LEM

PROFESSIONAL SOUND

PROCON SERIES

POWER AMPLIFIERS

SERVICE MANUAL

GENERALMUSIC®

code 270266

Index

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 1/8W 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.

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PROCON400 - Test procedures and 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 supply capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100E 30W 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.
• Do not check the amplifier with the speakers connected use the appropriate load resistors only.
• BE CAREFUL increasing the Variac you must not exceed the nominal mains voltage plus its tolerance (see specifications) any upper voltage can be cause of damage.

VISUAL CHECK

• 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.

TESTING GEAR

• Audio Generator
• Dual Trace Oscilloscope
• Digital Multimeter
• 4E 300W, 8E 200W, 100E 30W resistors
• Variac

SETUP

• Connect the Variac between the Mains and the amplifier and set it at zero voltage.
• Turn full counter-clockwise the LEVEL potentiometers.
• Connect the audio generator to the channel inputs and set it to 1KHz 775mVrms (0dBm) sinusoidal signal.
• Connect the two scope traces to the amplifier outputs, before the relay, and set them in DC at 20V/div. 2mS/div.

SUPPLY CHECK

• Verify with the Multimeter the insulation between the heatsinks and all transistor collectors mounted on them; placing the multimeter tips between the screw heads and the collector pins you can exclude an erroneus reading due to the insulation of the heatsink anodization.
• Verify with the Multimeter the NTC (RT1 or RT2) and R122 or R222 paralleled resistor value, it must be about 1.17K (at 25°c).
• Turn on the Amplifier.
• Remove the transformer secondary fuses, set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:
F1-F2 = 28±2Vac.
F3-F4 = 85±8Vac.
• Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
• Set up the Variac slowly monitoring the oscilloscope screen, it should display no signal; if you notice a DC voltage or a protection trips check the amplifier as suggested in the ADVICES section.
• As soon as the +12VF supply circuit reaches its nominal value, all cooling fans run at their minimum and the speaker output relay (J401) switches.
• When the Variac ac voltage reaches the nominal voltage verify the DC supplies as follow:
+VCC = +57±5Vdc
-VCC = -57±5Vdc
U101 pin 8 = +15±1Vdc
U101 pin 4 = -15±1Vdc
U401 pin 3 = +12±1Vdc
• If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry.

CHANNEL CHECK

• Be sure you have disconnected the load resistor.
• Increasing the input signal also the output signal raise accordingly, it must be symmetrical without visible distortion or oscillation as shown in figure (note: the figure is representative don`t refer to the levels displayed). If there is a distortion read the section ADVICES.
• When the input signal exceeds -18dBm (~8Vpp on output) the SIGNAL led lights and the fan turns at its maximum speed.
• Firstly you must check the channel without load, afterwards you must repeat the check with the loads attached, the following table reports the approx. maximum level obtainable with this amplifier:

	out level	in level
no load	**110Vpp**	**+4.5dB**
1CH 8E	**104Vpp**	**+4dB**
1CH 4E	**92Vpp**	**+3dB**
2CH 8E	**90Vpp**	**+3dB**
2CH 4E	**80Vpp**	**+2dB**

CLIP LED ADJUSTMENT

• Check if the clip led lights at approx. 0dBm on input level, if necessary adjust the trimmer W301 and W302 on display board.

OFFSET ADJUSTMENT

• Set the input level at minimum (no signal), the output dc offset voltage must be within ±20mV, if necessary adjust the W201 (CH1) or W201 (CH2) trimmers to be within this threshold.

BIAS ADJUSTMENT

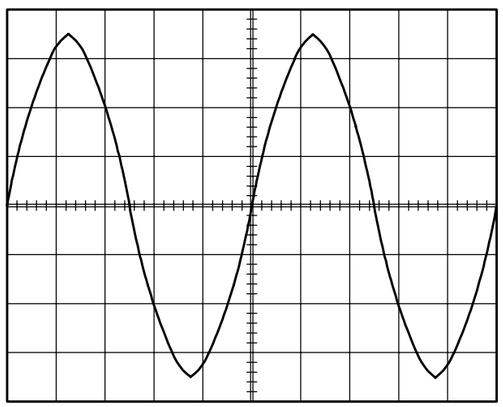
• No bias adjustment is necessary for this amplifier circuitry.

ADVICES

• 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 rail.
• If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail.
• The dc voltages printed on the schematics are measured with the amplifier in steady state without input signal and nominal mains voltage supply, it can be useful to localize a damage.

FIGURES

OSCILLOSCOPE FIGURE



TRACE setting:
TIMEBASE: 2mS/div.
AMPLITUDE: 20V/div.

PROCON750 - Test procedures and 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 supply capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100E 60W 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.
• Do not check the amplifier with the speakers connected use the appropriate load resistors only.
• BE CAREFUL increasing the Variac you must not exceed the nominal mains voltage plus its tolerance (see specifications) any upper voltage can be cause of damage.

VISUAL CHECK

• 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.

TESTING GEAR

• Audio Generator
• Dual Trace Oscilloscope
• Digital Multimeter
• 4E 500W, 8E 300W, 100E 60W resistors
• Variac

SETUP

• Connect the Variac between the Mains and the amplifier and set it at zero voltage.
• Turn full counter-clockwise the LEVEL potentiometers.
• Connect the audio generator to the channel inputs and set it to 1KHz 775mVrms (0dB) sinusoidal signal.
• Connect the two scope traces to the amplifier outputs, before the relay, and set them in DC at 20V/div. 2mS/div.

SUPPLY CHECK

• Verify with the Multimeter the insulation between the heatsinks and all transistor collectors mounted on them; placing the multimeter tips between the screw heads and the collector pins you can exclude an erroneus reading due to the insulation of the heatsink anodization.
• Verify with the Multimeter the NTC (RT1 or RT2) and R122 or R222 paralleled resistor value, it must be about 1.17K (at 25°c).
• Turn on the Amplifier.
• Remove the transformer secondary fuses, set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:
F1-F2 = 28±2Vac.
F3-F4 = 104±10Vac.
• Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
• Set up the Variac slowly monitoring the oscilloscope screen, it should display no signal; if you notice a DC voltage or a protection trips check the amplifier as suggested in the ADVICES section.
• As soon as the +12VF supply circuit reaches its nominal value, all cooling fans run at their minimum and the speaker output relay (J401) switches.
• When the Variac ac voltage reaches the nominal voltage verify the DC supplies as follow:
+VCC = +75±5Vdc
-VCC = -75±5Vdc
U101 pin 8 = +15±1Vdc
U101 pin 4 = -15±1Vdc
U401 pin 3 = +12±1Vdc
• If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry.

CHANNEL CHECK

• Be sure you have disconnected the load resistor.
• Increasing the input signal also the output signal raise accordingly, it must be symmetrical without visible distortion or oscillation as shown in figure (note: the figure is representative don`t refer to the levels displayed). If there is a distortion read the section ADVICES.
• When the input signal exceeds -18dBm (~8Vpp on output) the SIGNAL led lights and the fan turns at its maximum speed.
• Firstly you must check the channel without load, afterwards you must repeat the check with the loads attached, the following table reports the approx. maximum level obtainable with this amplifier:

	out level	in level
no load	**148Vpp**	**+7dBm**
1CH 8E	**128Vpp**	**+5.5dBm**
1CH 4E	**120Vpp**	**+4.5dBm**
2CH 8E	**120Vpp**	**+5dBm**
2CH 4E	**104Vpp**	**+4dBm**

CLIP LED ADJUSTMENT

• Check if the clip led lights at approx. 0dBm on input level, if necessary adjust the trimmer W301 and W302 on display board.

OFFSET ADJUSTMENT

• Set the input level at minimum (no signal), the output dc offset voltage must be within ±20mV, if necessary adjust the W201 (CH1) or W201 (CH2) trimmers to be within this threshold.

BIAS ADJUSTMENT

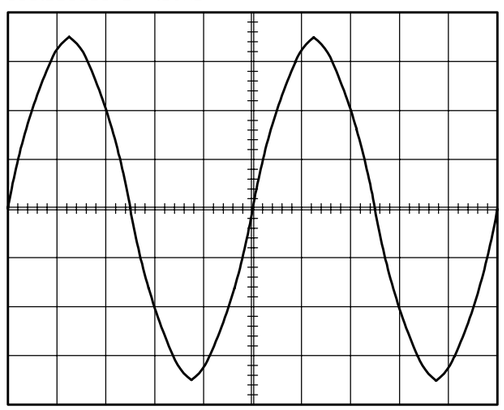
• No bias adjustment is necessary for this amplifier circuitry.

ADVICES

• 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 rail.
• If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail.
• The dc voltages printed on the schematics are measured with the amplifier in steady state without input signal and nominal mains voltage supply, it can be useful to localize a damage.

FIGURES

OSCILLOSCOPE FIGURE



TRACE setting:
TIMEBASE: 2mS/div.
AMPLITUDE: 20V/div.

PROCON950 - Test procedures and 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 supply capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100E 70W 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.
• Do not check the amplifier with the speakers connected use the appropriate load resistors only.
• BE CAREFUL increasing the Variac you must not exceed the nominal mains voltage plus its tolerance (see specifications) any upper voltage can be cause of damage.

VISUAL CHECK

• 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.

