EBBETT INVERTER

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

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 (3)) and control system block diagram (section 16 (2)) it can be seen that low voltage, high current DC is taken from the battery, filtered, and fed into low voltage windings of the power transformer. Positive is fed to a centre tap, and by the "push-pull" operation of PM1 and PM2 power modules, alternating current flows in the primary winding. High Impedance signal voltage is applied to the PM1 and PM2 modules and resultant output is shown in the control circuit waveform drawings (section 16 (4)). The turns-ratio of the transformer (approx 1:20 in 12v unit, 1:10 in 24v unit) steps the input up to normal mains output. This transformer is an "inverter special" with unusual, large wire gauges, winding layers, and flux densities. The transformer forms a "low pass filter" and cannot be changed to an alternative type. A sinusoidal current is produced by a "switch mode" PWM input signal to the PM1 and PM2 modules as shown, coupled with the action of the filter network.

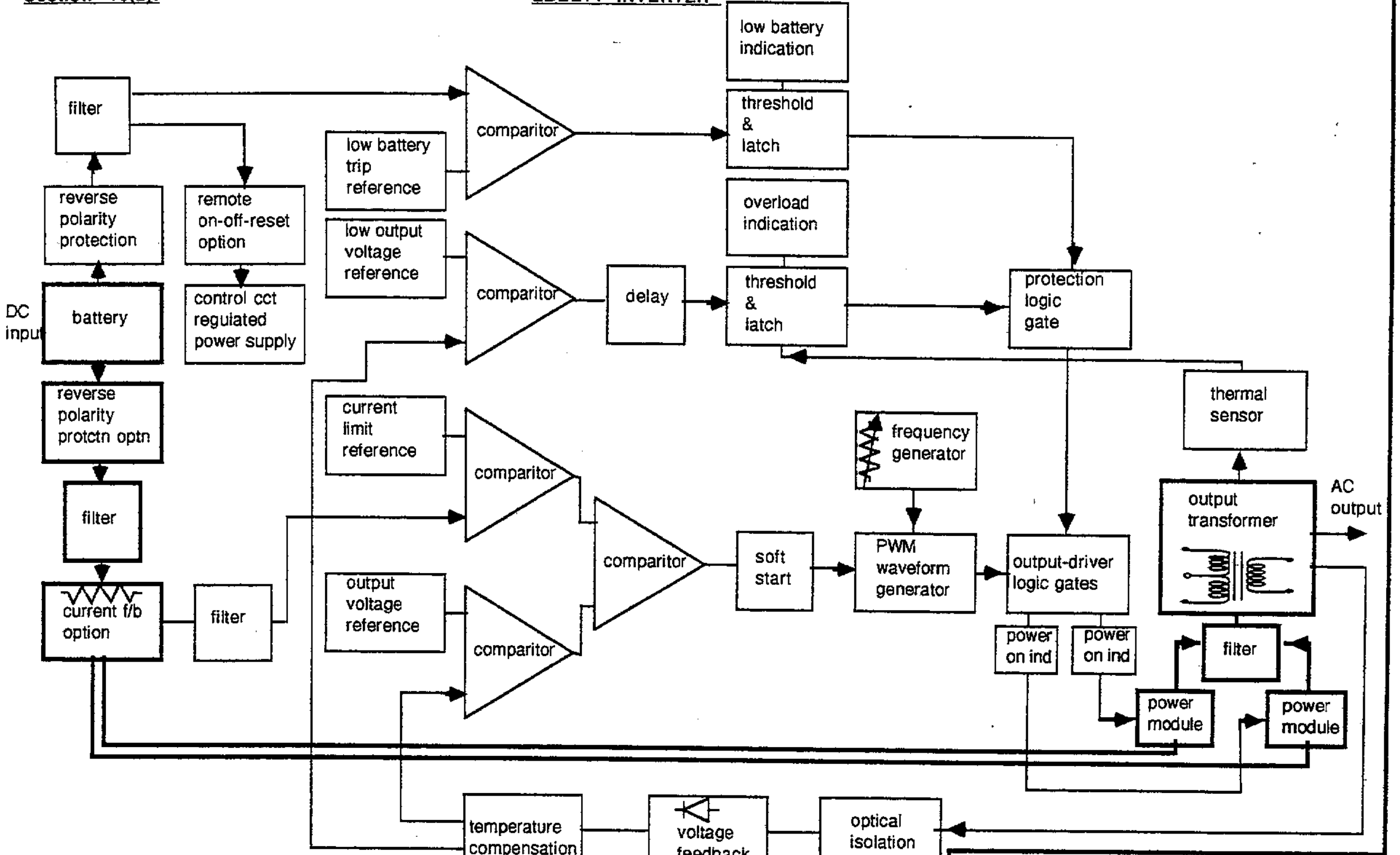
Under no circumstances should the inverter be run with any filters disconnected.

