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# SOUNDCRAFT CPS2000

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## Console Power Supply

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### *User and Technical Manual*

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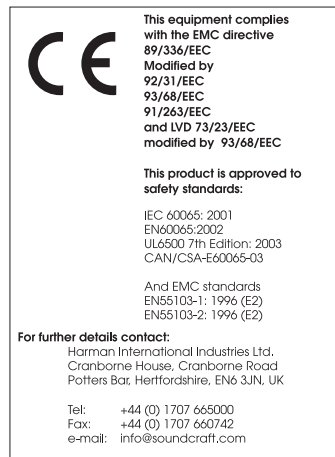
**For your own safety and to avoid invalidation of the warranty all text marked with these Warning Symbols should be read carefully.**



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**IMPORTANT: please read this manual carefully before connecting your Soundcraft console power supply to the mains for the first time.**

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Part No. ZM0198-05

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# Introduction

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# IMPORTANT SAFETY INSTRUCTIONS

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Clean only with a dry cloth.
- Do not block any ventilation openings. Ventilation should not be impeded by covering the ventilation openings with items such as newspapers, table cloths, curtains etc. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose of a polarised or grounding type plug. A polarised plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Use only with the cart, stand, tripod, bracket or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. It is recommended that all maintenance and service on the product should be carried out by Soundcraft or its authorised agents. Soundcraft cannot accept any liability whatsoever for any loss or damage caused by service, maintenance or repair by unauthorised personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- No naked flame sources, such as lighted candles, should be placed on the apparatus.
- **WARNING:** To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Do not expose the apparatus to dripping or splashing and do not place objects filled with liquids, such as vases, on the apparatus.
- Terminals marked with the lightning symbol are hazardous live and the external wiring connected to these terminals requires installation by an "instructed person" or the use of ready made leads or cords.
- **THIS APPARATUS MUST BE EARTHED.** Under no circumstances should the safety earth be disconnected from the mains lead.
- The mains supply disconnect device is the mains plug. It must remain accessible so as to be readily operable when the apparatus is in use.
- If any part of the mains cord set is damaged, the complete cord set should be replaced. The following information is for reference only.
- The wires in the mains lead are coloured in accordance with the following code:
- Earth (Ground):Green and Yellow (US - Green/Yellow)
- Neutral:Blue (US - White)
- Live (Hot):Brown (US - Black)
- As the colours of the wires in the mains lead may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:
- The wire which is coloured Green and Yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth symbol 
- The wire which is coloured Blue must be connected to the terminal in the plug which is marked with the letter N
- The wire which is coloured Brown must be connected to the terminal in the plug which is marked with the letter L
- Ensure that these colour codes are followed carefully in the event of the plug being changed
- This unit is capable of operating over a range of mains voltages as marked on the rear panel. It is important to ensure that the correct mains fuse is fitted before switching on the unit.



# Introduction



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## **WARNING: THIS APPARATUS MUST BE EARTHED**

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The CPS2000 is a linear power supply which, like other linear supplies, produces DC voltages by rectifying, smoothing and regulating AC voltages from the secondary windings of a mains transformer. Soundcraft mixing consoles employ a number of dc voltage supply levels in their operation and these are all provided at the output of each supply unit.

In regulating these voltages there is considerable heat generated, the dissipation of which is achieved through a substantial heat sink on each side of the unit. Two fans are incorporated which draw air over the heatsinks to provide adequate heat dissipation for the regulators and reduce the outer case temperature.

The CPS2000 is designed for installation in a 19" rack unit, occupying 4U of rack height. Refer to the section "RECOMMENDATIONS FOR INSTALLATION" on Page 7.

LEDs are provided on the front panel to show the operation of the regulating circuits, and a digital voltmeter monitors the mains supply voltage.

The CPS2000 may be linked to a second CPS2000 to provide automatic power backup in the event of one of the units failing.

## **MAINS VOLTAGE SELECTION.**

Special attention should be paid to the following information:



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**Do not change the voltage setting without first turning the unit off and unplugging the mains lead. Ensure that the cover plate over the mains voltage selection switches is replaced after correct voltage selection has been made and that the cover plate is positioned to show the correct mains voltage.**

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This unit is capable of operating over a wide range of mains voltages by means of a comprehensive set of selectable voltage settings. It is important to ensure that the correct voltage setting has been selected for the level of local mains voltage supply, for safe, uninterrupted operation of the unit.

There are two mains voltage selection switches behind a cover plate on the front of the unit. Voltage selection is achieved by moving the switches using a screwdriver blade, into the correct positions, as shown by the symbols marked on the front panel. In this way the unit is set up for operation at one of the following ranges of mains supply:

NOMINAL VOLTAGE	OPERATING VOLTAGE RANGE
<i>V<sub>rms</sub></i> AC	<i>V<sub>rms</sub></i> AC
230	195-253
200	170-220
115	98-126
100	85-110





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## **OPERATING VOLTAGE RANGE**

It is very important to use the correct mains voltage selection. A wide operating range of mains voltages is provided to enable the unit to function down to only 85Vrms on the mains supply. This facility is incorporated to overcome the problems that some power supplies have with internal regulation when operating from a poorly regulated mains supply.



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**Do not operate the PSU with a consistently high (above nominal) reading on the mains meter. Operation with the mains higher than +10% may cause serious damage**

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The mains meter is essentially a peak-reading device, as it is the peak value of the mains waveform which is the most important factor in providing the correct mains voltage to the power supply. For this reason, and because with long power cables it is common for the mains waveform to become distorted, the indication of the meter may not agree with readings taken with the usual types of quasi-RMS reading testmeter.



Note that the meter measures the voltage actually available at the PSU, and therefore will indicate any voltage drop on mains supply wiring.

## **REPLACING MAINS FUSE.**

In the event of incorrect switching of the mains voltage selectors, a mains power surge or underrated fuse value, the mains fuse in the front panel will blow and the CPS2000 will not function. Switch the ON/OFF switch to the OFF position. Check the fuse and replace if necessary; also check that the voltage selection is correct for the mains supply level before switching the unit ON again.



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**To avoid risk of fire replace only with the correct value fuse, as indicated on the unit.**

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In the event of repeated failure of the mains fuse consult the Soundcraft dealer from where the unit was purchased.



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**This unit contains no user serviceable parts. Refer all servicing to a qualified service engineer, through the appropriate Soundcraft dealer.**

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# Warranty

1 **Soundcraft** is a trading division of Harman International Industries Ltd.

**End User** means the person who first puts the equipment into regular operation.

**Dealer** means the person other than Soundcraft (if any) from whom the End User purchased the Equipment, provided such a person is authorised for this purpose by Soundcraft or its accredited Distributor.

**Equipment** means the equipment supplied with this manual.

2 If within the period of three years from the date of delivery of the Equipment to the End User it shall prove defective by reason only of faulty materials and/or workmanship to such an extent that the effectiveness and/or usability thereof is materially affected the Equipment or the defective component should be returned to the Dealer or to Soundcraft and subject to the following conditions the Dealer or Soundcraft will repair or replace the defective components. Any components replaced will become the property of Soundcraft.

3 Any Equipment or component returned will be at the risk of the End User whilst in transit (both to and from the Dealer or Soundcraft) and postage must be prepaid.

4 This warranty shall only be available if:

a) the Equipment has been properly installed in accordance with instructions contained in Soundcraft's manual; and

b) the End User has notified Soundcraft or the Dealer within 14 days of the defect appearing; and

c) no persons other than authorised representatives of Soundcraft or the Dealer have effected any replacement of parts maintenance adjustments or repairs to the Equipment; and

d) the End User has used the Equipment only for such purposes as Soundcraft recommends, with only such operating supplies as meet Soundcraft's specifications and otherwise in all respects in accordance Soundcraft's recommendations.

5 Defects arising as a result of the following are not covered by this Warranty: faulty or negligent handling, chemical or electro-chemical or electrical influences, accidental damage, Acts of God, neglect, deficiency in electrical power, air-conditioning or humidity control.

6. The benefit of this Warranty may not be assigned by the End User.

7. End Users who are consumers should note their rights under this Warranty are in addition to and do not affect any other rights to which they may be entitled against the seller of the Equipment.

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# **Recommendations for Installation of the CPS 2000**

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# Recommendations for Installation

The CPS2000 power supply is provided with front panel fixing holes for 19" rack-mounting and will occupy 4U of rack space. Rear support should be provided when fitted in a 19" rack.



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**The CPS2000 is a heavy unit (30kg,) and should be regarded as a two-man lift. Take suitable precautions when lifting**

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As with any power supply that contains a large mains-voltage transformer, it is preferable to provide a degree of physical isolation of the unit from other electronic equipment, particularly that which carries low level audio signals, to avoid any possible hum pick-up. For this reason the unit is used with a long (6.5 metres) output cable to enable it to be positioned away from the mixing console.

For the same reason, when rack-mounting it is preferable to avoid locating the unit adjacent to signal processing equipment.

It should be noted that if a complete rack containing a CPS2000 unit is to be operated from a different mains supply level, then the unit should be withdrawn from the rack in order to reselect the mains voltage setting, at the same time as resetting any other equipment.

The other important consideration when rack-mounting the unit is the need for natural convection of air over the case and an unrestricted air flow through the unit. Note that air is drawn in at the front of the unit and expelled through the rear panel.

Good ventilation BELOW the unit, in the floor or back of the rack, and similarly ABOVE the unit, at the top of the rack, will ensure a path for continuous air flow.

Other equipment in the rack which is known NOT to produce a significant amount of heat should be mounted BELOW the unit. Equipment that also relies on good air flow within the rack (ie. most power amplifiers and other power supplies) should be given due consideration and some space should be provided between such units and between these and the CPS2000 unit. Forced convection, by means of a fan-tray, may be desirable in this situation.



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**The CPS2000 will operate as a free-standing unit without requiring any special cooling arrangement, but should not be allowed to be accidentally or deliberately covered over in any way.**

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**Do not operate the unit with the top cover removed as this exposes hazardous voltages.**

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**The filters on the cooling fans must be inspected regularly and cleaned if necessary to maintain good airflow through the unit. This will be particularly important if the unit is used in a dusty environment.**

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Finally, some consideration should be given to the earthing arrangement of the system at the centre of which are the console and the CPS2000 (and any other Soundcraft power supply units). The console chassis is earthed, through the mains earth, via the power supply. When rack-mounting the CPS2000 (and any other Soundcraft power supply units) care should be taken to avoid any possible 'ground loops' in the system which would introduce audible hum to otherwise clean audio signals. Ground loops may occur where signal processing equipment, patched to the console, has its signal earth commoned to the equipment chassis. The ground loop is formed if this chassis and the power supply chassis are in electrical contact through the fixing rails they share in the rack. To avoid this situation, standard isolating washers may be employed when fixing the power supply (or supplies) or any other unit into the rack.



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**W A R N I N G : THIS APPARATUS MUST BE EARTHED. Under no circumstances should the mains earth be disconnected from the CPS2000 power supply unit.**

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### **GENERAL**

As with all electrical/electronic equipment care should be taken when handling this unit. Avoid general mishandling and do not drop. Avoid storage and operation in dusty locations and do not expose to corrosive atmospheres.



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**To avoid risk of fire do not expose this unit to rain or moisture.**

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Retain all packaging for transportation in the event of the unit requiring servicing. Retain this manual safely, along with all other relevant documents.

For touring/mobile transportation it is advisable to install the CPS2000 in a flight case to provide mechanical protection. Refer to your Soundcraft dealer for a suitable case.

Where the CPS2000 is enclosed in a touring case, provision must be made for adequate ventilation to the rear of the unit to ensure unrestricted supply of air for the cooling fan.