TESTING GEAR

• Audio Generator
• Dual Trace Oscilloscope
• Digital Multimeter
• 4E 600W, 8E 400W, 100E 70W resistors
• Variac
• Digital Thermometer (not indispensable)

SETUP

• Connect the Variac between the Mains and the amplifier and set it at zero voltage.
• Turn full counter-clockwise the LEVEL potentiometers.
• Connect the audio generator to the channel inputs and set it to 1KHz 775mVrms (0dBm) sinusoidal signal.
• Connect the two scope traces to the amplifier outputs, before the relay, and set them in DC at 20V/div. 2mS/div.

SUPPLY CHECK

• Verify with the Multimeter the insulation between the heatsinks and all transistor collectors mounted on them; placing the multimeter tips between the screw heads and the collector pins you can exclude an erroneus reading due to the insulation of the heatsink anodization.
• Verify with the Multimeter the NTC (RT1) and R1 paralleled resistor value, it must be about 7KE (at 25°c).
• Turn on the Amplifier.
• Remove the transformer secondary fuses, set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:

F1-F2 = 28±2Vac.
F3-F4 = 119±12Vac.

• Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
• Set up the Variac slowly monitoring the oscilloscope screen, it should display no signal; if you notice a DC voltage or a protection trips check the amplifier as suggested in the ADVICES.
• As soon as the +12VF supply circuit reaches its nominal value, all cooling fans run at their minimum and the speaker output relais (J201-202) switch.
• When the Variac ac voltage reaches the nominal voltage verify the DC supplies as follow:

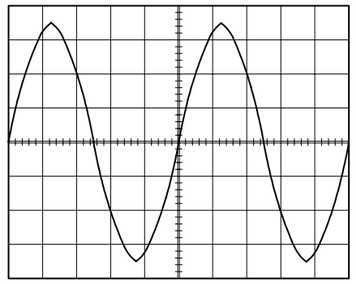
+VCC = +81±6Vdc
-VCC = -81±6Vdc
U201 pin 8 = +12±0.5Vdc
U201 pin 4 = -12±0.5Vdc
U202 pin 3 = +12±0.5Vdc

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

CHANNEL CHECK

• Be sure you have disconnected the load resistor.
• Increasing the input signal also the output signal raise accordingly, it must be symmetrical without visible distortion or oscillation as shown in figure (note: the figure is representative don`t refer to the levels displayed). If there is a distortion read the section ADVICES.

OSCILLOSCOPE FIGURE



TRACE setting:
TIMEBASE: 2mS/div.
AMPLITUDE: 20V/div.

• When the input signal exceeds -25dBm (9Vpp on output) the SIGNAL led lights and the fans turn at their maximum speed.
• Firstly you must check the channel without load, afterwards you must repeat the check with the loads attached, the following table reports the approx. maximum level obtainable with this amp:

	out level	in level
no load	**160Vpp**	**+0dBm**
1CH 8E	**158Vpp**	**-0.7dBm**
1CH 4E	**128Vpp**	**-1.5dBm**
2CH 8E	**130Vpp**	**-1.3dBm**
2CH 4E	**116Vpp**	**-2.5dBm**

CLIP LED ADJUSTMENT

• Check if the clip led lights at -6/-5dBm on input (~80Vpp on output), if necessary adjust the trimmers W301/2 on display board.

OFFSET ADJUSTMENT

• Set the input level at minimum (no signal), the output dc offset voltage must be within ±20mV, if necessary adjust the VR101 trimmer (for each channel) to be within this threshold.

BIAS ADJUSTMENT

• No bias adjustment is necessary for this amplifier circuitry; in any case the amplifier has the possibility to adjust it if necessary. To check properly the bias proceed as follows:
• Using a sinusoidal signal (1KHz or more) and the 4E load attached, wait till the heatsink temperature reaches about 60°c.
• Turn down the signal at the smallest intensity you can read on your oscilloscope trace connected at the amplifier output.
• Zoom in the crossing region using the amplitude, timebase and trigger controls of your oscilloscope. If you see a distortion, try to eliminate it adjusting the VR102 trimmer.
• Finally, set the input level at minimum and verify with the multimeter attached across an emitter resistance (p.e. R132) that the dc voltage doesn`t exceed 10mV.

ADVICES

• 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 resistance across emitter and collector of each device. Unsolder and lift one leg of each base pin and check the base-collector resistance. Replace any device 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 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 rail.
• If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail.
• The dc voltages printed on the schematics are measured with the amplifier in steady state without input signal and nominal mains voltage supply, it can be useful to localize a damage.

PROCON1100 - Test procedures and 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 supply capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100E 80W 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.
• Do not check the amplifier with the speakers connected use the appropriate load resistors only.
• BE CAREFUL increasing the Variac you must not exceed the nominal mains voltage plus its tolerance (see specifications) any upper voltage can be cause of damage.

VISUAL CHECK

• 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.

TESTING GEAR

• Audio Generator
• Dual Trace Oscilloscope
• Digital Multimeter
• 4E 650W, 8E 400W, 100E 80W resistors
• Variac
• Digital Thermometer (not indispensable)

SETUP

• Connect the Variac between the Mains and the amplifier and set it at zero voltage.
• Turn full counter-clockwise the LEVEL potentiometers.
• Connect the audio generator to the channel inputs and set it to 1KHz 775mVrms (0dBm) sinusoidal signal.
• Connect the two scope traces to the amplifier outputs, before the relay, and set them in DC at 20V/div. 2mS/div.

SUPPLY CHECK

• Verify with the Multimeter the insulation between the heatsinks and all transistor collectors mounted on them; placing the multimeter tips between the screw heads and the collector pins you can exclude an erroneus reading due to the insulation of the heatsink anodization.
• Verify with the Multimeter the NTC (RT1) and R1 paralleled resistor value, it must be about 7KE (at 25°c).
• Turn on the Amplifier.
• Remove the transformer secondary fuses, set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:

F1-F2 = 28±2Vac.
F3-F4 = 127±12Vac.

• Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
• Set up the Variac slowly monitoring the oscilloscope screen, it should display no signal; if you notice a DC voltage or a protection trips check the amplifier as suggested in the ADVICES.
• As soon as the +12VF supply circuit reaches its nominal value, all cooling fans run at their minimum and the speaker output relais (J201-202) switch.
• When the Variac ac voltage reaches the nominal voltage verify the DC supplies as follow:

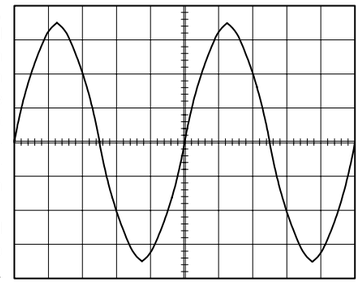
+VCC = +88±6Vdc
-VCC = -88±6Vdc
U201 pin 8 = +12±0.5Vdc
U201 pin 4 = -12±0.5Vdc
U202 pin 3 = +12±0.5Vdc

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

CHANNEL CHECK

• Be sure you have disconnected the load resistor.
• Increasing the input signal also the output signal raise accordingly, it must be symmetrical without visible distortion or oscillation as shown in figure (note: the figure is representative don`t refer to the levels displayed). If there is a distortion read the section ADVICES.

OSCILLOSCOPE FIGURE



TRACE setting:
TIMEBASE: 2mS/div.
AMPLITUDE: 20V/div.

• When the input signal exceeds -24dBm (9Vpp on output) the SIGNAL led lights and the fans turn at their maximum speed.
• Firstly you must check the channel without load, afterwards you must repeat the check with the loads attached, the following table reports the approx. maximum level obtainable with this amp:

	out level	in level
no load	**175Vpp**	**+1.6dBm**
1CH 8E	**150Vpp**	**+0.5dBm**
1CH 4E	**140Vpp**	**-0.2dBm**
2CH 8E	**142Vpp**	**+0dBm**
2CH 4E	**124Vpp**	**-1.2dBm**

CLIP LED ADJUSTMENT

• Check if the clip led lights at -6/-5dBm on input (~82Vpp on output), if necessary adjust the trimmers W301/2 on display board.

OFFSET ADJUSTMENT

• Set the input level at minimum (no signal), the output dc offset voltage must be within ±20mV, if necessary adjust the VR101 trimmer (for each channel) to be within this threshold.

BIAS ADJUSTMENT

• No bias adjustment is necessary for this amplifier circuitry; in any case the amplifier has the possibility to adjust it if necessary. To check properly the bias proceed as follows:
• Using a sinusoidal signal (1KHz or more) and the 4E load attached, wait till the heatsink temperature reaches about 60°c.
• Turn down the signal at the smallest intensity you can read on your oscilloscope trace connected at the amplifier output.
• Zoom in the crossing region using the amplitude, timebase and trigger controls of your oscilloscope. If you see a distortion, try to eliminate it adjusting the VR102 trimmer.
• Finally, set the input level at minimum and verify with the multimeter attached across an emitter resistance (p.e. R132) that the dc voltage doesn`t exceed 10mV.

ADVICES

• 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 resistance across emitter and collector of each device. Unsolder and lift one leg of each base pin and check the base-collector resistance. Replace any device 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 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 rail.
• If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail.
• The dc voltages printed on the schematics are measured with the amplifier in steady state without input signal and nominal mains voltage supply, it can be useful to localize a damage.

PROCON1250 - Test procedures and 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 supply capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100E 90W 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.
• Do not check the amplifier with the speakers connected use the appropriate load resistors only.
• BE CAREFUL increasing the Variac you must not exceed the nominal mains voltage plus its tolerance (see specifications) any upper voltage can be cause of damage.

