PROFESSIONAL SOUND

PROCON SERIES

POWER AMPLIFIERS

SERVICE MANUAL

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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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code 270266

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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

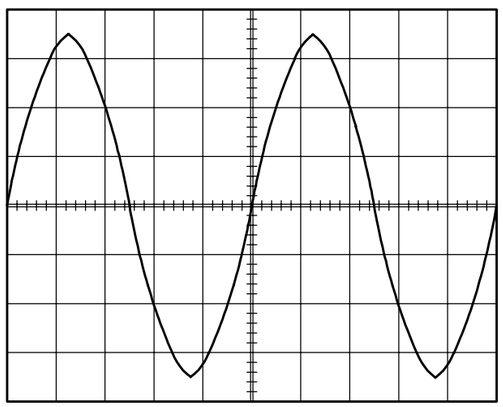
• No bias adjustment is necessary for this amplifier circuitry.

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

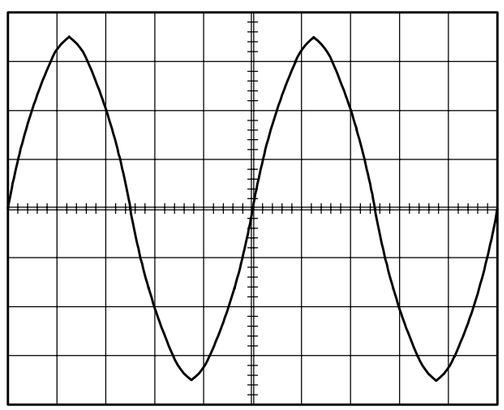
• No bias adjustment is necessary for this amplifier circuitry.

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.

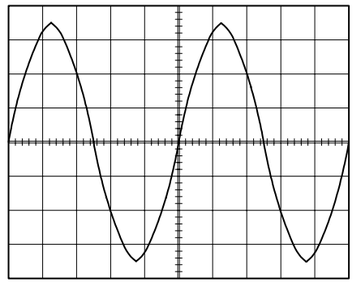
SUPPLY CHECK

• 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.
• When the input signal exceeds -25dBm (9Vpp on output) the SIGNAL led lights and the fans turn at their maximum speed.

OSCILLOSCOPE FIGURE



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

• 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.

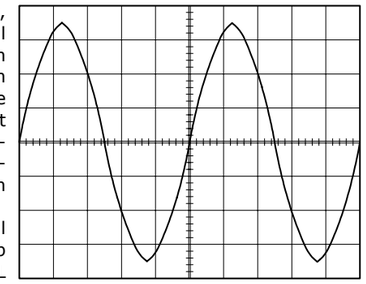
SUPPLY CHECK

• 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.
• When the input signal exceeds -24dBm (9Vpp on output) the SIGNAL led lights and the fans turn at their maximum speed.

OSCILLOSCOPE FIGURE



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

• 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.

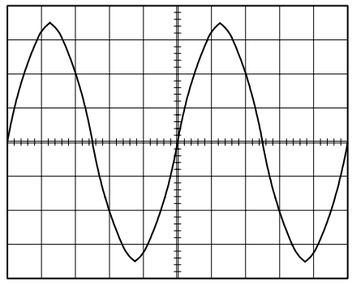
SUPPLY CHECK

• 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.

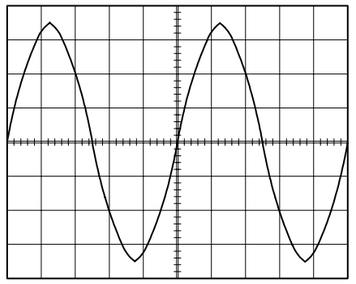
SUPPLY CHECK

• 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

U402 TA7317P SPEAKER PROTECTION CIRCUIT

THERMIC SWITCH 90°c

CLIP ADJ

OFFSET ADJ

U101 TL072 OR TL082

HGB768001 VOL BOARD

SW200

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF

TRANSFORMER

BRIDGE1 36MB20A

IC401 7812

(PCBA HQ7.7302)

(PCBA HQ7.7307)

(PCBA HQ7.7301)

