6115-G-350-302
JULY 1989

GENERATOR SET DIESEL ENGINE DRIVEN 4.5kW (5.6kVA) 240V AC, SINGLE PHASE, 50 Hz (AIR LOG 4169A)

TECHNICAL DESCRIPTION

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

PUBLICATIONS AUTHORITY
Directorate Gen ral of Defence Quality Assurance
Royal Arsenal West, Woolwich, SE18 6ST

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PREFACE

Sponsor: EME10 (c) (4)

INTRODUCTION

1 Service users should forward any comments concerning this publication through the channels prescribed in AESP 0100-P-011-013.

2 The subject matter of this publication may be affected by Defence Council Instructions (DCIs), Standard Operating Procedures (SOPs) or by Local Regulations (LRs). When any such Instruction, Order or Regulation contradicts any portion of this publication they are to be taken as the overriding authority.

RELATED AND ASSOCIATED PUBLICATIONS

Related Publications

3 The Octad for the subject equipment consists of the publications shown below. All references are prefixed with the first eight digits of this publication.

CATEGORIES AND INFORMATION LEVELS

CATEGORY / LEVEL	1	2	3	4		5				6	7		8	
				1	2	1	2	3	4		1	2	1	2
1 USER/OPERATOR	101	201	201	411	411	201	201	*	*	601	*	*	*	*
2 UNIT MAINTENANCE	*	*	302	*	*	512	522	532	*	*	712	721	*	*
3 FIELD MAINTENANCE	*	*	302	*	*	512	522	532	*	*	*	*	*	*
4 BASE MAINTENANCE	*	*	*	*	*	*	*	*	*	*	*	*	*	*

1.0 Purpose & Planning Information
2.0 Operating Information
3.0 Technical Description
4.1 Installation Instructions
4.2 Prep for Special Environments
5.1 Failure Diagnosis
5.2 Repair Instructions
5.3 Inspection Standards
5.4 Calibration Procedures
6.0 Maintenance Schedules
7.1 Illustrated Parts Catalogue
7.2 Commercial Parts List
8.1 Modification Instructions
8.2 General Instructions

* Not published

Note ...

Reference to AESP 0100-A-001-001 must be made to ensure the availability of the listed publications.

Associated Publications

Code No.	Type	Title
2815-B-641	AESP	Engine, Diesel 1 and 2 Cylinder, Petter A Range, Air and Water Cooled.

WARNINGS...

LETHAL VOLTAGES

(1) VOLTAGES OUTPUT FROM THIS GENERATOR SET CAN ENDANGER LIFE. CARELESSNESS CAN BE FATAL. ENSURE THAT THE CHASSIS IS CORRECTLY EARTHED AND THAT THE EARTH LEAKAGE CIRCUIT BREAKER FUNCTIONS CORRECTLY FOR OUTPUT 4.

(2) BEFORE OPENING THE ACCESS COVER TO THE EMERGENCY TERMINALS, THE EMERGENCY TERMINALS 13A CIRCUIT BREAKER SHOULD BE AT THE OFF POSITION.

(3) THIS GENERATOR SET IS FITTED WITH RFI/EMP FEED THROUGH FILTERS. THE GENERATOR SET MUST BE CORRECTLY EARTHED BEFORE USE.

INJURY TO PERSONNEL

(1) WHEN REMOVING/REPLACING THE ENGINE/ALTERNATOR FROM THE CHASSIS, PREVENT INJURY TO PERSONNEL BY USING ADEQUATE SUPPORT DURING THE LIFTING OPERATIONS.

(2) PRECAUTIONS SHOULD BE TAKEN TO PREVENT EXHAUST GASES FROM ENTERING TRENCHES OR OTHER AREAS OCCUPIED BY PERSONNEL.

SPILLAGE OF DIESEL FUEL

PRECAUTIONS SHOULD BE TAKEN TO PREVENT THE SPILLAGE OF FUEL ONTO THE SOFT NOISE ABSORBANT AREAS WITHIN THE ENGINE ENCLOSURE AND THE ACOUSTIC COVER. ANY SUCH SPILLAGES SHOULD BE ATTENDED TO IMMEDIATELY. ANY SPILLAGES MUST BE CLEANED UP BEFORE RUNNING THE GENERATOR SET.

BOOST CHARGING

BOOST CHARGING OF SEALED FOR LIFE (MAINTENANCE FREE) BATTERY. THE GENERATOR SET IS FITTED WITH SUCH A BATTERY. ON NO ACCOUNT MUST THIS BATTERY BE SUBJECTED TO A RAPID BOOST CHARGE OF THE TYPE USED FOR A NORMAL LEAD/ACID TYPE OF BATTERY. ANY BOOST CHARGE MUST BE FROM A CONSTANT VOLTAGE SOURCE NOT EXCEEDING 15 VOLTS AND A MAXIMUM CHARGE CURRENT OF 35 AMPERES (30 AMPERES NOMINAL).

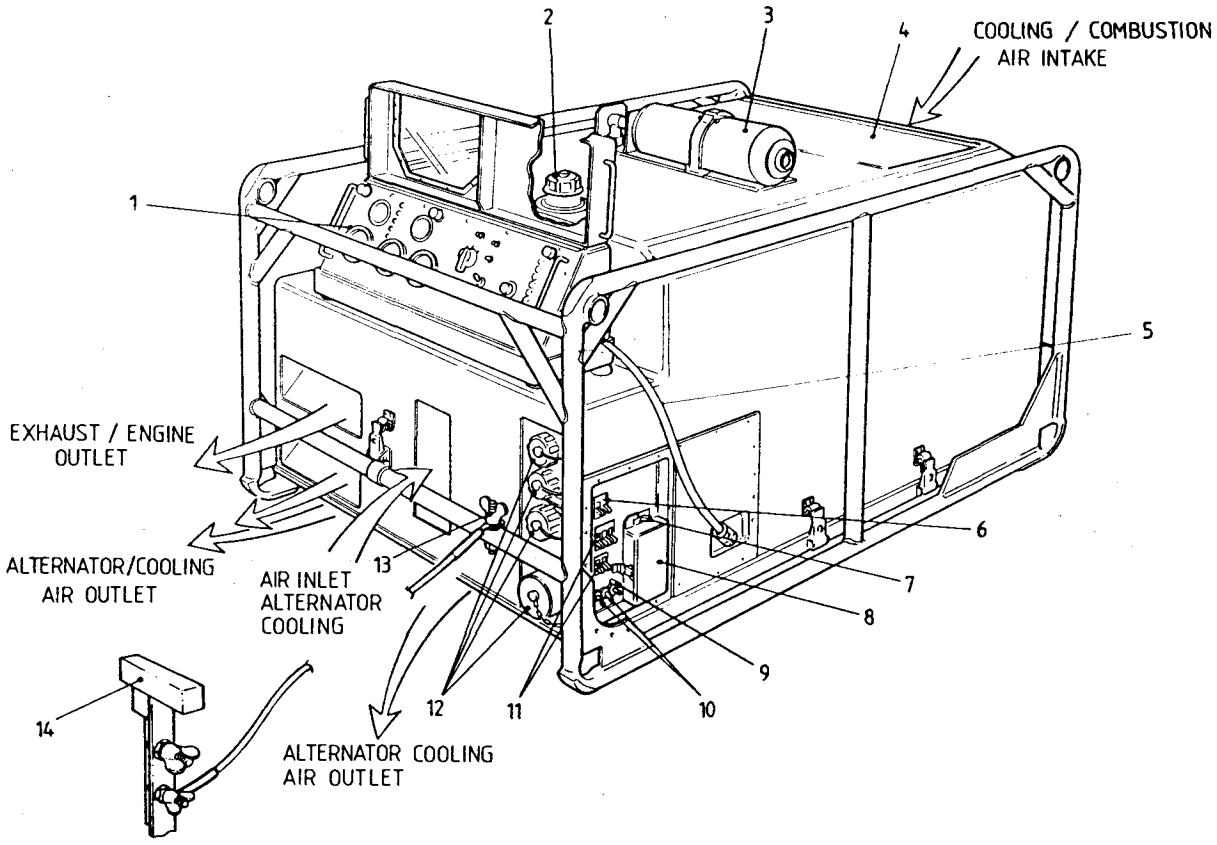
Chapter 1

GENERAL DESCRIPTION

CONTENTS

GENERAL

1 The Air-Log Limited Generator Set 4169A (Fig 1) is a chassis mounted, diesel driven, air-cooled generator set that can be lifted by six men and manhandled over rough ground by four men. The combined engine/alternator unit is enclosed within a demountable glass reinforced plastic (GRP) acoustic cover, that houses a demountable output panel control box that can be remotely deployed. The generator set is supplied with five extension exhaust tubes, two of which are flexible. The generator set can be operated mounted singly on FV2380 Mk II Trailer, or as a pair mounted on a FV2406 Mk II Trailer. Four clamps, installed as a mounting kit, secure each set to the decking of the trailers.



1. Output Panel Control Box
2. Fuel Filler Cap
3. Fire Extinguisher (BCF)
4. Stowage Compartment
5. 3/4 m Cable
6. Generator Output Switch
7. Emergency Terminals Switch (30A)
8. Emergency Output Terminals Cover
9. Synchro Lamp and Switch
10. Single/Parallel Mode Switches (2 off)
11. Output ON/OFF Switches
12. Output Sockets
13. Earth (Ground) Connector
14. Earth Spike and earth lead

Fig 1 Generator Set - General View

ROLE

2 The generator set is designed for field use and is especially suitable for powering communications equipment and other equipment where good cyclic regularity is needed from the engine to produce a good quality sine wave output from the alternator. The brushless alternator is close coupled to the engine and is able to produce a high quality, single phase sine wave output of 240V 50Hz (nominal) with low distortion and noise levels. Maximum continuous output is 5.6 kVA at 0.8 power factor. Normal starting is by battery but there is also an emergency rope and pulley start capability which is a two-man function. The generator set is enclosed in a GRP acoustic cover.

