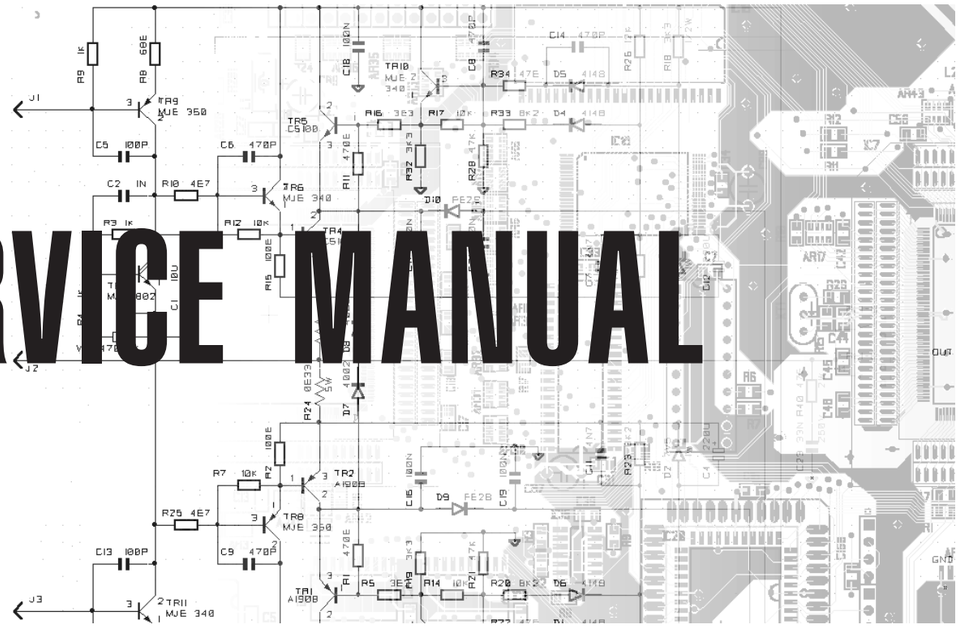
ENERGY 2

HIGH PERFORMANCE POWER AMPLIFIER

SERVICE MANUAL



GENERALMUSIC®

CODE: 277287

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Warnings

Notice

Service must be carried out by qualified personnel only.Any tampering carried out by unqualified personnel during the guarantee period will forfeit the right to guarantee.
For a correct operation of the instrument, after having switched off, be careful to wait at least 3 seconds before switching on again.
To improve the device's specifications, the schematic diagrams may be subject to change without prior notice.
All components marked by this symbol have special safety characteristics, when replacing any of these components use only manufacturer's specified parts.
The (μ) micro symbol of capacitance value is substituted by U.
The (Ω) omega symbol of resistance value is substituted by E.
The electrolytic capacitors are 25Vdc rated voltage unless otherwise specified.
All resistors are 1/8Ω unless otherwise specified.
All switches shown in the "OFF" position. All DC voltages measured to ground with a voltmeter 20KOhm/V.

- ← Soldering point.
- Male connector.
- Female connector.
- M/F faston connector.
- Supply voltage.
- Test point.
- Flag joined with one or more flags with the same signal name inscribed.
- Logic supply ground.
- Analog supply ground.
- Chassis ground.
- Earth ground.

ATTENTION

Observe precautions when handling electrostatic sensitive devices.

Address

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GENERALMUSIC on the NET: http://www.generalmusic.com

TECHNICAL SPECIFICATIONS

Dimensions:	(WxHxD)	483x88x507mm (2U)
Weight:		23 Kg - 50.6 lbs
Power Requirements:	230Vac±10% 50/60Hz	2000VA
or	115Vac±10% 50/60Hz	2000VA
Load selector:		* 2Ω ** 4Ω
Output Power:	(2Ω stereo/parallel)*	900Watts
	(4Ω stereo/parallel)**	1000Watts
	(8Ω stereo/parallel)**	500Watts
	(4Ω bridge)*	1800Watts
	(8Ω bridge)**	2000Watts
	(16Ω bridge)**	1000Watts
Max. Undistorted Out:	(2Ω stereo/parallel)*	120±2Vpp
	(4Ω stereo/parallel)**	180±5Vpp
Input Sensitivity:	(constant sensitivity)	0.775Vrms (0dB)
	(constant gain)	1.65Vrms (+6.5dB)
Input Impedance:	(balanced)	30KΩ
	(unbalanced)	15KΩ
Voltage Gain:	(constant sensitivity)	38±0.5dB
	(constant gain)	32±0.5dB
Slew Rate:		23V/µS
Damping Factor:	(8Ω stereo/parallel)	>400
Frequency Response	(-0.2dB)	20Hz÷20KHz
at Full Power:	(-3dB)	10Hz÷80KHz
IMD:	(SMPTE 60Hz/7KHz 4:1)	<0.02%
THD:	(THD+N)	<0.02%
S/N Ratio:	(unweighted)	>100dB
Crosstalk:	(1KHz)	>90dB

INTRODUCTION

Power Performances

The amplifier Energy 2 operates in *AB class* using the last BJT generation in plastic package, it has been designed using a *Floating Bridge Configuration*: this configuration, making the most from the double stage power supply, enables to obtain very consistent power with very high dynamics and low distortion even at low impedances.

Double Stage Power Supply

For each amplifier section in the Mains Transformer there are two secondary windings which are connected in parallel or in series according to the effective power requirements. In this manner the amplifier only receives the necessary voltage when there is an effective demand of power with a considerable reduction of dissipated heat.

Protections

Loudspeaker protection: in case of the breakdown of the output BJTs or other fault condition, a *DC Sensor* on power output circuit is able to interrupt the amplifier circuit avoiding that current peaks reach the load. Moreover a *Soft Start* circuit delays the connection of the speakers by the *Output Relay* every time the amplifier is turned on, when it is turned off the relay disconnect the load immediately.

Thermal protection and cooling system: Inside the amplifier there is an highly sophisticated cooling system able to protect it from overheat and to ensure the upmost efficiency and reliability. The cooling system has two separate heat sink structures (for positive and negative rails) for each channel constructed with tinplated copper, instead of alluminium, for more efficiency. Air flow thru the unit is ensured by two variable speed fans controlled by the SOA circuit, if the temperature rise again the control circuit gradually reduces the power supply to the final stage and at the same time enables the input limiter. As soon as the temperature reaches the normal level , the amplifier gradually returns to normal operation. The amplifier protect itself, by entering in a complete muting status, only in extremely abnormal operating condition (e.g.obstruction of the air vents) and in case of temperature rising further.

SOA processors: In conjunction with the thermal protection the SOA processors constantly detect the power dissipation of the output BJT ensuring that they always remain in their Safe Operating Area. In this particular amplifier the SOA processors are three per channel, the first and most important checks the signal output stage, the second SOA circuit checks the ground output stage and the third circuit checks the voltage translator stage, all three circuits operate accordly.

Current Limiters: These circuits detect the current on final and translator stages, accordly with SOA processors limiting the excessive current on the load, and finally enable the *Input Limiter*.

Transformer Thermal Protection: This protection disconnects the load (muting the amplifier) until the cooling restores the normal temperature.

Anti-Clipping Limiter: The input signal is constantly checked to instantly recognize a possible amplifier clip, this circuit is an efficient limiter that operate without an excessive dynamic compression to obtain the better listening, it operates accordly the protection circuit.

TEST PROCEDURES & ADJUSTMENTS

Precaution

- To prevent short circuit during any test, **the oscilloscope must be EARTH insulated**, this occurs because some test require to connect its probe to the amplifier output, non-compliance may cause damages to oscilloscope inputs circuitry.
- Before removing or installing any modules and connectors, **disconnect the amplifier from AC MAINS** and measure the DC supply voltages across each of the power suppliy capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100Ω 50W resistor across the applicable caps to discharge them for your safety. Remember to remove the discharge resistor immediately after discharging caps. **Do not power up the amplifier with the discharge resistor connected**.
- Read these notes entirely before proceeding to any operation. These notes are not comprehensive of all damages that possibly occur, but includes some specifically advices, checks and adjustments relative to this amplifier.

Visual Check

- Remove top and bottom covers from the amplifier chassis.
- Use compressed air to clear dust in the amplifier chassis.
- Before proceed to supply the amplifier check visually the internal assembly, if appears an evident damage find the most possible reasons that cause it.
- Check the wiring cables for possible interruptions or shorts.
- If the damage has burnt a printed circuit board don't try to repair it, replace with a new one.