VISUAL CHECK

• 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.

TESTING GEAR

• Audio Generator
• Dual Trace Oscilloscope
• Digital Multimeter
• 4E 700W, 8E 450W, 100E 90W resistors
• Variac
• Digital Thermometer (not indispensable)

SETUP

• Connect the Variac between the Mains and the amplifier and set it at zero voltage.
• Turn full counter-clockwise the LEVEL potentiometers.
• Connect the audio generator to the channel inputs and set it to 1KHz 775mVrms (0dBm) sinusoidal signal.
• Connect the two scope traces to the amplifier outputs, before the relay, and set them in DC at 20V/div. 2mS/div.

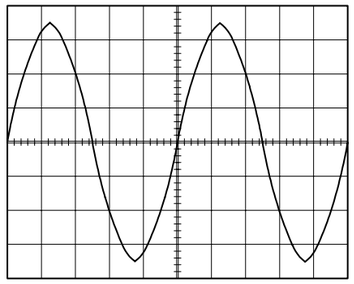
SUPPLY CHECK

• Verify with the Multimeter the insulation between the heatsinks and all transistor collectors mounted on them; placing the multimeter tips between the screw heads and the collector pins you can exclude an erroneus reading due to the insulation of the heatsink anodization.
• Verify with the Multimeter the NTC (RT1) and R1 paralleled resistor value, it must be about 7KE (at 25°c).
• Turn on the Amplifier.
• Remove the transformer secondary fuses, set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:
F1-F2 = 28±2Vac.
F3-gnd and F4-gnd = 69±7Vac.
• Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
• Set up the Variac slowly monitoring the oscilloscope screen, it should display no signal; if you notice a DC voltage or a protection trips check the amplifier as suggested in the ADVICES.
• As soon as the +12VF supply circuit reaches its nominal value, all cooling fans run at their minimum and the speaker output relais (J201-202) switch.
• When the Variac ac voltage reaches the nominal voltage verify the DC supplies as follow:
+VCC = +93±7Vdc
-VCC = -93±7Vdc
U201 pin 8 = +12±0.5Vdc
U201 pin 4 = -12±0.5Vdc
U202 pin 3 = +12±0.5Vdc
• If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry.

CHANNEL CHECK

• Be sure you have disconnected the load resistor.
• Increasing the input signal also the output signal raise accordingly, it must be symmetrical without visible distortion or oscillation as shown in figure (note: the figure is representative don`t refer to the levels displayed). If there is a distortion read the section ADVICES.

OSCILLOSCOPE FIGURE



• When the input signal exceeds -23dBm (10Vpp on output) the SIGNAL led lights and the fans turn at their maximum speed.
• Firstly you must check the channel without load, afterwards you must repeat the check with the loads attached, the following table reports the approx. maximum level obtainable with this amp:

	out level	in level
no load	**180Vpp**	**+2.0dBm**
1CH 8E	**160Vpp**	**+1.0dBm**
1CH 4E	**144Vpp**	**+0.3dBm**
2CH 8E	**148Vpp**	**+0.6dBm**
2CH 4E	**130Vpp**	**-0.5dBm**

CLIP LED ADJUSTMENT

• Check if the clip led lights at -6/-5dBm on input (~84Vpp on output), if necessary adjust the trimmers W301/2 on display board.

OFFSET ADJUSTMENT

• Set the input level at minimum (no signal), the output dc offset voltage must be within ±20mV, if necessary adjust the VR101 trimmer (for each channel) to be within this threshold.

BIAS ADJUSTMENT

• No bias adjustment is necessary for this amplifier circuitry; in any case the amplifier has the possibility to adjust it if necessary. To check properly the bias proceed as follows:
• Using a sinusoidal signal (1KHz or more) and the 4E load attached, wait till the heatsink temperature reaches about 60°c.
• Turn down the signal at the smallest intensity you can read on your oscilloscope trace connected at the amplifier output.
• Zoom in the crossing region using the amplitude, timebase and trigger controls of your oscilloscope. If you see a distortion, try to eliminate it adjusting the VR102 trimmer.
• Finally, set the input level at minimum and verify with the multimeter attached across an emitter resistance (p.e. R132) that the dc voltage doesn`t exceed 10mV.

ADVICES

• 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 resistance across emitter and collector of each device. Unsolder and lift one leg of each base pin and check the base-collector resistance. Replace any device 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 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 rail.
• If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail.
• The dc voltages printed on the schematics are measured with the amplifier in steady state without input signal and nominal mains voltage supply, it can be useful to localize a damage.

PROCON1500 - Test procedures and 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 supply capacitors. If your measurement on any of the caps is greater than 10Vdc, connect a 100E 100W 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.
• Do not check the amplifier with the speakers connected use the appropriate load resistors only.
• BE CAREFUL increasing the Variac you must not exceed the nominal mains voltage plus its tolerance (see specifications) any upper voltage can be cause of damage.

VISUAL CHECK

• 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.

TESTING GEAR

• Audio Generator
• Dual Trace Oscilloscope
• Digital Multimeter
• 4E 800W, 8E 500W, 100E 100W resistors
• Variac
• Digital Thermometer (not indispensable)

SETUP

• Connect the Variac between the Mains and the amplifier and set it at zero voltage.
• Turn full counter-clockwise the LEVEL potentiometers.
• Connect the audio generator to the channel inputs and set it to 1KHz 775mVrms (0dBm) sinusoidal signal.
• Connect the two scope traces to the amplifier outputs, before the relay, and set them in DC at 20V/div. 2mS/div.

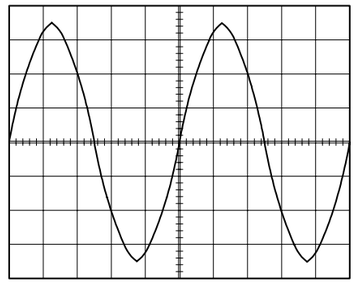
SUPPLY CHECK

• Verify with the Multimeter the insulation between the heatsinks and all transistor collectors mounted on them; placing the multimeter tips between the screw heads and the collector pins you can exclude an erroneus reading due to the insulation of the heatsink anodization.
• Verify with the Multimeter the NTC (RT1) and R1 paralleled resistor value, it must be about 7KE (at 25°c).
• Turn on the Amplifier.
• Remove the transformer secondary fuses, set the Variac to the nominal mains voltage, check with the Multimeter the AC supply voltages:
F1-F2 = 28±2Vac.
F3-gnd and F4-gnd = 71±8Vac.
• Re-set the Variac at zero voltage, turn off the amplifier and put the fuses back on its holders.
• Set up the Variac slowly monitoring the oscilloscope screen, it should display no signal; if you notice a DC voltage or a protection trips check the amplifier as suggested in the ADVICES.
• As soon as the +12VF supply circuit reaches its nominal value, all cooling fans run at their minimum and the speaker output relais (J201-202) switch.
• When the Variac ac voltage reaches the nominal voltage verify the DC supplies as follow:
+VCC = +100±8Vdc
-VCC = -100±8Vdc
U201 pin 8 = +12±0.5Vdc
U201 pin 4 = -12±0.5Vdc
U202 pin 3 = +12±0.5Vdc
• If one or more voltages don't correspond, check the rectifiers, capacitors and transformers disconnecting them from circuitry.

CHANNEL CHECK

• Be sure you have disconnected the load resistor.
• Increasing the input signal also the output signal raise accordingly, it must be symmetrical without visible distortion or oscillation as shown in figure (note: the figure is representative don`t refer to the levels displayed). If there is a distortion read the section ADVICES.

OSCILLOSCOPE FIGURE



• When the input signal exceeds -24dBm (10Vpp on output) the SIGNAL led lights and the fans turn at their maximum speed.
• Firstly you must check the channel without load, afterwards you must repeat the check with the loads attached, the following table reports the approx. maximum level obtainable with this amp:

	out level	in level
no load	**190Vpp**	**+1.8dBm**
1CH 8E	**170Vpp**	**+0.8dBm**
1CH 4E	**158Vpp**	**+0.2dBm**
2CH 8E	**159Vpp**	**+0.3dBm**
2CH 4E	**142Vpp**	**-0.8dBm**

CLIP LED ADJUSTMENT

• Check if the clip led lights at -6/-5dBm on input (~88Vpp on output), if necessary adjust the trimmers W301/2 on display board.

OFFSET ADJUSTMENT

• Set the input level at minimum (no signal), the output dc offset voltage must be within ±20mV, if necessary adjust the VR101 trimmer (for each channel) to be within this threshold.

BIAS ADJUSTMENT

• No bias adjustment is necessary for this amplifier circuitry; in any case the amplifier has the possibility to adjust it if necessary. To check properly the bias proceed as follows:
• Using a sinusoidal signal (1KHz or more) and the 4E load attached, wait till the heatsink temperature reaches about 60°c.
• Turn down the signal at the smallest intensity you can read on your oscilloscope trace connected at the amplifier output.
• Zoom in the crossing region using the amplitude, timebase and trigger controls of your oscilloscope. If you see a distortion, try to eliminate it adjusting the VR102 trimmer.
• Finally, set the input level at minimum and verify with the multimeter attached across an emitter resistance (p.e. R132) that the dc voltage doesn`t exceed 10mV.

