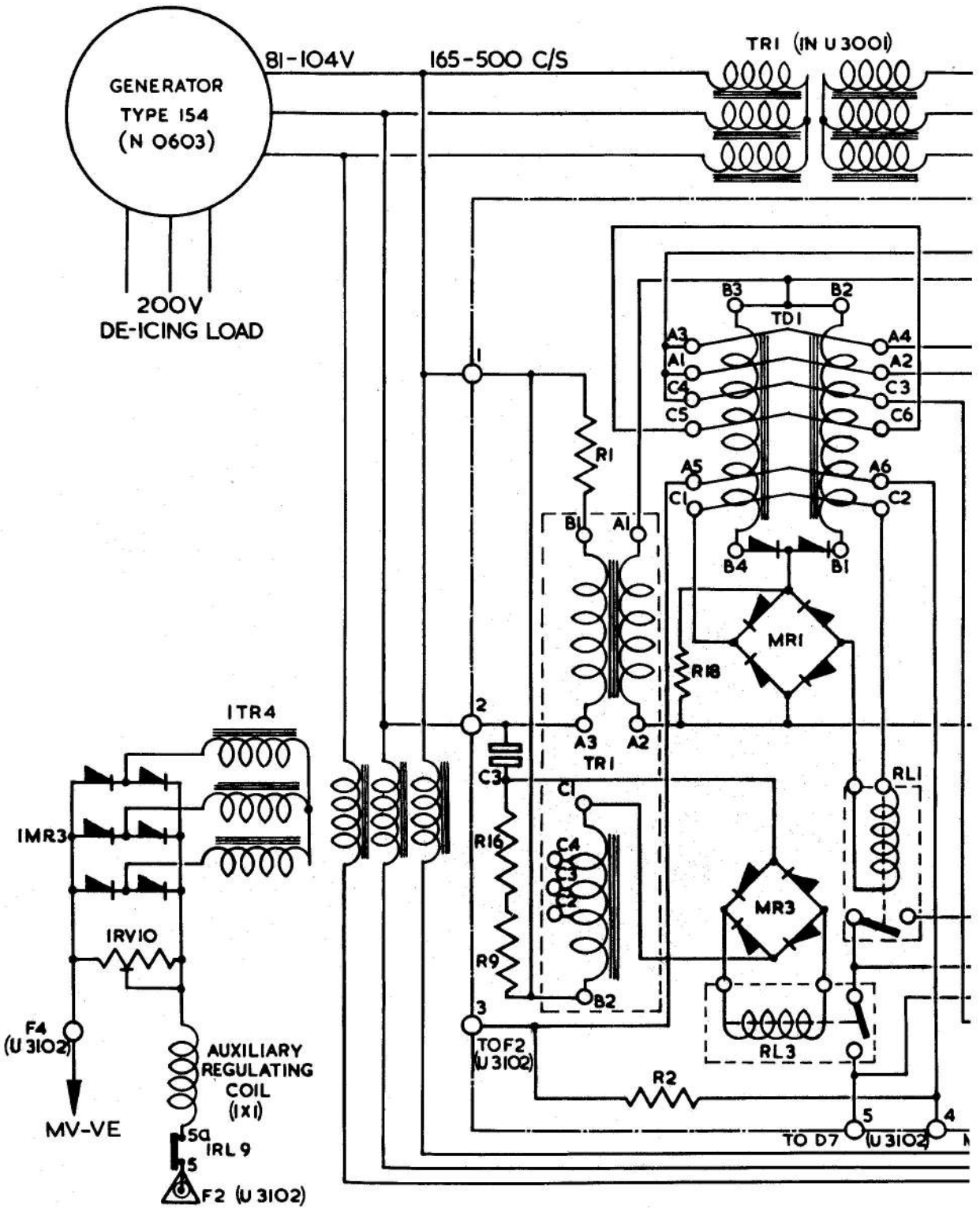
