Service Manual **P7**

Issue 1.0

FMJ P7
7-Channel Amplifier

ARCAM

Contents List

Section	Issue	
Technical specifications		
▪ Technical specification	-	
▪ Rear panel silk screen	-	
Amplifier board L924		
▪ Circuit description	-	
▪ Component overlay	1.0	
▪ Parts list	1.1	
▪ Circuit diagrams	1.1	
Controller board L925		
▪ Circuit description	-	
▪ Component overlay	1.0	
▪ Parts list	1.2	
▪ Circuit diagrams	1.2	
Transformer specifications		
▪ L911TX	1.0	
▪ L912TX	1.0	
▪ L920TX	1.0	
▪ L921TX	1.0	
Mechanical		
▪ General assembly parts list	-	
▪ Assembly diagrams		
Front panel	-	
TX tray	-	-
Rear panel	-	
Chassis	-	

Technical Specifications

Contents

Technical Specifications

All measurements are with 230V/50Hz mains power

Continuous output power

All channels driven, 20Hz – 20Khz, 8 ohm	150W per channel	1.05kW total
All channels driven, 20Hz – 20kHz, 4 ohm	230W per channel	1.62kW total
One or two channels driven at 1kHz, 8 ohm	160W per channel	
One or two channels driven at 1kHz, 4 ohm	250W per channel	
One or two channels driven at 1kHz, 3.2 ohm	300W per channel	

Peak output current capability 25A per channel

Total harmonic distortion
At any level up to rated power, into 4 or 8 ohms <0.05% (20Hz – 20kHz)
Typically <0.005% at 1kHz

Frequency response +-0.2dB (20Hz – 20 kHz)
-1dB at 1Hz and 100kHz

Residual hum and noise
Referenced to full power -122dB, 20Hz – 20kHz, unweighted

Voltage gain x 28.3 (1V input gives 100W/8 ohm output)

Input impedance 22k ohm in parallel with 470pF

Output impedance 50m Ohm at 20Hz, 1kHz
120m ohm at 20kHz

Power requirements 115V or 230VAC, 50/60Hz, 3kW maximum via heavy duty IEC mains inlet
A soft start system eliminates large inrush currents at switch on

Dimensions W430 x D450 x H180 mm

Weight 31kg (68 Ib) nett
35kg (77 Ib) packed

7 RS BACK

6 R SURR

5 RIGHT

4 CENTRE

3 LEFT

2 L SURR

1 LS BACK

POWER INLET

230V

~

50 – 60 Hz
3700 VA
MAX

12V TRIGGER
IN

WARNING: THIS APPLIANCE MUST BE EARTHED.

CAUTION – SHOCK HAZARD, DO NOT OPEN.
ACHTUNG – VOR OEFFNEN DES GERAETES NETZSTECKER ZIEHEN.
ATTENTION – RISQUE DE CHOC, NE PAS ENLEVER.
PRECAUCION – PELIGRO DESCARGA, NO ABRIR.

RADIO INTERFERENCE (USA) THIS PRODUCT COMPLIES WITH PART 15 OF FCC RULES, OPERATION IS SUBJECT TO THE FOLLOWING CONDITIONS; (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

THIS PRODUCT IS CERTIFIED BY THE MANUFACTURER TO COMPLY WITH DHHS RULE 21 CFR SUBPART J APPLICABLE AT THE DATE OF MANUFACTURE.

CE

SERIAL No. LABEL

DESIGNED & MADE IN THE UK BY:
A & R CAMBRIDGE LTD, WATERBEACH,
CAMBRIDGE, CB5 9PB.

Amplifier Board L924

Contents

P7 Amplifier Module

Circuit Description

Refer to L924 circuit diagrams

Introduction

L924 is the power amplifier module for the P7 multichannel amplifier. There are 7 identical modules in the P7. The circuit design is based on the A85 / A32 output stage topology.
The main features of the amplifier module are as follows:

- Preset 'THX' gain (29dB closed loop gain). 0dBV input signal corresponds to 100 watts into 8Ω output power
- Capable of producing 150 watts of sinusoidal output power into an 8Ω resistive load (with greater than 250W into 3.2Ω subject to thermal dissipation limits)
- Relay coupled output for silent power on / off and load protection
- Opto-isolated fault and control lines to the microprocessor PCB (to avoid hum loops and instability, to improve EMC performance and crosstalk)
- DC coupled signal path with integrating servo to remove residual DC errors
- Instantaneous load protection
- Mono block design (each channel is electrically isolated from all others and has independent power supply windings on the mains transformer)
- Integrated modular heatsink for good thermal performance and ease of assembly / servicing
- Low harmonic and intermodulation distortion
- Flat frequency response
- Fast (and symmetrical) slew rate
- High damping factor
- Unconditionally stable into loads of up to ±90° phase angle

Sheet 1

The input to the amplifier is connected via SK103. The 2 phono sockets are connected in parallel to allow 'daisy-chaining' of amplifier modules. R104 provides a DC leakage path to the chassis (i.e. mains power earth) to prevent small transformer leakage currents causing the electrical 0V of the amplifier to rise significantly above mains earth potential. C104 provides an EMC coupling between the local input ground and the chassis to reduce common mode RF noise.

Star point SP101 connects the differently named electrical 0V nets at a single point. This is to ensure the correct wiring topology of the ground connections on the printed circuit board. SP101 provides a good common ground reference point when making voltage measurements on the PCB. Note that 0V_DIG is ***not*** connected to SP101, as this is the microprocessor ground.

Relay RLY101 connects the output of the amplifier to the load via socket SK105.

L101 and R103 form part of a 'Zobel' network to decouple the load at high frequencies to ensure amplifier stability into capacitive loads.

Note that signals 6 through 9 are open collector outputs, active low, referred to 0V_DIG with no pull-up resistors. This is because they are wire OR'd on the microprocessor PCB (L925), where the pull-up resistors to +5V digital are located.

The line 'NFB' provides for a portion of the negative feedback of the amplifier to be taken on the load side of RLY101. The components that allow for this (R236 thru R239) are not presently fitted, meaning that RLY101 is not included in the feedback loop.

SK104 connects to the microcontroller PCB. Note that all signals on this connector are electrically isolated from the amplifier circuit itself, via either opto isolators or the relay coil of RLY101. The 10-pin connector has the following signals:

SK104

Pin	Type	Name	Description
1	GND	0V DIG	Microprocessor ground return
2	PSU	+24V_DIG	+24 volt digital power supply (referred to 0V_DIG only) for relay coil RLY101
3		MUTE	Not used
4	I/P	OUT_RLY	Relay drive for the output relay RLY101 (LOW = output relay ON)
5			Not used
6	O/P	THERMPROT	Open collector thermal fault signal (LOW = FAULT)
7	O/P	VIPROT	Open collector short circuit fault signal (LOW = FAULT)
8	O/P	DCPROT	Open collector DC fault signal (LOW = FAULT)
9	O/P	FAULT	Open collector overall fault signal (LOW = FAULT)
10			Not used

Sheet 2

Port INPUT connects the input of the amplifier, referred to 0V_SIG, which is the precision signal ground reference.

Zener diodes DZ202 and DZ203 limit the input signal amplitude to approximately 5.3Vpk. This is to prevent damage to the input of op-amp IC200, due to a leaky source signal or electrostatic discharge.

R223, R228 and C210 form a passive 1st order low pass filter with a –3dB corner frequency of roughly 330kHz to prevent ultrasonic signals from entering the circuit and possibly causing damage.

The main amplifier circuit is a 'classic' current feedback design.

IC200A is configured as a non-inverting amplifier with a gain of 2. Its purpose is to provide current outputs (via its power supply pins) and a current input (via its output pin). This forms the voltage to current (transimpedance) conversion and phase splitting necessary to drive the voltage gain stage. The 'current feedback' occurs because when IC200 drives its 44Ω load to ground, the power supply pin currents are half-wave rectified versions of the drive current of the amplifier. This causes voltage gain, which is buffered and passed on to the outputs. The feedback from the output to pin 1 of IC200 acts to reduce the gain of the amplifier; when this current is roughly equal to the current required to drive the input signal into 44Ω, equilibrium is reached and the closed loop gain is defined. The output stage provides the vast majority of the current required to drive the 44Ω signals to ground. The op-amp only provides a very small error current sufficient to give the required voltage magnification.

Transistors TR204 and TR203 are wired as cascodes (common base amplifiers). Their purpose is to provide IC200 with ±15V power supply rails, whilst allowing IC200's power supply pin currents to pass through them to the NPN and PNP current mirrors.

The resistor, zener diode and capacitor circuits on the bases of TR204 and TR203 are to provide a controlled ramp up during power on, a stable power supply voltage and good local HF decoupling.

Transistors TR200, TR201 and TR202 form a PNP Wilson current mirror. Likewise TR205, TR207 and TR206 form an NPN Wilson current mirror. The outputs of these two current mirrors are connected together via the bias network around TR212.

The two current mirrors combine to provide a very high-gain current to voltage (transresistance) gain stage, which provides all the voltage gain of the amplifier (roughly 80dB at low frequency).

C205, C207, R221 and R222 provide the loop compensation for the amplifier. They combine to produce an open-loop pole at roughly 10kHz and a corresponding open-loop zero around 500kHz. This allows for good time domain performance and clean square wave reproduction. The amplifier is designed to be critically damped. There should be no ringing or overshoot apparent on the output signal when a (small) step function is applied to the input.

Diodes D200 and D202 act to limit the current through TR202 and TR206 in the event of a fault condition. When the input current exceeds 14mA the diodes conduct and the transresistance stage becomes a constant current source, killing the open loop gain and preventing damage to the transistors.

Resistors R219 and R220 decouple the supplies for the amplifier gain stages from the main power rails. This is to permit the bootstrap circuit to modulate these supplies, increasing efficiency. The bootstrap will be described in more detail later.

TR212 provides a 4.7V bias voltage to allow the following pre-driver stage to operate in class ‘A’. It also acts as a V_{BE} multiplier for TR209 and TR214 to maintain an approximately constant current as the ambient temperature inside the box changes.

TR209 and TR214 form a class ‘A’ pre-driver emitter follower stage to boost the current gain and isolate the transresistance stage from the output transistors. This is important to keep the loop gain of the amplifier high and thus minimise distortion. TR208 and TR213 act as a current limit (roughly 30mA) to prevent the destruction of TR209 and TR214 in a fault condition.

R247, R248, R249 and R250 are to loosely decouple the emitters of TR209 and TR214 from the output stage. This is very important. The output devices (Sanken power Darlingtons) have inbuilt temperature compensating diodes which control the bias voltage to their bases. Each output device has a 150Ω resistor so that the inbuilt diodes can accurately control quiescent V_{BE} and hence collector current as the output power and device temperature varies. Preset potentiometer RV200 adjusts the quiescent current. *NB Ensure that the amplifier has fully warmed up before adjusting the quiescent current.* D201 protects the output devices from destruction in the event of the preset potentiometer going open circuit. PL200 allows the test engineer to measure the bias voltage (and thus collector current).

C217, C218, C220 and C221 provide local HF stability around the output transistors to prevent parasitic oscillation. D204 and D205 are catch diodes to reduce the effects of induced back-EMF in the loudspeaker load.

R254 and C223 form part of the ‘Zobel’ network that ensures the amplifier sees a constant load of roughly 4.7Ω at very high frequencies. This helps to improve stability and reduce HF output noise.

C208 and C209 provide local high frequency decoupling for the output devices.

IC200B forms the DC integrating servo. Its purpose is to remove residual DC errors due to slight device mismatch and component tolerances. It is configured as an inverting integrator with a time constant of 0.47 seconds. Any positive DC offset at the output of the amplifier will cause the output of the op-amp to go negative, increasing the current in the negative supply pin and thus ‘pulling’ the output down to ground (and vice versa). D203 protects the inverting input of IC200B in a fault condition.

The bootstrap circuit consists of C213, C214, R241, R242, R219 and R220. The purpose of the bootstrap is to allow the output voltage swing to modulate the power supply rails of the input and voltage gain stages. This allows this circuit’s power supply voltage to exceed the main power rails connected to the output devices, allowing the driver stage to fully drive the output and thus give the best thermal efficiency. The ‘bottom’ of R219 sees a peak-to-peak voltage swing of approximately 15 volts at full output power (i.e. it goes 7.5 volts above the rail at the peak of the cycle). The ‘top’ of R220 should see the same voltage swing.

Sheet 3

This sheet contains the protection circuits and interface to the microprocessor signals.

TR309, TR305 and their associated components form the instantaneous load protection circuit for the output transistors. They sense the voltage across the 0.22Ω emitter resistors (hence emitter current) and the collector-emitter voltage, cutting off the base drive to the output transistors when the collector current or device power dissipation exceeds a preset limit.

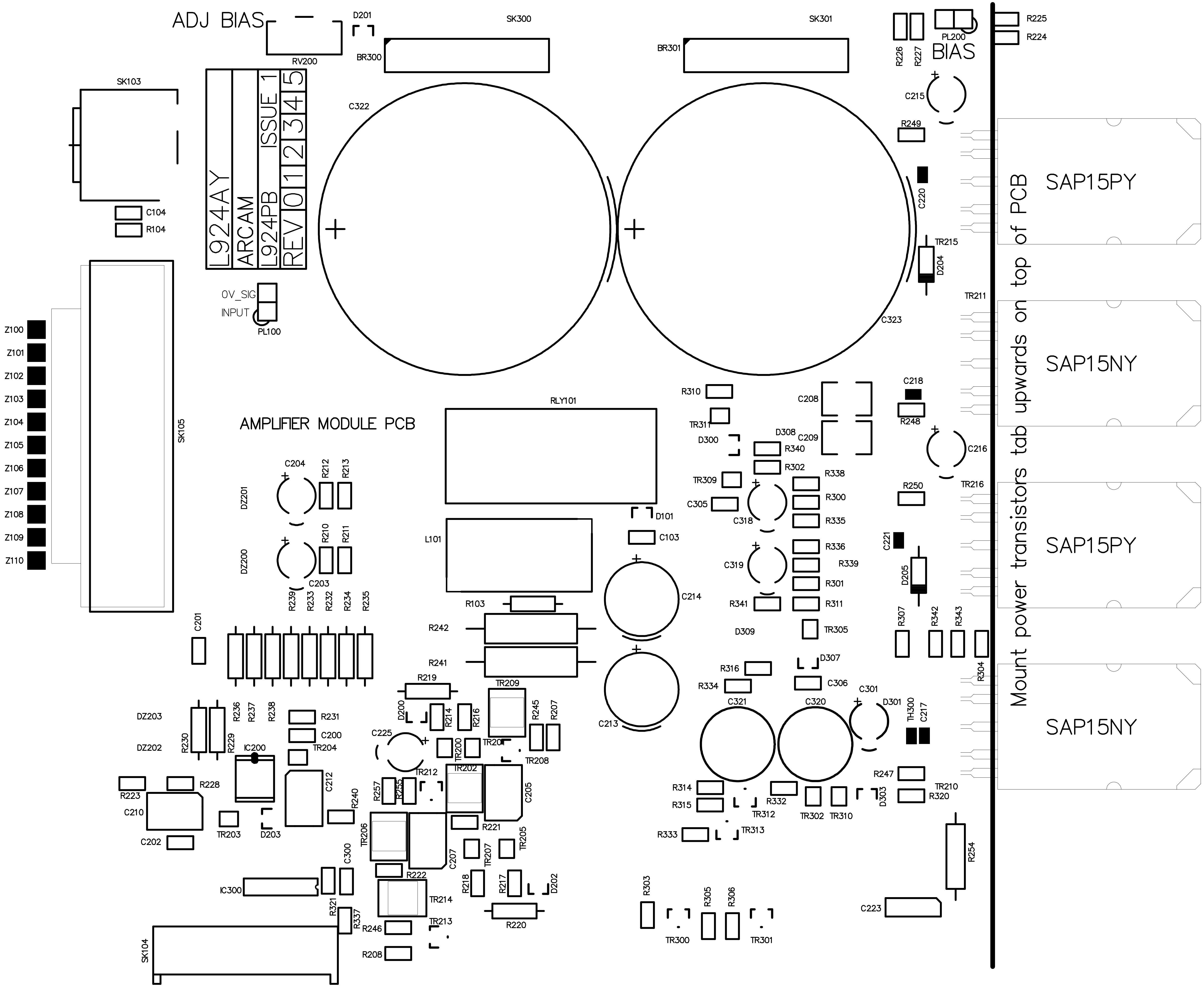
The protection circuit is designed to allow large (unrestricted) currents into loads of 3Ω and above but limit the current into a short circuit or very low impedance load. C318, C319, R335 and R336 form a 2.2ms time constant, which will allow larger transients of current delivery for a few milliseconds, to ensure that the amplifier has a sufficiently large transient capability to drive ‘difficult’ loudspeaker loads with a music signal.

TR311 also turns on when the protection circuit activates. This switches on optocoupler IC300B causing a fault signal to be transmitted to the microcontroller. The microcontroller will then switch off the output relay to protect the amplifier.

TR310, TR302 and their associated components form the DC offset detection circuit. A positive DC offset at the output will turn on TR310. A negative DC offset at the output will turn on TR302, thus causing TR313 to turn on. In either case optocoupler IC300A is switched on causing a fault signal to be transmitted to the microcontroller. The microcontroller will then switch off the output relay to protect the loudspeaker voice coils from overheating.

Thermistor TH300 is connected to the positive supply rail, adjacent to the collector leg of one of the power output devices. This allows it to sense the collector temperature of the output device. Its impedance when cool is low, typically a few hundred ohms. In the event of a thermal overload (above 110°C), TH300 will go to a high impedance state. This will turn on TR301, which then turns on TR300, causing optocoupler IC300D to switch on, sending a fault signal to the microcontroller. The microcontroller will then switch off the output relay until such time as the unit has cooled down to an acceptable level (80°C or so). TR301 is configured with a small amount of hysterisis (positive feedback) to ensure a clean signal is transmitted to the microprocessor via IC300D.

Optocoupler IC300C is connected in series with the 3 optocouplers mentioned above, producing an overall fault signal. This is so that the microcontroller can determine in which module the fault has occurred, permitting selective control of the output relay for each module in the amplifier.