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**Use only the 16 Amp mains lead supplied, no other type is to be used.**

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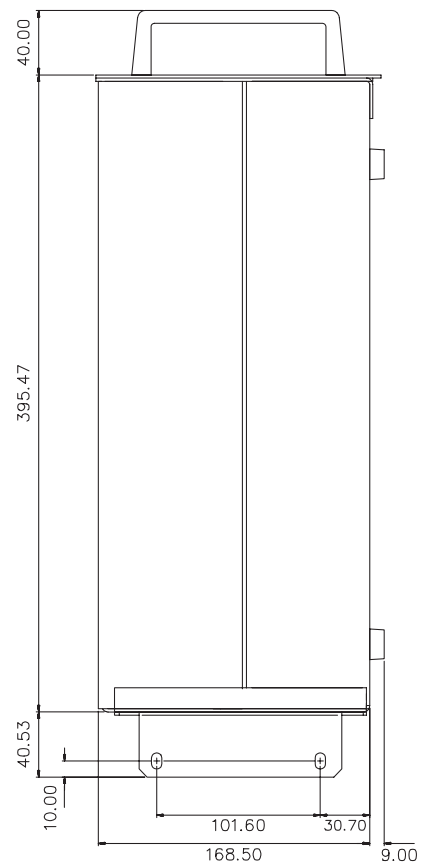
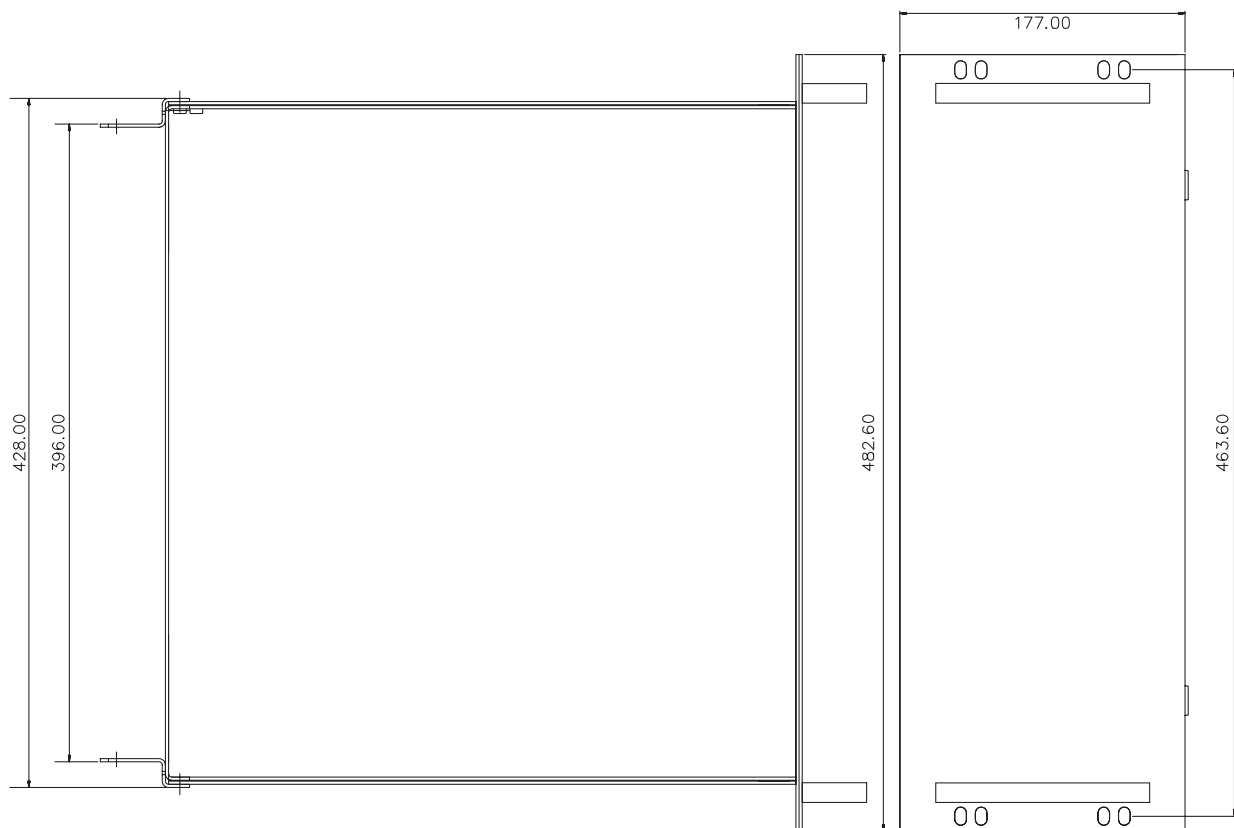
**Use only the DC output lead supplied, no other type is to be used.**

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# Dimensions

All dimensions in millimeters







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# Technical Specification

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# Technical Specification

## **MAINS INPUT VOLTAGE RANGE:**

230/200/115/100 V AC +10% / -15% @ 50/60Hz

## **RATED INPUT POWER (Max):**

980 WATTS

## **MAINS FUSE RATING:**

Use T10AL/250V (slow-blow).

## **OUTPUTS**

DC. VOLTAGE RAIL	MAX. OUTPUT CURRENT
+17V	16.00 AMPS
-17V	16.00 AMPS
+48V	0.30 AMPS
+8V	1.25 AMPS



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**All voltage and current measurements are to be taken at the console-end of the power supply cable.**

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## **OPERATING TEMPERATURE RANGE (Ambient):**

-10 TO +40°C.

## **HUMIDITY:**

Similar unit tested at 0-90% RH non-condensing +/-5% Relative Humidity at 40 °C for 16 hours. Load switched between 20% and 100% at regular 30 minute intervals.

## **OVERALL DIMENSIONS:**

HEIGHT:		177.00mm. (4U)
WIDTH:	Chassis	440.00mm.
	Front panel	482.60mm.
DEPTH: (excl. handles)		436.00mm.

## **WEIGHT:**

(Excl. packing): 30Kg

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## Circuit Description

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**CAUTION: THE FOLLOWING SECTIONS ARE FOR USE BY QUALIFIED SERVICE PERSONNEL ONLY. TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING, OTHER THAN THAT CONTAINED IN PREVIOUS SECTIONS, UNLESS YOU ARE QUALIFIED TO DO SO.**

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# Circuit Description

## **INTRODUCTION.**

The CPS2000 power supply provides +/-17V at 16 Amps, +8V at 1.25 Amp, and +48V at 0.3 Amp. The main PCB (SC3804) is in LH and RH halves. The LH PCB carries the +17V and +48V supplies. The RH PCB carries the -17V and +8V supplies. A separate PCB (SC3817) carries the mains voltage selector switches at the front of the unit.

## **THE +/- 17V RAILS. SC3804**

This consists of two identical +17V supplies connected together to give +/-17V.

Each 17V supply is a linear regulator with conventional fullwave rectification and a large (100,000uF) reservoir capacitor. This is combined with a second power supply that powers the driver transistors, the cooling fan, and the digital mains meter. The main series pass elements are 250W discrete bipolar transistors connected in parallel with suitable current-sharing precautions and mounted on a fan-cooled heatsink. The voltage reference and servo control amplifier is provided by a 723 regulator IC. The circuitry of the +17V regulator is described in detail below:

### **The +17V Supply. (LH PCB)**

The transformer secondary is fused by means of 32 Amp Safeclip (BS88) fuses mounted in holders on the floor of the chassis. They are NOT intended for customer replacement. A spare fuse will be provided, but it is stressed that these fuses will only blow in the event of catastrophic failure, such as a major short in the wiring or a failed bridge rectifier.

The fullwave bridge rectifier is mounted on the heatsink, at the hottest end as it is the most heat-tolerant of the semiconductors. The reservoir capacitors are mounted by clips on the floor of the chassis. For safety reasons, the reservoir capacitor is discharged by bleeder resistor R9 at switchoff; this takes about 30 seconds. A red warning LED on the PCB is on whenever the capacitor is charged. The unregulated DC is approx +26 to +29V.

The 723 IC contains a 7.15V nominal Zener diode, defining the voltage that appears at Pin 6. Zener references generate appreciable noise, and this, plus any ripple, is filtered out by R10,C10. R10 is in series with the positive input of the servo opamp (Pin 5) and is made roughly equal in resistance to the feedback divider R16,17 etc to minimise bias-current offsets.

The feedback divider R16,17,18 & PR1 derives a fraction of the output voltage and delivers it to the negative input of the servo opamp. (Pin 4) The negative feedback keeps this point also at 17.15V, so the actual output voltage is determined by the feedback divider ratio, which is trimmed over a narrow range by PR3.

The output of the servo opamp controls the output through TR8, which is an emitter follower driving the parallel pass devices TR4,5,6. R41 is included for diagnostic purposes, so that the current being supplied by the 723 (only a few mA) can be measured. The power supply to TR8 is taken from the +12V supply. This has its 0V side connected to the positive unregulated DC supply of 26 - 29V, (at nominal mains) giving a total voltage of approx 38 - 41V for the driver; this also powers the 723 IC. This subrail markedly reduces the minimum drop across the pass elements and therefore increases the efficiency.

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The 723 IC is powered through R11, which allows ripple filtering by C9, and voltage protection by DZ1,2. These Zeners are not required to reduce ripple; their function is purely protective, preventing the 40V Vmax spec of the 723 being exceeded should the mains voltage rise above nominal.

The current through the pass devices TR4-7 is shared equally due to the current-sharing resistors R35-45. The drop across these at full load is approx 200mV which is more than enough to swamp Vbe differences in the main transistors.

50 Amp Schottky diode D7 on the output allows supplies to be paralleled for redundancy.

### ***The Mains Voltage Meter.***

The incoming mains voltage is continuously indicated on the front panel by a 3.5 Digit Panel Meter. (DPM) This is powered from a +5V supply derived from the +12V subrail by 7805 regulator REG2.

The +5V supply is reduced to +2.5V by R30,31, and buffered by IC2-A to generate a half-rail for the DPM input.

The incoming mains is monitored by differential amplifier IC1-A, which looks at the voltage between Live and Neutral; this avoids problems with having one side of the meter connected to Earth, which is often not at quite the same potential as Neutral. The Voltage is picked off via two special BSI safety-approved 680K resistors on the voltage select PCB (SC3817) which connect to CN3. The circuitry around IC1-A (R21-24) gives unity gain, but the presence of the 680K resistors on the input gives suitable scaling of the 50Hz signal.

The signal is applied to precision full-wave rectifier IC1-B, IC2-B via DC-blocking cap C5; this circuit is biased by the +2.5V half-rail. The rectified output is smoothed by C6 and scaled by R39 and PR1 before applying it to the DPM input on CN1 Pin 8. (IN HI)

Note the DPM has a differential input, so the cold side (IN LO, Pin 7) is connected to the +2.5V half-rail.

### ***The Mutual Shutdown System.***

Equipment containing some kinds of op-amp is vulnerable to damage when only one of the +/-17V rails fails, as in this case excessive supply currents can be drawn, damaging fuse resistors on the modules.

When both 17V supplies are working normally, current flows through DZ8, OPTO1, and across to the RH PCB. OPTO1 is on so the base drive to TR22 is shunted away and the 723 works normally. Likewise, TR24 is kept on via R100, and ensures TR28 stays off.

If either supply fails there is insufficient voltage to keep DZ8 conducting, and current flow ceases in the mutual shutdown line. TR22 is turned via the special supply generated by D13, C26, and the internal node of the 723 IC3 is pulled down to ground, turning it off. Likewise, in the -17V supply, TR28 is turned via the special supply generated by D14, C25, and the internal node of IC4 is pulled down to ground, turning it off.

C27,30 delay the action of mutual shutdown sufficiently to allow the supplies to start, as they may not rise to working voltage at exactly the same rate.