Special Features

3 The generator set contains protection circuits that can disconnect the load when an electrical fault occurs and can also shut down the engine should operational parameters exceed predetermined levels. Two generator sets of the same type can be connected in parallel to provide extra output capability or load transfer. Other important features of the generator set are the low audible noise level and low infra-red emissions. Five extension exhaust tubes (two flexible and three rigid) are supplied so that exhaust gases can be piped up to five metres from the generator set, should this be required.

Deployment

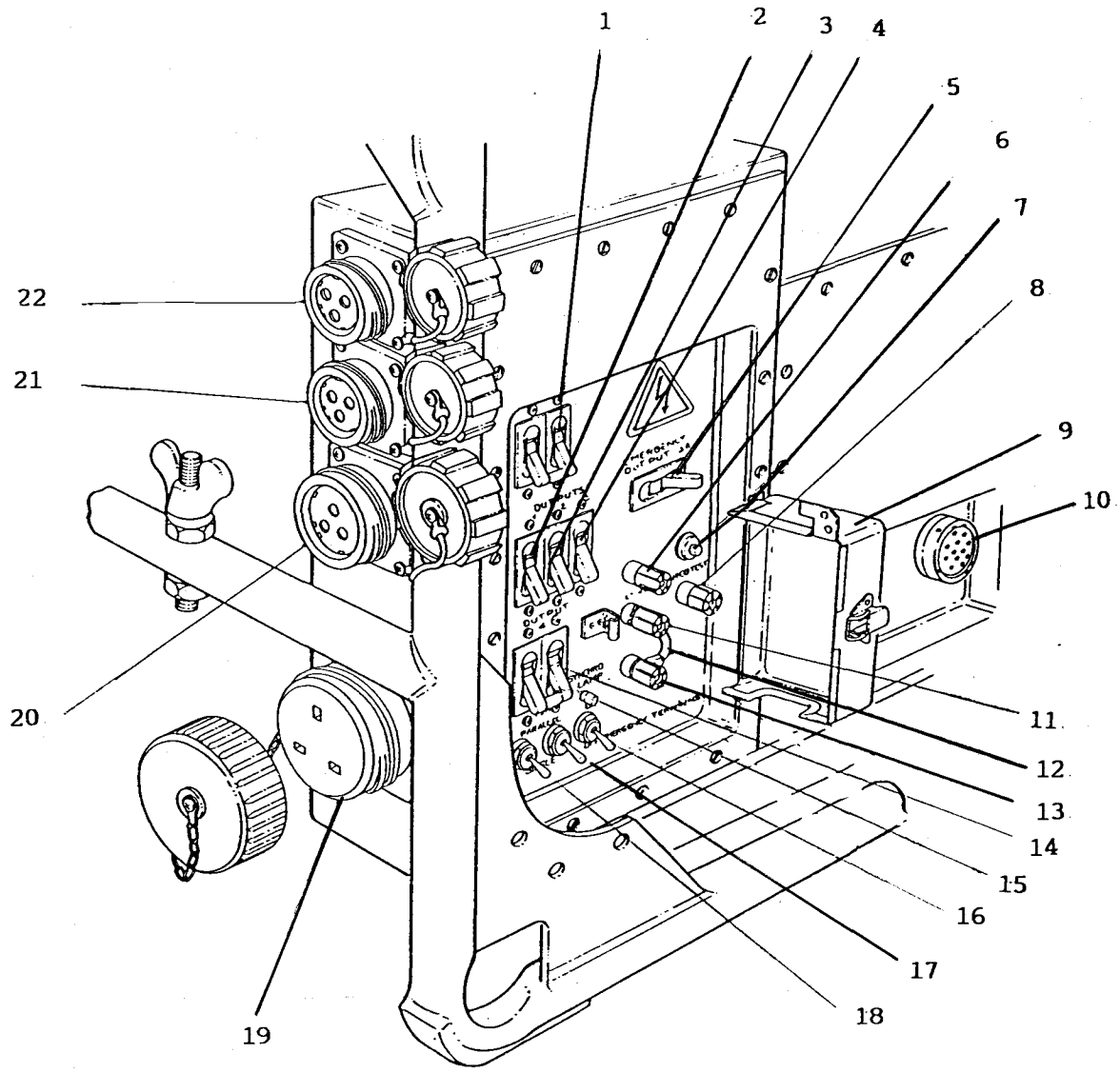
4 The generator set can be deployed at ground level as a free-standing unit or it can be trailer mounted as a single item or in pairs. The generator set will function at any angle up to 20 degrees in any axis.

CONSTRUCTION

5 The engine/alternator assembly is contained in a welded tubular chassis assembly and held in place by nuts and bolts and shock mounts. There is an integral fuel tank of 25 litres (5.5 gallons) capacity which is mounted onto the engine assembly. The engine is a Petter AD2, twin cylinder, air cooled diesel unit which is fuelled by mechanical injection. Pre-heaters are built in to assist cold starting. The engine is close coupled to the alternator which is an Allam brushless unit with low electrical noise output. The alternator is bolted onto the engine and can be separated with the engine/alternator assembly removed from the chassis assembly, as described in category 5 of this AESP.

Fixed Box

6 This a fabricated steel box, housing externally and internally mounted items (Fig 2). The externally mounted items consist of the power output connectors, output circuit breakers, output emergency terminals, and synchronising switches and lamps for running two generators in parallel. The acoustic cover is cut away for easy access to these items. Also mounted to an exterior panel of the fixed box is the output connector for the interconnecting cable to the output panel control box (para. 12). The fixed box contains two screwed-on panels that can be removed for easy access and removal of externally and internally mounted items. The internally mounted items include the engine protection printed circuit board, residual current



1. Power ON/OFF Circuit Breaker
2. OUTPUT 1 Circuit Breaker
3. OUTPUT 2 Circuit Breaker
4. OUTPUT 3 Circuit Breaker
5. EMERGENCY Output 13A Switch
6. LINE Terminal (Emergency Output)
7. RCD TEST Button
8. STOWAGE Terminal
9. Emergency Output Terminals Cover
10. 41-Way Socket Connector for Interconnecting Cable to Output Panel Control Box
11. NEUTRAL Terminal (Emergency Output)
12. Wire Link/Strap
13. EARTH Terminal (Emergency Output)
14. OUTPUT 4 Circuit Breaker
15. SYNCHRO Lamp
16. SYNCHRO Lamp ON/OFF Switch
17. PARALLEL/SINGLE 'B' Switch
18. PARALLEL/SINGLE 'A' Switch
19. OUTPUT 4 Socket Connector (13A)
20. OUTPUT 1 Socket Connector (30A)
21. OUTPUT 2 Socket Connector (15A)
22. OUTPUT 3 socket Connector (15A)

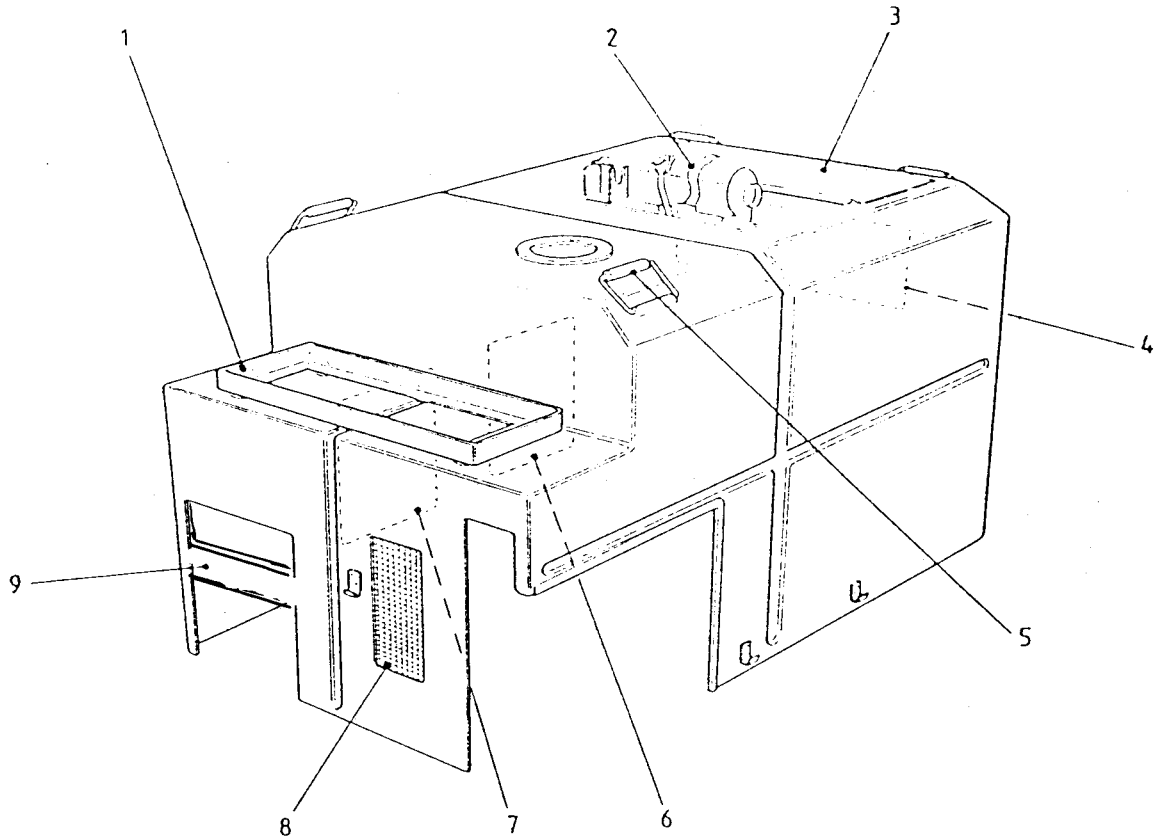
Fig 2 Fixed Box - General View

6 Continued.

detector unit, load disconnection relay, dc connecting relay, current transformer CT1, automatic voltage regulator, filters, and termination boards TB1 and TB2. Information on the removal of these items is contained in category 5 of this AESP.

