



# Deluxe Stereo Amplifier

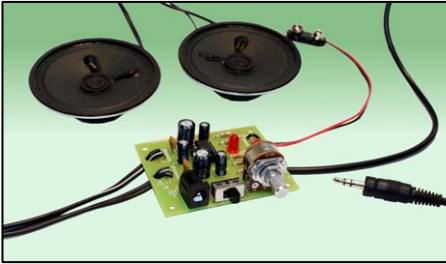


## Build Instructions

Issue 1.0



## Build Instructions



Before you put any components in the board or pick up the soldering iron, just take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

You will find it easiest to start with the small components and work up to the taller larger ones. If you've not soldered before get your soldering checked after you have done the first few joints.

### Step 1

Start with the five resistors (shown right):  
The text on the PCB shows where R1, R3 etc go. Make sure that you put the resistors in the right place.

R1 is 1K (brown, black, red coloured bands)  
R3 and R4 are 4.7Ω (yellow, purple, gold coloured bands)  
R5 and R6 are 10K (brown, black, orange coloured bands)



### Step 2

Solder the Integrated Circuit (IC) holder in to IC1. When putting this into the board, be sure to get it the right way around. The notch on the IC holder should line up with the notch on the lines marked on the PCB. Once this has been done insert the 8 pin IC into this socket making sure that the notch on the device matches the notch on the IC holder.



### Step 3

There are two ceramic disc capacitors (as shown right). These should be soldered into C6 and C7. It does not matter which way around they go.



### Step 4

Solder the LED (as shown left) into the PCB where it is labeled LED1. When putting it into the board make sure the flat edge on the LED matches the outline on the PCB.

### Step 5

Solder the PCB mount right angled on / off switch (shown right) into SW1. The row of three pins that exit the back of the switch must be soldered, but it doesn't matter if you can't solder the other two pins.



### Step 6

Solder the DC power socket (shown left) into the PCB where it is labeled CONN1.

### Step 7

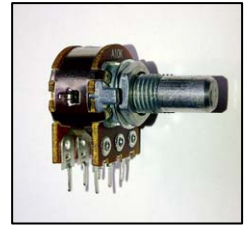
Now solder in the five electrolytic capacitors (an example is shown right). The capacitors have text printed on the side that indicates their value. The capacitors are placed as:  
C1 and C2 = 100μF. C3 = 10μF. C4 and C5 = 470μF.  
Make sure the capacitors are the correct way around. The capacitors have a '-' sign marked on them which should match the same sign on the PCB.





### Step 8

Solder the dual potentiometer (shown right) into the PCB where it is labeled R2. Make sure the volume knob is facing away from the PCB.



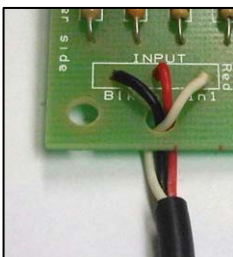
### Step 9

The kit is supplied with a metre of twin cable. This cable will be used to connect the two speakers. You will need to cut this to the required length for each speaker in your enclosure design.

Take each piece of wire that you have cut off and strip the ends of the wire. Connect one end of each to the two terminals on the speaker (shown above left), and the other end of each to the terminals on the PCB marked SPEAKER1 and SPEAKER2, after feeding it through the strain relief hole. It does not matter which way around these connections go.

### Step 10

The PP3 battery clip (shown right) should be attached to the terminals labeled POWER. Connect the red wire to '+' and the black wire to '-' after feeding it through the strain relief hole.



### Step 11

The stereo jack / iPod lead (see picture left) should be connected to the 'INPUT' terminal. First feed the wires through the strain relief hole. The black wire should be connected to the terminal labeled 'BLK'. The other two can go to either of the two remaining inputs.