ADJ BIAS
RV200
D201
SK300
BR300
SK301
BR301
R226
R227
PL200
BIAS
R225
R224
SK103
L924AY
ARCAM
L924PB
ISSUE 1
REV 0 1 2 3 4 5
C322
C323
C215
R249
C220
TR215
D204
TR211
SAP15PY
SAP15NY
SAP15PY
SAP15NY
Mount power transistors tab upwards on top of PCB
C104
R104
0V_SIG
INPUT
PL100
SK105
Z100
Z101
Z102
Z103
Z104
Z105
Z106
Z107
Z108
Z109
Z110
AMPLIFIER MODULE PCB
RLY101
R310
TR311
D300
D308
C208
C209
C218
R248
C216
R340
R302
R338
TR309
R300
C305
C318
R335
R336
C319
R339
R301
R341
R311
R250
TR216
C221
D205
C204
R212
R213
DZ201
R210
R211
DZ200
C203
D101
L101
C103
C214
R103
R242
R241
C213
R239
R233
R232
R234
R235
C201
D309
TR305
R307
R342
R343
R304
D307
R316
R334
C306
C301
D301
TH300
C217
C321
C320
R219
TR209
R245
R207
D200
R214
R216
C225
TR200
TR201
TR208
DZ203
DZ202
R236
R237
R238
R231
C200
R230
R229
IC200
TR204
TR212
TR202
R223
R228
C210
C212
R240
R257
R255
C205
TR203
D203
C202
TR206
R221
TR205
TR207
C207
R222
C300
IC300
R218
R217
D202
R321
R337
TR214
TR213
R246
R208
R220
SK104
R247
TR210
R320
R314
R315
R332
TR312
TR302
TR310
D303
R333
TR313
R254
R303
R305
R306
TR300
TR301
C223

L924 Amplifier Module Parts List Issue 1.1

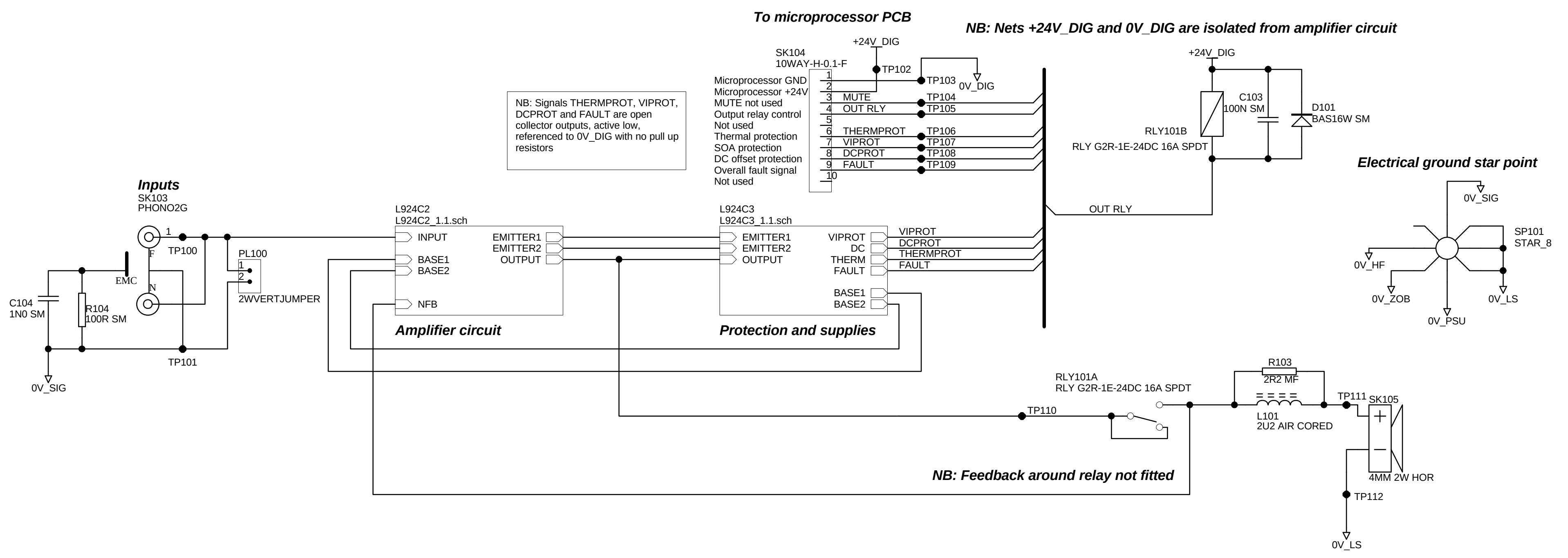
Designator	Part	Description
BR300	3BGBU8D	Diode Bridge Rectifier GBU8D Plastic Package 8A 200V
BR301	3BGBU8D	Diode Bridge Rectifier GBU8D Plastic Package 8A 200V
C103	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C104	2C210	Capacitor SM 1206 NPO Ceramic 50V 5% 1N0
C200	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C201	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C202	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C203	2N710	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 100UF 25V
C204	2N710	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 100UF 25V
C205	2D110W2	Capacitor Boxed Polyprop 5mm Pitch 250V 5% 100P
C207	2D110W2	Capacitor Boxed Polyprop 5mm Pitch 250V 5% 100P
C208	2C410A	Capacitor SM 1812 X7R Ceramic 500V 10% 100N
C209	2C410A	Capacitor SM 1812 X7R Ceramic 500V 10% 100N
C210	2D147W	Capacitor Boxed Polyprop 5mm Pitch 100V 5% 470P
C212	2K447	Capacitor Boxed Polyester 5mm Pitch 10% 63V 470N
C213	2N710B	Capacitor Radial Electrolytic Dia 10mm Pitch 5mm 100UF 100V
C214	2N710B	Capacitor Radial Electrolytic Dia 10mm Pitch 5mm 100UF 100V
C215	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C216	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C217	2C047B	Capacitor SM 0805 NPO Ceramic 200V 5% 47PF
C218	2C047B	Capacitor SM 0805 NPO Ceramic 200V 5% 47PF
C220	2C047B	Capacitor SM 0805 NPO Ceramic 200V 5% 47PF
C221	2C047B	Capacitor SM 0805 NPO Ceramic 200V 5% 47PF
C223	2K347	Capacitor Boxed Polyester 5mm Pitch 10% 63V 47N
C225	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C300	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C301	2N710	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 100UF 25V
C305	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C306	2C410	Capacitor SM 1206 X7R Ceramic 50V 10% 100N
C318	2N710	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 100UF 25V
C319	2N710	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 100UF 25V
C320	2V710	Capacitor Non-Polar Radial Electrolytic 100UF 16V
C321	2V710	Capacitor Non-Polar Radial Electrolytic 100UF 16V
C322	2P910AM	Capacitor Radial Electrolytic Dia 40mm PCB Mount 10000uF 71V
C323	2P910AM	Capacitor Radial Electrolytic Dia 40mm PCB Mount 10000uF 71V
D101	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D200	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D201	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D202	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D203	3AV99W	Diode Dual Surface Mount Small Signal BAV99 SOT-23 Package
D204	3B4003	Diode 1N4003 DO-41 Package
D205	3B4003	Diode 1N4003 DO-41 Package
D300	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D301	3CW315V	Zener Diode 0.25W Surface Mount BZX84C15V SOT-23 Package
D303	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D307	3AS16W	Diode Surface Mount Small Signal BAS16W SOT-23 Package
D308	3CW322V	
D309	3CW322V	
DZ200	3CW315V	Zener Diode 0.25W Surface Mount BZX84C15V SOT-23 Package
DZ201	3CW315V	Zener Diode 0.25W Surface Mount BZX84C15V SOT-23 Package
DZ202	3CW34V7	Zener Diode 0.25W Surface Mount BZX84C4V7 SOT-23 Package
DZ203	3CW34V7	Zener Diode 0.25W Surface Mount BZX84C4V7 SOT-23 Package
IC200	5B072D	Opamp TL072CD SO-8 Package
IC300	5T3Q66	Opto Isolator Quad PC3Q66Q
L101	7D002C	Inductor AC 2u2 SELF BONDED
PL100	8K6201	CON SINGLE ROW HDR 0.1IN VERTICAL 2WAY
PL200	8K6201	CON SINGLE ROW HDR 0.1IN VERTICAL 2WAY
R103	1H822	Resistor Metal Film 0.25W 1% 2R2
R104	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R207	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R208	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R210	1A327	Resistor 1206 Surface Mount 0.25W 1% 27K

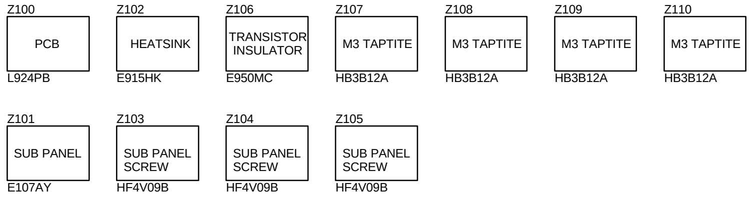
L924 Amplifier Module Parts List Issue 1.1

Designator	Part	Description
R211	1A327	Resistor 1206 Surface Mount 0.25W 1% 27K
R212	1A327	Resistor 1206 Surface Mount 0.25W 1% 27K
R213	1A327	Resistor 1206 Surface Mount 0.25W 1% 27K
R214	1A047	Resistor 1206 Surface Mount 0.25W 1% 47R
R216	1A047	Resistor 1206 Surface Mount 0.25W 1% 47R
R217	1A047	Resistor 1206 Surface Mount 0.25W 1% 47R
R218	1A047	Resistor 1206 Surface Mount 0.25W 1% 47R
R219	1H122	Resistor Metal Film 0.25W 1% 220R
R220	1H122	Resistor Metal Film 0.25W 1% 220R
R221	1A233	Resistor 1206 Surface Mount 0.25W 1% 3K3
R222	1A233	Resistor 1206 Surface Mount 0.25W 1% 3K3
R223	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R224	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R225	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R226	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R227	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R228	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R229	1H022	Resistor Metal Film 0.25W 1% 22R
R230	1H022	Resistor Metal Film 0.25W 1% 22R
R231	1A247	Resistor 1206 Surface Mount 0.25W 1% 4K7
R232	1H156	Resistor Metal Film 0.25W 1% 560R
R233	1H156	Resistor Metal Film 0.25W 1% 560R
R234	1H168	Resistor Metal Film 0.25W 1% 680R
R235	1H168	Resistor Metal Film 0.25W 1% 680R
R236	1H239	Resistor Metal Film 0.25W 1% 3K9
R237	1H239	Resistor Metal Film 0.25W 1% 3K9
R238	1H239	Resistor Metal Film 0.25W 1% 3K9
R239	1H239	Resistor Metal Film 0.25W 1% 3K9
R240	1A510	Resistor 1206 Surface Mount 0.25W 1% 1M0
R241	1C210	Resistor Carbon Film 2W 5% 1K0
R242	1C210	Resistor Carbon Film 2W 5% 1K0
R245	1A022	Resistor 1206 Surface Mount 0.25W 1% 22R
R246	1A022	Resistor 1206 Surface Mount 0.25W 1% 22R
R247	1A115	Resistor 1206 Surface Mount 0.25W 1% 150R
R248	1A115	Resistor 1206 Surface Mount 0.25W 1% 150R
R249	1A115	Resistor 1206 Surface Mount 0.25W 1% 150R
R250	1A115	Resistor 1206 Surface Mount 0.25W 1% 150R
R254	1D847	Resistor Carbon Film 0W5 5% 4R7
R255	1A268	Resistor 1206 Surface Mount 0.25W 1% 6K8
R257	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R300	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R301	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R302	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R303	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R304	1A127	Resistor 1206 Surface Mount 0.25W 1% 270R
R305	1A310	Resistor 1206 Surface Mount 0.25W 1% 10K
R306	1A310	Resistor 1206 Surface Mount 0.25W 1% 10K
R307	1A339	Resistor 1206 Surface Mount 0.25W 1% 39K
R310	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R311	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R314	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R315	1A110	Resistor 1206 Surface Mount 0.25W 1% 100R
R316	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R320	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R321	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R332	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R333	1A322	Resistor 1206 Surface Mount 0.25W 1% 22K
R334	1A247	Resistor 1206 Surface Mount 0.25W 1% 4K7
R335	1A022	Resistor 1206 Surface Mount 0.25W 1% 22R
R336	1A022	Resistor 1206 Surface Mount 0.25W 1% 22R
R337	1A210	Resistor 1206 Surface Mount 0.25W 1% 1K0
R338	1A133	Resistor 1206 Surface Mount 0.25W 1% 330R

L924 Amplifier Module Parts List Issue 1.1

Designator	Part	Description
R339	1A133	Resistor 1206 Surface Mount 0.25W 1% 330R
R340	1A310	Resistor 1206 Surface Mount 0.25W 1% 10K
R341	1A310	Resistor 1206 Surface Mount 0.25W 1% 10K
R342	1A412	Resistor 1206 Surface Mount 0.25W 1% 120K
R343	1A410	Resistor 1206 Surface Mount 0.25W 1% 100K
RLY101	A220	Relay 1P2T 24V
RV200	6F110V	Preset Vertical Mount 100R linear
SK103	8D226	Phono socket 2 way vertical gold
SK104	8K2810	CON HORIZ PCB SKT 10WAY
SK105	8D421	Connector 4mm 2 way horizontal
SK300	8K2302	CON MINIFIT HCS V 2WAY
SK301	8K2302	CON MINIFIT HCS V 2WAY
TH300	1T007	Thermistor PTC SM 110 degrees C
TR200	4AFMMT597	Transistor FMMT597 SOT23 Package
TR201	4AFMMT597	Transistor FMMT597 SOT23 Package
TR202	4B1740	Transistor 2SA1740 SOT-89 Package
TR203	4AFMMT597	Transistor FMMT597 SOT23 Package
TR204	4AFMMT497	Transistor FMMT497 SOT23 Package
TR205	4AFMMT497	Transistor FMMT497 SOT23 Package
TR206	4B4548	Transistor 2SC4548 SOT-89
TR207	4AFMMT497	Transistor FMMT497 SOT23 Package
TR208	4AFMMT497	Transistor FMMT497 SOT23 Package
TR209	4B4548	Transistor 2SC4548 SOT-89
TR210	4CSAP15N	Transistor SAP15NY
TR211	4CSAP15N	Transistor SAP15NY
TR212	4AFMMT497	Transistor FMMT497 SOT23 Package
TR213	4AFMMT597	Transistor FMMT597 SOT23 Package
TR214	4B1740	Transistor 2SA1740 SOT-89 Package
TR215	4CSAP15P	Transistor SAP15PY
TR216	4CSAP15P	Transistor SAP15PY
TR300	4AFMMT497	Transistor FMMT497 SOT23 Package
TR301	4AFMMT597	Transistor FMMT597 SOT23 Package
TR302	4AFMMT597	Transistor FMMT597 SOT23 Package
TR305	4AFMMT597	Transistor FMMT597 SOT23 Package
TR309	4AFMMT497	Transistor FMMT497 SOT23 Package
TR310	4AFMMT497	Transistor FMMT497 SOT23 Package
TR311	4AFMMT497	Transistor FMMT497 SOT23 Package
TR312	4AFMMT497	Transistor FMMT497 SOT23 Package
TR313	4AFMMT497	Transistor FMMT497 SOT23 Package
Z100	L924PB	BLANK PCB 7 CHANNEL AMP MODULE
Z101	E107AY	ASSEMBLY OF REAR PANEL MODULE AND SILK SCREEN
Z102	E915HK	Finished Heatsink for single channel amp module
Z103	HF4V09B	SCREW SELF-TAPPING-SEMS NO.4 X 9MM PAN TORX-SLOT STEEL ZINC-PLATE BLK
Z104	HF4V09B	SCREW SELF-TAPPING-SEMS NO.4 X 9MM PAN TORX-SLOT STEEL ZINC-PLATE BLK
Z105	HF4V09B	SCREW SELF-TAPPING-SEMS NO.4 X 9MM PAN TORX-SLOT STEEL ZINC-PLATE BLK
Z106	E950MC	INSULATOR P7 TRANSISTOR INSULATING PAD
Z107	HB3B12A	SCREW TAPTITE HEXAGON WASHER FACE M3X12MM
Z108	HB3B12A	SCREW TAPTITE HEXAGON WASHER FACE M3X12MM
Z109	HB3B12A	SCREW TAPTITE HEXAGON WASHER FACE M3X12MM
Z110	HB3B12A	SCREW TAPTITE HEXAGON WASHER FACE M3X12MM





DRAWING TITLE
P7 Amplifier Module

ARCAM

Filename: L924C1 1.1.sch

Notes:

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
02_E055	JR	4/3/2002	FIXED DC FAULT AT POWER ON SEQUENCE BY FEEDBACK	1.1

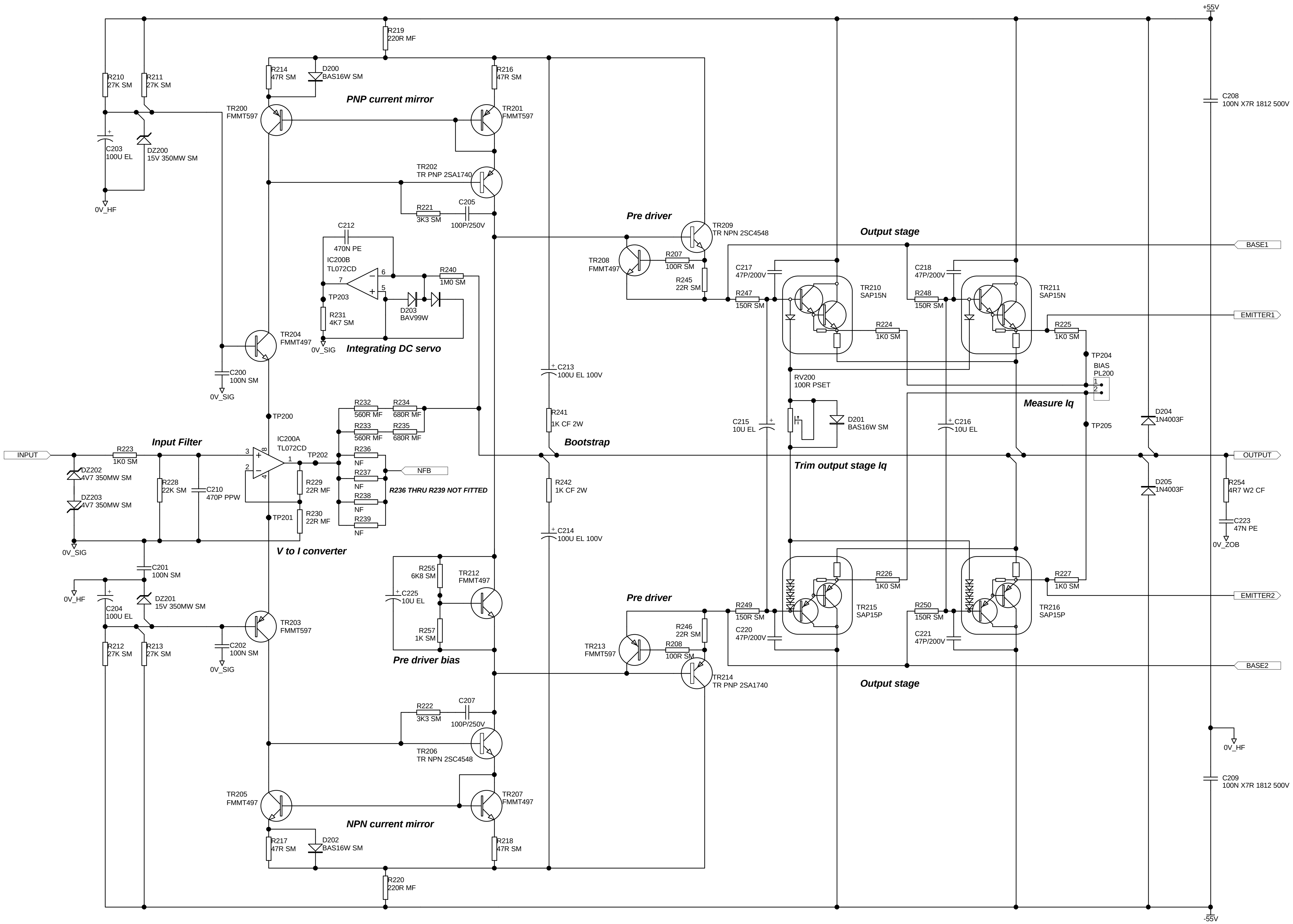
A & R Cambridge Ltd.
Pembroke Avenue
Waterbeach
Cambridge CB5 9PB

Contact Engineer: Jonny Reckless
Contact Tel: (01223) 203200

Printed: 7 Mar 2002

Sheet 1 of 3

DRAWING NO. L924CT



DRAWING TITLE
P7 Amplifier Module

ARCAM

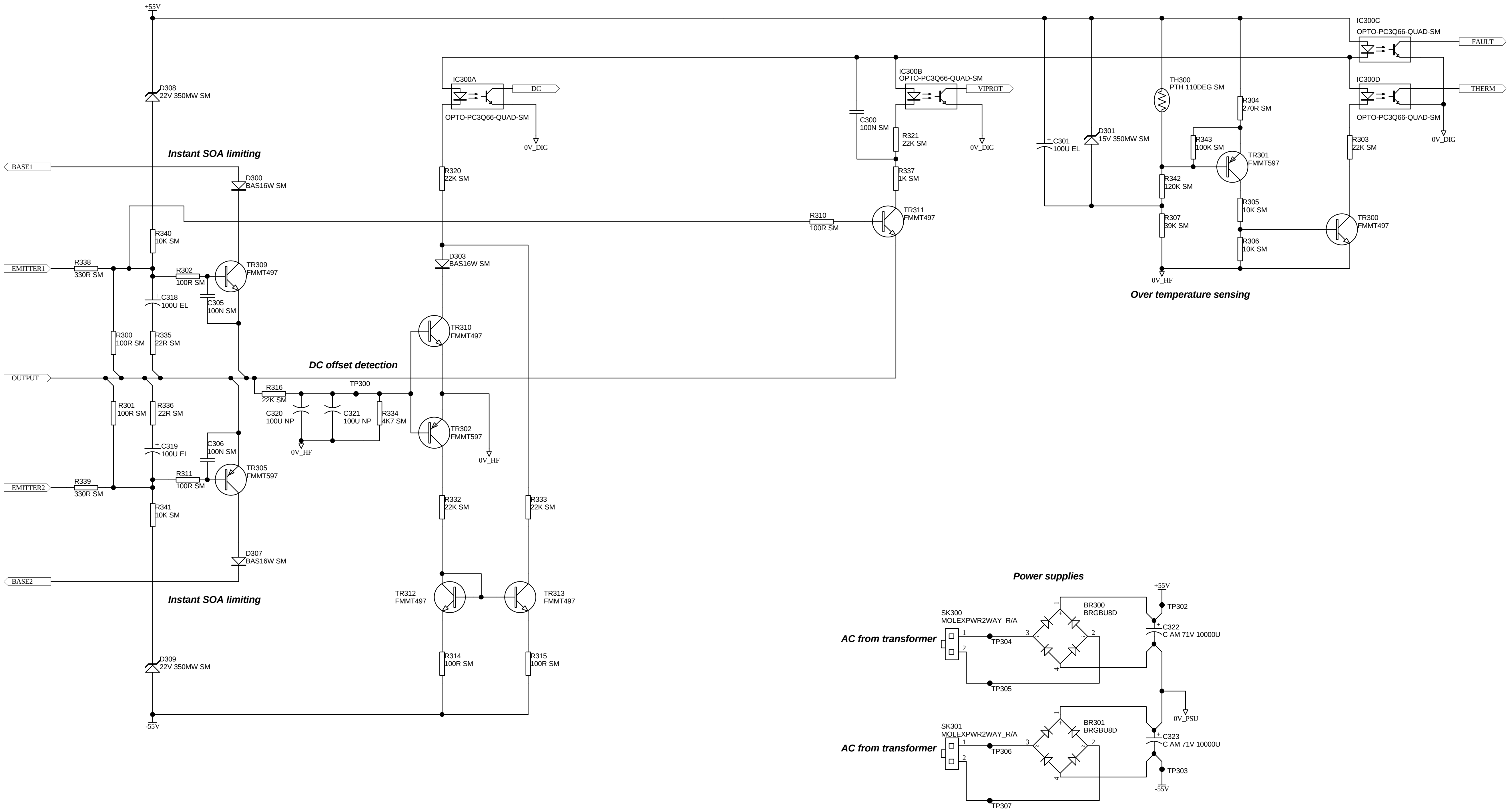
Filename: L924C2 1.1.sch

Notes:

A & R Cambridge Ltd.
Pembroke Avenue
Waterbeach
Cambridge CB5 9PB

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
02_E055	JR	4/3/2002	FIXED DC FAULT AT POWER ON SEQUENCE BY FEEDBACK	1.1

Contact Engineer: Jonny Reckless | Contact Tel: (01223) 203200 | Printed: 7 Mar 2002 | Sheet 2 of 3 | DRAWING NO. L924CT



DRAWING TITLE

P7 Amplifier Module

ARCAM

Filename: L924C3 1.1.sch

Notes:

A & R Cambridge Ltd.
Pembroke Avenue
Waterbeach
Cambridge CB5 9PB

Contact Engineer: Jonny Reckless

Contact Tel: (01223) 203200

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
02_E055	JR	4/3/2002	FIXED DC FAULT AT POWER ON SEQUENCE BY FEEDBACK	1.1

Printed: 7 Mar 2002

Sheet 3 of 3

DRAWING NO. L924CT

Controller Board L925

Contents

P7 Controller Circuit Description

The Amp controller PCB Panel consists of 6 PCBs.