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When shutdown has occurred, the supply is reset by turning the mains briefly off and on. R100 discharges C25 so that the circuit is ready for use at the next switch-on. The special supplies generated by D13, C26, and D14, C25, are designed to discharge very quickly at power-off, and it should not be necessary to turn the PSU off for more than a second to reset it.

### ***Overcurrent Protection.***

The simplest form of overcurrent protection is the constant-current system; when an attempt is made to draw excessive current, the output voltage is reduced so that no more than a fixed maximum can be drawn. The high current capability of this PSU means that constant current protection alone is not practical as the dissipation in the pass devices is too high for the cooling system to deal with, and in the long term they will overheat.

The standard answer to this problem is foldback current-limiting. Once again the output voltage is reduced to prevent excessive current flow, but it is more severely reduced so that the current flowing is not limited to a fixed maximum, but to a value lower than that which triggered the protection originally. This greatly reduces the dissipation in the supply in protection mode.

This system accomplishes its task, but can give trouble as the supply may work perfectly into a resistive test load but not start into a real console load. The problem is that a mixing console is essentially a constant-current load; as the supply voltage is increased, almost the full current is drawn when only 2 or 3 volts are applied. There are thus two stable states, with rails normal and the full current drawn, or with the supply shut down to the few volts that will cause the foldback current to flow. When the supply is switched on, it tends to stick in the second of these two states.

The CPS2000 avoids this problem by implementing constant-current protection that causes complete shutdown (rather than foldback) after a fixed time delay. This is described for the +17V supply; the -17V supply operates identically.

The first part of the problem is to measure the output current without dropping 0.6V across a resistor to turn on a protection transistor. At 16 Amps the losses in this drop would be unacceptable. Therefore supply current is measured by the voltage drop across 0.05R resistors (R35,36 in parallel) which carry a quarter of the output current and so drop 200 mV at full load. This is compared with a 200mV reference voltage across R86, derived from bands-gap reference IC8 which sits on the output rail, by differential amplifier TR18,19. When the input to TR19 exceeds the 200mV applied to TR18, TR19 conducts and pulls down the internal 723 node at pin 13, reducing the output voltage.

This causes current to cease in the mutual shutdown line, as described above, and after a brief delay caused by C27,30, both 17V supplies are shut down.

ISSUE 8 operates exactly as above. The only difference is that the differential amplifier TR18,19 has its tail fed from a negative subrail at approx -26V. This subrail is generated from the AC input to the PCB by charge-pump C41,42,D22,23. The resulting negative voltage is stabilised by 8V2 Zener DZ10, and applied to R73. This keeps the tail current of TR18,19 more constant, and so maintains the transconductance (current out for voltage in) at a higher level, giving closer feedback control of current-limiting under extreme conditions. The RH PCB operates identically.

## ***Undervoltage warning.***

The supply gives a warning indication when the mains voltage has fallen so low that regulation is about to be lost. The Headroom Indicator subsystem illuminates all the decimal points on the DPM, giving a clear signal that something is amiss.

The voltage across the pass transistors is monitored by TR3; when this voltage falls too low, TR3 turns off, turning off TR1. TR1 collector is then pulled up to +40V by R26, charging C7 through D5, and so turning on TR2. This connects the DPM decimal point connections to the local 0V (actually +26 TO +29V above supply 0V) via current-limiting resistors R32-34. The peak-hold action of D5/C7 is required as the voltage across the pass transistors includes a large ripple content that would leave the decimal points rather dim if they were being strobed at 100 Hz.

An identical circuit (TR9, TR10) monitors headroom in the -17V supply. The voltage across the pass transistors is monitored by TR10. When this voltage falls too low, TR10 turns off, turning off TR9. TR9 collector is connected to the LH PCB via connectors CN8-CN7, and the cessation of current drawn indicates low headroom. On the LH PCB, when this current ceases D12 anode is pulled high by R78, and TR2 turns on, illuminating the decimal points on the meter.

## ***The -17V Supply. (RH PCB)***

The actual 17V section of this is identical to that in the +17V section.

The +12V subrail circuitry is much simpler as it only provides power for the driver TR11, the 723, and the fan. There is no mains meter circuitry here.

## ***The Temperature Protection System.***

This is designed to protect the +/-17V rails only. The +48V and +8V regulators incorporate internal thermal protection, and in any case, their heat dissipation is very small compared with the heatsink size. The +/-17V rails, however are vulnerable to blocked cooling vents or fan failure, so protection is provided that shuts down the 17V rails if the TO3 device cans exceed 100 degC.

The thermal sensor on the RH heatsink is LM35DZ TR31. It outputs 10mV per degreeC above freezing point (0 degC) and applies it to IC5-B non-inverting input. IC5-B is used as a comparator, with R114,106 giving a small amount of hysteresis to prevent dither or oscillation.

IC reference TR29 produces a stable 1.237V which is reduced to 1.00V by R104,112. This is applied to the inverting inputs of IC5-A,B as the shutdown temperature reference, and represents 90 degC at the TO3 can top\*. TR27 senses the temperature of the LH heatsink.

\* Temperature shutdown takes place at 100 degC on some earlier issue PCB's.

If either heat sensor exceeds 100 degC the output of the associated op-amp goes high, applying voltage to the top of R109, and enabling the relaxation LED-flashing oscillator IC6-B. LED7 flashes at approx 2 Hz.

If JMP2 is fitted in the "ON" position, shutdown of the +/-17V rails is also implemented. TR30 is turned on via R117, which turns on TR28, and shuts down the -17V supply. The mutual shutdown system then also shuts down +17V. If JMP2 is in the "OFF" position, only the LED flashing occurs.

### **The +48V Supply.**

Max current rating is 0.3 Amps. The +48V phantom supply is based on the high-voltage regulator TL783C. (REG1) The AC input is fused by F4 and fullwave rectified by BR4; C1,24 are the reservoir capacitors. The unregulated DC may rise as high as +85V on high mains.

The TL783C maintains a fixed 1.27 V between its ADJ and OUT pins, so the adjustable voltage-divider R1-PR2-R2 gives an output of approx 48V. This can be finely adjusted by PR2. The divider current is also used to power the rail indicator LED3, minimising the current wasted inside the regulator circuit.

An output current of 0.5A and a wide (+10/-20%) mains range means that a TL783C alone is only marginally capable of handling the power dissipation. Therefore preregulator TR16,17, working as an emitter-follower biased from the +48V output by zener DZ5, absorbs some of the voltage drop, so that only approx 62V appears on the TL783C input. C28 ensures HF stability of REG1.

Two protection diodes are included. D1 protects the regulator from reverse voltage if there is a charged capacitor across the output but the voltage on C1,24 has collapsed. D2 prevents the ADJ pin from rising above the OUT pin (due to the charge on C2) if the output is shorted.

Conventional diode D6 on the output allows supplies to be paralleled for redundancy.

### **The +8V Supply.**

Max current rating 1.25 Amps. This supply is primarily intended for powering console internal computers; it will be regulated down to +5V inside the console.

The AC input is fused by F4 and fullwave rectified by BR4. The unregulated DC is about +15V on nominal mains. The LM317T regulator maintains a fixed 1.25V between its ADJ and OUT pins, so fixed voltage-divider R68,69 gives an output of approx 8.4 V. C23 reduces output ripple from 1 mV to approx 180 uV at full load.

Two protection diodes are included. D9 protects the regulator from reverse voltage if there is a charged capacitor across the output but the voltage on C20,21 has collapsed. D10 prevents the ADJ pin from rising above the OUT pin (due to the charge on C23) if the output is shorted.

Conventional diode D11 on the output allows supplies to be paralleled for redundancy.

### **Mains Voltage Select PCB. SC3817**

This PCB (SC3817) carries the inrush suppressor and two DPCO switches that select the transformer primary connections to suit the incoming mains voltage.

The first switch A selects between EUROPE and USA/JAPAN settings. The second switch B selects high and low variations on this:

Mains	Mains	Nominal	Dropout	Dropout
Switch A	Switch B	Mains	Voltage	Voltage



Setting	Setting	Voltage	Spec'd	Measured
EUROPE	230/115	230	195	186
EUROPE	200/100	200	170	164
USA/JAPN	230/115	115	98	95
USA/JAPN	200/100	100	85	85

Note that the dropout voltages in the rightmost column were measured on a CPS2000, and are significantly lower than the guaranteed dropout specification of -15%.

### ***Fan Control PCB. SC4032.***

Thermostatic fan control was fitted to the CPS2000 from February 1999. The controller is a separate PCB (SC4032) mounted on the front heatsink bracket, with a thermal sensor pressed against the top surface of the heatsink.

The CPS2000 fan control system adapts the fan speed to the power drawn. This gives a substantial reduction in fan noise under almost all circumstances; the exception being 10% high mains and maximum current drawn, which naturally sets the fan to full speed. The PCB (with associated mounting bracket) may be retrofitted to existing CPS2000 units.

The servo circuit consists of opamp IC1-A, temperature sensor IC5, shunt regulator IC4, and fan control devices TR7,TR10.

IC4 maintains 2.50V between its "anode" and "cathode"; this is the precise voltage that drives the reference chain R53,55. TR8 also uses this voltage to set its emitter at 4.4V above ground; this keeps IC1's inputs within their common-mode range. Thus both ends of the voltage divider R53-R55 are fixed at defined voltages.

LM35DZ temperature sensor IC5 outputs 10mV per degreeC above freezing point (0 degC) and applies it to IC1-A non-inverting input. The desired heatsink temperature is set at the junction of R53,55, which sits at +5.0V approx. This is 600mV above the +4.4V rail, and so represents 60 degC.

R52,57 set the servo loop gain. This is designed to be safely below the level at which slow thermal oscillations would occur. R56,D19 increase the loop gain when IC1-A output is below 4V. This prevents the fan sitting for long periods in a not-quite-running state where it consumes current but does not rotate. The voltage range 1-4V where this occurs is thus skipped over quickly.

The fan is driven through feedback amplifier TR7,10, which has a voltage gain of 1.3 times. This allows the fan to be driven over its full operating voltage range despite the output saturation limits of IC1-A. This gives improved cooling at high temperatures and mains voltages.

The CPS2000 thermal shutdown system is quite separate and has no connection with this PCB.

# FAULTFINDING NOTES.



**SAFETY:** These safety notes are directed to those testing and repairing this power supply. Legal requirements mean that we must not encourage untrained personnel to take the lid off.

## **+/- 17V RAILS.**

- 1) A convenient position for attaching a test meter to 0V is the top leg of bleeder resistor R9 (top leg of R47 on RH PCB) Remember these resistors run hot.
- 2) If one side of the +/-17V supply is not working, the mutual shutdown system will close down both sides of the supply. This makes faultfinding difficult as it is often not obvious which side has failed. The mutual shutdown can be disabled by putting on jumpers JMP1 & JMP3 on PCBs at Issue 6 and above.



**IT IS ESSENTIAL THAT THESE JUMPERS ARE REMOVED AFTER SERVICING IS COMPLETED! FAILURE TO DO THIS MAY CAUSE SEVERE CONSOLE DAMAGE IF ONLY ONE 17V RAIL SHUTS DOWN.**

- 3) If the wireform connecting the two PCBs is disconnected, the mutual shutdown will close down both sides of the supply. The Headroom Alarm dots will also show on the DPM as an active low from the RH PCB is required to suppress them, and this is now missing.
- 4) If there is no power to the 723 IC (eg if R11 or R48 is open-circuit) the output will remain low, but no damage occurs.
- 5) It is possible to swop over the two 2-pin connections on the LH PCB in error. The fan will not run, but no circuit damage occurs.

## **+48V SUPPLY.**

- 1) If TR17 fails short-circuit, the regulator will appear to work, but since all voltage is dropped across the TL783 regulator, this will overheat and shut down at high currents. The TL783 should not be damaged if this is the only fault present.
- 2) If zener DZ5 fails short-circuit, the regulator will not turn on, and there will be only 300 mV approx at the output.
- 3) As usual, the unregulated supply to the +48V regulator can reach +90V, and should be treated with some respect.

