EBBETT BATTERY CHARGER

OR BATTERY ELIMINATOR / DC POWER SUPPLY

SERVICE SUPPLEMENT

Manufactured by;
Ebbett Automation Ltd,
70-72 Victoria Street,
Petone, Wellington,
New Zealand.
Phone 00-64-4-568-6377
Fax 00-64-4-568-2374

8/10/91

Section 15:

SCOPE

The purpose of this supplement is to provide a service agent sufficient information to be able to provide local service after warranty has lapsed. It is intended that this include;

(1) establishing whether a unit is in fact faulty,

(2) being able to carry out test procedures to localise the fault, and

(3) carrying out component replacements.

The supplement should be read in conjunction with, and as an extension of, the Operators Manual.

Be familiar with the Operators Manual first.

WARNING -

This manual is provided to enable educated diagnosis of faults, and repair after lapse of the warranty. Our comprehensive guarantee provides full cover during its term, and unless previously authorised in writing, breaking of seals and tampering with internal wiring etc., will render the warranty invalid.

CONTENTS

Section 16 (1):

ELECTRICAL CIRCUIT - EXPLANATION OF OPERATION

The Operator's Manual describes the basic overall operation of the unit. From the electrical schematic (Section (16:2) it can be seen that 230V main power is fed to the input of the power transformer via a contact of a miniature circuit breaker (MCB) which is ganged to a second contact in the output DC of the unit. The output of the transformer has a centre tap connected to negative rail, and phase controlled SCRs in each of the legs, producing a voltage controlled, full wave, DC output. This DC is then filtered and fed via the second MCB contact to the battery connection. A reverse-polarity diode is connected across the upstream side and trips this contact in the event of incorrect connection.

RFI suppression filters are connected across the power devices, and a thermal device in the transformer windings trips the low current electronic control circuits. The power devices are opto-isolated from the electronic drive, are floating above earth, and their performance therefore always remains unaffected by changes in external circuit impedance and battery condition.

The control PCB contains the control circuit shown in Section 16:3. Output from the power transformer is fed into terminals 4 & 5 and rectified by diodes D1 & D2 in a similar centre-tap configuration to the main power circuit. From this test point (1), D12 feeds a series regulator (Reg 1) to provide the 7V power supply for the whole PCB, and another circuit (TR) supplies power to the power transistor output stage for the SCR gate drives.

A third circuit via R1 provides phase reference signal that is filtered (test point 2), and fed into a square wave generator. Here the op amp threshold can be set to give a mark/space ratio that allows for signal variations as a result of mains input voltage extremes, and provides a consistent negative-going synch-edge under all conditions (test point 3).

