Assembly Instructions for FK602 *(2W Mono Power Amp)*

What it does:

This circuit is designed to amplify a low level audio signal and play it out to a speaker. It has on-board volume control.

What we are making:

This system is ideal for an audio docking station for mobile phones, radios, computers, etc.

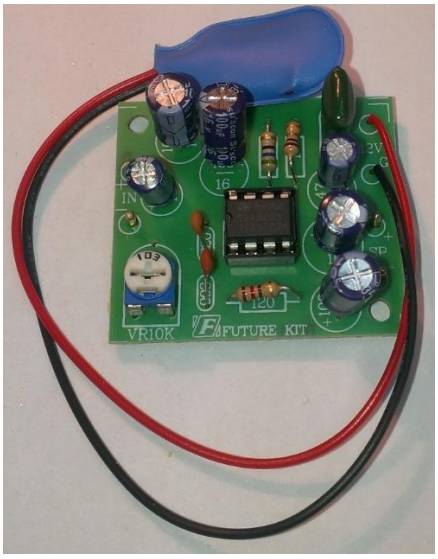

Fig 1: Finished Product

Technical Specs:

- Power supply: 3-12VDC
- Current Average: 300mA when using 12V DC and driving into 8 Ohm speakers .
- Max output power: 2W
- Volume control equipped
- Voltage Gain (at Freq 1kHz): 34dB
- S/N ratio: 80dB
- Frequency Response : 25Hz to 20kHz @ -3dB
- Distortion *(Speakers = 8 Ohms, Pout = 500mW, Freq = 1kHz):* < 0.5%
- PCB dimensions: 41.1 x 36.1 mm

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How it works:

The audio input signal is passed through the input capacitor (C1) . It is then "divided" by the volume control potentiometer (VR1) to give anything from full input strength down to almost zero input strength.

The "divided" signal is then fed into the pin3 of the Audio Amplifier IC (TBA820M) .

The output of the Audio Amplifier IC (pin5) is coupled via C8 to the output pin. C3 and R3 are used to remove the risk of any unwanted high frequency oscillations (heard by us as "Squeals").

The "Gain" of the amplifier is controlled by C5 and R1. (Note: this "Gain control" is a function of the TBA820M IC).

Before you start:

1) Make sure that you have all your equipment available. You will need:
    a. Soldering Iron
    b. Solder
    c. Cleaning pad (We recommend sponge which is wet with water).
    d. Side Cutters
    e. Kit FK602
    f. Instruction sheet
    g. A waste bin (or bag) close by for a lot of small "off cuts".
    h. We recommend a clean mat or surface protector for your desk.
    i. Ensure that you are in a well ventilated area. The fumes from the solder resin can become annoying (though they are not toxic to humans).
    j. Wash your hands after working with the electronics kits and the solder. Especially before you eat anything ! !

2) Ensure that you have plenty of space around you. (You are going to need to "spread out" your components at the start, and avoid getting them mixed with some-one else's.)
3) Ensure that you have good lighting to see and read your components.
4) We recommend that you also have some spare "bags" (or other containers) to store your components and work between classes. This is in the event that you do not get everything finished in one session.
   (It can be disappointing to spend some time sorting your components and then finding them all mixed up again when you return!)
5) Do NOT rush! Time spent carefully sorting at the start and avoiding errors is wisely invested, rather than trying to fix problems later!
6) Read through the instructions for each "Step" before you start doing that step. There are often handy tips & advice in the instructions!