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO3P

BOTTOM ----- FRONT VIEWS

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	
APP. R.FALCONI	REV: A	PROCON400 POWER AMPLIFIER	

HGB768012 - INPUT, PROTECTION & SUPPLY BOARD

HGB768014-375+375W AMPLIFIER MODULE

HGB768002-DISPLAY BOARD

OUTPUTS

SPEAKONCH1

CH1 MIN.4OHM

SPEAKONCH2

CH2 MIN.4OHM

HGB768001 VOL BOARD (PCBA HQ7.7191)

HGB768001 VOL BOARD (PCBA HQ7.7191)

(PCBA HQ7.7301)

(PCBA HQ7.7332)

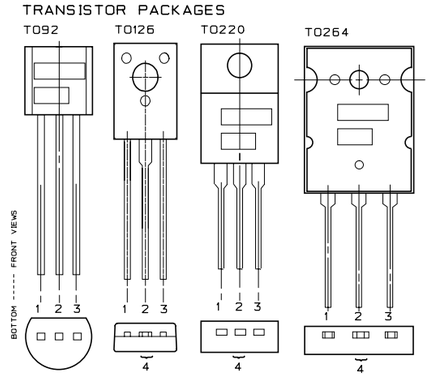
(PCBA HQ7.7308)

TRANSFORMER

THERMIC SWITCH 90°c

SW200

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# 550701.scm	PCB#	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DATE 12/06/02	SCHEMATIC DIAGRAM	
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-.12 DISCHRG -VCC GROUND SPEAKER PROTECTION CIRCUIT

U201 TL072

CZ208 CZ206 CZ207

FAN1 CH1 FAN2 CH2

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

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

CZ201 CZ202

KN201 KN202 JK201 JK202

INPUTS CH1 CH2

U201 TL072 OR TL082

D205 1N4004 R214 120K

SW200

D201 1N4004 D202 1N4004 D203 1N4004 D204 1N4004 D207 1N4004 D208 1N4004

IC202 7812 IC203 79L12 IC205 7812

F1 T1A F2 T1A

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

F3 T15A F4 T15A

BRIDGE1 36MB20A

+VCC (RED) IBLK -VCC (YEL)

(PCBA HG7.7333)

HGB768002-DISPLAY BOARD

POWER

CH1 CLIP SIGNAL

CH2 CLIP SIGNAL

CLIP ADJ

(PCBA HG7.7301)

HGB768001 VOL BOARD

LEVEL CH1 LEVEL CH2

CH1 SIGNAL CH2 SIGNA

(PCBA HG7.7.179)

768272 - SOFT START BOARD

(OPTIONAL)

NOTICE: REPLACE THIS CIRCUIT ENTIRELY.

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF

230VAC 0VAC

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

⚠ TRANSFORMER

(PCB# 313114)

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

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

PVCCA +VCC (RED) OUTA (GRN) AGNDA (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

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

PVCCB +VCC (RED) OUTB (GRN) BGNDB (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
CKD G.RICCI	DATE 13/06/02	SCHEMATIC DIAGRAM	
APP. R.FALCONI	REV: A	PROCON950 POWER AMPLIFIER	

OUTPUTS

SPEAKONCH1

CH1 MIN.4OHM

SPEAKONCH2

CH2 MIN.4OHM

HGB768000 - INPUT, PROTECTION & SUPPLY BOARD

HGB768002-DISPLAY BOARD

(PCBA HQ7.7301)

HGB768006 - CH1-550W AMPLIFIER MODULE

IPCBA HQ7.7xxx1

HGB768005 - CH2-550W AMPLIFIER MODULE

IPCBA HQ7.7198

HGB768001 VOL BOARD (LEVEL CH1)

HGB768001 VOL BOARD (LEVEL CH2)

INPUTS

SHIELD

768272 - SOFT START BOARD (OPTIONAL)

NOTICE: REPLACE THIS CIRCUIT ENTIRELY.

