AVALON SERIES

LOUDSPEAKER SYSTEMS

passive **active**

12 — 12 A

15 — 15 A

15 S — 15 SA

SERVICE MANUAL

GENERALMUSIC®

CODE: 270241

Index

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

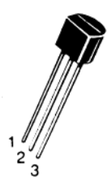
GENERALMUSIC S.p.A. Sales Division: 47842 S.Giovanni in Marignano (RN) ITALY - Via delle Rose, 12 - tel. 0541/959511 - fax 0541/957404
GENERALMUSIC on the NET: http://www.generalmusic.com

AVALON TECHNICAL SPECIFICATIONS

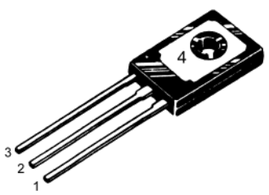
		AV-12	AV-15	AV-15S
LOUDSPEAKER SPECIFICATIONS				
COMPONENTS	*High*	1" tweeter with phasing plug and EWT horn	1" compression driver with EWT horn	
	Low	12" woofer	15" woofer	15" woofer
POWER HANDLING	*W continuous*	200	350	350
(EIA RS-426A)	*W peak*	400	600	600
IMPEDANCE	*Ohms*	4 / 8	4 / 8	4
PASSIVE CROSSOVER	*Hz*	5 kHz 8 Ω: 6 / 12 dB/oct. 4 Ω: 0 / 12 dB/oct.	2,6 kHz 8 Ω: 6 / 12 dB/oct. 4 Ω: 12 / 18 dB/oct.	200 Hz 12 / 6 dB/oct.
CONNECTIONS (passive versions)		4-way SPEAKON + JACK (input + link)		
CONSTRUCTION		High density polyetylene enclosure + polyetylenic foam Protection metal grid		
DIMENSIONS	*mm (WxHxD)*	436x616x420	500x706x490	500x706x490
WEIGHT (passive / active)	*kg*	15 / 18,5	20 / 26	18,5 / 24,5
AMPLIFIER SPECIFICATIONS (active versions)				
EIA OUTPUT POWER (1kHz, max THD 1%)	*W*	180	300	300
POTENZA D'USCITA IHF (Tone burst 10% 20 ms Max THD 0,1%)	*W*	200	350	350
INPUT SENSITIVITY	*dB (V)*	0 (0.775V)		
INPUT IMPEDANCE	*kohms*	30 (balanced) - 15 (unbalanced)		
ACTIVE CROSSOVER	*Hz*			From 80 to 320 @ 12db/oct.
DISTORSION	*%*	<0.02 (THD+Noise)		
CONTROLS		Volume - Shield on/off - XOVER frequency (AV-15SA)		
DISPLAY		SIGNAL/LIMIT LED - ON LED		
CONNECTIONS		COMBO + XLR-M (input + link)		COMBO + XLR-M (input) XLR-M (output)
POWER SUPPLY		See label on the apparatus		
SYSTEM SPECIFICATIONS				
SENSITIVITY (SPL 1W/1m)	*dB*	97	99	97
MAX SPL continuous	*dB*	120	124	122
MAX SPL peak	*dB*	123	127	125
FREQUENCY RESPONSE	*Hz (-10dB)*	70-20000	60-20000	50-200
DISPERSION (OxV)		60x40	60x40	
NOTE:	* Measured with the anti-clipping circuit off.			

Transistor Packages

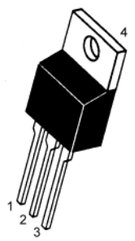
TO92
BC550, BC560:
1=Collector
2=Base
3=Emitter
2N5401, 2N5550
1=Emitter
2=Base
3=Collector



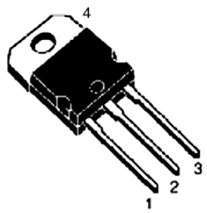
TO126
MJE340, MJE350, MJE802:
1=Emitter
2=Collector
3=Base
4=Collector



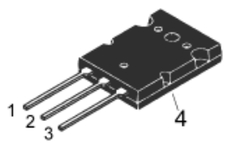
TO220
MJE15030,MJE15031:
1=Base
2=Collector
3=Emitter
4=Collector



TO218
TIP35C,TIP36C, MJE4342, MJE4352:
1=Base
2=Collector
3=Emitter
4=Collector

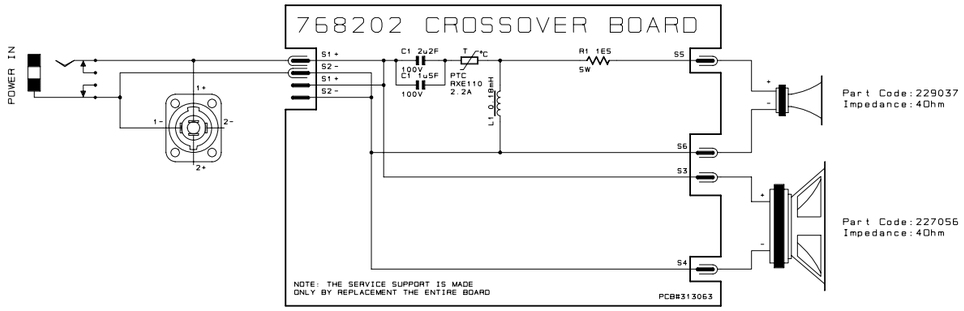


TO264
MJL21193, MJL21194:
1=Base
2=Collector
3=Emitter
4=Collector



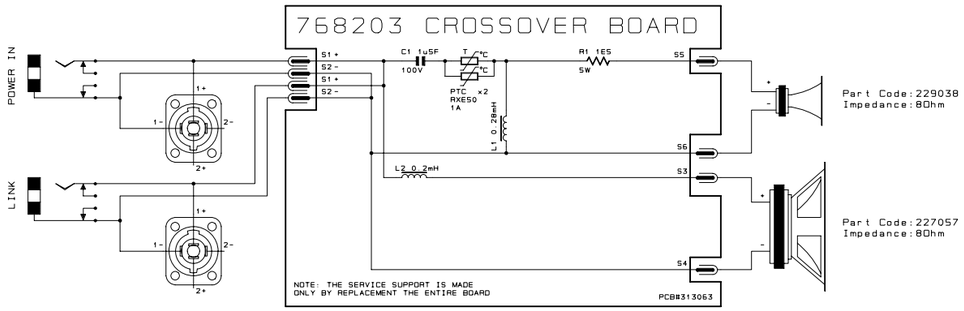
AV12-4

SPECIFICATION	
WAYS	2
XOVER FREQ.	4000Hz
SLOPE LP	0dB/oct.
SLOPE HP	12dB/oct.
POWER max.	200W
IMPEDANCE (nominal)	4ohm



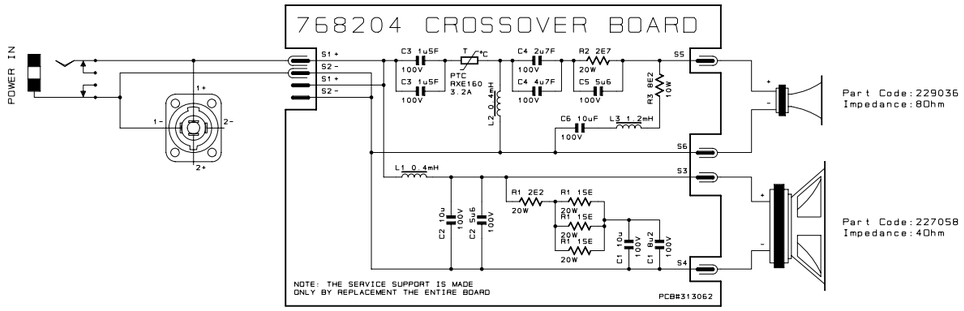
AV12-8

SPECIFICATION	
WAYS	2
XOVER FREQ.	5000Hz
SLOPE LP	6dB/oct.
SLOPE HP	12dB/oct.
POWER max.	200W
IMPEDANCE (nominal)	8ohm



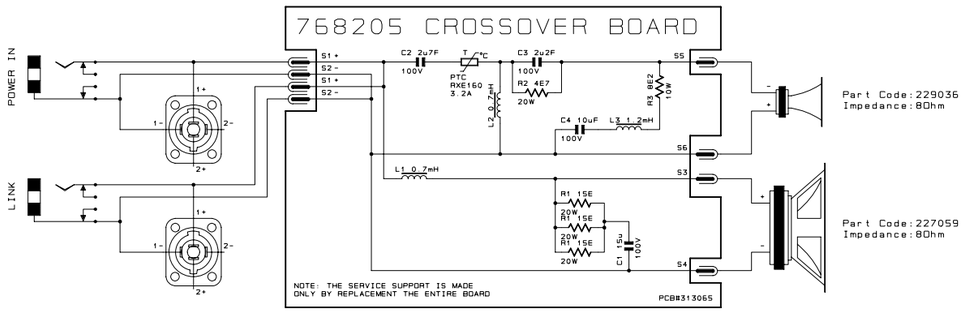
AV15-4

SPECIFICATION	
WAYS	2
XOVER FREQ.	2600Hz
SLOPE LP	12dB/oct.
SLOPE HP	18dB/oct.
POWER max.	350W
IMPEDANCE (nominal)	4ohm