Acoustic Cover

7 The acoustic cover, Fig 3, is fabricated from glass reinforced plastic, supplemented with noise absorbant sponge material. The acoustic cover contains cut-away areas and hinged panels for access to chassis or engine mounted items. The acoustic cover also contains input-output louvres and grills for easy flow of cooling and induction air for the generator set. The cover is held in place by means of seven quick-release fasteners. Lifting the cover from the chassis assembly is a two-man task.



1. Output Panel Control Box Mounting Tray
2. BCF Fire Extinguisher Securing Strap
3. Stowage Compartment Access Hatch
4. Cooling Air Inlet
5. Lifting Handle (4 off)
6. Engine Oil Access Hatch
7. Exhaust System Access Hatch
8. Air Inlet for Alternator Cooling
9. Cooling Air Outlet Ducts

Fig 3 Acoustic Cover - General View

Chapter 2

DESCRIPTION AND PRINCIPLES OF OPERATION

CONTENTS

Introduction

1 The generator set consists of the items shown in Fig 1, with the two main items being the Petter AD2 engine and the alternator.

Engine

2 The engine is a Petter AD2 twin cylinder air-cooled diesel engine of 734 cc capacity; bore and stroke are 80.0 x 73.0 mm respectively. The engine is supplied to a build standard defined in the current Air-Log Limited production drawing and is included in the MOD type approval list DEF-STAN 28-2. The two cylinders are a vertical in-line north/south configuration. The flywheel is of the high inertia type producing good cyclic regularity. The drive from the AD2 engine is taken from the flywheel end of the crankshaft, which is mechanically coupled to the alternator rotor shaft. The engine mechanical speed governor is preset to 3300 rpm and acts as a back-up safety device in the event of a failure in the electronic governing and control systems.

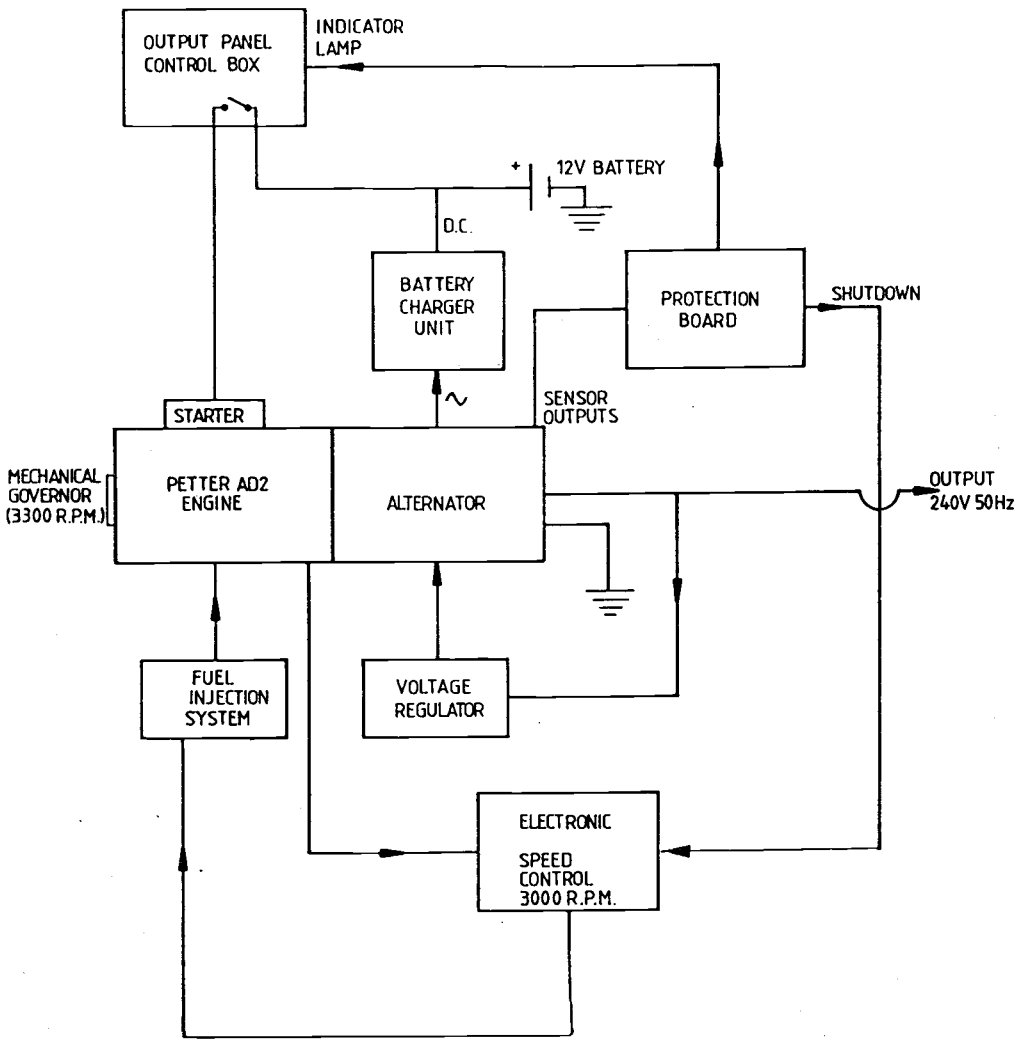


Fig 1 Generator Set Block Diagram

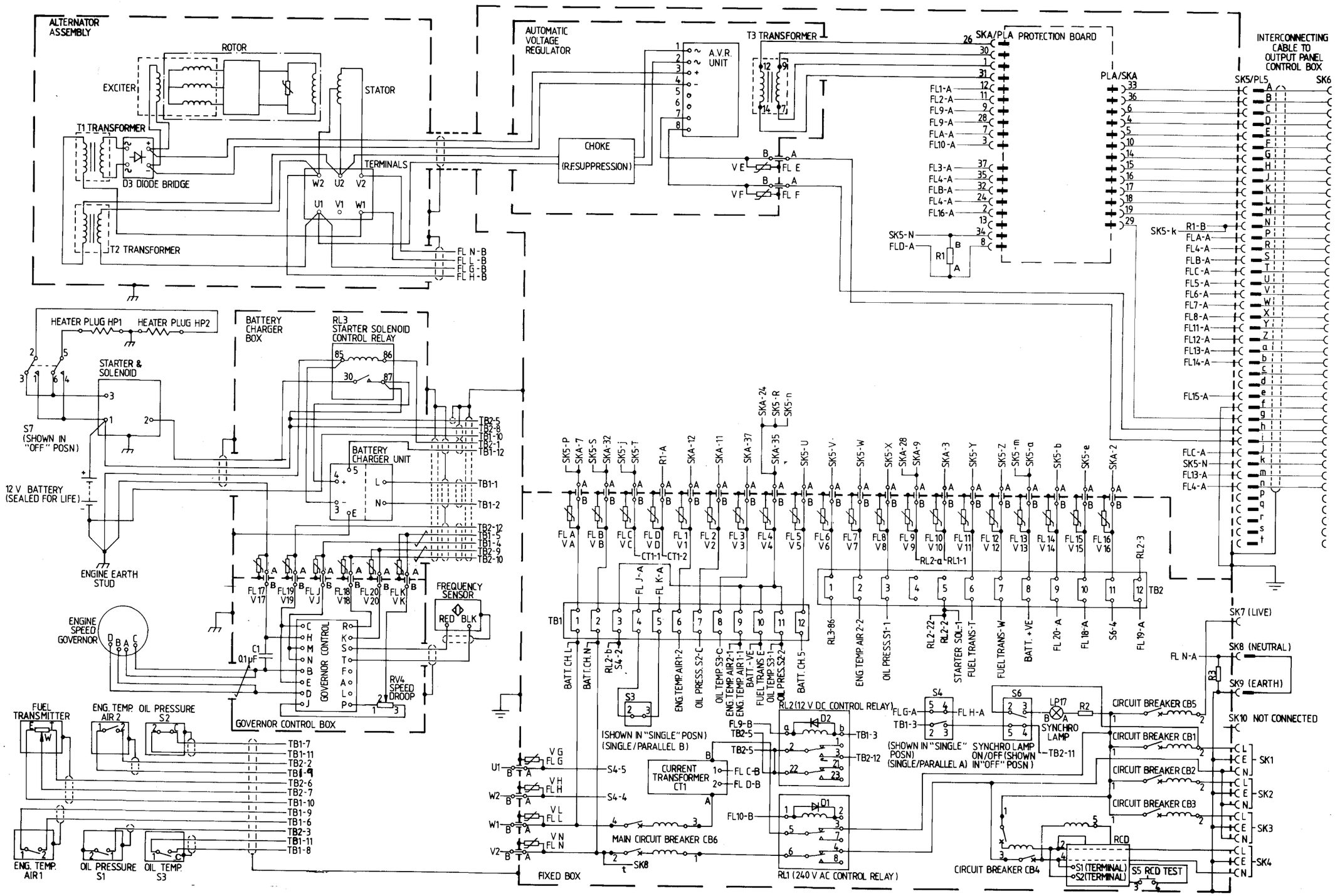


Fig 2

Generator Set - Circuit Diagram

Fig 2

Alternator

3 The alternator (Fig 3) is an Allam MT3E self exciting brushless generator which produces a good quality sine wave output of low electrical noise level. The output is 240V 50Hz (nominal) at 3000 rpm; this produces a maximum continuous output of 4.5kW (5.6 kVA at 0.8 power factor). Voltage output and frequency are essentially a function of rotor speed, therefore the engine speed is governed electronically to 3000 rpm. Provision is made to trim the engine speed from the output panel control box with reference to the frequency meter. The output voltage can also be adjusted from the output panel control box, within the limits 220 to 250V. The generator bearings are permanently lubricated and there are no sliding contacts within the rotor assembly; the generator therefore needs no mechanical maintenance except for routine visual inspection.