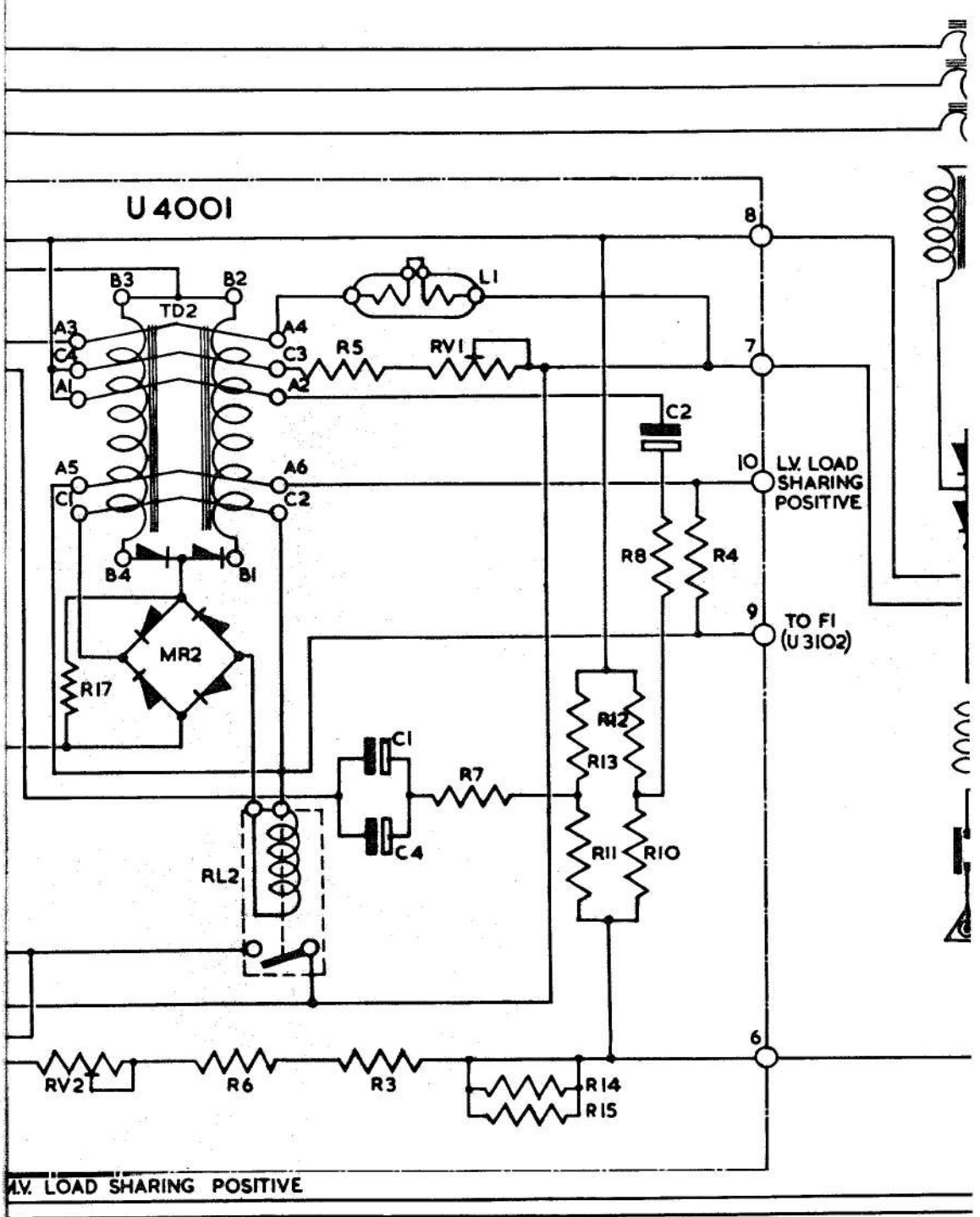