Circuit Diagram:

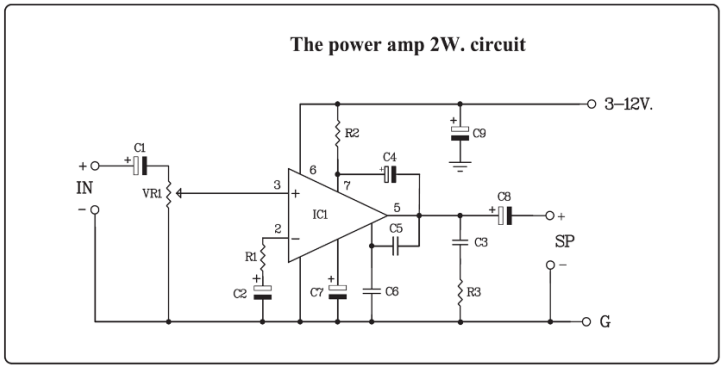
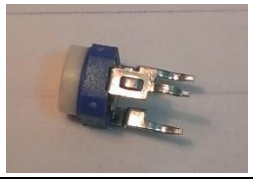


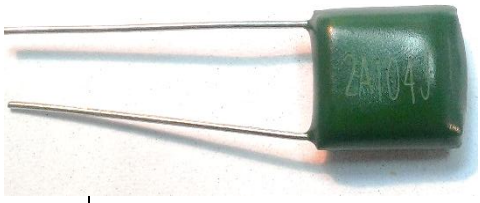
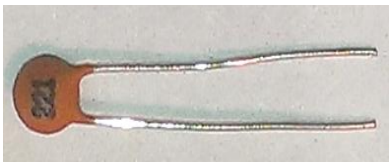
Fig 2: Circuit Diagram for the system.

How to build it:

Step 1. Identify your components and sort them into groups.

Use the checklist below to ensure that you have all your necessary components. *(We recommend that you "tick off" each component when you know you have it clearly identified).*

FK602 2W Mono Audio Amp					
For this task you are required to :					
		Identify all of the components within your kit, to ensure that your kit is complete			
		Assemble the kit so that it works as per the instructions			
Component Name	**Value**	**Qty**		**Identification Markings**	**Image**
Resistor 120Ω	120 Ohms	1		brown-red-brown-gold	
Resistor 56Ω	56 Ohms	1			
Resistor 1Ω	1 Ohm	1			
Trimmer Potentiometer (Sometimes called a "trimpot")	10,000 Ohms	1		103	
Capacitor (Electrolytic) 10µF	0.00001 Farads or $10X10^{-6}$ Farads	1		10µF	
Capacitor (Electrolytic) 47µF	0.000047 Farads or $47X10^{-6}$ Farads	1		47µF	

Capacitor (Electrolytic) 100µF	0.0001 Farads or $100X10^{-6}$ Farads	3		100µF	
Capacitor (Electrolytic) 220µF	0.00022 Farads or $220X10^{-6}$ Farads	1		220µF	
Capacitor (Mylar) 0.1µF	0.0000001 Farads or $100X10^{-9}$ Farads	1		104	
Capacitor (Ceramic) 3nF OR 3.3nF in some kits	0.000000033 Farads or $3.3X10^{-9}$ Farads	1		302 OR 332	
Capacitor (Ceramic) 220 pF	0.00000000022 Farads or $220X10^{-12}$ Farads	1		221	
IC Socket		1			
Audio Amp IC		1		TBA820M	
Battery Snap (9V)		1			

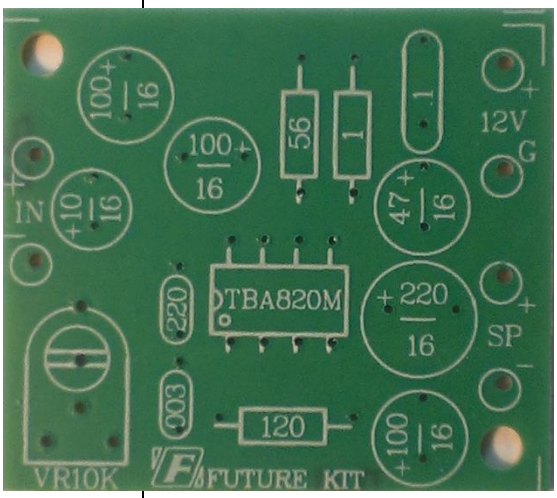
Stakes (for wire connections)		6			
PCB (Empty)		1				

Fig 3.1 Identifying Component Values

Step 2. Installing the Resistors

By referring to *Fig 3.1* determine the value of each resistor and place them in their correct positions as indicated on the printed circuit board (PCB).