- Controller PCB
- Display PCB
- Connector PCB
- Mains Switch PCB
- 2x Wire Clamp PCBs

Overview

The controller PCB contains the microprocessor and most of the circuitry for controlling the P7 amplifier. The display PCB provides the LEDs and resistors for the simple 7 LED display for the front panel of the unit. The mains switch PCB provides a means of supporting the front panel mounted mains switch. The connector PCB fits on the base of the chassis near the rear panel and provides a means of connecting the 7 amplifier modules to a connector which is then linked to the controller PCB. The connector PCB also provides a means of mounting the rear panel mounted trigger input connector and connecting its signals to the mains controller PCB.
The cable clamp PCBs are used to hold the transformer power cables neatly to the side of the chassis base.

The controller PCB

The controller PCB provides the following functionality

- Mains power distribution, switching and soft-start
- Voltage selection for 115/230V operation.
- +5V (for logic) supplies
- +22V (for relay and fan) supplies
- Variable speed fan drive
- Relay control for soft starts and sequenced power up/ power down for switch on, switch off and fault conditions.
- Heatsink temperature measurement for fan speed control
- Transformer Thermal trip monitoring
- Mains supply monitoring for output muting
- Soft start resistor monitoring to prevent soft start resistor overdissipation
- Amplifier module fault status monitoring for module over-temperature, module DC offset, module VI limit
- Output muting relays drive circuit
- Amplifier status display drive circuitry via the front panel mounted LEDs.
- Watch-dog failsafe mechanism which activates in the case of microprocessor failure

Mains power distribution, switching and soft-start

The mains input supply is connected directly to the control PCB via SK100. The mains supply is routed through the power relay RLY100 and through the 3 parallel resistors R100, R101, R102. These form a high power rated 50-Ohm resistor that is used to limit the inrush current into the 2 large power toroids. These toroids are mounted beneath the transformer tray at the front of the unit. The 50-Ohm series resistor limits the inrush current to 5A and is allowed to remain in circuit for a few hundred milliseconds after power on. After the power amplifier module electrolytic capacitors have charged to full supply voltage the current through the resistor falls to a low value (which is sensed by the circuitry around IC105 as described below) and the soft start resistor is then switched out of circuit by relay RLY101. This arrangement of power relays ensures that relay RLY101 never switches high voltages and its contacts remain clean.

Voltage selection for 115/230V operation

The control PCB provides a means of configuring the unit for 115V or 230V operation. This is achieved by having 2 connectors marked with the appropriate voltage for each of the units 3 transformers (1 auxiliary transformer which powers the control PCB and 2 large toroids each of which powers 3 ½ amplifier modules). The connectors SK101, SK102 for the aux TX and SK103, SK104 for the Right hand power toroid and SK105, SK106 for the left hand power torroid are configured to place the two primary windings of each transformer in parallel for 115V operation and in series for 230V operation. The arrangement of fuses (6 in total which are all fitted) ensures that each winding has a series fuse when configured in parallel for 115V operation and 1 of each pair of fuses is used to fuse the series configured windings when set for 230V operation. In this way there are 2 parallel fuses for each transformer when set for 115V (to allow twice the current as required). The fuses are time delay types.

C121 is X rated and provides suppression for rectifier switching transients for EMC conducted noise compliance. RC100 is a series RC network to prolong relay life.

+5V supply (for logic)

The auxiliary transformer has 2 secondary windings. These are rectified by full wave rectifiers to form the DC supplies.

The +5V supply is rectified by D101, D102, D105, D106 and smoothed by C102. The supply is then regulated by the 3 terminal 5V regulator REG100. The supply is designed to provide 9.5V DC to th input of the regulator when fed with a nominal 230V. This allows 8V at the input to the regulator (so that it remains within regulation) when fed from 195V mains supply. The regulator is fitted with a heatsink. C103 is provided to eliminate input transients. C107 ensures regulator stability.

+22V supply (for relay and fan)

The +22V supply is formed in a similar manner by D103, D104, D107, D108 and C101. The supply voltage is chosen to give 22V when driven from a mains voltage of 230V. This gives around 24V when the mains supply is at its maximum value (265V). This is due to the relays having a maximum specified input voltage of 24V.

Variable fan speed drive

The fan for the amplifier is required to be very quiet. This is achieved by having the fan speed proportional to temperature. The temperature is measured by the microprocessor (as described below) and when the temperature exceeds a programmed threshold then the fan is switched on at its lowest speed (approx 7V). As the temperature of the unit increases the fan speed is increased until it is operating at full speed (12V). This is achieved by having the microprocessor output a PWM 5V pk to pk square wave on line PWM_OUT. The square wave is filtered by R112, C108 to form a DC level. The amplitude of the DC level is thus proportional to the duty cycle that is under microprocessor control. The filtered DC signal is then amplified by the simple 4 transistor amplifier formed around TR100, TR113, TR114 and TR115. The gain of the amplifier is set by R117, R118 to around 6. This ensures that the PWM_OUT signal duty cycle can move the output of the amplifier over the required range. C104, C113 provide suppression for EMC and C112 provides amplifier loop compensation. The supply to the fan is fused by F101 this fuse limits current in the event of the fan stalling. If the fuse blows the watchdog timer cct immediately switches off the power relays to ensure failsafe condition.

Relay control

The power relay and soft-start relay (RLY100, RLY101) respectively are driven by microprocessor signals MPOWER and MSOFT_ST*. Transistors TR108, TR111 buffer the microprocessor outputs. Diodes D115 and D119 prevent damage to the collectors of the transistors by the inductance of the relay coils at coil switch off.

The power for the relay coils (+22V_SW) is provided through TR116. This transistor is off (hence relays off) when the watchdog circuit detects no microprocessor activity (as described below) or the fan fuse F101 is blown (as described above).

Heatsink temperature measurement

The microprocessor monitors the temperature of the heatsink using the circuitry around TR112. Capacitor C114 is alternately charged through fixed resistor R122 (2K2) and thermistor TH100. The time taken to charge the capacitor is measured by the microprocessor. The ratio of the time taken to charge the capacitor through the 2K2 fixed resistor compared with the time taken to charge the capacitor through the thermistor allows the microprocessor to calculate the resistance of the thermistor. The software is then able to establish the temperature of the thermistor from its resistance.
Three microprocessor lines are involved in this measurement. TREF, TTEMP, C_DISCH.

A measurement cycle proceeds as follows.
C_DISCH goes high to discharge C114. After a delay to ensure C114 is fully discharged C_DISCH then goes Low and TREF is set as an output and goes high. TTEMP is set as an input. This allows C114 to charge through R122. The time taken for C114 to charge to the input high threshold of the micro is measured by timing through input TTEMP.
When the threshold is reached, C_DISCH is again taken high to discharge the capacitor.
After a delay to ensure C114 is fully discharged C_DISCH then goes Low and TTEMP is set as an output and goes high. TREF is set as an input. This allows C114 to charge through TH100. The time taken for C114 to charge to the input high threshold of the micro is measured by timing through input TREF.
When the threshold is reached, C_DISCH is again taken high to discharge the capacitor.

This cycle is repeated continuously and the ratio of capacitor charge times allows the ratio of resistance R122 to resistance TH100 to be measured. The measurement is immune to variation in value of C114, saturation voltage of TR112 and average supply voltage on the 5V rail. The variation of input voltage 1 threshold of the TREF and TTEMP inputs is not compensated for but in practice this is usually found to be minimal. The method should give a measurement accuracy of a few degrees C that is all that is needed for fan speed control.

Transformer Thermal trip monitoring

The main power transformers have thermal trips built into them. These are normally closed and go open when the trip temperature is exceeded. The trips are put in series and pulled to 5V through R131. In the event of 1 (or both) transformer trips going open circuit then line TX_OVTEMP goes high and the microprocessor is then able to power the amplifier down as required.

Mains supply monitoring for output muting

In order to prevent thumps through the loudspeaker when the amplifier is switched off it is necessary to detect the removal of the mains supply so that the amplifier modules can be muted.

This is affected by the circuitry around TR101 and the microprocessor. The AC supply for the 22V rail is sensed by R109. At the positive peak of the mains supply TR101 is turned on and saturates thereby discharging C109. In the event of the AC supply disappearing then C109 will not be discharged and will instead charge to 5V through R132. The time constant R132 . C109 = 47mS sets the time taken for line PWROK* to go high. So if the mains supply disappears for around 5 capacitor charge cycles then PWROK* will notify the microprocessor which will then mute the amplifier outputs.

Soft start resistor monitoring

The soft start resistor is used to limit the inrush current into the large power transformers. The resistor is designed to be in-circuit only for the duration of the inrush current at switch on. The resistor must be shorted out by the relay before the amplifier is configured to deliver output current. Also in the event of a fault (e.g. a short across one of the amplifier module reservoir capacitors) then the resistor might be exposed to a situation which might cause over dissipation.

This is avoided by having the microprocessor monitor the voltage across the resistor so that in the event of a fault the amplifier can be switched off before damage to the resistor occurs.

The voltage across the soft-start resistor is monitored by the circuitry around IC105. When voltage is present across the soft-start resistor (only the positive half cycle is sensed) then the opto-transistor is turned on. This discharges C100.
The RC time constant R104, C100 = 220mS dictates that line SSPROT* will be low until around ¼ of a second after the voltage across the soft-start resistor has fallen to zero.

Amplifier module fault status monitoring

- Module over-temperature
- Module DC offset
- Module VI limit

The amplifier modules contain circuitry that senses the above fault conditions. The fault status is indicated to the control PCB by means of open collector transistors on each module that are ON when the fault exists.

The means of connecting the fault lines to the control PCB requires explanation.

There are 7 amplifier modules, each of which has 3 fault lines. If these were tracked individually then this would require 21 lines to the control PCB.

In order to reduce the number of lines required then the connections are changed so that the 3 fault lines from each of the are 7 modules are connected in parallel. So that e.g. the VI limit fault line is pulled low when any one of the 7 modules exhibits a VI limit fault. In order for the controller to establish which module has the fault (so that it can be indicated on the front panel display) each module also provides an address line. A fault occurring on a particular module will cause both the fault line to be low and also the address line. In this way the amplifiers can be monitored by the controller through a total of 10 lines.

The address lines are called:
FAULTn* (where n = 1 to 7 as per amplifier module number)

The fault lines are:
FLT_DC* to indicate a DC offset error
FLT_VI* to indicate VI limit protection
FLT_TEMP* to indicate that the temperature of the output transistors has exceeded the 110C trip temperature.

Output muting relays

The muting relays are on the amplifier modules. The relays allow the amplifier to be disconnected from the loudspeaker load. This is required for muting switch on and switch off thumps and in the event of fault conditions.

The relays are driven from the control PCB by the simple open collector transistor drive arrangement formed around TR102, TR104- TR110. The diodes D111-D118 protect the transistor collectors against over voltage spikes occurring when the inductive relay coils are switched off.

The open collector transistors are driven through the 74HC259 type addressable latch. This configuration allows 24 output lines to be provided from 7 microprocessor lines. The outputs of one of the 259s (IC103) are used to drive the muting relay transistors. The remaining packages (IC101, IC102) are used to drive the display LEDs as described below.

Control of the 259s is as follows. Each has 3 address bits S0, S1, S2 which allows one of 8 outputs to be selected, a DATA input which allows a 0 or a 1 to be latched to the output and a GATE input which transfers the signal on DATA to the selected (addressed) output of the package. The GATE input is also used as a chip select to select which of the 3 packages is being controlled. This allows the S and DATA inputs to be connected in parallel on multiple packages.

Amplifier status display

The amplifier status is indicated via the front panel mounted LEDs. IC101, IC102 are used to directly drive the tricolour LEDs which are mounted on the LED PCB. Each channel has a single Tricolour LED. The LED has a red and green LED built in and the third colour (yellow) is produced by having both Red and Green LEDs ON at the same time.

IC101 is connected to the red LEDs and IC102 is connected to the green LEDs.

Watch-dog

The watch dog circuit provides a failsafe mechanism which places the amplifier in a safe (OFF) state in the event of the microprocessor failing or crashing. The circuitry monitors the average voltage on the WATCHDOG line and if it falls outside its required voltage then it removes the power supply to the relays which has the effect of muting the amplifier outputs and removing the power to the power amplifier toroids.

The line WATCHDOG is toggled by the software in the micro. Every time it completes a program loop it toggles the state of the line. This results in a 50% duty cycle signal that is averaged to 2.5V by the filter R114, C110. The voltage is then fed to the window comparator formed around IC104. The network R105, R106 and R107 sets the upper and low thresholds at 75% of 5V and 25% of 5V respectively.

The outputs are open collector and if the filtered WATCHDOG signal exceeds the upper threshold or falls below the lower threshold then the b-e junction of TR103 is pulled low and TR116 is then turned off – which removes the power to the relays.

The filtered WATCHDOG signal can only move outside the window if the WATCHDOG line sits high (or low) continuously. This can only occur if the microprocessor breaks or the software crashes.

This protection scheme also includes the fan fuse (F101). If the fan fuse blows then TR103 gets no base current that also immediately removes the power supply to the relays.

LED PCB

The LED PCB contains the 7 bicolour LEDs and their current limiting resistors. The LED PCB also provides a means of routing the mains switch wiring to the control PCB via the LED PCB to control PCB flexfoil cable.

Connector PCB

The connector PCB provides a means of joining the amplifier modules to the control PCB via the 22way flexfoil cable. The PCB also includes circuitry for the 12V trigger circuit.

The trigger circuit is formed around SK201. The 12V trigger signal is converted to a 5V logic level compatible signal by R200, D200. C201 and C202 provide EMC suppression (since the signal is ultimately routed to the Control PCB which contains a microprocessor). R202 isolates the ground pin of the jack socket from the amplifier ground. This prevents possible ground loop problems with other hifi components connected in the system.

The zener diode clamped signal is limited to 4.7V pk amplitude. This is fed to the microprocessor via line TRIG/RC5

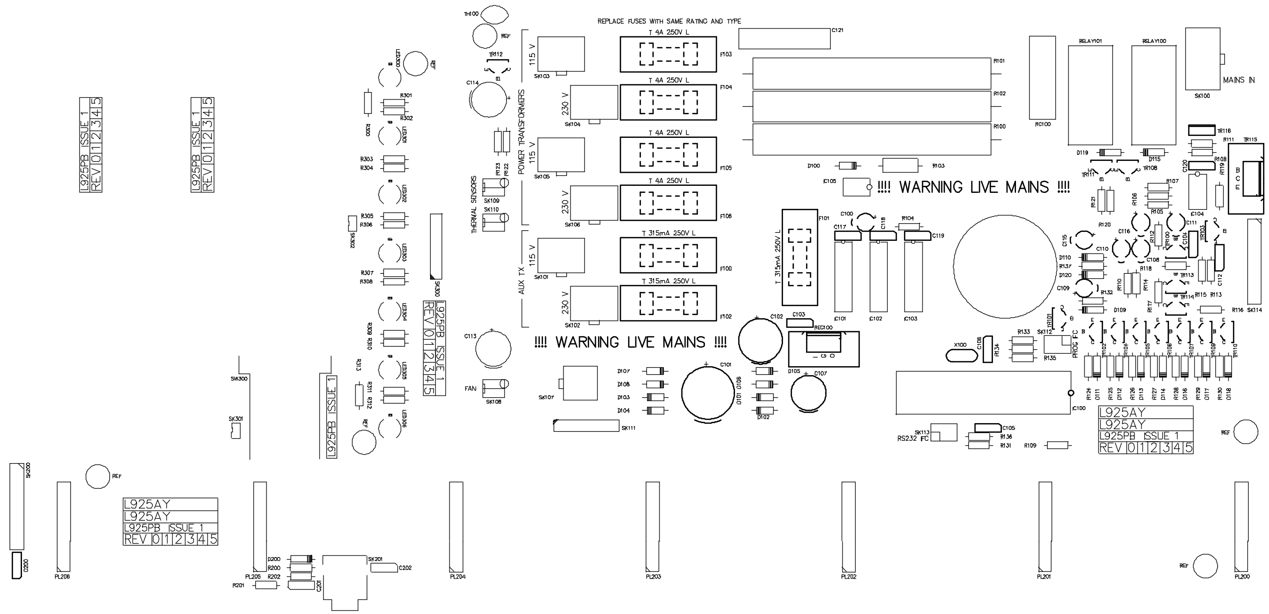
Fault conditions

Fault D.C
When a D.C fault is created on an amplifier all the LEDS turn red accept the module with the fault that flashes green.

Fault V.I
When a V.I fault is created all the LEDS turn red accept the module with the fault which flash red.

Therm fault (amplifier overheating)
When a therm fault is created all the LEDS stay green and the amp module with the fault flashes amber.

Thermal trip (TX overheating)
When a thermal trip is created all the LEDS flash amber, stating that it is a transformer problem.



