



## 100W SUBWOOFER KIT

Powerful bass from a small cabinet thanks to  
the dual speaker principle

Total solder points: 383

Difficulty level: *beginner* 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☒ *advanced*



# K8077

**Features :**

- ☑ bass-reflex system with adjustable tube
- ☑ compact size due to dual-speaker principle
- ☑ adjustable level and filter response
- ☑ auto power-on/off system
- ☑ phase switch (0°-180°)
- ☑ line level and speaker level inputs for maximum compatibility
- ☑ 'Full-range'-option for use in active speaker system
- ☑ separate chamber for electronics avoids air leaks

**Specifications**

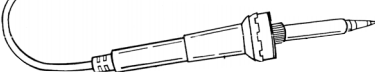
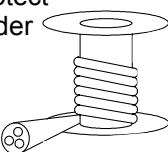
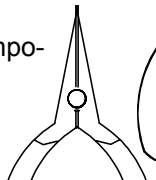
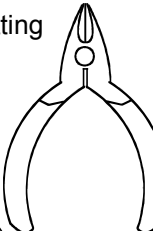
- power output: 100Wrms/ 4ohm (10% THD)
- filter freq. response:
  - ✓ wide: 25 - 110Hz (-6dB)
  - ✓ narrow: 18 - 65Hz (-6dB)
- speakers: two 6.5" 8 ohm drivers
- line level input sensitivity: 500mV
- auto turn-on level: 5mV
- volume\*: approx. 20 liter
- power supply: 120/230VAC
- dimensions\*: 460x310x210mm / 18,22 x 12,28 x 8,32"

(\*) recommended enclosure. Drawings for enclosure are included

## 1. Assembly (Skipping this can lead to troubles !)

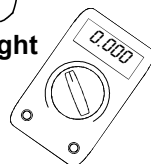
Ok, so we have your attention. These hints will help you to make this project successful. Read them carefully.

### 1.1 Make sure you have the right tools:

- A good quality soldering iron (25-40W) with a small tip. 
- Wipe it often on a wet sponge or cloth, to keep it clean; then apply solder to the tip, to give it a wet look. This is called 'thinning' and will protect the tip, and enables you to make good connections. When solder rolls off the tip, it needs cleaning.
- Thin raisin-core solder. Do not use any flux or grease. 
- A diagonal cutter to trim excess wires. To avoid injury when cutting excess leads, hold the lead so they cannot fly towards the eyes.
- Needle nose pliers, for bending leads, or to hold components in place. 
- Small blade and Phillips screwdrivers. A basic range is fine. 



**For some projects, a basic multi-meter is required, or might be handy**



### 1.2 Assembly Hints :

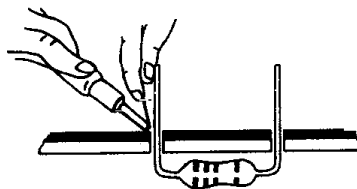
- ⇒ Make sure the skill level matches your experience, to avoid disappointments.
- ⇒ Follow the instructions carefully. Read and understand the entire step before you perform each operation.
- ⇒ Perform the assembly in the correct order as stated in this manual
- ⇒ Position all parts on the PCB (Printed Circuit Board) as shown on the drawings.
- ⇒ Values on the circuit diagram are subject to changes.
- ⇒ Values in this assembly guide are correct\*

- ⇒ Use the check-boxes to mark your progress.
- ⇒ Please read the included information on safety and customer service

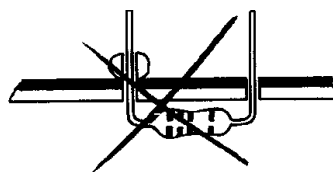
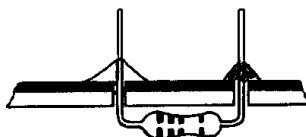
\* Typographical inaccuracies excluded. Always look for possible last minute manual updates, indicated as 'NOTE' on a separate leaflet.

### 1.3 Soldering Hints :

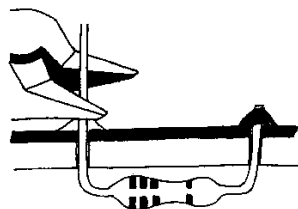
1- Mount the component against the PCB surface and carefully solder the leads



2- Make sure the solder joints are cone-shaped and shiny

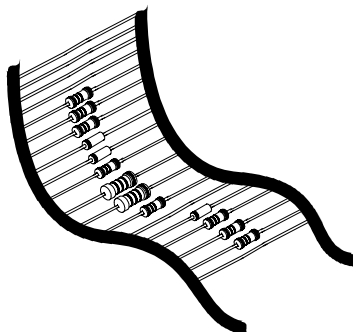


3- Trim excess leads as close as possible to the solder joint



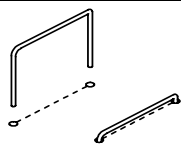
**AXIAL COMPONENTS ARE TAPED IN THE CORRECT MOUNTING SEQUENCE !**

REMOVE THEM FROM THE TAPE ONE AT A TIME !

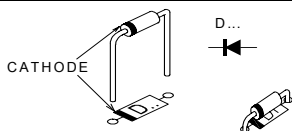


## 1. Jump wires.

- ☐ J1 ... J8
- ☐ R3
- ☐ R4
- ☐ R8
- ☐ R11

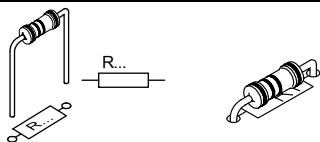


## 2. Diodes (check the polarity)



- ☐ D1 : **BAT85**
- ☐ D2 : 1N4148
- ☐ D3 : 1N4148
- ☐ D4 : 1N4148
- ☐ D5 : 1N4007
- ☐ D6 : 1N4007
- ☐ D7 : 1N4007
- ☐ D8 : 1N4007
- ☐ D9 : 1N4007
- ☐ D10 : 1N4007

## 3. 1/4W resistors.



- ☐ R1 : 22K (2 - 2 - 3 - B)
- ☐ R2 : 22K (2 - 2 - 3 - B)
- ☐ R7 : 47K (4 - 7 - 3 - B)
- ☐ R12 : 22K (2 - 2 - 3 - B)
- ☐ R13 : 22K (2 - 2 - 3 - B)
- ☐ R14 : 33K (3 - 3 - 3 - B)
- ☐ R15 : 22K (2 - 2 - 3 - B)
- ☐ R16 : 10K (1 - 0 - 3 - B)
- ☐ R17 : 22K (2 - 2 - 3 - B)
- ☐ R18 : 1K (1 - 0 - 2 - B)
- ☐ R19 : 10K (1 - 0 - 3 - B)
- ☐ R20 : 1K (1 - 0 - 2 - B)
- ☐ R21 : 1M (1 - 0 - 5 - B)
- ☐ R22 : 33K (3 - 3 - 3 - B)

- ☐ R23 : 1K (1 - 0 - 2 - B) \*
- ☐ R24 : 100K (1 - 0 - 4 - B)
- ☐ R25 : 390K (3 - 9 - 4 - B)
- ☐ R26 : 15K (1 - 5 - 3 - B)
- ☐ R27 : 470 (4 - 7 - 1 - B)
- ☐ R28 : 15K (1 - 5 - 3 - B)
- ☐ R29 : 100K (1 - 0 - 4 - B)
- ☐ R30 : 100K (1 - 0 - 4 - B)
- ☐ R34 : 10K (1 - 0 - 3 - B)
- ☐ R35 : 10K (1 - 0 - 3 - B)
- ☐ R36 : 10K (1 - 0 - 3 - B)
- ☐ R37 : 10K (1 - 0 - 3 - B)
- ☐ R39 : 10K (1 - 0 - 3 - B)
- ☐ R40 : 100K (1 - 0 - 4 - B)
- ☐ R41 : 33K (3 - 3 - 3 - B)
- ☐ R42 : 100 (1 - 0 - 1 - B)
- ☐ R43 : 47K (4 - 7 - 3 - B)
- ☐ R44 : 330 (3 - 3 - 1 - B)
- ☐ R45 : 220 (2 - 2 - 1 - B)
- ☐ R46 : 47 (4 - 7 - 0 - B)
- ☐ R47 : 3K3 (3 - 3 - 2 - B)
- ☐ R48 : 680 (6 - 8 - 1 - B)
- ☐ R49 : 3K3 (3 - 3 - 2 - B)
- ☐ R50 : 3K3 (3 - 3 - 2 - B)
- ☐ R51 : 10 (1 - 0 - 0 - B)
- ☐ R52 : 3K3 (3 - 3 - 2 - B)
- ☐ R53 : 1K5 (1 - 5 - 2 - B)
- ☐ R54 : 3K3 (3 - 3 - 2 - B)
- ☐ R55 : 680 (6 - 8 - 1 - B)
- ☐ R56 : 1K (1 - 0 - 2 - B)
- ☐ R57 : 220 (2 - 2 - 1 - B)
- ☐ R58 : 47 (4 - 7 - 0 - B)
- ☐ R61 : 1K8 (1 - 8 - 2 - B) \*
- ☐ R62 : 470 (4 - 7 - 1 - B)

(\*) Select operation mode :

### Subwoofer:

R61 : not mounted  
R23 : 1K

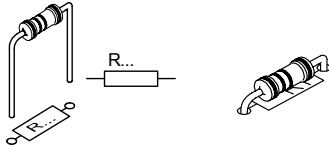
### Full range:

R61 : 1K8  
R23 : not mounted

### Full range with 6dB bass boost:

R61 : 1K8  
R23 : 1K

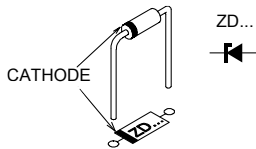
#### 4. Metallfilm resistors.