Test Instruments

- Audio Generator
- Dual Trace Oscilloscope
- Digital Multimeter
- 2Ω 1000W, 4Ω 2000W, 100Ω 50W resistors
- 1 Mains cord terminated with insulated Faston
- Variac (0÷250Vac)
- Temperature Meter

Initial Setup

- Turn the amplifier on bottom side.
- Disconnect the *Power Switch* from the amplifier internal mains line and reconnect it directly to the Mains Line with the other cord.
  Set the Variac at zero voltage and connect it between the amplifier mains socket and the Mains Line.
- Set the amplifier controls as follows:
  MODE on parallel (PAR),
  MINIMUM LOAD on 4Ω,
  EARTH selector on grounds attached,
  SENSITIVITY on 0.775V
  and turn full clockwise the level potentiometers.
- Short R63 and R175 on the *Inputs, Drivers & SOA Processor Board* to de-activate the limiters on each channel.
- The procedures that follow must be executed subsequently in the order specified.
- The procedures are divided in two phases: the first initial test is intended to locate the most probably faults, the second final test is intended to verify and to adjust the amplifier with load connected.

Protections & Ac Supply Check

- Turn the amplifier on top side.
- Remove the *Main Transformer* secondary fuses (4 x16A) and then check them with the Multimeter.
- Turn on the amplifier, the relais on the *Main Transformer* primary winding must be turn on one a time, the fans go immediately to the max. speed and after some seconds return to the slow speed, and also the output relay must turn on. During this time the protect red led lights.
- If somethings goes different, the amplifier has probably some problem on

the *Protections Board*, first of all check its supplies:
CN4 pin 6 = +24Vdc
CN4 pin 9 = -24Vdc
CN6 pin 8 = +15Vdc
CN6 pin 11 = -15Vdc

- If the fans don't start or go only to the max. speed, you must check the *Fan Driver* circuit (TR1,2,4,6).
  If all the circuit is good, you must check on the *Inputs, Drivers & SOA Processor Board* the TR16,17,18,19,22 and the SOA Processor circuits preceding the transistors; to check them quickly disconnect CN3 and CN6 the fan must go only at slower speed.
- If the *Primary Tranformer Relais* don't start (also selecting 2Ω or 4Ω minimum load switch) check their driver circuits, the fault must be probably in the *Transformer Relais Driver* circuit on the *Protections Board* , refer to schematics.
- If the *Outputs Relay* doesn't start the fault must probably located in the relay driver or in Soft Start circuit on the *Protections Board* , refer to schematics.
- Turn off the amplifier and check with the multimeter if the SCR on *Controlled Bridge Boards* are shorted. If one or more are shorted, replace it with a new one, check also the bridges.
- Set the oscilloscope CH1 to 10V/div. 5mS and connect its probe to R48 side TR19(c) on *Protections Board*, turn on the amplifier: a series of pulses appear on the screen that will became stable about +15Vdc, these pulses activate the SCR on the *Controlled Bridge Boards* to slowly charge the capacitors. If the pulses aren't displayed your amplifier has probably some fault on *Soft Start* circuit, refer to schematics.
- Set the Variac at the nominal mains voltage, measure with the Multimeter the AC supply voltages between the secondaries: 43±3Vac
- Switch to 2Ω minimum load and measure again the voltages: 33±3Vac.
- Re-set the minimum load at 4Ω and the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.

Dc Supply Initial Check

- **SETUP:**
  Connect the audio generator to a channel input and set it to 1KHz 775mV$_{RMS}$ (0dB) sinusoidal signal.
  Connect the CH1 scope GND clip to the output GND and connect the oscilloscope probe tips CH1/2 to the channel outputs before the relay, set both to DC 20V/div. 200µS/div.
- Turn on the amplifier and afterwards increase the Variac slowly monitoring the Outputs with the oscilloscope CH1/2 connected, it should display the sinusoidal input signal amplified with no distortions, if a distortion or a protection trip occur, turn off the amplifier, wait some minutes and disconnect the supplies from the Power Amplifier Board that doesn't work properly, to do this you must disconnect the red and the blue wires from capacitors, continue to check the supplies.
- **CAUTION: Before re-connecting the Power Amplifier Boards to the supplies, you must have the capacitors discharged for your safety: connect a 100Ω 50W resistor across the caps and remove the resistor just after they are discharged.**
- Finally verify the DC supplies at the capacitor terminals: 58±2Vdc
- If one or more voltages don't correspond:
  Check the SCR located on *Controlled Bridge Board* and its driver transistor (TR9,10,13,14) located on *Power Supply Board*, particularly check the insulation from the heating and the driver transistors and the diodes D19, 20, 21, 22.
  Re-check the rectifiers, capacitors and transformers disconnecting them from circuitry, refer to schematics.

Channels Initial Check

- Re-set the Variac at zero voltage and eventually re-connect the damaged Power Amplifier Board that you have previously disconnected from supply.
- Set up the Variac slowly and check on the oscilloscope display the output of the damaged channel:
- If a dc voltage is present, turn off the amplifier and check all the output transistors TR13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, their drivers TR5, 7, 9, 11 and all active and passive components interested with the signal path, particularly also include TR29, 30, 31, 32, 33, 34 and D15, 16 for channel A or TR1, 2, 3, 4, 5, 6 and D1, 2 for channel B mounted on *Inputs, Drivers & SOA Processor Board.*
- If appears a simmetrical clipping before the maximum output voltage (refer to technical spec.), the supply translator circuit of the channel under test, located on *Power Supply Board* doesn't work properly: check its driver circuit refer to schematics.
- If appears an asimmetrical clipping before the maximum output voltage (refer to technical spec.), the grounding power amplifier doesn't work properly; this fault can also be checked measuring the dc voltage between output ground and the +Vcc and the voltage between output ground and -Vcc for the channel under test, all measures must be simmetrical near 28Vdc without input signal, if not, check the virtual ground driver (R115/R142 ch.A or R52/R47 ch.B) located on *Inputs, Drivers & SOA Processor Board*, refer to schematics.
- If no signal appears: try to disconnect R41,46 to deactivate the signal deletion caused by SOA circuit, then checked the right operation of the channel, check the cable connections of SOA circuits, check its active and passive components and verify its adjustments. If also the signal doesn't appear check the input circuits, refer to schematics.
- **Note: If one or more of described faults appear only with the load connected (see the following checks) may be that one or more output, ground or voltage translator transistors is interrupted.**

Dc Supply Final Check

- These procedures are intended for one channel at a time, repeat these operation for the other channel.
- **SETUP:**
  Connect the CH1 scope GND clip to the output GND.
  Connect the CH1 probe tip to the CHA amplifier output before the relay.
  Connect the CH2 probe tip to the red wire (+Vcc1).
  Set both to DC 20V/div. 200µS/div.
  Insert the temperature meter through two transistor cases interstice located at centre of heatsink of CHA on the *Power Supply Board* .
  Connect the 4Ω 2000W load to CHA out.
  Connect the audio generator to the channel input CHA and set it to 1KHz 775mV$_{RMS}$ (0dB) sinusoidal signal, and set the amplifier to Stereo mode.
  Connect the Mains Line as described in the initial setup section.
  Set the LEVEL potentiometers at zero.
  Set the Variac at zero voltage.
- Increase slowly the Variac to reach the mains voltage: check that the supply circuit operate correctly measuring +28±2Vdc on the red wire (+Vcc1) and -28±2Vdc on the blue wire (-Vcc1) respect the CHA GND output.
- Increasing the CHA input level check the right operation of the Supply Voltage Translator: verifying that the CH2 voltage level remain the same until the CH1 signal reach 26Vp, afterwards increasing the input level the voltage of CH1 must envelope externally the CH2 signal with an offset of 10÷12V.
- Increasing the level of input signal the envelope is stopped more about 100±5Vdc and the signal clip must occur at 180±5Vpp. Decrease the level and connect the CH2 probe to the blue wire (-Vcc1), repeat the test for the negative supply.
- Connect the 2Ω instead 4Ω load and verify that the output signal must be limited at 64±2Vp. If it doesn't happen check the limit circuit (TR23 for CHA, TR24 for CHB) on *Power Supply Board*.
- Disconnect the fan and wait until the temperature reaches 110±5°C: the primary transformer relais switch to 2Ω minimum load and the fan, reconnecting it, goes at maximum speed (23Vdc).
- Turn off the Amplifier and the Variac. Connect CH1 scope GND tip to R38 terminal side CN2 (SCR cathode) and its probe tip to R41 side CN2 (SCR gate), set it to 200mV/div. 1mS/div.
- Turn on the Amplifier and the Variac simultaneously and verify that the voltage on the SCR gate shift from 0 to 0.8Vp in less than one second.
- Repeat the last test after moving the CH1 GND tip to R44 side CN2 and its probe tip on R46 side CN2 to check the second SCR.
- Repeat all these tests for CHB, where Vcc1 become Vcc2, CN2, R38, R41, R44, R46 become CN3, R48, R50, R53, R55 respectively.