Also, under no circumstances should the inverter be run with the control board terminals 6-7, 10-11, or 12-13 disconnected.

- Catastrophic failures of components will result.

Section 16(2):

EBBETT INVERTER



TITLE: Control Block Diagram	
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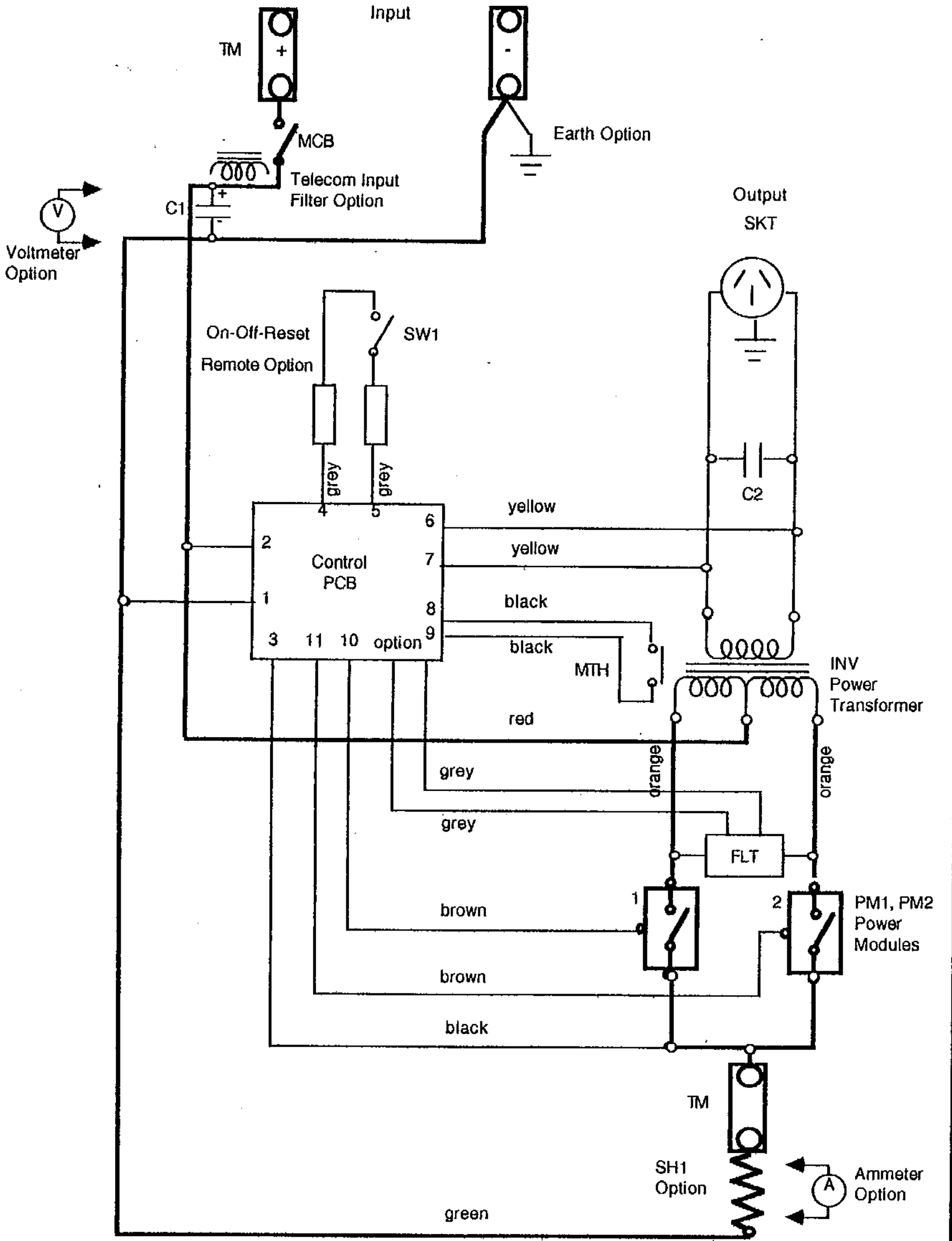
DRAWN BY: GAE	DATE: 1/12/87

