P56 STEAM ENGINE SIMULATOR

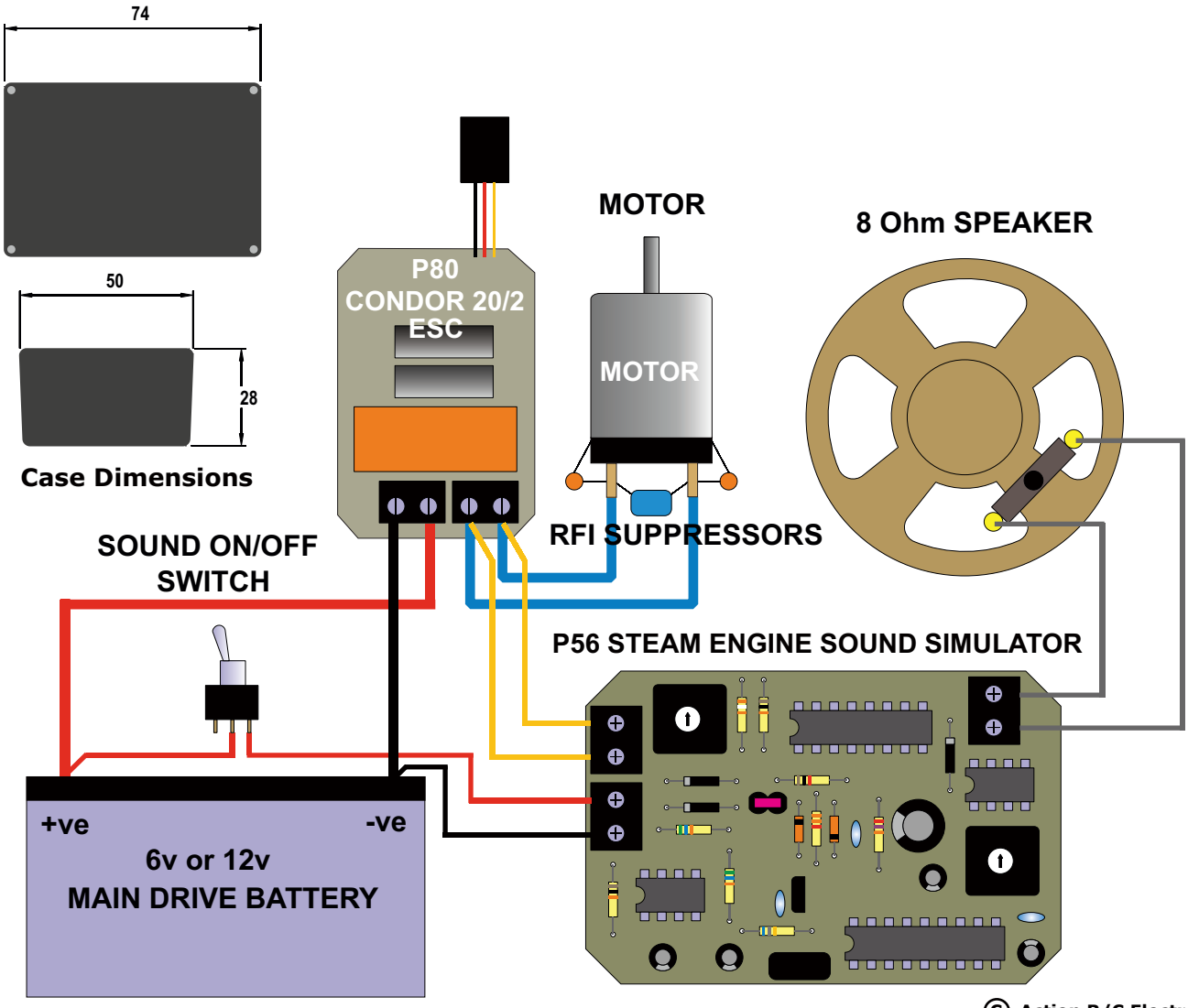
NOTE - THIS UNIT IS ONLY SUITABLE FOR USE WITH ACTION CONDOR SPEED CONTROLLERS AND MAY EITHER NOT FUNCTION WITH, OR BE DAMAGED BY USE WITH SPEED CONTROLLERS MANUFACTURED BY OTHER COMPANIES.