## **+8V SUPPLY.**

- 1) This is a completely standard IC regulator circuit. The regulator REG3 is the only part that is likely to fail.
- 2) This supply contains mains voltages on the voltage select PCB, the mains switch, etc, and the usual precautions must be taken.
- 3) The main reservoir capacitors have a capacity of one tenth of a Farad, and are charged to +26V.



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## **THIS IS DANGEROUS.**

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The danger lies not in the voltage, but in the enormous currents that will flow if the capacitor terminals are shorted. A small screwdriver will simply disappear in a violent explosion. The main bodily danger is from metal watchstraps, etc. Serious burns are very likely if these contact the capacitor.

For safety reasons, the reservoir capacitors are discharged at switchoff by bleeder resistors R9 and R47; this takes about 30 seconds. Red warning LEDs on the PCB are ON when the capacitors are charged.

### ***Fuse Replacement***



The 32A fuses mounted on either side of the transformer must be replaced with identical parts only. Soundcraft part number ZD8900.

F1, located on the voltage selector PCB, must be replaced with an identical part. Soundcraft part number ZD8112.



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# Parts List

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# Spare Parts

Notes:

1) The 'Module/PCB Assemblies' section is indented to show those items which are part of another, higher level, item.

2) Some of the descriptions are preceded by one of the following 3 symbols:

# - STATIC SENSITIVE. Anti-static precautions must be taken whilst handling this part.

! - SAFETY CRITICAL PART. A part of a different type may not be substituted.

@ - A part from a specific Manufacturer. Using an equivalent from another manufacturer may lead to loss of performance.

# Top-Level Structures

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**CPS2000 POWER SUPPLY**

**RW8009**

Description . . . . .	Part Number
!CPS2000 WIRED TESTED PSU CHAS . . . . .	RY8009
!5X20MM T2A/250V AS FUSE . . . . .	ZD8102
!5X20MM T10A/250V AS FUSE . . . . .	ZD8110
!5X20MM T12.5A/250V AS FUSE . . . . .	ZD8112
!CPS2000 FUSE 32A BS88 . . . . .	ZD8900
CPS2000 USER&TECH GUIDE . . . . .	ZM0198

# MAIN ASSEMBLIES

## ! CPS2000 WIRED TESTED PSU CHAS

**RY8009**

Ident	Description	Part Number
---	80MM FAN FILTER ASSY	HZ2211
---	CPS2000 PSU CVR PLATE	PB0720-02
---	CPS2000 LID	PH1402-03
---	CPS2000 FRONT PNL	PJ1508-04
---	CPS2000 WIRED CHASSIS ASSY	RS5978
---	CPS2000 TEMP SENSOR WFM.	RV3952

## CPS2000 WIRED CHASSIS ASSY

**RS5978**

Ident	Description	Part Number
---	CPS2000 PSU TRANS CLAMP PLATE	PF0646-01
---	CPS2000 TX GUARD PLATE	PK2563-01
---	CPS2000 LH MODULE ASSY	RS5974
---	CPS2000 RH MODULE ASSY	RS5975
---	CPS2000 FRONT SUB PNL ASSY	RS5976
---	CPS2000 CHASSIS ASSY	RS5977
pcb	CPS2000 STAR POINT PCB	SC4066-01
W/Form	CPS2000 TX WFM ASSY	RV3656
W/Form	CPS2000 MNS INLT TO MNS SWT WM.	RV3657
W/Form	CPS2000 MNS TO VOL SEL PCB WFM	RV3659
W/Form	CPS2000 MAINS METER WFM	RV3660
W/Form	CPS2000 LH/RH PCB LINKING WFM	RV3661
W/Form	CPS2000 DC OUTPUT WFM	RV3662
W/Form	CPS2000 OV LINK WFM	RV3663
W/Form	CPS2000 RESERVR CAP TO PCB WFM	RV3664
W/Form	CHASSIS EARTH WFM 600MM	RV3695-600

## CPS2000 LH MODULE ASSY

**RS5974**

Ident	Description	Part Number
---	2WY MTHD .1" FML	FF0585
---	PAPST 12V 2.4W 80MM FAN	HD0005
---	CPS2000 EXTRUDED HEATSINK	PN1260-03
---	CPS2000 PSU PCB ASSY	RI3804 or RJ3804
---	30CMX30CM THERMALLY CNDCTV SHT	ZC0223
---	TO-220 SIL PAD SELF ADHESIVE	ZC0250
---	SIL PAD 900 .009"THK ADH BACKE	ZC0251
---	TO3 INSULATING WASHER	ZC10029
D7 (on SC3804-09)	DIODE MBR5025L 50A 25V SCK	BA0023
D7 (on SC3804-10)	DIODE MBR6045WT.	BA10018
REG1	VOLTAGE REG TL783CKC	BE0455
REG2	V.REG LM7805 +5V 1A	BE0424
TR4	MJ15024 NPN POWER TRANS TO3	BD0373
TR5	MJ15024 NPN POWER TRANS TO3	BD0373
TR6	MJ15024 NPN POWER TRANS TO3	BD0373
TR7	MJ15024 NPN POWER TRANS TO3	BD0373
TR8	MJL3281A DRIVER TRANSISTOR	BD0399
TR17	MJL3281A DRIVER TRANSISTOR	BD0399
W/Form	LINK WFM(FREE ENDS)100MM	RV4084-100
pcb ass	CPS2000 FAN CONTROL PCB ASSY	RA4032

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**CPS2000 RH MODULE ASSY****RS5975**

Ident	Description	Part Number
—	2WY MTHD .1" FML	FF0585
—	PAPST 12V 2.4W 80MM FAN	HD0005
—	CPS2000 EXTRUDED HEATSINK	PN1260-03
—	CPS2000 PSU PCB ASSY	RI3804 or RJ3804
—	30CMX30CM THERMALLY CONDCTV SHT	ZC0223
—	TO-220 SIL PAD SELF ADHESIVE	ZC0250
—	SIL PAD 900 .009"THK ADH BACKE	ZC0251
—	TO3 INSULATING WASHER	ZC10029
D8 (on SC3804-09)	DIODE MBR5025L 50A 25V SCK	BA0023
D8 (on SC3804-10)	DIODE MBR6045WT.	BA10018
REG3	V.REG +1.2/37V 1.5A (LM317T)	BE0430
TR11	MJL3281A DRIVER TRANSISTOR	BD0399
TR12	MJ15024 NPN POWER TRANS TO3	BD0373
TR13	MJ15024 NPN POWER TRANS TO3	BD0373
TR14	MJ15024 NPN POWER TRANS TO3	BD0373
TR15	MJ15024 NPN POWER TRANS TO3	BD0373
W/Form	LINK WFM(FREE ENDS)100MM	RV4084-100
pcb ass	CPS2000 FAN CONTROL PCB ASSY	RA4032

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**CPS2000 FRONT SUB PNL ASSY****RS5976**

Ident	Description	Part Number
—	! C1350AA HIGH INRUSH NON ILLUM	DL8003
—	LED 3.5DIGIT PANEL METER	JE0418
—	CPS2000 FRONT SUB-PNL	PF0648-04
—	CPS2000 MTR BRKT	PF0653-02
—	! SCHRTR FUSEHOLDER	ZD8014
—	! SCHRTR FUSE CARRIER	ZD8015
—	! SCHRTR FUSEHOLDER INSULATOR	ZD8016
—	! 5X20MM T10A/250V AS FUSE	ZD8110
W/Form	CPS2000 MNS SWT TO VOLT SEL WM	RV3658
pcb ass	CPS2000 VOLTAGE SEL PCB ASSY	RD3817

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**CPS2000 CHASSIS ASSY****RS5977**

Ident	Description	Part Number
—	CAP ELEC VERT 10,000UF 40V DC	CE0507
—	! IEC INLET SKT 16A PNL MNT	FJ8010
—	CPS2000 REAR LH BRACKET	PG1301-01
—	CPS2000 REAR RH BRACKET	PG1302-01
—	CPS2000 BASE PANEL	PJ1507-04
—	PSU EARTH SYMBOL SLF-ADH	ZA0078



## CPS2000 FAN CONTROL PCB ASSY

RA4032

Ident	Description	Part Number
—	CPS2000 HEATSINK BRACKET	PF0655-02
—	TO-220 SIL PAD SELF ADHESIVE	ZC0250
pcb	CPS2000 FAN CONTROL PCB	SC4032-01
C1	POLY-CAP 5MM 5% 63V 100N	CC0252
CN1	2WY MTHD.1"R/A LCKG ML HDR S12	FF0648
D19	DIODE 1N4148	BA0001
IC1	JRC DUAL OP AMP 072BDE	BE0413
IC4	TL431 SHUNT REGULATOR	BE0503
IC5	LM35DZ THERMAL SENSOR	BE0477
P1	CPS2000 FAN CONTROL WFM	RV4016-140
P2	CPS2000 FAN CONTROL WFM	RV4016-140
R32	MF 0.25W RES 1% 680R BL	AP1345
R33	MF 0.25W RES 1% 9K1 BL	AP1372
R35	MF 0.25W RES 1% 10K BL	AP1373
R36	MF 0.25W RES 1% 390R BL	AP1339
R38	MF 0.25W RES 1% 120R BL	AP1327
R52	MF 0.25W RES 1% 4K7 BL	AP1365
R53	MF 0.25W RES 1% 3K9 BL	AP1363
R55	AP 0.25W RES 1% 1K BL	AP1349
R56	MF 0.25W RES 1% 100K BL	AP1397
R57	MF 0.25W RES 1% 1M BL	AP1421
R58	MF 0.25W RES 1% 10K BL	AP1373
TR7	NPN TRANS 2SC2240BL(TAPED)	BD0302
TR8	PNP TRANS 2SA970GR (TAPED)TOSH	BD0301
TR10	BD680 TRANS	BD0368
TR10	TO126 CLIP-ON H/SNK RDPT PF730	PN1235

## CPS2000 VOLTAGE SEL PCB ASSY

RD3817

Ident	Description	Part Number
—	! FUSE COVER SCHURTER 853-9561	ZD8013
—	! 5X20MM T12.5A/250V AS FUSE	ZD8112
pcb	CPS2000 PSU VOLTAGE SEL PCB	SC3817-04
CN1	2WY MTHD.1"R/A LCKG ML HDR S12	FF0648
F1	! SCHURTER FUSE CLIP 10A/250V	ZD0317
R1	! RES MF 10M 5% 0.5W VR37	AD8107
R2	! RES MF 10M 5% 0.5W VR37	AD8107
SW1	! TW VOLTAGE SELECTOR SWT	DJ8000
SW2	! TW VOLTAGE SELECTOR SWT	DJ8000
TH1	INRUSH SUPPRESSOR 20SP0R7	AZ2265

## CPS2000 PSU PCB ASSY

RI3804

Ident	Description	Part Number
pcb	CPS2000 PSU PCB	SC3804-09 or SC3804-10
BR1	BDG RECT BR22 2A	BC0212
BR2	BDG RECT 6A 200V	BC0209
BR3	BDG RECT BR22 2A	BC0212
BR4	BDG RECT 6A 200V	BC0209
C1	CAP ELEC VERT 470UF 100V O/D S	CE0436
C2	CAP ELEC VERT 47UF 63V SKP 0.2	CE0402
C3	CAP ELEC VERT 47UF 63V SKP 0.2	CE0402