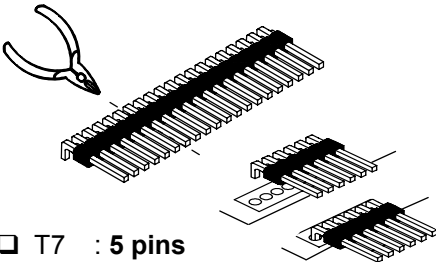
- ☐ R5 : 100 (1 - 0 - 1 - B - 9)
- ☐ R6 : 470 (4 - 7 - 1 - B - 9)
- ☐ R9 : 100 (1 - 0 - 1 - B - 9)
- ☐ R10 : 470 (4 - 7 - 1 - B - 9)
- ☐ R31 : 820 (8 - 2 - 1 - B)
- ☐ R32 : 820 (8 - 2 - 1 - B)
- ☐ R33 : 560 (5 - 6 - 1 - B)
- ☐ R38 : 2K7 (2 - 7 - 2 - B - 9)

#### 5. Zener diodes (check the polarity)

- ☐ ZD1 : 5V1
- ☐ ZD2 : 5V1
- ☐ ZD3 : 15V0
- ☐ ZD4 : 15V0
- ☐ ZD5 : 9V1

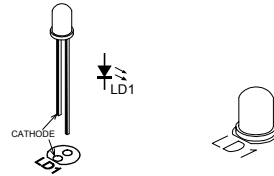


#### 6. Pinheaders



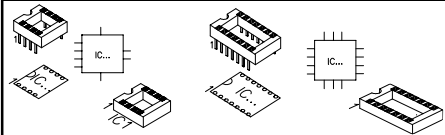
- ☐ T7 : 5 pins
- ☐ T8 : 6 pins
- ☐ T9 : 6 pins

#### 7. LEDs. Watch the polarity!



- ☐ LD3 : RED (-35/+35VDC)

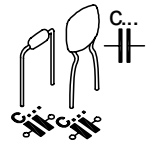
#### 8. IC sockets. Watch the position of the notch!

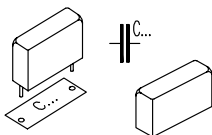


- ☐ IC1 : 8p
- ☐ IC2 : 14p
- ☐ IC3 : 8p

#### 9. Capacitors

- ☐ C1 : 390pF (391)
- ☐ C2 : 390pF (391)
- ☐ C3 : 100nF (104)
- ☐ C4 : 100nF (104)
- ☐ C5 : 100nF (104)
- ☐ C6 : 100nF (104)
- ☐ C7 : 100nF (104)
- ☐ C8 : 100nF (104)
- ☐ C9 : 100nF (104)
- ☐ C10 : 100nF (104)
- ☐ C11 : 680pF (680)
- ☐ C12 : 680pF (680)
- ☐ C13 : 47nF (473)
- ☐ C14 : 47pF (47)
- ☐ C15 : 47pF (47)
- ☐ C16 : 47pF (47)
- ☐ C17 : 1nF (102)
- ☐ C18 : 100pF (101)
- ☐ C19 : 10nF (103)

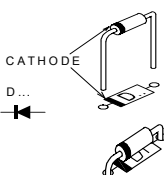




- ☐ C20 : 0,047 $\mu$ F / 63V
- ☐ C21 : 0,068 $\mu$ F / 63V
- ☐ C22 : 4700pF/ 100V
- ☐ C23 : 0,022 $\mu$ F / 63V
- ☐ C24 : 0,022 $\mu$ F / 63V

## 10. Diodes (check the polarity)

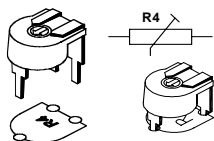
- ☐ D11 : 1N5404
- ☐ D12 : 1N5404
- ☐ D13 : 1N5404
- ☐ D14 : 1N5404



## 11. Trim potentiometer

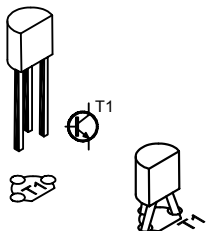
- ☐ RV3 : 1K

Turn RV3 fully counter-clockwise



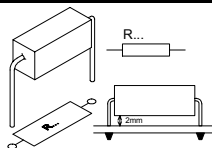
## 12. Transistors

- ☐ T1 : BC547B
- ☐ T2 : BC547B
- ☐ T3 : BC640
- ☐ T4 : BC640
- ☐ T5 : BC557
- ☐ T6 : BC639



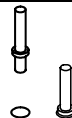
## 13. 5W resistors

- ☐ R59 : 0,47
- ☐ R60 : 0,47



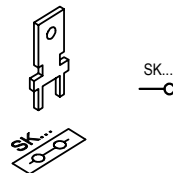
## 14. PCB tab

- ☐ SK12 : GND



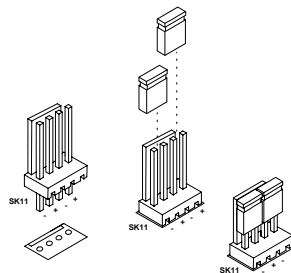
## 15. Flat receptacles

- ☐ LS+
- ☐ LS-
- ☐ AC BLUE
- ☐ AC RED
- ☐ AC GREY
- ☐ AC YELLOW



## 16. Male board wire connector

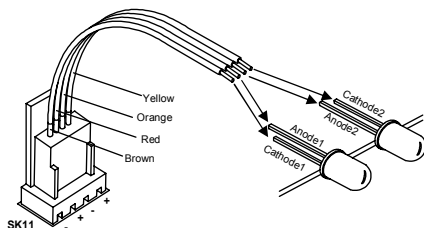
- ☐ SK11



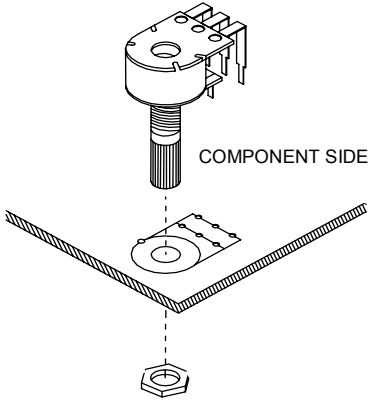
**Remark:** if you wish to have a 'POWER' and 'ON' indication in a remote location, you can remove the shunts and connect the supplied female board to wire connector and two extra LED's

Wiring diagram:

Brown	cathode1	ON
Red	anode1	
Orange	anode2	POWER
Yellow	cathode2	

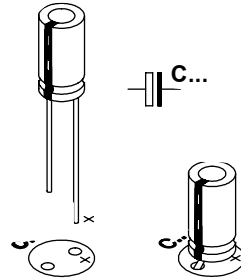


## 17. Potentiometers



- ❑ RV1 : Stereo log. 50K
- ❑ RV2 : Stereo log. 50K

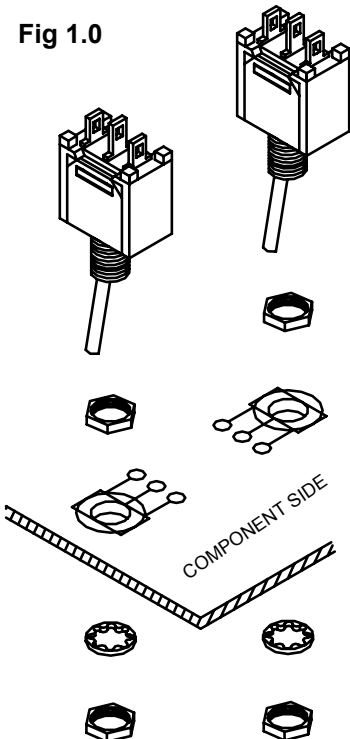
## 18. Electrolytic capacitors. Watch the polarity !