ADVICES

• 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 resistance across emitter and collector of each device. Unsolder and lift one leg of each base pin and check the base-collector resistance. Replace any device 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 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 rail.
• If the positive cycle appears distorted, you can assume that the problem is in the circuitry of the negative rail.
• The dc voltages printed on the schematics are measured with the amplifier in steady state without input signal and nominal mains voltage supply, it can be useful to localize a damage.

HGB768011 - INPUT, PROTECTION & SUPPLY BOARD

HGB768013-200+200W AMPLIFIER MODULE

HGB768002-DISPLAY BOARD

OUTPUTS

SPEAKONCH1 – CH1 + MIN.4OHM

SPEAKONCH2 – CH2 + MIN.4OHM

(BLU) P3 P4 (GRN)

J401 J401

P1 CH1 (BLU)

P2 CH2 (GRN)

THERMIC SWITCH 90°c CZ403

+12V R405 6K8 -12V

U402 TA7317P +VCC 9, MUTING 8, VOK_IN 1, DISCHRG 7, -VCC 5, GROUND 4, ±VDC1 2, ±VDC2 3, SPEAKER PROTECTION CIRCUIT, RELAY 6

R406 39K R407 39K +12VF D407 1N4006 J401

C410 100U R409 4K7 R411 27K C408 100U R410 27K C411 22U R408 220K R408 6K8

CZ404 +12VF

HGB768002-DISPLAY BOARD

+12VF L305 R313 1K2 L303 R311 1K R309 10K Q303 9014C R310 10K R302 10K R308 47K C302 10U CLIP ADJ D302 1N4004 R307 8K2

L304 R312 1K Q304 9014C

L301 R305 1K R303 10K Q301 9014C R304 10K R301 10K R308 47K C301 10U CLIP ADJ D301 1N4004 R301 8K2

L302 R306 1K Q302 9014C

(PCBA HQ7.7301)

CH1 POWER SIGNAL CLIP

CH2 SIGNAL CLIP

OFFSET ADJ R212 10K D101A 4148 D102A 4148 R209 270E W201 10K R210 270E C208 47U R213 47K

R214 1K R215 1K +56.4V +56.4V Q205 2SA965 +56.8V Q206 2SA965 R220 68E C212 100N 100V

C209 680P Q201 2SC2240 Q202 2SC2240 C215 100P R225 22K R206 1K5 C207 10U 50V C208 820P R220 22K -0.63V C210 47U R216 680E

R219 15K -34.3V Q203 2SC2240 Q204 2SC2240 R218 10K C211 47U 50V R217 10K

R211 15K R221 10K R222 2K2 R223 390E C214 1N Q209 2N5551 R224 1K8 -55.8V Q207 2SC2235 Q208 2SC2235 R226 220E R227 220E C216 100N 100V

D204 4148 D203 4148 CZ202 CZ202A CZ203 CZ203A

HGB768001 VOL BOARD LEVEL CH1 W1 50KA (PCBA HQ7.7.179) CZ201

HGB768001 VOL BOARD LEVEL CH2 W2 50KA (PCBA HQ7.7.179) CZ101

KN201 JK201 C204 100P R204 5K1 C202 47U R202 5K1 C203 68P R203 5K1 C201 47U R201 5K1 U101 TL072 OR TL082 C205 47U R205 470K

KN101 JK101 C104 100P R104 5K1 C102 47U R102 5K1 C103 68P R103 5K1 C101 47U R101 5K1 U101 TL072 OR TL082 C105 47U R105 470K

C20 100N SW200 C200 10N R200 10E

CH1 INPUTS CH2 SHIELD

R114 1K R115 1K +56.4V +56.4V Q105 2SA965 +56.8V Q106 2SA965 R120 68E C112 100N 100V

D101 4148 D102 4148 R109 270E W101 10K R110 270E C108 47U R113 47K OFFSET ADJ R112 10K

C109 680P Q101 2SC2240 Q102 2SC2240 C115 100P R125 22K R106 1K5 C107 10U 50V C106 820P R120 22K -0.63V C110 47U R116 680E

R119 15K -34.3V Q103 2SC2240 Q104 2SC2240 R118 10K C111 47U 50V R117 10K

R111 15K R121 10K R122 2K2 R123 390E C114 1N Q109 2N5551 R124 1K8 -55.8V Q107 2SC2235 Q108 2SC2235 R126 220E R127 220E C116 100N 100V

D104 4148 D103 4148 CZ102 CZ102A CZ103 CZ103A

CZ203A PVCCA +VCC (RED) OUTA CH1 (BLU) GNDA (BLK) NVCCA (YEL) -VCC PVCCB +VCC (RED) NVCCB (YEL) -VCC GNDB (BLK) OUTB CH2 (GRN)

+1.0V C217 100P 500V Q210 2SC2690 +0.42V D205 4148 RT2 DKF503 1°C Q214 2SC5198 Q216 2SC5198 R231 4E7 R238 4E7

C219 10U 50V Q212 2SC2240 D207 4148 R229 7K5 R232 270E R235 10E R237 0E43 5W R241 10E R243 0E43 5W R246 5E1 2W L201 1UH

R228 270E D208 4148 R230 7K5 R233 270E Q213 2SA970 C220 10U 50V D206 4148 -0.42V

-1.0V C218 100P 500V Q211 2SA1220 R234 4E7 R240 4E7 Q215 2SA1941 Q217 2SA1941 R236 10E R239 0E43 5W R242 10E R244 0E43 5W R245 10E 5W C221 100N 100V R247 10E

+1.0V C117 100P 500V Q110 2SC2690 +0.42V D105 4148 RT1 DKF503 1°C Q114 2SC5198 Q118 2SC5198 R131 4E7 R139 4E7

C119 10U 50V Q112 2SC2240 D105B 4148 R129 7K5 R132 270E R135 10E R137 0E43 5W R141 10E R143 0E43 5W R146 4E7 2W L101 1UH

R128 270E Q113 2SA970 C120 10U 50V D106 4148 D106B 4148 R130 7K5 R133 270E R136 10E R138 0E43 5W R142 10E R144 0E43 5W R145 10E 5W C121 100N 100V

-1.0V C118 100P 500V Q111 2SA1220 R134 4E7 R140 4E7 Q115 2SA1941 Q119 2SA1941

CZ103 CZ103A

D401 1N4004 D402 1N4004 D403 1N4004 D404 1N4004 D405 1N4004 D406 1N4004 CZ401 F1 T1A F2 T1A

+12V R401 2K2 2W C405 470U C407 470U DW401 15V 1W C401 47U C403 100N

-12V R402 2K2 2W DW402 15V 1W C402 47U C404 100N

U101 TL072 IC401 7812 IN OUT GND C405 1000U C408 220U +12VF

(PCBA HQ7.7302)

CZ503 +12VF CZ501 D501 1N4004 RS01 10K D502 1N4004 R502 10K C501 10U RS03 100K Q501 2N5401 R505 10K Q502 2N5550 OR 2N5551 R506 10K C502 22U Q503 2C2690 DW503 3V9 1W C503 100N C504 220U CZ502 FAN1

(PCBA HQ7.7307)

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF 230VAC WHT C1 100N 250VAC 0VAC WHT

14VAC-YEL 0VAC-BLK 14VAC-YEL 42VAC-RED 0VAC-BLK 42VAC-RED

F3 T10A F4 T10A BRIDGE1 36MB20A C2 100N 50V +VCC (RED) CE2 1000U 80V (BLK) CE3 1000U 80V -VCC (YEL)

TRANSFORMER

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO3P

BOTTOM ----- FRONT VIEWS

1 2 3 4

NOTE: ALL DC VOLTAGES ENCLOSED INTO SQUARES ARE MEASURED IN STEADY STATE WITHOUT INPUT SIGNAL AT 25°C AND NOMINAL MAINS VOLTAGE SUPPLY.

DRW G.BOCCATO	DWG# 550700.scm	PCB#	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DATE 12/06/02	SCHEMATIC DIAGRAM	ALL RIGHTS ARE RESERVED. NO COPIES OR REPRODUCE THIS DOCUMENT WITHOUT WRITTEN CONSENT BY GENERALMUSIC.
APP. R.FALCONI	REV: A	PROCON400 POWER AMPLIFIER	

HGB768012 - INPUT, PROTECTION & SUPPLY BOARD

OUTPUTS

SPEAKONCH1

– CH1 + MIN.4OHM

SPEAKONCH2

– CH2 + MIN.4OHM

(BLU) P3

(GRN) P4

J401

P1 CH1 (BLU)

P2 CH2 (GRN)

CZ403 THERMIC SWITCH 90°c

+12VF

D407 1N4006

J401

U402 TA7317P

+VCC +VDC1 +VDC2 MUTING RELAY VOK_IN DISCHRG -VCC GROUND SPEAKER PROTECTION CIRCUIT

R406 39K R407 39K R408 220K R409 6K8

C410 100U C411 22U C412 100U C413 100U R404 27K R405 27K

+12V -12V

R405 5K6

HGB768002-DISPLAY BOARD

CH1 CLIP SIGNAL POWER

CH2 CLIP SIGNAL

L305 R313 1K2 L303 R311 1K L304 R312 1K L301 R305 1K L302 R306 1K

Q303 9014C Q304 9014C Q301 9014C Q302 9014C

R309 10K R310 10K R303 10K R304 10K

W302 47K W301 47K

C302 10U C301 10U

CLIP ADJ CLIP ADJ

D302 1N4004 D301 1N4004

R307 8K2 R301 8K2

+12VF +12VF

CZ404

(PCBA HQ7.7301)