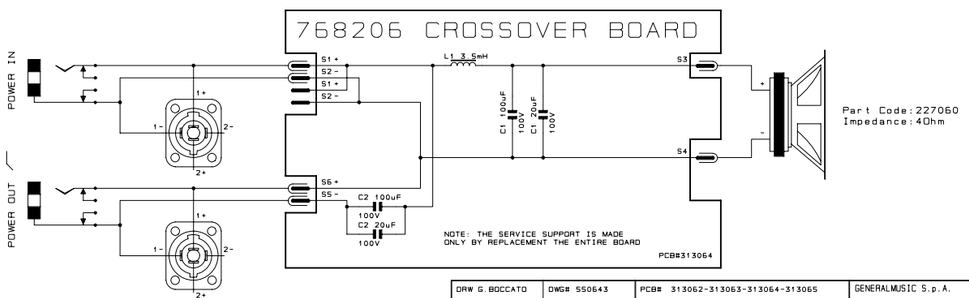
AV15-8

SPECIFICATION	
WAYS	2
XOVER FREQ.	2600Hz
SLOPE LP	6dB/oct.
SLOPE HP	12dB/oct.
POWER max.	350W
IMPEDANCE (nominal)	8ohm



AV15S

SPECIFICATION	
WAYS	1
XOVER FREQ.	250Hz
SLOPE LP	12dB/oct.
SLOPE HP	6dB/oct.
POWER max.	350W
IMPEDANCE (nominal)	4ohm



DRW G.BOCCATO	DWG# 550643	PCB# 313062-313063-313064-313065	GENERALMUSIC S.p.A.
CKD R.MAGALOTTI	DATE 30-09-99	DESCRIPTION Avalon Passive	
APP C.ZUCCATTI	REV# A		

Spare Part List (PASSIVE VERSIONS)

Code	Description

Accessories

277334	Owner's Manual

AV-12 4 Ohm

778112	Cables Assembly	
727601	Inputs Panel Assembly AV-12/4 Ohm	
778144	*	Jack-Speakon Cables Assembly
141200	**	Speakon Socket (NL4MP Neutrik)
140193	**	Jack Mono Socket
768202	*	**Crossover Filter Board (Pcb#313063) AV-12/4 Ohm**
667692	*	Rear Panel AV-12/4 Ohm
667702	Handle	
667700	Grid	
657270	EWT(TM) Elliptical Horn	
657267	Box	
229037	**1" 4ohm Horn Tweeter**	
227056	**12" 4ohm Woofer Speaker**	
210242	Filler for Speaker Box (Specify m²)	
210217	Black Sealer (specify mt)	
210215	Adhesive Rubber Foam 10x1.9mm (Specify mt)	
210211	Gasket between Tweeter and Horn	
120964	M4i M5e x17.5mm Threaded Pin for Woofer	
120148	Screw M5x65mm for Handle	
120147	Screw M4x8mm for Speakers	

AV-12 8 Ohm

778112	Cables Assembly	
727602	Inputs Panel Assembly AV-12/8 OHM	
778144	*	Jack-Speakon Cables Assembly
141200	**	Speakon Socket (NL4MP Neutrik)
140193	**	Jack Mono Socket
768203	*	**Crossover Filter Board (Pcb#313063) AV-12/8 Ohm**
667693	*	Rear Panel AV-12/8 Ohm
667702	Handle	
667700	Grid	
657270	EWT(TM) Elliptical Horn	
657267	Box	
229038	**1" 8ohm Horn Tweeter**	
227057	**12" 8ohm Woofer Speaker**	
210242	Filler for Speaker Box (Specify m²)	
210217	Black Sealer (specify mt)	
210215	Adhesive Rubber Foam 10x1.9mm (Specify mt)	
210211	Gasket between Tweeter and Horn	
120964	M4i M5e x17.5mm Threaded Pin	
120148	Screw M5x65mm for Handle	
120147	Screw M4x8mm for Speakers	

AV-15 4 Ohm

778112	Cables Assembly	
727603	Inputs Panel Assembly AV-15/4 Ohm	
778144	*	Jack-Speakon Cables Assembly
141200	**	Speakon Socket (NL4MP Neutrik)
140193	**	Jack Mono Socket
768204	*	**Crossover Filter Board (Pcb#313062) AV-15/4 Ohm**
667694	*	Rear Panel AV-15/4 Ohm
667703	Handle	
667701	Grid	
657270	EWT(TM) Elliptical Horn	
657268	Box	
229036	**1" 8ohm Horn Compression Driver**	
227058	**15" 4ohm Woofer Speaker**	
210242	Filler for Speaker Box (Specify m²)	
210217	Black Sealer (specify mt)	
210215	Adhesive Rubber Foam 10x1.9mm (Specify mt)	
210211	Gasket between Tweeter and Horn	
120965	M4i M5e x24mm Threaded Pin	
120148	Screw M5x65mm for Handle	
120147	Screw M4x8mm for Speakers	

AV-15 8 Ohm

727604	Inputs Panel Assembly AV-15/4 Ohm	
778144	*	Jack-Speakon Cables Assembly
141200	**	Speakon Socket (NL4MP Neutrik)
140193	**	Jack Mono Socket
768205	*	**Crossover Filter Board (Pcb#313065) AV-15/8 Ohm**
667695	*	Rear Panel AV-15/8 Ohm
667703	Handle	
667701	Grid	
657270	EWT(TM) Elliptical Horn	
657268	Box	
229036	**1" 8ohm Horn Compression Driver**	
227059	**15" 8ohm Woofer Speaker**	
210242	Filler for Speaker Box (Specify m²)	
210217	Black Sealer (specify mt)	
210215	Adhesive Rubber Foam 10x1.9mm (Specify mt)	
210211	Gasket between Tweeter and Horn	
120965	M4i M5e x24mm Threaded Pin	
120148	Screw M5x65mm for Handle	
120147	Screw M4x8mm for Speakers	

AV-15S 4 Ohm

841208	Cables Assembly	
727605	Inputs Panel Assembly AV-15S/4 Ohm	
778144	*	Jack-Speakon Cables Assembly
141200	**	Speakon Socket (NL4MP Neutrik)
140193	**	Jack Mono Socket
768206	*	**Crossover Filter Board (Pcb#313064) AV-15S/4 Ohm**
667696	*	Rear Panel AV-15S/4 Ohm
667703	Handle	
667701	Grid	
657269	Box	
347393	Threaded Clog (to steady on the floor)	
227060	**15" 4ohm Woofer Speaker**	
210242	Filler for Speaker Box (Specify m²)	
210217	Black Sealer (specify mt)	
210215	Adhesive Rubber Foam 10x1.9mm (Specify mt)	
177721	Fixing Plate (to fix the Floor Bracket)	
120965	M4i M5e x24mm Threaded Pin	
120148	Screw M5x65mm for Handle	
120147	Screw M4x8mm for Speakers	
667704	Floor Bracket with Threaded Knobs	

Note:

Each spare part is single quantity unless otherwise specified.

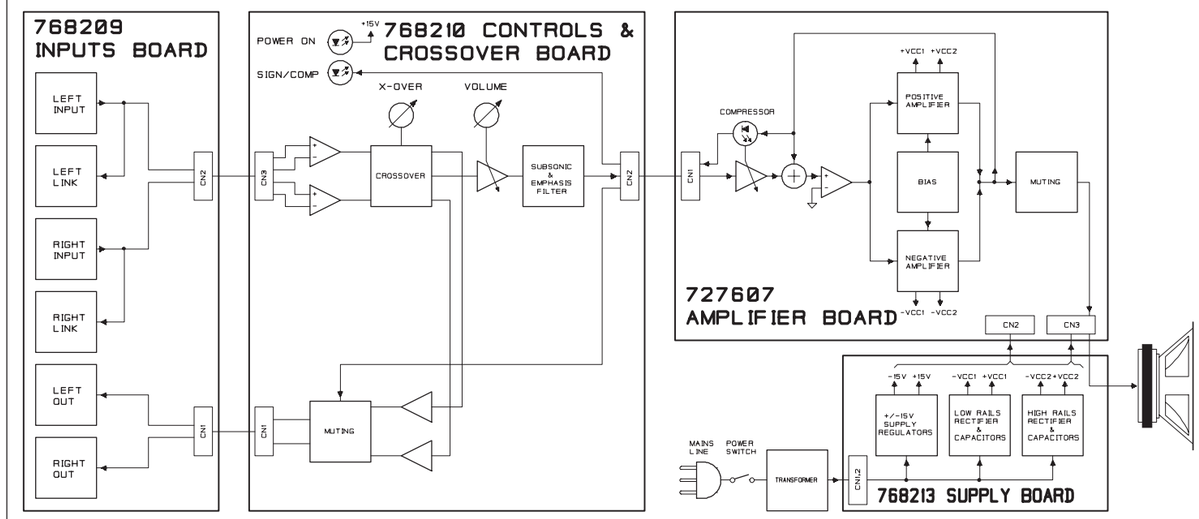
Asterisk prefix explanation:

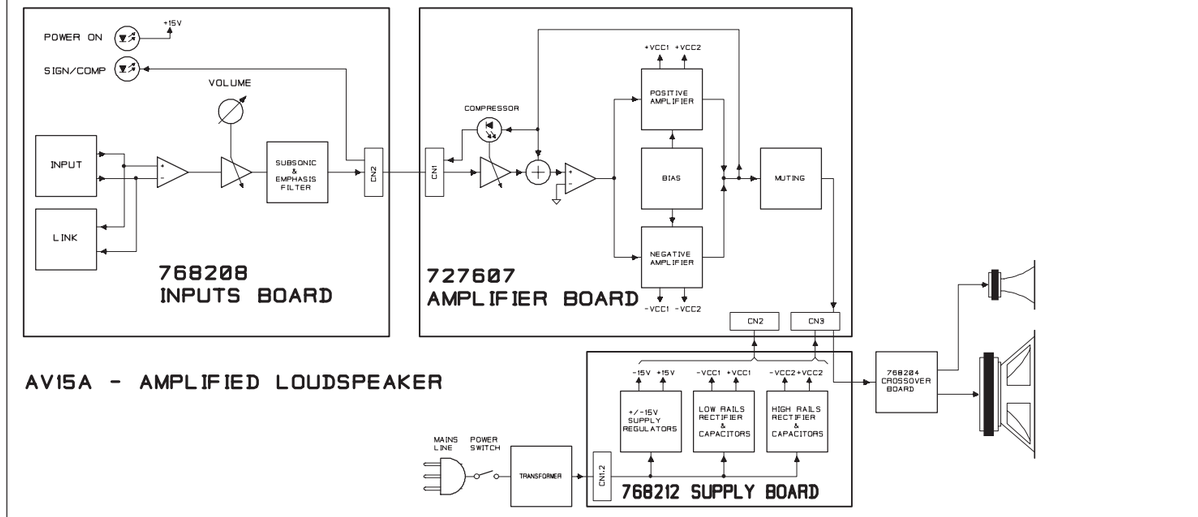
Omitted	= First level spare part.
One asterisk	= Second level, part of previous listed first level part.
Two asterisk	= Third level, part of previous listed second level part.
Three asterisk	= .....

Any request for not above mentioned part must encompass specific description including:

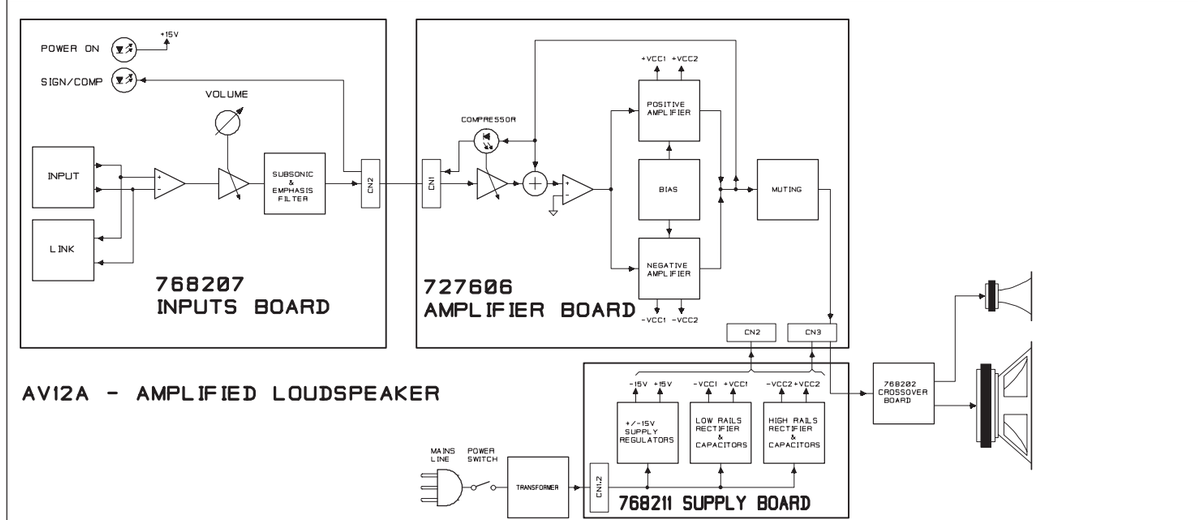
1) Model name,
2) Section name,
3) Module code,
4) Reference name,
5) Quantity number.

AV15SA - AMPLIFIED SUBWOOFER SPEAKER - BLOCK DIAGRAM





AV15A - AMPLIFIED LOUDSPEAKER



AV12A - AMPLIFIED LOUDSPEAKER

DRW G.BOCCATO	DWG# 550644	PCB#	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DSK# 5 PART: 1/1	SCHEMATIC DIAGRAM AVALON SERIES ACTIVE	
APP. C.ZUCCATTI	REV: 09/10/99	BLOCK DIAGRAMS	

TEST PROCEDURES & ADJUSTMENTS

These procedures are relative to the ACTIVE versions (amplified loudspeakers) only.

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 10W 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 amplified speaker.
- **Do not check the amplifier with the speaker connected use only an appropriate load resistor.**

Remarks

- The power supply utilizes a dual bipolar DC rail configuration with low and high voltages; one positive and one negative low rail (+/-Vcc1) and one positive and one negative high rail (+/-Vcc2).

Visual Check

- Check the speakers for any damaging (cone-breaking, interruption or so).
- 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
- Temperature Meter
- 4Ω 500W, 100Ω 10W resistors
- Variac (0÷250Vac)

AV12A Amplified Loudspeaker

The following adjustment and notes are relative to this model only.

TECHNICAL SPECIFICATIONS

Dimensions:	(WxHxD)	436x616x420mm
Weight:		28,5Kg
Power Requirements:	(230Vac±10% 50Hz)	210VA
	(115Vac±10% 50/60Hz)	210VA
Output Power*:	(4Ω)	200W
Max. Undistorted Out*:	(4Ω)	80Vpp
Sensitivity:	(1W/1m)	97dB$_{SPL}$
Max SPL:	(continuous)	120dB$_{SPL}$
	(peak)	123dB$_{SPL}$
Frequency Response	(amplifier+speaker)	70Hz÷20kHz
	(only amplifier -3dB)	10Hz÷60kHz
Input Sensitivity:	(0dB)	0.775V$_{RMS}$
Input Impedance:	(balanced)	30KΩ
	(unbalanced)	15KΩ
Voltage Gain:		31±1dB
IMD:	(SMPTE 60Hz/7KHz 4:1)	<0.1%
THD:	(THD+N)	<0.1%
S/N Ratio:	(unweighted)	>100dB

*Note: measured with the limiter deactivated.

Setup

- Connect the Variac between the mains and the amplifier and set it at zero voltage.
- Turn full clockwise the LEVEL potentiometer.
- Connect the audio generator to the channel input and set it to 1kHz 775mV$_{RMS}$ (0dB) sinusoidal signal.
- Place the temperature sensor between heatsink and the PTC (R59).
- The procedures that follow must be executed subsequently in the order specified.

Supply Check

- Remove the transformer secondary fuses (located on SUPPLY board), set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:

  F1-F2=76±2Vac

  F3-F4=42±1.5Vac.
- Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
- Connect the oscilloscope probe CH1 to the channel output, before RL1, set it to 20V/div. 1mS/div.
- Set up the Variac slowly monitoring the Outputs with the oscilloscope CH1 connected, it should display the sinusoidal input signal amplified with no distortions, if a distortion occur check the AMPLIFIER board as suggested in the ADVICES section.
- If the protection trips, turn off the amplifier, wait some minutes and disconnect the supplies from the amplifier module (CN2, CN3 on AMPLIFIER board), continue to check the supplies.
- Finally verify the DC supplies on SUPPLY board:

CN2 pin 5 (+Vcc2)	=+54±2Vdc
CN3 pin 1 (+Vcc1)	=+29±1.5Vdc
CN3 pin 5-6 (-Vcc1)	=-29±1.5Vdc
CN3 pin 4 (-Vcc2)	=-54±2Vdc
CN2 pin 3	=+15±1Vdc
CN2 pin 2	=-15±1Vdc

- If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry, refer to schematics.

Channels Check

- Verify, with the Multimeter, the insulation between the heatsink and the transistors collectors.
- Verify, with the Multimeter, the PTC resistor value (R59), it must be between 50Ω and 200Ω.
- **SETUP:**

  Connect the CH1 scope GND clip to CN2 pin 6 (SGND terminal).

  Connect the CH1 probe tip to CN3 pin 2 or 3 (PWR out).

  Connect the CH2 probe tip to D20 anode and set its sensitivity at 5V/div.

  Set the LEVEL potentiometer full clockwise.