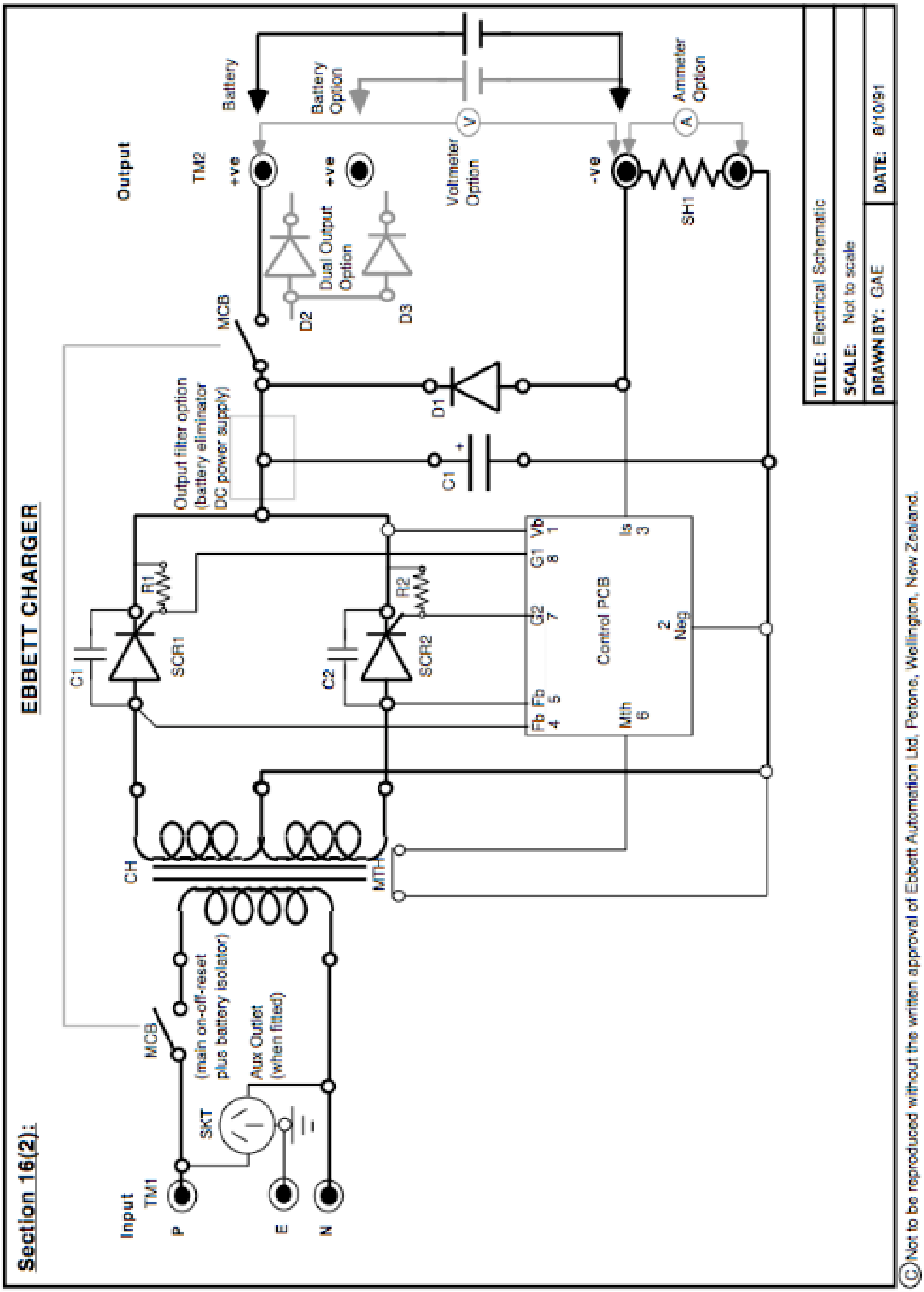
The output is then AC coupled, conditioned, and summed with the output of the "Output Voltage" potentiometer to provide the reference ramp (test point 4) for the phase control op amp. Battery voltage is fed into terminal 1 and summed with a current limit signal from the "Maximum Current" op amp (test point 9). This signal is smoothed and provides the DC bias for the phase control op amp (IC terminals 5 & 6).
Where a boost option is installed, on initial power up, Vb signal at terminal 1 is fed into an additional voltage comparitor stage of IC2. The output of this modifies the calibration of the summing point at pin 6. At start-up this point is held low until the battery reaches a voltage determined by the value of R17. When preset boost voltage is reached, the comparitor output changes over, latches high and allows the calibration to revert back to normal. On power-down the latch resets.
The resultant output (test point 5) is square wave whose leading edge varies according to battery voltage, and within a preset current limit. This signal is then opto-isolated and fed into the TRI amplier to control the phase angle switching of the SCR gates.

When overheated the transformer microtherm disables pin 2 of the opto-coupler, and the circuit automatically resets on temperature fall.

The "Power On" LED illuminates according to the average voltage of the output stage.

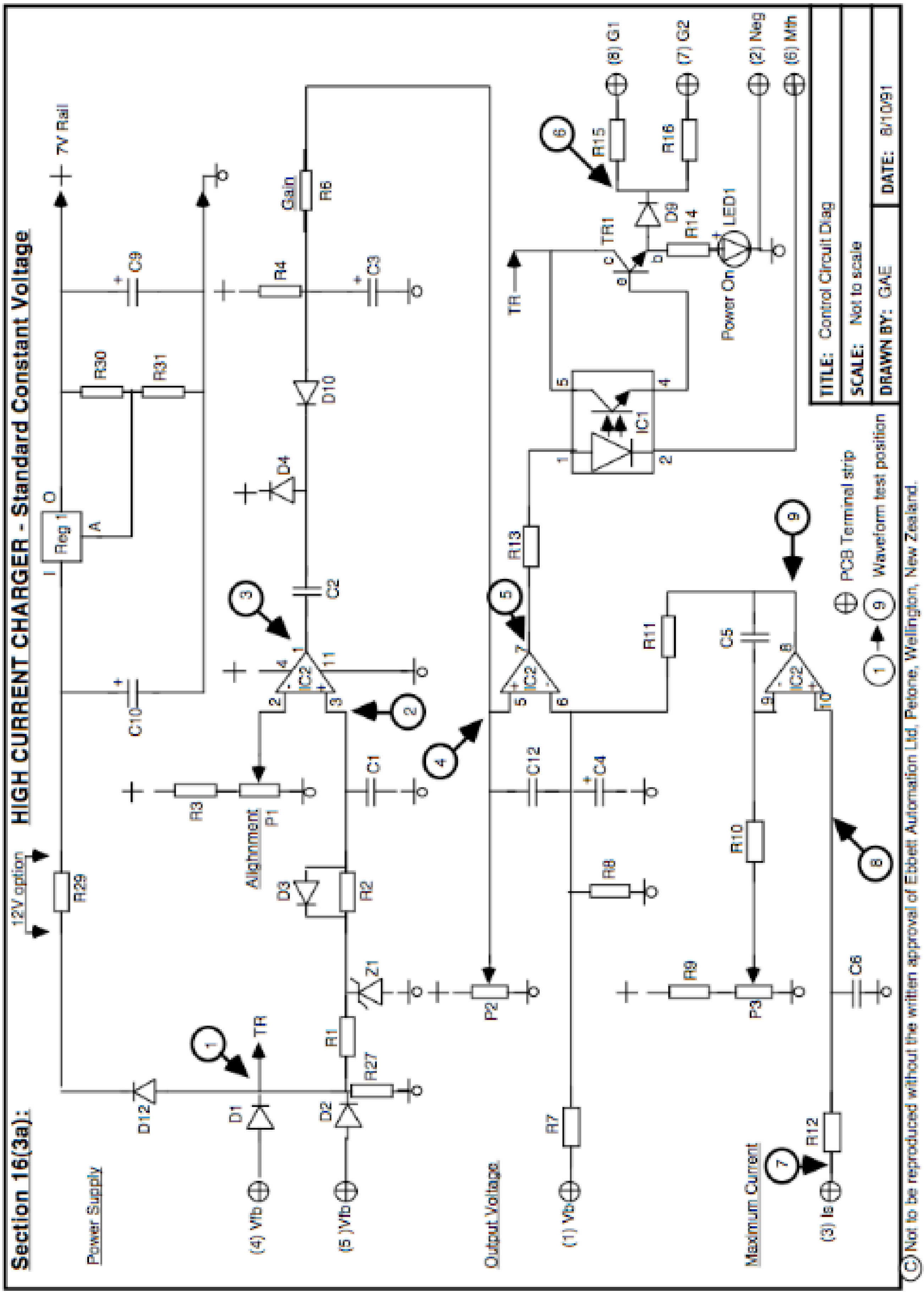
Section 16 (2):