HGB768001 VOL BOARD

LEVEL CH1 W1 50KA

(PCBA HQ7.7191)

CZ201

LEVEL CH2 W2 50KA

(PCBA HQ7.7191)

CZ101

KN201 JK201 KN101 JK101

C204 100P R204 5K1 C202 47U R202 5K1 C201 47U R201 5K1 C203 6P8 C205 47U R203 5K1 U101 TL072 OR TL082 R205 470K

C104 100P R104 5K1 C102 47U R102 5K1 C101 47U R101 5K1 C103 6P8 C105 47U R103 5K1 R105 470K

C20 100N C200 10N R200 10E SW200

INPUTS CH1 CH2 SHIELD

R408 220K

U401 TA7317P

+VCC +VDC1 +VDC2 MUTING RELAY VOK_IN DISCHRG -VCC GROUND SPEAKER PROTECTION CIRCUIT

C411 22U

R405 5K6

-12V

R208 15K R209 270E R210 270E W201 470E R211 15K

D101A D102A 4148

OFFSET ADJ R212 10K

C208 47U R213 47K

R206 1K5

C206 820P R207 22K

R214 1K R215 1K

+73.4V

Q205 2SA965 +73.9V Q206 2SA965

R220 68E

C212 100N 100V

CZ203

C213 100P

D204 D203 4148

R222 1K2

C214 1N

Q209 2N5551

R224 1K8

R223 510E

-72.9V

Q207 2SC2235 Q208 2SC2235

R226 220E R227 220E C216 100N 100V

C209 680P Q201 2SC2240 Q202 2SC2240

C215 100P R225 22K

-0.67V

R219 15K

-43.9V

Q203 2SC2240 Q204 2SC2240

R217 10K R218 10K C211 47U 50V

R221 10K 1W R216 510E C210 47U

HGB768014-375+375W AMPLIFIER MODULE

CZ203A CZ202A CZ103A CZ102A

PVCCA +VCC (RED)

+1.0V -1.0V

C217 100P 500V

Q210 2SC2690 +0.46V

RT2 DKF503 1C

R231 4E7 R245 4E7

Q214 2SC5200 Q218 2SC5200

D205 4148

C219 10U 50V

Q212 2SC2240

D207 R229 5K6 R232 270E

R235 10E R237 0E43 5W R247 10E R249 0E43 5W

R252 5E1 2W L201 10U

OUTA CH1 (BLU)

D208 R230 5K6 R233 270E

Q213 2SA970

C220 10U 50V

D206 4148

-0.46V

Q211 2SA1220

C218 100P 500V

R236 10E R238 0E43 5W R248 10E R250 0E43 5W

R251 10N 100V C221

R224 4E7 R246 4E7

Q215 2SA1943 Q219 2SA1943

GNDA (BLK)

NVCCA (YEL) -VCC

PVCCB +VCC (RED)

Q114 2SC5200 Q118 2SC5200

Q110 2SC2690

RT1 DKF503 1C

R231 4E7 R245 4E7

D105 4148

C119 10U 50V

Q112 2SC2240

D105B R129 5K6 R132 270E

R235 10E R237 0E43 5W R247 10E R249 0E43 5W

R152 4E7 2W L101 1UH

OUTB CH2 (GRN)

D106B R130 5K6 R133 270E

Q113 2SA970

C120 10U 50V

D106 4148

-0.46V

Q111 2SA1220

C118 100P 500V

R236 10E R238 0E43 5W R248 10E R250 0E43 5W

R151 10N 100V C121

R234 4E7 R246 4E7

Q115 2SA1943 Q119 2SA1943

GNDB (BLK)

NVCCB (YEL) -VCC

CZ103 CZ402 CZ503 CZ501 CZ502

D401 1N4004 D402 1N4004 D403 1N4004 D404 1N4004 D405 1N4004 D406 1N4004

+12V -12V +12VF

R401 2K2 2W R402 2K2 2W

C406 470U C407 470U C408 220U

DW401 15V 1W DW402 15V 1W

C401 47U C402 47U C403 100N C404 100N

U101 TL072

IC401 7812 IN OUT GND

C405 1000U

CZ401 F1 T1A F2 T1A

14VAC-YEL 0VAC-BLK 14VAC-YEL 54VAC-RED 0VAC-BLK 54VAC-RED

F3 T15A F4 T15A

BRIDGE1 56MB20A

C2 100N 100V

CE2 10000U 80V CE3 10000U 80V

+VCC (RED) (BLK) -VCC (YEL)

⚠ TRANSFORMER

⚠ MAINS (EU) 230VAC ±10% 50Hz

⚠ POWER ON/OFF

230VAC WHT 0VAC

C1 100N 630VAC

(PCBA HQ7.7332)

C501 10U 50V

R503 100K

Q501 2N5401

D501 1N4004 R501 10K D502 1N4004 R502 10K

R505 10K R506 10K

Q502 2N5550 OR 2N5551

Q503 2SC2690

C502 22U

DW501 3V9 1W

(PCBA HQ7.7308)

C503 100N C504 22U

FAN1

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO264

BOTTOM ----- FRONT VIEWS

1 2 3

4

NOTE: ALL DC VOLTAGES ENCLOSED INTO SQUARES ARE MEASURED IN STEADY STATE WITHOUT INPUT SIGNAL AT 25°C AND NOMINAL MAINS VOLTAGE SUPPLY.

DRW G.BOCCATO	DWG# 550701.scm	PCB#	GENERALMUSIC S.p.A. ITALY
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APP. R.FALCONI	REV: A	PROCON750 POWER AMPLIFIER	

OUTPUTS

SPEAKONCH1

– CH1 + MIN.4OHM

SPEAKONCH2

– CH2 + MIN.4OHM

HGB768000 - INPUT, PROTECTION & SUPPLY BOARD

P3 P1 P4 CH1 P2 CH2

J201 J202 D206 1N4006

CH1 THERMIC SWITCH 90°c

CH2 THERMIC SWITCH 90°c

CZ204 CZ205

U204 TA7317P +VCC ±VDC1 ±VDC2 MUTING RELAY VOK-IP DISCHRG -VCC GROUND SPEAKER PROTECTION CIRCUIT

U201 TL072

CZ208 CZ206 CZ207 CZ201 CZ202 CZ203

FAN1 CH1 FAN2 CH2

D209 1N4004 R224 10K D210 1N4004 R225 10K

Q201 2N5401 Q202 2N5550 OR 2N5551 Q203 2SC2690 OR 8D139

D205 1N4004 R214 120K D202 1N4004 D201 1N4004 D204 1N4004 D203 1N4004 D208 1N4004 D207 1N4004

IC202 7812 IC203 79L12 IC205 7812

SW200

F1 T1A F2 T1A F3 T1.5A F4 T1.5A

BRIDGE1 36MB20A

14VAC-YEL 0VAC-BLK 14VAC-YEL 58VAC-RED 0VAC-BLK 58VAC-RED

+VCC (RED) IBLK -VCC (YEL)

(PCBA HG7.7333)

HGB768002-DISPLAY BOARD

POWER

CH1 SIGNAL CLIP

CH2 SIGNAL CLIP

CLIP ADJ

(PCBA HG7.7301)

HGB768001 VOL BOARD

LEVEL CH1 — CH1 SIGNAL

LEVEL CH2 — CH2 SIGNA

(PCBA HG7.7179)

INPUTS

CH1 KN201 JK201

CH2 KN202 JK202

768272 - SOFT START BOARD

(OPTIONAL)

NOTICE: REPLACE THIS CIRCUIT ENTIRELY.

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF

230VAC WHT 0VAC WHT

(PCB# 313114)

NOTE: C1 IS PRESENT ONLY WHEN C3 (ON 768272) IS ABSENT.

⚠ TRANSFORMER

SHIELD

HGB768004 - CH1-475W AMPLIFIER MODULE

CH1 SIGNAL

OFFSET ADJ

BIAS ADJ

Q105A 2SA940A Q106A 2SA940A Q107A 2SC2073A Q108A 2SC 2073A

Q109A 2SC 2240

Q110A 2SC5198 Q111A 2SA1941

Q112A 2SC2240 Q113A 2SA970

Q114A 2SC5200 Q115A 2SA1943 Q116A 2SC5200 Q117A 2SA1943 Q118A 2SC5200 Q119A 2SA1943

Q1A 2SC200K Q2B 2SC200K

D103A FR107 OR BA159 D104A FR107 OR BA159 D105A FR107 OR BA159 D106A FR107 OR BA159

PVCCA +VCC (RED) OUTA (GRN) GNDA (BLK) NVCCA (YEL) -VCC

(PCBA HG7.7314)

HGB768003 - CH2-475W AMPLIFIER MODULE

CH2 SIGNAL

OFFSET ADJ

BIAS ADJ

Q105B 2SA940A Q106B 2SA940A Q107B 2SC2073A Q108B 2SC 2073A

Q109B 2SC 2240

Q110B 2SC5198 Q111B 2SA1941

Q112B 2SC2240 Q113B 2SA970

Q114B 2SC5200 Q115B 2SA1943 Q116B 2SC5200 Q117B 2SA1943 Q118B 2SC5200 Q119B 2SA1943

Q1B 2SC200K Q2C 2SC200K

D103B FR107 OR BA159 D104B FR107 OR BA159 D105B FR107 OR BA159 D106B FR107 OR BA159

PVCCB +VCC (RED) OUTB (GRN) GNDB (BLK) NVCCB (YEL) -VCC

(PCBA HG7.7314)

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO3P TO264

BOTTOM ----- FRONT VIEWS

1 2 3 4

NOTE: ALL DC VOLTAGES ENCLOSED INTO SQUARES ARE MEASURED IN STEADY STATE WITHOUT INPUT SIGNAL AT 25°C AND NOMINAL MAINS VOLTAGE SUPPLY.