REQUIREMENTS

This sound simulator is suitable for use with a 6 or 12 volt power source. It requires an input from a motor controlled by an ACTion Condor electronic speed controller. Connect the power wires for this sound unit right back to the battery terminals. A separate battery pack can be used but it should be the same voltage as the motor drive battery. If separate batteries are used, the negative of both the Steam Engine Sound battery and negative of the main motor drive battery should be connected together. Without the two negatives connected together, no speed information will reach the sound unit, it will just "hiss". This project has a removable link; removing it will cause the unit to change from multi-cylinder sound to single cylinder sound.

IC AND MOS TRANSISTOR DESIGN

Voltage requirement	6 volt or 12 volt
Single cyl/compound sound	Link (remove for single cyl)
Puffing range	Adjustable
Stationary "hiss"	Adjustable
Volume	Adjustable
Connections	Screw connection
Speaker	Not supplied
Speaker impedance required	8 ohms
Speaker size recomended	Minimum 2 inch mylar cone



www.action-electronics.co.uk

P56 STEAM ENGINE SIMULATOR

ACTion R/C ELECTRONICS

This Sound Unit is suitable for use with a 6 or 12 Volt power source. It requires an input from a motor controlled **ONLY** by an ACTion Condor relay-equipped Electronic Speed Controller. **IT CANNOT BE GUARANTEED TO WORK WITH ANY OTHER TYPE OF SPEED CONTROLLER.** A separate battery pack can be used but it should be the same voltage as the motor drive battery, and the negative terminals of both the Steam Engine Sound battery and the main motor drive battery should be connected together. Without this connection, no speed information will reach the sound unit; it will just Hiss. This project has a removable link; removing it will cause the unit to change from multi-cylinder sound to single cylinder sound.

Voltage requirement	6 volt or 12 volt
Single cyl/compound sound	Link (remove from Pins shown for single cyl)
Puffing range	Adjustable
Stationary "hiss"	Adjustable
Volume	Adjustable
Case size	74mm x 50mm x 28mm
Speaker impedance required (speaker not supplied)	8 ohms
Speaker size recommended	Minimum 2 inch mylar cone