ELECTRICAL SCHEMATIC



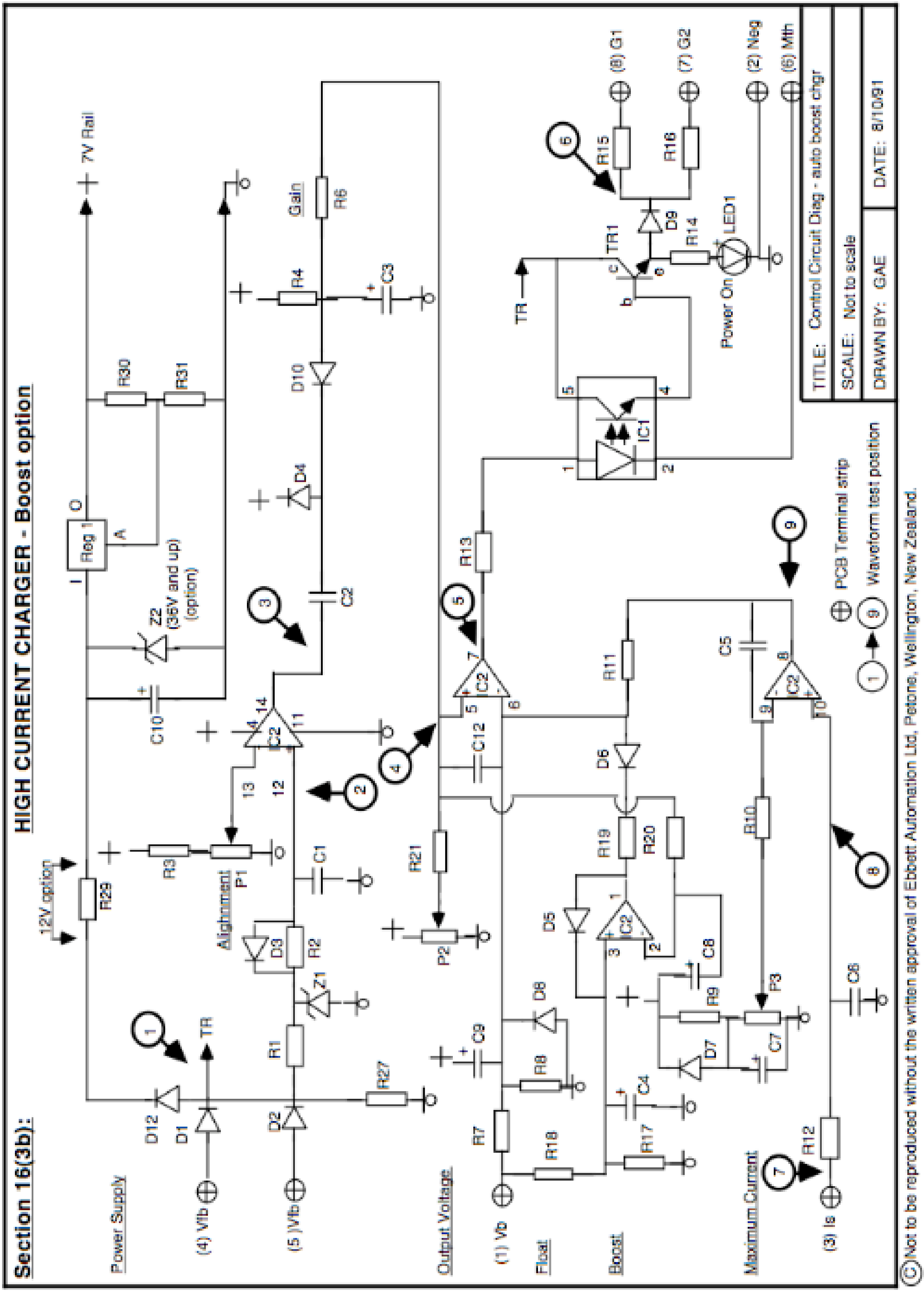
Section 16 (3a):