EBBETT INVERTER



TITLE: Electrical Schematic	
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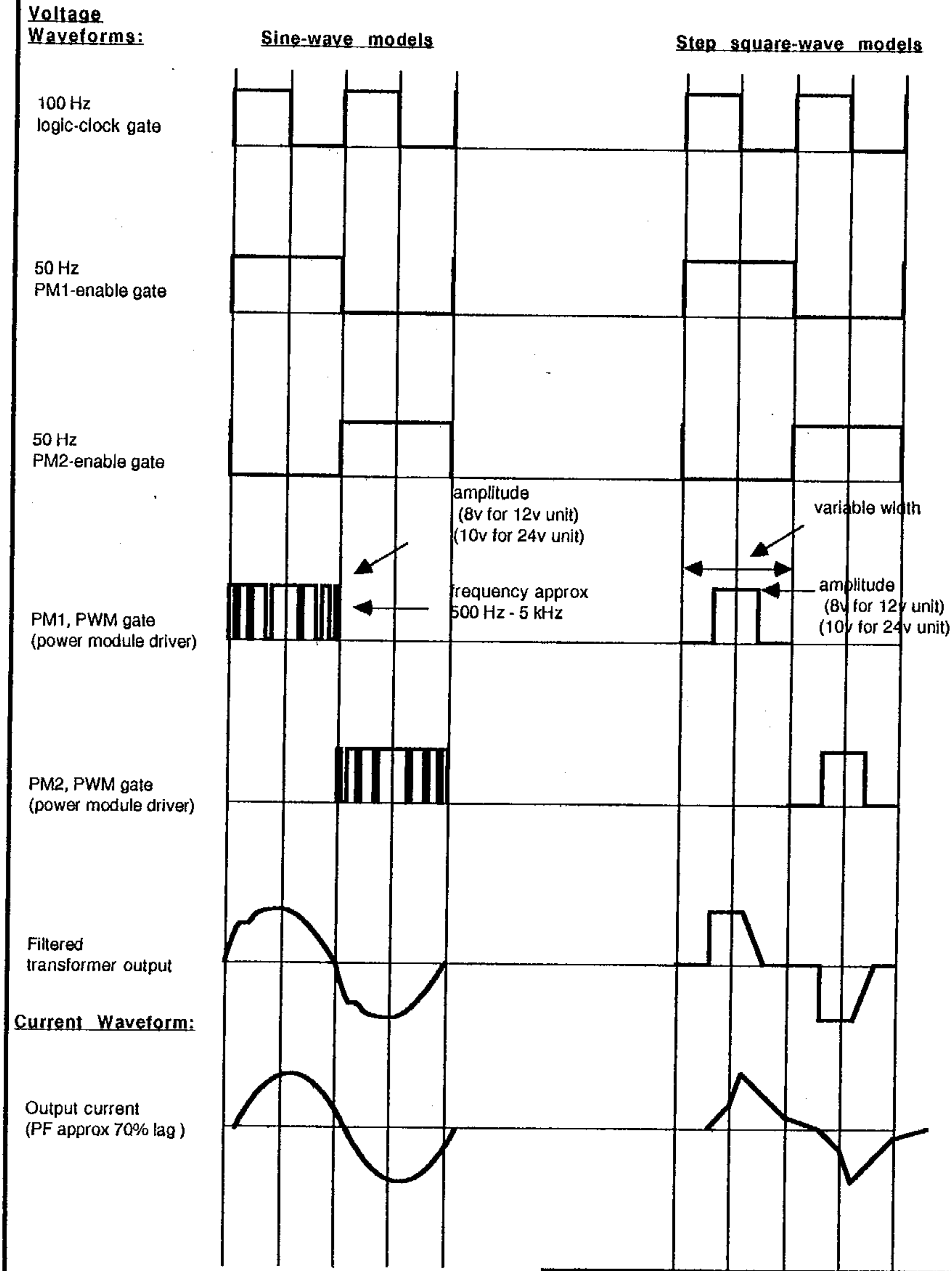
DRAWN BY: GAE	DATE: 10/10/91