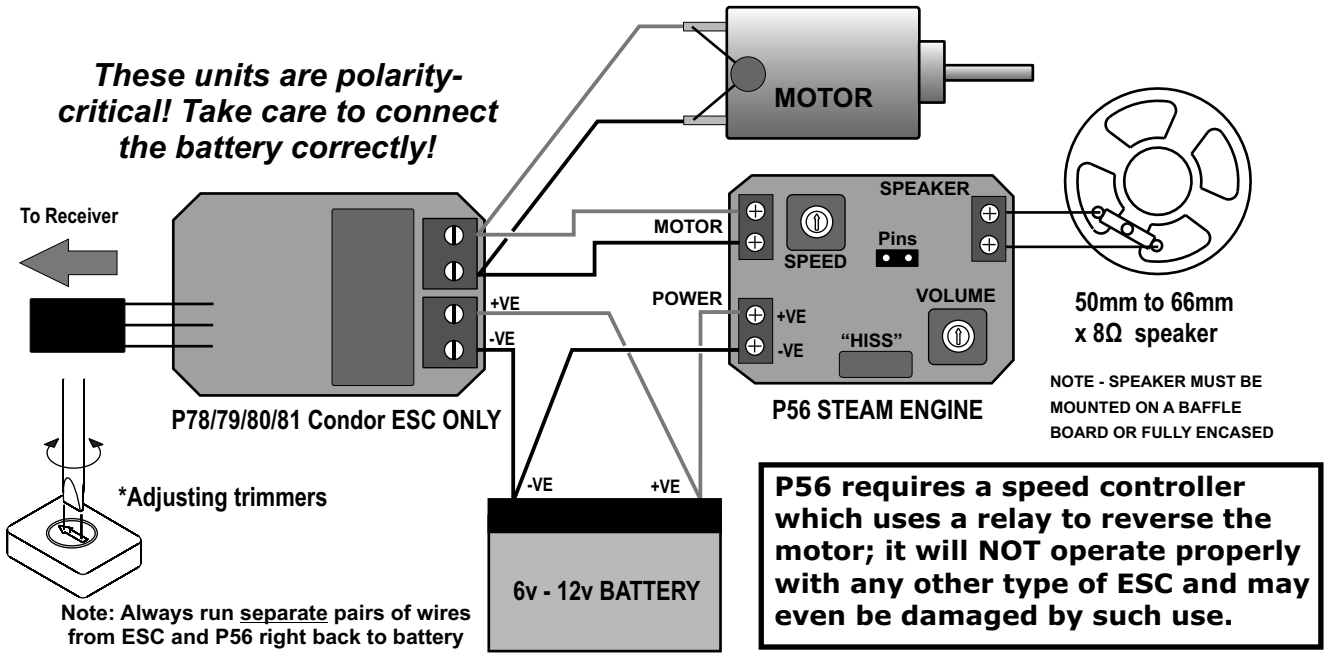
SETUP

1. Connect the Speaker terminals to your speaker
2. Connect the positive (+) and negative (-) Power terminals to the battery.
3. Connect the two terminals marked MOTOR to the brush connections on the motor.
4. The "HISS" trimmer control should be adjusted so that a continuous hiss is heard with the motor stopped.
5. The other two trimmers can be adjusted for the puffing speed range and the volume. Use a fine screwdriver as shown. Drill suitable holes in the ABS case to allow the wires to access the screw terminal connector blocks, and use Velcro pads to secure the case to the inside of the model.

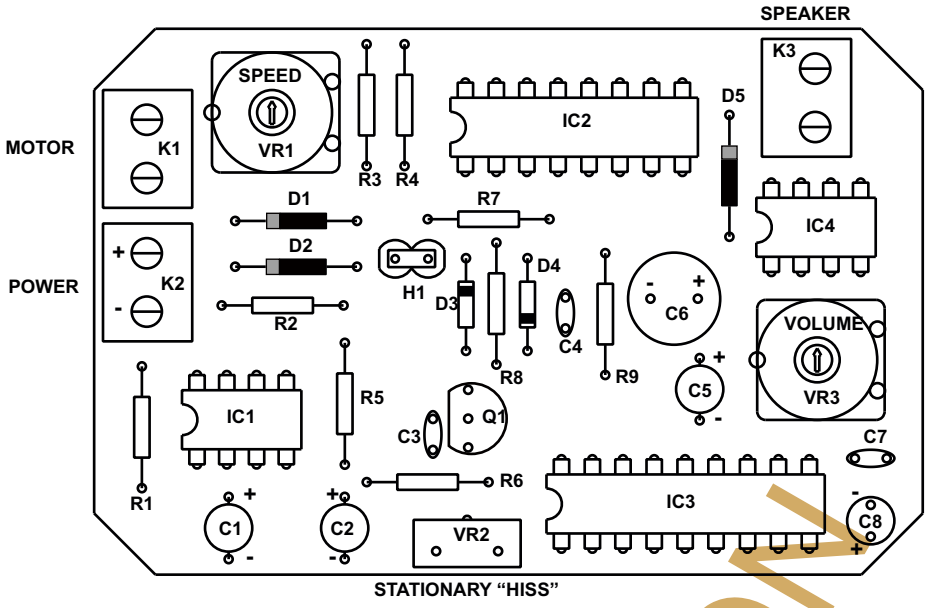
RECOVERY SERVICE

A recovery or repairs service ensures that you will not be left with a dead unit for any reason. The Service Charge for this kit is £13.00 including parts (including return shipping cost IN UK).
All returns should include full Credit Card details (Name & Address of cardholder, Card Number, Expiry Date and Card Security Number)