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

IPCBA HQ7.7333

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO3P TO264

BOTTOM ----- FRONT VIEWS

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# 550703.sch	PCB#	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DATE 13/06/02	SCHEMATIC DIAGRAM	
APP. R.FALCONI	REV: A	PROCON1100 POWER AMPLIFIER	

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

D206 1N4006

U204 TA7317P

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

U201 TL072

HGB768002-DISPLAY BOARD

POWER

CH1 SIGNAL CLIP

CH2 SIGNAL CLIP

CLIP ADJ

(PCBA HQ7.7301)

CZ208

HGB768008 - CH1-625W AMPLIFIER MODULE

CH1 SIGNAL

OFFSET ADJ

BIAS ADJ

Q105A 2SA940A Q106A 2SA940A

Q2B 2SC2001K Q1A 2SC2001K

RT1 DKF503

Q101A 2SC2240 Q102A 2SC2240

Q103A 2SC2240 Q104A 2SC2240

Q107A 2SC2073A Q108A 2SC 2073A

Q109A 2SC 2240

Q110A 2SC5198

Q111A 2SA1941

Q112A 2SC2240

Q113A 2SA970

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

(PCBA HQ7.7198)

HGB768007 - CH2-625W AMPLIFIER MODULE

CH2 SIGNAL

OFFSET ADJ

BIAS ADJ

Q105B 2SA940A Q106B 2SA940A

Q2C 2SC2001K Q1B 2SC2001K

RT2 DKF503

Q101B 2SC2240 Q102B 2SC2240

Q103B 2SC2240 Q104B 2SC2240

Q107B 2SC2073A Q108B 2SC 2073A

Q109B 2SC 2240

Q110B 2SC5198

Q111B 2SA1941

Q112B 2SC2240

Q113B 2SA970

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

(PCBA HQ7.7198)

HGB768001 VOL BOARD

LEVEL CH1 — CH1 SIGNAL — (PCBA HQ7.7179)

LEVEL CH2 — CH2 SIGNA — (PCBA HQ7.7179)

CZ201 CZ202

INPUTS

CH1 KN201 JK201 U201 TL072 OR TL082

CH2 KN202 JK202 U201 TL072 OR TL082

SHIELD

SW200

768272 - SOFT START BOARD (OPTIONAL)

NOTICE: REPLACE THIS CIRCUIT ENTIRELY.

RL1 TR1 BC337

IC202 7812 IC203 79L12 IC205 7812

CZ203

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

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

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF

R4 68E 20W

230VAC 0VAC

(PCB# 313114)

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

TRANSFORMER

BRIDGE1 3EM620A BRIDGE2 3EM620A

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

FAN1 CH1 FAN2 CH2

CZ206 CZ207

TRANSISTOR PACKAGES

TO92 TO126 TO220 TO3P TO264

BOTTOM ----- FRONT VIEWS

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
CKD G.RICCI	DATE 13/06/02	SCHEMATIC DIAGRAM	
APP. R.FALCONI	REV: A	PROCON1250 POWER AMPLIFIER	

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

+12V

U204 TA7317P

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

R231 3K3 R223 330K R225 2K7 C223 22U R220 3K9 -12V

C221 10U R222 120K C224 47U R218 56K R216 56K R217 56K

R211 100E C211 100U C212 100N C213 100U C214 100N R212 100E U201 TL072

R221 33K C220 10U R222 56K

CZ206 CZ207

FAN1 CH1 FAN2 CH2

+12VF

R227 180K C227 10U Q201 2N5401

D209 1N4004 R224 10K D210 1N4004 R225 10K R228 10K C226 22U R229 47K

Q202 2N5550 OR 2N5551 Q203 2SC2690 OR BD139 DX201 10E 5W

C228 100N C229 22U

HGB768001 VOL BOARD LEVEL CH1 W1 50K IPCBA HQ7.7.179

CH1 SIGNAL

CZ201 CZ202

HGB768001 VOL BOARD LEVEL CH2 W2 50K IPCBA HQ7.7.179

CH2 SIGNA

CH1

INPUTS

CH2

KN201 JK201 C202 47U R202 4K7 C204 100P R204 8K2 C203 6P8 R203 8K2 C201 47U R201 4K7 U201 TL072 OR TL082 C205 47U R205 470K