Section 16(4):

EBBETT INVERTER



TITLE:	Control Circuit Waveforms
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DRAWN BY: GAE	DATE: 10/10/91

Section 17:

OPERATION, ADJUSTMENTS, AND TEST PROCEDURES

(1) Correct operation check

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

If you still suspect an inverter fault, turn off and disconnect the unit, discharge the input 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:

- Correct polarity of applied voltage.
- Correct name-plate input voltage (12v unit input 10v to 14.5v),
  (24v unit input 20v to 28v).

MCB turned on, output (across CI), correct input voltage.

Control PCB:

- Terminal 1 should be at the same potential as the -ve input terminal. Use this as the common point for all further tests.
- Terminal 2 should be the inverter +ve input voltage.
- Terminal 3 should be 0 volts.
- Terminal 4 should be approx 1v less than inverter +ve input voltage.
- Terminal 5 should be shorted to 4.
- Terminals 8-9 should be shorted together and measure 0v.
- Terminals 10-11 (drivers to power modules), must show waveforms as shown in section 16(4).
- Drivers to filter networks of other options (where fitted) must show digital logic waveforms.
- Power-on LED indicators must be lit to the same intensity.

Inverter "high output voltage" must be present at terminals 6-7 within 3- 5 seconds after start up.

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 (unit hot)

P1 - Output voltage:	-	Set to 230 volts RMS in NZ.
P2 - Maximum current (where installed):	-	Set current limit to 100% load.
P3 - Frequency:	-	Set to 50 Hz in NZ.
R32 - Low Battery Trip:	-	Selected to suit the more common requirement of lead-acid batteries. Can be substituted for higher value to raise trip level for Ni Cad batteries if desired.
R22 - Low output voltage limit:	-	Factory set to approx 195-205 volts. Can be substituted for lower value to raise limit if desired.

Note - Comparisons of voltage and current using standard multimeters are valid only on perfect sine-wave inverter models. For true RMS measurements on all other models, moving-iron meters must be used.

Section 15:

SCOPE

The purpose of this supplement is to provide a service agent sufficient information to be able to provide basic, 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) carry out modular replacements. All Inverters have been designed to be portable and easily removed from the field and transported to the factory for any major repair or replacement. We believe that we can best maintain high standards of "Quality Assurance" this way, and that is why we are currently marketing in countries only where we have technical facilities.