- ❑ C25 ... C28 : 10 $\mu$ F / 35V
- ❑ C29 : 22 $\mu$ F / 50V
- ❑ C30 ... C35 : 100 $\mu$ F / 50V
- ❑ C36 : 470 $\mu$ F / 16V

## 19. Switches

Fig 1.0



- ❑ SW1 : Phase
- ❑ SW2 : Mode

- ✔ Position the switches onto the PCB first.
- ✔ Mount a wire jumper onto each switch connector and connect these with the switch connector on the PCB.

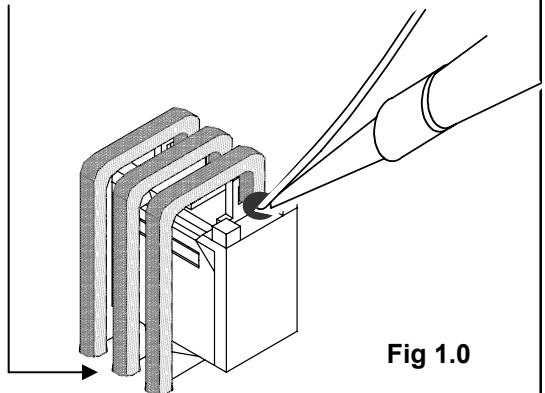


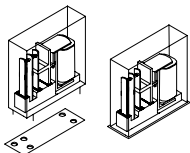
Fig 1.0



## 20. Relais

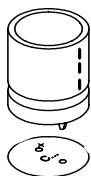
❑ RY1 : VR5V242C

( 24VDC - 5A - 2C )



## 21. Electrolytic capacitors.

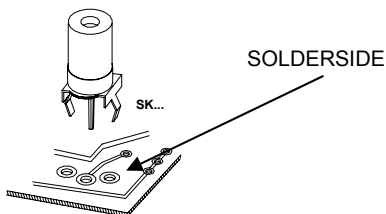
Watch the polarity !



❑ C37 : 3300 $\mu$ F / 50V

❑ C38 : 3300 $\mu$ F / 50V

## 22. Female cinch connectors



☞ **MOUNT THEM ON THE  
SOLDERSIDE !**

### Mount first :

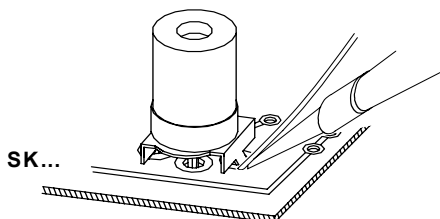
❑ SK1 : LOW LEVEL IN 'RIGHT'

❑ SK3 : HIGH LEVEL IN 'RIGHT'

### Mount now :

❑ SK2 : LOW LEVEL IN 'LEFT'

❑ SK4 : HIGH LEVEL IN 'LEFT'

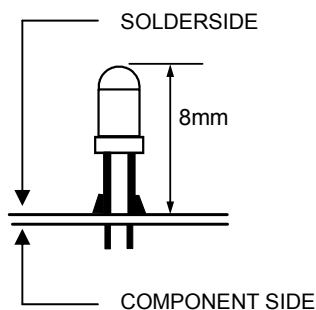
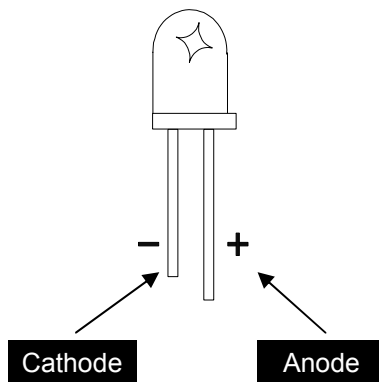


## 23. LEDs

❑ LD1 : POWER (red)

❑ LD2: ON (red)

*Mount both LEDs on the solder side  
at 8mm of the PCB cathode is  
marked with 'C'.*



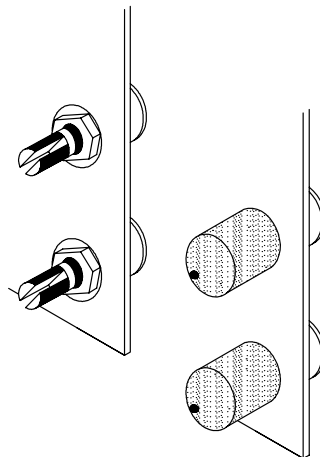
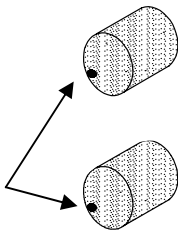
☞ **Inspect the complete assembly.  
Once the PCB is mounted on the  
heatsink, the solder side is no  
longer accessible.**

## 24. Fixing the knobs

Slide the knobs fully onto the potentiometer axes.  
Turn potentiometers fully counterclockwise

Watch the position of  
the dot !

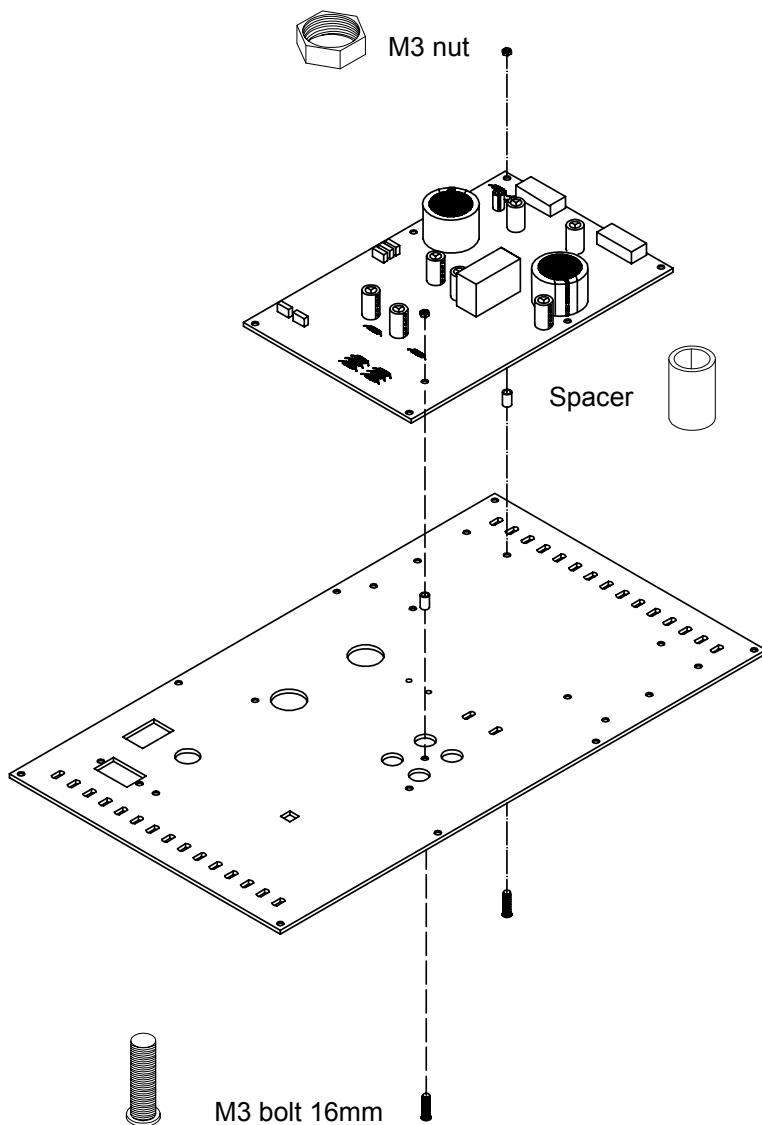
!



## 25. Fixing the PCB onto the heatsink

### *Fixing the PCB onto the heatsink :*

- (1) Slide 2 x 5mm plastic spacers over the black bolts.
- (2) Carefully position the PCB onto the two bolts
- (3) fasten using two nuts.