DRW G.BOCCATO	DWG# 550702.scm	PCB#	GENERALMUSIC S.p.A. ITALY
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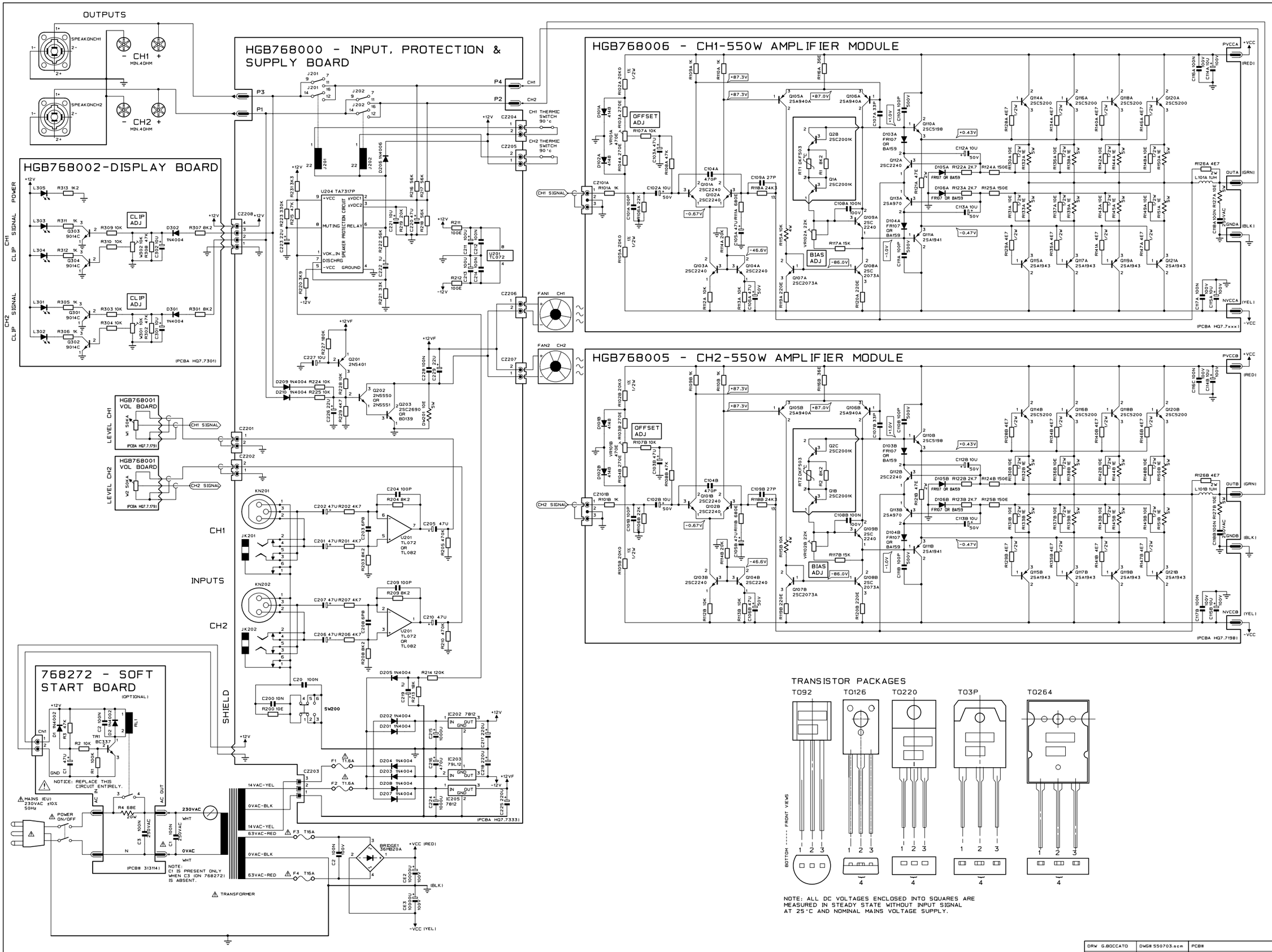
APP. R.FALCONI	REV: A	PROCON950 POWER AMPLIFIER	



DRW G.BOCCATO	DWG# 550703.sch	PCB#	GENERALMUSIC S.p.A. ITALY
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OUTPUTS

SPEAKONCH1

- CH1 + MIN.4OHM

SPEAKONCH2

- CH2 + MIN.4OHM

HGB768000 - INPUT, PROTECTION & SUPPLY BOARD

P3 P1 P4 CH1 P2 CH2

J201 J202 CH1 THERMIC SWITCH 90°c CH2 THERMIC SWITCH 90°c CZ204 CZ205

D208 1N4006

U204 TA7317P +VCC ±VDC1 ±VDC2 MUTING RELAY SPEAKER PROTECTION CIRCUIT VOK-IZ DISCHRG -VCC GROUND

U201 TL072

CZ208 CZ206 CZ207 CZ201 CZ202 CZ2203

FAN1 CH1 FAN2 CH2

D209 1N4004 R224 10K D210 1N4004 R225 10K

Q201 2N5401 Q202 2N5550 OR 2N5551 Q203 2SC2690 OR BD139

IC202 7812 IC203 79L12 IC205 7812

F1 T1.6A F2 T1.6A F3 T20A F4 T20A

14VAC-YEL 0VAC-BLK 68.5VAC-RED

BRIDGE1 3EM620A BRIDGE2 3EM620A

+VCC (RED) -VCC (YEL) (BLK)

CE1 CE2 CE3 10000U 100V

SW200

SHIELD

HGB768002-DISPLAY BOARD

CH1 CLIP SIGNAL POWER

CH2 CLIP SIGNAL

CLIP ADJ

L305 L303 L304 L301 L302

Q303 9014C Q304 9014C Q301 9014C Q302 9014C

D302 1N4004 D301 1N4004

(PCBA HQ7.7301)

HGB768001 VOL BOARD

LEVEL CH1 LEVEL CH2

W1 50K A W2 50K A

CH1 SIGNAL CH2 SIGNA

(PCBA HQ7.179)

INPUTS

CH1 KN201 JK201 C202 47U R202 4K7 C201 47U R201 4K7 C204 100P R204 8K2 C205 47U R205 470K R203 8K2

CH2 KN202 JK202 C207 47U R207 4K7 C206 47U R206 4K7 C209 100P R209 8K2 C210 47U R210 470K R208 8K2

768272 - SOFT START BOARD (OPTIONAL)

CN1 D1 1N4002 D2 1N4002 RL1 TR1 BC337 R1 10K R2 10K R3 4K7 C1 47U C2 100N C3 100N

NOTICE: REPLACE THIS CIRCUIT ENTIRELY.

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF AC IN AC OUT R4 68E 20W C1 100N 250VAC C3 100N 250VAC

230VAC WHT 0VAC WHT

(PCB# 313114)

NOTE: C1 IS PRESENT ONLY WHEN C3 (ON 768272) IS ABSENT.

TRANSFORMER

HGB768008 - CH1-625W AMPLIFIER MODULE

CZ101A R101A 1K CH1 SIGNAL

OFFSET ADJ R107A 10K

Q101A 2SC2240 Q102A 2SC2240 Q104A 470P C104A C102A 10U 50V C109A 27P R118A 27K

Q105A 2SA940A Q106A 2SA940A +93.0V +92.4V

Q2B 2SC2001K RT1 DKF503 R2 8K2 Q1A 2SC2001K -0.67V

Q103A 2SC2240 Q104A 2SC2240 -48.7V

BIAS ADJ -91.0V Q107A 2SC2073A

Q110A 2SC5198 Q111A 2SA1941 Q112A 2SC2240 Q113A 2SA970 Q108A 100N 100V C107A 33P 500V C111A 100P 500V

D103A FR107 OR BA159 D104A FR107 OR BA159 D105A R122A 2K7 R124A 150E D106A R123A 2K7 R125A 150E FR107 OR BA159

+0.50V -0.47V +1.0V -1.0V C112A 10U 50V C113A 10U 50V

Q114A 2SC5200 Q116A 2SC5200 Q118A 2SC5200 Q120A 2SC5200 Q122A 2SC5200

Q115A 2SA1943 Q117A 2SA1943 Q119A 2SA1943 Q121A 2SA1943 Q123A 2SA1943

PVCCA +VCC (RED) OUTA (GRN) GNDA (BLK) NVCCA (YEL) -VCC

L101A 1UH R126A 4E7 R127A 10E 3WAC C116A 100N 100V C114A 100U 100V C117A 100N C115A 100U 100V

(PCBA HQ7.7198)