It is not our policy to have agents or users become involved in some detailed individual component replacement. Many years of development go into our design and performance criteria. We use transformers that are wound in special layers and to unorthodox flux densities, integrated circuits and transistors that are tested to our performance specifications before insertion. (ie, only some brands of the same IC have schmitt-trigger inputs, others have varying capacitances and rise-times, some transistors of the same type have intolerable audible noise levels, etc). It is not always possible for us to document enough of this sort of information and provide ongoing staff training facilities to ensure QA standards comparable to our own. We prefer to control these critical areas ourselves directly.

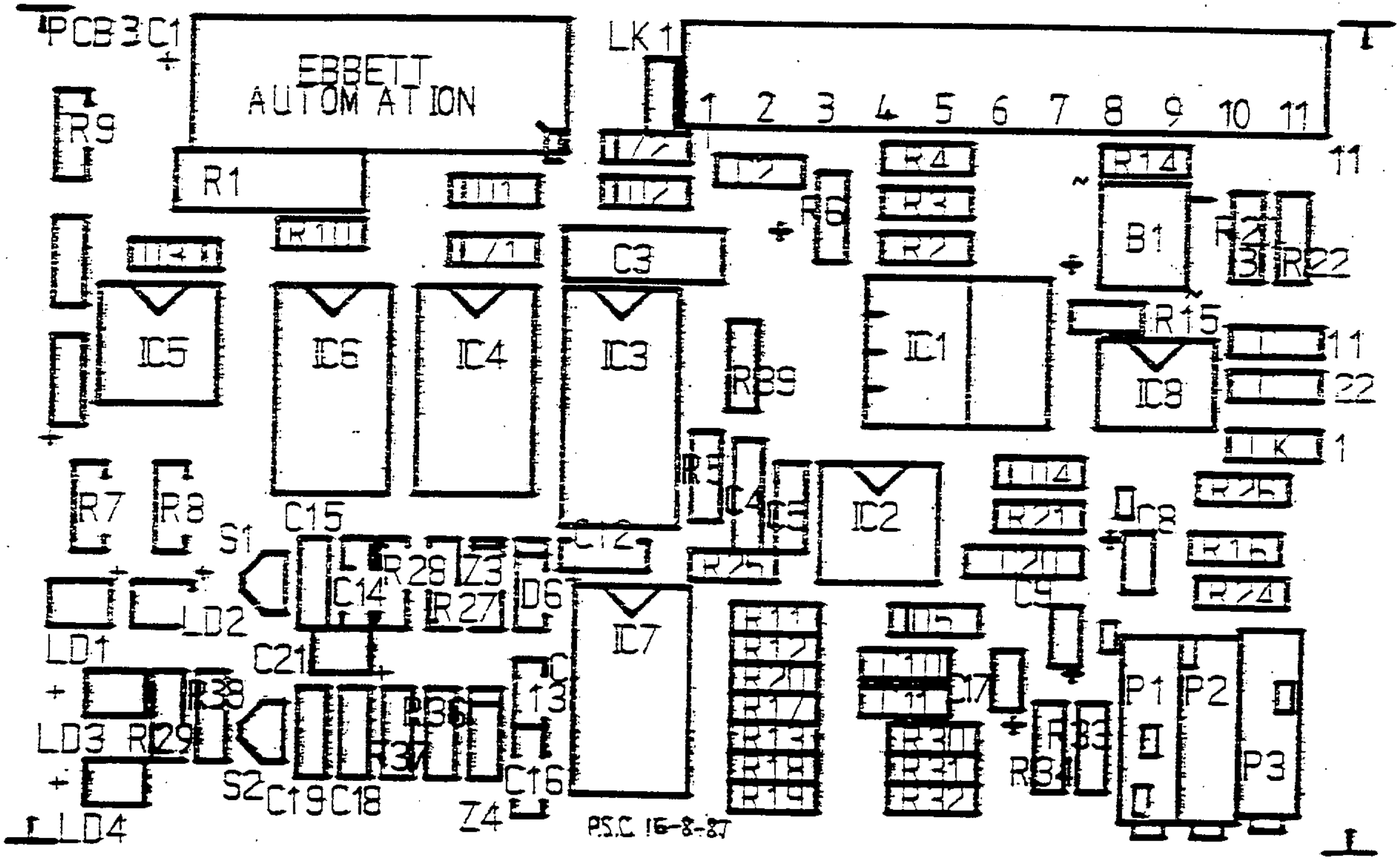
The supplement should be read in conjunction with, and as an extension of, the Operators Manual.