C4	CAP ELEC VERT 47UF 25V TPD SKP	CE0401
C5	CAP ELEC VERT 2.2UF 50V TPD SS	CE0416
C6	CAP ELEC TANT 2.2UF 16V	CF0504
C7	CAP ELEC VERT 2.2UF 50V TPD SS	CE0416
C8	CAP CER 470P 100V PRF TPD (N47	CA0008
C9	CAP ELEC VERT 100UF 63V SKP 5M	CE0430
C10	CAP ELEC VERT 220UF 25V SKP	CE0422
C11	CAP ELEC VERT 47UF 25V TPD SKP	CE0401
C12	CAP ELEC RAD 2200UF 35V SKR	CE0443
C13	CAP ELEC RAD 2200UF 35V SKR	CE0443
C14	CAP ELEC RAD 2200UF 35V SKR	CE0443
C15	CAP ELEC RAD 2200UF 35V SKR	CE0443
C16	CAP ELEC VERT 100UF 63V SKP 5M	CE0430
C17	CAP ELEC VERT 220UF 25V SKP	CE0422
C18	CAP CER 470P 100V PRF TPD (N47	CA0008
C19	CAP ELEC VERT 47UF 25V TPD SKP	CE0401
C20	CAP ELEC RAD 2200UF 35V SKR	CE0443
C21	CAP ELEC RAD 2200UF 35V SKR	CE0443
C22	CAP ELEC VERT 47UF 63V SKP 0.2	CE0402
C23	CAP ELEC VERT 47UF 63V SKP 0.2	CE0402
C24	CAP ELEC VERT 470UF 100V O/D S	CE0436
C25	CAP ELEC VERT 2.2UF 50V TPD SS	CE0416
C26	CAP ELEC VERT 2.2UF 50V TPD SS	CE0416
C27	CAP ELEC VERT 330MF 6.3V SKP 6	CE0455
C28	MICRO-BOX 5MM 5% 100V 220N	CC0251
C29	CAP ELEC VERT 2.2UF 50V TPD SS	CE0416
C30	CAP ELEC VERT 330MF 6.3V SKP 6	CE0455
C31	CAP CER ML 10N 100V 5MM	CA0027
C32	CAP ELEC RAD 470UF 63V SKR	CE0442
C33	CAP ELEC RAD 470UF 63V SKR	CE0442
C41	CAP ELEC RAD 470UF 63V SKR	CE0442
C42	CAP ELEC RAD 470UF 63V SKR	CE0442
CN1	16WY G80 IDC VERT ML LTCH HDR	FA0092
CN2	2WY MTHD .1" VERT LCKNG ML HDR	FF0641
CN3	2WY MTHD .1" VERT LCKNG ML HDR	FF0641
CN4	4WY MLX ML HDR	FF0862
CN5	4WY MLX ML HDR	FF0862
CN6	2WY MTHD .1" VERT LCKNG ML HDR	FF0641
CN7	6WY MTHD .1" VERT LCKG ML HDR	FF0649
CN8	6WY MTHD .1" VERT LCKG ML HDR	FF0649
CN10	2WY MTHD .1" VERT LCKNG ML HDR	FF0641
CN11	2WY MTHD .1" VERT LCKNG ML HDR	FF0641
D1	DIODE 1N4001	BA0005
D2	DIODE 1N4001	BA0005
D3	DIODE 1N4148	BA0001
D4	DIODE 1N4148	BA0001
D5	DIODE 1N4148	BA0001
D6	DIODE 1N4001	BA0005
D9	DIODE 1N4001	BA0005
D10	DIODE 1N4001	BA0005
D11	DIODE SCHOTTKY 3A 20V IN5820	BA0028
D12	DIODE 1N4148	BA0001
D13	DIODE 1N4001	BA0005
D14	DIODE 1N4001	BA0005
D16	DIODE 1N4148	BA0001
D17	DIODE 1N4148	BA0001
D19	DIODE 1N4148	BA0001
D20	DIODE 1N4148	BA0001
D21	DIODE 1N4148	BA0001
D22	DIODE 1N4001	BA0005

D23	DIODE 1N4001	BA0005
D24	DIODE 1N4001	BA0005
D25	DIODE 1N4001	BA0005
D26	DIODE 1N4148	BA0001
D27	DIODE 1N4148	BA0001
DZ7	ZENER DIODE 400MW 4.7V	BB0111
DZ8	ZENER DIODE 500MW 27V	BB0128
DZ1	ZENER DIODE 1.3W 18V BZX85	BB0142
DZ2	ZENER DIODE 1.3W 18V BZX85	BB0142
DZ3	ZENER DIODE 1.3W 18V BZX85	BB0142
DZ4	ZENER DIODE 1.3W 18V BZX85	BB0142
DZ5	ZENER DIODE 400MW 11V	BB0106
DZ10	ZENER DIODE 400MW 8.2V	BB0113
DZ11	ZENER DIODE 400MW 8.2V	BB0113
DZ18	ZENER DIODE 400MW 3.3V	BB0101
F1	! SCHURTER FUSE CLIP 10A/250V	ZD0317
F1	! FUSE COVER SCHURTER 853-9561	ZD8013
F1	! 5X20MM T3.15A/250V AS FUSE	ZD8103
F2	! SCHURTER FUSE CLIP 10A/250V	ZD0317
F2	! FUSE COVER SCHURTER 853-9561	ZD8013
F2	! 5X20MM T2A/250V AS FUSE	ZD8102
F3	! SCHURTER FUSE CLIP 10A/250V	ZD0317
F3	! FUSE COVER SCHURTER 853-9561	ZD8013
F3	! 5X20MM T3.15A/250V AS FUSE	ZD8103
F4	! SCHURTER FUSE CLIP 10A/250V	ZD0317
F4	! FUSE COVER SCHURTER 853-9561	ZD8013
F4	! 5X20MM T2A/250V AS FUSE	ZD8102
IC1	OP297 OP AMP 8PIN DIP	BE0546
IC2	OP297 OP AMP 8PIN DIP	BE0546
IC3	LM723J/883 V.REG MIL SPEC	BE0544
IC4	LM723J/883 V.REG MIL SPEC	BE0544
IC5	JRC DUAL OP AMP 072BDE	BE0413
IC6	JRC DUAL OP AMP 072BDE	BE0413
IC7	LM385 VOLTAGE REFERENCE	BE0531
JMP1	2WY HONDA .1" SIL HDR (GOLD)	FF0613
JMP2	2WY HONDA .1" JUMPER (GOLD)	FF0614
JMP2	3WY .1" SIL HDR(GLD)2.54MM PIN	FF0637
JMP3	2WY HONDA .1" SIL HDR (GOLD)	FF0613
LED1	LED 3MM RED S/B PRE 3/4 TP/RL	JA0167R
LED2	T1 3/4 5MM LED GREEN	JA0034
LED3	T1 3/4 5MM LED GREEN	JA0034
LED4	LED 3MM RED S/B PRE 3/4 TP/RL	JA0167R
LED5	T1 3/4 5MM LED GREEN	JA0034
LED6	T1 3/4 5MM LED GREEN	JA0034
LED7	T1 3/4 5MM LED RED	JA0033
OPTO1	CNY17-1 OPTO-COUPLER	BD0348
PR1	CERMIT TRIMMER HORIZ 2K	DE0483
PR2	CERMIT TRIMMER HORIZ 1K	DE0482
PR3	CERMIT TRIMMER HORIZ 2K	DE0483
PR4	CERMIT MULTI TRIMMER 5K SD/ADJ	DE0516
PR5	CERMIT MULTI TRIMMER 5K SD/ADJ	DE0516
R1	MF 0.25W RES 1% 120R BL	AP1327
R2	MF 0.25W RES 1% 3K9 BL	AP1363
R3	MF 0.25W RES 1% 100R BL	AP1325
R4	MF 0.25W RES 1% 33K BL	AP1385
R5	MF 0.25W RES 1% 2K4 BL	AP1358
R6	MF 0.25W RES 1% 33K BL	AP1385
R7	MF 0.25W RES 1% 2K4 BL	AP1358
R9	W/W RES 4W 470R VTM	AH0744
R10	MF 0.25W RES 1% 2K2 BL	AP1357

R11	CF RES 1/2W 5% 330R	AF0537
R12	MF 0.25W RES 1% 22K BL	AP1381
R13	MF 0.25W RES 1% 10K BL	AP1373
R14	MF 0.25W RES 1% 10K BL	AP1373
R15	MF 0.25W RES 1% 10K BL	AP1373
R16	MF 0.25W RES 1% 4K7 BL	AP1365
R17	MF 0.25W RES 1% 5K6 BL	AP1367
R18	MF 0.25W RES 1% 6K2 BL	AP1368
R19	MF 0.25W RES 1% 100R BL	AP1325
R20	MF 0.25W RES 1% 1K6 BL	AP1354
R21	MF 0.25W RES 1% 10K BL	AP1373
R22	MF 0.25W RES 1% 10K BL	AP1373
R23	MF 0.25W RES 1% 47K BL	AP1389
R24	MF 0.25W RES 1% 47K BL	AP1389
R25	MF 0.25W RES 1% 33K BL	AP1385
R26	MF 0.25W RES 1% 10K BL	AP1373
R26	MF 0.25W RES 1% 33K BL	AP1385
R27	MF 0.25W RES 1% 10K BL	AP1373
R28	MF 0.25W RES 1% 47K BL	AP1389
R29	MF 0.25W RES 1% 47K BL	AP1389
R30	MF 0.25W RES 1% 47K BL	AP1389
R31	MF 0.25W RES 1% 82K BL	AP1395
R32	AF 0.25W RES 1% 330R BL	AP1337
R33	AF 0.25W RES 1% 330R BL	AP1337
R34	AF 0.25W RES 1% 330R BL	AP1337
R35	W/W RES 2W 10% OR1	AG0654
R36	W/W RES 2W 10% OR1	AG0654
R37	W/W RES 2W 10% OR1	AG0654
R38	W/W RES 2W 10% OR1	AG0654
R39	MF 0.25W RES 1% 470K BL	AP1413
R41	MF 0.25W RES 1% 10R BL	AP1301
R42	W/W RES 2W 10% OR1	AG0654
R43	W/W RES 2W 10% OR1	AG0654
R44	W/W RES 2W 10% OR1	AG0654
R45	W/W RES 2W 10% OR1	AG0654
R46	MF 0.25W RES 1% 2K2 BL	AP1357
R47	W/W RES 4W 470R VTM	AH0744
R48	CF RES 1/2W 5% 330R	AF0537
R49	MF 0.25W RES 1% 2K2 BL	AP1357
R50	MF 0.25W RES 1% 10R BL	AP1301
R51	MF 0.25W RES 1% 10K BL	AP1373
R52	MF 0.25W RES 1% 10K BL	AP1373
R53	MF 0.25W RES 1% 22K BL	AP1381
R54	MF 0.25W RES 1% 10K BL	AP1373
R55	MF 0.25W RES 1% 100R BL	AP1325
R56	W/W RES 2W 10% OR1	AG0654
R57	W/W RES 2W 10% OR1	AG0654
R58	W/W RES 2W 10% OR1	AG0654
R59	W/W RES 2W 10% OR1	AG0654
R60	W/W RES 2W 10% OR1	AG0654
R61	W/W RES 2W 10% OR1	AG0654
R62	W/W RES 2W 10% OR1	AG0654
R63	W/W RES 2W 10% OR1	AG0654
R64	MF 0.25W RES 1% 4K7 BL	AP1365
R65	MF 0.25W RES 1% 5K6 BL	AP1367
R66	MF 0.25W RES 1% 6K2 BL	AP1368
R67	MF 0.25W RES 1% 1K6 BL	AP1354
R68	MF 0.25W RES 1% 180R BL	AP1331
R69	MF 0.25W RES 1% 1K1 BL	AP1350
R70	MF 0.25W RES 1% 680R BL	AP1345