Fig.4

PP9091 253066/2979 10/62 2256 C & P Gp. 924 (4)



Circuit diagram
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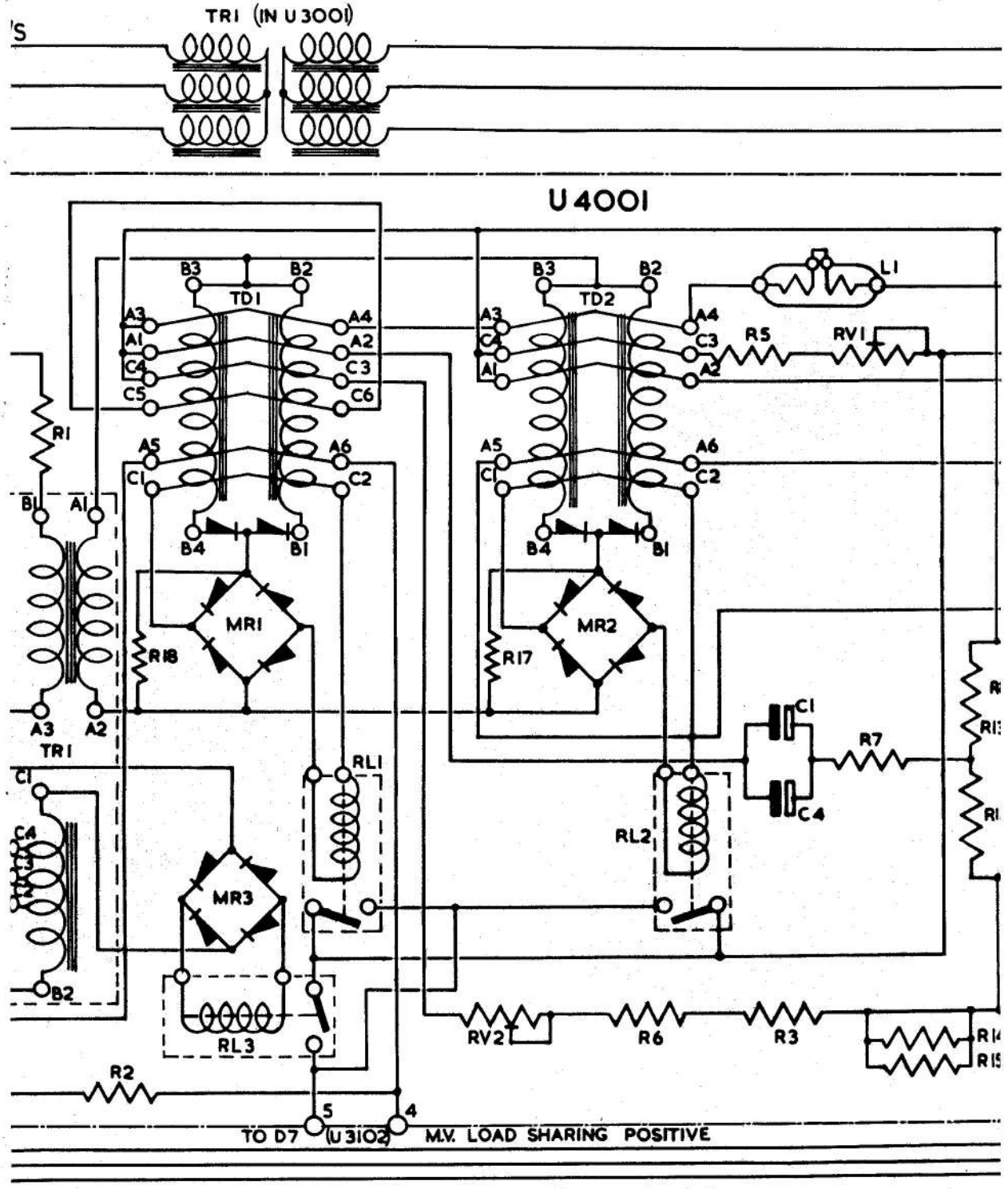

Circuit diagram
RESTRICTED

1/2979 10/62 2256 C & P Gp. 924 (4)