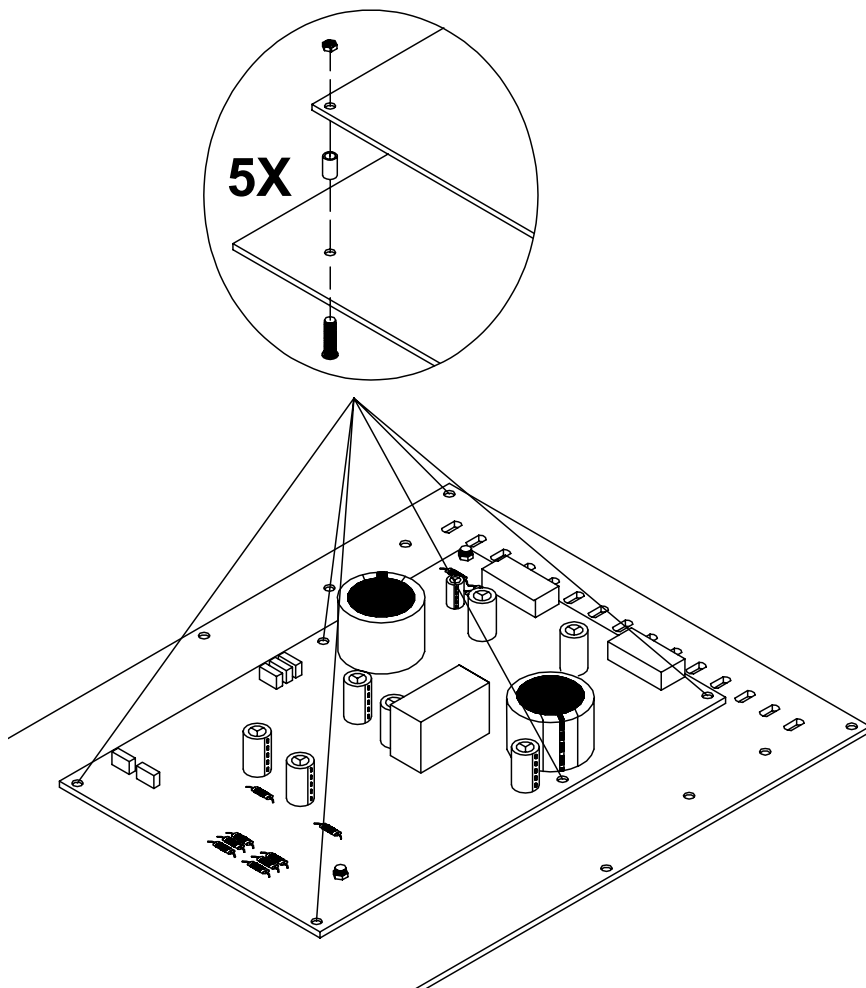


## Tighten gently, making sure that :

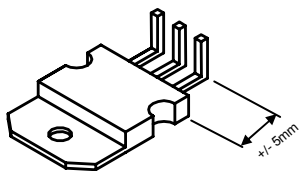
- the leds protrude the holes
- the cinch (RCA) connectors do not touch the heatsink
- the knobs do not touch the heatsink
- the switches do not touch the heatsink

(4) fit the remaining bolts and spacers

(5) fit the nuts and tighten them all, while minding the position of the knobs, switches, leds and connectors




## 26. Fixing the power transistors T8 (TIP147) & T9 (TIP142)

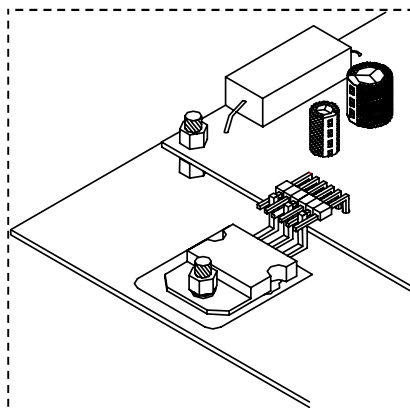
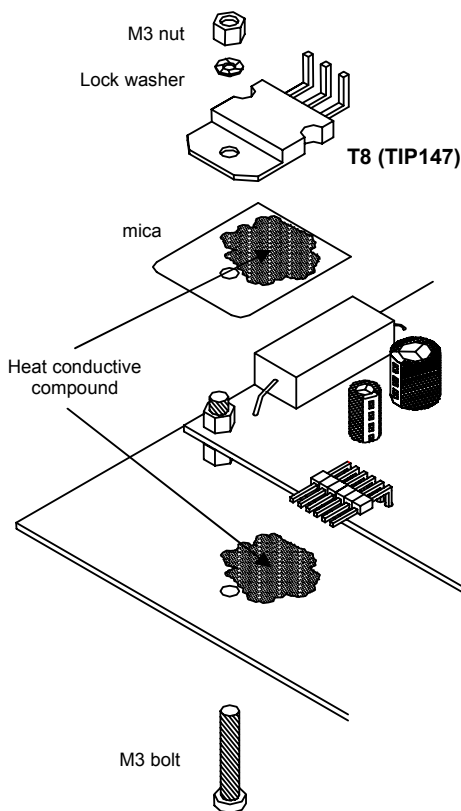


bend both transistors as indicated.

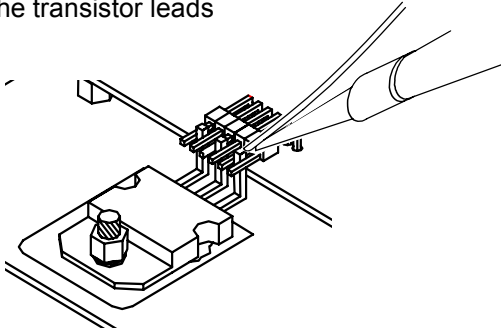
- apply a drop of heat conductive compound on the heatsink.
- position the mica onto the heatsink so that the hole coincide with the hole in the heatsink, press gently.
- apply a drop of heat conductive compound on the mica.
- Mount the transistor on the heatsink, using a 16mm bolt, lock washer and nut.

 **Make sure the transistor leads are correctly positioned between the pins of the pinheader.**

- Tighten gently.

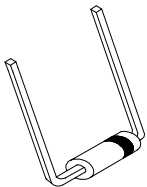


- Solder the transistor leads



*Repeat for the remaining transistor T9 (TIP142)*

## 27. Fitting diode D15 (1N4007)

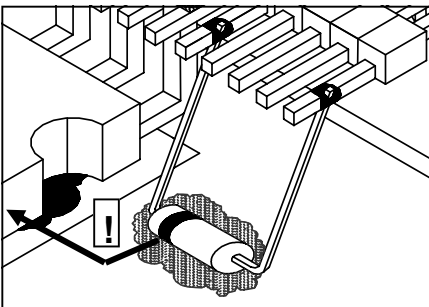
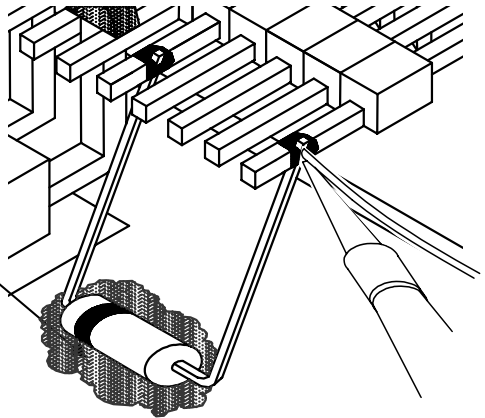


Bend the leads as indicated.

Put a large drop of heat conductive compound on the heatsink.

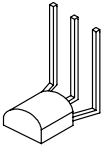
Solder the diode to the two outer pins of the pin header.

⚠ Make sure that the diode is bent towards the heat conductive compound.

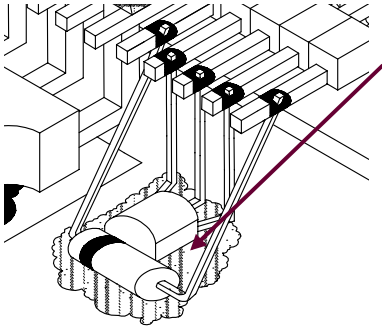


Mind the direction of the ring. It should face transistor T9

## 28. Fitting transistor T7 (BC547)



Bend the leads as indicated.



Put a large drop of heat conductive compound on the heatsink.

Solder the transistor to the remaining pins of the pinheader.

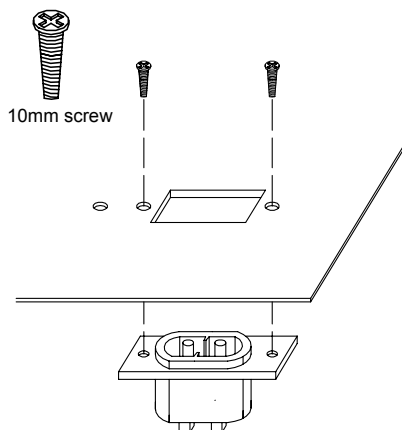
☞ The flat side of the transistor must face the heatsink.