Channel Final Check

- These procedures are intended for one channel at a time, repeat these operation for the other channel.
- If you have already repaired the channel under test:
  Verify, with the Multimeter, the insulation between the heatsink and the TR8,10 transistors collectors.
  Turn the trimmer VR1 full clockwise and VR2 full counter-clockwise to re-adjust the Bias current.
- **SETUP:**
  Connect the scope CH1 and the amplifier as described in Dc Supply Final Check section.
  Connect the CH2 probe tip to the heatsink of the channel under test.
  Insert the temperature meter through the PTC R27 (for CHB) or through the TR15,16 (for CHA) interstice located on the *Power Amplifier Board* at centre of heatsink.
  Set the LEVEL potentiometers at maximum.
- **INITIAL TEST:**
  Increase slowly the Variac. The channel output signals must be symmetrical respect the GND without visible distortion and oscillation. If there is a distortion read the section ADVICES and proceed to check the other channel.
  Increasing the level of input signal the signal clip must occur at 180± 5Vpp.
- **BANDWIDTH CHECK:**
  Decrease the level to obtain a 50Vp output signal, sweep the generator

frequency from 20Hz to 20KHz, the output level must have not detectable level changes.
Set back the frequency at 1KHz.

- **BIAS ADJUSTMENT:**
Disconnect the fan and wait until the temperature reaches 50°C, set the input level at zero, measure with the Multimeter the voltage across the tips of R34 and the tips of R40, adjust VR1 trimmer to read 1±0.05mVdc.
Verify that the temperature is not changed and adjust VR2 trimmer to read 1±0.05mVdc across the tips of R30 and the tips of R43.
Set the CH1 an CH2 scopes at 0.2V/div. 200μS/div., adjust the input level until the sinewave reach 0.5Vp, no crossover distortion must be detectable: if necessary re-adjust VR2 until the distortion disappears without exceed 6mVdc between R30 and R43 terminals.
Re-connect the fan.

- **OUTPUT CURRENT CHECK (GROUND AMPLIFIER):**
Connect the ground clip of CH1 scope at the CHA amplifier ground out, and its probe tip to the emitter of TR16 and CH2 probe tip to TR21 emitter.
Vary the input level to obtain 0.5Vp on output and verify that the difference of their peaks are less than 0.1V.
Verify the correct division of the output current between the output transistor, connecting alternatively CH2 probe tip to the TR17 and TR18 emitters checking that their peak levels are within 10% themselves.
Moving the CH1 probe tip on TR21 emitter, repeat the measure with the CH2 tip connected alternatively to TR19 and TR20 emitters.

- **OUTPUT CURRENT CHECK (SIGNAL AMPLIFIER):**
Connect the ground clip of CH1 scope at the CHA amplifier output, and its probe tip to the emitter of TR13 and CH2 probe tip to TR24 emitter.
Vary the input level to obtain 0.5Vp on output and verify that the difference of their peaks are less than 0.1V.
Verify the correct division of the output current between the output transistor, connecting alternatively CH2 probe tip to the TR14 and TR15 emitters checking that their peak levels are within 10% themselves.
Moving the CH1 probe tip on TR24 emitter, repeat the measure with the CH2 tip connected alternatively to TR22 and TR23 emitters.

- **SHORT CIRCUIT SENSOR CHECK:**
Short the load temporarely and verify that the current protection sensor (TR3, TR4) limits simmetrically the signal at 0.8±0.1Vp.

Input Circuit Check

- These procedures are intended for one channel at a time, repeat these operation for the other channel.
- **SIGNAL/CLIP SENSOR CHECK:**
Set the LEVEL pot to minimum, then increase the level and check the SIGNAL/CLIP led activity: it must turn on (green light) when the amplifier output is higher than 0.5Vp.
- **CMRR ADJUSTMENT:**
Temporarily disconnect pin 3 from pin 1 and short the pin 2 (positive input) and pin 3 (negative input) of XLR or Jack plug.
Adjust the trimmer VR7 (CHA) or VR4 (CHB) on *Inputs, Drivers & SOA Processor Board* to obtain the minimum output level. Re-set the generator plug with the input signal at pin 2 (positive input) and pin 3 (negative input) short with pin 1 (GND).
- **GAIN ADJUSTMENT:**
Set the input signal to 0dB. Connect the Multimeter on the output of the channel under test, set it in dB scale if available, set the input SENSITIVITY at 1.65V_{RMS}, adjust the trimmer VR6 (CHA) or VR5 (CHB) to obtain 32dB (30.8V_{RMS}) on the output.
Set the SENSITIVITY to 0.775V_{RMS} and verify that the Multimeter show 38.5 dB (84.1V_{RMS}).

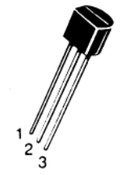
- **LIMITER ADJUSTMENT:**
Remove the shorts from R175 (CHA) and from R63 (CHB) on *Inputs, Drivers & SOA Processor Board*, connect CH2 probe tip to IC7 pin 14 (CHA) or to IC4 pin 8 (CHB) and set it at 5V/div. 2mS/div., change the generator frequency to 100Hz, increase the signal to obtain about 40Vp on output and adjust the VR10 (CHA) or VR3 (CHB) for the minimum signal on CH2 trace without CH1 trace attenuation.
Change the frequency to 10KHz and adjust the C56 (CHA) or C37 (CHB) to minimize the signal on CH2 scope without CH1 attenuation.
Re-set the generator at 1KHz, increase the signal and verify that the clipping remain costant with the limiter intervention indicated by the red colour of the SIGNAL/CLIP led.

- **SOA ADJUSTMENT:**
Set the scope sensitivity at 5V/div. (both channels).
Connect the CH1 GND clip to S6 and its probe tip to IC6 (CHA) or IC3 (CHB) pin 8, connect CH2 probe tip to IC10 (CHA) or IC5 (CHB) pin 8 set both at 5V/div. 200μs/div..
Insert the temperature meter through the PTC R27 (for CHB) or through the TR15,16 (for CHA) interstice located on the *Power Amplifier Board* at the centre of heatsink.
Verify that the two scope traces are located about 11±0.5Vdc.
Short temporarely the load, verify that both the traces move to the scope screen centre and the fans turn to maximum speed.
Disconnect the fan and leave the temperature increasing until reaches 70°C disconnect the load and adjust:
VR8 (CHA) VR2 (CHB) to have the scope negative trace at 10.5Vdc.
VR9 (CHA) VR1 (CHB) to have the scope positive trace at 11.5Vdc.
Short again the load, verify that the scope traces move more about 2V from the screen centre when the temperature reach 100±5°C; re-active the fans, they would go at the max. speed, decrease the input level at zero and verify that the voltage remains at 28±2V until the temperature reaches 85±2°C on the heatsink, then change the load back to 4Ω.
- **AMPLIFIER BRIDGE MODE CHECK:**
Set the amplifier in BRIDGE mode (input signal to channel A) and MINIMUM LOAD at 2Ω, connect the CH2 probe to the bridge output: the output voltage must be 120±2Vp.
- **SIGNAL TO NOISE RATIO CHECK:**
Disconnect the audio generator and short the input (pin 1,2,3 of XLR plug shorted) the output signal (noise) must be less 1mV.
- **OFFSET SENSOR CHECK:**
Set the Variac to zero voltage output, disconnect the load. Turn on the amplifier, connect temporarily (by means of a suitable 100KΩ resistor with a conductor wire) the positive terminal of C4 (CHA) or C5 (CHB) to +15Vdc supply (CN6 pin 8): the PROTECT led must turn on in 3 seconds approx., the output relay must switch off.
Remove the connection, wait until the leds turn off and after some seconds repeat the check with -15Vdc supply (available on CN6 pin 11), the led PROTECT must turn on again.
- **SLEW RATE CHECK:**
Set the scope sensitivity to 10V/div. 1μS/div. and set the generator to 1KHz square wave mode. Check the output square wave rising and falling edge slopes: both must be 20V/μS or more.

Advices

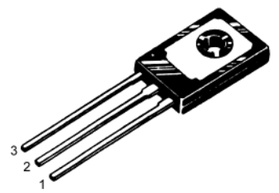
- Check the channels one at time to determine which is right (note: if you have a spare amplifier module that you know as right, use it).
- If you have determinate that the problem is a short on a rail, you must check the output transistors.
To determine which transistor devices are bad, use a soldering iron to lift one leg of each emitter pin and measure the emitter-collector resistance on each device. Unsolder and lift one leg of each base pin and check the base-collector resistance of each transistor and replace any that measure as a short.
- If all the transistors are OK, unsolder and lift one leg of each diode and check them.
- Check the circuit board for open foil traces.
- Use the Multimeter as Ohm-meter to check the resistors, particularly the base and emitter resistors of damaged transistor.
- Check all active components (transistor and diodes) on the signal path before a faulted component.
- Check all active components (transistor and diodes) connected to the output net when a output transistor has been faulting.
- If the input sinewave appears to be distorted during the negative cycle, you can assume that the problem is located somewhere in the circuitry of the positive rail.
If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail. Refer to the schematics.