## Checking Your Amplifier PCB

Carefully check the following before you insert the batteries:

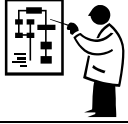
**Audio equipment may become damaged if connected to an incorrectly built amplifier.**

### Check the bottom of the board to ensure that:

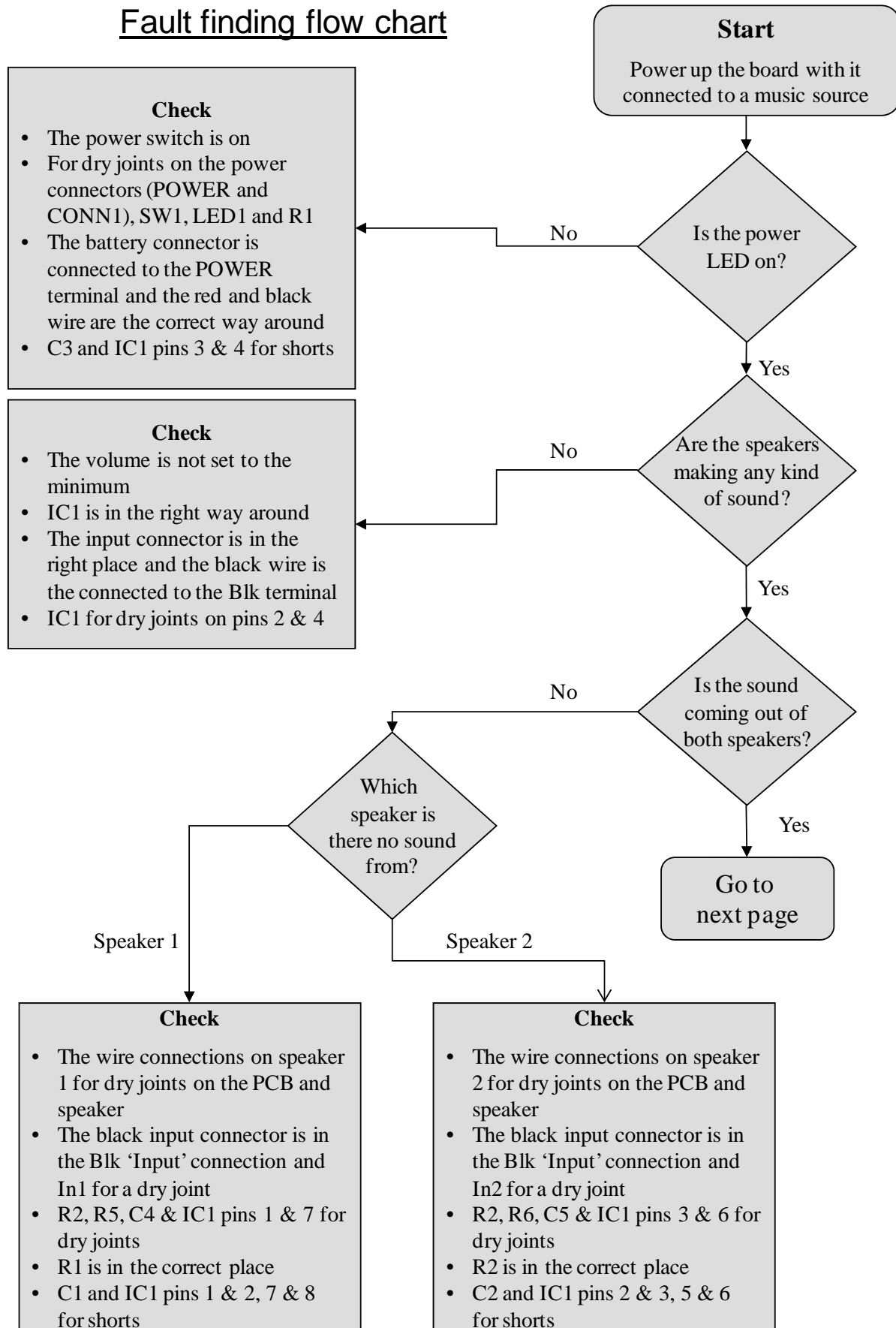
- All holes (except the 4 large (3 mm) holes in the corners) are filled with the lead of a component.
- All these leads are soldered.
- Pins next to each other are not soldered together.