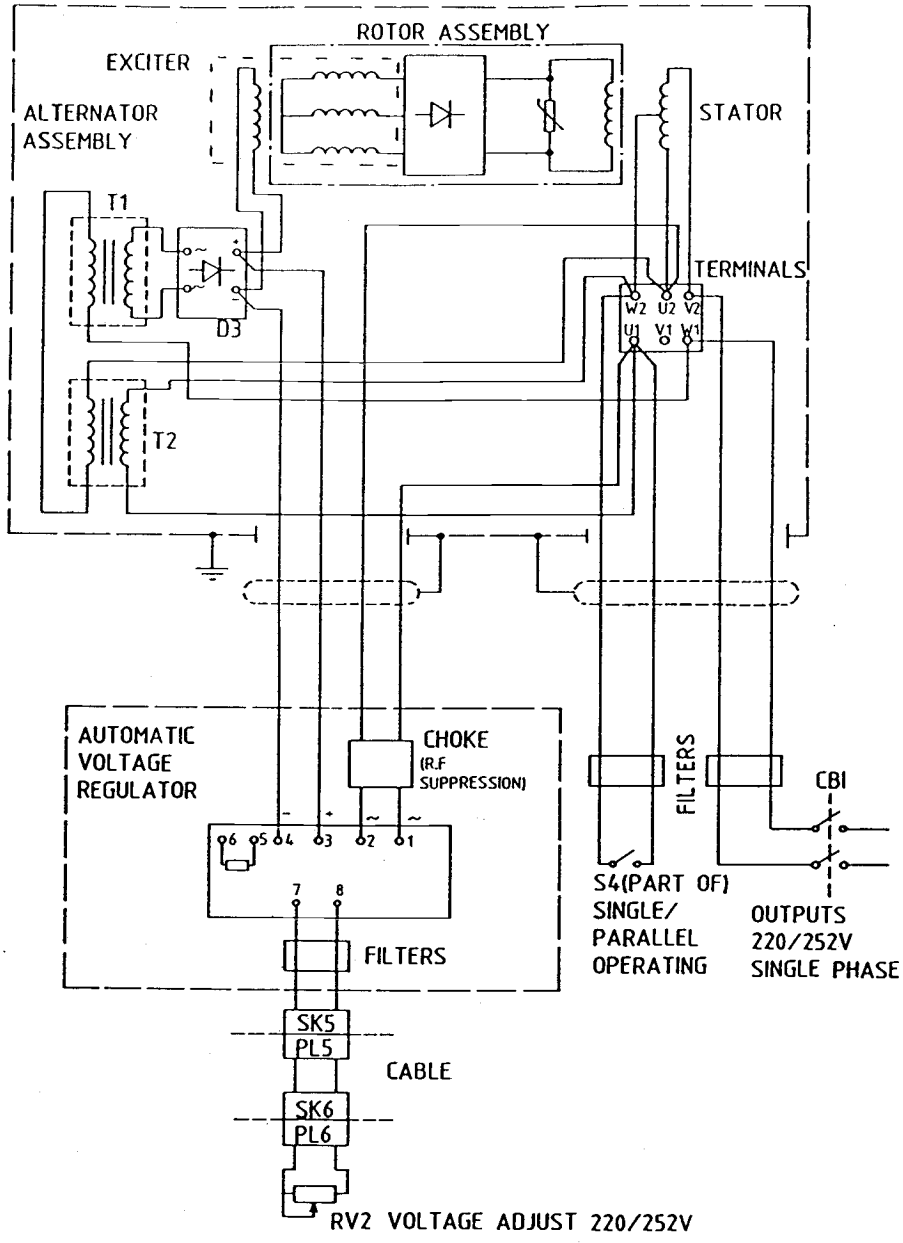
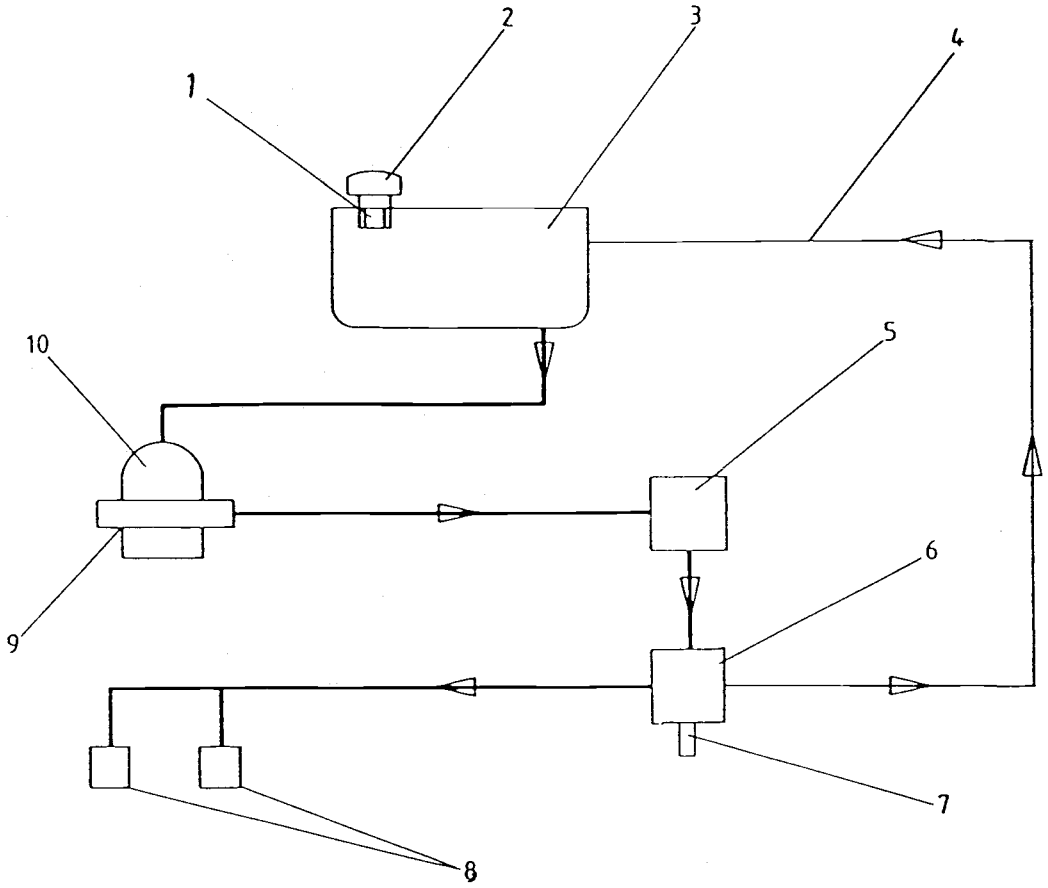


Fig 3 Alternator - Schematic Circuit

Fuel System

4 The engine (Fig 4) is fuelled by mechanical injection of diesel oil; there is a single injector mounted into each of the two cylinder heads. To assist cold starting, a preheater plug is mounted into each cylinder head. The diesel fuel is contained in a 25 litres (5 gallons) tank mounted in the chassis assembly. The fuel is pumped mechanically through the fuel system which contains a replaceable filter within the fuel filter bowl. The fuel pump can be operated by hand to prime the fuel system if it has been allowed to run dry. In normal use the fuel system is self bleeding and does not require priming. The fuel system contains a fuel flow regulator with a mechanical actuator arm which is controlled from the engine speed electronic governor unit. The fuel actuator is automatically operated to the correct position when the engine starter switch is operated on the output panel control box.
FCU = 24 litres.