  The load resistor is disconnected.
- **INITIAL TEST:**

  Increase slowly the Variac. The channel output signals must be symmetrical respect the GND without visible distortion and oscillation as shown in *Fig.1 Trace A* (*Trace B* shown the amplifier 2nd stage input). If there is a distortion read the section ADVICES.
- **HIGH RAIL CHECK:**

  Connect the CH2 probe tip to D25 cathode and set its sensitivity at 20V/div. When the output signal (Positive half-wave) is less than 22Vp the voltage on D25 cathode must remain constant at 28V, when the output signal exceeds 22Vp the voltage must follow the output signal with 6V offset (see *Fig.2 Trace B*), to check the negative high rail connect the probe to D26 anode (see *Fig.2 Trace C*).
- Connect the 4Ω 500W load on the output and repeat the INITIAL and HIGH RAIL checks.
- **GAIN ADJUSTMENT:**

  Set the generator level at -10dB (0,245V$_{RMS}$), adjust the trimmer VR2 on INPUTS board to obtain an output level of 14.5Vp (10V$_{RMS}$).
- Re-set the generator level at 0dB (0,775V$_{RMS}$),
- **SIGN/COMP SENSOR CHECK:**

  Set the LEVEL pot to minimum, set the scope timebase at 1V/div. 1mS/div., then increase the level and check the SIGNAL/COMP led activity: it must turn on (green light) when the amplifier output is higher than 1Vp. Set the scope at 20V/div. and increase the level, check the led: it must change from green to red colour when the amplifier output signal is 36±2Vp, increasing the input level the output signal must keep the same level, this is due to the limiter-compression circuitry (IC2, DL1, IC1).
- **BIAS ADJUSTMENT:**

  With resistive load connected wait until the temperature reach 50°c.

  Set the generator level at zero, connect the Multimeter across the resistors R60, then adjust VR1 trimmer to read 13±0.5mVdc.
- **BANDWIDTH CHECK:**

  Switch alternatively the generator frequency to 100Hz and 10kHz, no level changes must be detectable respect 1kHz.
- **OFFSET SENSOR CHECK:**

  Set the Variac to zero voltage output, disconnect resistive load from the amplifier output, connect temporarily (by means of a suitable conductor wire) CN2 pin 3 (+15Vdc) to R72 side RL1, the protection circuitry (TR14,15,16) detect the DC voltage and open the output relay (RL1) within 3 seconds approx.

  Remove the connection, wait until the relay switch on and after some seconds repeat the check with -15Vdc (available on CN2 pin 2), the protection circuitry must open the relay again.
- **SIGNAL TO NOISE RATIO CHECK:**

Disconnect the audio generator and short the input (pin 1,2,3 of XLR socket shorted) the output signal (noise) must be less than 1mV.

AV15A Amplified Loudspeaker

The following adjustment and notes are relative to this model only.

TECHNICAL SPECIFICATIONS

Dimensions:	(WxHxD)	500x706x490mm
Weight:		26Kg
Power Requirements:	(230Vac±10% 50Hz)	370VA
	(115Vac±10% 50/60Hz)	370VA
Output Power*:	(4Ω)	350W
Max. Undistorted Out*:	(4Ω)	105Vpp
Sensitivity:	(1W/1m)	99dB$_{SPL}$
Max SPL:	(continuous)	124dB$_{SPL}$
	(peak)	127dB$_{SPL}$
Frequency Response	(amplifier+speaker)	60Hz÷20kHz
	(only amplifier -3dB)	10Hz÷60kHz
Input Sensitivity:	(0dB)	0.775V$_{RMS}$
Input Impedance:	(balanced)	30KΩ
	(unbalanced)	15KΩ
Voltage Gain:		33±1dB
IMD:	(SMPTE 60Hz/7KHz 4:1)	<0.1%
THD:	(THD+N)	<0.1%
S/N Ratio:	(unweighted)	>100dB

*Note: measured with the limiter deactivated.

Setup

- Connect the Variac between the mains and the amplifier and set it at zero voltage.
- Turn full clockwise the LEVEL potentiometer.
- Connect the audio generator to the channel R input and set it to 150Hz 775mV$_{RMS}$ (0dB) sinusoidal signal.
- Place the temperature sensor between heatsink and the PTC (R59).
- The procedures that follow must be executed subsequently in the order specified.

Supply Check

- Remove the transformer secondary fuses (located on SUPPLY board), set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:

  F1-F2=102±2Vac

  F3-F4=60±1.5Vac.
- Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
- Connect the oscilloscope probe CH1 to the channel output, before RL1, set it to 20V/div. 1mS/div.
- Set up the Variac slowly monitoring the Outputs with the oscilloscope CH1 connected, it should display the sinusoidal input signal amplified with no distortions, if a distortion occur check the AMPLIFIER board as suggested in the ADVICES section.
- If the protection trips, turn off the amplifier, wait some minutes and disconnect the supplies from the amplifier module (CN2, CN3 on AMPLIFIER board), continue to check the supplies.
- Finally verify the DC supplies on SUPPLY board:

  CN2 pin 5 (+Vcc2) =+71±2Vdc

  CN3 pin 1 (+Vcc1) =+42±1.5Vdc

  CN3 pin 5-6 (-Vcc1) =-42±1.5Vdc

  CN3 pin 4 (-Vcc2) =-71±2Vdc

  CN2 pin 3 =+15±1Vdc

  CN2 pin 2 =-15±1Vdc
- If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry, refer to schematics.

Channels Check

- Verify, with the Multimeter, the insulation between the heatsink and the transistors collectors.
- Verify, with the Multimeter, the PTC resistor value (R59), it must be between 50Ω and 200Ω.
- **SETUP:**

  Connect the CH1 scope GND clip to CN2 pin 6 (SGND terminal).

  Connect the CH1 probe tip to CN3 pin 2 or 3 (PWR out).

  Connect the CH2 probe tip to D20 anode and set its sensitivity at 5V/div.

  Set the LEVEL potentiometer full clockwise.

  The load resistor is disconnected.
- **INITIAL TEST:**

  Increase slowly the Variac. The channel output signals must be symmetrical respect the GND without visible distortion and oscillation as shown in *Fig.1 Trace A* (*Trace B* shown the amplifier 2nd stage input). If there is a distortion read the section ADVICES.
- **HIGH RAIL CHECK:**

  Connect the CH2 probe tip to D25 cathode and set its sensitivity at 20V/div. When the output signal (Positive half-wave) is less than 34Vp the voltage on D25 cathode must remain constant at 40V, when the output signal exceeds 40Vp the voltage must follow the output signal with 6V offset (see *Fig.2 Trace B*), to check the negative high rail connect the probe to D26 anode (see *Fig.2 Trace C*).
- Connect the 4Ω 500W load on the output and repeat the INITIAL and HIGH RAIL checks.
- **GAIN ADJUSTMENT:**

  Set the generator level at -10dB (0,245V$_{RMS}$), adjust the trimmer VR2 on INPUTS board to obtain an output level of 19Vp (13.4V$_{RMS}$).
- Re-set the generator level at 0dB (0,775V$_{RMS}$),
- **SIGN/COMP SENSOR CHECK:**

  Set the LEVEL pot to minimum, set the scope timebase at 1V/div. 1mS/div., then increase the level and check the SIGNAL/COMP led activity: it must turn on (green light) when the amplifier output is higher than 1Vp. Set the scope at 20V/div. and increase the level, check the led: it must change from green to red colour when the amplifier output signal is 50±2Vp, increasing the input level the output signal must keep the same level, this is due to the limiter-compression circuitry (IC2, DL1, IC1).
- **BIAS ADJUSTMENT:**

  With the load connected wait until the temperature reach 50°c.

  Set the generator level at zero, connect the Multimeter across the resistors R60, then adjust VR1 trimmer to read 15±0.5mVdc.
- **BANDWIDTH CHECK:**

  Switch alternatively the generator frequency to 100Hz and 10kHz, no level changes must be detectable respect 1kHz.
- **OFFSET SENSOR CHECK:**

  Set the Variac to zero voltage output, disconnect resistive load from the amplifier output, connect temporarily (by means of a suitable conductor wire) CN2 pin 3 (+15Vdc) to R72 side RL1, the protection circuitry (TR14,15,16) detect the DC voltage and open the output relay (RL1) within 3 seconds approx.

  Remove the connection, wait until the relay switch on and after some seconds repeat the check with -15Vdc (available on CN2 pin 2), the protection circuitry must open the relay again.
- **SIGNAL TO NOISE RATIO CHECK:**

  Disconnect the audio generator and short the input (pin 1,2,3 of XLR socket shorted) the output signal (noise) must be less than 1mV.

AV15SA Amplified Subwoofer

The following adjustment and notes are relative to this model only.

TECHNICAL SPECIFICATIONS

Dimensions:	(WxHxD)	500x706x490mm
Weight:		24,5Kg
Power Requirements:	(230Vac±10% 50Hz)	370VA
	(115Vac±10% 50/60Hz)	370VA
Output Power*:	(4Ω)	350W
Max. Undistorted Out*:	(4Ω)	105Vpp
Sensitivity:	(1W/1m)	97dB$_{SPL}$
Max SPL:	(continuous)	122dB$_{SPL}$
	(peak)	125dB$_{SPL}$
Frequency Response	(filter+amplifier+speaker)	50Hz÷320Hz
	(only amplifier -3dB)	10Hz÷60KHz
Input Sensitivity:	(0dB)	0.775V$_{RMS}$
Input Impedance:	(balanced)	30KΩ
	(unbalanced)	15KΩ
Voltage Gain:	(@150Hz)	33±1dB
IMD:	(SMPTE 60Hz/7KHz 4:1)	<0.1%
THD:	(THD+N)	<0.1%
S/N Ratio:	(unweighted)	>100dB

Setup

- Connect the Variac between the mains and the amplifier and set it at zero voltage.
- Turn full clockwise the LEVEL and X-OVER potentiometers.
- Connect the audio generator to the channel R input and set it to 150Hz 775mV$_{RMS}$ (0dB) sinusoidal signal.
- Place the temperature sensor between heatsink and the PTC (R59).
- The procedures that follow must be executed subsequently in the order specified.