### Check the top of the board to ensure that:

- The speakers, power lead etc are connected to the right place.
- The '-' on the capacitors match the same marks on the PCB.
- The colour bands on R1 are brown, black, red.
- The colour bands on R3 & R4 are yellow, purple, gold.
- The colour bands on R5 & R6 are brown, black, orange.
- C3 is a 10 $\mu$ F capacitor.
- The red and black wires on the battery clip match the red & black text on the PCB.
- The notch on the IC is next to C1 & C4.
- The flat edge on the LED matches the outline on the PCB.

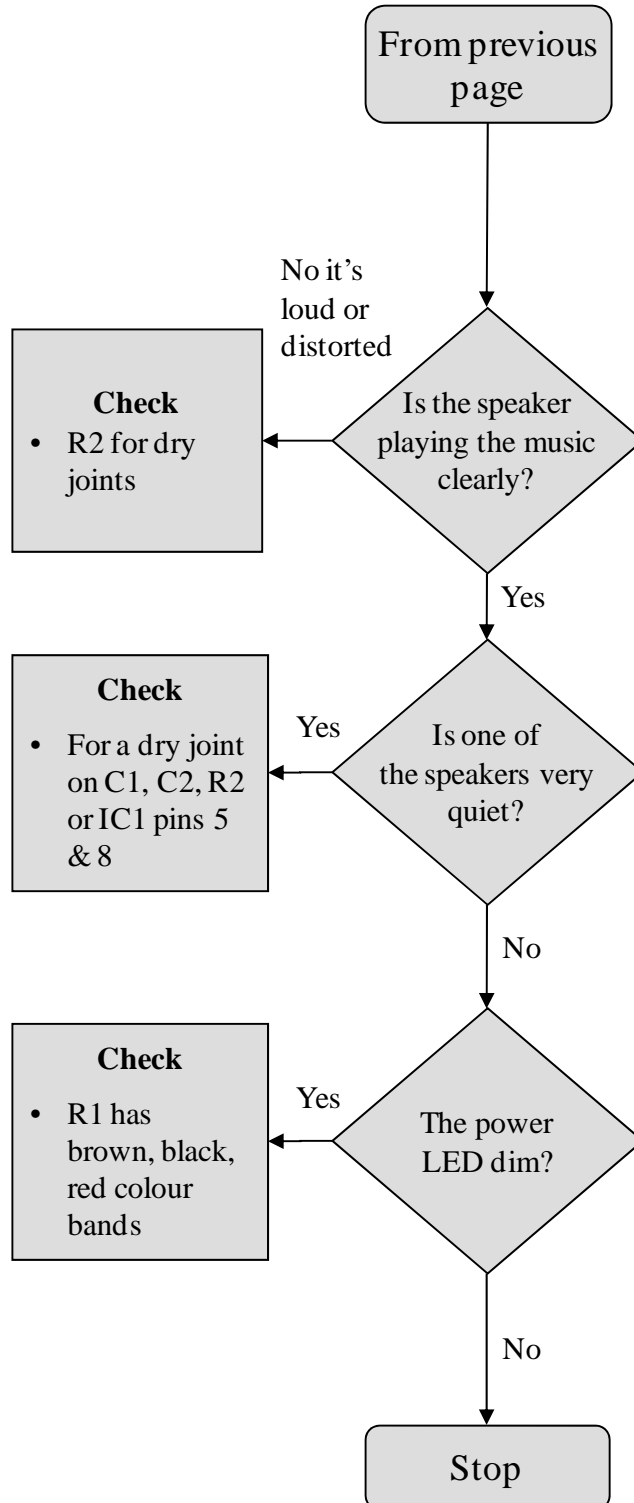


## Fault finding flow chart



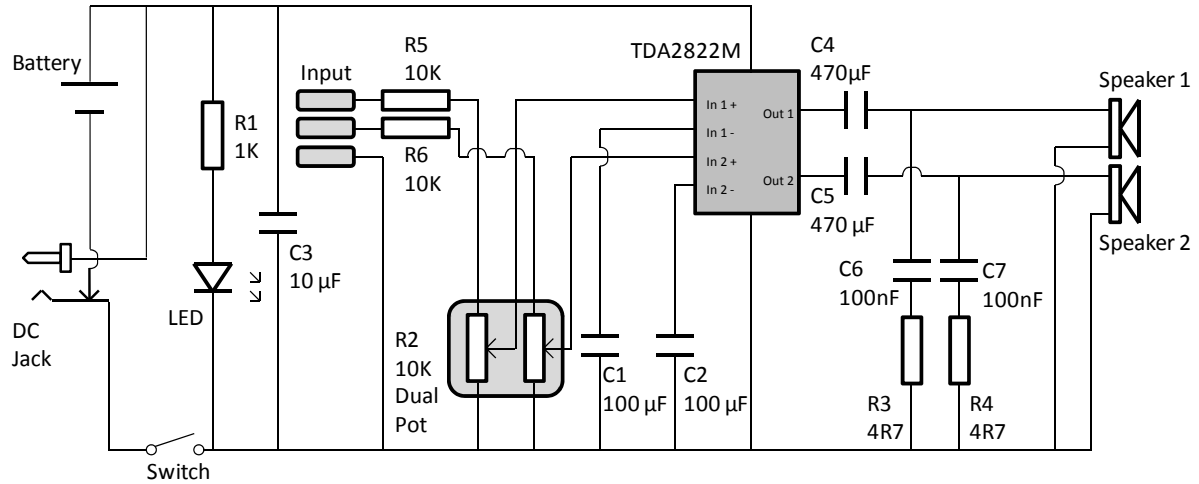


## Fault finding flow chart continued



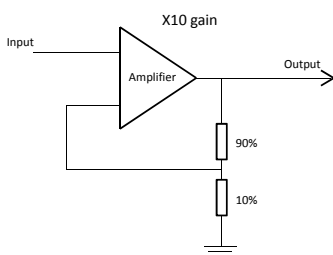


## How the Amplifier Works



At the centre of the circuit is an audio amplifier Integrated Circuit or IC. Inside the IC are lots of transistors, which are connected together to allow the small input signal to be amplified into a more powerful output that can drive a speaker.

All amplifiers need to use feedback to ensure the amount of gain stays the same. This allows the output to be an exact copy of the input just bigger. The gain is the number of times bigger the output is compared to the input, so if an amplifier has a gain of 10 and there is 1 volt on the input there will be 10 volts on the output. An operational amplifier has two inputs, these are called the inverting (-) and non-inverting (+) inputs. The output of the operational amplifier is the voltage on the non-inverting input less the voltage on the inverting input multiplied by the amplifiers gain. In theory an operational amplifier has unlimited gain so if the non-inverting input is a fraction higher than the inverting input (there is more + than -) the output will go up to the supply voltage. Change the inputs around and the output will go to zero volts. In this format the operational amplifier is acting as a comparator, it compares the two inputs and changes the output accordingly.