HGB768007 - CH2-625W AMPLIFIER MODULE

CZ101B R101B 1K CH2 SIGNAL

OFFSET ADJ R107B 10K

Q101B 2SC2240 Q102B 2SC2240 Q104B 470P C104B C102B 10U 50V C109B 27P R118B 27K

Q105B 2SA940A Q106B 2SA940A +93.0V +92.4V

Q2C 2SC2001K RT2 DKF503 R2 8K2 Q1B 2SC2001K -0.67V

Q103B 2SC2240 Q104B 2SC2240 -48.7V

BIAS ADJ -91.0V Q107B 2SC2073A

Q110B 2SC5198 Q111B 2SA1941 Q112B 2SC2240 Q113B 2SA970 Q108B 100N 100V C107B 33P 500V C111B 100P 500V

D103B FR107 OR BA159 D104B FR107 OR BA159 D105B R122B 2K7 R124B 150E D106B R123B 2K7 R125B 150E FR107 OR BA159

+0.50V -0.47V +1.0V -1.0V C112B 10U 50V C113B 10U 50V

Q114B 2SC5200 Q116B 2SC5200 Q118B 2SC5200 Q120B 2SC5200 Q122B 2SC5200

Q115B 2SA1943 Q117B 2SA1943 Q119B 2SA1943 Q121B 2SA1943 Q123B 2SA1943

PVCCB +VCC (RED) OUTB (GRN) GNDB (BLK) NVCCB (YEL) -VCC

L101B 1UH R126B 4E7 R127B 10E 3WAC C116B 100N 100V C114B 100U 100V C117B 100N C115B 100U 100V

(PCBA HQ7.7198)

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO3P TO264

BOTTOM ----- FRONT VIEWS

1 2 3 4

NOTE: ALL DC VOLTAGES ENCLOSED INTO SQUARES ARE MEASURED IN STEADY STATE WITHOUT INPUT SIGNAL AT 25°C AND NOMINAL MAINS VOLTAGE SUPPLY.

DRW G.BOCCATO	DWG# 550704.scm	PCB#	GENERALMUSIC S.p.A. ITALY
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HGB768000 - INPUT, PROTECTION & SUPPLY BOARD

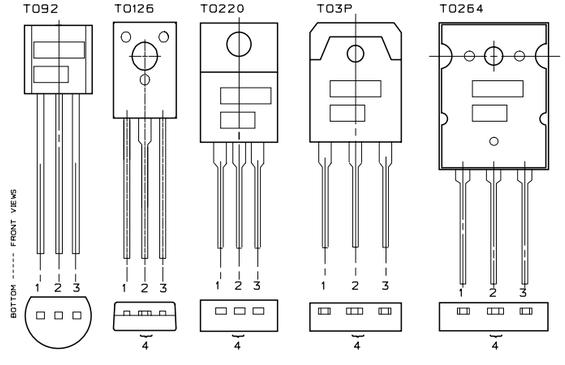
HGB768010 - CH1-750W AMPLIFIER MODULE

HGB768009 - CH2-750W AMPLIFIER MODULE

HGB768002-DISPLAY BOARD

768272 - SOFT START BOARD

TRANSISTOR PACKAGES



NOTE: ALL DC VOLTAGES ENCLOSED INTO SQUARES ARE MEASURED IN STEADY STATE WITHOUT INPUT SIGNAL AT 25°C AND NOMINAL MAINS VOLTAGE SUPPLY.

DRW G.BOCCATO	DWG# 550705.sch	PCB#	GENERALMUSIC S.p.A. ITALY
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Spare Part List

Legend	
EU	= Europe Version
US	= US Version
code	description

PROCON 400/750

		Assembly
130285		Mains Cable (EU)
110291		16A 250Vac Bipolar Power Switch
020493		100n 250Vac MKP EMI Capacitor “Siemens”
HGB238001		Transformer 230Vac 550W (EU) (Procon 400)
HGB238002		Transformer 230Vac 900W (EU) (Procon 750)
080608		36MB20A 35A 200V Rectifier Diode Bridge
HGB030000		10000u 80V -10+50% V Electrolytic Capacitor VT
110038		T16A Fuse 6.3x32mm (EU)(US) (Procon 750)
110027		T10A Fuse 6.3x32mm (EU)(US) (Procon 400)
141200		Speakon Socket (NL4MP Neutrik)
HGB347000		Volume Knob
HGB140000		Dual Red/Blk Binding Post
HGB110300		12Vdc 0.25A 80x25mm Fan
110360		Fan Grid 80mm

Input, Protection & Supply Board

HGB768012	*	**Input, Protection & Supply Board (PCBA HQ7.7332)(Procon750)**
HGB768011	*	**Input, Protection & Supply Board (PCBA HQ7.7302)(Procon400)**
HGB140001	*	2sw 2pos H Slider Switch
HGB140002	*	Hor Female XLR Socket
HGB140003	*	Jack Horizontal S-F Socket
HGB110301	*	Relay 12V / 2 Switch 10A 250Vac
HGB100000	*	TA7317P Speaker Protection Circuit
HGB090009	*	2SA965-O TO92 Pnp Transistor
HGB090007	*	2SC2235-O TO92 Npn Transistor
HGB090000	*	2SC2240GR TO92 LN Npn Transistor
110011	*	T1A Fuse 5x20mm (EU)
100061	*	TL072 Dual J-Fet Operational Amplifier
100045	*	7812 +12V 1A Voltage Regulator
090200	*	2N5550/1 TO92 Npn Transistor
080158	*	1N4004 1A 400V Rectifier Diode
080103	*	1N4148 100mA 75V Signal Diode
060521	*	2K2 2W 10% Resistor
060253	*	10E 5W 10% Wire Resistor
050691	*	470K 1/4W 5% Resistor
050651	*	220K 1/4W 5% Resistor
050571	*	47K 1/4W 5% Resistor
050561	*	39K 1/4W 5% Resistor
050541	*	27K 1/4W 5% Resistor
050531	*	22K 1/4W 5% Resistor
050511	*	15K 1/4W 5% Resistor
050491	*	10K 1/4W 5% Resistor
050471	*	6K8 1/4W 5% Resistor
050401	*	1K8 1/4W 5% Resistor
050391	*	1K5 1/4W 5% Resistor
050381	*	1K2 1/4W 5% Resistor
050371	*	1K 1/4W 5% Resistor
050301	*	270E 1/4W 5% Resistor
050291	*	220E 1/4W 5% Resistor
050231	*	68E 1/4W 5% Resistor
030721	*	1000u 25V 20% Vert Electrolytic Capacitor
030650	*	470u 25V 20% Vert Electrolytic Capacitor
030565	*	220u 25V 20% Vert Electrolytic Capacitor
030485	*	100u 25V 20% Vert Electrolytic Capacitor
030403	*	47u 25V 20% Vert Electrolytic Capacitor
030324	*	22u 50V 20% Vert Electrolytic Capacitor
030245	*	10u 50V 20% Vert Electrolytic Capacitor
021024	*	100n 63V 10% MKT Polyester Capacitor
010595	*	100n 50V -20+80% Ceramic Cap. Multilayer
010443	*	680p 50V 10% CL2 Ceramic Capacitor
010335	*	100p 500V 10% CL2 Ceramic Capacitor
010200	*	6p8 50V 10% CL2 Ceramic Capacitor

Volume Board

HGB768001		**Volume Board (PCBA HQ7.7.179)**
HGB075000	*	50KA RK16 Hor Rotary Potentiometer K15 40CLK

Display Board

HGB768002		**Display Board (PCBA HQ7.7301)**
MDL090000	*	9014C Npn TO92 Ebc 50V 0,15A
080158	*	1N4004 1A 400V Rectifier Diode
070181	*	10K 20% Horizontal Linear Trimmer
050571	*	47K 1/4W 5% Resistor
050491	*	10K 1/4W 5% Resistor
050381	*	1K2 1/4W 5% Resistor
050371	*	1K 1/4W 5% Resistor
042634	*	20K0 1/4W 1% Metalized Film Resistor
030245	*	10u 50V 20% Vert Electrolytic Capacitor

Amplifier Module

HGB768014		**375+375W Amplifier Module (PCBA HQ7.7308)**
HGB768013		**200+200W Amplifier Module (PCBA HQ7.7307)**
090201	*	2N5400/1 TO92 Pnp Transistor
090200	*	2N5550/1 TO92 Npn Transistor
HGB090008	*	2SC2690 TO126 Npn Transistor
HGB090010	*	2SA1220 TO126 Pnp Transistor
HGB090014	*	2SA1943 TO264 Pnp Transistor
HGB090013	*	2SC5200 TO264 Npn Transistor
HGB090006	*	2SA1941 TO3P/TO218 Pnp Transistor
HGB090005	*	2SC5198 TO3P/TO218 Npn Transistor
HGB090004	*	2SA970GR TO92 LN Pnp Transistor
HGB090001	*	2SC2001K TO92 Npn Transistor
HGB090000	*	2SC2240GR TO92 LN Npn Transistor
HGB080800	*	Ntc type DKF503 (Thermometrics)
080158	*	1N4004 1A 400V Rectifier Diode
080103	*	1N4148 100mA 75V Signal Diode
060253	*	10E 5W 10% Wire Resistor
060210	*	4E7 2W 10% Resistor
050611	*	100K 1/4W 5% Resistor
050491	*	10K 1/4W 5% Resistor
050461	*	5K6 1/4W 5% Resistor
050301	*	270E 1/4W 5% Resistor
050131	*	10E 1/4W 5% Resistor
050091	*	4E7 1/4W 5% Resistor
030324	*	22u 50V 20% Vert Electrolytic Capacitor
030245	*	10u 50V 20% Vert Electrolytic Capacitor
030245	*	10u 50V 20% Vert Electrolytic Capacitor
020481	*	100n 100V10% MKT Polyester Capacitor
010595	*	100n 50V -20+80% Ceramic Cap. Multilayer
010335	*	100p 500V 10% CL2 Ceramic Capacitor