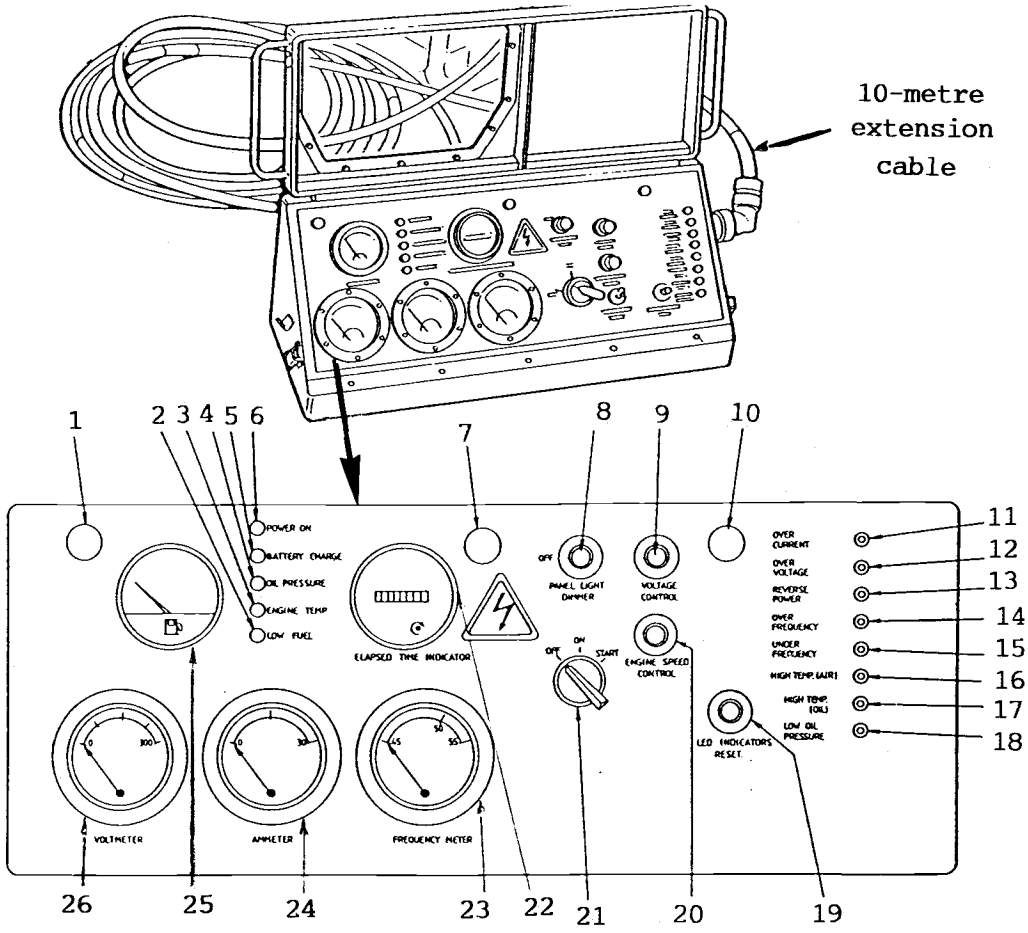


1. Fuel Tank Inlet Filter
2. Fuel Tank filler Cap
3. Fuel Tank
4. Fuel Bleed Pipe
5. Fuel Filter Bowl
6. Fuel Flow Regulator
7. Mechanical Actuator (Controled from Electronic Governor)
8. Fuel Injectors
9. Fuel Pump Hand Primer
10. Fuel Pump

Fig 4 Fuel System Block Diagram

Output Panel Control Box (Figs 5 and 6)

5 The output panel control box is normally mounted in a tray, on top of the acoustic cover, but it can be remotely deployed by using the 10-metre extension interconnecting cable supplied with the generator set. The output panel control box provides the means for starting and stopping the generator set, adjusting the output, monitoring the performance, and receiving indicator lamp warnings of mechanical and electrical problems.



1. Panel Lamp
2. Low Fuel Indicator
3. Engine Temperature (Excessive) Indicator
4. Oil Pressure (Low) Indicator
5. Battery Charge (Failed) Indicator
6. Power On Indicator
7. Panel Lamp
8. Panel Lamps Dimmer Control
9. Voltage Control
10. Panel Lamp
11. Over Current Indicator
12. Over Voltage Indicator
13. Reverse Power Indicator
14. Over Frequency Indicator
15. Under Frequency Indicator
16. High Air Temperature Indicator
17. High Oil Temperature Indicator
18. Low Oil Pressure Indicator
19. LED Indicators Reset Button
20. Engine Speed Control
21. OFF/ON/START switch
22. Elapsed Time Indicator
23. Frequency Meter
24. Ammeter
25. Fuel Gauge
26. Voltmeter

Fig 5 Output Panel Control Box (Demounted) - General View

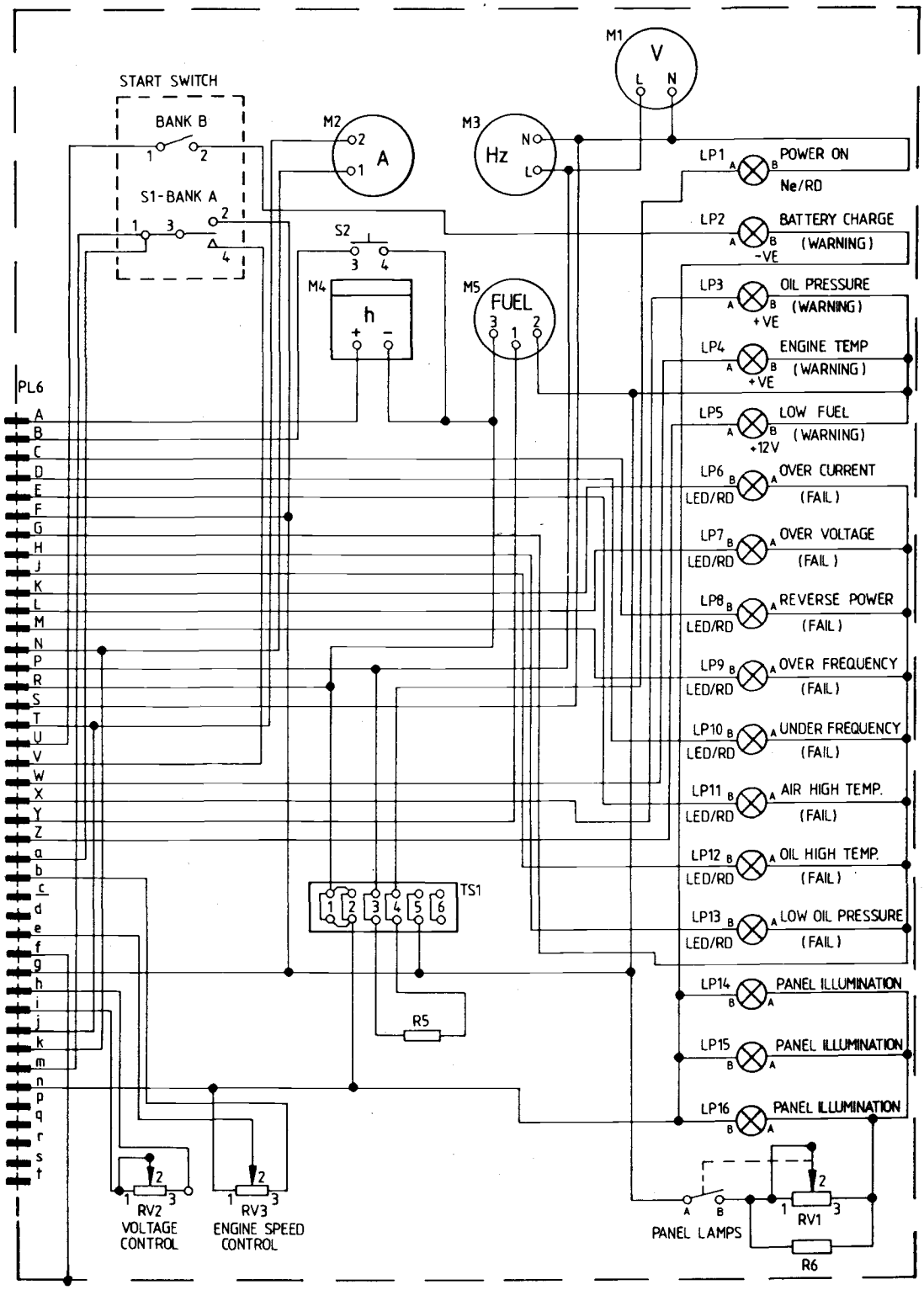


Fig 6 Output Panel Control Box - Circuit Diagram

Battery Charger Unit

6 The battery charger unit (Fig 7) comprises a transformer and main pcb module; and a small auxiliary pcb, all mounted in a die-cast box within the chassis assembly. The battery charger unit is a constant voltage device with an output of 6A, providing a charging current of 2A (nominal) driven from the alternator. It is specially designed for use with the sealed for life (maintenance free) battery supplied with the generator. Normal repair of the battery charger unit is by substitution of the printed circuit board.

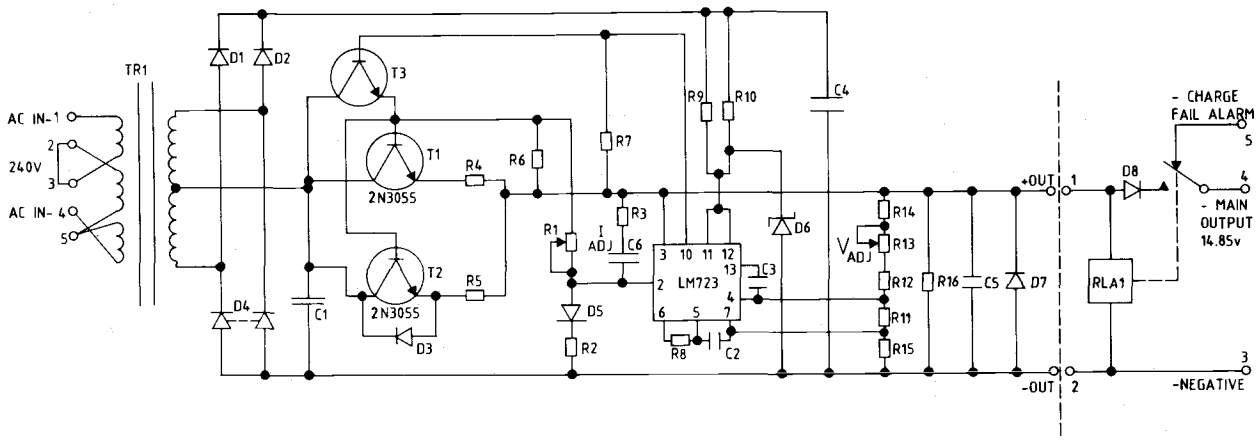


Fig 7 Battery Charger Unit - Circuit Diagram

Principles of Operation

7 Operation of the battery charger is detailed as follows:

7.1 When 240V ac is applied to the primary winding of TR1, the output of the secondary winding is rectified and applied, via D1 or D2 and R9 and R10, to pins 11 and 12 of Integrated Circuit LM723. At the same time the output from the secondary winding centre tap is applied to the collectors of T1, T2 and T3.