MECHANICAL DATA	
LAYER STACKUP	
L925pb_1.GTO	Top Overlay

MATERIAL	FR4	NOTES:–
COPPER WEIGHT	2oz	1/ Manufacture in accordance with IPC–A–600F Class 1.
HOLE SIZES	FINISHED (SEE NOTE 2)	2/ Always use NC drill file as reference.
ROUTING	SEE NOTE 3	3/ All routing 2.0mm unless otherwise shown on drill drawing.
COPPER LAYERS	TWO	4/ Mark month/year of manufacture on ident layer.
MINIMUM WIDTH	10 MIL	5/ Scoring denoted by ->>>- on drill drawing.
MINIMUM GAP	10 MIL	
RESIST	GREEN	
IDENT	WHITE	GENERAL TOLERANCES
VENDOR CODES	SEE NOTE 4	PCB Dims. +/– 0.2mm
FINISH	HASL	Routing +/– 0.1mm All holes +/–0.08mm
SCORING	SEE NOTE 5	ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

DRAWING TITLE L925PB Top Overlay					
ARCAM	Filename: L925pb_1.PCB				
	DRAWING NO.				
	7CH CONTROLLER	02_E041	KAL	07/02/02	Issue 1 Release, Various connectors moved — 1
A & R Cambridge Ltd. Pembroke Avenue Waterbeach Cambridge CB5 9PB		E.C.O. No.	INITIALS	DATE	DESCRIPTION OF CHANGE — ISSUE
	Contact Engineer: Kevin Lamb		Contact Tel: +44 (0) 1223 203293	Printed: 12–Feb–2002	Sheet 2 of 8

L925 Controller Board Parts List Issue 1.2

Designator	Part	Description
C100	2N547	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 4U7 50V
C101	2N833A	Capacitor Radial Electrolytic Dia 16mm Pitch 7.5mm 3300UF 35V
C102	2N810	Capacitor Radial Electrolytic Dia 10mm Pitch 5mm 1000UF 25V
C103	2K410	Capacitor Boxed Polyester 5mm Pitch 10% 63V 100N
C104	2K410	Capacitor Boxed Polyester 5mm Pitch 10% 63V 100N
C105	2K410	Capacitor Boxed Polyester 5mm Pitch 10% 63V 100N
C106	2K410	Capacitor Boxed Polyester 5mm Pitch 10% 63V 100N
C107	2N722B	Capacitor Radial Electrolytic Dia 10mm Pitch 5mm 220UF 50V
C108	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C109	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C110	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C111	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C112	2K210	Capacitor Boxed Polyester 5mm Pitch 5% 100V 1NF
C113	2N747	Capacitor Radial Electrolytic Dia 10mm Pitch 5mm 470UF 25V
C114	2N747	Capacitor Radial Electrolytic Dia 10mm Pitch 5mm 470UF 25V
C115	2N610	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 10UF 50V
C116	2N647	Capacitor Radial Electrolytic Dia 5mm Pitch 5mm 47UF 35V
C117	2A410	Capacitor Ceramic 5mm Pitch 50V 10% 100nF
C118	2A410	Capacitor Ceramic 5mm Pitch 50V 10% 100nF
C119	2A410	Capacitor Ceramic 5mm Pitch 50V 10% 100nF
C120	2A410	Capacitor Ceramic 5mm Pitch 50V 10% 100nF
C121	2D447	Capacitor X2 Boxed Polypropylene 22.5mm Pitch 275V 470NF
C200	2A410	Capacitor Ceramic 5mm Pitch 50V 10% 100nF
C201	2A210	Capacitor Ceramic 5mm Pitch 50V 20% 1nF
C202	2A210	Capacitor Ceramic 5mm Pitch 50V 20% 1nF
D100	3B4003	Diode 1N4003 DO-41 Package
D101	3B4003	Diode 1N4003 DO-41 Package
D102	3B4003	Diode 1N4003 DO-41 Package
D103	3B4003	Diode 1N4003 DO-41 Package
D104	3B4003	Diode 1N4003 DO-41 Package
D105	3B4003	Diode 1N4003 DO-41 Package
D106	3B4003	Diode 1N4003 DO-41 Package
D107	3B4003	Diode 1N4003 DO-41 Package
D108	3B4003	Diode 1N4003 DO-41 Package
D109	3A4148	Diode Small Signal 1N4148 DO-35 Package
D110	3A4148	Diode Small Signal 1N4148 DO-35 Package
D111	3A4148	Diode Small Signal 1N4148 DO-35 Package
D112	3A4148	Diode Small Signal 1N4148 DO-35 Package
D113	3A4148	Diode Small Signal 1N4148 DO-35 Package
D114	3A4148	Diode Small Signal 1N4148 DO-35 Package
D115	3A4148	Diode Small Signal 1N4148 DO-35 Package
D116	3A4148	Diode Small Signal 1N4148 DO-35 Package
D117	3A4148	Diode Small Signal 1N4148 DO-35 Package
D118	3A4148	Diode Small Signal 1N4148 DO-35 Package
D119	3A4148	Diode Small Signal 1N4148 DO-35 Package
D120	3F5711	DIODE SCHOTTKY 1N5711 DO-35 Package
D200	3C04704	Zener Diode 0.5W BZX79C4V7 DO-35 Package
F100	C11316	FUSE BUSSMANN S504 T315mA 20MM
F100-1	8S004	FUSEHOLDER 20MM PCB
F100-2	F022	FUSEHOLDER COVER TO SUIT 8S004
F101	C11316	FUSE BUSSMANN S504 T315mA 20MM
F101-1	8S004	FUSEHOLDER 20MM PCB
F101-2	F022	FUSEHOLDER COVER TO SUIT 8S004
F102	C11316	FUSE BUSSMANN S504 T315mA 20MM
F102-1	8S004	FUSEHOLDER 20MM PCB
F102-2	F022	FUSEHOLDER COVER TO SUIT 8S004
F103	C12406	FUSE BUSSMANN S504 T4A 20MM
F103-1	8S004	FUSEHOLDER 20MM PCB
F103-2	F022	FUSEHOLDER COVER TO SUIT 8S004
F104	C12406	FUSE BUSSMANN S504 T4A 20MM
F104-1	8S004	FUSEHOLDER 20MM PCB
F104-2	F022	FUSEHOLDER COVER TO SUIT 8S004
F105	C12406	FUSE BUSSMANN S504 T4A 20MM
F105-1	8S004	FUSEHOLDER 20MM PCB

L925 Controller Board Parts List Issue 1.2

Designator	Part	Description
F105-2	F022	FUSEHOLDER COVER TO SUIT 8S004
F106	C12406	FUSE BUSSMANN S504 T4A 20MM
F106-1	8S004	FUSEHOLDER 20MM PCB
F106-2	F022	FUSEHOLDER COVER TO SUIT 8S004
HS100	F007	HEATSINK TO-220 23 degC/W CLIP ON
HS101	F007	HEATSINK TO-220 23 degC/W CLIP ON
IC100	L022AY	PROGRAMMED PIC16F877 WITH SOFTWARE FOR P7
IC100-1	8S040	IC SKT 40PIN 0.6IN
IC101	5J74259	IC 8 BIT ADDRESSABLE LATCH 74HC259N
IC102	5J74259	IC 8 BIT ADDRESSABLE LATCH 74HC259N
IC103	5J74259	IC 8 BIT ADDRESSABLE LATCH 74HC259N
IC104	5M393A	IC COMPARATOR LM393AN DIP-8 PACKAGE
IC105	5T4N35	Opto Isolator 4N35
JP100	8K004	CON JUMPER SOCKET 0.1IN GOLD BLUE
LED300	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
LED301	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
LED302	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
LED303	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
LED304	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
LED305	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
LED306	3D002	LED 5mm Red/Green Tricolour SPR-54MVWT
PB	L925PB	BLANK PCB CONTROLLER FOR MULTI CHANNEL AMP
PL200	8K2910	CON VERT HEADER 10WAY
PL201	8K2910	CON VERT HEADER 10WAY
PL202	8K2910	CON VERT HEADER 10WAY
PL203	8K2910	CON VERT HEADER 10WAY
PL204	8K2910	CON VERT HEADER 10WAY
PL205	8K2910	CON VERT HEADER 10WAY
PL206	8K2910	CON VERT HEADER 10WAY
R100	1W115A	Resistor Axial Wirewound 17W 5% 150R
R101	1W115A	Resistor Axial Wirewound 17W 5% 150R
R102	1W115A	Resistor Axial Wirewound 17W 5% 150R
R103	1E410	Resistor Carbon Film 1W 5% 100K
R104	1H347	Resistor Metal Film 0.25W 1% 47K
R105	1H347	Resistor Metal Film 0.25W 1% 47K
R106	1H322	Resistor Metal Film 0.25W 1% 22K
R107	1H322	Resistor Metal Film 0.25W 1% 22K
R108	1H310	Resistor Metal Film 0.25W 1% 10K
R109	1H310	Resistor Metal Film 0.25W 1% 10K
R110	1H310	Resistor Metal Film 0.25W 1% 10K
R111	1H222	Resistor Metal Film 0.25W 1% 2K2
R112	1H410	Resistor Metal Film 0.25W 1% 100K
R113	1H410	Resistor Metal Film 0.25W 1% 100K
R114	1H410	Resistor Metal Film 0.25W 1% 100K
R115	1H110	Resistor Metal Film 0.25W 1% 100R
R116	1H110	Resistor Metal Film 0.25W 1% 100R
R117	1H147	Resistor Metal Film 0.25W 1% 470R
R118	1H222	Resistor Metal Film 0.25W 1% 2K2
R119	1H310	Resistor Metal Film 0.25W 1% 10K
R120	1H222	Resistor Metal Film 0.25W 1% 2K2
R121	1H222	Resistor Metal Film 0.25W 1% 2K2
R122	1H222	Resistor Metal Film 0.25W 1% 2K2
R123	1H222	Resistor Metal Film 0.25W 1% 2K2
R124	1H222	Resistor Metal Film 0.25W 1% 2K2
R125	1H222	Resistor Metal Film 0.25W 1% 2K2
R126	1H222	Resistor Metal Film 0.25W 1% 2K2
R127	1H222	Resistor Metal Film 0.25W 1% 2K2
R128	1H222	Resistor Metal Film 0.25W 1% 2K2
R129	1H222	Resistor Metal Film 0.25W 1% 2K2
R130	1H222	Resistor Metal Film 0.25W 1% 2K2
R131	1H247	Resistor Metal Film 0.25W 1% 4K7
R132	1H247	Resistor Metal Film 0.25W 1% 4K7
R133	1H247	Resistor Metal Film 0.25W 1% 4K7
R134	1H247	Resistor Metal Film 0.25W 1% 4K7

L925 Controller Board Parts List Issue 1.2

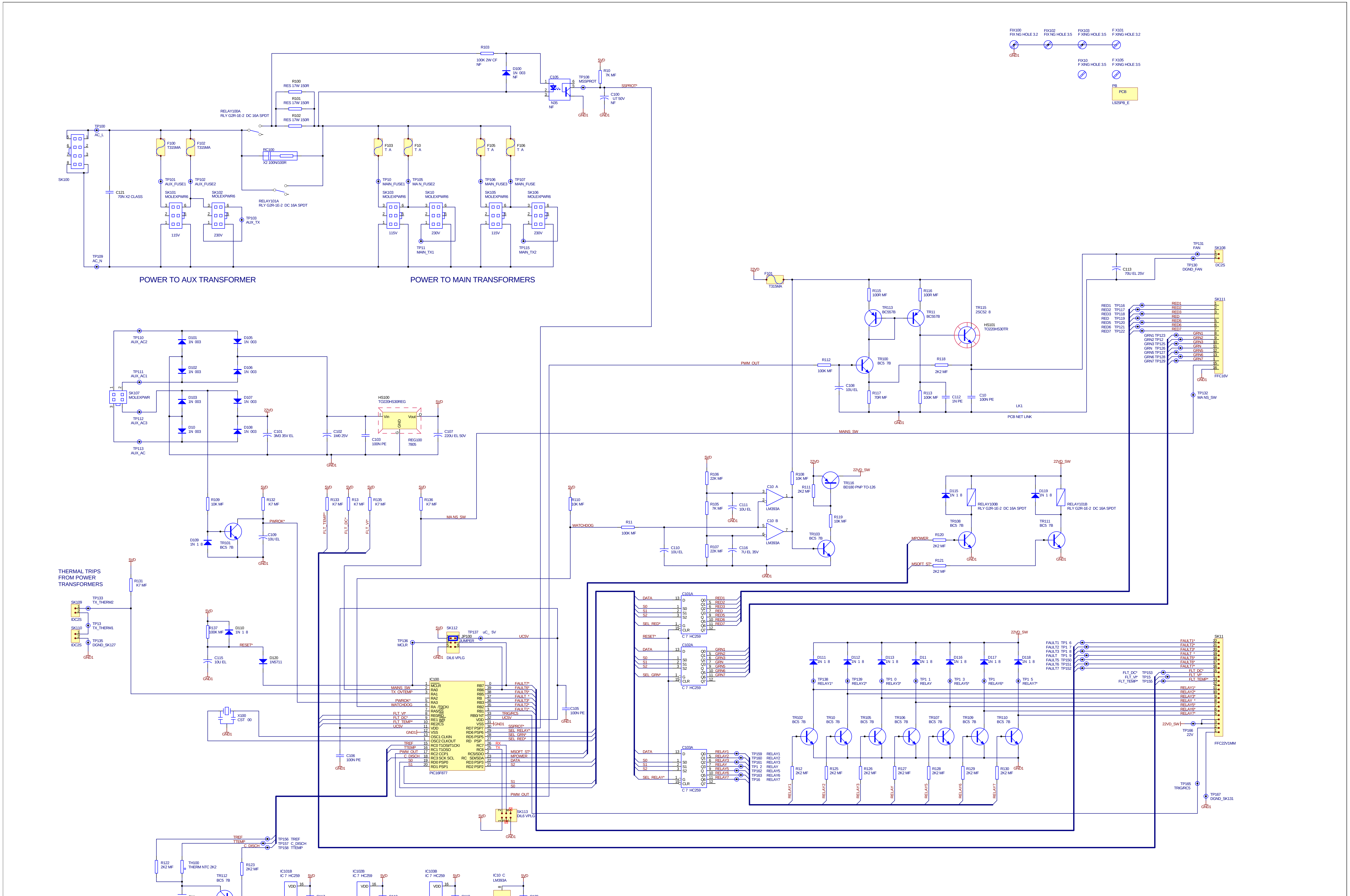
Designator	Part	Description
R135	1H247	Resistor Metal Film 0.25W 1% 4K7
R136	1H247	Resistor Metal Film 0.25W 1% 4K7
R137	1H410	Resistor Metal Film 0.25W 1% 100K
R200	1H210	Resistor Metal Film 0.25W 1% 1K0
R201	1H222	Resistor Metal Film 0.25W 1% 2K2
R202	1H210	Resistor Metal Film 0.25W 1% 1K0
R300	1H122	Resistor Metal Film 0.25W 1% 220R
R301	1H122	Resistor Metal Film 0.25W 1% 220R
R302	1H122	Resistor Metal Film 0.25W 1% 220R
R303	1H122	Resistor Metal Film 0.25W 1% 220R
R304	1H122	Resistor Metal Film 0.25W 1% 220R
R305	1H122	Resistor Metal Film 0.25W 1% 220R
R306	1H122	Resistor Metal Film 0.25W 1% 220R
R307	1H122	Resistor Metal Film 0.25W 1% 220R
R308	1H122	Resistor Metal Film 0.25W 1% 220R
R309	1H122	Resistor Metal Film 0.25W 1% 220R
R310	1H122	Resistor Metal Film 0.25W 1% 220R
R311	1H122	Resistor Metal Film 0.25W 1% 220R
R312	1H122	Resistor Metal Film 0.25W 1% 220R
R313	1H122	Resistor Metal Film 0.25W 1% 220R
RC100	2K410R	RC SUPPRESSOR 100N+100R X2 RATED 250V
REG100	5D7805	IC VOLTAGE REGULATOR +5V L7805CV TO-220 PACKAGE
RELAY100	A220	Relay 1P2T 24V
RELAY101	A220	Relay 1P2T 24V
SK100	8K2308	CON MINIFIT HCS 8WAY
SK101	8K2306	CON MINIFIT HCS 6WAY
SK102	8K2306	CON MINIFIT HCS 6WAY
SK103	8K2306	CON MINIFIT HCS 6WAY
SK104	8K2306	CON MINIFIT HCS 6WAY
SK105	8K2306	CON MINIFIT HCS 6WAY
SK106	8K2306	CON MINIFIT HCS 6WAY
SK107	8K2304	CON MINIFIT HCS 4WAY
SK108	8K6602	CON KK SERIES 0.1in VERTICAL FRICTION LOCK HDR 2WAY
SK109	8K6602	CON KK SERIES 0.1in VERTICAL FRICTION LOCK HDR 2WAY
SK110	8K6602	CON KK SERIES 0.1in VERTICAL FRICTION LOCK HDR 2WAY
SK111	8K8516	CON 1.00MM VERTICAL FFC 16WAY
SK112	8K6306	CON HDR DUAL ROW 0.1IN VERTICAL 6WAY
SK113	8K6306	CON HDR DUAL ROW 0.1IN VERTICAL 6WAY
SK114	8K8022B	CON 1.00MM VERTICAL FFC 22WAY FMN SERIES
SK200	8K8022B	CON 1.00MM VERTICAL FFC 22WAY FMN SERIES
SK201	8D228	CON MIN JACK 3.5MM SINGLE
SK300	8K8516	CON 1.00MM VERTICAL FFC 16WAY
SK301	8K2402	CON CT SERIES VERTICAL 2WAY
SK302	8K2402	CON CT SERIES VERTICAL 2WAY
SW300	A1007	SW PUSH MAINS
TH100	1T006	THERMISTOR NTC 2K2
TR100	4A547	Transistor BC547B TO92 Package
TR101	4A547	Transistor BC547B TO92 Package
TR102	4A547	Transistor BC547B TO92 Package
TR103	4A547	Transistor BC547B TO92 Package
TR104	4A547	Transistor BC547B TO92 Package
TR105	4A547	Transistor BC547B TO92 Package
TR106	4A547	Transistor BC547B TO92 Package
TR107	4A547	Transistor BC547B TO92 Package
TR108	4A547	Transistor BC547B TO92 Package
TR109	4A547	Transistor BC547B TO92 Package
TR110	4A547	Transistor BC547B TO92 Package
TR111	4A547	Transistor BC547B TO92 Package
TR112	4A547	Transistor BC547B TO92 Package
TR113	4A557	Transistor BC557B TO92 Package
TR114	4A557	Transistor BC557B TO92 Package
TR115	4B5248	Transistor 2SC5248E TO220 Package
TR116	4B180	Transistor BD180 TO126 Package
X100	7W005	CERAMIC RESONATOR 4.00MHz

Control PCB
L925CT1_1.2.SCH

Interface PCB
L925CT2_1.2.SCH

Main Switch and LED Display
L925CT3_1.2.sch

DRAWING TITLE **P7 Amp Controller**					
2 3 4 2 5	Filename: **L925CT0_1.2.Sch**	02_E061	KAL	20/03/02	CHANGED R200 VALUE. CORRECTED SK301 & SK302 TO 8K2402 JP100 ADDED ON SK112 PIS 1 & 2 , F102 PART CORRECTED TO 315mA	1.2
	Notes:	02_E054	KAL	7/03/02	CHANGED C121 VALUE. REMOVED SOFT START PROTECTION	1.1
A & R Cambridge Ltd. Pembroke Avenue Waterbeach Cambridge CB5 9PB		02_E041	KAL	7/02/02	PRODUCTION ISSUE PCB CHANGES ONLY	1.0
		ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
	Contact Engineer: Kevin Lamb	Contact Tel: (01223) 203252	Printed: 18-Apr-2002	Sheet 1 of 4	DRAWING NO. **L925CT**	



DRAWING TITLE **P7 Amp Controller**

2 3 4 2 5

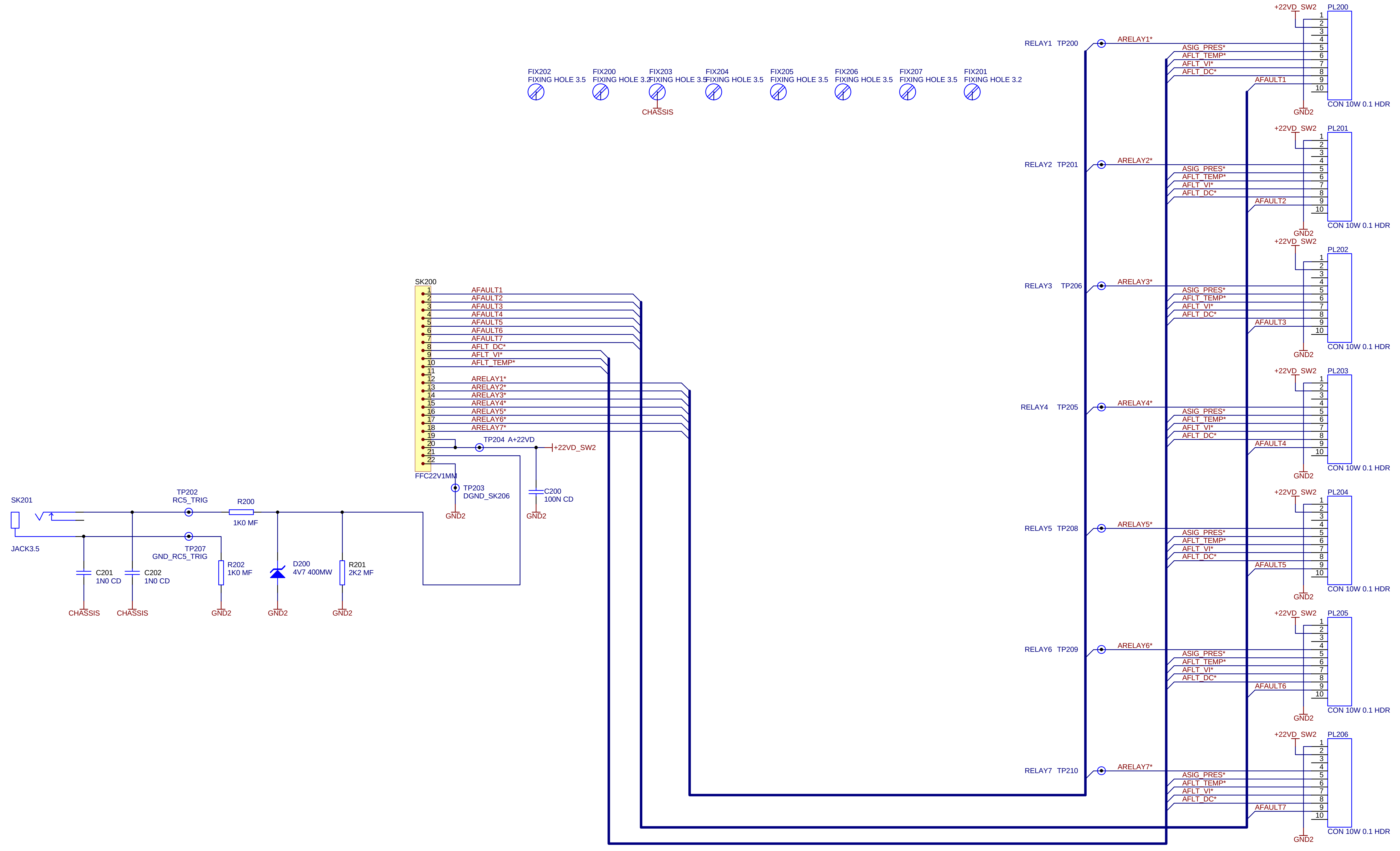
A & R Cambridge Ltd
Pembroke Avenue
Waterbeach
Cambridge CB5 9PB