R71	MF 0.25W RES 1% 10K BL	AP1373
R72	MF 0.25W RES 1% 22K BL	AP1381
R73	MF 0.25W RES 1% 7K5 BL	AP1370
R74	MF 0.25W RES 1% 47K BL	AP1389
R75	MF 0.25W RES 1% 100K BL	AP1397
R76	ZERO OHM RESISTOR (METAL SLUG)	AZ2222
R78	MF 0.25W RES 1% 10K BL	AP1373
R79	MF 0.25W RES 1% 8K2 BL	AP1371
R80	MF 0.25W RES 1% 6K8 BL	AP1369
R81	MF 0.25W RES 1% 2K2 BL	AP1357
R82	MF 0.25W RES 1% 6K8 BL	AP1369
R83	MF 0.25W RES 1% 2K2 BL	AP1357
R84	MF 0.25W RES 1% 30K BL	AP1384
R85	MF 0.25W RES 1% 2K4 BL	AP1358
R87	MF 0.25W RES 1% 1K8 BL	AP1355
R88	MF 0.25W RES 1% 47K BL	AP1389
R89	MF 0.25W RES 1% 100K BL	AP1397
R90	MF 0.25W RES 1% 2K2 BL	AP1357
R92	MF 0.25W RES 1% 30K BL	AP1384
R93	MF 0.25W RES 1% 2K4 BL	AP1358
R94	MF 0.25W RES 1% 7K5 BL	AP1370
R97	MF 0.25W RES 1% 6K8 BL	AP1369
R98	MF 0.25W RES 1% 4K3 BL	AP1364
R99	MF 0.25W RES 1% 8K2 BL	AP1371
R100	MF 0.25W RES 1% 100K BL	AP1397
R101	MF 0.25W RES 1% 47K BL	AP1389
R102	AP 0.25W RES 1% 1K BL	AP1349
R103	MF 0.25W RES 1% 220K BL	AP1405
R104	MF 0.25W RES 1% 47K BL	AP1389
R105	! RES MF 10M 5% 0.5W VR37	AD8107
R107	MF 0.25W RES 1% 4K7 BL	AP1365
R108	MF 0.25W RES 1% 4K7 BL	AP1365
R109	MF 0.25W RES 1% 220K BL	AP1405
R110	MF 0.25W RES 1% 100K BL	AP1397
R111	MF 0.25W RES 1% 680K BL	AP1417
R112	MF 0.25W RES 1% 100K BL	AP1397
R113	MF 0.25W RES 1% 100K BL	AP1397
R114	MF 0.25W RES 1% 100K BL	AP1397
R115	MF 0.25W RES 1% 47K BL	AP1389
R116	MF 0.25W RES 1% 6K8 BL	AP1369
R117	MF 0.25W RES 1% 100K BL	AP1397
R118	MF 0.25W RES 1% 22K BL	AP1381
R119	ZERO OHM RESISTOR (METAL SLUG)	AZ2222
R120	MF 0.25W RES 1% 10K BL	AP1373
R121	MF 0.25W RES 1% 10K BL	AP1373
R122	MF 0.25W RES 1% 5K1 BL	AP1366
R106	! RES MF 10M 5% 0.5W VR37	AD8107
REG1	3WY MTHD 0.1" R/A ML	FD0309
REG2	3WY MTHD 0.1" R/A ML	FD0309
REG3	3WY MTHD 0.1" R/A ML	FD0309
TR2	NPN TRANS 2SC2240BL(TAPED)	BD0302
TR8	LM385 VOLTAGE REFERENCE	BE0531
TR9	NPN TRANS 2SC2240BL(TAPED)	BD0302
TR10	PNP TRANS 2SA970GR (TAPED)TOSH	BD0301
TR16	MPSA42 NPN TRANS	BD0369
TR18	NPN TRANS 2SC2240BL(TAPED)	BD0302
TR19	NPN TRANS 2SC2240BL(TAPED)	BD0302
TR20	PNP TRANS 2SA970GR (TAPED)TOSH	BD0301
TR21	NPN TRANS 2SC2240BL(TAPED)	BD0302
TR22	NPN TRANS 2SC2240BL(TAPED)	BD0302

TR23	.....	NPN TRANS 2SC2240BL(TAPED)	.....	BD0302
TR24	.....	NPN TRANS 2SC2240BL(TAPED)	.....	BD0302
TR25	.....	NPN TRANS 2SC2240BL(TAPED)	.....	BD0302
TR27	.....	LM35DZ THERMAL SENSOR	.....	BE0477
TR28	.....	NPN TRANS 2SC2240BL(TAPED)	.....	BD0302
TR29	.....	LM385 VOLTAGE REFERENCE	.....	BE0531
TR30	.....	PNP TRANS 2SA970GR (TAPED)TOSH	...	BD0301
TR31	.....	LM35DZ THERMAL SENSOR	.....	BE0477

## MISCELLANEOUS HARDWARE

Description	Part Number	Used in: (part number)
2BA VIBRATION RESIST.SOLDR TAG	NE0409	RV3656, RV3662
6/32 UNCX10/16"PCB STUD	NZ2317	RI3804
CAPACITOR MOUNTONG BRKT VERT.	NZ2356	RS5977
CPS2000 TO3P MOUNTING CLIP	NZ2354	RS5974, RS5975
FAN GASKET 80.00MM	NZ2357-02	RS5974, RS5975
HANDLE 120MM STAINLESS STEEL	NZ2362	RY8009
M3 BARB NUT	NB0175	RA4032
M3 NYLON INSERT NUT ZINC	NB0113	RS5976, RS5977, RS5978
M3 S/PROOF WASHER ZINC	NC0221	RS5974, RS5975
M3.5 NYLON BUSH	ND0392	RS5974, RS5975
M3X10 SPACER + STUD 6MM LG HTS	ND0419	RS5974, RS5975
M3X10MM CSK POZI SCR BLK ISO	NA0115	RS5977
M3X12MM PAN POZI SCR BLK ISO.	NA0237	RS5978
M3X6 PN PZI W/CAPT WASHER ZNC	NA0401	RA4032
M3X8MM PAN POZI BLK SCR ISO	NA0130	RS5974, RS5975, RY8009
M4 CRINKLE WSHR BERYLLIUM COPP	NC0278	RS5977, RY8009
M4 NYLON INSERT NUT TYPE T ZIN	NB0127	RS5977, RS5978, RY8009
M4 PLAIN STL WSHR ZNC CLR 9MM	NC0249	RS5978
M4 SPIRE NUT SNU1218-17-40 ZNC	NB0156	RS5978
M4X10MM PAN POZI STL SCR BLK I.	NA0146	RS5977, RS5978, RY8009
M4X16MM PAN POZI SCR ZINC ISO	NA0125	RS5974, RS5975
M4X20 PAN POZI ZINC	NA0422	RS5977
M4X9 1MM THICK RUBBER WASHER	NC0293	RS5974, RS5975
M5 CRINKLE WSHR BERRYLLIUM COP	NC0303	RS5978
M5 NYLON INSERT NUT ZINC	NB0116	RS5974, RS5975
M5 STAR SOLDER TAG	NE0418	RS5978
M5X12 SKT CAP HD ST/STEEL	NA0449	RY8009
M5X12MM CSK POZI BLK SCR ISO	NA0091	RS5978, RY8009
M5X30MM PAN POZI SCR ZINC ISO	NA0094	RS5974, RS5975
M6 NYLON INSERT NUT ZINC	NB0117	RS5978
M6X20MM PAN POZI CLR SCR	NA0317	RS5978
NO.4X3/4"PAN POZI BLK S/T	NA0129	RS5976
NO.4X7.90 RET SPACER RICHCO	ND0454	RS5976
NO.6 PLASTIC WASHER 1.58MM	NC0295	RA4032, RS5974, RS5975
NO.6X1/2"TYPE B CSK POZI BLACK.	NA0073	RY8009
NO.8X3/8"PAN POZI B BLACK SCR	NA0372	RS5978
NO6X5/8"TYPE B PAN POZI BLK.	NA0258	RS5974, RS5975
NYLOCK NUT ZINC 6-32 UNIFIED	NB0173	RS5974, RS5975
PLASTIC SNAP RIVET.	NZ2332	RA4032
RICHO SCREW ON PLASTIC FEET.	ZZ2541	RS5977
VIB RES CRIMP TAG V5 TIN PLT	NE0416	RV3657, RV3695-600

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# Fan Control

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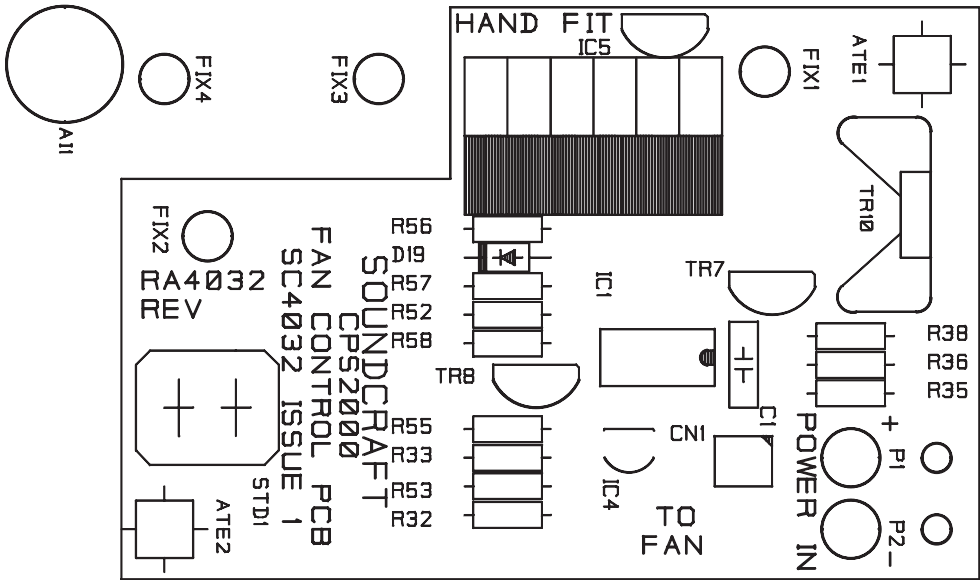
# CPS2000 Fan Control & PCB SC4032

## Technical Description

The later models of the CPS2000 are fitted with a fan control servo system that adapts the fan speed to the power drawn. This gives a substantial reduction in fan noise under almost all circumstances; the exception being 10% high mains and maximum current drawn, which naturally sets the fan to full speed. The PCB (with associated mounting bracket) may be retrofitted to existing CPS2000 units.