ACTION R/C ELECTRONICS, 1 Llwyn Bleddyn, Llanllechid, Bangor LL57 3EF, United Kingdom

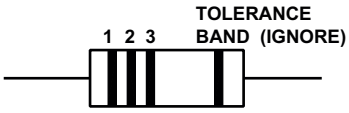


P56 STEAM ENGINE SOUND UNIT
Instructions for Kit version

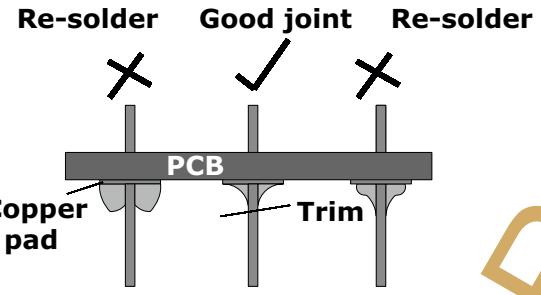


Components Layout

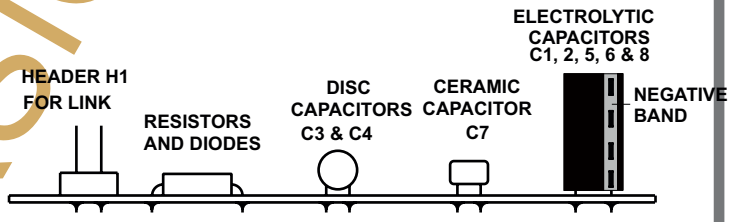
NOTE; VALUE OF R8 IS DIFFERENT FOR 6V AND 12V VERSIONS - SEE KIT INSTRUCTIONS FOR DETAILS



Resistor colour bands



Soldering Tips



Component mounting details

PARTS LIST

IC1	555 CMOS IC + SOCKET (HANDLE WITH CARE)
IC2	4017 CMOS IC + SOCKET (HANDLE WITH CARE)
IC3	18 PIN CUSTOM SOUND IC + SOCKET (UNMARKED)
IC4	TDA7052 IC + SOCKET
Q1	BS170P MOS DEVICE (HANDLE WITH CARE)
D1,2,5	1 AMP DIODES 1N40043 (BLACK PLASTIC/PRINTED BAR)
D3,4	BAT85 SIGNAL DIODE (SMALL GLASS CASE/DARK BAR)
R1,4	10K RESISTOR 1/4 WATT (BROWN/BLACK/ORANGE)
R2,5	56K OHM RESISTOR 1/4 WATT (GREEN/BLUE/ORANGE)
R3	39K OHM RESISTOR 1/4 WATT (ORANGE/WHITE/ORANGE)
R6	680K RESISTOR 1/4 WATT (BLUE/GREY/YELLOW)
R7	1K RESISTOR 1/4 WATT (BROWN/BLACK/RED)
R8 for 12v version	3K3 RESISTOR 1/4 WATT (ORANGE/ORANGE/RED)
R8 for 6v version	1K RESISTOR 1/4 WATT (BROWN/BLACK/RED)
R9	27K RESISTOR 1/4 WATT (RED/MAUVE/ORANGE)
VR1	1M MIN ENCLOSED HORIZONTAL PRESET
VR2	1M MIN ENCLOSED VERTICAL PRESET
VR3	4K7 MIN ENCLOSED HORIZONTAL PRESET
C1,2,8	1uF MIN RADIAL ELECTROLYTIC CAPACITOR
C3,4	0.01uF CERAMIC DISC CAPACITOR (marked 103)
C5	100uF MIN RADIAL ELECTROLYTIC CAPACITOR
C6	220uF MIN RADIAL ELECTROLYTIC CAPACITOR
C7	0.1uF CERAMIC CAPACITOR (blue, marked 104)
H1	2 PIN HEADER with LINK
K1,2,3	TWIN SCREW CONNECTOR BLOCKS
CASE	TYPE RX2010 plus ACTion logo
SPEAKER	8 Ohm IMPEDANCE (Not supplied with kit)

P56 KIT INSTRUCTIONS

PCB
The PCB for this Project is fully prepared and requires no additional work. It is manufactured from high-grade Glass Fibre Board.