<u>CONTROL CIRCUIT DIAGRAM - Standard Constant Voltage</u>



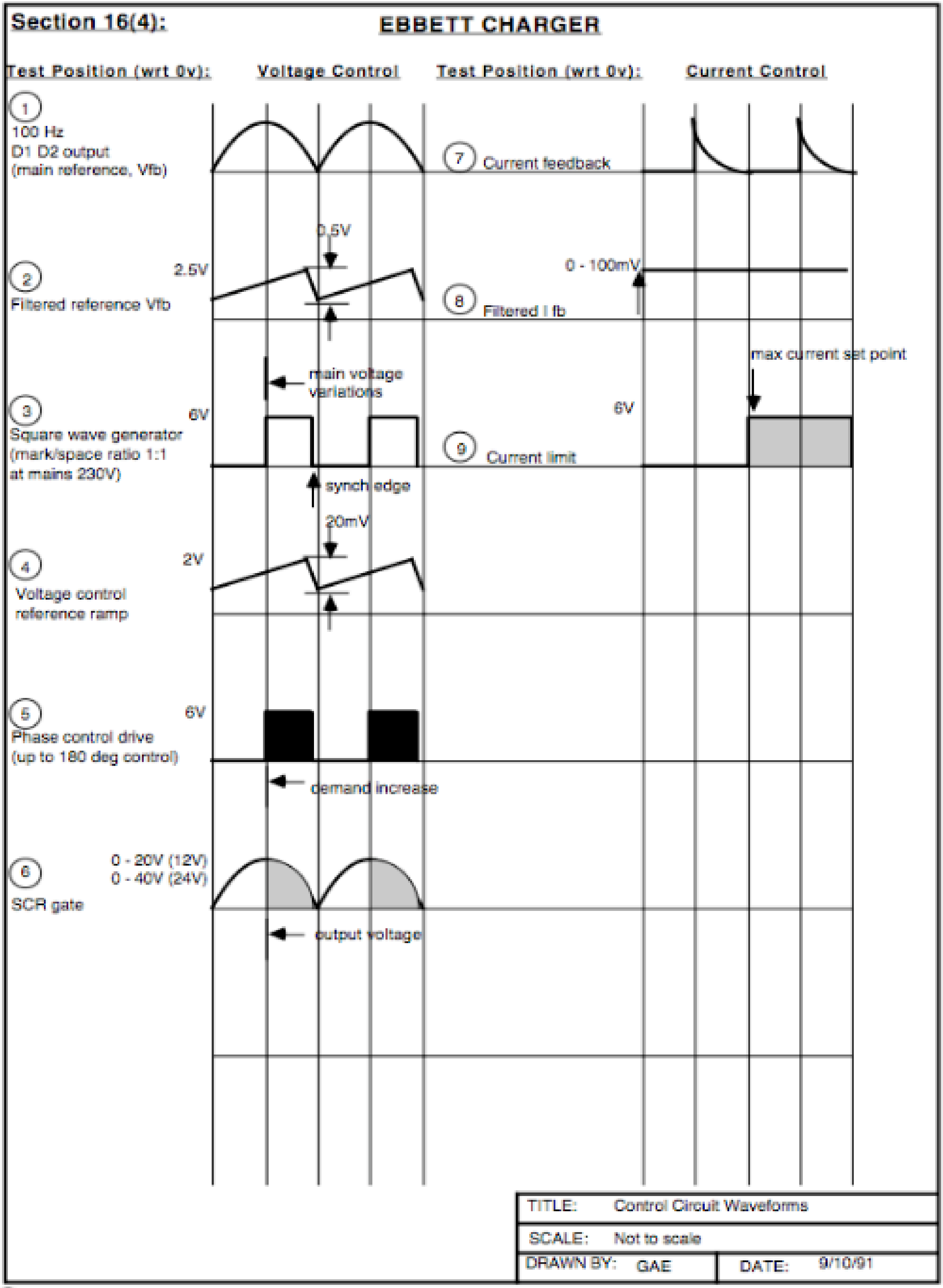
Section 16 (3b):