KN202 JK202 C207 47U R207 4K7 C209 100P R209 8K2 C208 6P8 R208 8K2 C206 47U R206 4K7 U201 TL072 OR TL082 C210 47U R210 470K

SHIELD

C20 100N C200 10N R200 10E SW200

D205 1N4004 R214 120K C219 1U R213 18K

D202 1N4004 D201 1N4004 IC202 7812 C215 1000U C217 220U

D204 1N4004 D203 1N4004 D208 1N4004 D207 1N4004 IC203 79L12 C216 470U C218 220U

F1 T1.6A F2 T1.6A

IC205 7812 C224 1000U C223 220U

CZ203

14VAC-YEL 0VAC-BLK 14VAC-YEL 71.5VAC-RED 0VAC-BLK 71.5VAC-RED 0VAC-BLK

F3 T25A F4 T25A

BRIDGE1 35B620A +VCC (RED) C2 100N C2E 1000U 100V

BRIDGE2 35B620A -VCC (YEL) C3 100N C3E 1000U 100V

(BLK)

TRANSFORMER

HGB768002-DISPLAY BOARD

+12V

CH1 CLIP SIGNAL POWER

L305 R313 1K2

L303 R311 1K Q303 9014C R309 10K R310 10K VR02 10K R308 47K C302 10U D302 1N4004 R307 8K2

L304 R312 1K Q304 9014C

CH2 CLIP SIGNAL

L301 R305 1K Q301 9014C R303 10K R304 10K VR01 10K R302 47K C301 10U D301 1N4004 R301 8K2

L302 R306 1K Q302 9014C

CLIP ADJ

CZ208

IPCBA HQ7.7301I

768272 - SOFT START BOARD (OPTIONAL)

CN1 D1 1N4002 R3 2K7 C2 100N D2 1N4002 RL1 R2 10K TR1 BC337 C1 47U R1 100K

NOTICE: REPLACE THIS CIRCUIT ENTIRELY.

MAINS (EU) 230VAC ±10% 50Hz

POWER ON/OFF

AC IN AC OUT R4 68E 20W C3 100N 275VAC C1 100N 275VAC

230VAC WHT 0VAC WHT

NOTE: C1 IS PRESENT ONLY WHEN C3 IGN 7682721 IS ABSENT.