TOOLS
For construction you will require a soldering iron and flux cored solder; a small pair of wire cutters, a small screwdriver for adjustment and connections plus, as always in electronics construction, a good level of light.

PARTS
All the parts for the kit should be laid out on a clean surface so that they can be correctly identified.

- The resistors, rods with a wire at each end and a series of colour bands, are colour coded as directed in the Parts List. See also Resistor Colour Bands drawing.
- The small black plastic diodes have a silver bar marked at one end, this bar is clearly marked on the layout drawing. The tiny glass components are also diodes and have a black bar at one end.
- The electrolytic capacitors C1, C2, C5, C6 and C8 are marked with the value and working voltage, and a vertical bar with Negative signs on it which signifies which leg goes to the negative. All capacitor polarisations are shown on the drawing.
- The small ceramic capacitors C3, C4 & C7 are non-polarised and can be fitted either way round.
- The little moulding with two gold pins is known as a header (H1). It is used to link two places on the PCB like a switch. You will note that it has a long pin end and a short pin end. The short pin ends are the ones to solder into the PCB leaving the long ends to hold the moulded link.
- The two 8-pin ICs are marked with their type codes, as is Q1, the Field Effect Transistor. The 16-pin IC is marked CD4017BE or similar and 8-pin IC 1 is marked LMC555 or similar. The 18-pin custom sound IC is not marked. As it is the only 18-pin IC, no confusion can exist. IC3 is a TDA7052.
- Each IC has a moulded socket; 2 x 8 pin, 1 x 14 pin and 1 x 18 pin. You will note a small notch on one end; this should be orientated as per the drawing then, when the ICs are fitted later, they should also have their notch in the same orientation ensuring that they are the right way round.

CONSTRUCTION
As the PCB layout for this project is well spaced and most components can easily be fitted at any stage of the construction, a full schedule of instructions is not required; just points to watch out for have been listed. Components can be fitted in whatever order you wish.

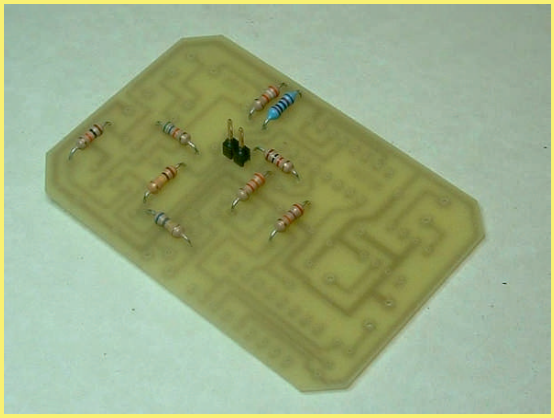
- IC sockets are provided for all four IC devices; they should be fitted to reduce handling of sensitive devices.
- The link for H1 should be fitted after H1 has been soldered into the PCB so that it will not get lost.
- Fit the IC's in their sockets and MOS Transistor Q1 (BS170P)as the last operation in the construction.
- WARNING -STATIC SENSITIVE DEVICES- IC1, IC2 and Q1 are MOS devices, they are sensitive to static charges from your body and can be damaged by touching the legs. They should not be handled any more than is required. When removed from the protective conductive foam before fitting, do not touch the legs of the devices. When fitted and soldered into the PCB they will be much safer but try not to handle the rear of the PCB any more than you have to. Often static damage does not stop a device from working but may reduce its life.
- When fitting IC sockets and ICs, ensure that the small notch at one end is in accordance with the drawing.
- The polarity of capacitors C1, C2, C5, C6 and C8 must be observed. See the drawings.
- The polarity of the black diodes D1, D2 and D5 (1N4003) should also be noted, as should that of the tiny glass diodes which are BAT85 type. See the silver or dark bars marked on the drawing for all diodes.
- All resistors and the remaining non-polarised capacitors can be fitted either way round; just ensure that the correct value goes in the right place. Note that the value of R8 depends upon the voltage you are intending to use: it is 3.3KΩ for a 12v system and 1KΩ for 6v - See Parts List and drawing.
- When installing VR1, VR2 and VR3, note that they are not all the same value. VR1 (horizontal mount) and VR2 (vertical mount) are both 1 MΩ while VR3 (horizontal mount) is 4.7 KΩ.
- Ensure that the wires to the connector blocks can be inserted from the outside edge of the PCB.
- When the PCB construction is complete, set all the controls to centre position.
- The rear of the board can now be cleaned with something like an old toothbrush and some spirit cleaner. Then check all over the soldered side of the board for good joints and no solder bridges between tracks.
- Time now to tackle the case; not a lot to it really it's just a matter of enabling the wiring to enter the case for connection. You can just file a narrow slot the length of the two-way connector blocks or file a notch out of the top of each end of the case at the appropriate positions. This is all that the case requires; now you can fit the ACTion badge.