Transistor Packages



TO92

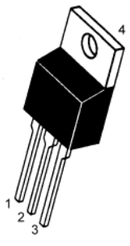
BC337, BC550, BC560	2N5550, 2N5401
1=Collector	1=Emitter
2=Base	2=Base
3=Emitter	3=Collector



TO126

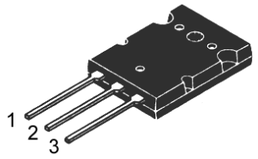
MJE340, MJE350, MJE802

1=Emitter
2=Collector
3=Base



TO220

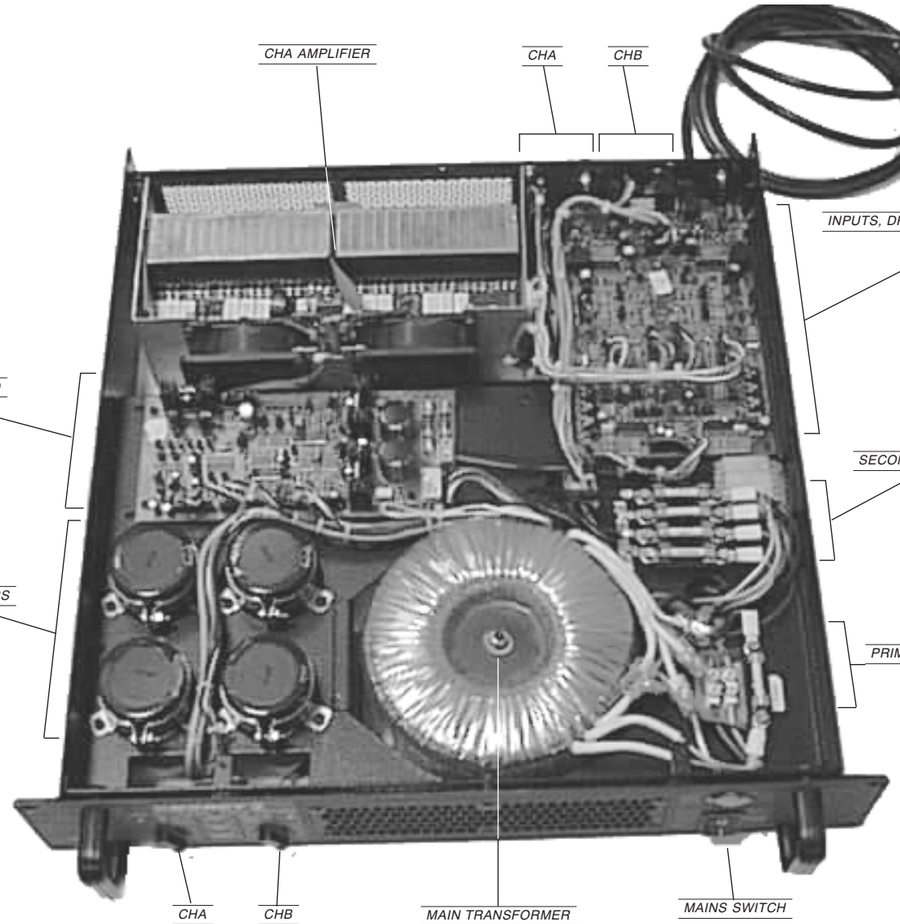
TIP127, MJE15030, MJE15031	BTW69
1=Base	1=Kathode
2=Collector	2=Anode
3=Emitter	3=Gate
4=Collector	



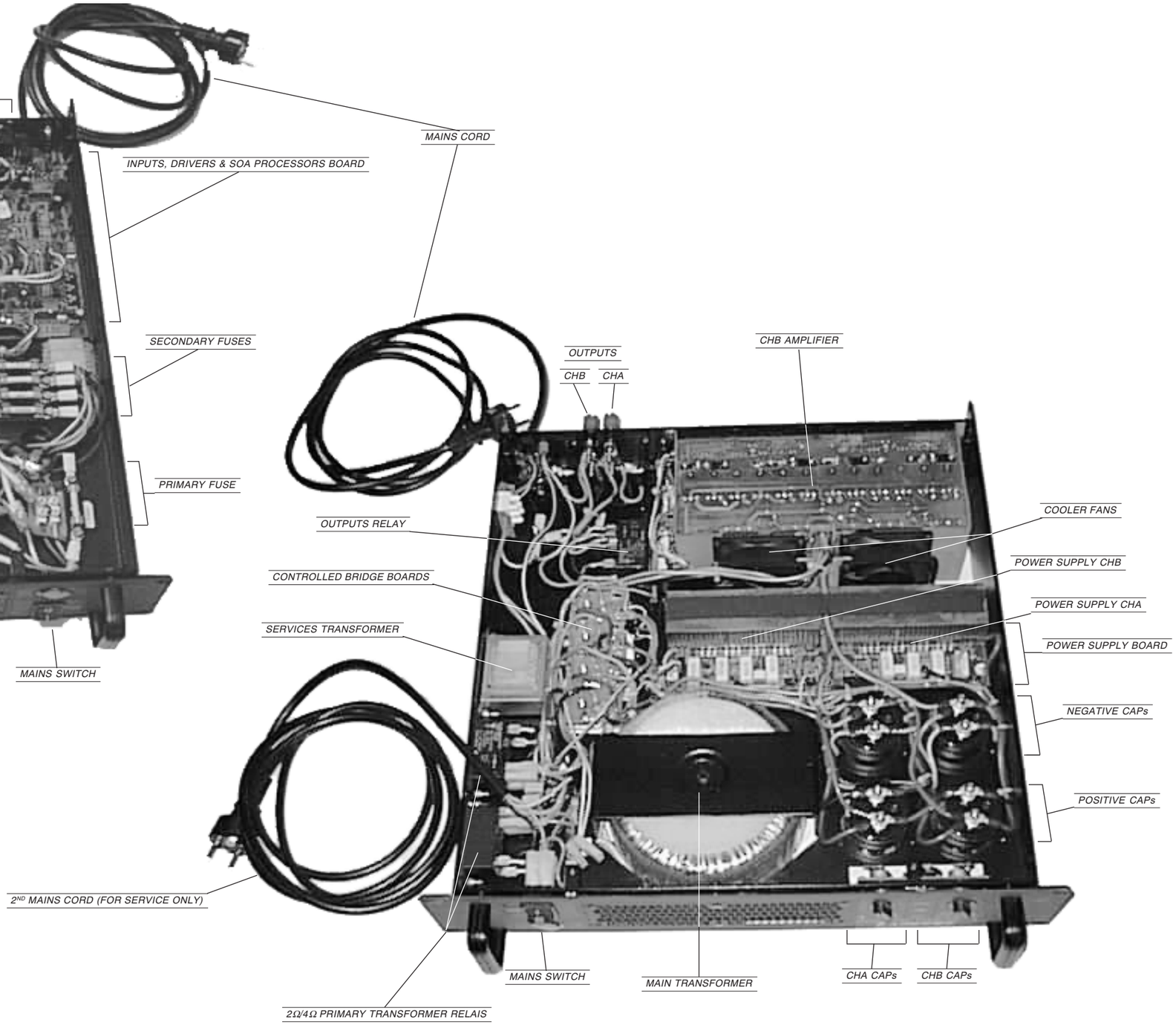
TO264

MJE21193, MJE21194

1=Base
2=Collector
3=Emitter



TOP VIEW

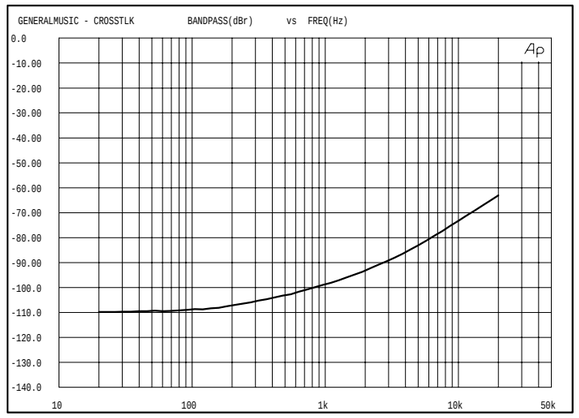


BOTTOM VIEW

DRW: BOCCATO	DWG:	SCHEMATIC DIAGRAM ENERGY 2	GENERALMUSIC S.p.A. Italy
CKD:	DISK: PART: 1/1	TOP & BOTTOM VIEWS	
APP:	REV: 19-05-98		