Be familiar with the Operators Manual first.

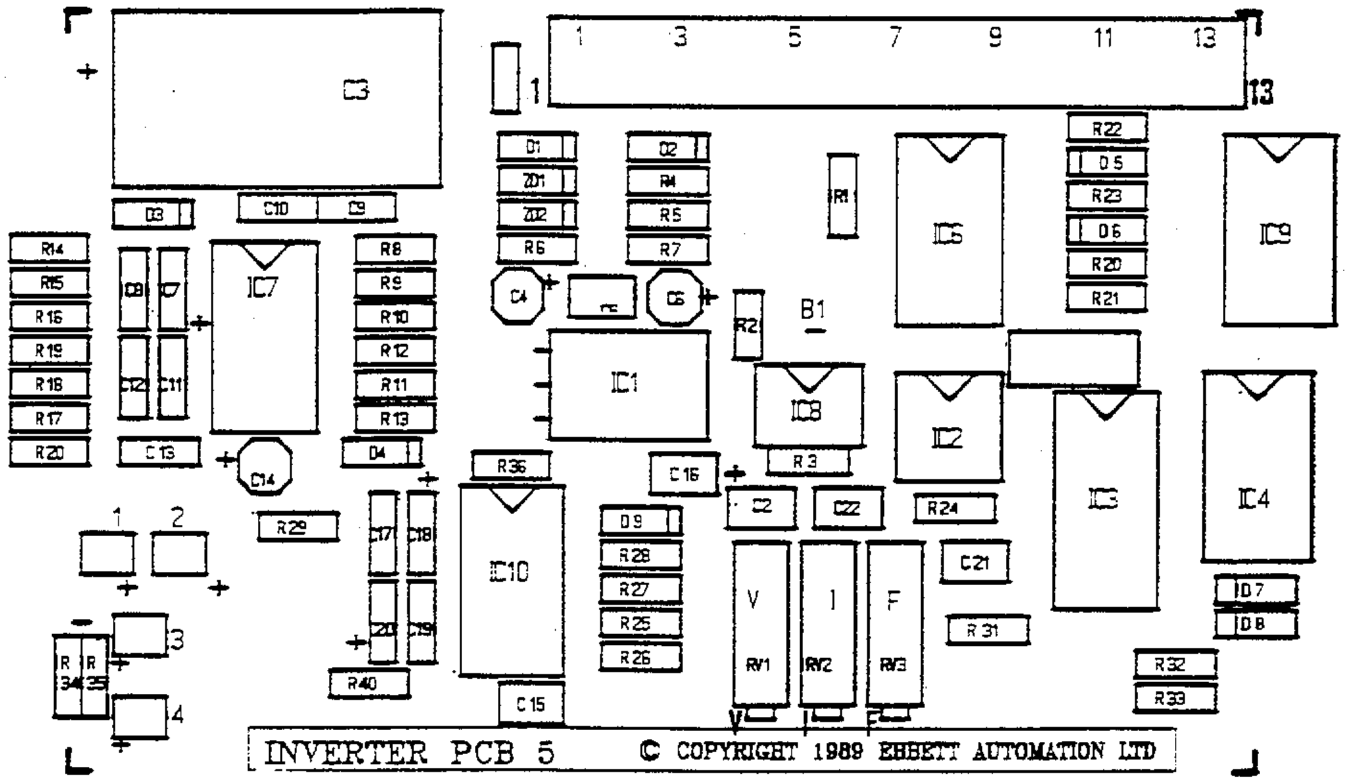
WARNING - This manual is provided to enable educated diagnosis of faults, and repair after lapse of the warranty. Our comprehensive guaranty provides full cover during it's term, and breaking of seals and tampering with internal wiring etc. will render the warranty invalid.