Supply Check

- Remove the transformer secondary fuses (located on SUPPLY board), set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:

  F1-F2=102±2Vac

  F3-F4=60±1.5Vac.
- Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
- Connect the oscilloscope probe CH1 to the channel output, before RL1, set it to 20V/div. 1mS/div.
- Set up the Variac slowly monitoring the Outputs with the oscilloscope CH1 connected, it should display the sinusoidal input signal amplified with no distortions, if a distortion occur check the AMPLIFIER board as suggested in the ADVICES section.
- If the protection trips, turn off the amplifier, wait some minutes and disconnect the supplies from the amplifier module (CN2, CN3 on AMPLIFIER board), continue to check the supplies.
- Finally verify the DC supplies on SUPPLY board:

CN2 pin 5 (+Vcc2)	=+71±2Vdc
CN3 pin 1 (+Vcc1)	=+42±1.5Vdc
CN3 pin 5-6 (-Vcc1)	=-42±1.5Vdc
CN3 pin 4 (-Vcc2)	=-71±2Vdc
CN2 pin 3	=+15±1Vdc
CN2 pin 2	=-15±1Vdc

- If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry, refer to schematics.

Channels Check

- Verify, with the Multimeter, the insulation between the heatsink and the transistors collectors.
- Verify, with the Multimeter, the PTC resistor value (R59), it must be between 50Ω and 200Ω.
- **SETUP:**

  Connect the CH1 scope GND clip to CN2 pin 6 (SGND terminal).

  Connect the CH1 probe tip to CN3 pin 2 or 3 (PWR out).

  Connect the CH2 probe tip to D20 anode and set its sensitivity at 5V/div.

  Set the LEVEL potentiometer full clockwise.

  The load resistor is disconnected.
- **INITIAL TEST:**

  Increase slowly the Variac. The channel output signals must be symmetrical respect the GND without visible distortion and oscillation as shown in *Fig.1 Trace A* (*Trace B* shown the amplifier 2nd stage input). If there is a distortion read the section ADVICES.
- **HIGH RAIL CHECK:**

  Connect the CH2 probe tip to D25 cathode and set its sensitivity at 20V/div. When the output signal (Positive half-wave) is less than 34Vp the voltage on D25 cathode must remain constant at 40V, when the output signal exceeds 40Vp the voltage must follow the output signal with 6V offset (see *Fig.2 Trace B*), to check the negative high rail connect the probe to D26 anode (see *Fig.2 Trace C*).
- Connect the 4Ω 500W load on the output and repeat the INITIAL and HIGH RAIL checks.
- **GAIN ADJUSTMENT:**

  Set the generator level at -10dB (0,245V_{RMS}), adjust the trimmer VR1 on CONTROLS & CROSSOVER board to obtain an output level of 19Vp (13.4V_{RMS}).
- Re-set the generator level at 0dB (0,775V_{RMS}),
- **SIGN/COMP SENSOR CHECK:**

  Set the LEVEL pot to minimum, set the scope timebase at 1V/div. 1mS/div., then increase the level and check the SIGNAL/COMP led activity: it must turn on (green light) when the amplifier output is higher than 1Vp. Set the scope at 20V/div. and increase the level, check the led: it must change from green to red colour when the amplifier output signal is 50±2Vp, increasing the input level the output signal must keep the same level, this is due to the limiter-compression circuitry (IC2, DL1, IC1).
- **BIAS ADJUSTMENT:**

  With the load connected wait until the temperature reach 50°c.

  Set the generator level at zero, connect the Multimeter across the resistors R60, then adjust VR1 trimmer to read 15±0.5mVdc.
- **BANDWIDTH CHECK:**

  The bandwidth of the amplifier board only is linear within the audio range (20Hz-20kHz), but in this case is limited by the X-OVER circuitry on CONTROLS & CROSSOVER board.

  Figure 3 and 4 show the LowPass and the HighPass response, check the correspondance with it for some frequency values (50,100,150,300 for example).
- **OFFSET SENSOR CHECK:**

  Set the Variac to zero voltage output, disconnect resistive load from the amplifier output, connect temporarily (by means of a suitable conductor wire) CN2 pin 3 (+15Vdc) to R72 side RL1, the protection circuitry (TR14,15,16) detect the DC voltage and open the output relay (RL1) within 3 seconds approx.

  Remove the connection, wait until the relay switch on and after some seconds repeat the check with -15Vdc (available on CN2 pin 2), the protection circuitry must open the relay again.
- **SIGNAL TO NOISE RATIO CHECK:**

  Disconnect the audio generator and short the input (pin 1,2,3 of XLR socket shorted) the output signal (noise) must be less than 1mV.

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.
- 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 low rail.

  If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative low rail.
- If the high rails appear distorted or are not modulating as shown in figure, then the problem probably exists somewhere in the circuitry of the respective (+ or -) defective high rail. Refer to the schematics.

Figures

Figure 1 and 2 show the right shape of the traces but not their real levels, refer to the levels mentioned in the chapter of appropriate amplified loudspeaker.

Figure 3 and 4 show the frequency response of the AV15SA crossover.