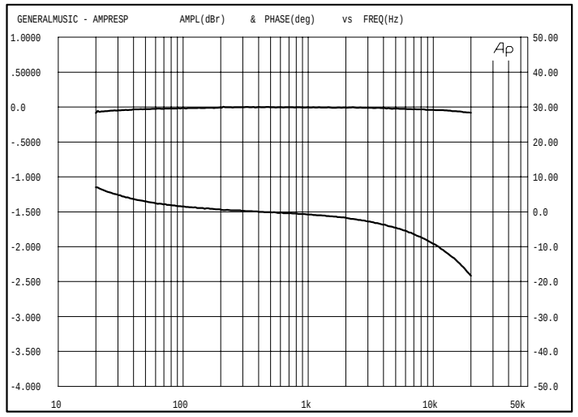
Frequency Response

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω
Output Power: 5W



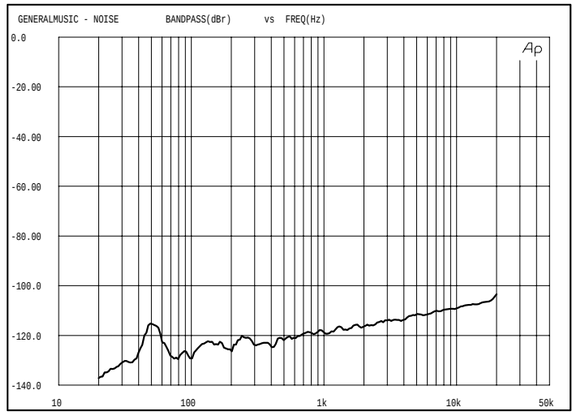
Crosstalk

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω
Output Power: 500W



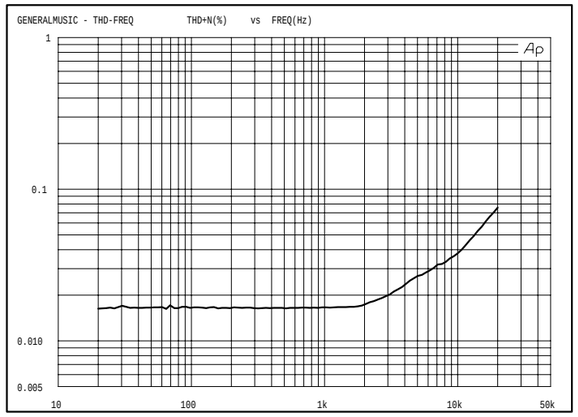
Frequency Response

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω
Output Power: 500W



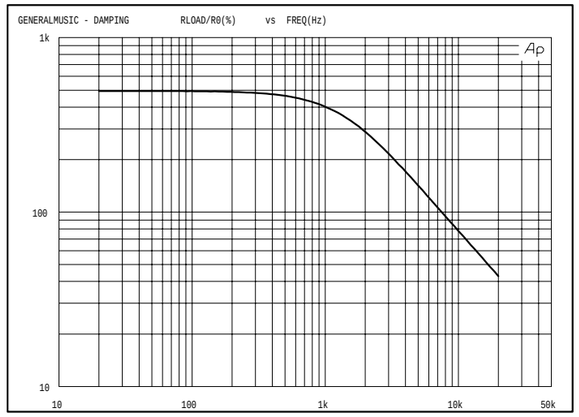
Signal to Noise Ratio

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω



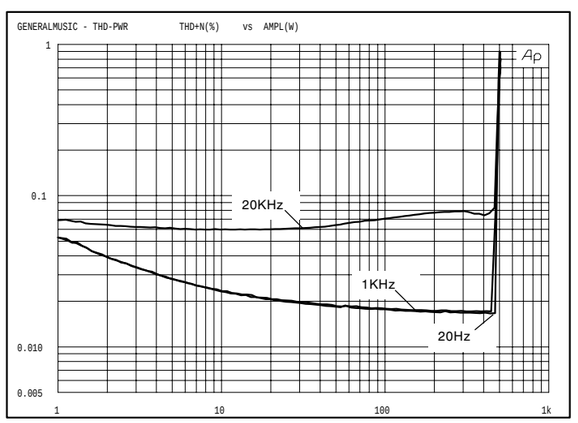
Distortion (THD+Noise) vs Frequency

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω
Output Power: 500W



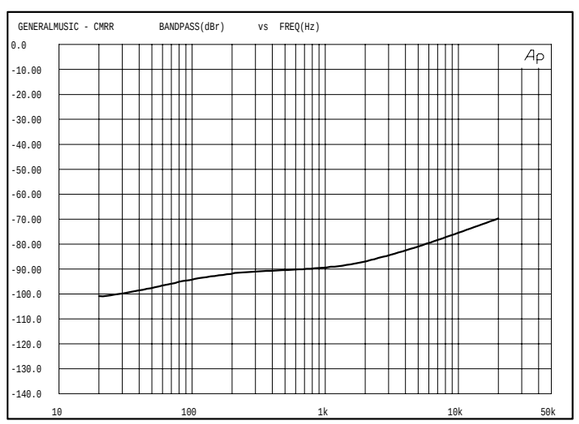
Damping Factor

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω
Output Power: 500W



Distortion (THD+Noise) vs Output Power

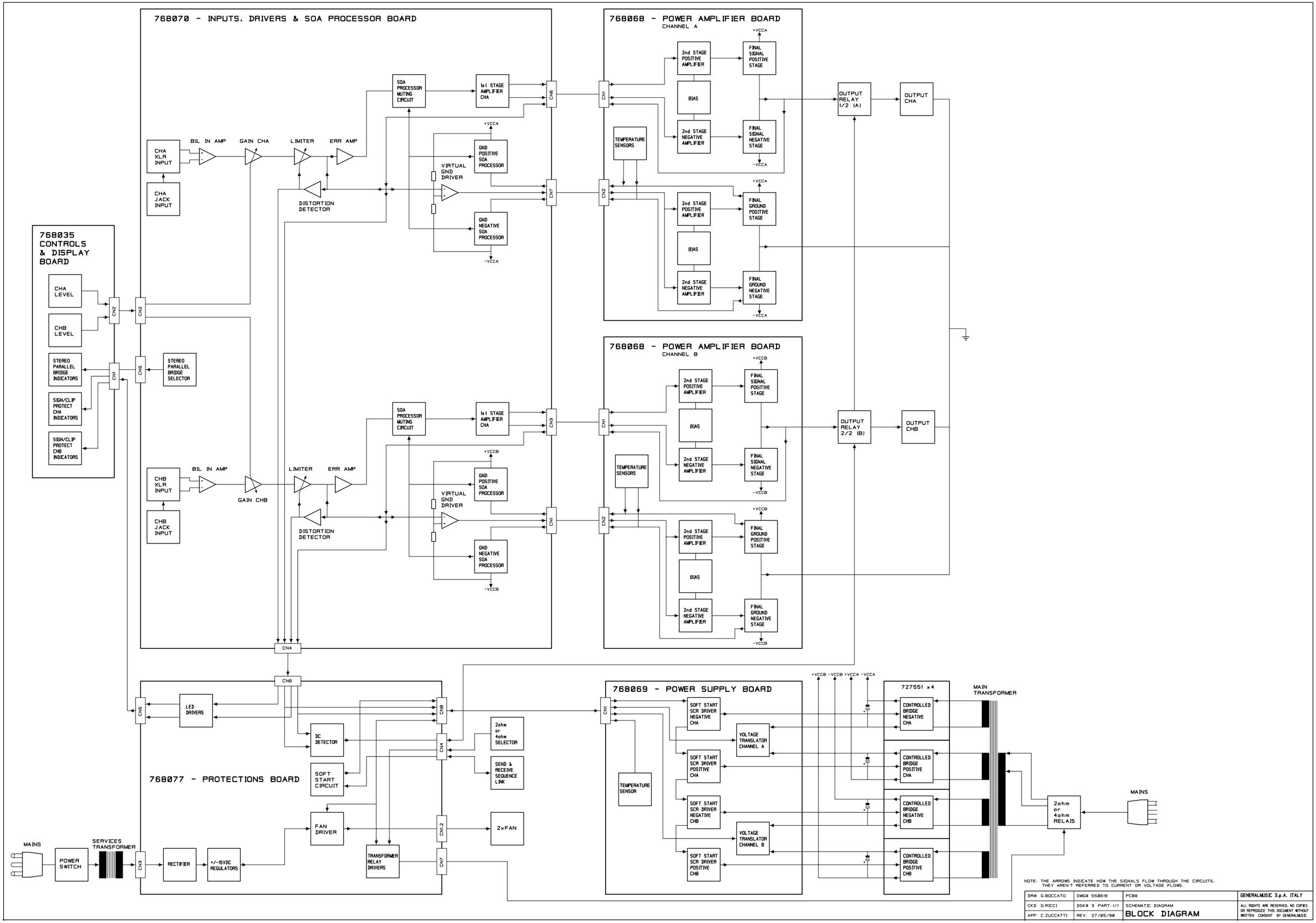
STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω



CMRR

STEREO configuration
Both channels
Input level: 0dB
Load Impedance: 8Ω

DRW: BOCCATO	DWG:	SCHEMATIC DIAGRAM ENERGY 2	GENERALMUSIC S.p.A. Italy
CKD:	DISK: PART: 1/1	MEASUREMENT	
APP:	REV: 19-05-98		


768070 - INPUTS, DRIVERS & SOA PROCESSOR BOARD
768068 - POWER AMPLIFIER BOARD
CHANNEL A
768068 - POWER AMPLIFIER BOARD
CHANNEL B
768035 CONTROLS & DISPLAY BOARD
768077 - PROTECTIONS BOARD
768069 - POWER SUPPLY BOARD
727551 x4
CHA LEVEL
CHB LEVEL
STEREO PARALLEL BRIDGE INDICATORS
SIGN/CLIP PROTECT CHA INDICATORS
SIGN/CLIP PROTECT CHB INDICATORS
STEREO PARALLEL BRIDGE SELECTOR
CHA XLR INPUT
CHA JACK INPUT
CHB XLR INPUT
CHB JACK INPUT
BIL IN AMP
GAIN CHA
GAIN CHB
LIMITER
ERR AMP
DISTORTION DETECTOR
SOA PROCESSOR MUTING CIRCUIT
1st STAGE AMPLIFIER CHA
GND POSITIVE SOA PROCESSOR
GND NEGATIVE SOA PROCESSOR
VIRTUAL GND DRIVER
+VCCA
-VCCA
+VCCB
-VCCB
2nd STAGE POSITIVE AMPLIFIER
2nd STAGE NEGATIVE AMPLIFIER
BIAS
TEMPERATURE SENSORS
FINAL SIGNAL POSITIVE STAGE
FINAL SIGNAL NEGATIVE STAGE
FINAL GROUND POSITIVE STAGE
FINAL GROUND NEGATIVE STAGE
OUTPUT RELAY 1/2 (A)
OUTPUT CHA
OUTPUT RELAY 2/2 (B)
OUTPUT CHB
CN1
CN2
CN3
CN4
CN5
CN6
CN7
CN8
CN.2
LED DRIVERS
DC DETECTOR
SOFT START CIRCUIT
FAN DRIVER
2ohm or 4ohm SELECTOR
SEND & RECEIVE SEQUENCE LINK
2xFAN
TRANSFORMER RELAY DRIVERS
TEMPERATURE SENSOR
SOFT START SCR DRIVER NEGATIVE CHA
SOFT START SCR DRIVER POSITIVE CHA
SOFT START SCR DRIVER NEGATIVE CHB
SOFT START SCR DRIVER POSITIVE CHB
VOLTAGE TRANSLATOR CHANNEL A
VOLTAGE TRANSLATOR CHANNEL B
CONTROLLED BRIDGE NEGATIVE CHA
CONTROLLED BRIDGE POSITIVE CHA
CONTROLLED BRIDGE NEGATIVE CHB
CONTROLLED BRIDGE POSITIVE CHB
MAIN TRANSFORMER
2ohm or 4ohm RELAIS
MAINS
SERVICES TRANSFORMER
POWER SWITCH
RECTIFIER
+/-15VDC REGULATORS
NOTE: THE ARROWS INDICATE HOW THE SIGNALS FLOW THROUGH THE CIRCUITS.
THEY AREN'T REFERRED TO CURRENT OR VOLTAGE FLOWS.
DRW G.BOCCATO
DWG# 550619
PCB#
GENERALMUSIC S.p.A. ITALY
CKD G.RICCI
DSK# 3 PART: 1/1
SCHEMATIC DIAGRAM
BLOCK DIAGRAM
APP. C.ZUCCATTI
REV: 27/05/98
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768070 - INPUTS, DRIVERS & SOA PROCESSOR BOARD

737065 - POWER AMPLIFIER BOARD

CHA

PCB#319053

737065 - POWER AMPLIFIER BOARD

CHB

PCB#319053

PCB#319059

768035
CONTROLS &
DISPLAY BOARD

PCB#319045

768077
PROTECTIONS
BOARD

PCB#319024

727551 - CONTROLLED BRIDGE BOARD

PCB#319041

727547 - POWER SUPPLY BOARD

PCB#319054

OUTPUT RELAY

- CH.A +

- BRIDGE +

- CH.B +

SEQUENCE LINK

SEND

RECEIVE

MINIMUM LOAD

4 OHM

2 OHM

4OHM RELAY

2OHM RELAY

4 OHM MODE

2 OHM MODE

MAINS

EARTH LIFT

DRW G.BOCCATO	DWG# 550516	PRINTED CIRCUIT CODE :	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DISK:3 PART:1/1	SCHEMATIC DIAGRAM	
APP.C.ZUCCATTI	REV: 23-05-98	WIRING CONNECTIONS	

768077 - PROTECTIONS BOARD

MAINS (EU. VERSION)
230VAC +/-15% 50/60Hz
MAINS (U.S. VERSION)
115VAC +/-15% 50/60Hz

MAINS
MAINS POWER SWITCH
F6 T400mA
C1 100N 250VAC
T2
230V
WHITE
0V
22V
RED
BLACK
237060 - SERVICE TRANSFORMER 230V (EU. VER.)
237061 - SERVICE TRANSFORMER 115V (U.S. VER.)
CN3
F2 T1 6A
F1 T1 6A
D5 W02M
IC1 7815
IC3 7915
IC2 LM339
IC4 LM339
C12 2200U 35V
C23 2200U 35V
C21 10U
C22 10U
C19 100N
C20 100N
C11 100N
C15 100N
C10 10U
C14 10U
D2 4148
R2 10K
+24V
-24V
+15V
-15V

FAN STARTER
D1 4002
R5 6E8
R6 1K
TR4 BC560
R24 15K
C6 10U
R25 22K
FAN DRIVER
TR2 BC560
R4 10K
R17 1E5
TR1 TIP127
R3 1K
C1 100N
C3 22U
CN1
CN2
FAN+
FAN-

R27 10K
TR6 2N5550
R28 10K
R25 4K7
R23 470E
D12 4148

TRANSFORMER RELAY DRIVERS
C33 10U
C34 100N
R68 10K
R75 10K
C35 100N
R79 220K
R80 220K
R69 10K
R71 10K
R77 1K
C31 10U
R73 10K
D21 4002
C29 100N
TR31 BC337
R70 10K
R78 1K
C32 10U
R72 10K
R74 10K
D22 4002
C30 100N
TR32 BC337
CN7
4OHMRLY 1
GNDRLY 2
2OHMRLY 3
TO RELAIS

SOFT START CIRCUIT
R14 10K
R16 10K
C9 10N
D6 4148
D8 4148
R42 4K7
R43 4K7
R8 10K
R9 10K
R10 27K
R11 10K
C7 10U
D3 4148
D4 4148
C2 10U
R13 100E
R12 10K
R81 100E
TR5 BC550
C8 1U
TR3 BC560
IC2 LM339
R47 10K
TR19 BC550
R48 1K
R46 10K
C18 1N
D10 4148
R45 100E
TR18 BC550
R44 47K
R66 10K
TR29 BC550
R57 10K
TR28 BC550
R62 10K
SUPPLY TEMP. SENSOR
R65 47K
D13 4148
TR30 BC550
C36 1000U
R64 10K
-24V
CN8
SOFTSTART+ 1
OUT(CHB)` 2
PTC+ 3
PTC- 4
OUT(CHA)` 5
SOFTSTART- 6
TO POWER SUPPLY BOARD CN1

OC1 TLP521
D19 4002
D17 4148
R63 1K5
R67 47K
R56 10K
TR24 BC560
R50 10K
TR23 BC560
R51 47K
C26 1U
R49 100K
TR22 BC550
R35 10K
TR14 BC560
R34 1K
R38 47K
C16 1U
R37 10K
TR15 BC560
TR20 BC560
C25 1U
D11 4148
RL1
D16 28V 1W
D15 4148
C28 100N
R7 100E
D20 4002
RL1