☞ **Make sure that the transistor and diode leads do not touch each other and make sure that the diode does not touch the power transistor.**

## 29. Mounting the power supply section

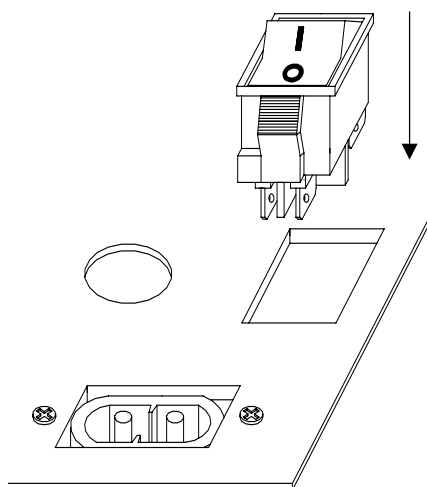
### 1. Mounting the AC connector

Position the AC connector at the PCB side of the heatsink and fix by means of two 10mm black screws.



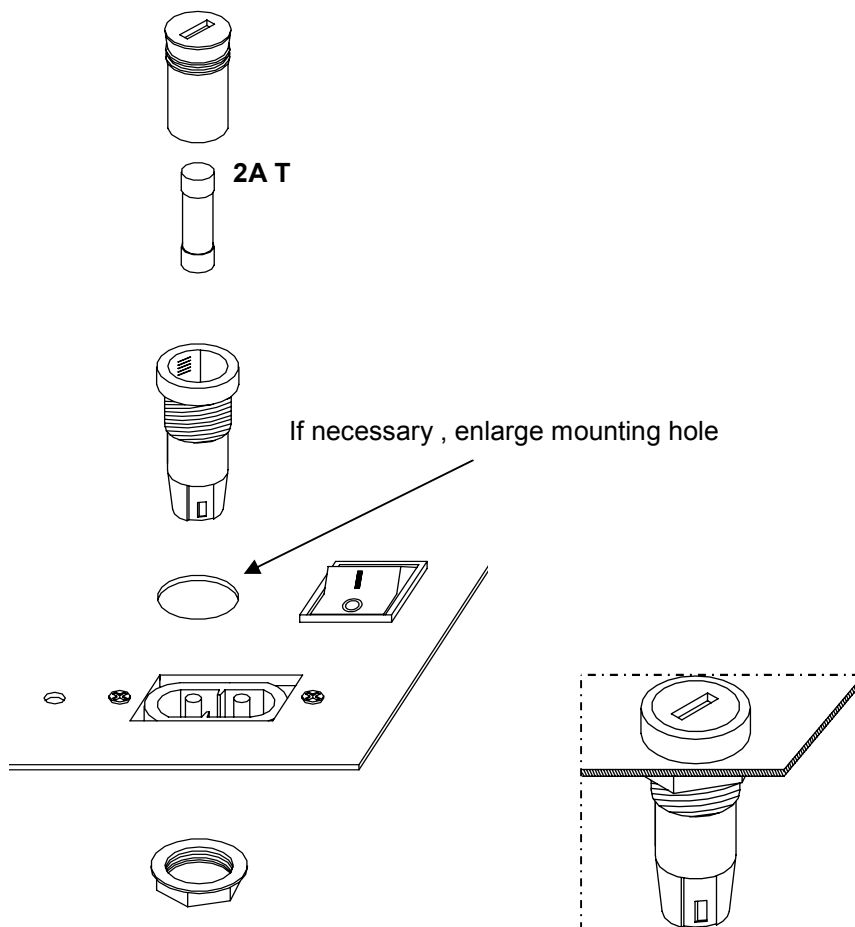
### 2. Mounting the power switch

Click the power switch onto the heatsink. Make sure the '0'-position of the switch faces the AC connector.





### 3. Mounting the fuse holder



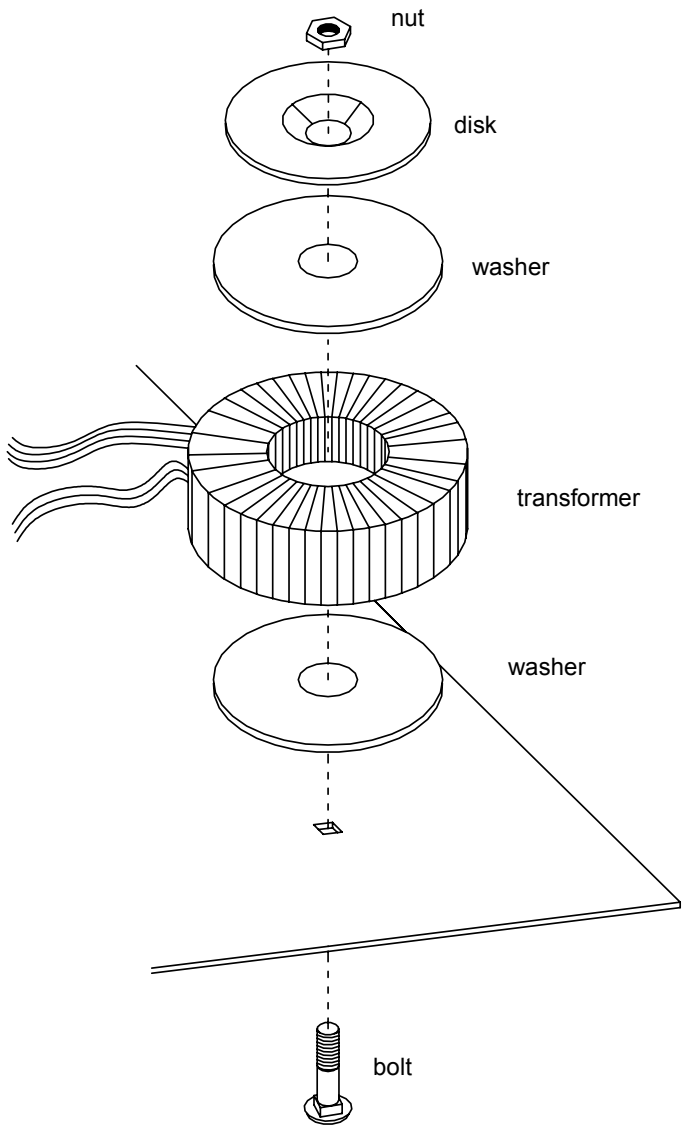
Place the fuse holder and fix with the included nut.

Place a 2A T fuse.

4. Fixing the transformer

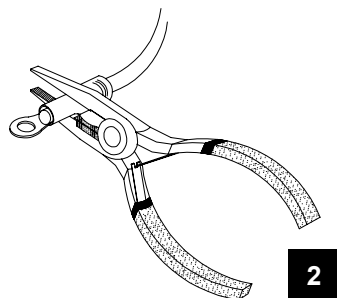
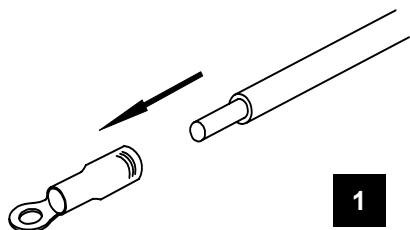
Rotate the transformer in such a way that the red/yellow/blue/grey wires point towards the PCB.

Tighten the nut

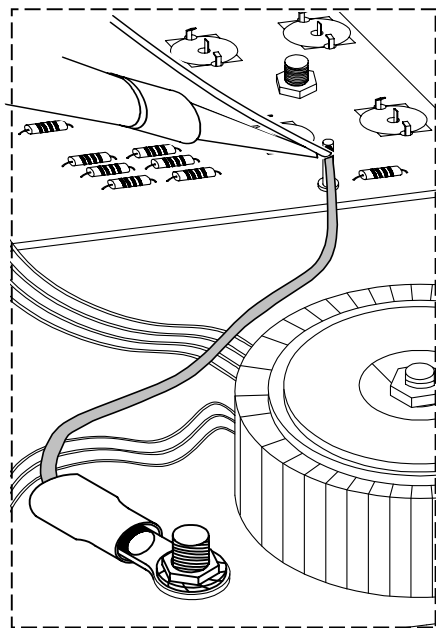
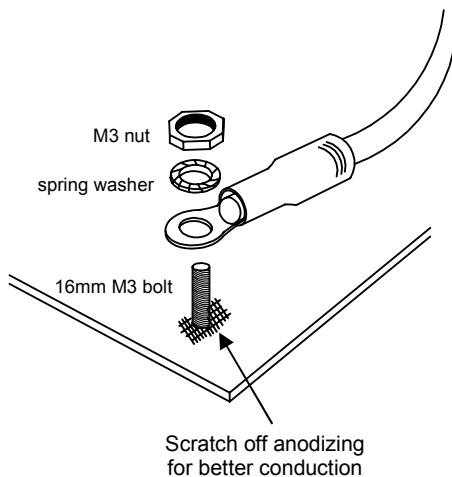


## 5. Wiring the ground connection

Connect one end of the cable to the red ring terminal.

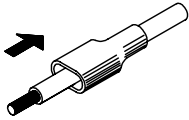


Connect the ring terminal to the chassis by means of a black bolt, spring washer and nut.