TESTING
Having built the unit it's simply a matter of connecting your speaker and power wires from whatever battery pack you are using. You don't need a Speed Controller to initially test it; it can be connected to its battery and the either chuffing sounds or a continuous steam sound will be heard. Adjust the VR2 to just give a continuous sound of escaping steam. Set VR1 for the Maximum rate you require. You can set the volume control VR3 to a setting that suits the speaker you are using. The final setting will also depend on your speaker installation in the model.

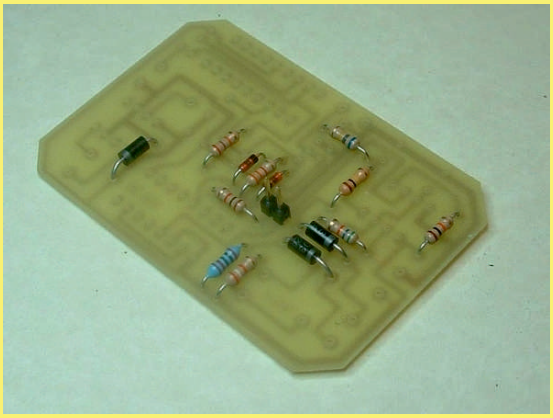
SPEAKER
Speakers as small as 1.5" will work with this unit as most of the noise is of a high frequency nature. Bear in mind that speakers smaller than about 2" will give reduced volume due to their low efficiency; larger speakers have the disadvantage of being difficult to hide whilst still allowing most of the sound out. The high frequency hiss sound will best be served by a mylar waterproof cone speaker. A size of about 2" to 3.5" diameter (54mm - 89mm) will suffice. A speaker, as you are probably aware, requires a case or rather an enclosure of some kind to present the best sound. The absolute minimum requirement is a baffle; a flat piece of plywood, plasticard or similar about twice the speaker cone area with a hole cut, almost as big in diameter as the speaker, which should be fastened to it. Evostick or other contact adhesive gives a good bond in most cases. If you can provide a enclosed area (usually easier on a model boat, but can be difficult in other models) and mount this baffle so as to seal up the space behind, you will be providing the best installation for the Project. You will need an opening to the outside to hear the sound through.