Filename: L925C 1_1 2 sch

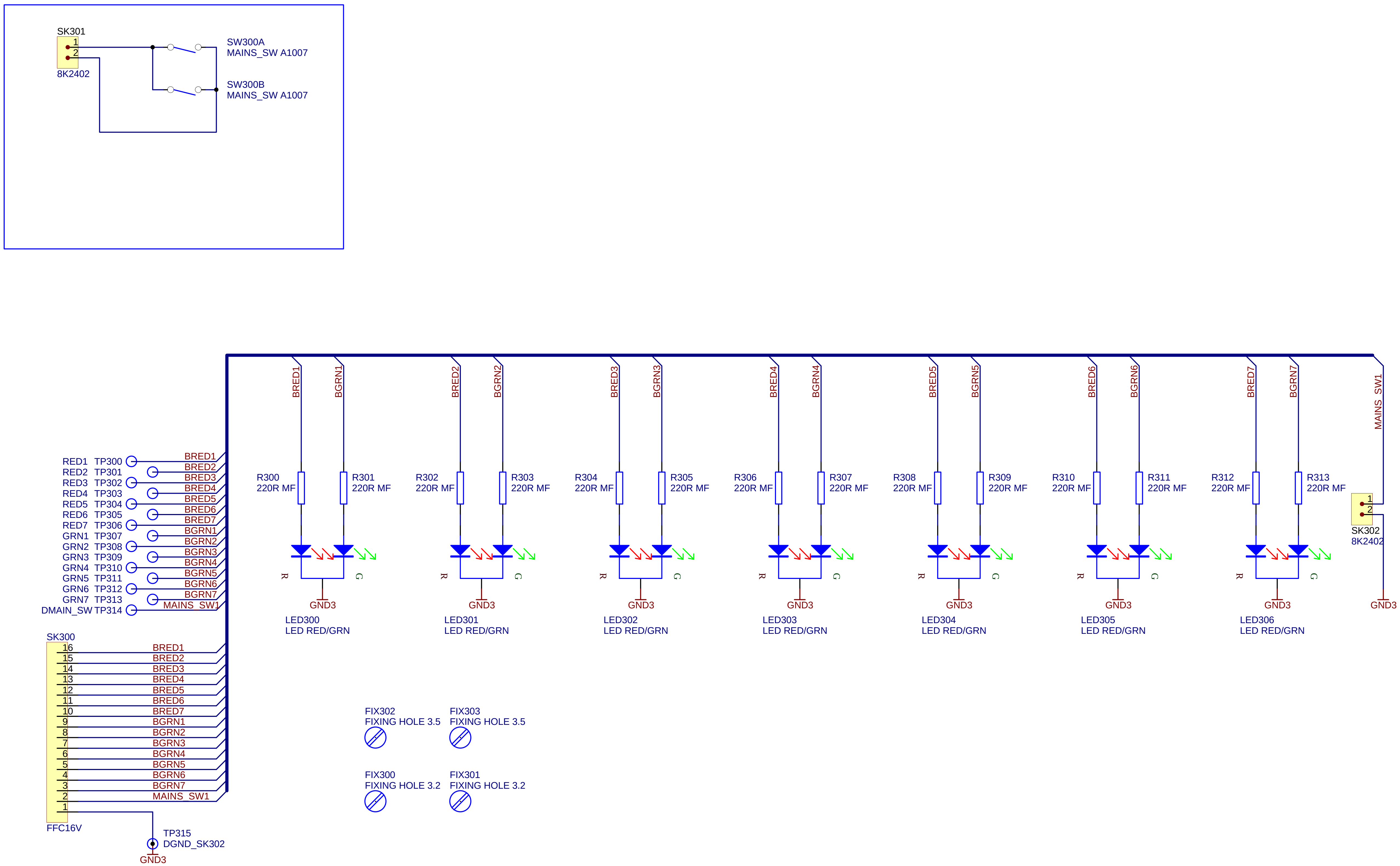
Notes:

ECO No	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
02_E061	KAL	20/03/02	CHANGED R200 VALUE. CORRECTED SK301 & SK302 TO 8K2 02 JP100 ADDED ON SK112 P S 1 & 2 , F102 PART CORRECTED TO 315mA	1.2
02_E05	KAL	7/03/02	CHANGED C121 VALUE. REMOVED SOFT START PROTECTION	1.1
02_E0 1	KAL	7/02/02	PRODUCTION ISSUE PCB CHANGES ONLY	1.0

Contact Engineer: Kevin Lamb | Contact Tel: 01223) 203252 | Printed: 18 Apr 2002 | Sheet 2 of 4 | DRAWING NO L925CT



DRAWING TITLE **P7 Amp Controller**					
2 3 4 2 5	Filename: L925CT2 1.2.Sch	02_E061	KAL	20/03/02	CHANGED R200 VALUE. CORRECTED SK301 & SK302 TO 8K2402 JP100 ADDED ON SK112 PIS 1 & 2 , F102 PART CORRECTED TO 315mA	1.2
	Notes:	02_E054	KAL	7/03/02	CHANGED C121 VALUE. REMOVED SOFT START PROTECTION	1.1
A & R Cambridge Ltd. Pembroke Avenue Waterbeach Cambridge CB5 9PB		02_E041	KAL	7/02/02	PRODUCTION ISSUE PCB CHANGES ONLY	1.0
		ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
	Contact Engineer: Kevin Lamb	Contact Tel: (01223) 203252	Printed: 18 Apr 2002	Sheet 3 of 4	DRAWING NO. **L925CT**	



DRAWING TITLE **P7 Amp Controller**

2 3 4 2 5

A & R Cambridge Ltd.
Pembroke Avenue
Waterbeach
Cambridge CB5 9PB

Filename: L925CT3_1.2.Sch

Notes:

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
02_E061	KAL	20/03/02	CHANGED R200 VALUE. CORRECTED SK301 & SK302 TO 8K2402 JP100 ADDED ON SK112 PIS 1 & 2 , F102 PART CORRECTED TO 315mA	1 2
02_E054	KAL	7/03/02	CHANGED C121 VALUE. REMOVED SOFT START PROTECTION	1.1
02_E041	KAL	7/02/02	PRODUCTION ISSUE PCB CHANGES ONLY	1 0

Contact Engineer: Kevin Lamb | Contact Tel: (01223) 203252 | Printed: 18-Apr-2002 | Sheet 4 of 4 | DRAWING NO. L925CT

Transformer Specifications

Contents

Transformer Specification For 115/230V P7 transformer

Arcam Part Number L911TX

Material Safety Specification

1. Winding Wire to be Grade 2 (130C rating) to BS 60317-4 1995

2. Mylar Polyester Insulator 130C Rated

3. Potting Compound PC3502 E135297(M)

Mechanical Specification

1. Middle of transformer to be potted (as shown).

2. Primary windings connect to 6 way MOLEX connector 39-01-2065. Secondary windings connect to 2 way molex connector 39-01-3028. Use MOLEX pin 44476-3112.
MOLEX connectors have pin numbers indicated on them.

3. Primary wires are enclosed in a common sleeve. Each secondary winding is individually sleeved.
Use PVC sleeving.

4. All wire lengths in mm. Lengths are +5.0, -0

5. Please adhere rubber insulating pad to bottom of transformer as shown.

Electrical Specification

1. Transformer to have dual 115V primaries to allow parallel operation for 115V input and series operation with 230V input.

2. Transformer input voltage range

115V -18% +14% (97.5V to 132 5V)
230V -18% +14% (195V to 265V)

3. Transformer to have 7 secondary windings as show in the adjacent drawing.

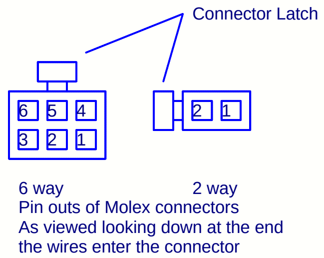
4. Loaded DC voltages specified at 230V AC in (with transformer primaries in series)

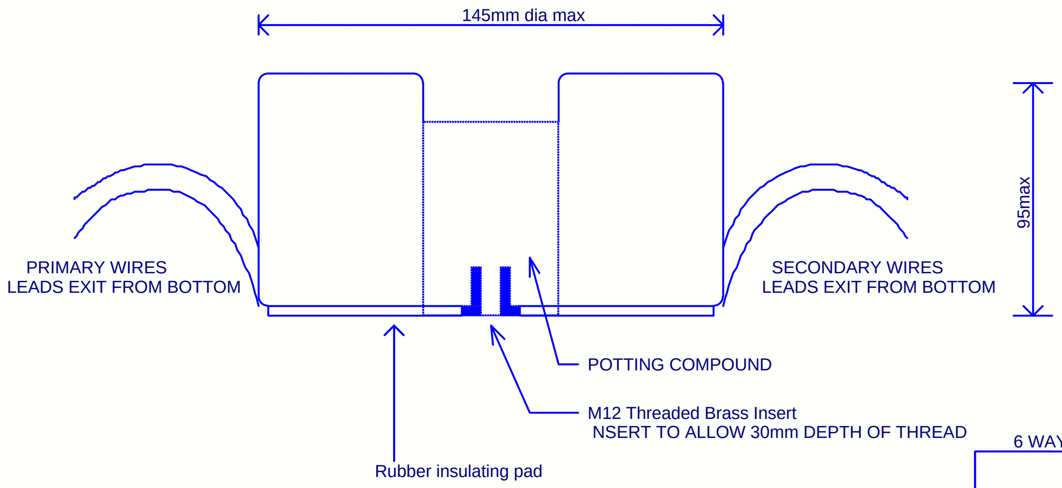
5. Each secondary winding to have a full wave (4diode) bridge to produce a single DC rail.
(AS shown in diagram)

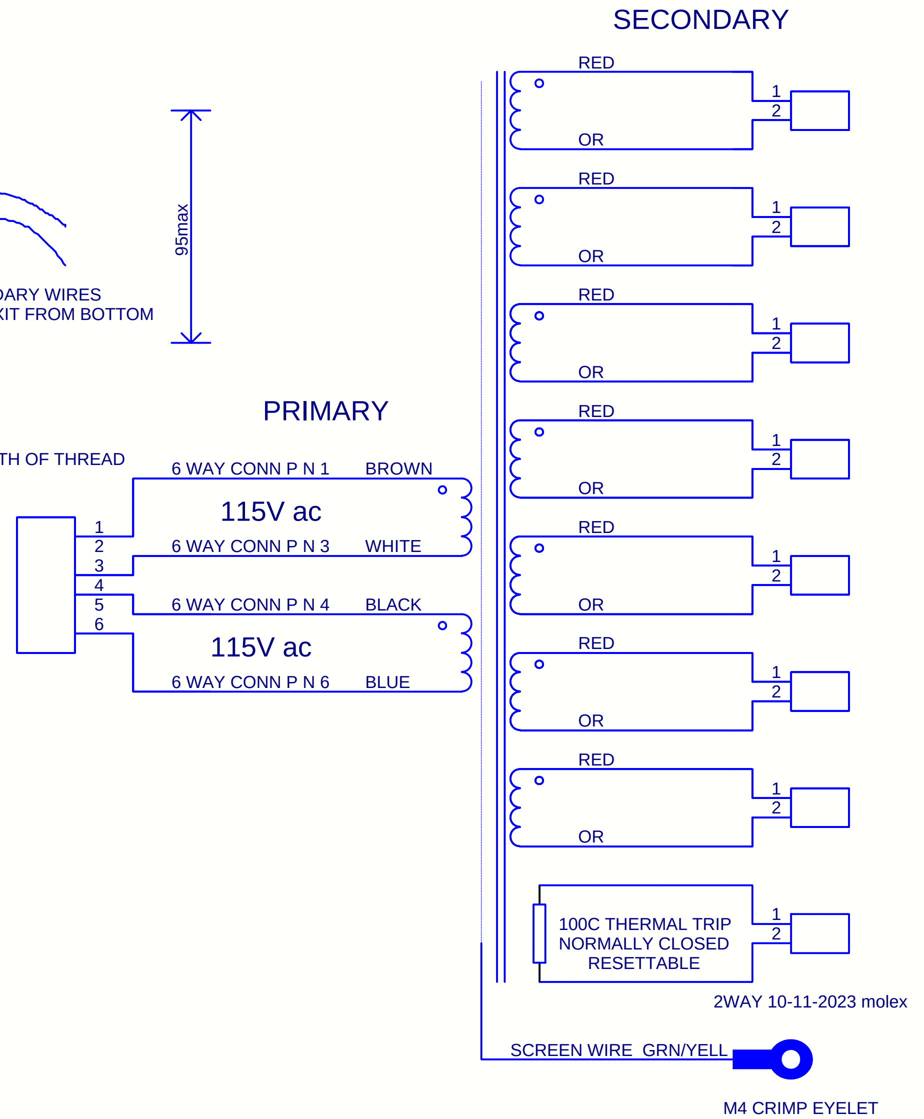
Output Capacitance to be 10000uF per rail.

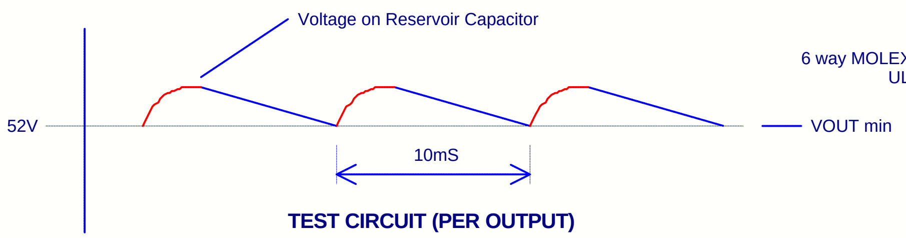
VOUTmin = 52V dc @ Io = 2A (with 230V AC in) See dwg

This figure to be the minimum voltage on the reservoir capacitor as shown in the diagram

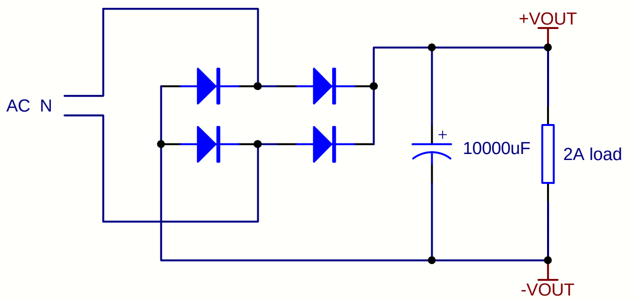


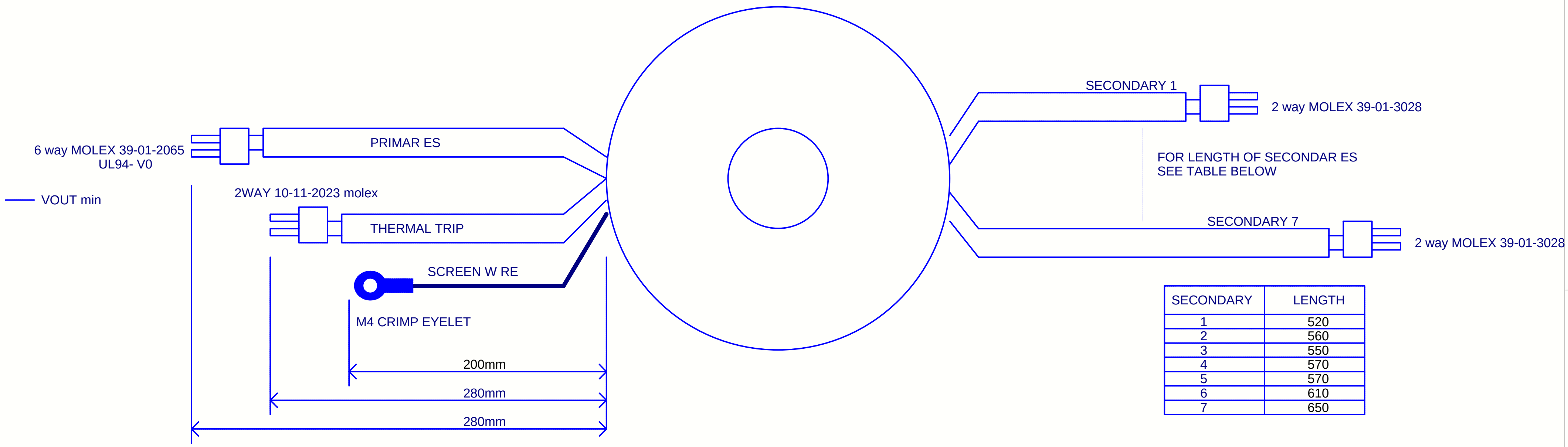






TEST CIRCUIT (PER OUTPUT)





SECONDARY	LENGTH
1	520
2	560
3	550
4	570
5	570
6	610
7	650

DRAWING TITLE
POWER TRANSFORMER FOR P7 115/230V

2 3 4 2 5
A & R Cambridge Ltd.
Pembroke Avenue
Denny Industrial Centre
Waterbeach
Cambridge CB5 9PB