IPCB# 313114I

HGB768010 - CH1-750W AMPLIFIER MODULE

CZ101A R101A 1K R102A 20K0 1% 1/2W R103A 270E R104A 270E R105A 20K0 1% 1/2W

D101A 4148 VR101A 10K D102A 4148

OFFSET ADJ R107A 10K

R108A 47K C103A 47U

R109A 1K R110A 1K R116A 36E

+99.1V +99.7V Q105A 2SA940A Q106A 2SA940A C107A 33P

C104A 470P C101A 2SC2240 Q102A 2SC2240 C102A 10U 50V

C109A 27P R118A 30K

-0.67V -53.4V

Q2B 2SC2001K RT1 DKF503 R1 8K2 Q1A 2SC2001K

C108A 100N 100V

Q103A 2SC2240 Q104A 2SC2240 R114A 20K R115A 10K 4W VR02A 22K R117A 15K

BIAS ADJ -96.5V

Q107A 2SC2073A Q108A 2SC 2073A

R112A 10K R113A 10K C105A 47U 50V R119A 220E R120A 220E

C110A 100P 500V Q110A 2SC5198 +0.51V

D103A FR107 OR BA159 C112A 10U 50V R124A 150

Q112A 2SC2240 D105A R122A 2K7 FR107 OR BA159 R125A 150E

Q113A 2SA970 D106A R123A 2K7 FR107 OR BA159 C113A 10U 50V

D104A FR107 OR BA159 -0.51V

Q111A 2SA1941 C111A 100P 500V -1.0V

R121A 47E

R128A 4E7 R134A 4E7 R140A 4E7 R146A 4E7 R152A 4E7 R158A 4E7 R164A 4E7

Q114A 2SC5200 Q116A 2SC5200 Q118A 2SC5200 Q120A 2SC5200 Q122A 2SC5200 Q124A 2SC5200 Q126A 2SC5200

R130A 10E R136A 10E R142A 10E R148A 10E R154A 10E R160A 10E R166A 10E

R132A 1E R138A 1E R144A 1E R150A 1E R156A 1E R162A 1E R168A 1E

R126A 4E7 L101A 1UH C116A 100N C114A 10U 100V

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

C118A 150N R173A 10E 250VAC

R131A 10E R137A 10E R143A 10E R149A 10E R155A 10E R161A 10E R167A 10E

R133A 1E R139A 1E R145A 1E R151A 1E R157A 1E R163A 1E R169A 1E

R129A 4E7 R135A 4E7 R141A 4E7 R147A 4E7 R153A 4E7 R159A 4E7 R165A 4E7

Q115A 2SA1943 Q117A 2SA1943 Q119A 2SA1943 Q121A 2SA1943 Q123A 2SA1943 Q125A 2SA1943 Q127A 2SA1943

C107A 100N C115A 10U 100V

(PCBA HQ7.7312)

HGB768009 - CH2-750W AMPLIFIER MODULE

CZ101B R101B 1K R102B 20K0 1% 1/2W R103B 270E R104B 270E R105B 20K0 1% 1/2W

D101B 4148 VR101B 10K D102B 4148

OFFSET ADJ R107B 10K

R108B 47K C103B 47U

R109B 1K R110B 1K R116B 36E

+99.1V +99.7V Q105B 2SA940A Q106B 2SA940A C107B 33P

C104B 470P C101B 2SC2240 Q102B 2SC2240 C102B 10U 50V

C109B 27P R118B 30K

-0.67V -53.4V

Q2C 2SC2001K RT2 DKF503 R2 8K2 Q1B 2SC2001K

C108B 100N 100V

Q103B 2SC2240 Q104B 2SC2240 R114B 20K R115B 10K 4W VR02B 22K R117B 15K

BIAS ADJ -96.5V

Q107B 2SC2073A Q108B 2SC 2073A

R112B 10K R113B 10K C105B 47U 50V R119B 220E R120B 220E

C110B 100P 500V Q110B 2SC5198 +0.51V

D103B FR107 OR BA159 C112B 10U 50V R124B 150

Q112B 2SC2240 D105B R122B 2K7 FR107 OR BA159 R125B 150E

Q113B 2SA970 D106B R123B 2K7 FR107 OR BA159 C113B 10U 50V

D104B FR107 OR BA159 -0.51V

Q111B 2SA1941 C111B 100P 500V -1.0V

R121B 47E

R128B 4E7 R134B 4E7 R140B 4E7 R146B 4E7 R152B 4E7 R158B 4E7 R164B 4E7

Q114B 2SC5200 Q116B 2SC5200 Q118B 2SC5200 Q120B 2SC5200 Q122B 2SC5200 Q124B 2SC5200 Q126B 2SC5200

R130B 10E R136B 10E R142B 10E R148B 10E R154B 10E R160B 10E R166B 10E

R132B 1E R138B 1E R144B 1E R150B 1E R156B 1E R162B 1E R168B 1E

R126B 4E7 L101B 1UH C116B 100N C114B 10U 100V

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

C118B 150N R173B 10E 250VAC

R131B 10E R137B 10E R143B 10E R149B 10E R155B 10E R161B 10E R167B 10E

R133B 1E R139B 1E R145B 1E R151B 1E R157B 1E R163B 1E R169B 1E

R129B 4E7 R135B 4E7 R141B 4E7 R147B 4E7 R153B 4E7 R159B 4E7 R165B 4E7

Q115B 2SA1943 Q117B 2SA1943 Q119B 2SA1943 Q121B 2SA1943 Q123B 2SA1943 Q125B 2SA1943 Q127B 2SA1943

C107B 100N C115B 10U 100V

(PCBA HQ7.7311)

CH1 SIGNAL

CH2 SIGNAL

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# 550705.sch	PCB#	GENERALMUSIC S.p.A. ITALY
CKD G.RICCI	DATE 13/06/02	SCHEMATIC DIAGRAM	
APP. R.FALCONI	REV: A	PROCON1500 POWER AMPLIFIER	

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.