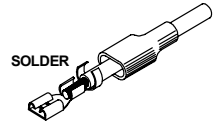
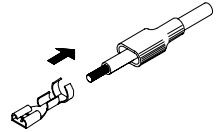
Solder the other end to the PCB tab  
(SK12)

## 6. Transformer wiring (red/yellow/blue/grey wires)

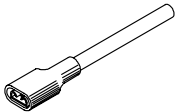


Slide an insulation sleeve over each wire.

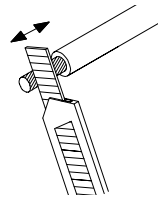
Solder a connector to each wire



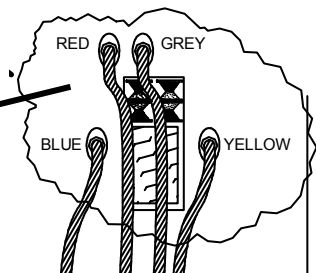
Slide the sleeve over the connector



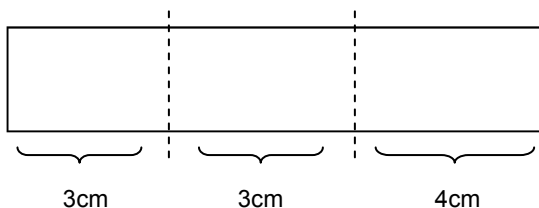
**REMARK :** In case you trim the wires, always remove the insulating lacquer (+/- 1cm)



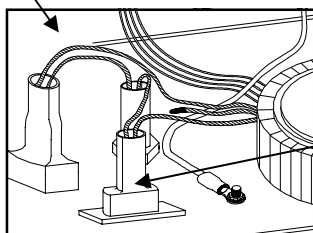
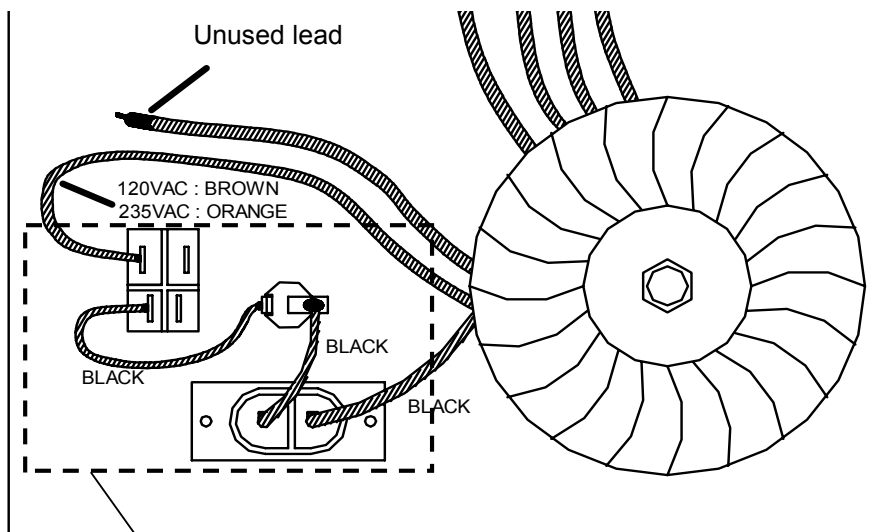
- Connect the wires to the PCB. Mind the colours!






- Group the wires by means of two cable ties
- Cut the largest of the two heatshrink tubes into 3 pieces: 3cm - 3cm - 4cm

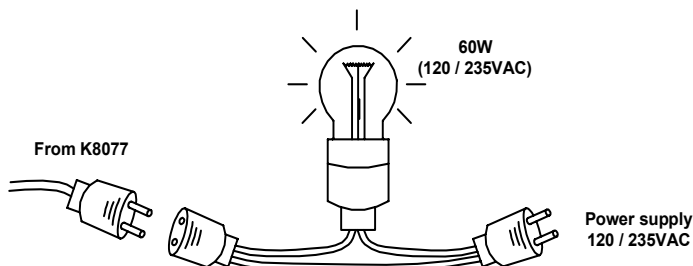


- Trim the black transformer wire to a length of 14cm. Slide a piece of heatshrink tube (3cm) over the black transformer wire.



- Solder the wire to the AC connector
- Use the remaining black wire to connect the second AC connector lug with the center connector of the fuse holder.
-  **Don't forget to slide a piece of heatshrink tube (4cm) over the wire.**
- Connect the remaining fuseholder-connector with the power switch.
-  **Don't forget the heatshrink tube.**
- Depending on your local AC voltage, connect either the brown wire (100-120VAC) or the orange wire (220-245VAC) to the power switch.
-  **Don't forget the heatshrink tube.**
- Trim the remaining wire to a length of 11cm. Insulate the end by means of a piece of heatshrink tube.
- Group the wires by means of two cable ties.

### 30. Testing the unit



 **Make sure that the IC's are removed from their sockets.**

We recommend to construct a small test-jig, and connect the unit as shown below.

1. Put the power switch in the 'I' position
2. Put the 'MODE'-switch in the 'AUTO-ON'-position.
3. When power is applied, the 'POWER' led should light.

If the light bulb remains lit, turn off the power immediately and check your circuit.

By means of a multi meter set to DC volts, you can check the following voltages:

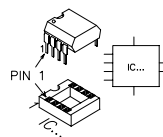
*Use the GND tab next to the red transformer wire as '-'*

- J2: +15V
- J3: -15V
- Left lead of R33: +24V or slightly higher
- Right lead of R37: +5V

4. Turn off the power and mount the IC's.
5. Turn on the power again repeat the above measurements.

- ☐ IC1 : TL072
- ☐ IC2 : TL074
- ☐ IC3 : VK8077

(programmed PIC10F200-I/PG)



**If OK, flip the 'MODE'-switch to 'ON'**

Once again, if the light bulb remains lit, turn off the power immediately and check your circuit. LD3 should light.

*Check the following voltages:*

- Cathode D11: +35V
- Anode D12: -35V

6. Connect the multimeter across R60 (right power resistor).
7. Meter should read 0V (Mind the polarity) !
8. Adjust RV3 until the meter reads 10mV

**Wait a while until the readout remains constant**

9. Remove the multimeter and turn off the power

## 31. Assembly of the enclosure

Refer to the included mounting instructions.

- (A) Mark all holes according to the diagram. Use a **2mm** drill to pre-drill the holes
- (B) Mark the two holes for the speakers, as indicated.  
Mark the hole for the reflex tube, as indicated  
Carefully cut-out the holes using an electric jigsaw



**If necessary, smooth the edges with sanding paper**

- (C) Mark the position of the wooden supports for the heatsink. (5mm from edge)
- (D) Cut 4 pieces of 10x15mm wood (2 x 174mm, 2 x 131mm)
- (E) Pre-drill 2 holes in each wooden support, 20mm from edge and in the center
- (F) Pre-drill two 3,5mm holes in the backside of the housing according to the diagram.
- (G)
  - Fix the wooden supports using two screws and glue.
  - Assemble the enclosure, according to the drawings 1 to 3
  - Fix the bass reflex tube, according to drawing 4
- (H) **Drawing 1 :**
  - Position both speakers in such a way that their connectors face each other. Mark the holes and remove the speakers.
  - Pre-drill the holes with a 2mm drill.

### **Drawing 2 :**

- cut 20 cm red and 20 cm black wire. Solder the red wire to the '+' terminal of a speaker, solder the black wire to the '-' terminal of the speaker.

### **Drawing 3 :**

- Put some silicone adhesive round the speaker hole closest to the bass tube. Fix the speaker using the supplied 25mm screws.
- Solder the red wire from the mounted speaker and the remaining red wire to the '+' of the second speaker.
- Solder the black wire from the mounted speaker and the remaining black wire to the '-' of the second speaker.
- Guide the red and black wire trough the 3.5mm holes of the enclosure (6).
- Put some silicone adhesive round the speaker hole closest to the bass tube. Fix the speaker using the supplied 25mm screws.

- (I)
  - Fix the speaker wires with some glue and trim them to a length of 20cm
  - Slide an insulating sleeve over both wires. Solder a connector to both wires and slide the insulating sleeves over the connector.
  - Fix the 4 plastic feet by means of a 23mm screw and put the enclosure on its feet.
  