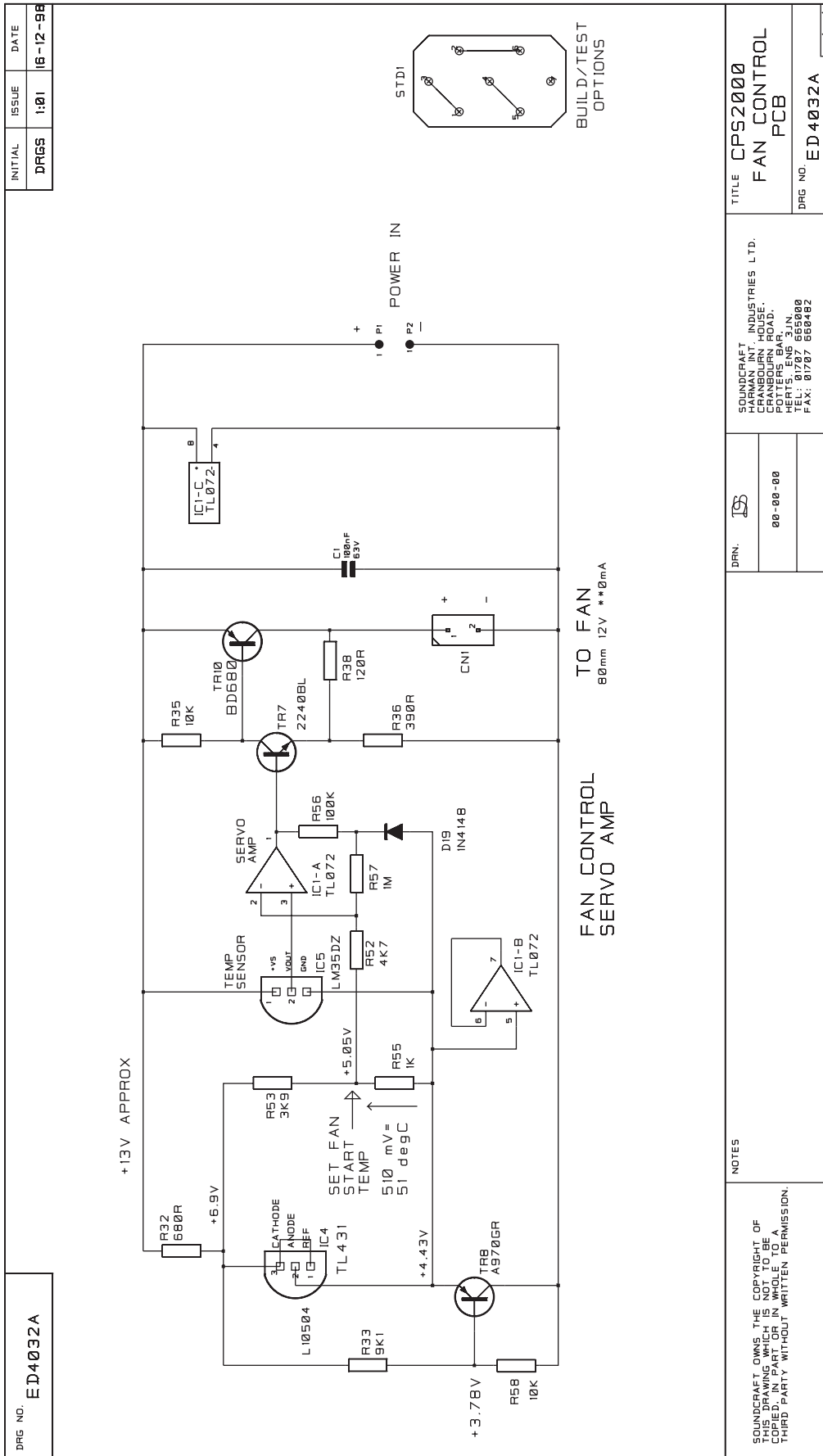
The servo circuit consists of opamp IC1-A, temperature sensor IC5, shunt regulator IC4, and fan control devices TR7,TR10. IC4 maintains 2.50V between its "anode" and "cathode"; this is the precise voltage that drives the reference chain R53,55. TR8 also uses this voltage to set its emitter at 4.4V above ground; this keeps IC1's inputs within their common-mode range. Thus both ends of the voltage divider R53-R55 are fixed at defined voltages. LM35DZ temperature sensor IC5 outputs 10mV per degreeC above freezing point (0 degC) and applies it to IC1-A non-inverting input. The desired heatsink temperature is set at the junction of R53,55, which sits at +5.0V approx. This is 600mV above the +4.4V rail, and so represents 60 degC. R52,57 set the servo loop gain. This is designed to be safely below the level at which slow thermal oscillations would occur. R56,D19 increase the loop gain when IC1-A output is below 4V. This prevents the fan sitting for long periods in a not-quite-running state where it consumes current but does not rotate.

The voltage range 1-4V where this occurs is thus skipped over quickly. The fan is driven through feedback amplifier TR7,10, which has a voltage gain of 1.3 times. This allows the fan to be driven over its full operating voltage range despite the output saturation limits of IC1-A. This gives improved cooling at high temperatures and mains voltages. The CPS2000 thermal shutdown system is quite separate and has no connection with this PCB.





# CPS2000 Fan Control Circuit Diagram



DRN.	SOUNDCRAFT INT. INDUSTRIES LTD. HARMAN INT. HOUSE, CRANBURN ROAD, POTTERS BAR, HERTS. EN6 3JN. 055000 TEL: 01707 664002 FAX: 01707 664162	TITLE CPS2000 FAN CONTROL PCB
00-00-00	DRG NO. ED4032A	REV. 1 OF 1

**NOTES**

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# Technical Drawings

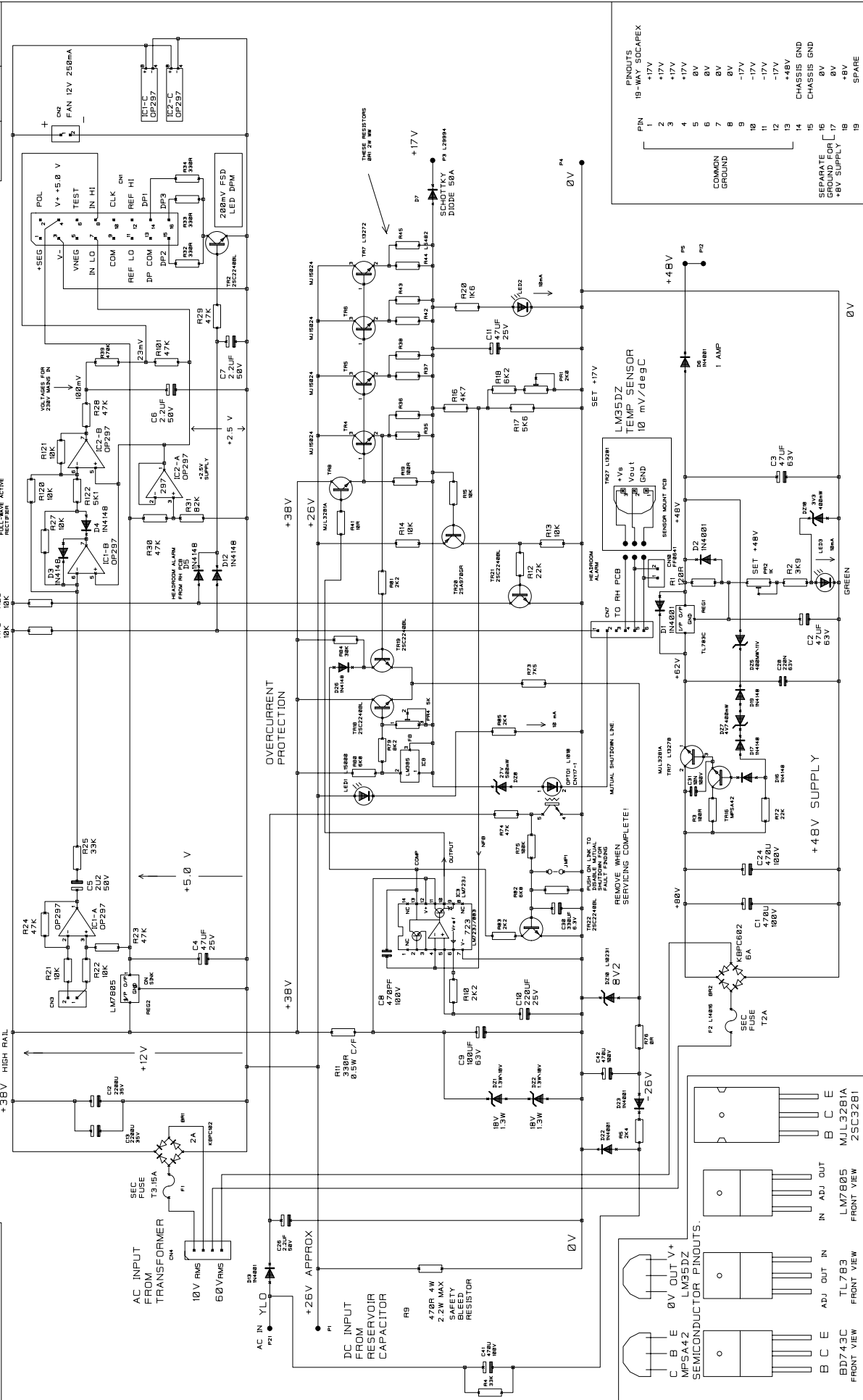
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## Circuit Diagrams

ED3804A	Issue 9
ED3804B	Issue 9
ED3804A	Issue 10
ED3804B	Issue 10
ED3817	Issue 4

## PCB Layouts

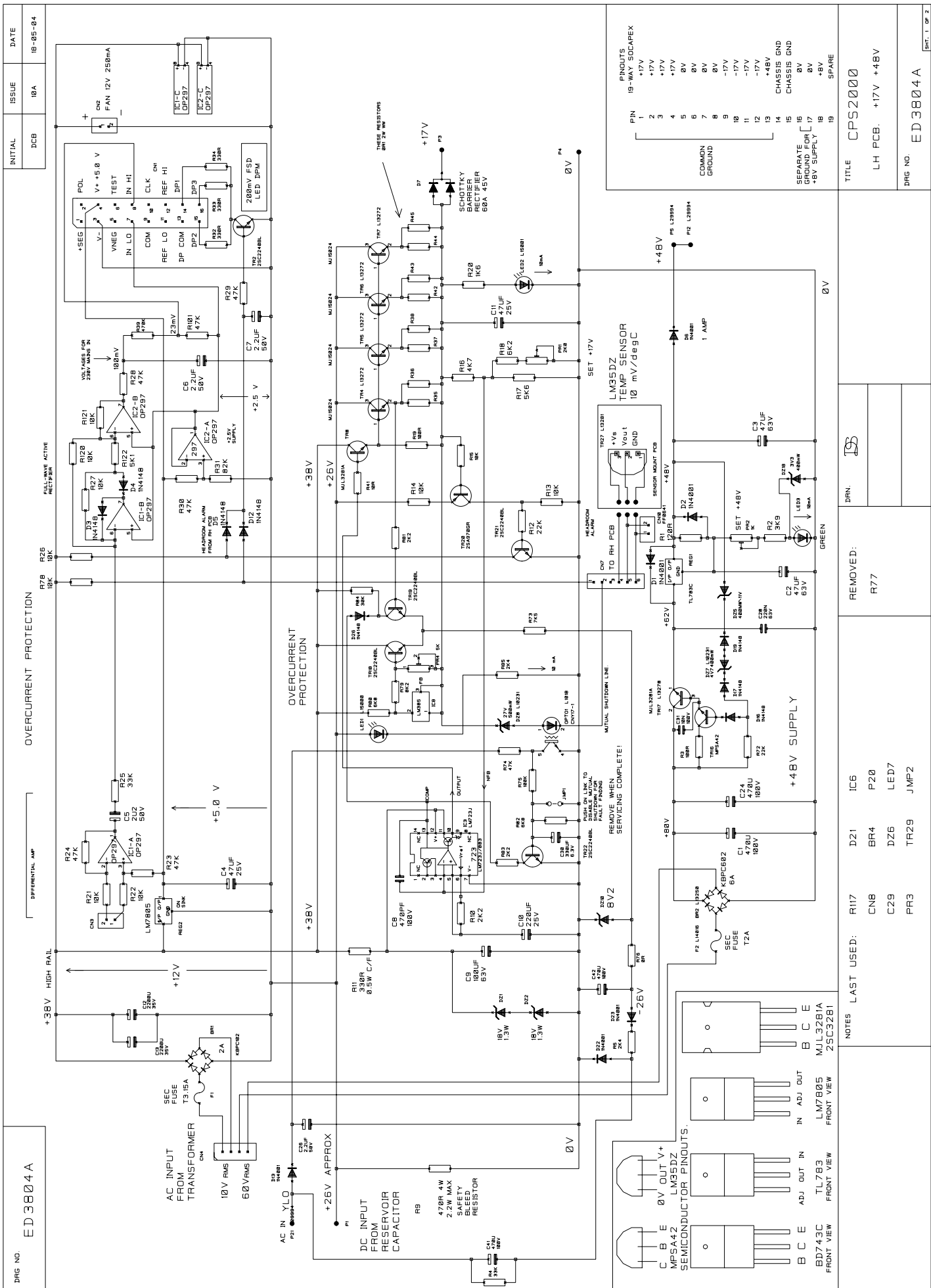
SC3804	Issue 9
SC3804	Issue 10
SC3817	Issue 4