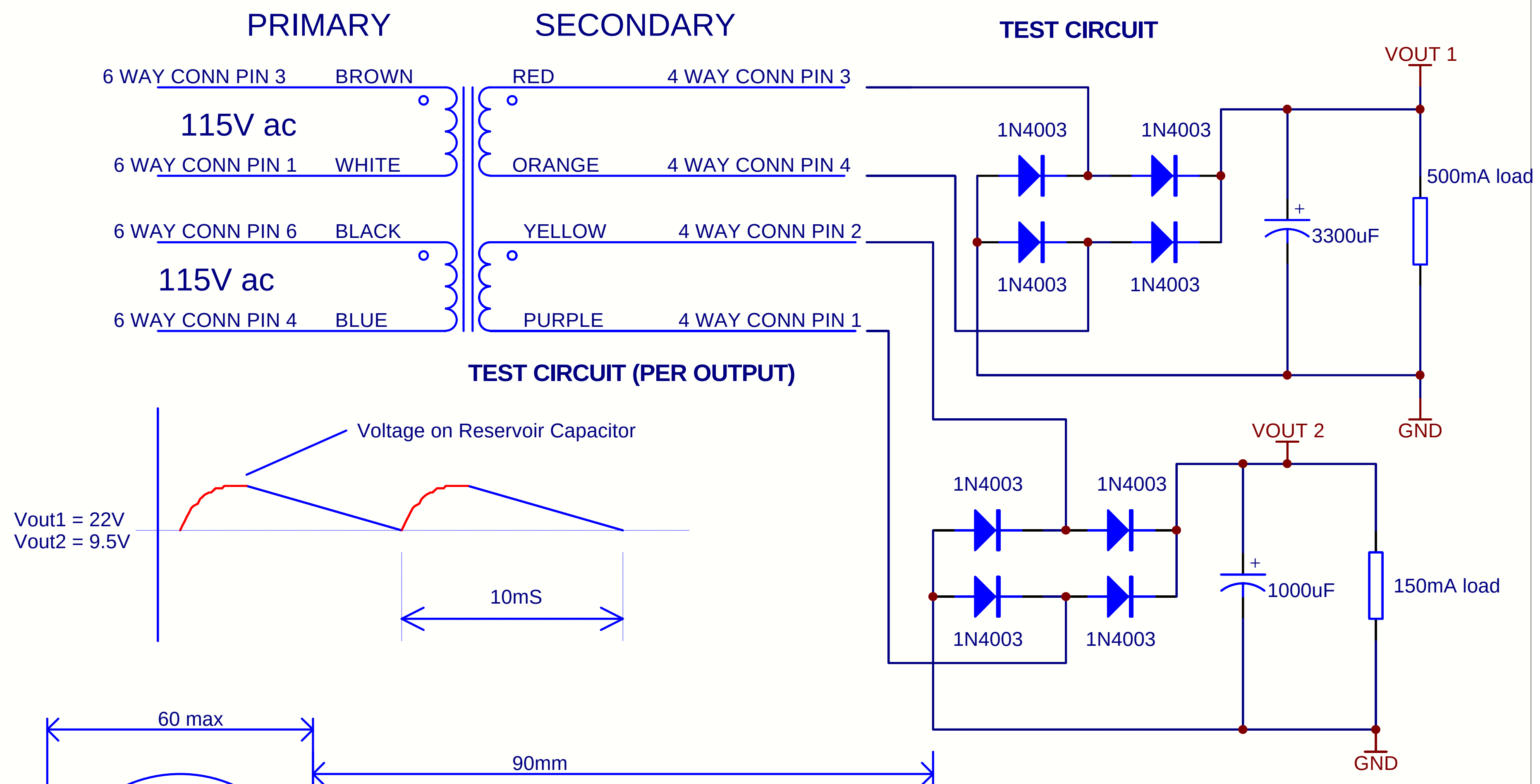
Circuit Diagram

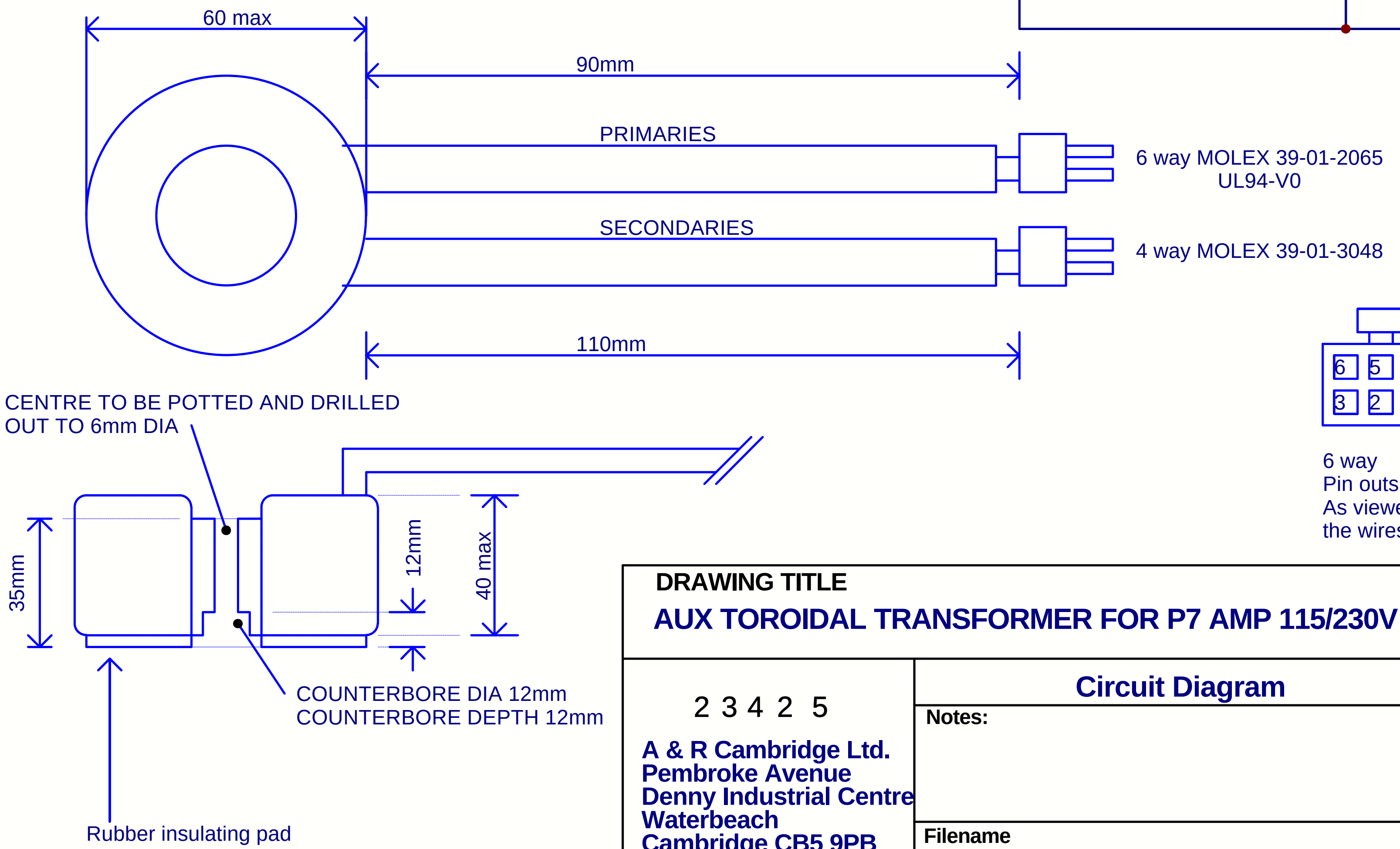
Notes

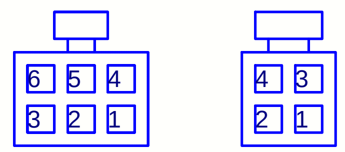
ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
	KAL	05-03-2002	Lead Out Changes to suit new wiring arrangement in amplifier	1
	KAL	4-12-2001	Lead Out Changes Mechanical Changes	D

Filename
J:\Development Projects\P7 Amp\Transformer Design\L911TX 1.ddb - Documents\L911TX 1.sch

Date Printed 6-Mar-2002 | Drawn by: KAL | Sheet 1 of 1 | DRAWING NO. L911TX







Pin outs of Molex connectors
As viewed looking down at the end
the wires enter the connector

Transformer Specification For 115/230V P7 Auxilliary Transformer
Arcam Part Number L912TX

Amthyst Part Number AD3595T

Material Safety Specification

1. Winding Wire to be Grade 2 (130C rating) to BS 60317-4 1995

2. Mylar Polyester Insulator 130C Rated

3. Potting Compound PC3502 E135297(M)

Mechanical Specification

1. Middle of transformer to be potted. Potting to be drilled out with an 6mm DIA Hole and then the bottom surface counterbored to a depth of 12mm with a 12mm dia drill as shown. Actual part which the counterbore is designed to clear extends up to 10mm from transformer mounting surface into counterbore.

2. Primary windings connect to 6 way MOLEX 39-01-2065. Secondary windings connect to 4 way molex connector 39-01-3048. Use MOLEX pin 44476-3112. MOLEX connectors have pin numbers indicated on them.

3. Use 24 AWG wire with colours as shown. Primary wires are enclosed in a common sleeve. Secondary wires are enclosed in a common screen. Use PVC sleeving.

4. All wire lengths in mm. Lengths are +5.0, -0

5. Please adhere rubber insulating pad to bottom of transformer as shown.

Electrical Specification

1. Transformer to have dual 115V primaries to allow parrallel operation for 115V input and series operation with 230V input.

2. Transformer input voltage range

115V -18% +14% (97.5V to 132.5V)
230V -18% +14% (195V to 265V)

3. Transformer to have two secondary windings as show in the adjacent drawing.

4. Loaded DC voltages specified at 230V AC in (with transformer primaries in series)

DC supplies to be generated by configuring the seconday windings with a full wave bridge (see diagram).
Output Capacitance to be 3300uF. 22V dc
Output Capacitance to be 1000uF. 9.5V dc

VOUT1 = 22.0V dc @ Io = 250mA (With 230V AC in)
VOUT2 = 9.5V dc @ Io = 150mA (With 230V AC in)

(this will ensure that VOUT2 is 8V at 195V AC in)

DRAWING TITLE

AUX TOROIDAL TRANSFORMER FOR P7 AMP 115/230V

2 3 4 2 5

A & R Cambridge Ltd.
Pembroke Avenue
Denny Industrial Centre
Waterbeach
Cambridge CB5 9PB

Circuit Diagram

Notes:

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
	KAL	05/03/2002	Changed counterbore details and numerous corrections.	1
	KAL	04/12/2001	Changed Lead Lengths	F

Filename J:\Development_Projects\P7_Amp\Transformer Design\L912tx_1.ddb - Documents\L912TX_1.Sch

Date Printed 6-Mar-2002 | Drawn by: KAL | Sheet 1 of 1 | DRAWING NO. L912TX

Transformer Specification For 100V P7 Amplifier

Arcam Part Number L920TX

Material Safety Specification

1. Winding Wire to be Grade 2 (130C rating) to BS 60317-4 1995

2. Mylar Polyester Insulator 130C Rated

3. Potting Compound PC3502 E135297(M)

Mechanical Specification

1. Middle of transformer to be potted (as shown).

2. Primary windings connect to 6 way MOLEX connector 39-01-2065. Secondary windings connect to 2 way molex connector 39-01-3028. Use MOLEX pin 44476-3112.
MOLEX connectors have pin numbers indicated on them.

3. Primary wires are enclosed in a common sleeve. Each secondary winding is individually sleeved.
Use PVC sleeving.

4. All wire lengths in mm. Lengths are +5.0, -0

5. Please adhere rubber insulating pad to bottom of transformer as shown.

Electrical Specification

1. Transformer to have dual 100V primaries to allow parallel operation for 100V input

2. Transformer input voltage range

100V -18% +14% (82V to 114V)

3. Transformer to have 7 secondary windings as show in the adjacent drawing.

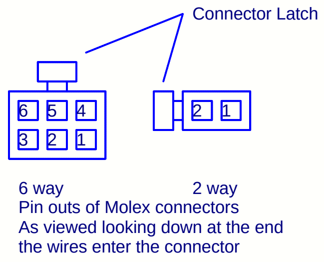
4. Loaded DC voltages specified at 100V AC in (with transformer primaries in parallel)

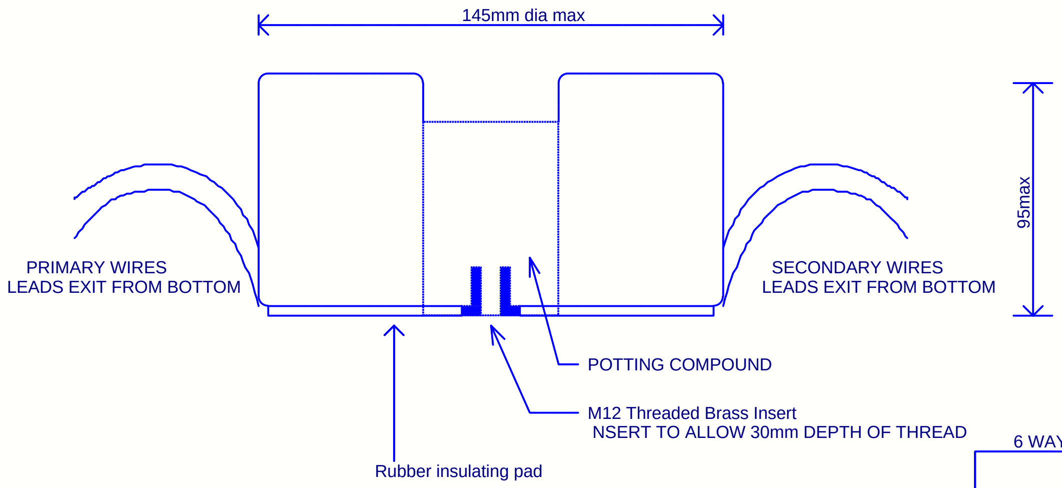
5. Each secondary winding to have a full wave (4diode) bridge to produce a single DC rail.
(AS shown in diagram)

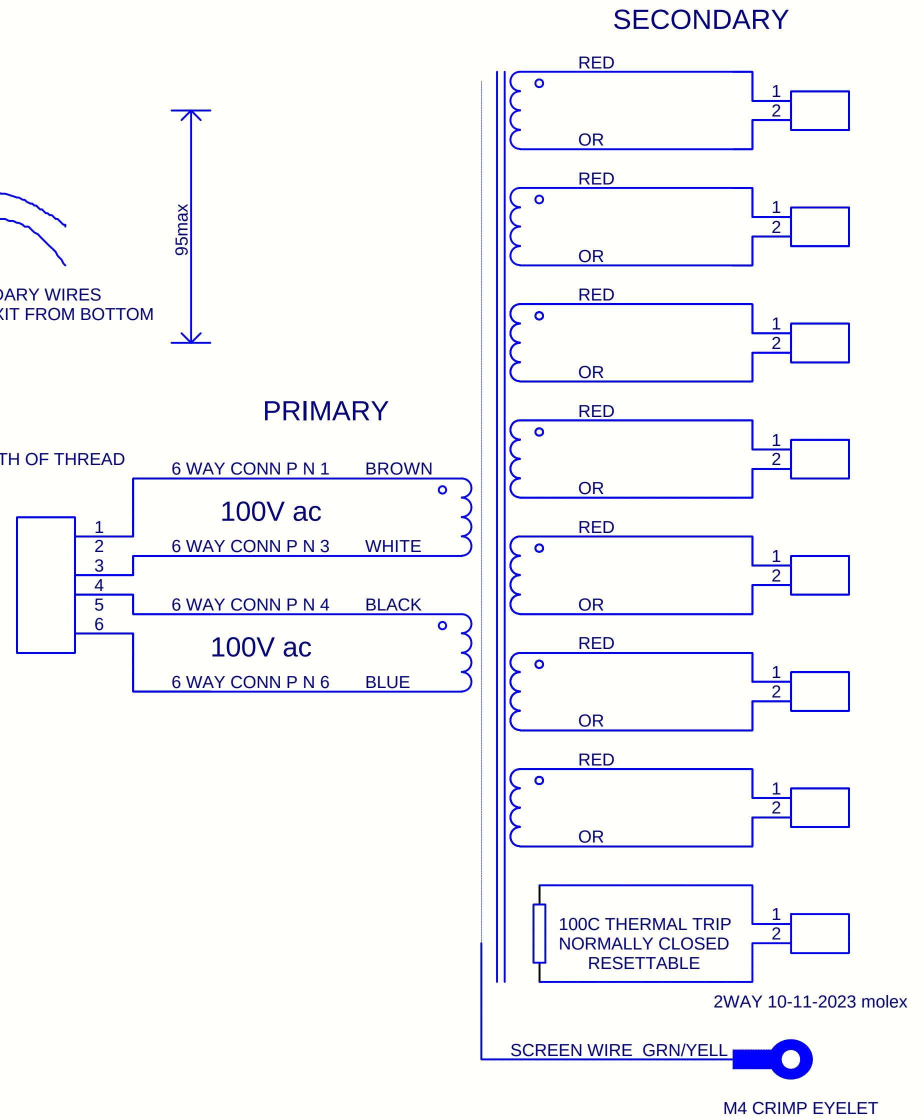
Output Capacitance to be 10000uF per rail.

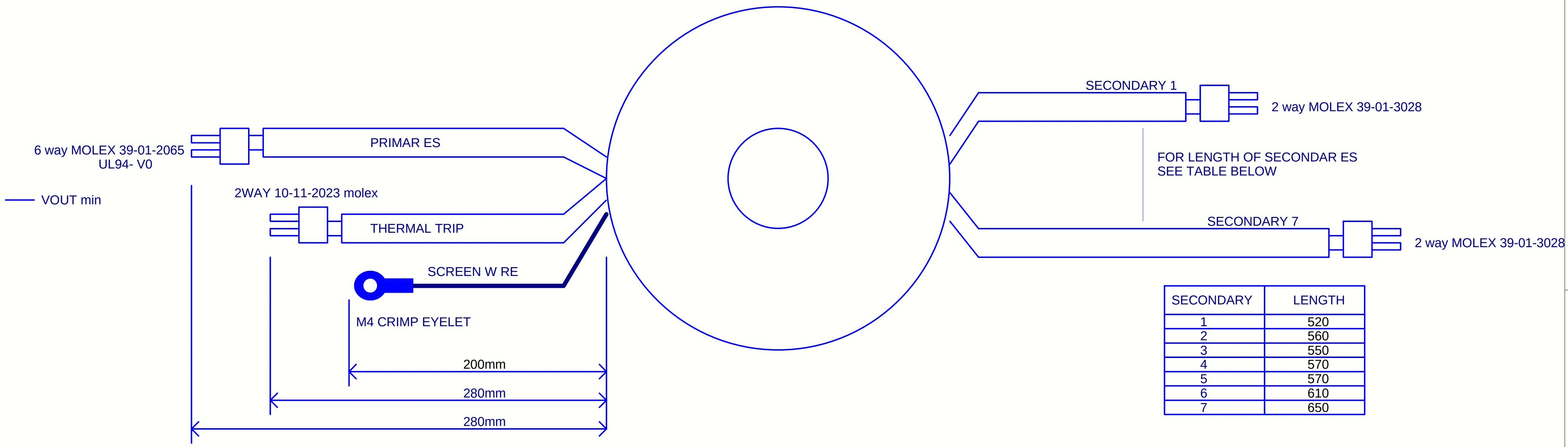
VOUTmin = 52V dc @ Io = 2A (with 100V AC in) See dwg

This figure to be the minimum voltage on the reservoir capacitor as shown in the diagram

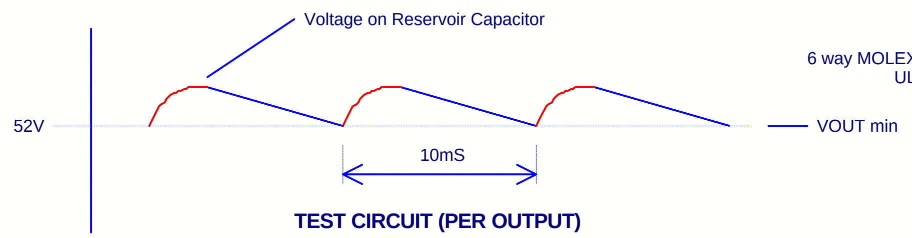




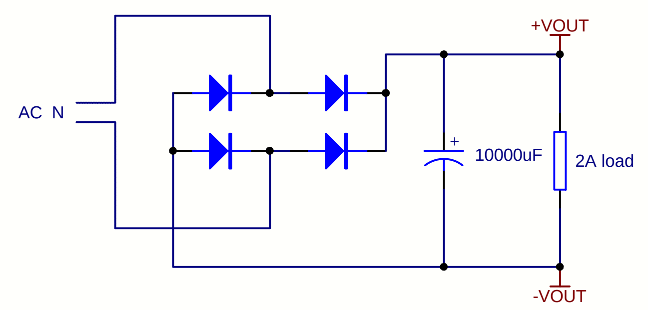




SECONDARY	LENGTH
1	520
2	560
3	550
4	570
5	570
6	610
7	650



TEST CIRCUIT (PER OUTPUT)



DRAWING TITLE

POWER TRANSFORMER FOR P7 100V (JAPAN)

2 3 4 2 5

A & R Cambridge Ltd.
Pembroke Avenue
Denny Industrial Centre
Waterbeach
Cambridge CB5 9PB

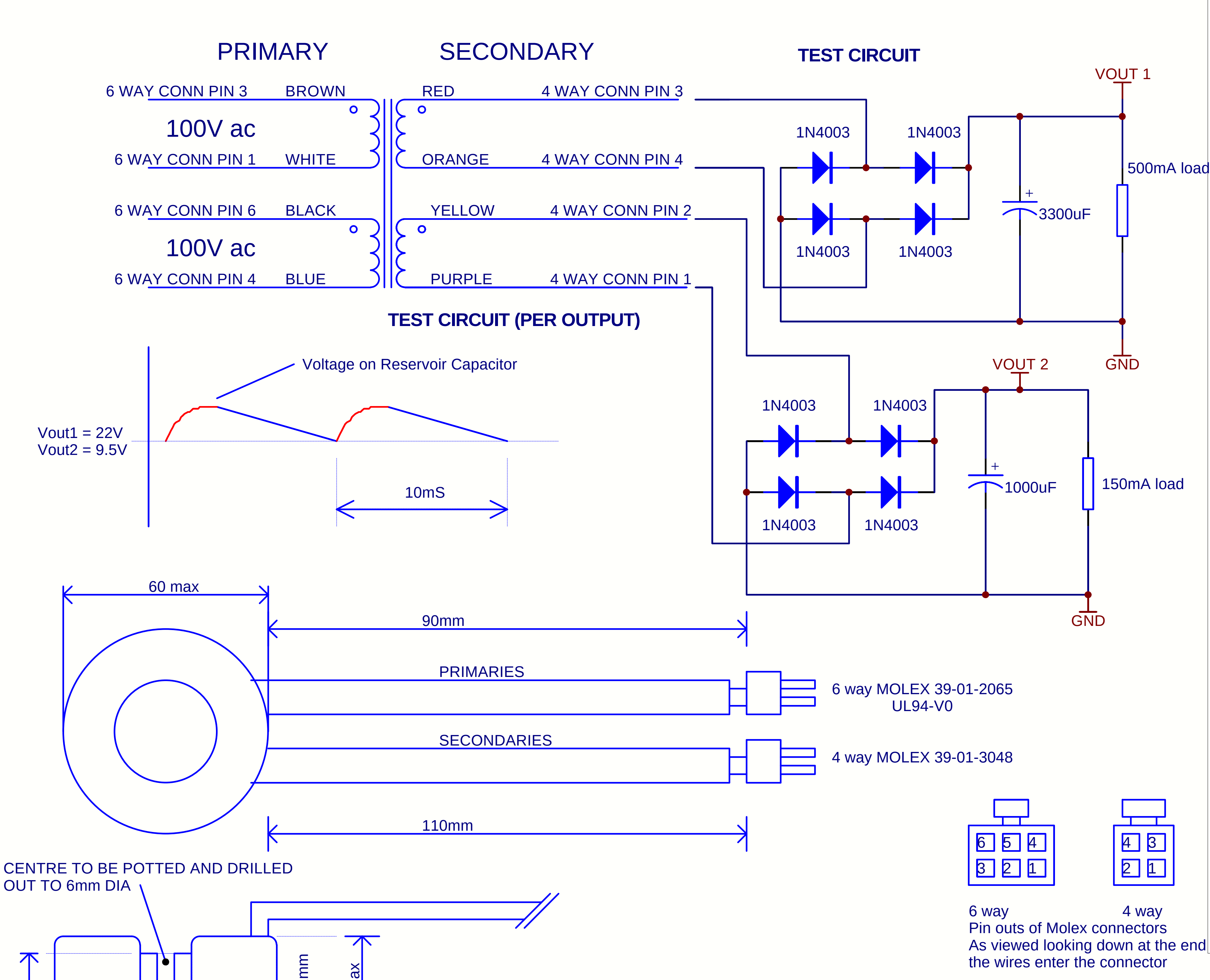
Circuit Diagram

Notes

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
	KAL	05-03-2002	Based on spec of 115/230V part (L911TX)	1

Filename
J:\Development Projects\P7 Amp\Transformer Design\L920TX 1.ddb - Documents\L920TX 1.sch

Date Printed 6-Mar-2002 | Drawn by: KAL | Sheet 1 of 1 | DRAWING NO. L920TX



Transformer Specification For 100V (JAPAN) P7 Auxilliary Transformer
Arcam Part Number L921TX

Material Safety Specification

1. Winding Wire to be Grade 2 (130C rating) to BS 60317-4 1995

2. Mylar Polyester Insulator 130C Rated

3. Potting Compound PC3502 E135297(M)

Mechanical Specification

1. Middle of transformer to be potted. Potting to be drilled out with an 6mm DIA Hole and then the bottom surface counterbored to a depth of 12mm with a 12mm dia drill as shown. Actual part which the counterbore is designed to clear extends up to 10mm from transformer mounting surface into counterbore.