7.2 LM723 outputs a signal from pin 10 to the base of T3, T3 begins to conduct and switches on T1 and T2. Current now flows from TR1 centre tap through the operating coil of relay RLA1 which energises and contact change over occurs. This action disconnects the battery supply to the Charge Fail Alarm lamp which extinguishes, and connects the output of TR1 centre tap to the battery.

7.3 Any change in voltage between + OUT and - OUT will change the value of the current flow through the resistor chain comprised of R14, R13, R12, R11 and R15. This change is sensed at LM723 pin 4 and results in a decrease or increase of the output signal from pin 10 to the base of T3. The change in bias on the base of T3 in turn changes the conduction through T1 and T2. Manual voltage adjustment is provided by R13.

7.4 Similarly any change in charging current is sensed at LM723 pin 3 and results in a decrease or increase of the output of pin 2 which in turn decreases or increases the bias applied to the bases of T1 and T2. Manual current adjustment is provided by R1.

Battery

8 This is a sealed for life lead/acid battery of 12V and 35 ampere hours capacity charged from the generator set via the battery charger unit; the physical size of the battery is 25 cm long x 10 cm wide x 20 cm high and it is mounted within the chassis assembly. The battery needs no topping up or other routine maintenance except for visual inspection for cracks or other damage. The battery negative terminal is connected to chassis (ground). Externally applied boost charges must only be applied from a constant voltage source. On no account should a motor vehicle type booster charger be used. This could cause catastrophic damage to the battery. The battery must be disconnected from the generator set before any external charge is applied (See WARNINGS, page (vii)/(viii)).

Engine Speed Electronic Control - Electronic Governor

9 This is an electronic unit (Fig 8), designed around the phase - locked loop principle to control engine speed with fast response time to load changes. It is mounted in a die-cast box adjacent to the engine pulley. There are three preset potentiometers on the engine control unit, these are SPEED, STABILITY and GAIN. A unit supplied with a generator is preset at the factory to suit the characteristics of the generator and should not need adjustment, except if a new unit is fitted. The preset speed is 3000 rpm. This unit controls the movement of the throttle actuator at start-up and during normal running.

Operation

10 The operation of the electronic governor is described as follows:

10.1 The electronic governor is comprised of an input amplifier, control loop incorporating a voltage controlled oscillator and phase detector, and speed control circuit. The unit receives a signal from the engine speed sensor at a frequency which is proportional to the speed at which the engine is running. This signal is amplified and input to the phase detector where it is compared with a preset reference signal from the voltage controlled oscillator. Any difference in frequency results in a change to the signal output to the speed control circuit which drives the engine throttle actuator. When the frequencies of the speed sensor signal and that of the voltage controlled oscillator are equal the control loop becomes 'locked' and outputs a steady signal to the speed control circuit.

10.2 During engine start up and initial acceleration the frequency of the signal, from the engine speed sensor, input to the phase detector will be low compared to the reference signal from the voltage controlled oscillator. This results in a high output to the speed control circuit which drives the throttle actuator to the maximum fuel setting.

10.3 As the engine accelerates up to speed the frequency of the signal from the speed sensor will increase, the frequency difference sensed at the phase detector will decrease, the output signal to the speed control circuit will be decreased and correspondingly the throttle actuator will be driven towards the minimum fuel setting. When the engine speed is at 3000 rpm the frequency of the speed sensor signal matches that of the reference signal and the control loop becomes 'locked'.
This results in a constant output signal (approx. +5V) to the speed control circuit and the throttle actuator is held at that particular fuel setting.

10.4 Any variation in engine speed, e.g. due to changes in the load on the alternator, will be sensed as a frequency change by the phase detector; as a result the control loop 'unlocks', the signal to the speed control circuit increases or decreases to drive the throttle actuator towards either a high or lower fuel setting. When the engine speed is at 3000 rpm the control loop becomes 'locked' and the engine speed remains constant.

10.5 To ensure smooth operation, and reduce 'overshoots', feedback techniques are employed in the control circuits. Fine control of engine speed is enabled by operation of the ENGINE SPEED control mounted on the OUTPUT PANEL CONTROL BOX. Engine speed droop control is brought into operation when generator sets are operated in parallel.

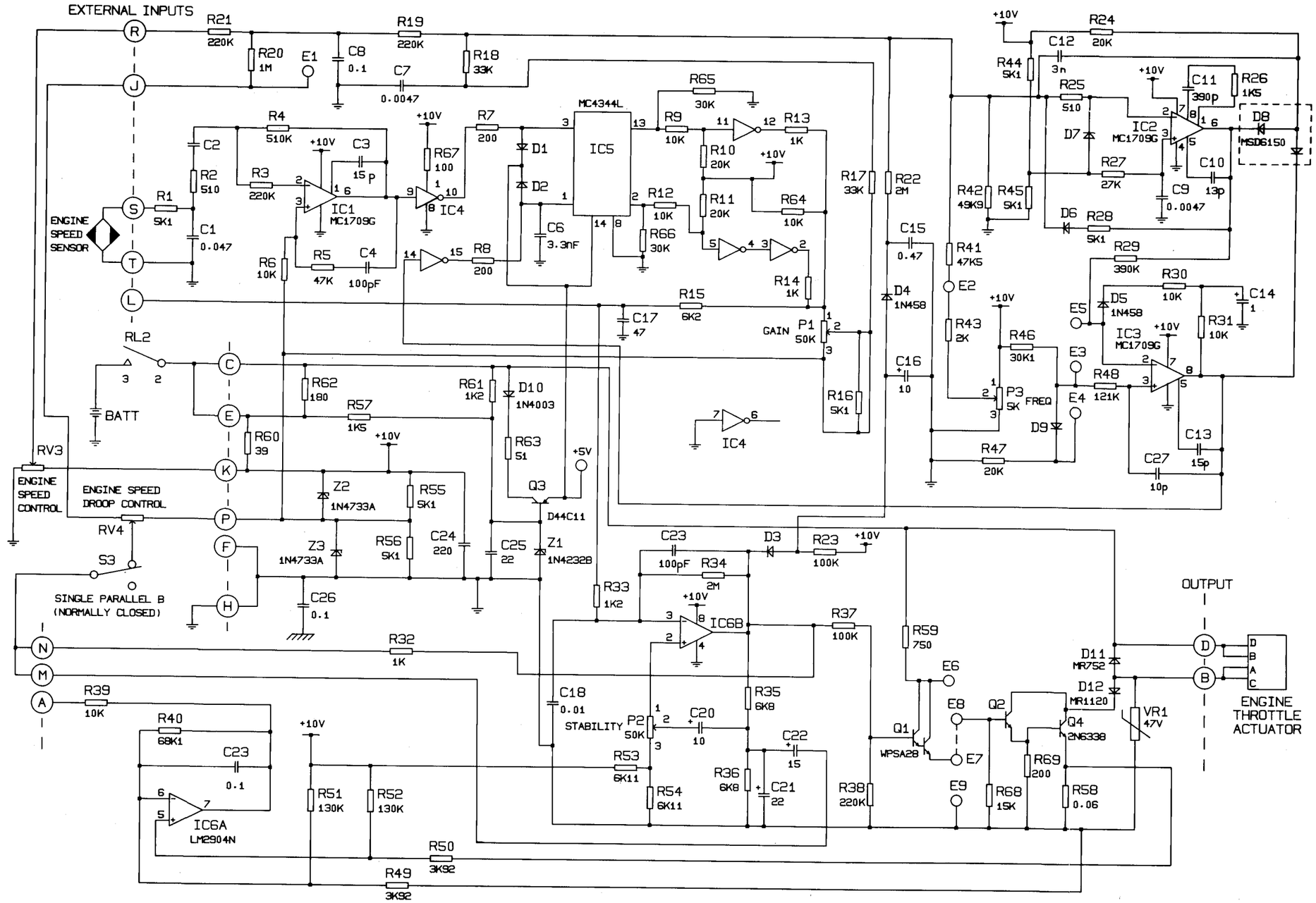


Fig 8 Engine Speed Control Unit Circuit

Mechanical Governor

11 The Petter AD2 engine is fitted with a mechanical engine governor which is preset to 3300 rpm for this application. The mechanical governor acts as a back-up safety device to limit the engine speed to 3300 rpm should there be a failure in the electronic governor and the engine protection electronic circuits.

Protection Board (Figs 9 and 10)

12 The generator set contains a protection printed circuit board which is able to monitor essential operational parameters either electronically, or by using external sensors. In some circumstances, the external sensors (mounted to the various parts of the generator assembly) provide a short circuit condition which is sensed by the protection board. The protection board can, via relay contacts, disconnect the load from the alternator (for electrical problems) and also shutdown the engine (for mechanical problems that could endanger the operational capability of the engine). Additionally, the protection board provides a visual indication of the problem by means of indicator lamps on the output panel control box. The functions of these lamps are defined in category 201. If the protection board has disconnected the load or shut down the engine, the circuits need to be reset before engine restart or load reconnection. This can be accomplished by operating the LED INDICATORS RESET button on the output panel control box. All adjustments are factory preset and must not be changed.

Principles of Operation

13 Operation of the protection circuits is described as follows:

13.1 The sensors monitoring ENG AIR TEMP, OIL TEMP and OIL PRESS (S2) are electrically similar with a set of contacts monitoring the relevant parameter. During normal engine running OIL PRESS (S2) contacts are normally closed, and the contacts of ENG AIR TEMP and OIL TEMP are normally open. OIL PRESS (S1) contacts form part of a warning circuit only and is not a function of the protection board. If a particular parameter exceeds its limits the sensor contacts operate and cause a comparator on the protection board to change state and activate a 5 sec timer. If the condition still persists at the end of this period of time, the load disconnect and engine shutdown relays are energised and the relevant warning LED on the output panel control box is lit.