Do this by carefully bending their wires down to form a 'U' shape and poke through the holes in the PCB as shown in *Fig4.1*.

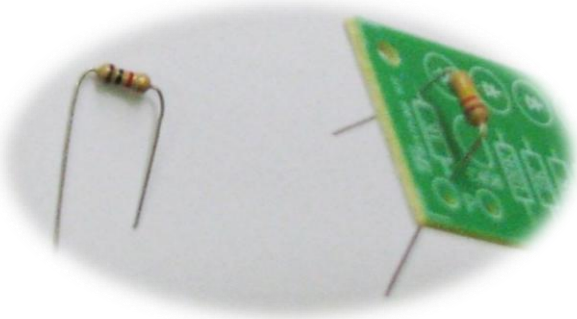


Fig 4.1 Installing Resistors

As far as possible, try to keep the resistors "oriented" in the same direction. (Try to keep the gold band at the same end of the installed resistors.) See Fig 4.2 for a suggested pattern.

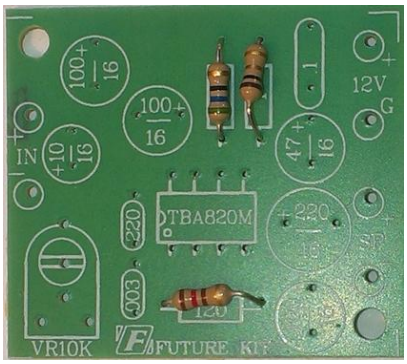


Fig 4.2 Installing Resistors with consistent orientation.

Step 3. Installing the Capacitors

Carefully identify all the different capacitors to be used.

There are three "families" of capacitors used in this kit. These are "Electrolytic" Capacitors ,"Mylar" Capacitors and "Ceramic" Capacitors Refer to Fig 3.1 to determine the values of the different capacitors.

Start by identifying the two (small) ceramic capacitors to installed. For these devices polarity does not matter, so you can insert them in either direction. We started by inserting the 220pF into the small oval marked with "220". Refer to Figure 5.1 for the PCB with the first Ceramic Capacitor installed.

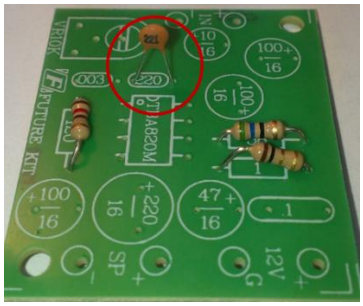


Fig 5.1 Identifying the position of the first Ceramic Capacitor.

Continue with the 3nF capacitor (refer to Figure 5.2) and then the mylar 0.1· F Capacitor (refer to Figure 5.3).

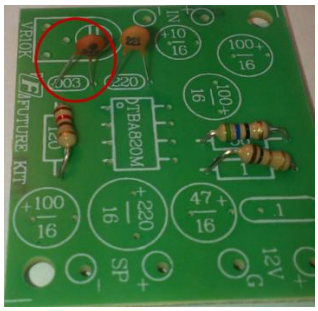


Fig 5.2 Identifying the position of the 3nF Ceramic Capacitor.

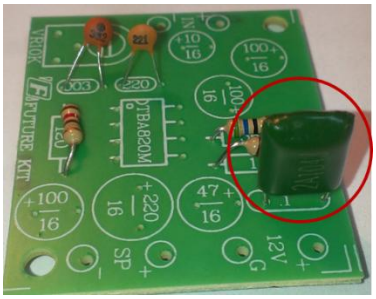


Fig 5.3 Identifying the position of the 0.1μF Mylar Capacitor.

Once these capacitors are in their correct positions solder each one into place and trim the excess wire from under the PCB.