PROCON 950/1100/1250/1500

		Assembly
130285		Mains Cable (EU)
110291		16A 250Vac Bipolar Power Switch
020493		100n 250Vac MKP EMI Capacitor “Siemens”
HGB238003		Transformer 230Vac 1100W (EU) (Procon 950)
HGB238004		Transformer 230Vac 1200W (EU) (Procon 1100)
HGB238005		Transformer 230Vac 1600W (EU) (Procon 1250)
HGB238006		Transformer 230Vac 1900W (EU) (Procon 1500)
080608		36MB20A 35A 200V Rectifier Diode Bridge
HGB030002		10000u 110V -10+50% V Electrolytic Capacitor VT (Procon1250/1500)
HGB030001		10000u 100V -10+50% V Electrolytic Capacitor VT (Procon950/1100)
110063		T25A Fuse 6.3x32mm (EU)(US) (Procon 1500)
110062		T20A Fuse 6.3x32mm (EU)(US) (Procon 1250)
110038		T16A Fuse 6.3x32mm (EU)(US) (Procon 950/1100)
141200		Speakon Socket (NL4MP Neutrik)
HGB347000		Volume Knob
HGB140000		Dual Red/Blk Binding Post
HGB110300		12Vdc 0.25A 80x25mm Fan (Procon 950/1100)
HGB110302		12Vdc 0.45A 80x25mm Fan (Procon 1250/1500)
110360		Fan Grid 80mm

Soft Start Board

768272		**Soft Start Board (Pcb#313114) (NL version only)**
140917	*	2 Contacts Vert Male Connector
120857	*	6.3mm Vertical Male Faston for Pcb
110324	*	Relay NO 1 SC.12V 20A R=160E
090152	*	BC337 TO92 Npn Transistor
080156	*	1N4002 1A 100V Rectifier Diode
080103	*	1N4148 100mA 75V Signal Diode
061341	*	68E 20W 5% Wire Resistor
052060	*	100K 1/8w 5% Resistor
052056	*	47K 1/8w 5% Resistor
052048	*	10K 1/8w 5% Resistor
030403	*	47u 25V 20% Vert Electrolytic Capacitor
020493	*	100n 250Vac MKP EMI Capacitor “Siemens”
010595	*	100n 50V -20+80% Ceramic Cap. Multilayer

Input, Protection & Supply Board

HGB768000		**Input, Protection & Supply Board (PCBA HQ7.7333) (Procon950/1100/1250/1500)**
HGB140001	*	2sw 2pos H Slider Switch
HGB140002	*	Hor Female XLR Socket
HGB140003	*	Jack Horizontal S-F Socket
HGB110301	*	Relay 12V / 2 Switch 10A 250Vac
HGB100000	*	TA7317P Speaker Protection Circuit
HGB090008	*	2SC2690 TO126 Npn Transistor
110012	*	T1.6A Fuse 5x20mm (EU) (Procon1100/1250/1500)
110011	*	T1A Fuse 5x20mm (EU) (Procon950)
100061	*	TL072 Dual J-Fet Operational Amplifier
100045	*	7812 +12V 1A Voltage Regulator
100043	*	7912 -12V 1A Voltage Regulator
090201	*	2N5400/1 TO92 Pnp Transistor
090200	*	2N5550/1 TO92 Npn Transistor
080158	*	1N4004 1A 400V Rectifier Diode
060253	*	10E 5W 10% Wire Resistor
050691	*	470K 1/4W 5% Resistor
050671	*	330K 1/4W 5% Resistor
050641	*	180K 1/4W 5% Resistor
050621	*	120K 1/4W 5% Resistor
050581	*	56K 1/4W 5% Resistor
050571	*	47K 1/4W 5% Resistor
050551	*	33K 1/4W 5% Resistor
050521	*	18K 1/4W 5% Resistor
050491	*	10K 1/4W 5% Resistor
050481	*	8K2 1/4W 5% Resistor
050451	*	4K7 1/4W 5% Resistor
050441	*	3K9 1/4W 5% Resistor
050431	*	3K3 1/4W 5% Resistor
050251	*	100E 1/4W 5% Resistor
050131	*	10E 1/4W 5% Resistor
042634	*	20K0 1/4W 1% Metalized Film Resistor
030721	*	1000u 25V 20% Vert Electrolytic Capacitor
030650	*	470u 25V 20% Vert Electrolytic Capacitor
030565	*	220u 25V 20% Vert Electrolytic Capacitor
030485	*	100u 25V 20% Vert Electrolytic Capacitor
030403	*	47u 25V 20% Vert Electrolytic Capacitor
030324	*	22u 50V 20% Vert Electrolytic Capacitor
030245	*	10u 50V 20% Vert Electrolytic Capacitor
030005	*	1u 50V 20% Vert Electrolytic Capacitor
021024	*	100n 63V 10% MKT Polyester Capacitor
021012	*	10n 63V 10% MKT Polyester Capacitor
010595	*	100n 50V -20+80% Ceramic Cap. Multilayer
010200	*	6p8 50V 10% CL2 Ceramic Capacitor

Volume Board

HGB768001		**Volume Board (PCBA HQ7.7.179)**
HGB075000	*	50KA RK16 Hor Rotary Potentiometer K15 40CLK

Display Board

HGB768002		**Display Board (PCBA HQ7.7301)**
MDL090000	*	9014C Npn TO92 Ebc 50V 0,15A
080158	*	1N4004 1A 400V Rectifier Diode
070181	*	10K 20% Horizontal Linear Trimmer
050571	*	47K 1/4W 5% Resistor
050491	*	10K 1/4W 5% Resistor
050381	*	1K2 1/4W 5% Resistor
050371	*	1K 1/4W 5% Resistor
050481	*	8K2 1/4W 5% Resistor
042634	*	20K0 1/4W 1% Metalized Film Resistor
030245	*	10u 50V 20% Vert Electrolytic Capacitor

Power Amplifier Module

HGB768010		**CH1-750W Amplifier Module (PCBA HQ7.7312)**
HGB768009		**CH2-750W Amplifier Module (PCBA HQ7.7311)**
HGB768008		**CH1-625W Amplifier Module (PCBA HQ7.7198)**
HGB768007		**CH2-625W Amplifier Module (PCBA HQ7.7198)**
HGB768006		**CH1-550W Amplifier Module (PCBA HQ7.7198)**
HGB768005		**CH2-550W Amplifier Module (PCBA HQ7.7198)**
HGB768004		**CH1-475W Amplifier Module (PCBA HQ7.7314)**
HGB768003		**CH2-475W Amplifier Module (PCBA HQ7.7314)**
HGB090014	*	2SA1943 TO264 Pnp Transistor
HGB090013	*	2SC5200 TO264 Npn Transistor
HGB090006	*	2SA1941 TO3P/TO218 Pnp Transistor
HGB090005	*	2SC5198 TO3P/TO218 Npn Transistor
HGB090004	*	2SA970GR TO92 LN Pnp Transistor
HGB090003	*	2SA940A TO220F Pnp Transistor
HGB090002	*	2SC2073A TO220F Npn Transistor
HGB090001	*	2SC2001K TO92 Npn Transistor
HGB090000	*	2SC2240GR TO92 LN Npn Transistor
HGB080800	*	Ntc type DKF503 (Thermometrics)
HGB080000	*	FR107 OR BA159 Fast Rec Diode 1A 1000V 500ns DO41
HGB061000	*	10K 4W 10% Resistor
230557	*	1uH Horizontal Coil For Amplifier
120857	*	6.3mm Vertical Male Faston for Pcb
080103	*	1N4148 100mA 75V Signal Diode
070201	*	22K 20% Horizontal Linear Trimmer
070106	*	470E 20% Horizontal Linear Trimmer
060336	*	47E 2W 10% Resistor
060253	*	10E 5W 10% Wire Resistor
060210	*	4E7 2W 10% Resistor
060151	*	1E 5W 10% Wire Resistor
052047	*	8K2 1/8w 5% Resistor
050571	*	47K 1/4W 5% Resistor
050541	*	27K 1/4W 5% Resistor
050531	*	22K 1/4W 5% Resistor
050511	*	15K 1/4W 5% Resistor
050491	*	10K 1/4W 5% Resistor
050421	*	2K7 1/4W 5% Resistor
050371	*	1K 1/4W 5% Resistor
050351	*	680E 1/4W 5% Resistor
050301	*	270E 1/4W 5% Resistor
050291	*	220E 1/4W 5% Resistor
050271	*	150E 1/4W 5% Resistor
042634	*	20K0 1/4W 1% Metalized Film Resistor
040134	*	10E 1/2W 5% Resistor
040091	*	4E7 1/2W 5% Resistor
030410	*	47u 50V 20% Vert Electrolytic Capacitor
030403	*	47u 25V 20% Vert Electrolytic Capacitor
030245	*	10u 50V 20% Vert Electrolytic Capacitor
020481	*	100n 100V10% MKT Polyester Capacitor
010426	*	470p 50V 10% CL2 Ceramic Capacitor
010345	*	100p 50V 10% CL2 Ceramic Capacitor
010335	*	100p 500V 10% CL2 Ceramic Capacitor
010293	*	33p 50V 10% CL2 Ceramic Capacitor
010282	*	27p 50V 10% CL2 Ceramic Capacitor

Note:

- All dimensions are in mm unless otherwise specified.
- 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.