Fig. 1

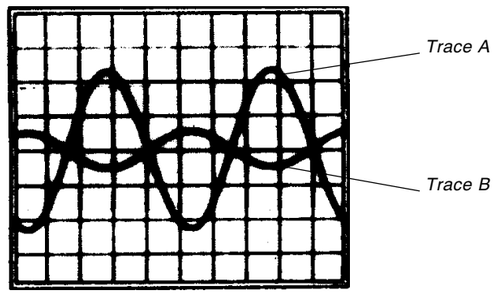


Fig. 2

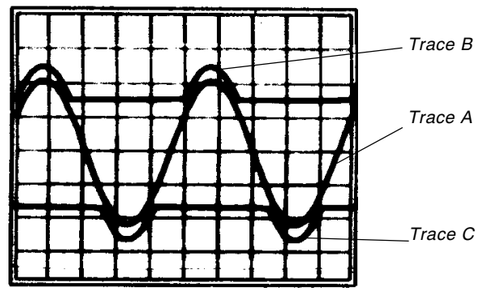


Fig. 3

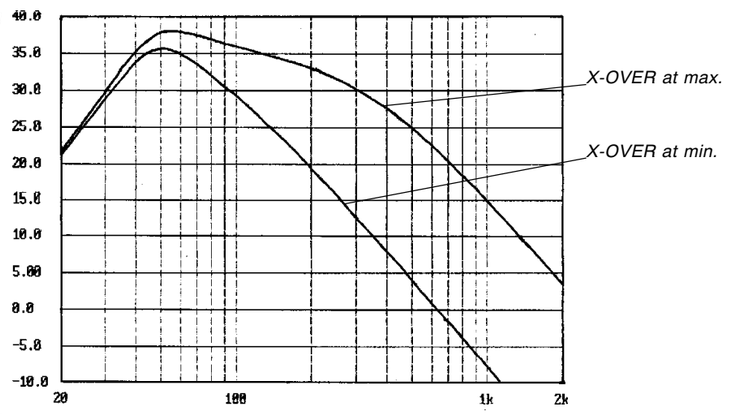
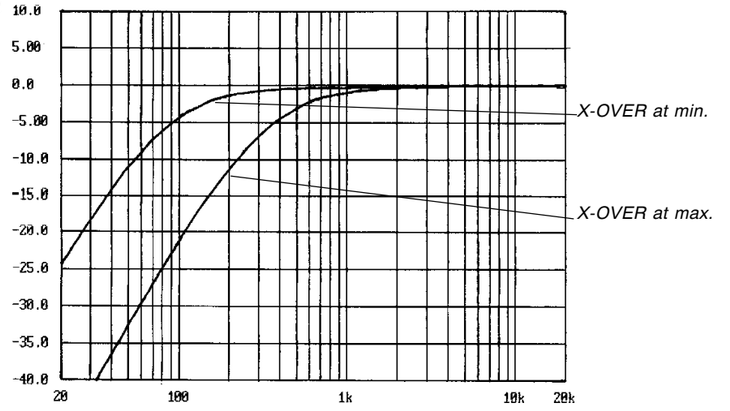
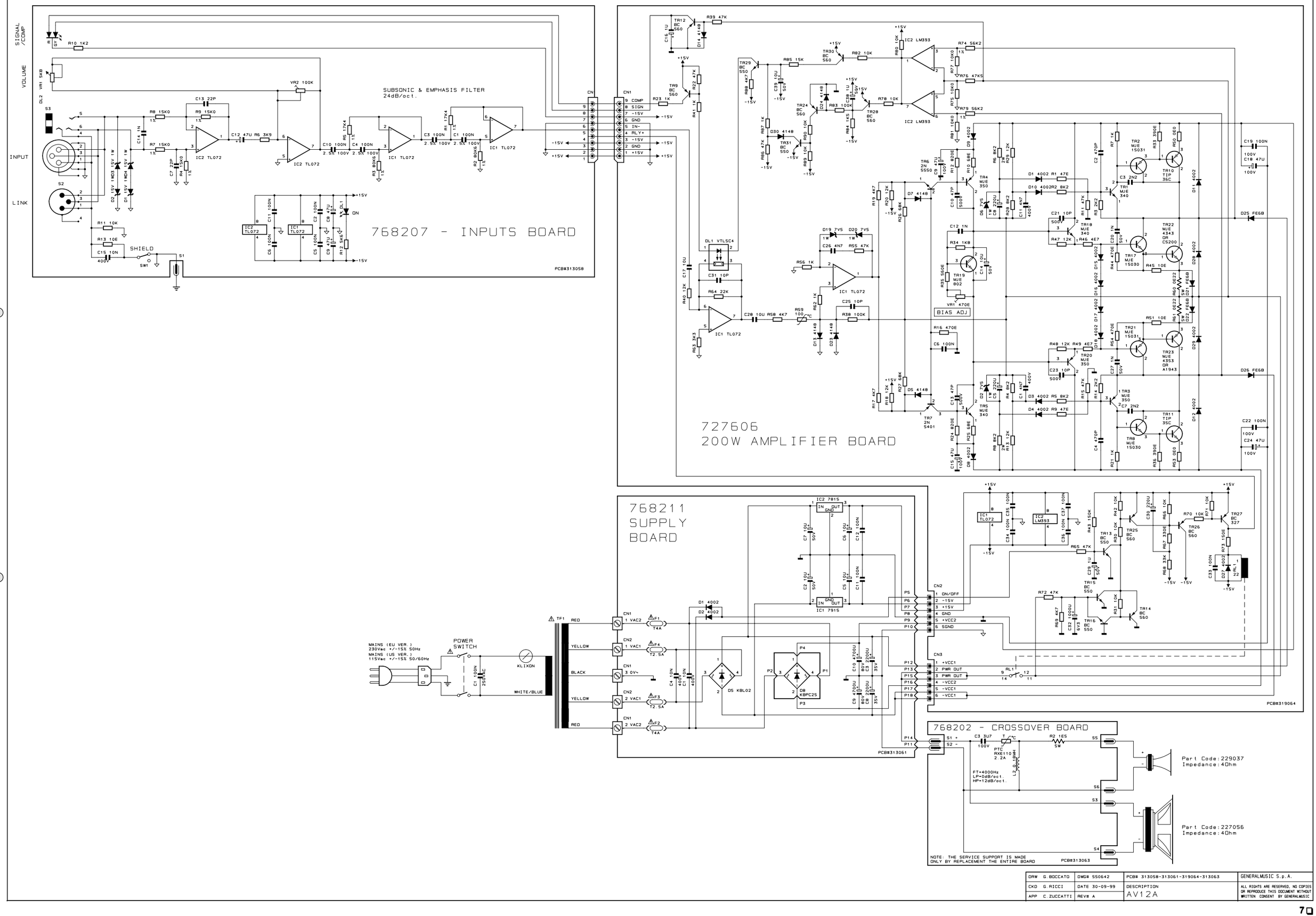
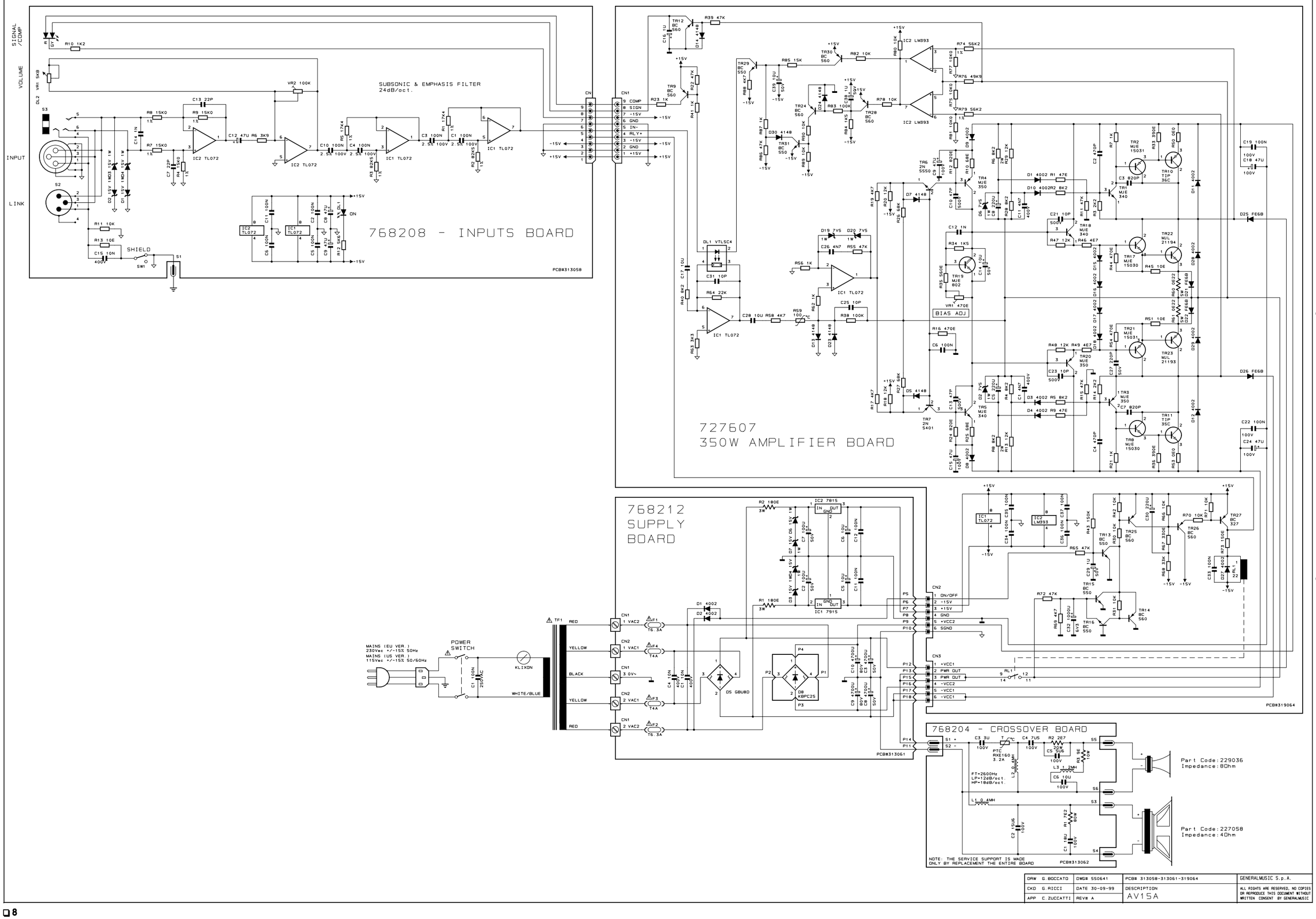