P56 STEAM ENGINE SOUND

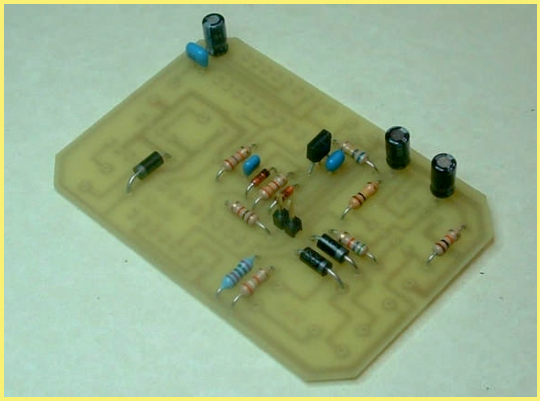
PHOTOGRAPHIC BUILD SEQUENCE FOR KIT VERSION



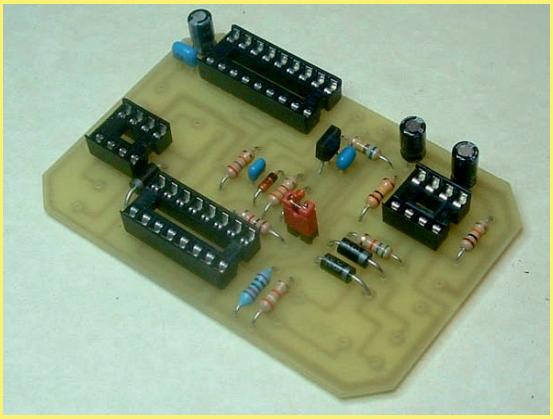
PICTURE 1: Resistors and two-pin header



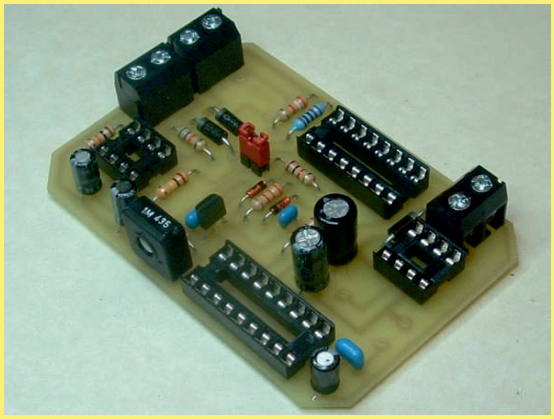
PICTURE 2: Add diodes



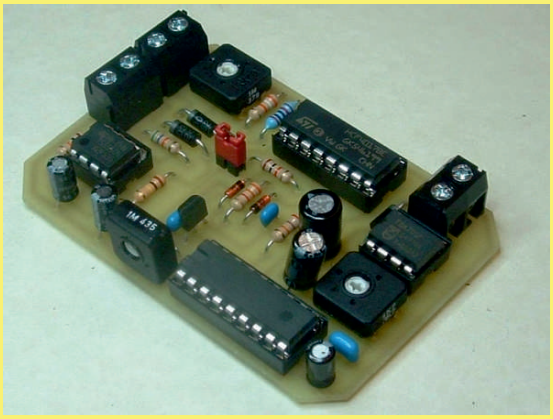
PICTURE 3: Fit capacitors and transistor



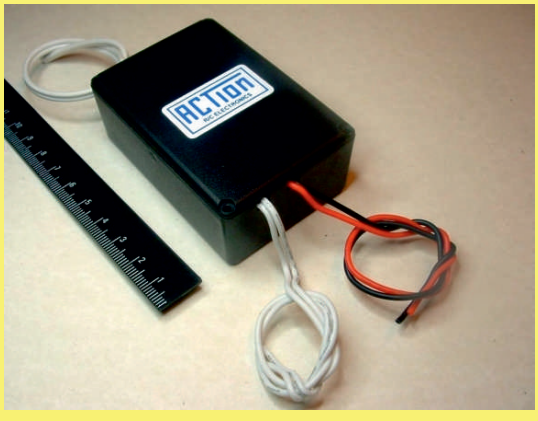
PICTURE 4: Fit four x I/C sockets



PICTURE 5: Fit large capacitors, screw



PICTURE 6: Add presets Vr1 & 3. Plug in 4 x I/C chips last. NOTE! ANTI-STATIC PRECAUTIONS REQUIRED



PICTURE 7: File slots in case for leads; fit lid and sticker. White leads at front are motor connections; speaker leads at rear.