With an infinite gain the amplifier is no good to amplify audio, which is where the feedback comes in. By making one of the inputs a percentage of the output the gain can be fixed, which allows the output to be a copy of the input but bigger. Now when the two inputs are compared and the output is adjusted, instead of it going up or down until it reaches 0 volts or  $V+$ , it stops at the point when the two inputs match and the output is at the required voltage.

Looking at the circuit diagram for the audio amplifier it's not obvious where the feedback is, this is because it is inside the IC. The TDA2822M chip has fixed the gain so the output is about 90 times bigger than the input. To make the gain useful in our application there is a potential divider on each channel that is fed into the IC ( $R2+R5$  and  $R2+R6$ ). Each of these reduces the input signal to a percentage of the original signal. As  $R2$  is a variable potentiometer, it can be used to vary this percentage, which in turn varies the output volume.  $C3$  is connected across the supply to make sure it remains stable. The other capacitors have a filtering role, either to cut out high frequency noise or get the best out of the speaker.

A power switch is inserted in the ground (0V) power line, which is used to turn the amplifier on and off. There is also a power LED that lights up when the power is switch is on.  $R1$  is used to limit the current flowing into this LED, which stops it drawing too much power, which over time will damage the LED. Power is supplied to the circuit by either a battery, or from a DC power socket. If a power supply is plugged into the DC power socket the battery is automatically disconnected.