2. Primary windings connect to 6 way MOLEX 39-01-2065. Secondary windings connect to 4 way molex connector 39-01-3048. Use MOLEX pin 44476-3112. MOLEX connectors have pin numbers indicated on them.

3. Use 24 AWG wire with colours as shown. Primary wires are enclosed in a common sleeve. Secondary wires are enclosed in a common screen. Use PVC sleeving.

4. All wire lengths in mm. Lengths are +5.0, -0

5. Please adhere rubber insulating pad to bottom of transformer as shown.

Electrical Specification

1. Transformer to have dual 100V primaries to allow parallel operation for 100V input.

2. Transformer input voltage range

100V -18% +14% (82V to 114V)

3. Transformer to have two secondary windings as show in the adjacent drawing.

4. Loaded DC voltages specified at 100V AC in (with transformer primaries in parallel)

DC supplies to be generated by configuring the seconday windings with a full wave bridge (see diagram).
Output Capacitance to be 3300uF. 22V dc
Output Capacitance to be 1000uF. 9.5V dc

VOUT1 = 22.0V dc @ Io = 250mA (With 100V AC in)
VOUT2 = 9.5V dc @ Io = 150mA (With 100V AC in)

(this will ensure that VOUT2 is 8V at 82V AC in)

DRAWING TITLE

AUX TOROIDAL TRANSFORMER P7 100V (JAPAN)

2 3 4 2 5

Circuit Diagram

Notes:

A & R Cambridge Ltd.
Pembroke Avenue
Denny Industrial Centre
Waterbeach
Cambridge CB5 9PB

ECO No.	INITIALS	DATE	DESCRIPTION OF CHANGE	ISSUE
	KAL	05/03/2002	Based on spec of 115/230V part (L912TX)	1

Filename J:\Development_Projects\P7_Amp\Transformer Design\L921tx_1.ddb - Documents\L921TX_1.Sch

Date Printed 6-Mar-2002 | Drawn by: KAL | Sheet 1 of 1 | DRAWING NO. L921TX

Mechanical Assembly

Contents

P7 General Assembly Parts List – issue 4

ITEM	240V	115V	100V	SILVER	BLACK	DESCRIPTION	WHERE USED	QTY
				E065AY	E065AYB	FASCIA ASSEMBLY	FITS TO FRONT OF CHASSIS	1
				E844CP	E844CPB	COVER		1
				E934MC	E934MCB	POWER BUTTON	FITS ONTO POWER SWITCH	1
				HA4V06S		SCREW MACHINE M4x6mm PAN TORX STAINLESS-STEEL NICKEL-PLATED	COVER TO CHASSIS	8
					HA4V06B	SCREW MACHINE M4x6mm PAN TORX STAINLESS-STEEL BLACK		
		E801SL	E802SL			VOLTAGE LABEL	ON REAR PANEL OVER 230V TEXT	1
		SL024	SL092			VOLTAGE LABEL	ON CARTON LABEL OVER 230V TEXT	1
	8A018					SCHURTER IEC C20 16A INLET	SCREWS TO REAR PANEL	1
	E064AY					REAR PANEL ASSEMBLY	FITS ONTO BACK OF CHASSIS	1
	E088AY					FAN ASSY.	FITS ONTO FAN MOUNTING BRACKET	1
	E106AY					TRANSFORMER TRAY ASSEMBLY		1
	E799RS					MAINS IEC LEAD		1
	E817CH					CHASSIS		1
	E879SL					PRODUCT CONFIGURATION CONTROL LABEL	ON O/S SIDE OF CHASSIS	1
	E888PM					BLANKING PLUG FOR 4MM BINDING POST	4MM BINDING POSTS	14
	E909PK					PAIR OF P7 PACKING CAPS (TOP/BOTTOM)		1
	E910PK					CARDBOARD PARTITION FOR MAINS LEAD		1
	E911PK					CARTON		1
	E920PK					POLY SHEET 1300x1000mm 350 GAUGE	TO PACKAGE UNIT	1
	E926MC					POWER SWITCH BRACKET	MOUNTS SWITCH TO FASCIA	1
	E932MC					BUSH (POWER BUTTON)	FITS INTO COUNTERBORE IN FASCIA	1
	E935MC					FOOT	FITS TO UNDERSIDE OF CHASSIS	4
	E937SL					CARTON LABEL P7		1
	E949MC					FAN MOUNTING BRACKET	FITS TO CHASSIS	1
	F044					CABLE TIE 100MM X 2.5MM T18R	THROUGH ‘HOOKS’ ON CHASSIS BASE TO SECURE TRANSFORMER CABLES	7
	F164					FOAM	TOP OF FASCIA ASSY.	400MM
	F211					EASY SLIDE BUMPON FOOT	STICKS TO RECESS IN FOOT	4
	F221					SYMMETRIC LOW LOAD ISODAMP ISOLATION GROMMET	FAN MOUNTING BRACKET	4
	H040					M3x14mm MALE-FEMALE SPACER	FITS DISPLAY PCB TO FASCIA	4
	HA12K30B					SCREW MACHINE M12x30mm HEX STEEL ZINC PLATED BLACK	POWER TX BOLT	2
	HA3V06A					SCREW MACHINE M3x6mm PAN TORX STEEL ZINC-PLATE CLEAR		28
	HA3V10A					SCREW MACHINE M3x10mm PAN T0RX-SLOT STEEL ZINC-PLATE CLEAR	FOOT FIXING	8
	HA3V10B					SCREW MACHINE M3x10mm PAN TORX-SLOT STEEL ZINC-PLATE BLACK	IEC INLET TO REAR PANEL. MODULE REAR PANEL TO REAR PANEL	16
	HA4D40A					SCREW MACHINE M4x40mm PAN POZI STEEL	FAN MOUNTING SCREWS	4

P7 General Assembly Parts List – issue 4

ITEM	240V	115V	100V	SILVER	BLACK	DESCRIPTION	WHERE USED	QTY
						ZINC-PLATE CLEAR		
	HA4D06A					SCREW MACHINE M4x6mm PAN POZI STEEL NICKEL-PLATED	FAN BRACKET (3) CHASSIS SAFETY EARTH (1) AND TRANSFORMER EARTH SCREEN WIRE (1)	5
	HA5L12B					SCREW MACHINE M5x12mm HEX STEEL ZINC-PLATE BLACK	MODULE TO TRAY	14
	HA5L30B					SCREW MACHINE M5x30mm HEX STEEL ZINC-PLATE BLACK	AUX TX TO TRAY	1
	HA5W10B					SCREW MACHINE M5x10mm BUTTON HEX-SOCKET STEEL ZINC-PLATE BLACK	TRAY TO CHASSIS	8
	HA6L60B					SCREW MACHINE M6x60mm CAP HEX-SOCKET STEEL ZINC-PLATE BLACK	MODULE TO CHASSIS	7
	HC8A13A					SCREW SELF-TAPPING NO8x13mm PAN SUPA STEEL ZINC-PLATE CLEAR	FRONT PANEL TO CHASSIS	6
	HF4V09B					SCREW SELF-TAPPING-SEMS NO4x9mm PAN TORX-SLOT STEEL ZINC-PLATE BLACK	REAR TO CHASSIS. COVER TO REAR	10
	HJ4A00F					M4 HEX NUT NYLOC	FAN MOUNTING	4
	HJ5A00A					NUT FULL M5 STEEL ZINC-PLATE CLEAR	MODULE TO TRAY	14
	HL12AB					WASHER PLAIN M12 STEEL ZINC-PLATE BLACK	POWER TX TO TRAY	2
	HL4SB					WASHER INT-SHAKEPROOF M4 STEEL ZINC-PLATE BLACK	CHASSIS SAFETY EARTH (1) TRANSFORMER EARTH SCREEN WIRE (1)	2
	HL5EB					WASHER PLAIN M5 STEEL ZINC-PLATE BLACK	AUX TX TO TRAY. MODULE TO TRAY	15
						WASHER M3 FIBRE ADHESIVE BACKED - O/D 8mm, I/D 3.6mm, THK 0.9mm	DISPLAY PCB MOUNTING & POWER SWITCH BRACKET AS REQUIRED.	
	L911TX	L911TX	L920TX			POWER TRANSFORMER	FITS UNDER TRANSFORMER TRAY	2
	L912TX	L912TX	L921TX			SECONDARY TRANSFORMER	FITS ONTO TRANSFORMER TRAY	1
	L924AY					AMP MODULE ASSEMBLY		7
	L925AY					CONTROL PCB ASSEMBLY		1
	L934CA					IEC INLET TO CONTROL PCB CABLE		1
	L936CA					CONTROL PCB TO CONNECTOR PCB FLEXFOIL		1
	L937CA					SWITCH PCB TO LED PCB 2 WIRE INTERCONNECT		1
	L938CA					CONTROL PCB TO LED PCB FLEXFOIL		1
	P3020					GRIP-SEAL POLYTHENE BAG 254X356 CLEAR 180 GAUGE	FOR REGISTRATION CARD, ENVELOPE AND HANDBOOK	1
	SH000					REGISTRATION CARD	IN POLY BAG P3020	1
	SH000A					ENVELOPE	IN POLY BAG P3020	1
	SH100					P7 HANDBOOK (MULTI-LANGUAGE)	IN POLY BAG P3020	1
	SM631					SELLOTAPE	PACKING	1

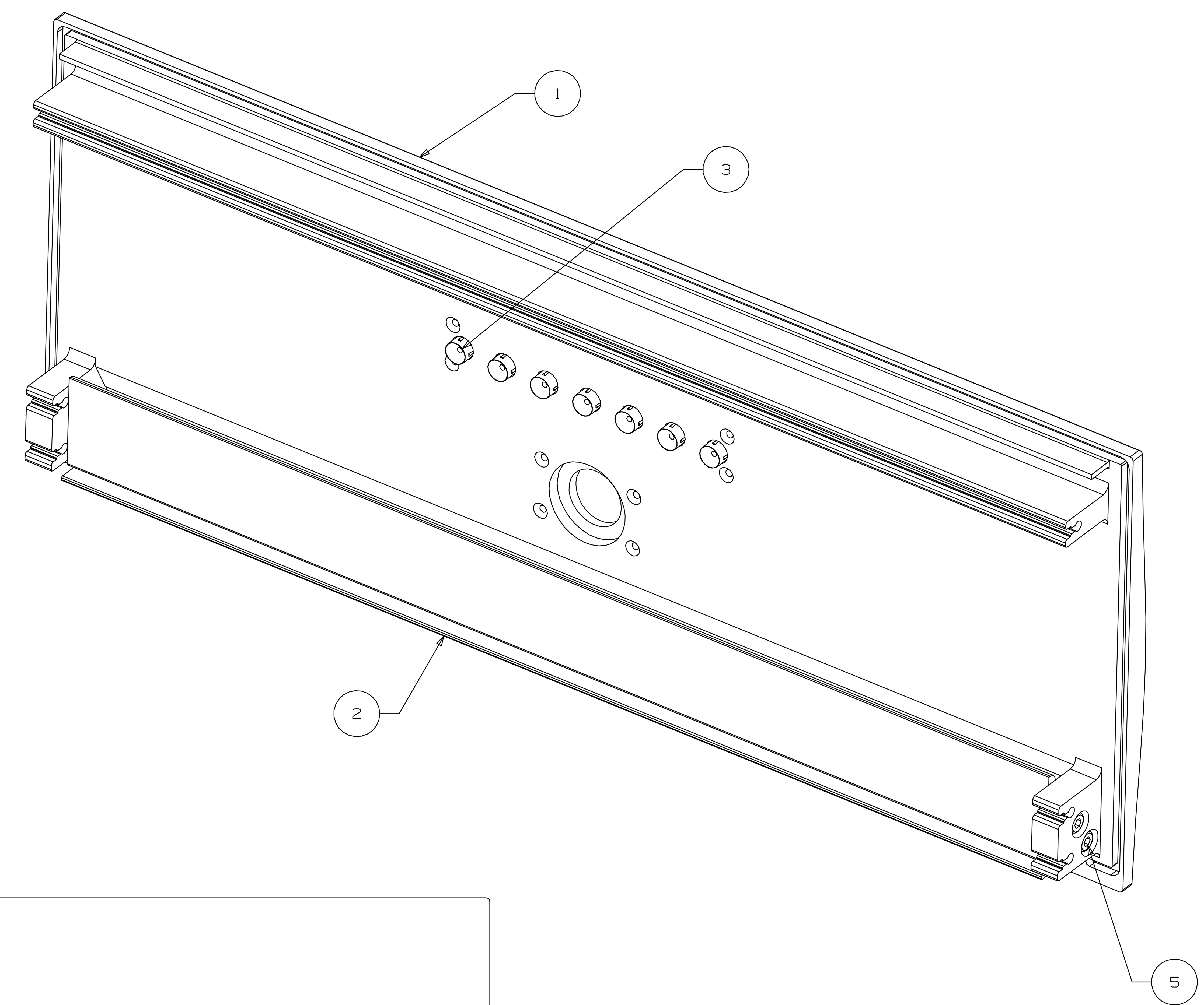
Australia	Israel	South Africa	Switzerland	Philippines	USA/Canada	Thailand	Japan	Europe	UK	Korea	H.Kong/Mal	Argentina	Description
8A019	8A020	8A021	8A022	8A019	8A023	8A023	8A023	8A024	8A025	8A024	8A024	8A019	High current IEC mains lead

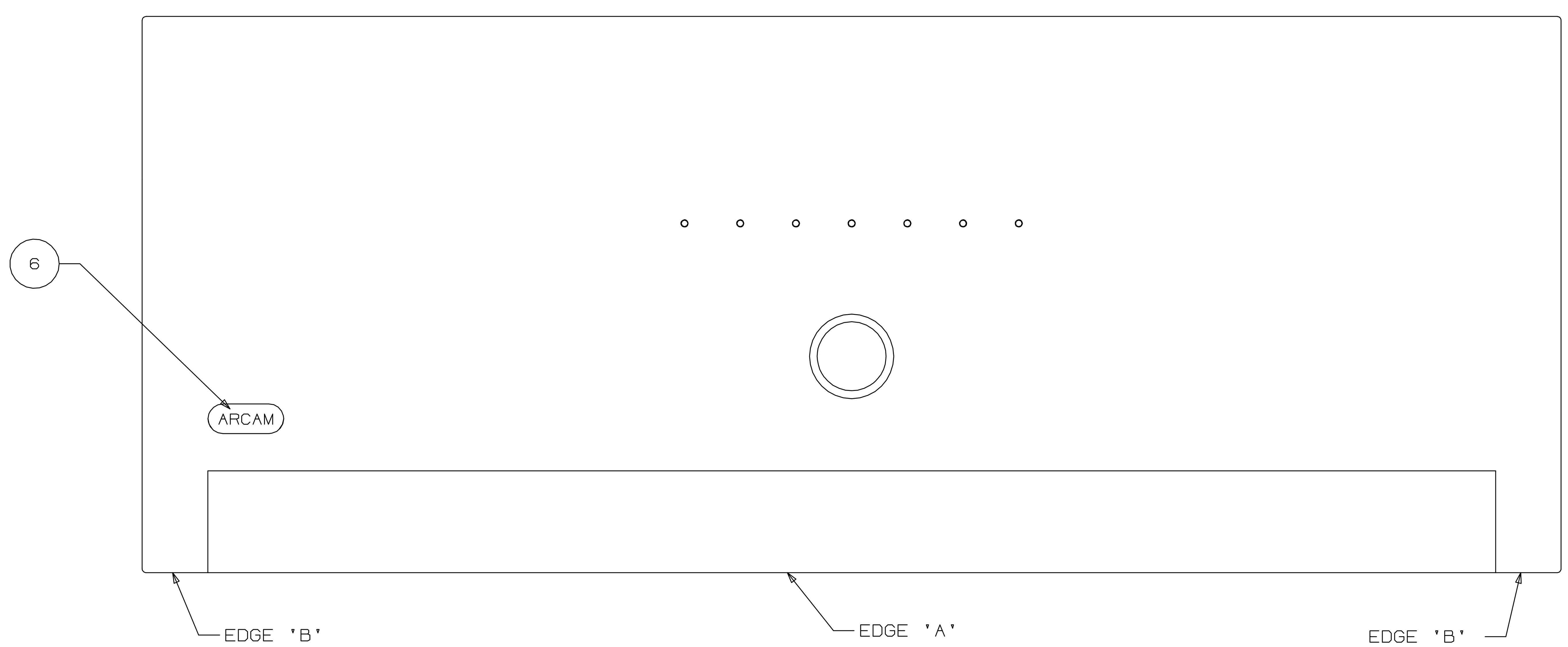
ARCAM
A & R CAMBRIDGE LTD

ECO NR.	DATE	CHG.	ZONE	DESCRIPTION OF CHANGE	REL	DR	CHK
--	18/07/01	--	--	PROTOTYPE RELEASE	B	MAR	--
--	05/12/01	--	--	E830MC ADDED, FP CHANGED	C	MGB	--
--	07/03/02	--	--	PRODUCTION RELEASE	1	MGB	--
02_E068	02/04/02	--	--	FRONT PANEL NOTE CHGANGED	2	MGB	--
--	--	--	--	--	--	--	--

NOTES: -

1. ASSEMBLE AIR SCOOP, (ITEM 2), INTO FRONT PANEL, (ITEM 1), USING SCREWS, (ITEM 5). ENSURE FRONT EDGE 'A' AND FRONT EDGES 'B' ARE PERFECTLY ALIGNED.
2. ASSEMBLE LIGHT-PIPES, (ITEM 3), INTO FRONT PANEL, PRESSING HOME SECURELY.
3. ASSEMBLE ARCAM BADGE (ITEM 6) INTO RECESS IN FRONT PANEL.
4. SCREEN FRONT PANEL USING ARCAM SILK SCREEN , (ITEM 4), SEE E042SS (PDF FILE) FOR TEXT COLOURS.