Next identify the "electrolytic" Capacitors *(They are the larger, blue cylindrical ones. There are four different values used in this kit.)* Now carefully identify which are their "+" and "-" legs. This is important!

Hints:

i) On new components, the longer leg is the "+" leg.
ii) These capacitors also have a big stripe marking their "-" leg.

Refer to Figure 5.4

Fig 5.4 Showing the different leg lengths and the "-" marking on the body of an electrolytic Capacitor.

Next , identify the "+" hole on the PCB for each of the electrolytic capacitors. This MUST have the longer leg inserted into it! Refer to Figure 5.5 for some of the marked holes.

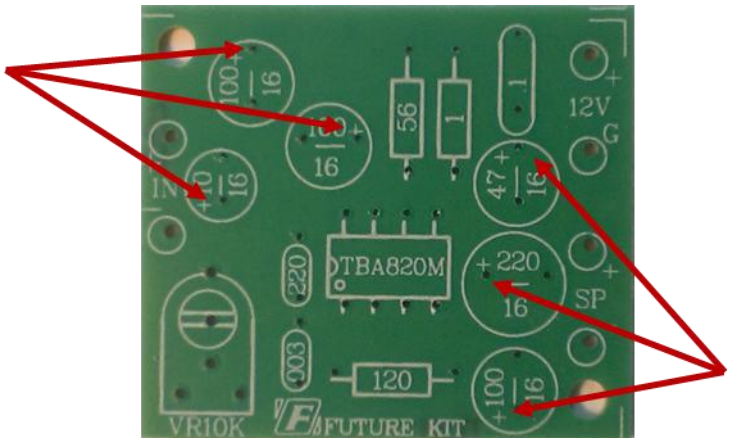


Fig 5.5 Showing the "+" holes on the PCB for some of the electrolytic Capacitors.

Once all your capacitors are in their correct positions and facing the correct way, solder each one into place and trim the excess wire from under the PCB. Refer to Figure 5.6 .

Fig 5.6 Showing the PCB with all six of the electrolytic Capacitors installed.

Step 4. IC Socket

Please inspect the IC Socket closely, and identify a small "notch" at one end of the plastic body.

Carefully insert the IC Socket so that the "notch" is at the same end as the marking on the PCB.

Take particular care to align the "notch" correctly, as that will later be used to identify the orientation for the IC to follow. Refer to Figure 6.1.

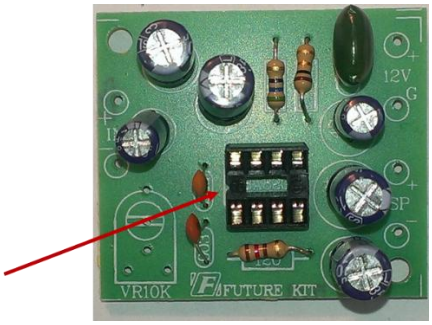


Fig 6.1 Showing the PCB with the IC Socket installed, and the "notch" highlighted for correct orientation.

Step 5. The Volume "Trimpot" (Trimmer Potentiometer):

Carefully align the three legs of the Trimpot (VR1) with the mounting holes. *(Please note that there are several different styles and sizes of trimpots, hence the board has been laid out to accept any of three different sized trimpots.)*
Refer to Fig 7.1 to see a sample of mounted trimpot.

Fig 7.1 Showing the trimpot installed .

Step 6. Insert the “Stakes” and Standoffs.

These are the short, thick gold pins which are inserted from the rear of the PCB, and then soldered into place.

Step 7. Install the Integrated Circuit (“IC”).

Carefully orient the IC to ensure that the “notch” is aligned with the markings on the PCB and the “notch” on the IC Socket.

Step 8. Connecting wires, speakers and Battery snap.

Once the standoffs are set, ‘tin’ each with solder. *(For more information on "tinning", please refer to our separate document "Towards Better Soldering").* The battery snap can be soldered into place by ‘tinning’ the leads and ensuring the black wire is attached to the ‘ground’ (G) or negative (-) pole and the red wire to the positive (+).