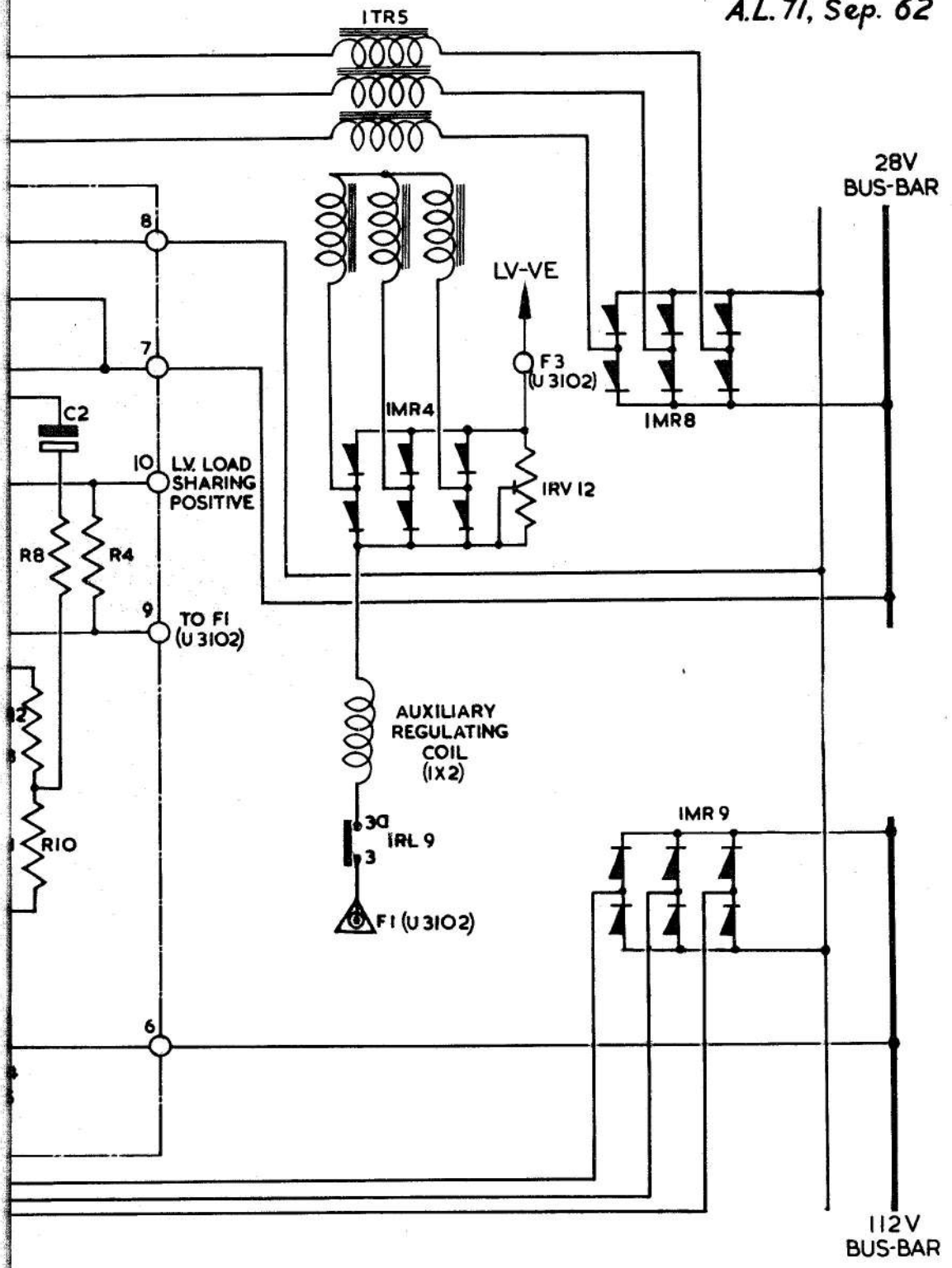
1TR5
28V
BUS-BAR
8
LV-VE
7
F3
(U 3102)
C2
IMR4
IMR8
10
LV. LOAD
SHARING
POSITIVE
IRV 12
R8
R4
9
TO F1
(U 3102)
AUXILIARY
REGULATING
COIL
(1X2)
IMR 9
30
1RL 9
3
F1 (U 3102)
R10
6
112V
BUS-BAR

Fig.4