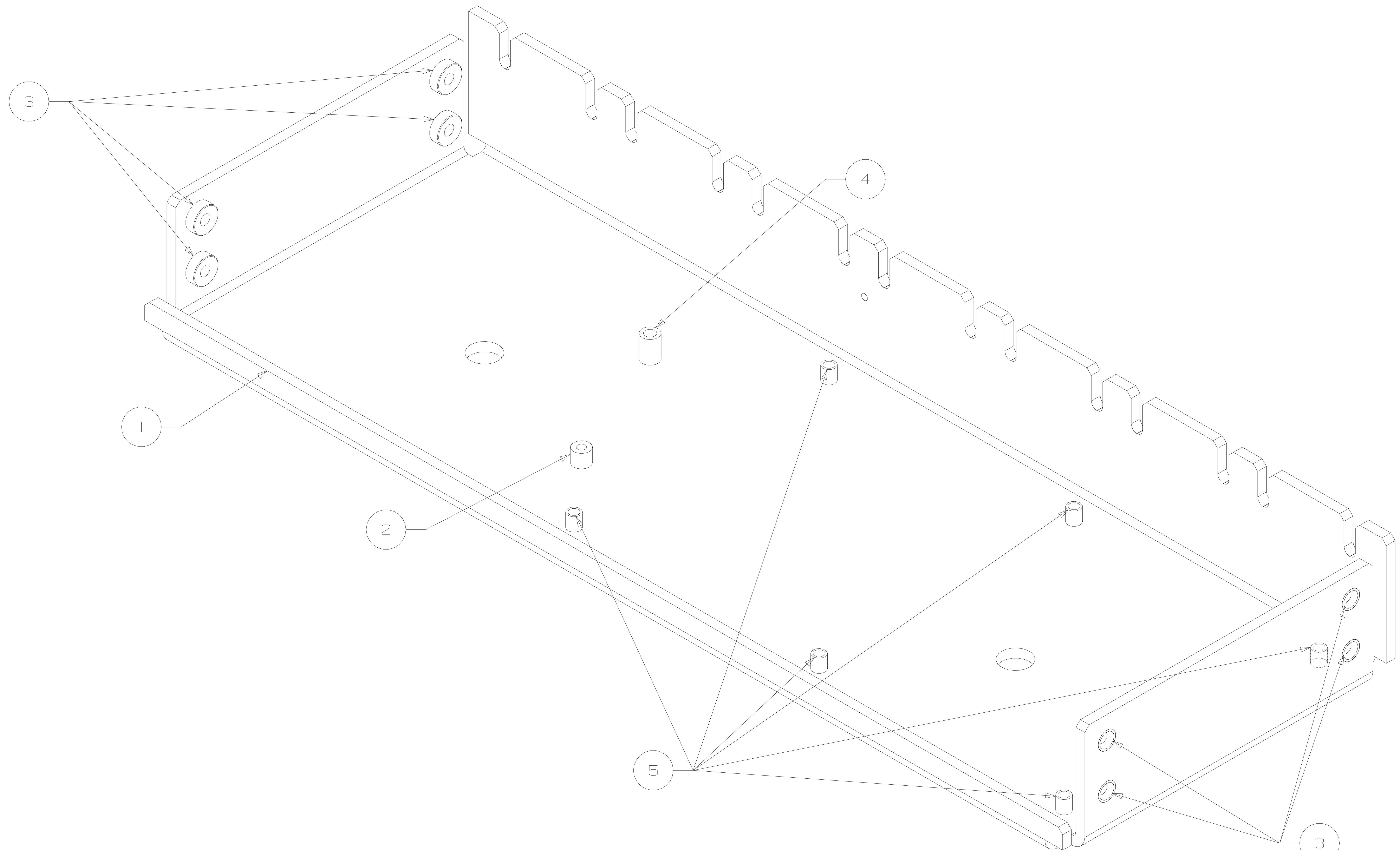


ARCAM A & R CAMBRIDGE LTD		DRAWN BY:	MAR.
		DATE:	18/07/01
TOLERANCES UNLESS 0.00±0.10 OTHERWISE STATED 0.0 ±0.20 ANGULAR TOL. +2 DEGREES	ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED	CHECKED BY:	--
		ORIGINAL SCALE 1:1	
MATERIAL: SEE RUNOUT SHEET		PLOT SCALE 1:1	
FINISH: SEE NOTES		SHT OF	
PART NUMBER AND DRAWING NUMBER E065AY		DRAWN WITH REFERENCE TO BS 308	
DRAWING TITLE FASCIA ASSY P7			A1

0 10 20 30 40 50 60 70 80 90 100

ECO NR.	DATE	CHG.	ZONE	DESCRIPTION OF CHANGE	REL	DR	CHK
--	20/12/01	--	--	INFORMATION RELEASE	A	MGB	--
--	02/01/02	--	--	PARTS TABLE ADDED, DRAWING WAS A1	B	SLS	MGB
--	11/03/02	--	--	PRODUCTION RELEASE	1	MGB	--
02_E111	31/5/02	--	--	E948MC UP-ISSUED FROM 1 TO 2	2	SLS	--
--	--	--	--	--	--	--	--

ARCAM
A & R CAMBRIDGE LTD



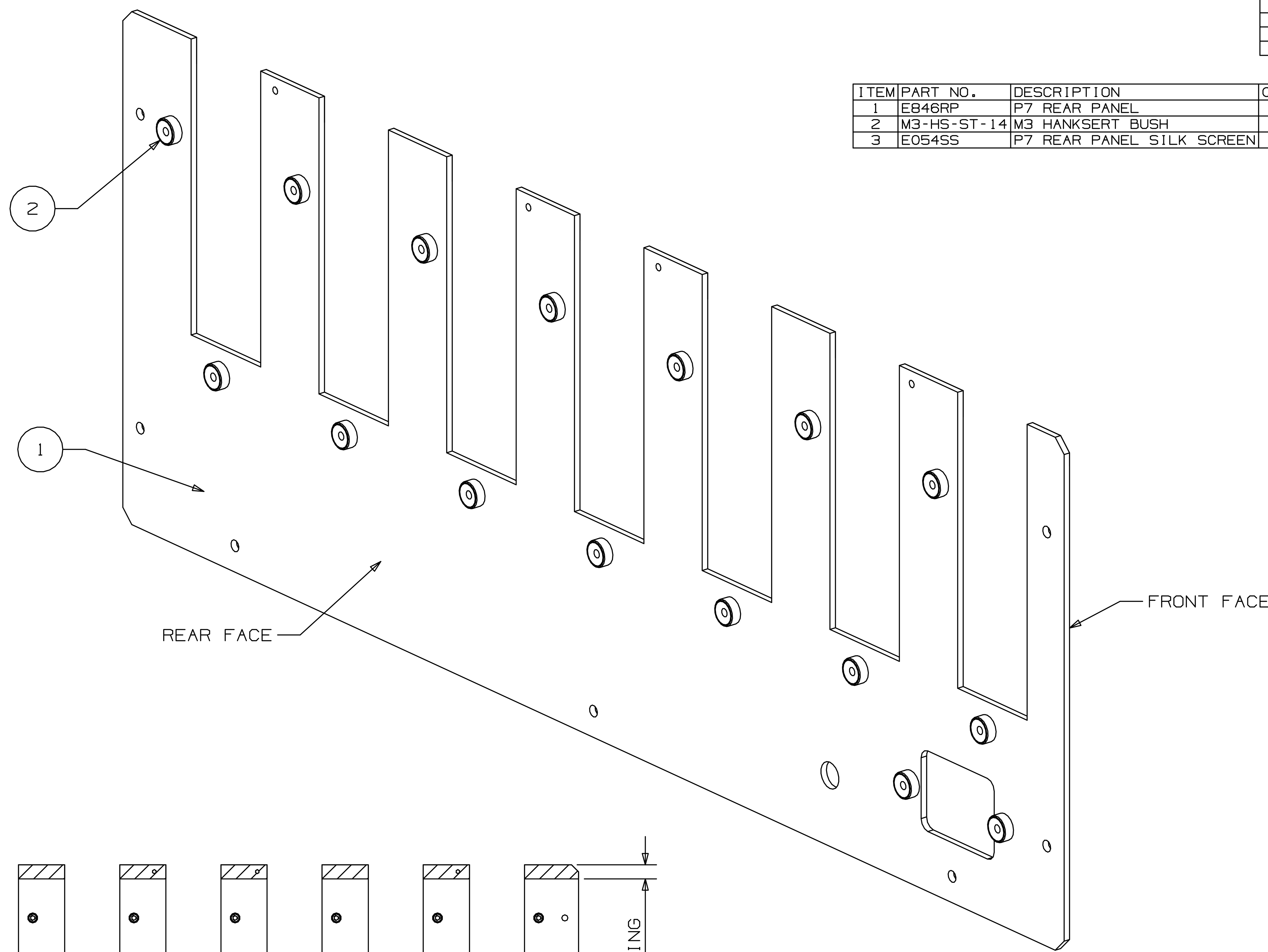
ITEM	PART NO.	DESCRIPTION	QTY	NOTES
1	E948MC	P7 TRANSFORMER TRAY	1	
2	PBSO-S-M4-10	M4x10mm BLIND STAND-OFF	1	OR EQUIVALENT
3	M5-HS-ST-08	M5 HANKSERT BUSH	8	OR EQUIVALENT
4	PBSO-S-M5-14	M5x14mm BLIND STAND-OFF	1	OR EQUIVALENT
5	PBSO-S-M3-10	M3x10mm BLIND STAND-OFF	6	OR EQUIVALENT

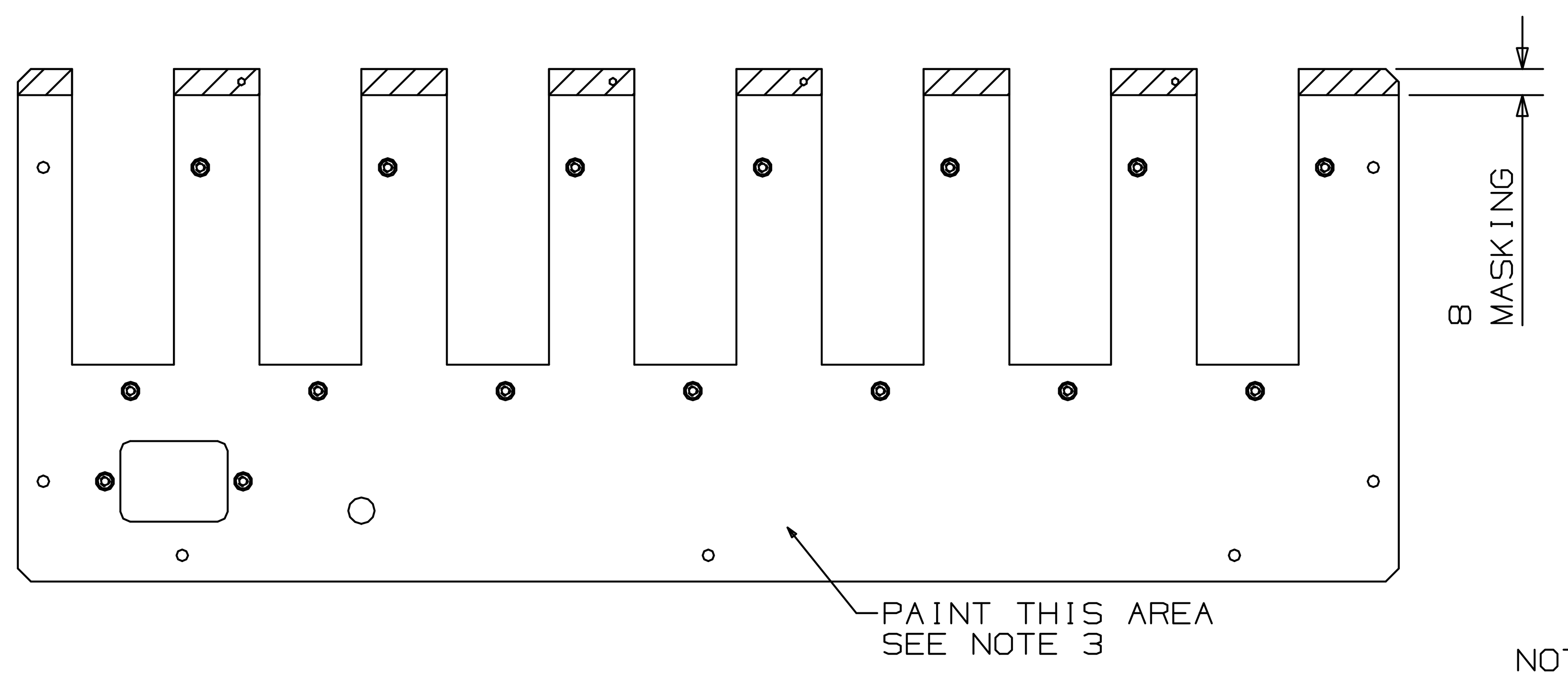
ARCAM A & R CAMBRIDGE LTD	DRAWN BY:	MGB
	DATE:	20/12/01
TOLERANCES UNLESS OTHERWISE STATED 0.00±0.10 0.0 ±0.20 ANGULAR TOL. +2 DEGREES / ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED	CHECKED BY:	--
	ORIGINAL SCALE 1:1	
MATERIAL: N/A	PLOT SCALE 1:1	
FINISH: N/A	SHT OF	
PART NUMBER AND DRAWING NUMBER E106AY	DRAWN WITH REFERENCE TO BS 308	
DRAWING TITLE P7 TRANSFORMER TRAY ASSY		A2

0 10 20 30 40 50 60 70 80 90 100

ECO NR.	DATE	CHG.	ZONE	DESCRIPTION OF CHANGE	REL	DR	CHK
--	02/01/02	--	--	INITIAL RELEASE	C	SLS	MGB
--	11/03/02	--	--	NOTE 2 CHANGED, PRODUCTION RELEASE	1	MGB	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

ITEM	PART NO.	DESCRIPTION	QTY	NOTES
1	E846RP	P7 REAR PANEL	1	
2	M3-HS-ST-14	M3 HANKSERT BUSH	16	OR EQUIVALENT
3	E054SS	P7 REAR PANEL SILK SCREEN	1	SEE NOTE 4





VIEW SHOWING MASKING AREA REQUIRED ON FRONT FACE
SCALE 1:2

NOTES:-
1. PROCESS PANEL WITH ALOCROM 1000.
2. MASK WHOLE OF REAR FACE, INSERT THREADS AND SHADED AREA ON FRONT FACE AS SHOWN.
3. PAINT BLACK IN ACCORDANCE WITH ARCAM SPEC. M08/0002.
4. SILK SCREEN USING ARCAM ARTWORK E054SS IN ACCORDANCE WITH ARCAM SPECS. M08/0004 (FONTS) AND M08/0001 (TEXT COLOUR).

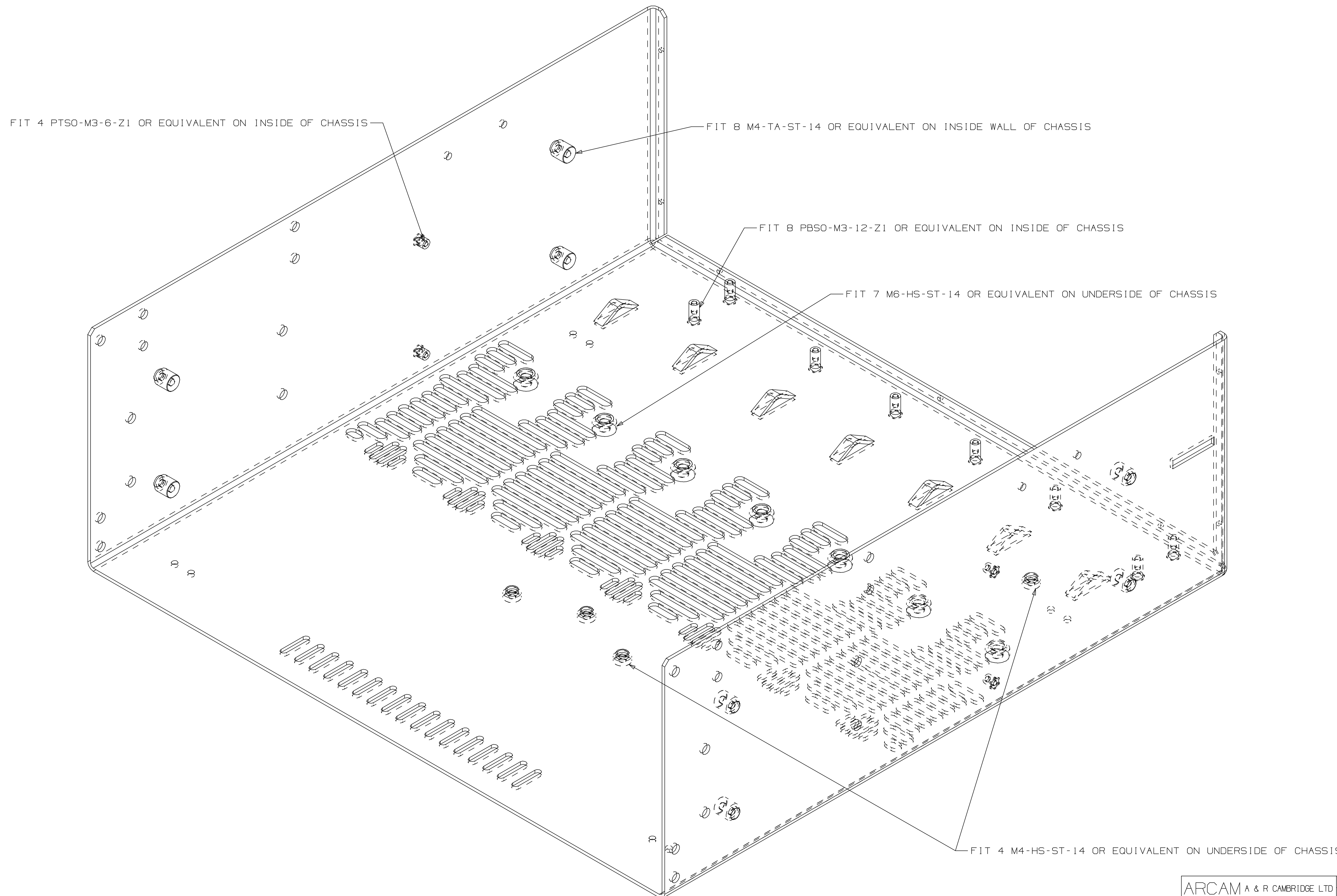
ARCAM
A & R CAMBRIDGE LTD

ARCAM A & R CAMBRIDGE LTD	DRAWN BY: SLS
	DATE: 02/01/02
TOLERANCES UNLESS OTHERWISE STATED 0.00±0.10 0.0 ±0.20 ANGULAR TOL. +2 DEGREES / ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED	CHECKED BY: MGB
	ORIGINAL SCALE 1:1 UOS
MATERIAL: N/A	PLOT SCALE 1:1
FINISH: SEE NOTES	SHT 1 OF 1
PART NUMBER AND DRAWING NUMBER E064AY	DRAWN WITH REFERENCE TO BS 308
DRAWING TITLE P7 REAR PANEL ASSY	A2

0 10 20 30 40 50 60 70 80 90 100

ECO NR.	DATE	CHG.	ZONE	DESCRIPTION OF CHANGE	REL	DR	CHK
--	21/12/01	--	--	FIRST RELEASE OF SHEETS 2 AND 3	E	SLS	--
--	30/1/02	--	--	MISSING SLOT WIDTH DIM ADDED,	F	SLS	--
				SLOT SIZE AMENDED TO AID MANUFACTURE,			
				TYPE D INSERTS CHANGED, WERE 14MM LONG			
--	26/03/02	--	--	TYPE A HOLES MOVED	1	MGB	--
				CABLE TIE ANCHORS ADDED			
				PRODUCTION RELEASE			

ARCAM
A & R CAMBRIDGE LTD



ARCAM A & R CAMBRIDGE LTD		DRAWN BY:	SLS
		DATE:	21/12/01
TOLERANCES UNLESS OTHERWISE STATED 0.00±0.10 0.0 ±0.20 ANGULAR TOL. +2 DEGREES	ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED	CHECKED BY:	--
		ORIGINAL SCALE 1:1	
MATERIAL: SEE SHEET 1		PLOT SCALE 1:1	
FINISH: SEE NOTES ON SHEET 1		SHT 3 OF 3	
PART NUMBER AND DRAWING NUMBER E817CH		DRAWN WITH REFERENCE TO BS 308	
DRAWING TITLE CHASSSIS FMJ 7-CH. AMP			A1

0 10 20 30 40 50 60 70 80 90 100

ARCAM

All parts can be ordered via spares@arcam.co.uk

Pembroke Ave, Waterbeach, Cambridge, CB5 9PB, ENGLAND
TEL: +44(0) 1223 203 203   FAX: +44(0) 1223 863 384