Fig. 4

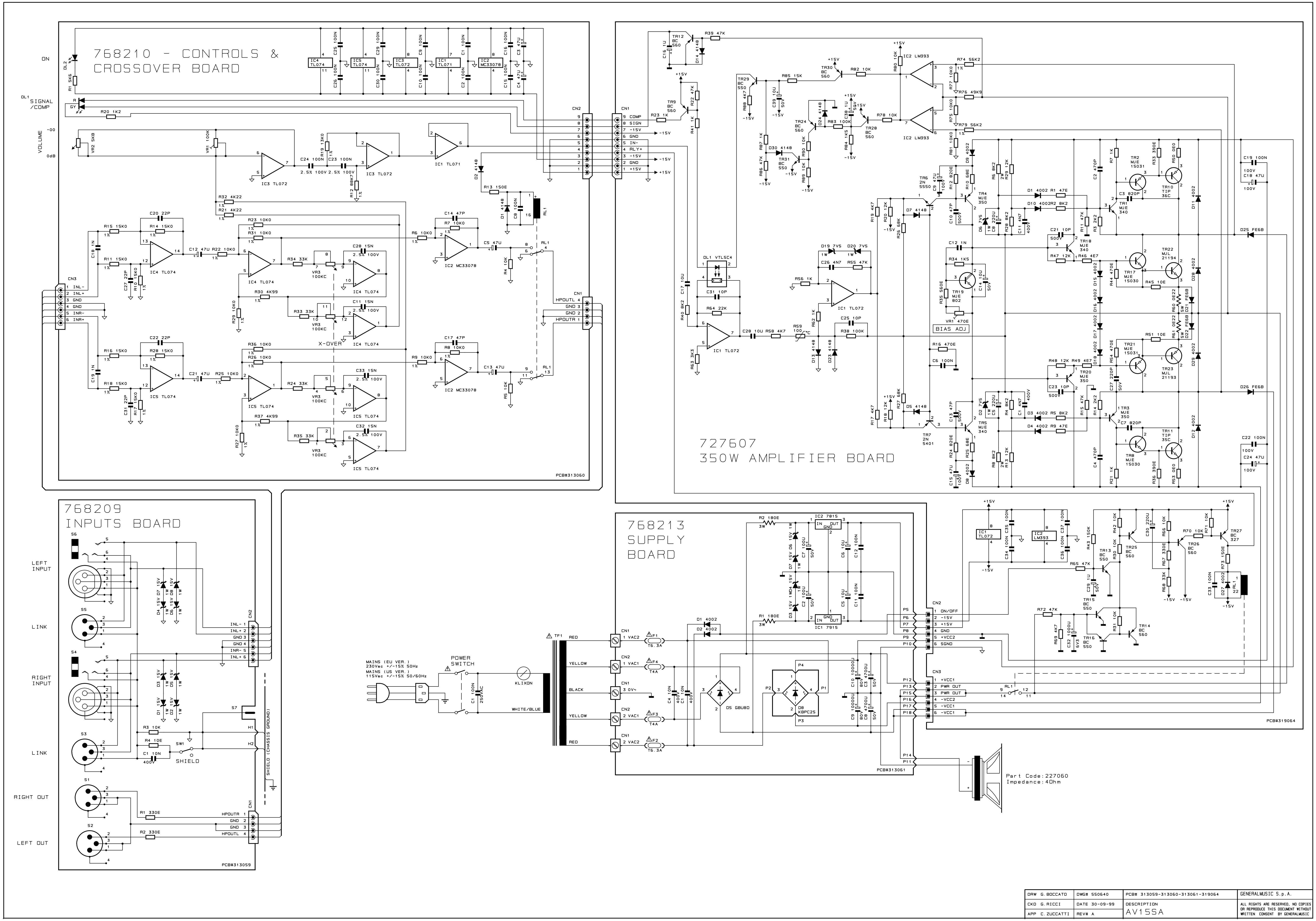




DRW G.BOCCATO	DWG# 550642	PCB# 313058-313061-319064-313063	GENERALMUSIC S.p.A.
CKD G.RICCI	DATE 30-09-99	DESCRIPTION AV12A	ALL RIGHTS ARE RESERVED, NO COPIES OR REPRODUCE THIS DOCUMENT WITHOUT WRITTEN CONSENT BY GENERALMUSIC
APP C.ZUCCATTI	REV# A		



DRW G.BOCCATO	DWG# 550641	PCB# 313058-313061-319064	GENERALMUSIC S.p.A.
CKD G.RICCI	DATE 30-09-99	DESCRIPTION AV15A	
APP C.ZUCCATTI	REV# A		


768210 - CONTROLS &
CROSSOVER BOARD
ON
SIGNAL /COMP
VOLUME
X-OVER
PCB#313060
727607
350W AMPLIFIER BOARD
BIAS ADJ
PCB#319064
768209
INPUTS BOARD
LEFT INPUT
LINK
RIGHT INPUT
LINK
RIGHT OUT
LEFT OUT
SHIELD
SHIELD (CHASSIS GROUND)
PCB#313059
768213
SUPPLY
BOARD
PCB#313061
MAINS (EU VER.) 230Vac +/-15% 50Hz
MAINS (US VER.) 115Vac +/-15% 50/60Hz
POWER SWITCH
KLIXON
RED
YELLOW
BLACK
YELLOW
RED
WHITE/BLUE
Part Code:227060
Impedance:4Ohm
DRW G.BOCCATO
DWG# 550640
PCB# 313059-313060-313061-319064
GENERALMUSIC S.p.A.
CKD G.RICCI
DATE 30-09-99
DESCRIPTION
AV15SA
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REV# A
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Spare Part List (ACTIVE VERSIONS)

Code		Description

Accessories

277334		Owner's Manual
130274		Mains Cable (EU)
130276		Mains Cable (US)

AV-12A

		Amplifier Assembly
737103		**200W Amplifier Module (EU)**
737104		**200W Amplifier Module (US)**
778146	*	Amplifier Cables Assembly
768211	*	**200W Supply Board (Pcb#313061)**
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
140081	**	H 2c P=10 Terminal Block
140069	**	H 3c P=10mm Terminal Block
110119	**	Fuse Clip 10A max (EU) (US)
100060	**	7815 +15V 1A Voltage Regulator
100049	**	7915 -15V 1A Voltage Regulator
080605	**	KBL02 4A 200V Rectifier Diode Bridge
080156	**	1N4002 1A 100V Rectifier Diode
030560	**	4700u 80v 20% Snap-In Electrolytic Capacitor
030526	**	2200u 35v 20% Snap-In Electrolytic Capacitor
020250	**	10n 400V 10% MKT Polyester Capacitor
768207	*	**Inputs Board (Pcb#313058)**
141189	**	Hor Female XLR-Jack Socket (NCJ6FK-H Neutrik)
141186	**	Hor Male XLR Socket (NC3MAH Neutrik)
140929	**	9 Contacts Vert Male Connector
120857	**	Vertical Male Faston 6.3mm
110267	**	1sw 2pos Horizontal Slider Switch
100061	**	TL072 Dual J-Fet Operational Amplifier
080743	**	3mm Wide Diffused Green Led
080742	**	Led 3mm Wide Diffused Red-Grn
080293	**	15V 1W 5% Zener Diode
074570	**	5K 31steps Linear Potentiometer
070245	**	100K 20% Vertical Linear Trimmer
042706	**	80K6 1/4W 1% Metalized Film Resistor
042630	**	17K4 1/4W 1% Metalized Film Resistor
042625	**	15K0 1/4W 1% Metalized Film Resistor
020250	**	10n 400V 10% MKT Polyester Capacitor
727606	*	**200W Amplifier Board (Pcb#319064)**
768214	**	200W Amplifier Board (Pcb#319064) without Power Transistors
141102	***	6 Contacts Vert Male Connector
140929	***	9 Contacts Vert Male Connector
110316	***	Relay 24V / 1 Switch no 16A 250V
100904	***	LM393 Dual Comparator
100061	***	TL072 Dual 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
090153	***	BC327 TO92 Pnp Transistor
080901	***	VTL5C4 Analog Optoisolator
080245	***	7V5 1W 5% Zener Diode
080171	***	FE6B 6A 100V Fast Recovery Diode
080156	***	1N4002 1A 100V Rectifier Diode
080103	***	1N4148 100mA 75V Signal Diode
070105	***	470E 20% Vertical Linear Trimmer
060591	***	8K2 2W 10% Resistor
060051	***	0E22 5W 5% Wire Resistor
042695	***	56K2 1/4W 1% Metalized Film Resistor
042685	***	47K5 1/4W 1% Metalized Film Resistor
042605	***	10K0 1/4W 1% Metalized Film Resistor
030715	***	1000u 6v3 20% Vert Electrolytic Capacitor
340154	**	TO3/TO218 Mica Washer
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
090920	**	MJE802 TO126 Npn Darl Transistor
090919	**	MJE15031 TO220 Pnp Transistor
090918	**	MJE15030 TO220 Npn Transistor
090913	**	MJE4352 TO218 Pnp Transistor
090912	**	MJE4342 TO218 Npn Transistor
090863	**	TIP36C TO218 Pnp Transistor
090862	**	TIP35C TO218 Npn Transistor
080821	**	Ptc 90 PTH59F04BE222TS
667697	*	Rear Panel
237077	*	**Transformer 230Vac 200W (EU)**
237078	*	**Transformer 115Vac 200W (US)**
210215	*	Adhesive Rubber Foam 10x1.9mm (Specify mt)
210212	*	Slider Switch Adhesive Gasket
110614	*	Mains Socket
110291	*	Power Switch
110029	*	T4A Fuse 5x20mm (EU)
110014	*	T2.5A Fuse 5x20mm (EU)
110036	*	T4A Fuse 6.3x32mm (US)
110035	*	T2.5A Fuse 6.3x32mm (US)
080607	*	KBPC25 25A 200V Rectifier Diode Bridge
020491	*	100nF 10% 250Vac Polyester Capacitor
		Box Assembly
778112		Cables Assembly
768202		**Crossover Filter Board (Pcb#313063) AV-12/4 Ohm**
667702		Handle
667700		Grid
659027		White Pot Knob
657271		Box
657270		EWT(TM) Elliptical Horn
229037		**1" 4ohm Horn Tweeter**
227056		**12" 4ohm Woofer Speaker**
210242		Filler for Speaker Box (Specify m²)
210217		Black Sealer (specify mt)
210215		Adhesive Rubber Foam 10x1.9mm (Specify mt)
210211		Gasket between Tweeter and Horn
120964		M4i M5e x17.5mm Threaded Pin
120148		Screw M5x65mm for Handle
120147		Screw M4x8mm for Speakers