DC DETECTOR
TR12 BC550
TR10 BC560
TR11 BC550
R22 100K
R2 10K
C5 1000U
R21 10K
R23 10K
TR7 BC550
TR8 BC560
TR9 BC550
R19 100K
R1 10K
C4 1000U
R20 10K
R30 10K
R40 10K
TR16 BC560
R54 10K
R39 10K
TR17 BC560
R55 10K
TR25 BC550
TR26 MJE802
R41 10K
C17 100U
D9 4002
R56 10K
R58 10K
R59 10K
R53 1K2
R52 1K2
TR27 BC550
R60 100K
TR21 BC550
R32 10K
C24 1U
D14 4148
R31 2K2
TR13 BC560
R33 1K

CN4
SOFTOUT+ 1
SOFTOUT- 2
SOFTIN+ 3
SOFTIN- 4
2OHMSEL 5
+24V 6
OUTRLY 7
8
-24V 9
SEND
RECEIVE
SEQUENCE LINK
+24V
OUTRLY
TO OUTPUT RELAY
4OHM
2OHM
MINIMUM LOAD

CN6
12 +24V
11 -15V
10 SGND
9
8 +15V
7 SDA
6 OUT(CHB)`
5 OUT(CHA)`
4 CHB-COMP
3 CHA-COMP
2 CHB-SIGN
1 CHA-SIGN
FROM INPUTS, POWER DRIVER & SDA PROCESSOR CN4

CN5
PROT(CHB) 1
SIGN(CHB) 2
CLIP(CHB) 3
4
SGND 5
6
SIGN(CHA) 7
CLIP(CHA) 8
PROT(CHA) 9

PCB#319024/1

768035 - CONTROLS & DISPLAY BOARD

CHB LEVEL
VR2 5KB
CHA LEVEL
VR1 5KB
CHB HOT 1
CHB CTR 2
CHB COLD 3
4
5
CHA HOT 6
CHA CTR 7
CHA COLD 8
9
FROM INPUTS DRIVERS & SDA PROCESSOR CN2

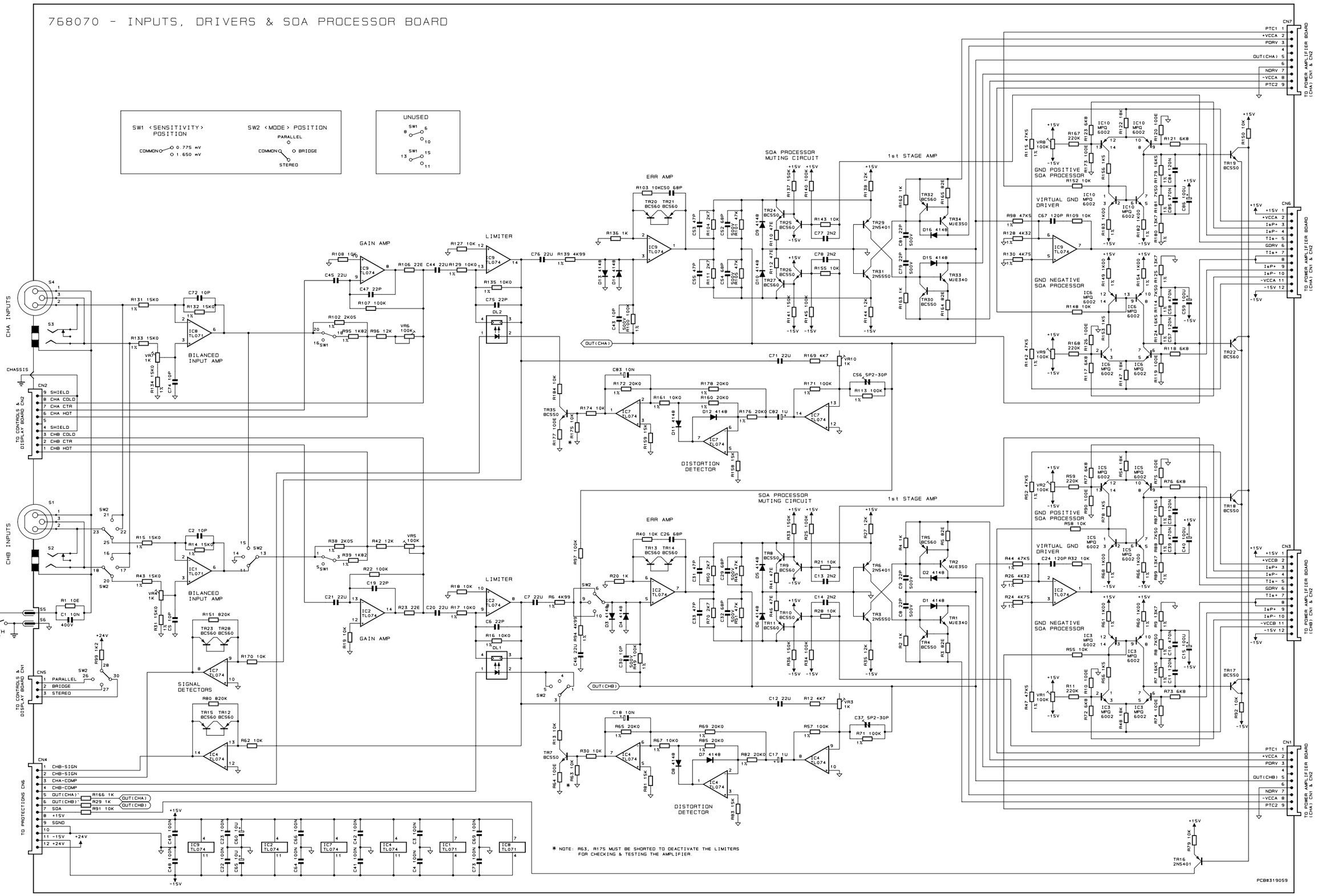
CHB PROTECT
DL5
CHB SIGN/CLIP
DL4
STEREO
DL3
BRIDGE
DL6
PARALLEL
DL7
CHA SIGNAL/CLIP
DL1
CHA PROTECT
DL2

CN1
1 PROT(CHB)
2 CLIP(CHB)
3 SIGN(CHB)
4 NC
5 STEREO
6 SGND
7
8 BRIDGE
9 PARALLEL
10 CLIP(CHA)
11 SIGN(CHA)
12 PROT(CHA)
STEREO
BRIDGE
PARALLEL

PCB#319045

DRW G.BOCCATO	DWG# 550517	PRINTED CIRCUIT CODE : 319024/1 319045	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DISK:3 PART: 1/1	SCHEMATIC DIAGRAM ENERGY 2	ALL RIGHTS ARE RESERVED. NO COPIES OR REPRODUCE THIS DOCUMENT WITHOUT WRITTEN CONSENT BY GENERALMUSIC.
APP. C.ZUCCATTI	REV: 23-05-98	PROTECTIONS BOARD	

768070 - INPUTS, DRIVERS & SOA PROCESSOR BOARD



DRW G.BOCCATO	DWG# 550519	PCB# 319059	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DSK# 3 PART: 1/1	SCHEMATIC DIAGRAM INPUTS, DRIVERS & SOA PROCESSOR BOARD	ALL RIGHTS ARE RESERVED, NO COPIES OR REPRODUCE THIS DOCUMENT WITHOUT WRITTEN CONSENT BY GENERALMUSIC
APP. C.ZUCCATTI	REV: 23-05-98		

768069 - POWER SUPPLY BOARD

768068 - AMPLIFIER BOARD (CHA) DUAL

SIGNAL POWER STAGE

GROUND POWER STAGE

DRW G. BOCCATO	DWG# 550518	PCB# 319053 - 319054 - 319041	GENERALMUSIC S.p.A. ITALY
CKD G. RICCI	DSK# 5 PART:	SCHEMATIC DIAGRAM ENERGY 2 POWER SUPPLY, POWER AMPLIFIER AND CONTROLLED BRIDGE BOARDS	ALL RIGHTS ARE RESERVED, NO COPIES OR REPRODUCE THIS DOCUMENT WITHOUT WRITTEN CONSENT BY GENERALMUSIC
APP.C. ZUCCATTI	REV: 20-05-98		

Spare Part List

abbreviation	explanation
(EU)	= specify Europe version
(US)	= specify U.S. version

Code		Description

Accessories

277286		Owner's Manual

Assembly

778072		Mains & Outs Cables Assembly
778071		Cables Assembly
778048		Supply Cables Assembly
667671		Filter Front Panel
667624		Rear Panel
667623		Front Panel
667542		Bottom Cover
667541		Top Cover
667539		Chassis
657232		Level Knob
340186		Adhesive Cable Fixing
238072		Main Transformer 230Vac 2100W (EU)
238073		Main Transformer 115Vac 2100W (US)
237060		Service Transformer 230Vac 60W (EU)
237061		Service Transformer 115Vac 60W (US)
210249		Air Foam Filter
210216		Adhesive Rubber Foam 20x5mm (Specify mt)
210215		Adhesive Rubber Foam 10x1.9mm (Specify mt)
190224		Lateroid Air Redirector
190222		Lateroid Cover
177542		Handle
130285		Mains Cable (EU) (US)
110317		Relay 24V / 1 Switch no 30A 250V
110291		Power Switch
110120		Fuse Clip 6,3x32mm
110115		Fuse Clip 5x20mm
110038		T15A Fuse 6.3x32mm (US)
110004		T400mA Fuse 5x20mm (EU)
030895		22000u 20% 63V Electrolytic Capacitor