CONTROL CIRCUIT DIAGRAM - Boost Option



Section 16 (4):

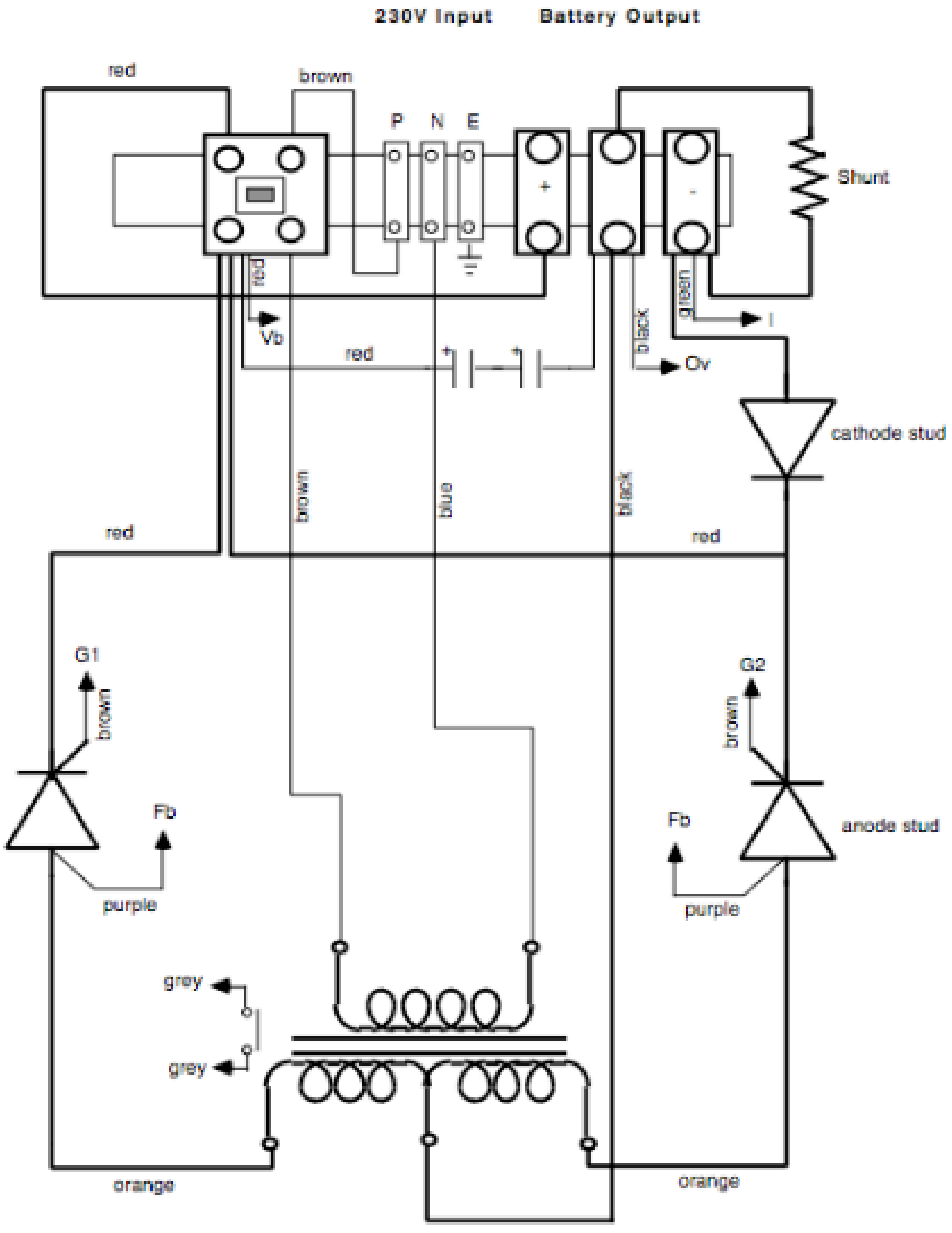
CONTROL CIRCUIT WAVEFORMS



Section 16 (5):

ELECTRICAL WIRING DIAGRAM

Section 16(5): **EBBETT BATTERY CHARGER - 10A**



Shunt = 350mm 28 / 0.3mm2 auto cable

TITLE: Wiring Diagram	
SCALE: Not to scale	
DRAWN BY: GAE	DATE: 8/10/91

Section 17:

OPERATION, ADJUSTMENTS, AND TEST PROCEDURES

(1) Correct Operation Check

Before suspecting a charger fault, refer to the Operator's Manual and go through the fault-finding chart.

If you still suspect a charger fault, turn off the power, disconnect the batteries, discharge the output capacitors, take off the cover and carry out visual checks for any possible mechanical damage, loose connections, broken wires etc. Then if necessary, reconnect and carry out an operational check as follows.