- (J)
  - put the heatsink in place and mark the 10 holes.
  - remove the heatsink
  - pre-drill the holes with a 1.5mm drill
  
  - connect the red speaker wire to the connector marked 'LS+'
  - connect the black speaker wire to the connector marked 'LS-'
  
  - Carefully put the amplifier module in place.
  - Fix the heatsink using ten 10mm black screws




## 32. Placement

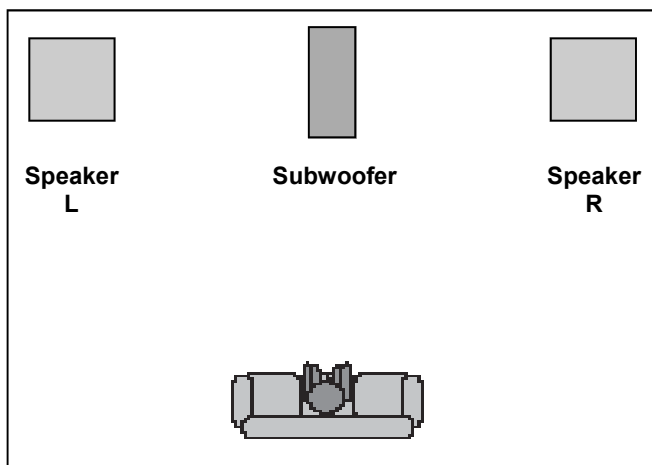
For best results, experiment with different positions.

We recommend to put the unit between the main speakers.

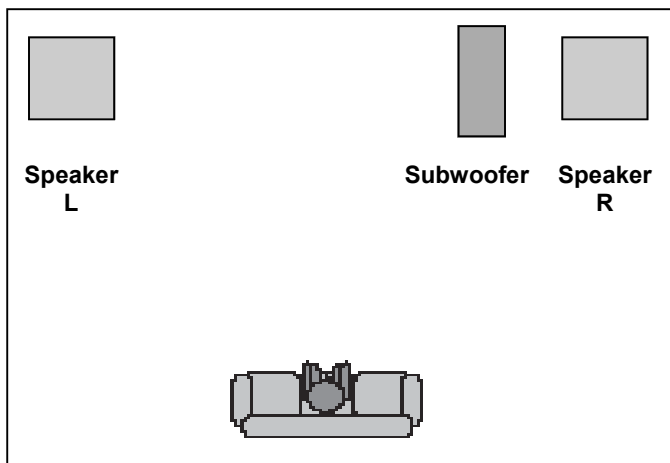
The closer to a wall or corner, the higher the efficiency (volume) will be, at the cost of a reduced sound quality.

 **Remark:** The unit is not magnetically shielded. Do not operate the unit in the close vicinity of CRT television sets or magnetic media.

### Central position :



### Decentral position :



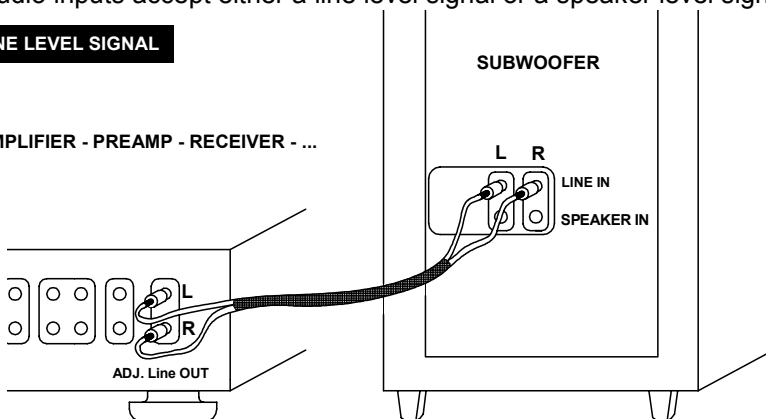
### 33. Connection

Just below the power switch you will notice two AC voltage indications (120VAC-235VAC). Strike out the one that does not apply with a black permanent marker. Use the supplied cord to connect the unit to the AC power grid. If necessary, cut the plug and replace it with a plug (not incl.) that fits your outlets.

The audio inputs accept either a line level signal or a speaker level signal.

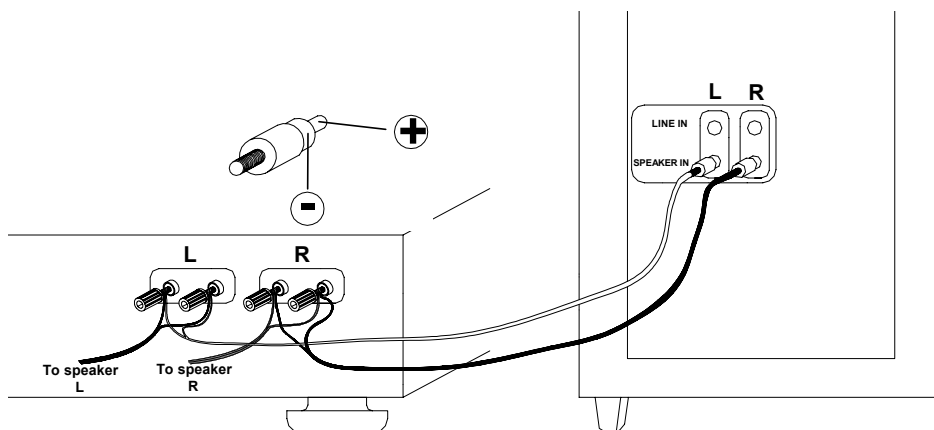
#### LINE LEVEL SIGNAL

AMPLIFIER - PREAMP - RECEIVER - ...



If your audio system is equipped with an adjustable line level output, you can connect it to the 'LINE IN'-inputs of the subwoofer.

#### SPEAKER LEVEL SIGNAL



If your system is not equipped with an adjustable line level output, connect the 'SPEAKER-IN'-inputs in parallel with the main speaker outputs of your amplifier.



**Never use both inputs simultaneously**

### 34. Use

- Turn the volume control (OUTPUT LEVEL) fully counter clockwise before first power-on.
- Turn-on the 'POWER'-switch. The 'POWER'-led will light.

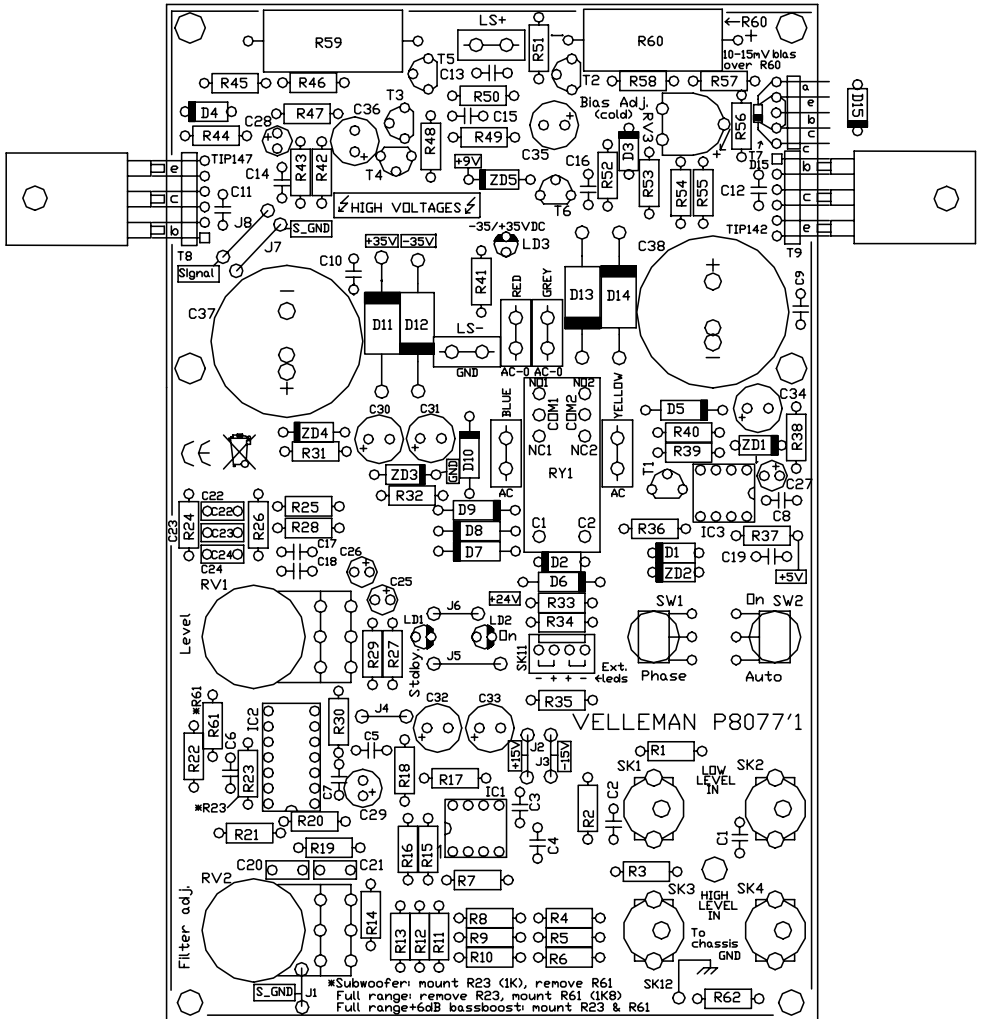
The unit will either immediately turn on ('ON'), or wait for an incoming audio signal ('AUTO-ON'), depending on the position of the 'MODE'-switch.