DRG NO.	ED3804A
INITIAL	RJNS
ISSUE	9.81
DATE	22-10-01
TITLE	CPS2000
DRG NO.	ED3804A
DRN.	IS
REMOVED:	R77
LAST USED:	R117, IC6, D21, BR4, P20, C29, PR3, DZ6, LED7, TR29, JMP2
NOTES	<p>BD743C TL783 FRONT VIEW</p> <p>B C E ADJ. OUT IN IN ADJ. OUT B C E LM7805 M/L328IA FRONT VIEW</p> <p>C B E MPSA42 LM35DZ SEMICONDUCTOR PINOUTS FRONT VIEW</p> <p>25C3281</p>

PIN	18-WAY SOCAPEX
1	+17V
2	+17V
3	+17V
4	+17V
5	0V
6	0V
7	0V
8	0V
9	-17V
10	-17V
11	-17V
12	-17V
13	+48V
14	CHASSIS GND
15	CHASSIS GND
16	0V
17	+8V SUPPLY
18	+8V
19	SPARE





DRG NO. ED3804A

OVERCURRENT PROTECTION

INITIAL DCB  
ISSUE 18A  
DATE 18-05-04

PINOUTS	
1	+17V
2	+17V
3	+17V
4	0V
5	0V
6	+17V
7	0V
8	0V
9	-17V
10	-17V
11	-17V
12	-17V
13	+48V
14	CHASSIS GND
15	CHASSIS GND
16	0V
17	SEPARATE 500V 1.0A SUPPLY
18	+8V
19	SPARE

TITLE CPS2000  
LH PCB. +17V +48V  
DRG NO. ED3804A  
SHT. 1 OF 2

REMOVED: R77

LAST USED: R117, IC6, C18, C19, PR3, D21, BR4, D26, TR29, JMP2

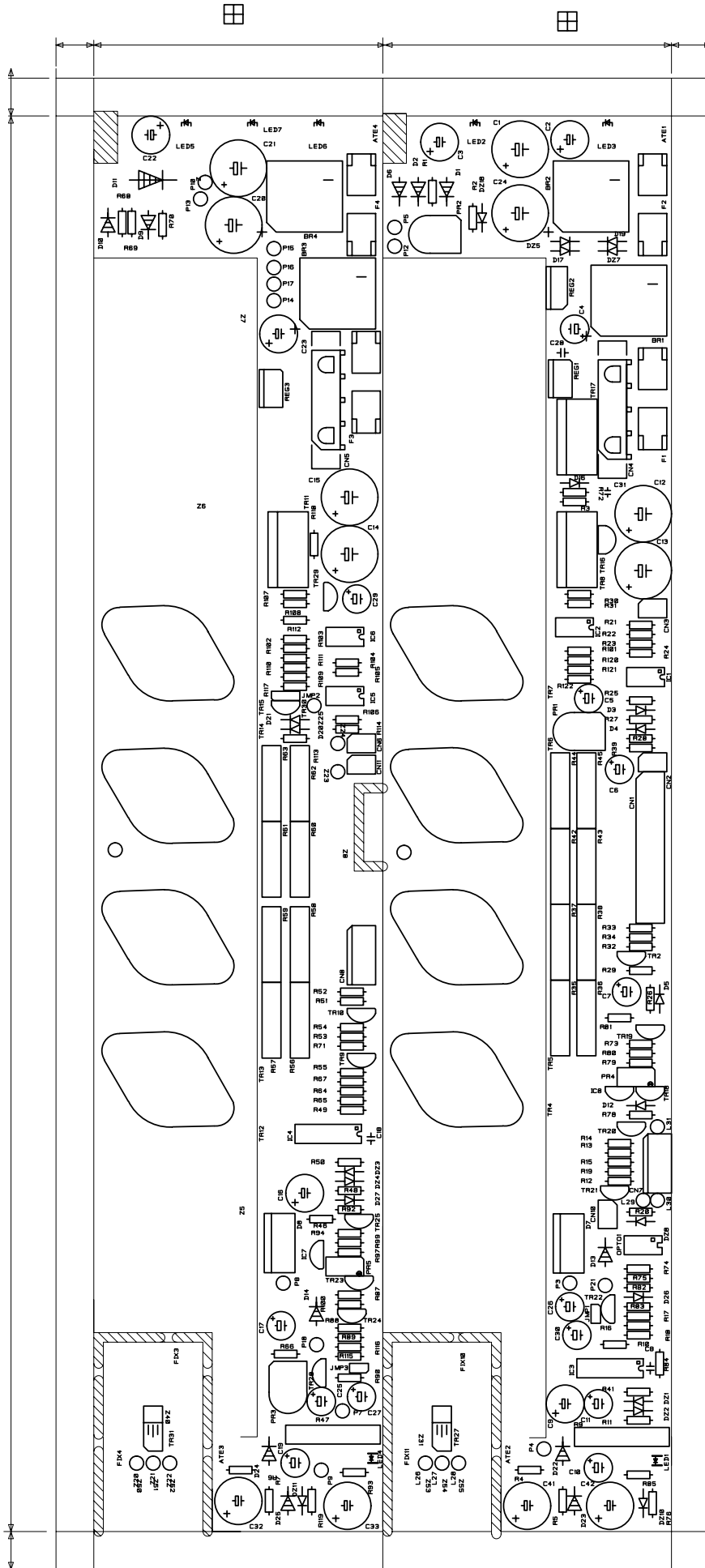
NOTES: REMOVE WHEN SERVICING COMPLETE!

SEMICONDUCTOR PINOUTS:  
MPSA42: C B E, IN, ADJ, OUT  
LM350Z: B C E, TL783, LM7805, FRONT VIEW  
25C32B1: B C E, FRONT VIEW

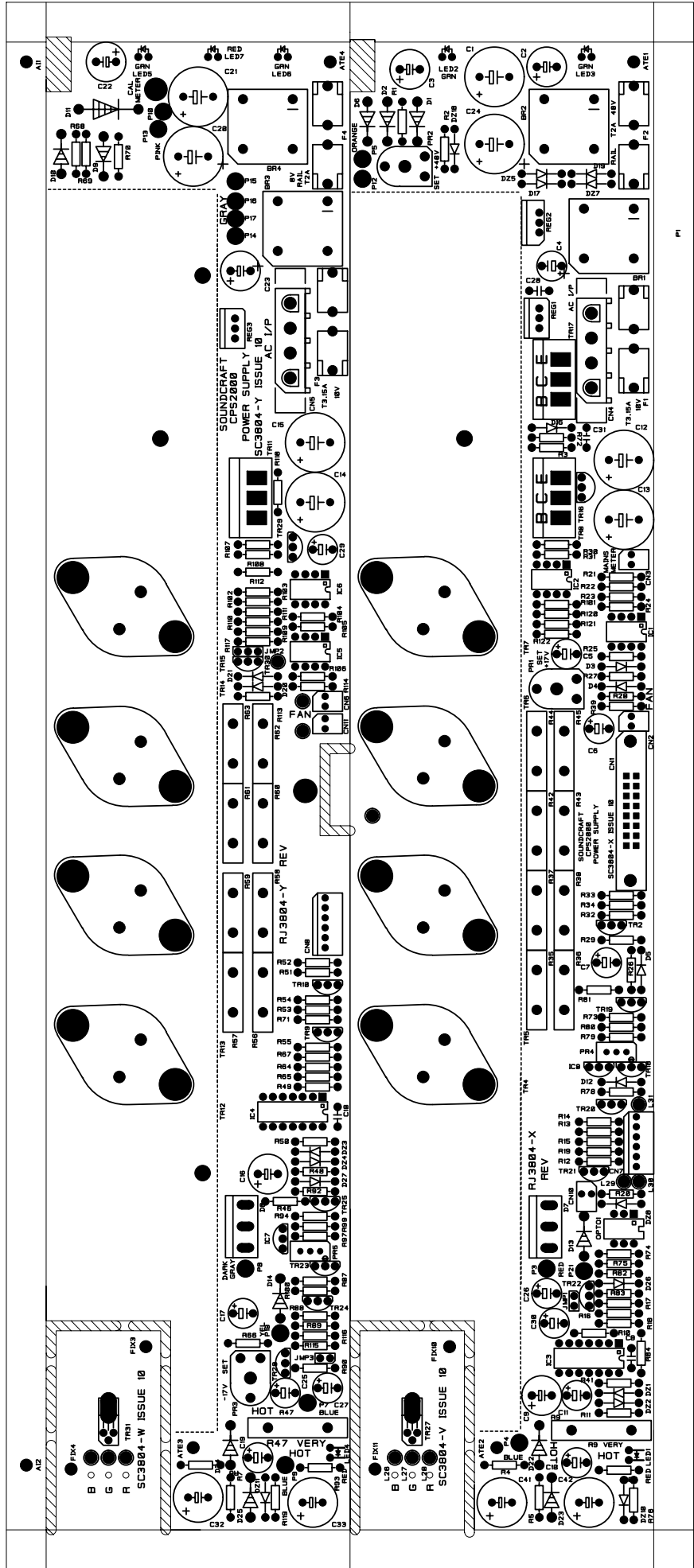


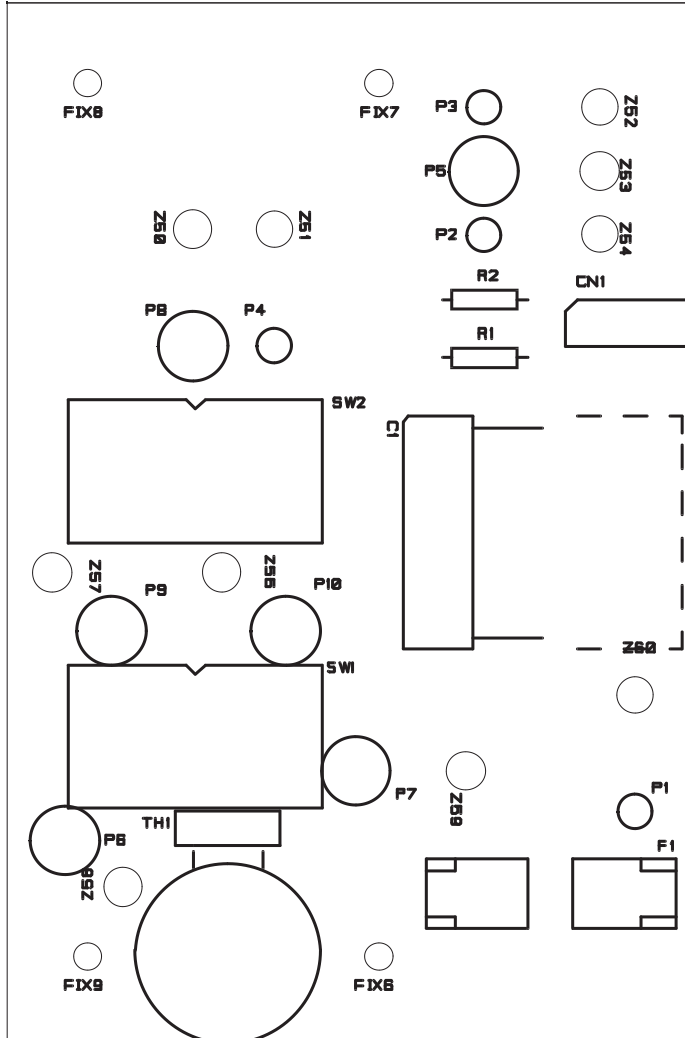






CP52000 POWER SUPPLY  
 CP3804 ISSUE 10 20/07/04





ED3817 Iss4



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