CONTENTS

ELECTRONIC CONTROL CARD LAYOUT - PCB3



ELECTRONIC CONTROL CARD LAYOUT - PCB5



Section 17:

(4) Control PCB Test

The control PCB can be removed, set up, and tested by simulating normal inputs. Connect a variable auto transformer (variac) and MI voltmeter to the terminals 6-7. Connect the low voltage input to a 0 to 12v or 0 to 24v variable supply (depending on inverter rating) and link terminals 4-5 and 8-9. The previous PCB tests can then be carried out again. If the variac is varied, 230v plus or minus 10v, the output waveforms at terminals 10 and 11 can be seen to change.

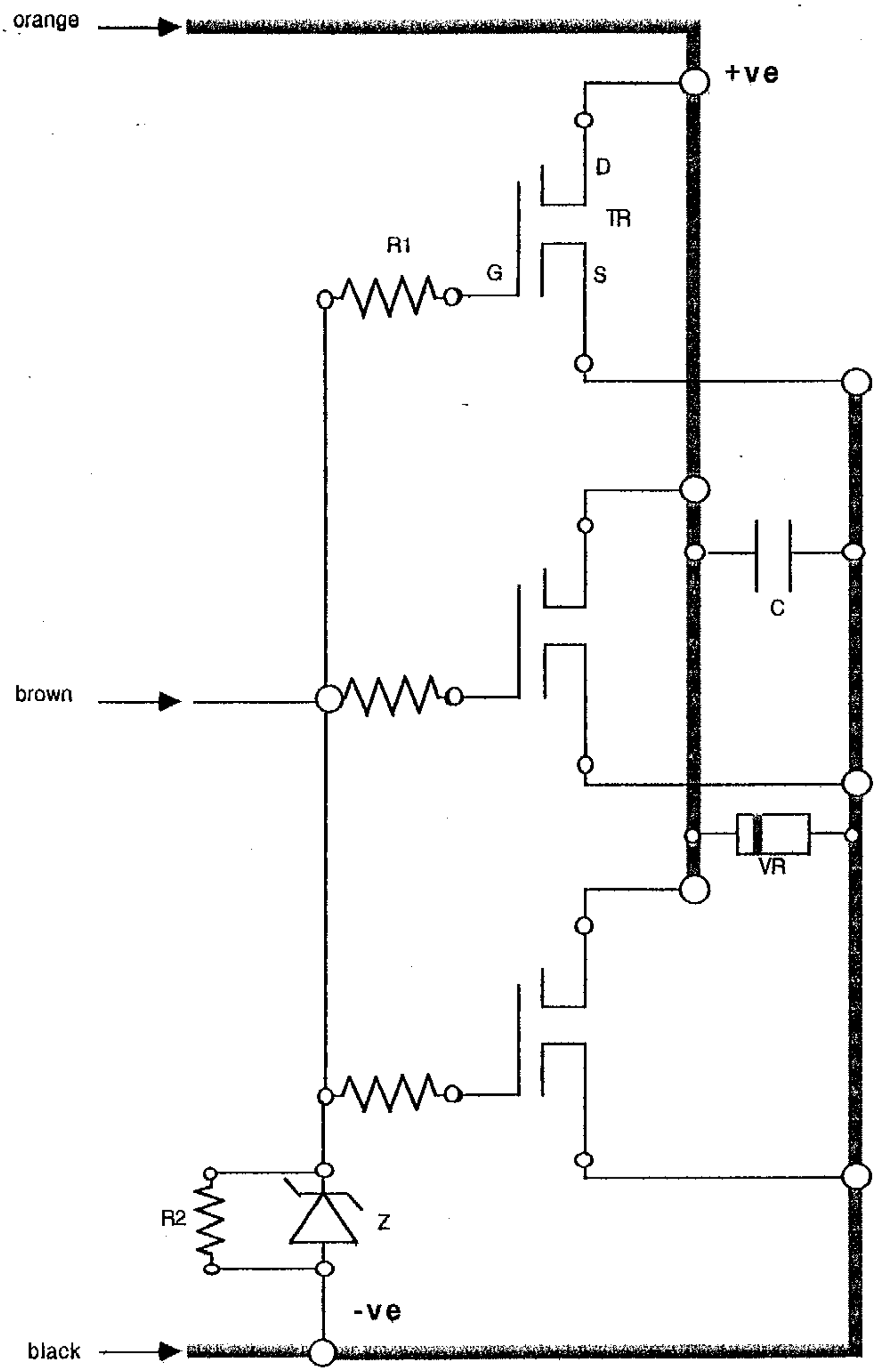
The "low battery trip" level can be checked by varying the DC voltage.