Input Terminals:
- 230v applied voltage.
- 230v output from MCB contact.

Output Terminals:
- Voltage exactly the same as that across the battery.
- Voltage exactly the same as that across D1.
  (If not, there is some loss of continuity in the external battery cable, or MCB.)

Control PCB
- Terminal (2) should be at the same potential as the SHI output terminal. Use this as the common point for further tests.
- Terminal (1) should be at the MCB +ve output voltage.
- Terminal (3) should be 0 to +100 mV depending on charger current.
- Terminal (6) should be 0 volts.
  (Must be shorted to -ve to enable charger output)
- Terminals (4 & 5) should measure AC (12V unit approx 14V)
  (24V unit approx 28V)
- The Power On LED should be fully illuminated if the battery voltage is less than 13V for 12V model,
  26V for 24V model.
- Terminals (7 & 8) should measure DC (12V unit approx 14V)
  (24V unit approx 28V)

Failure of any of the "power electronics" will probably cause damage to the control PCB and necessitate disconnection, removal, and individual testing of all modules.

(2) Adjustments

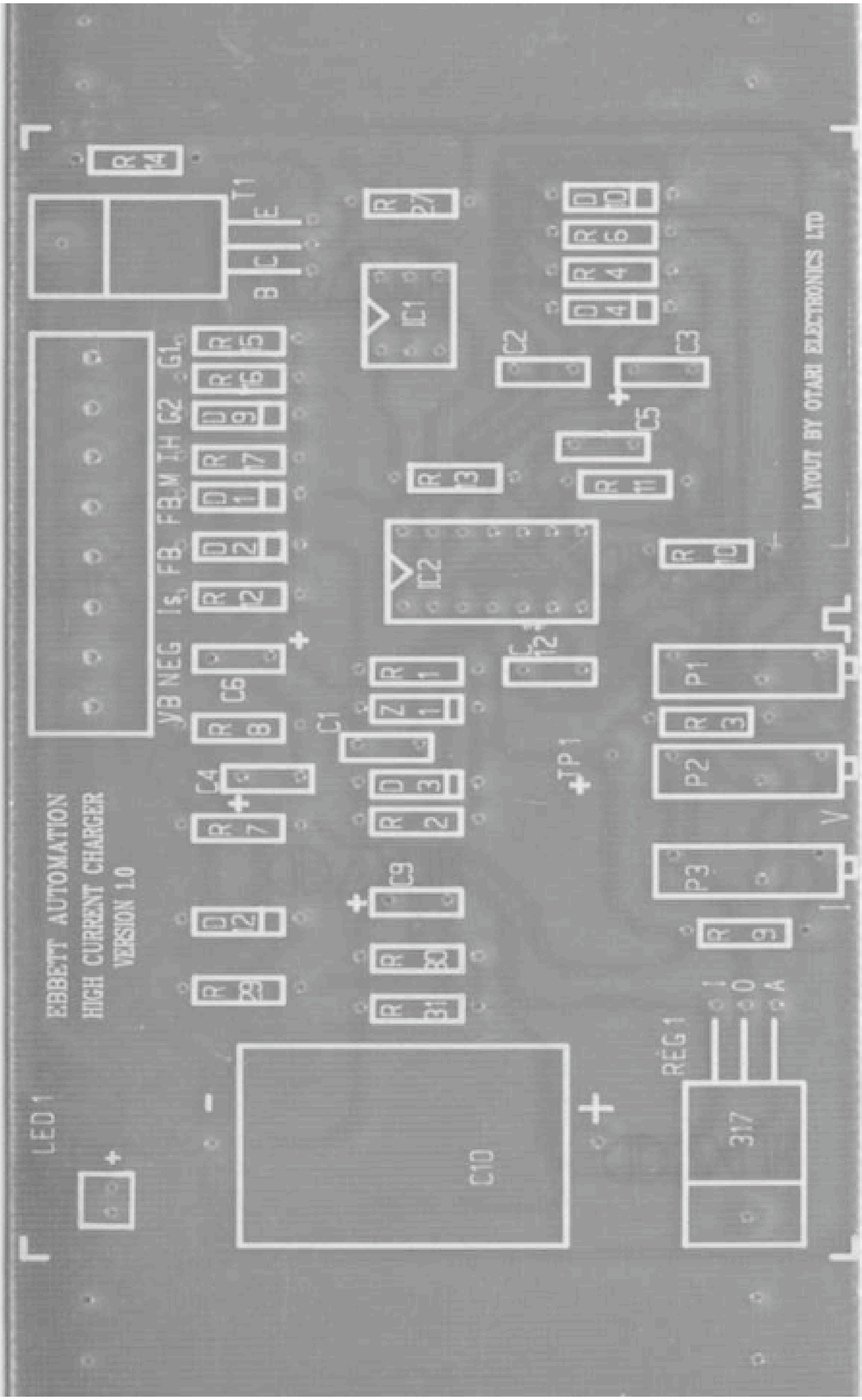
P1 - Electronic Alignment - Set to mark/space ratio 1:1 at 230V main input voltage.