Controls & Display Board

768035		**Controls & Display Board (Pcb#319045)**
141060	*	12 Contacts Vert Male Connector
141059	*	9 Contacts Vert Male Connector
080734	*	Led 2.5x5mm Rect Diff Red-Grn
080732	*	Led 2.5x5mm Rect Diff Yellow
080731	*	Led 2.5x5mm Rect Diff Red
074570	*	5K 31steps Linear Potentiometer

Protections Board

768077		**Protections Board (Pcb#319024)**
141060	*	12 Contacts Vert Male Connector
141059	*	9 Contacts Vert Male Connector
141058	*	6 Contacts Vert Male Connector
141056	*	3 Contacts Vert Male Connector
140068	*	3 Contacts Terminal Block
110305	*	Relay 12V / 2 Switch 1A 250V
110119	*	Fuse Clip 10A max (EU) (US)
110012	*	T1.6A Fuse 5x20mm (EU)
100929	*	TLP521-2 Dual Optocoupler
100921	*	LM339 Quad Voltage Comparator
100060	*	7815 +15V 1A Voltage Regulator
100049	*	7915 -15V 1A Voltage Regulator
090920	*	MJE802 TO126 Npn Darl Transistor
090558	*	TIP127 TO220 Pnp Darlington Transistor
090200	*	2N5550 TO92 Npn Transistor
090194	*	BC560 TO92 LN Pnp Transistor
090183	*	BC550 TO92 LN Npn Transistor
090152	*	BC337 TO92 Npn Transistor
080302	*	20V 1W 5% Zener Diode
080293	*	15V 1W 5% Zener Diode
080168	*	W02M 1.5A Rectifier Diodes Bridge
080156	*	1N4002 1A 100V Rectifier Diode
080103	*	1N4148 100mA 75V Signal Diode

Inputs, Drivers & SOA Processor Board

768070		**Inputs, Drivers & SOA Processor Board (Pcb#319059)**
757942	*	Manufacturer Analog Optoisolator
141184	*	Hor Female XLR Socket (NC3FPRH Neutrik)
141060	*	12 Contacts Vert Male Connector
141059	*	9 Contacts Vert Male Connector
141056	*	3 Contacts Vert Male Connector
140220	*	Jack Slim H F APJ678 Adimpex Socket
110299	*	4sw 2pos Horizontal Slider Switch
110255	*	6sw 3pos Vertical Slider Switch
100937	*	MPQ6002 Quad Compl Pair Trans
100084	*	TL074 Quad J-Fet Operational Amplifier
100019	*	TL071 LN J-Fet Operational Amplifier
090917	*	MJE350 TO126 Pnp Transistor
090916	*	MJE340 TO126 Npn Transistor
090201	*	2N5401 TO92 Pnp Transistor
090200	*	2N5550 TO92 Npn Transistor
090194	*	BC560 TO92 LN Pnp Transistor
090183	*	BC550 TO92 LN Npn Transistor
080103	*	1N4148 100mA 75V Signal Diode
070241	*	100K 20% Horizontal Linear Trimmer
070121	*	1K 20% Horizontal Linear Trimmer
042725	*	100K 1/4W 1% Metalized Film Resistor
042685	*	47K5 1/4W 1% Metalized Film Resistor
042634	*	20K0 1/4W 1% Metalized Film Resistor
042628	*	16K5 1/4W 1% Metalized Film Resistor
042625	*	15K0 1/4W 1% Metalized Film Resistor
042616	*	13K7 1/4W 1% Metalized Film Resistor
042605	*	10K0 1/4W 1% Metalized Film Resistor
042586	*	7K50 1/4W 1% Metalized Film Resistor
042565	*	4K99 1/4W 1% Metalized Film Resistor
042564	*	4K75 1/4W 1% Metalized Film Resistor
042557	*	4K32 1/4W 1% Metalized Film Resistor
042515	*	2K05 1/4W 1% Metalized Film Resistor
042513	*	1K82 1/4W 1% Metalized Film Resistor
042485	*	1K00 1/4W 1% Metalized Film Resistor
010602	*	5p2-30pF N750 Ceramic Capacitor Trimmer

Controlled Bridge Assembly

727551		**Quad Controlled Bridge Assembly (Pcb#319041 x4)**
340078	*	TO220 Insulated Bush
177587	*	Heatsink
141061	*	3 Contacts Hor Male Connector
120857	*	Vertical Male Faston 6.3mm
080608	*	36MB20A 35A 200V Rectifier Diode Bridge
080553	*	BTW69 40A 200V TO3 Scr Diode

Power Supply Assembly

727547		**Power Supply Assembly**
768069	*	Power Supply Board (Pcb#319054)
778074	**	Supply Cables Assembly
141059	**	9 Contacts Vert Male Connector
141058	**	6 Contacts Vert Male Connector
100929	**	TLP521-2 Dual Optocoupler
090201	**	2N5401 TO92 Pnp Transistor
090200	**	2N5550 TO92 Npn Transistor
090194	**	BC560 TO92 LN Pnp Transistor
080293	**	15V 1W 5% Zener Diode
080158	**	1N4006 1A 800V Rectifier Diode
080103	**	1N4148 100mA 75V Signal Diode
060591	**	8K2 2W 10% Resistor
060560	**	4K7 1W 5% Resistor
060034	**	0E15 5W 5% Wire Resistor
667545	*	Heatsink
558006	*	Quadruple MJL21194 Selection
090924	**	MJL21194 TO264 Npn Transistor
340079	*	TO220 Mica Washer
340078	*	TO220 Insulated Bush
090918	*	MJE15030 TO220 Npn Transistor
090917	*	MJE350 TO126 Pnp Transistor
090916	*	MJE340 TO126 Npn Transistor
080821	*	Ptc 90 PTH59F04BE222TS
080172	*	MUR1510 15A 100V Ultrafast Recovery Diode

Amplifiers Assembly

737065		**Dual Amplifiers Assembly with Fans**
727548	*	Fan Assembly
141055	**	Female Crimping Contact
141050	**	3 Contacts Female Connector Housing
110363	**	24Vdc (80x32cm) Fan
727546	*	Amplifier Assembly
768068	**	Amplifier Board (Pcb#319053)
778073	***	Amplifier Cables Assembly
230578	***	2u7H Vert Coil For Amplifier
230530	***	1uh 10% 630ma Rf Coil
141065	***	12 Contacts Hor Male Connector
141063	***	6 Contacts Hor Male Connector
090194	***	BC560 TO92 LN Pnp Transistor
090183	***	BC550 TO92 LN Npn Transistor
080158	***	1N4006 1A 800V Rectifier Diode
080156	***	1N4002 1A 100V Rectifier Diode
080103	***	1N4148 100mA 75V Signal Diode
070106	***	470E 20% Horizontal Linear Trimmer
060174	***	2E7 5W 10% Wire Resistor
060171	***	2E2 2W 10% Resistor
042345	***	75E0 1/4W 1% Metalized Film Resistor
667543	**	Heatsink
558005	**	Triple Selected Kit of MJL21194
090924	***	MJL21194 TO264 Npn Transistor
558004	**	Triple Selected Kit of MJL21193
090923	***	MJL21193 TO264 Pnp Transistor
340750	**	TO126 Mica Washer
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
190225	**	Lateroid Air Redirector
100925	**	LM334 Adjustable Current Source TO92
090920	**	MJE802 TO126 Npn Darl Transistor
090919	**	MJE15031 TO220 Pnp Transistor
090918	**	MJE15030 TO220 Npn Transistor
090917	**	MJE350 TO126 Pnp Transistor
090916	**	MJE340 TO126 Npn Transistor
080821	**	Ptc 90 PTH59F04BE222TS
190223	*	Lateroid Protection

Note:

Each spare part is single quantity unless otherwise specified.	
Asterisk prefix explanation:	
Omitted	= First level spare part.
One asterisk	= Second level, part of previous listed first level part.
Two asterisk	= Third level, part of previous listed second level part.
Three asterisk	= .....
Any request for not above mentioned part must encompass specific description including:	
1) Model name,	
2) Section name,	
3) Module code,	
4) Reference name,	
5) Quantity number.	