13.2 OVERVOLTAGE TRIP. This circuit comprises a transformer rectifer with its primary winding connected across the generator output. The dc output of the rectifier is monitored by a comparator. if the generator output voltage exceeds the limit, the comparator changes state and activates the 5 sec timer. After this time delay the load disconnection relay is energised and the OVERVOLTAGE LED on the output control panel is lit.

13.3 OVERCURRENT TRIP. Load current is monitored by a sense resistor, the ac voltage developed across the resistor is rectified and output to a comparator. If the load current exceeds a preset limit the comparator changes state and activates the 5 sec timer. After the time delay the load disconnection relay is energised and the OVERCURRENT LED on the output control panel is lit.

13.4 REVERSE POWER. Reverse power is monitored by a phase detection circuit whose reference phase is connected across the generator output voltage; whilst the variable phase monitors the load current. The output of the phase detector is a dc voltage which is compared with a preset reference voltage.. If the phase relationship between generator voltage and load current exceeds the preset limit the comparator changes state and activates the 5 sec timer. After the time delay the load disconnection relay is energised and the REVERSE POWER LED on the output control panel is lit.

13.5 FREQUENCY. The frequency of the output voltage is monitored by a frequency -to- voltage converter. The dc output of the converter is applied to a comparator. A change in frequency results in a change of the converter dc output ie an increase in frequency gives rise to an increase in output of the converter. If the frequency exceeds either the upper of lower limit the comparator changes state and activates the 5 sec timer. After the time delay the load disconnection and engine shutdown relays are energised and the UNDER FREQUENCY or OVER FREQUENCY LED on the output control panel is lit.

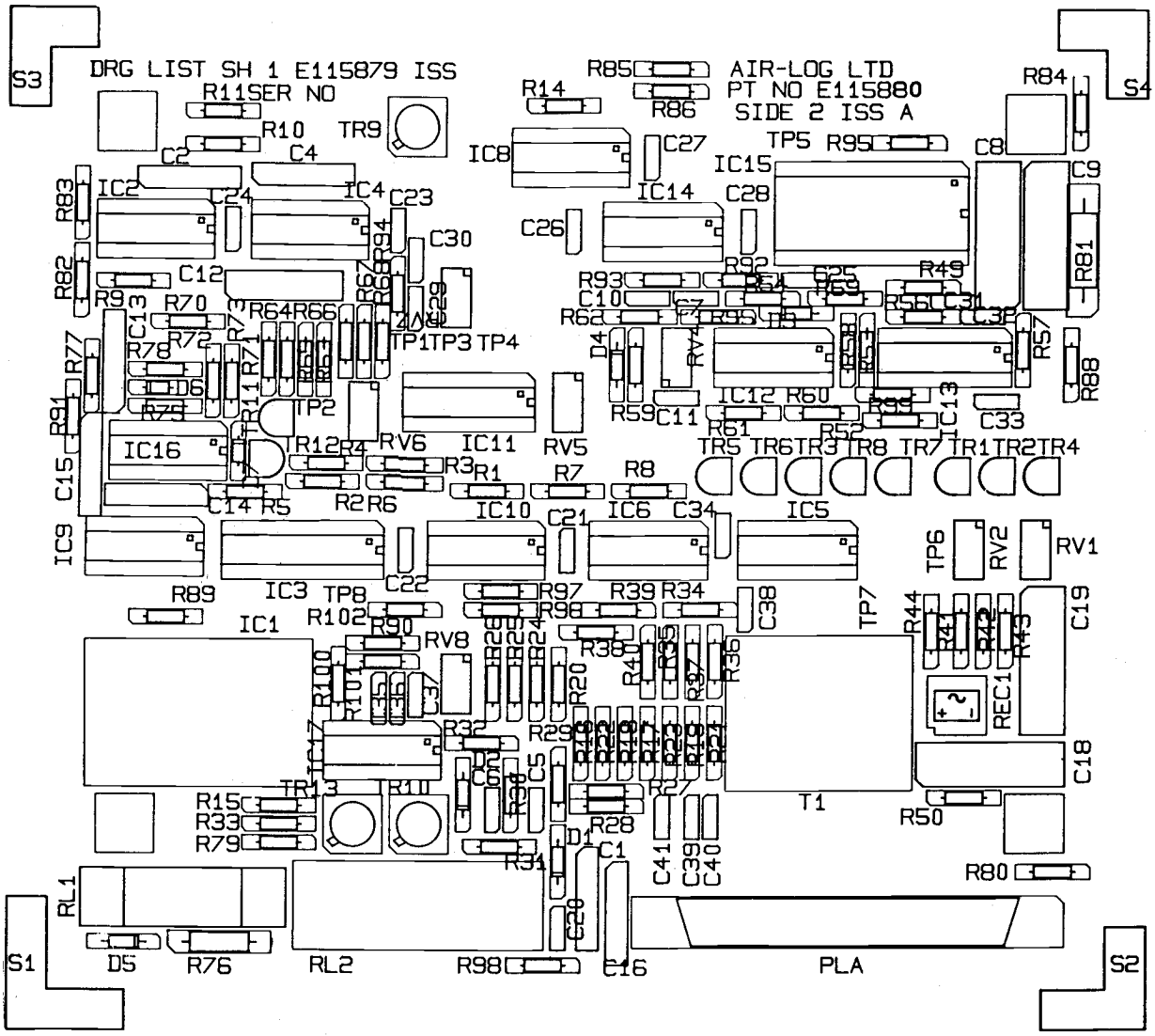
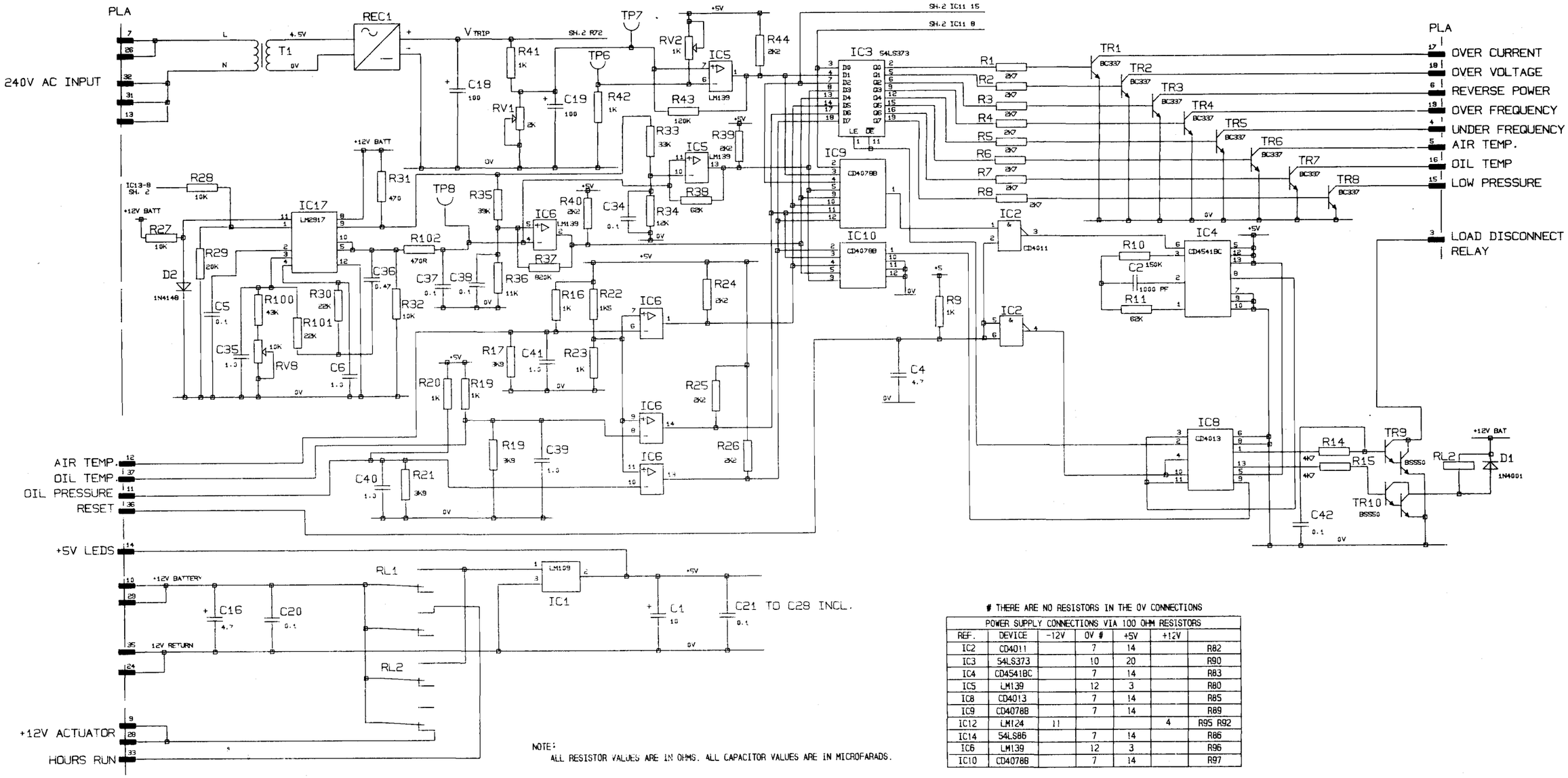


Fig 9 Protection PCB - Layout



\# THERE ARE NO RESISTORS IN THE 0V CONNECTIONS

POWER SUPPLY CONNECTIONS VIA 100 OHM RESISTORS						
REF.	DEVICE	-12V	0V #	+5V	+12V	
IC2	CD4011		7	14		R82
IC3	54LS373		10	20		R90
IC4	CD4541BC		7	14		R83
IC5	LM139		12	3		R80
IC8	CD4013		7	14		R85
IC9	CD4078B		7	14		R89
IC12	LM124	11			4	R95 R92
IC14	54LS86		7	14		R86
IC6	LM139		12	3		R96
IC10	CD4078B		7	14		R97

NOTE:
ALL RESISTOR VALUES ARE IN OHMS. ALL CAPACITOR VALUES ARE IN MICROFARADS.