P2 - Output Voltage - Factory set for float voltage of lead acid batteries.
Set to suit type of battery system in use.

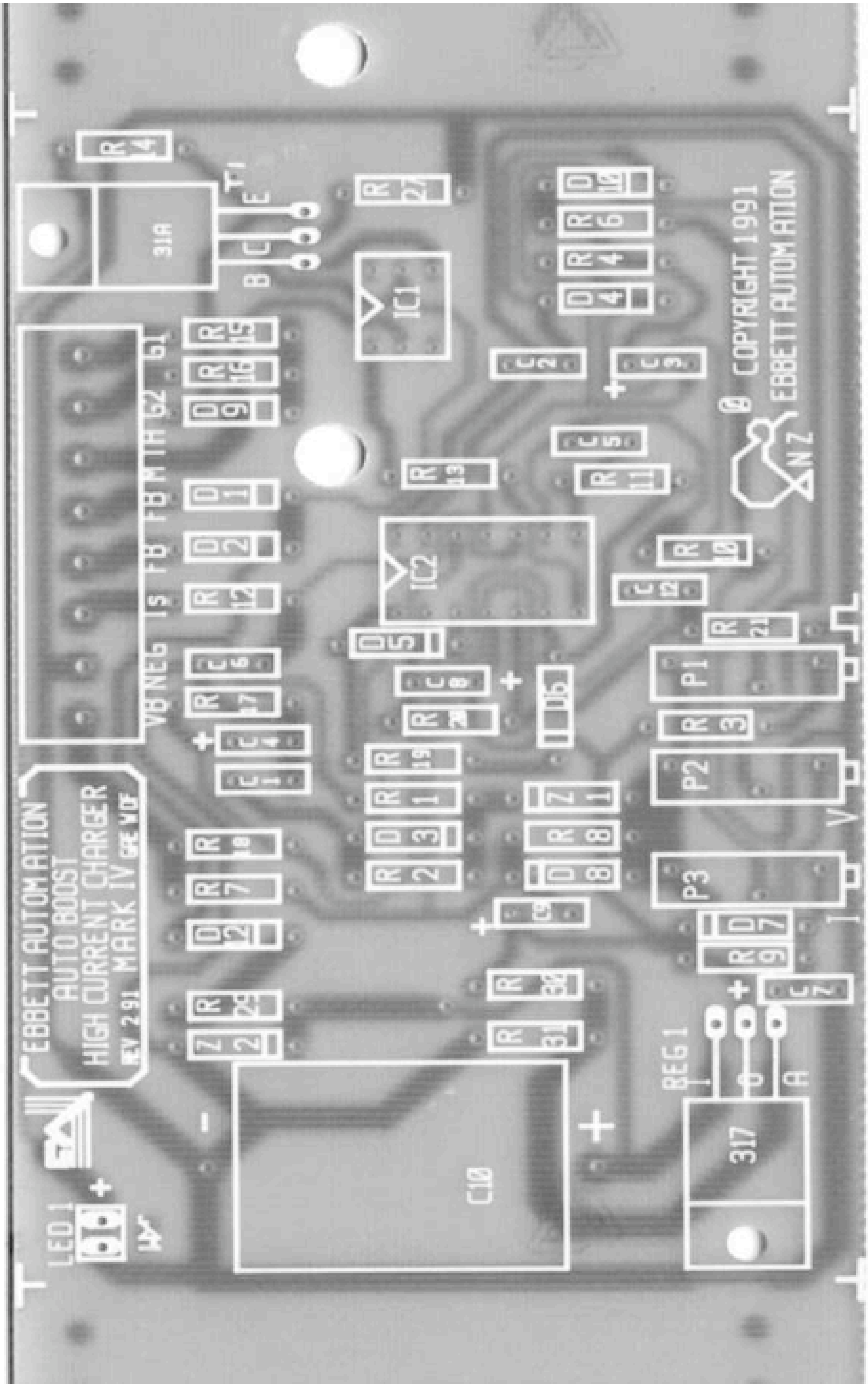
P3 - Maximum Current - Factory set to specified maximum load.
Settings can be reduced for other types of battery.
(Ref to factory). Breaking of seal will render warranty invalid.
Settings for other types of battery should be specified ex factory.

R17 - Boost Voltage Option - Resistor value predetermined to give boost 1.5-2V above float voltage setting.
(Increase in value lowers boost voltage value)

(3a) Electronic PCB1.0 Layout - Standard Constant Voltage.



(3b) Electronic PCB ABC Layout - Boost Option.



(4) Control PCB Test

The control PCB can be removed, set up, and tested by simulating normal inputs. Connect an equivalent ratio transformer to terminals 4 & 5 and centre tap to terminal 2. Short terminals 3 & 6 to -ve.