Refer to Figure 8 for final product.

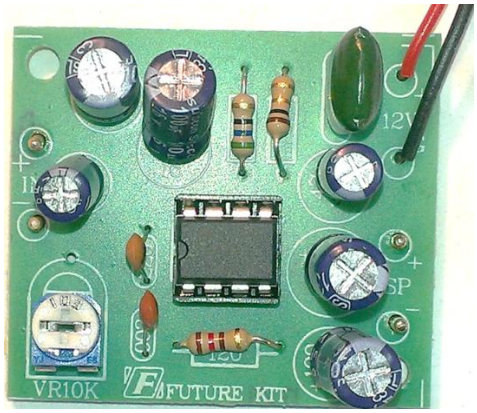


Fig 8 Showing the assembled product .

Connecting an Audio Source and the external Speaker:

Refer to Figure 9 for recommended wiring to external components.

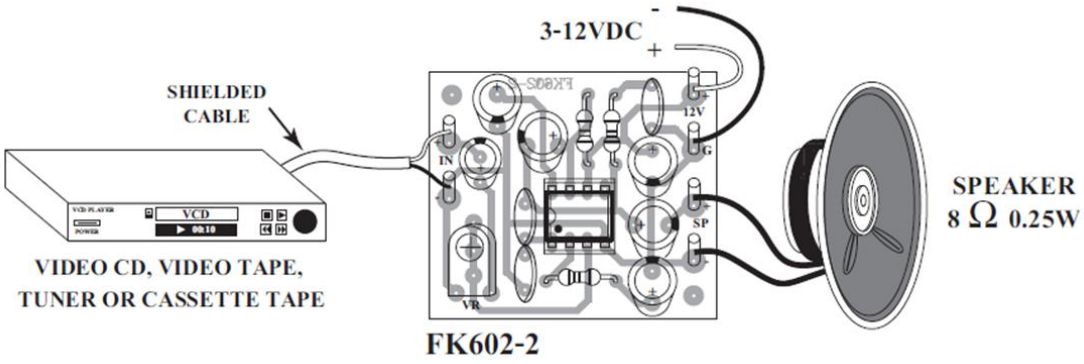


Fig 9 Attaching the wires

Testing:

Do not connect any input sound source yet! We must first check the system has been constructed correctly!

Apply the power supply at 9V DC. Watch for any sparks or signs of overheating.
If you see any sparks:

- Do not worry (yet). It is common for many circuits which have a lot of capacitors in them (like this one) to draw a large "inrush" current at the first contact.
- Disconnect the power immediately.
- Test for any "hot spots".
- If no obvious hot spots, then
    - Reconnect the power and watch for sparks a second time.
    - If NO sparks a second time, this is normal! Things are looking good!
    - If you continue to see sparks, you will need to recheck all of your soldering for any "Short Circuit" bridges.
- If you find a "hot spot" :
    - Check for solder bridges which are causing a short circuit somewhere.
    - Check that all components have been inserted correctly.
    - Check for any loose "wire" off cuts which may be causing a short circuit.

Once you have the power connected and no signs of other problems, it is time to apply an audio signal.

-Turn the trimpot fully anticlockwise (Volume is down as much as possible).

- Now apply the audio source .

- Slowly turn the volume trimpot clockwise.

- The volume of the output should rise with the trimpot turning.

- If the quality of the output sound starts to deteriorate, it is possible that the volume of the input is exceeding the limits of the system.

Care and Warnings:

The audio amp IC (TBA820M) is rated to a maximum of +12V DC. Do not apply any voltage above this. *(We recommend operating with a 9V DC battery as the power source for the first testing!)*

Most of the problems we have experienced with this kit are one of three kinds:

1) Soldering induced problems. (Short circuit bridges as well as poor quality "cold solder joints")
2) Component misplaced or misaligned.
3) Wire connections intermittent.