Fig 10 Protection PCB Circuit Diagram (Sheet 1 of 2) Fig 10

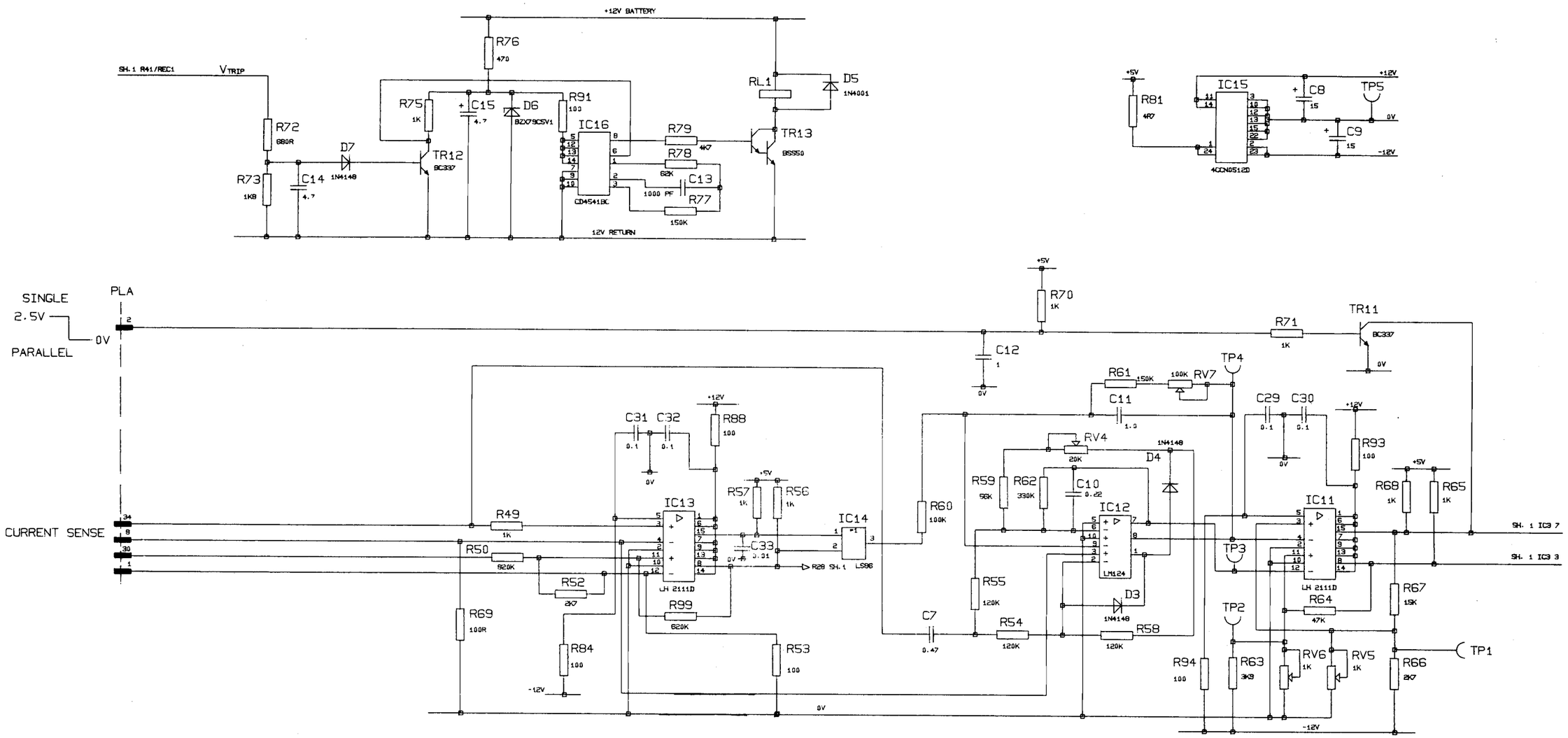


Fig 10

Protection PCB Circuit Diagram (Sheet 2)

Fig 10

Automatic Voltage Regulator Unit (AVR) (Fig 11)

14 The AVR is contained in a metal box within the right-hand section of the fixed box. The majority of the PCB mounted components are encapsulated in compound, however some components can be replaced if found to be faulty.

Principles of Operation (Figs 2 and 11)

15 The AVR Controls the alternator output voltage by varying the field current in the exciter windings. The exciter field current is derived from the rectified output of diode bridge D3 and connected in parallel to the d c terminals of the AVR. The AVR incorporates a voltage sensing circuit, and a trigger circuit controlling a silicon controlled rectifier (SCR). The voltage sensing signal is derived from the centre tap output of the alternator stator windings and is directly proportional to the main output voltage.

16 When the alternator is running the output from the secondary winding of T1 is rectified and applied to the exciter field windings and the AVR d c terminals. At the same time the AVR receives a voltage sense input from the stator windings. At governed speed and an output voltage of 240V, the voltage sensing signal developed by the AVR is insufficient to trigger the SCR and current flow from D3 is at a minimum and low in comparison to that flowing through the exciter field coils.

17 If the output voltage rises above 240V, a corresponding rise in output voltage from the stator centre tap is sensed in the AVR. The resultant generated error signal switches on the trigger circuit allowing the SCR to conduct and shunt current away from the exciter windings, exciter field current begins to fall reducing the main output voltage until such time that is is at 240V. At this point the voltage sensing signal input to the AVR has fallen too low to maintain conduction through the SCR and current flow from D3 to the AVR is at a minimum again.

18 Voltage trimming is available at RV2 mounted on the Output Panel Control Box.

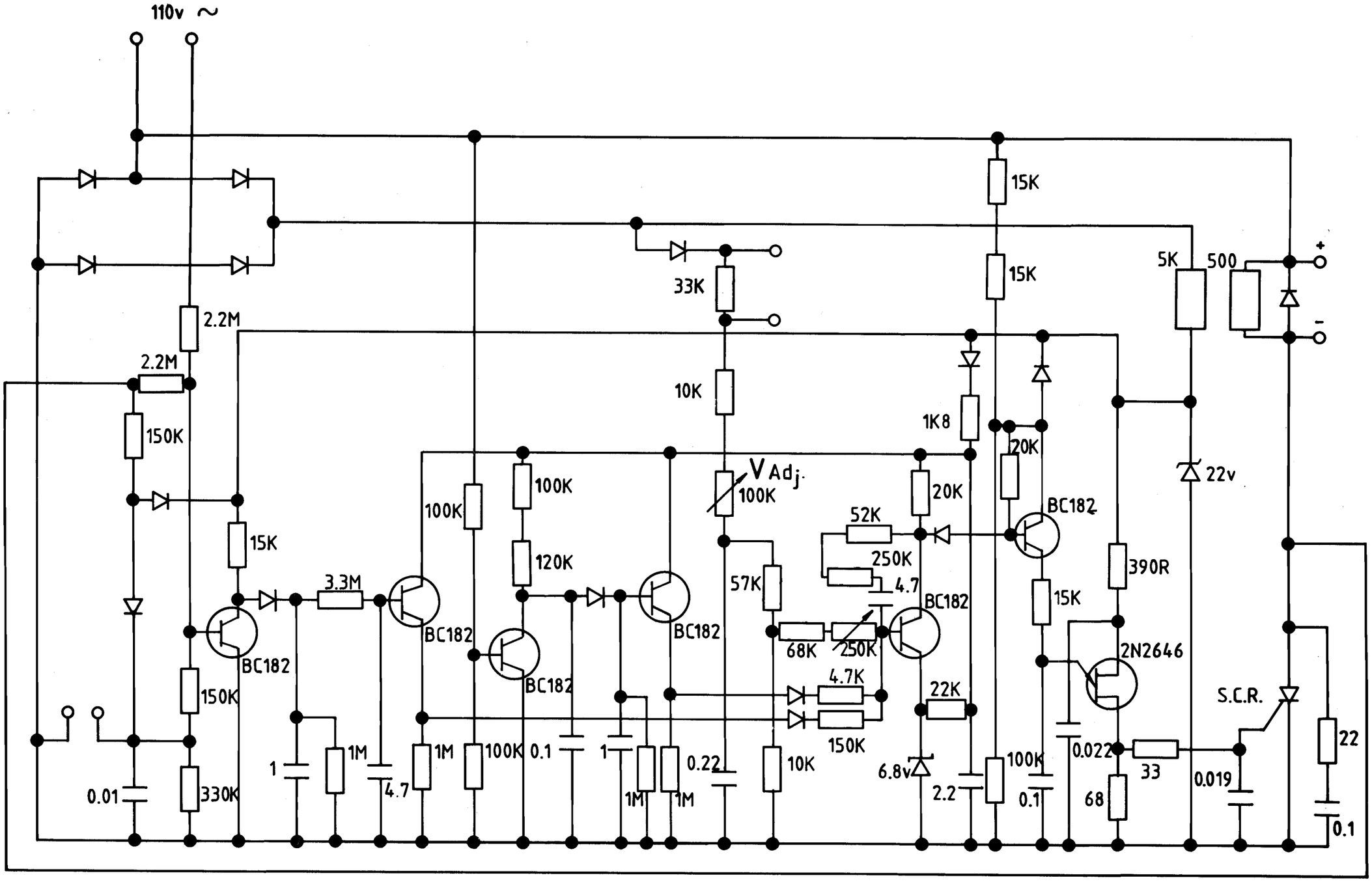


Fig 11 Automatic Voltage Regulator Unit - Circuit Diagram Fig 11