(5) Power Module Test

The power modules can be unsoldered from all external wiring, removed complete with heat-sink, and tested using a bench power supply. Connect a 12 volt, 5 watt, automotive bulb from the +ve supply to +ve connection (orange, diagram section 17(6).) of the power module. Connect -ve (black) of the module to -ve of the power supply. The bulb can then be turned on and off by applying 12v then Ov respectively to the gate input (Brown). The bulb must be either fully on, or fully off, with no intermediate partial-conduction condition. Also there must be no leakage, Gate to Drain or Source to Drain.

Failure of any transistor as a result of over-voltage applied to the inverter, will probably cause failure of all transistors in a module.

Section 17(6): **PM1 OR PM2 POWER MODULE SCHEMATIC**



R1 = 1 kilohm, 0.125W, 5%. R2 = 1 megohm, 0.125W, 5%.
C = 0.1uF, 50v, mylar, RFI suppresson.
VR = BZTO3C82 transient suppression diode.
TR = Mosfet transistor, varying number in parallel according to unit output rating.
(Tested to spec for matched response, capacitance, resistance, audible noise, etc)

TITLE: Power Module	
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DRAWN BY: GAE	DATE: 10/10/91

Section 18:

MAINTENANCE

The inverter is a solid state device with no moving parts other than the mechanical, miniature circuit-breaker (MCB) installed as a battery isolator, or low current on-off-reset switch (when fitted). 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 and frequency adjustments can be carried out annually, or in the event of the inverter being used in locations of extreme ambient temperature.

Section 19:

INVERTER PARTS SCHEDULE - MODEL: 01-112-0331, 400VA, 24V, NZ ARMY SPECIAL.

ITEM	DESCRIPTION	TECH SPECIFICATION	CUST PART NO
MCB	Miniature circuit-breaker NZI 161	20A.	
TM1	Terminal, Klippon SAKG 28, input	110A.	
TM2	SAKG 2.5, output	10A, 400V.	
CI	Capacitor, 2 x parallel, Philips 2222 050 58222	2,200 uF, 63V, high ripple.	
PCB 3	Electronic control card	Ebbett Inverter PCB 3,400VA, 24V, 20V trip, sine-wave output.	
C2	Capacitor	Polyester 1uF, 400V.	
INV5	Transformer	Inverter special.	
MTH	Temperature sensor	Microtherm, T10, 118 deg C.	
FLT	Filter network 112-01331	400VA, 24V, sine-wave model.	
PM1, PM2	Power modules, left & right	400/24, sine-wave, 3 x IRF 540 siliconix mosfet.	
SHI	Current shunt	1 mV per amp.	