AV-15A

		Amplifier Assembly
737105		**350W Amplifier Module (EU)**
737106		**350W Amplifier Module (US)**
778146	*	Amplifier Cables Assembly
768212	*	**350W Supply Board (Pcb#313061)**
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
140081	**	H 2c P=10 Terminal Block
140069	**	H 3c P=10mm Terminal Block
110119	**	Fuse Clip 10A max (EU) (US)
100060	**	7815 +15V 1A Voltage Regulator
100049	**	7915 -15V 1A Voltage Regulator
080606	**	GBU8D 8A Rectifier Diodes Bridge
080293	**	15V 1W 5% Zener Diode
080156	**	1N4002 1A 100V Rectifier Diode
060403	**	180E 3W 10% Resistor
030560	**	4700u 80v 20% Snap-In Electrolytic Capacitor
030555	**	4700u 50V 20% Snap-In Electrolytic Capacitor
768208	*	**Inputs Board (Pcb#313058)**
141189	**	Hor Female XLR-Jack Socket (NCJ6FK-H Neutrik)
141186	**	Hor Male XLR Socket (NC3MAH Neutrik)
140929	**	9 Contacts Vert Male Connector
120857	**	Vertical Male Faston 6.3mm
110267	**	1sw 2pos Horizontal Slider Switch
100061	**	TL072 Dual J-Fet Operational Amplifier
080743	**	3mm Wide Diffused Green Led
080742	**	Led 3mm Wide Diffused Red-Grn
080293	**	15V 1W 5% Zener Diode
074570	**	5K 31steps Linear Potentiometer
070245	**	100K 20% Vertical Linear Trimmer
042715	**	82K5 1/4W 1% Metalized Film Resistor
042630	**	17K4 1/4W 1% Metalized Film Resistor
042625	**	15K0 1/4W 1% Metalized Film Resistor
727607	*	**350W Amplifier Board (Pcb#319064)**
768215	**	350W Amplifier Board (Pcb#319064) without Power Transistors
141102	***	6 Contacts Vert Male Connector
140929	***	9 Contacts Vert Male Connector
110316	***	Relay 24V / 1 Switch no 16A 250V
100904	***	LM393 Dual Comparator
100061	***	TL072 Dual 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
090153	***	BC327 TO92 Pnp Transistor
080901	***	VTL5C4 Analog Optoisolator
080245	***	7V5 1W 5% Zener Diode
080171	***	FE6B 6A 100V Fast Recovery Diode
080156	***	1N4002 1A 100V Rectifier Diode
080103	***	1N4148 100mA 75V Signal Diode
070105	***	470E 20% Vertical Linear Trimmer
060591	***	8K2 2W 10% Resistor
060051	***	0E22 5W 5% Wire Resistor
042695	***	56K2 1/4W 1% Metalized Film Resistor
042687	***	49K9 1/4W 1% Metalized Film Resistor
042605	***	10K0 1/4W 1% Metalized Film Resistor
030715	***	1000u 6v3 20% Vert Electrolytic Capacitor
340783	**	TO264 Mica Washer
340154	**	TO3/TO218 Mica Washer
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
090924	**	MJL21194 TO264 Npn Transistor
090923	**	MJL21193 TO264 Pnp Transistor
090920	**	MJE802 TO126 Npn Darl Transistor
090919	**	MJE15031 TO220 Pnp Transistor
090918	**	MJE15030 TO220 Npn Transistor
090863	**	TIP36C TO218 Pnp Transistor
090862	**	TIP35C TO218 Npn Transistor
080821	**	Ptc 90 PTH59F04BE222TS
667698	*	Rear Panel
237068	*	**Transformer 230Vac 350W (EU)**
237069	*	**Transformer 115Vac 350W (US)**
210215	*	Adhesive Rubber Foam 10x1.9mm (Specify mt)
210212	*	Slider Switch Adhesive Gasket
110614	*	Mains Socket
110291	*	Power Switch
110029	*	T4A Fuse 5x20mm (EU)
110018	*	T6.3A Fuse 5x20mm (EU)
110037	*	T6.3A Fuse 6.3x32mm (US)
110036	*	T4A Fuse 6.3x32mm (US)
080607	*	KBPC25 25A 200V Rectifier Diode Bridge
020491	*	100nF 10% 250Vac Polyester Capacitor
		Box Assembly
778112		Cables Assembly
768204		**Crossover Filter Board (Pcb#313062) AV-15/4 Ohm**
667703		Handle
667701		Grid
659027		White Pot Knob
657272		Box
657270		EWT(TM) Elliptical Horn
229036		**1" 8ohm Horn Compression Driver**
227058		**15" 4ohm Woofer Speaker**
210242		Filler for Speaker Box (Specify m²)
210217		Black Sealer (specify mt)
210215		Adhesive Rubber Foam 10x1.9mm (Specify mt)
210211		Gasket between Tweeter and Horn
120965		M4i M5e x24mm Threaded Pin
120148		Screw M5x65mm for Handle
120147		Screw M4x8mm for Speakers

AV-15SA

		Amplifier Assembly
737107		**350W Amplifier Module (EU)**
737108		**350W Amplifier Module (US)**
778147	*	Amplifier Cables Assembly
768213	*	**350W Supply Board (Pcb#313061)**
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
100060	**	7815 +15V 1A Voltage Regulator
100049	**	7915 -15V 1A Voltage Regulator
080606	**	GBU8D 8A Rectifier Diodes Bridge
080293	**	15V 1W 5% Zener Diode
080156	**	1N4002 1A 100V Rectifier Diode
060403	**	180E 3W 10% Resistor
030884	**	10000U 80V 20% Snap-In Electrolytic Capacitor
030555	**	4700u 50V 20% Snap-In Electrolytic Capacitor
768210	*	Controls & Crossover Board (Pcb#313060)
140929	**	9 Contacts Vert Male Connector
140908	**	6 Contacts Vert Male Small Connector
140873	**	4 Contacts Vert Male Connector
110305	**	Relay 12V / 2 Switch 1A 250V
100919	**	MC33078 Dual LN Operational Amplifier
100084	**	TL074 Quad J-Fet Operational Amplifier
100061	**	TL072 Dual J-Fet Operational Amplifier
100019	**	TL071 LN J-Fet Operational Amplifier
080743	**	3mm Wide Diffused Green Led
080742	**	Led 3mm Wide Diffused Red-Grn
080103	**	1N4148 100mA 75V Signal Diode
075820	**	4x100K 16mm Hor Rotary Alog Potentiometer
074570	**	5K 31steps Linear Potentiometer
070241	**	100K 20% Horizontal Linear Trimmer
042717	**	88K7 1/4W 1% Metalized Film Resistor
042625	**	15K0 1/4W 1% Metalized Film Resistor
042617	**	13K0 1/4W 1% Metalized Film Resistor
042605	**	10K0 1/4W 1% Metalized Film Resistor
042565	**	4K99 1/4W 1% Metalized Film Resistor
042555	**	4K22 1/4W 1% Metalized Film Resistor
768209	*	**Inputs Board (Pcb#313059)**
141189	**	Hor Female XLR-Jack Socket (NCJ6FK-H Neutrik)
141186	**	Hor Male XLR Socket (NC3MAH Neutrik)
140935	**	6 Contacts Hor Male Connector
140872	**	4 Contatcs Hor Male Connector
110267	**	1sw 2pos Horizontal Slider Switch
080293	**	15V 1W 5% Zener Diode
727607	*	**350W Amplifier Board (Pcb#319064)**
768215	**	350W Amplifier Board (Pcb#319064) without Power Transistors
141102	***	6 Contacts Vert Male Connector
140929	***	9 Contacts Vert Male Connector
110316	***	Relay 24V / 1 Switch no 16A 250V
100904	***	LM393 Dual Comparator
100061	***	TL072 Dual 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
090153	***	BC327 TO92 Pnp Transistor
080901	***	VTL5C4 Analog Optoisolator
080245	***	7V5 1W 5% Zener Diode
080171	***	FE6B 6A 100V Fast Recovery Diode
080156	***	1N4002 1A 100V Rectifier Diode
080103	***	1N4148 100mA 75V Signal Diode
070105	***	470E 20% Vertical Linear Trimmer
060591	***	8K2 2W 10% Resistor
060051	***	0E22 5W 5% Wire Resistor
042695	***	56K2 1/4W 1% Metalized Film Resistor
042687	***	49K9 1/4W 1% Metalized Film Resistor
042605	***	10K0 1/4W 1% Metalized Film Resistor
030715	***	1000u 6v3 20% Vert Electrolytic Capacitor
340783	**	TO264 Mica Washer
340154	**	TO3/TO218 Mica Washer
340079	**	TO220 Mica Washer
340078	**	TO220 Insulated Bush
090924	**	MJL21194 TO264 Npn Transistor
090923	**	MJL21193 TO264 Pnp Transistor
090920	**	MJE802 TO126 Npn Darl Transistor
090919	**	MJE15031 TO220 Pnp Transistor
090918	**	MJE15030 TO220 Npn Transistor
090863	**	TIP36C TO218 Pnp Transistor
090862	**	TIP35C TO218 Npn Transistor
080821	**	Ptc 90 PTH59F04BE222TS
667699	*	Rear Panel
237068	*	**Transformer 230Vac 350W (EU)**
237069	*	**Transformer 115Vac 350W (US)**
210215	*	Adhesive Rubber Foam 10x1.9mm (Specify mt)
210212	*	Slider Switch Adhesive Gasket
110614	*	Mains Socket
110291	*	Power Switch
110029	*	T4A Fuse 5x20mm (EU)
110018	*	T6.3A Fuse 5x20mm (EU)
110037	*	T6.3A Fuse 6.3x32mm (US)
110036	*	T4A Fuse 6.3x32mm (US)
080607	*	KBPC25 25A 200V Rectifier Diode Bridge
020491	*	100nF 10% 250Vac Polyester Capacitor
		Box Assembly
667703		Handle
667701		Grid
659027		White Pot Knob
659026		Orange Pot Knob
657273		Box
347393		Threaded Clog (to steady on the floor)
227060		**15" 4ohm Woofer Speaker**
210242		Filler for Speaker Box (Specify m²)
210217		Black Sealer (specify mt)
210215		Adhesive Rubber Foam 10x1.9mm (Specify mt)
177721		Fixing Plate (to fix the Floor Bracket)
120965		M4i M5e x24mm Threaded Pin
120148		Screw M5x65mm for Handle
120147		Screw M4x8mm for Speakers
667704		Floor Bracket with Threaded Knobs

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.