☞ *If '**AUTO-ON**' has been selected, the unit will automatically turn-on when an audio signal is present. If the audio signal is absent for a while (e.g. because the source has been turned off), the unit will return to the standby mode.*

Put on your favourite music and adjust the volume of the main speakers. Adjust the volume control of the subwoofer (OUTPUT LEVEL) to an appropriate level. You can adapt the response curve to your personal taste by turning 'FILTER ADJUST'.

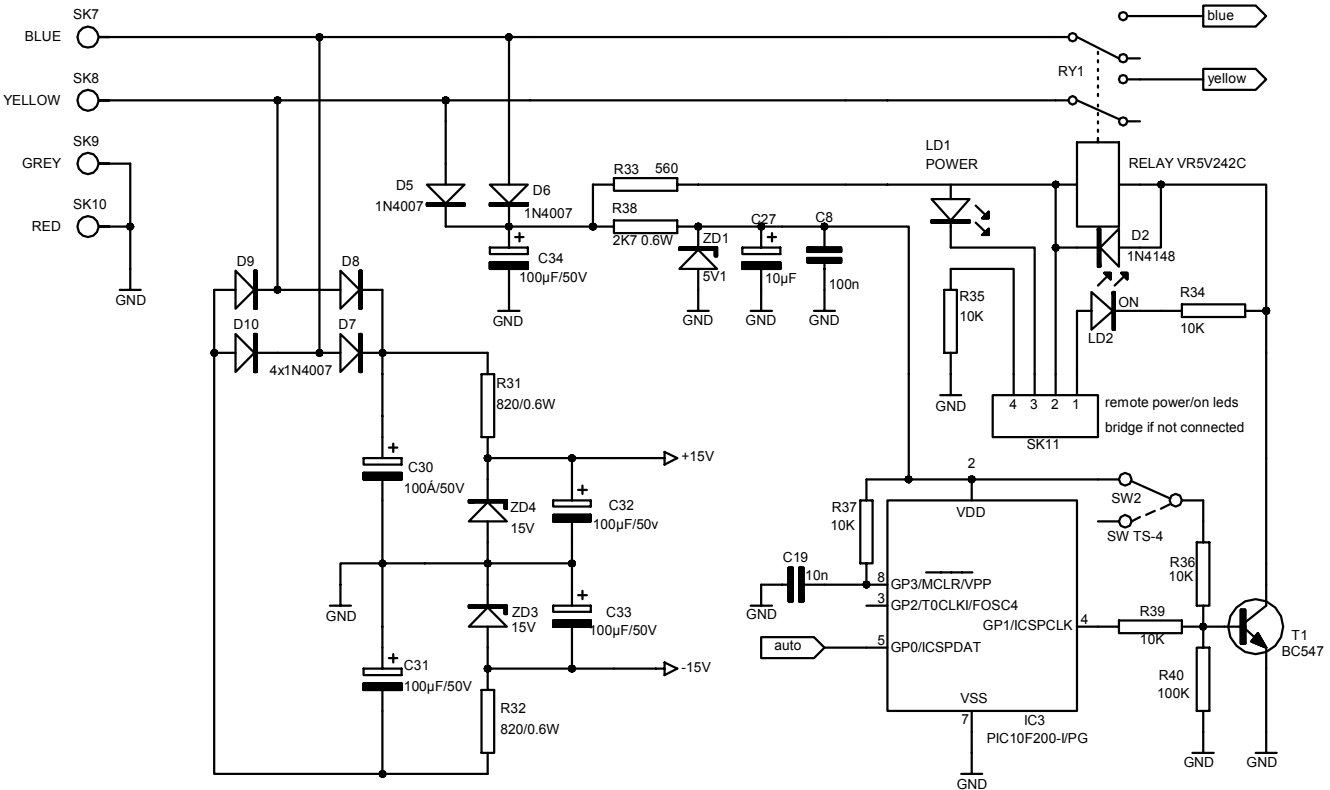
☞ *Make sure to try both positions of the 'PHASE'-switch. Only one position will give the best result.*

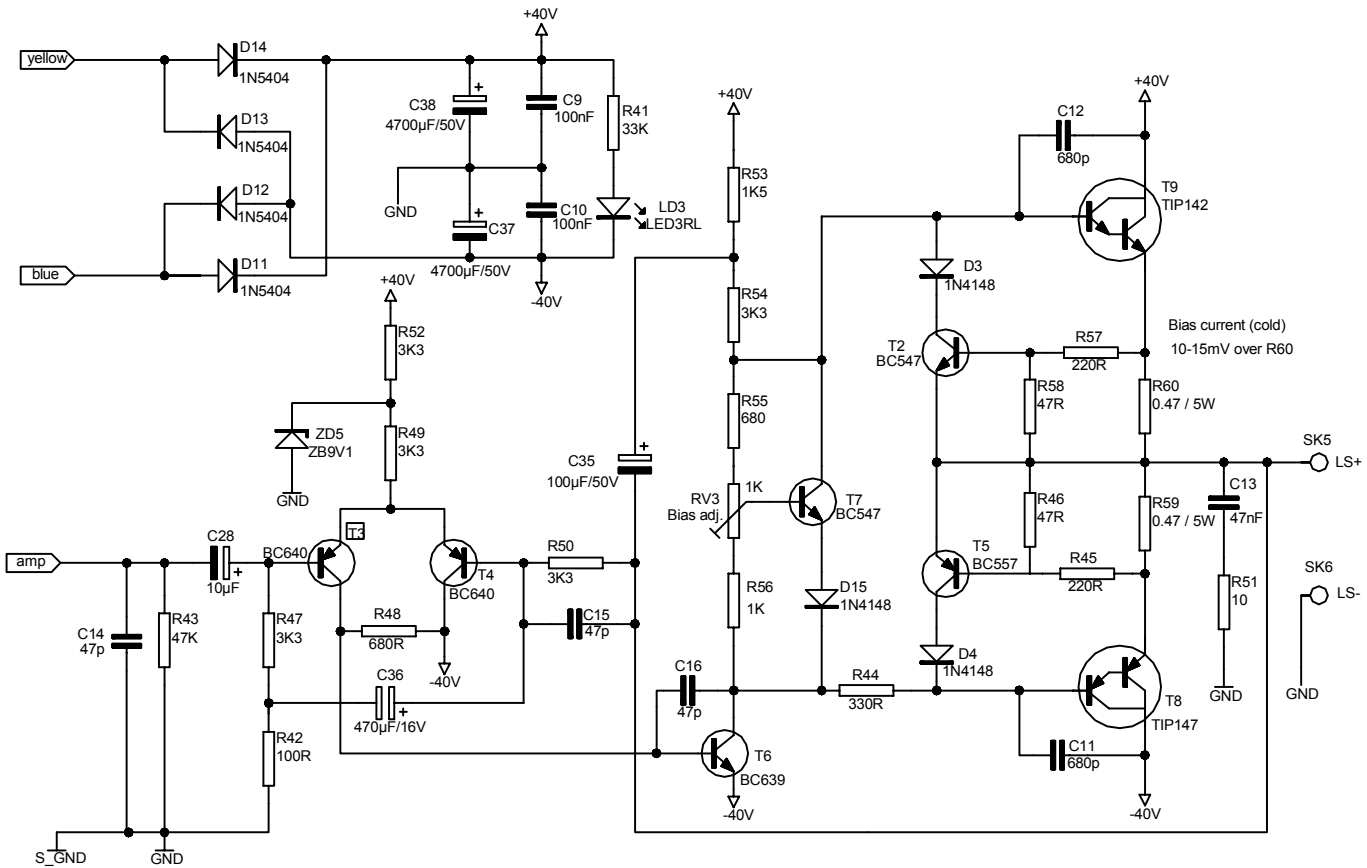
## 35. PCB



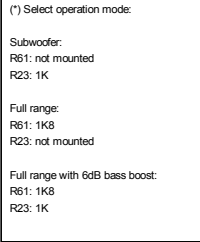
# 36. Schematic diagram

**PSU:**



**Power stage :**

## Schematic diagram





**VELLEMAN KIT NV**  
**Legen Heirweg 33**  
**9890 Gavere**  
**Belgium Europe**  
**Info ? : <http://www.velleman.be>**

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