Connect a 0 to 15V or 0 to 30V variable power supply (depending on charger voltage rating) to the +ve and -ve DC terminals 1 & 2 respectively. The previous PCB tests can then be carried out again. Firstly set up P1 (alignment), and then calibrate P2 (battery voltage).

If the DC power supply is varied, desired battery voltage plus or minus 0.2V, the output waveforms at terminals 7 & 8 can be seen to change in conduction angle from fully off to fully on. (On the boost option the voltage must be raised first to latch the boost comparator stage).

P3 can be set up only after the PCB has been reinstalled and the charger put on load. If it is to be altered it must be turned fully anti-clockwise first, and with a load on the battery (to keep battery voltage low) cautiously increased until specified maximum current is reached. A reading can be obtained with an ammeter in the battery lead.

Under no circumstances must the current be allowed to exceed the rating of the power devices.

(5) Power Device Test

The silicon-controlled rectifiers (SCRs) can be unsoldered from all external wiring, removed completely, and tested using a bench power supply. Connect a 12 volt, 5 watt, automotive bulb from the +ve supply to the anode (stud) of the SCR. Connect -ve to the cathode. The SCR can then be turned on by momentarily applying a shorting link between the Anode and Gate terminals. The bulb will turn on, and remain on until the power supply is turned off. The bulb must be either fully on, or fully off, with no intermediate, partial-conduction condition. Also there must be no leakage Anode to Gate.

Diodes can be tested for continuity in one direction only, using a standard multimeter.

Section 18:

MAINTENANCE

The charger is a solid state device with no moving parts other than the mechanical, miniature circuit-breaker (MCB) installed as a battery isolator. The only maintenance required is to ensure that air-vents remain clear, that the unit remains clean and dry, and that screws etc., do not work loose if the unit is installed in a location susceptible to vibration. (ie marine, automotive, industrial situations).

Calibration of the voltage adjustment can be carried out annually, or in the event of the charger being used in locations of extreme ambient temperature.

Section 19(1):

ELECTRICAL SCHEMATIC PARTS SCHEDULE - 10A

ITEM	DESCRIPTION	TECH SPECIFICATION	CUST PART NO
MCB	Miniature circuit-breaker	NZI 162, 16A, 2 pole.	
TM1, TM2	Terminal, Klippon	SAK 2.5, 25A.	
SKT	-	-	
C1	Capacitor, 2 x series	Philips 2222 050 58222, 10,000 uF, 25V. Electrolytic.	
C2, C3	Capacitor	Polyester 0.1uF, 50V.	
PCB V1	Electronic control card	Ebbett standard high power charger, 24V. Set 27.5V, 10A.	
CH	Transformer	CH6 / 24V, 15A, ratio 230 / 27.5-0-27.5.	
MTH	Temperature sensor	Microtherm, T10, 118 deg C.	
D1	Reverse polarity protection diode	Philips BYX 96, 200V, 30A (48A RMS).	
SCR1, SCR2	Silicon controlled rectifier	Westinghouse NO29 RH02, 200V, 30A (48A RMS).	
SHI	Current shunt	1 mV per amp, 350mm, 28 /.03mm auto cable.	
R1, R2	Resistor	1K, 0.125W.	

Section 19(2):

ELECTRONIC CIRCUIT PARTS SCHEDULE - ALL STANDARD MODELS

ITEM	DESCRIPTION	TECHNICAL SPECS		CUST PART NO
		24V Model	(12V substitution)	
REG1	Voltage regulator	LM 317		
IC1	Opto coupler	CNX38		
IC2	Quad op amp	324		
TR1	Power transistor	TIP29		
LED1	LED	20mA		
D1-D10	Diode	IN4001, 1A, 50V		
ZI	Zenner diode	3.3V, 0.5W		
P1-P3	Trim pot	10K, 20 turn		
R1	Resistor	22K, 0.125W	(10K)	
R2		100K		
R3-R6		10K		
R7		470K	(330)	
R8		100K		
R9		470K		
R10-R12		100K		
R13		470E		
R14		1K	(470E)	
R15-R16		10E,1W	(47E)	
R27		4K7, 0.125W	(2K2)	
R29		100E		
R30		220E		
R31		1K		
C1-C2	Capacitor, mylar	0.01uF, 50V		
C3	tant	1uF, 10V		
C4		1uF		
C5	mylar	0.1uF, 50V		
C6		0.01uF		
C7	tant	1uF, 10V		
C8, C9	electro	10uF, 10V		
C10	electro	1,000uF, 63V		
C12	mylar	0.01uF, 50V		

Boost Option

R17	Boost calibration resistor	44 - 53K, 0.125W
R18	Resistor	470K, 0.125W
R19		220K
R20		47K
D5	Diode	IN4001, 1A, 50V