

PARTS AND TOOLS

Wire

Insulated (with outer coating) and stranded (twisted from lots of little wires).

Switches

Momentary button (normally on or off) or switch style (Single Pull Double Throw or SPDT will work best and are quite easy to find. Connect the wire from your circuit to the center lead, then the wire out to one of the others).

Body contacts

While brass screws and knobs work the best, anything metal will work.

Potentiometers (pots)

Variable resistors in a variety of resistance (50k, 100k, and 500k audio taper best).

Light resistors

Like a potentiometer but use light to determine resistance (the brighter the light, the less resistance).

Tilt switch

Kind of like a Wii controller, tip the device and it trips the switch; these have mercury in them so be careful.

1/4" jack

To run out to an amp or mixer.

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Wire stripper

A cheap one should be fine, but make sure it takes small wires.

Diagonal cutters

For cutting wire and component leads, stronger than the wire cutter on your wire stripper.

Soldering iron and solder

A cheap one is fine though be sure it has a small enough tip. You'll also need solder and a piece of wet sponge for cleaning the iron's tip.

De-soldering pump

Absolutely indispensable for fixing soldering mistakes or removing existing parts.

BASIC TECHNIQUE

Crack it open.

Turn the device on. Depending on the device, it may also be useful to tape down a key or button so you can hear what your bends are doing.

Start connecting different parts on the circuit board. You can either use a wire with both ends stripped or with alligator clips; however a moist finger works well for finding body contact points. Chips (small black squares with lots of leads coming out of it) often make great connections with other parts of the circuit.

Many connections will do nothing, and some will crash the device. If the sound stops, immediately release the connection you are making, then turn the device off and on again. In most cases this is harmless.

Once you find a connection you like, mark it with masking tape (I recommend a little arrow and a number so you can remember exactly which points to solder). Some good parts to put between connection points include momentary switches, potentiometers, photo resistors, or tilt switches.

On keyboards there is often a small dial (a potentiometer) that can be rotated by a screwdriver. You can run a wire from this potentiometer to a screw or knob as a body contact or remove the pot entirely (a little more risky) and rewire a new pot mounted to the chassis. Now you can drastically change the pitch of a note while playing.

You may want to consider adding an instrument jack to your device to send the signal directly to an amp or mixer. Removing the internal speaker will also give you more room to mount switches.

You can also add a reset switch, in case while playing your bends crash the circuit. This is a simply a momentary switch between the positive lead of the battery and the circuit. The switch should be wired so that it is usually on, but when pressed the connection is broken and all power to the circuit is cut. If you feel confident doing this, you may want to do this first so you can easily reset the device while bending.

Remember that your bends may not be stable. I don't recommend live performances with bent instruments unless you are prepared for the instrument to crash. If you get a really amazing sound, I'd record it while you can. Turning on more than one bend a time can also create unpredictable results, which may be awesome but may also be unstable.

ADVANCED OPTIONS

If you have a device that seems especially bendable, you may run out of room to mount the switches and contacts on the device. If you've run out of room, or you don't want to drill a lot of holes in the chassis, the best option may be to run a ribbon cable (either many individual wires within an outer insulation or a flat series of small wires) to an external box with switches mounted to it. This can either be soldered to the connection points, or you can add a jack so the external box can be unplugged.

Many speaking or singing toys have what is called a timing circuit. This regulates the pitch and speed of the sound. If you find the resistor in this part of the circuit (often found as a body contact) you can swap out the resistor for a pot or body contact and make your Tickle Me Elmo squeal and groan.

RESOURCES

www.anti-theory.com/soundart/circuitbend

Reed Ghazala is often considered the father of circuit bending and this is his great site

www.generalguitargadgets.com

If you're ready to build your own effects to add, this site has lots of free schematics

www.bugbrand.co.uk/pages/resources.htm

A list of resources from a site of great handmade guitar effects

www.makezine.com/blog

Cool magazine, cool blog with lots of DIY hardware hacking projects

www.createdigitalmusic.com/tag/circuit-bending-challenge

Create Digital Music's reader circuit bending challenge – videos of great bends

Handmade Electronic Music by Nicolas Collins

A great book on all things musical and electronic, designed for beginners to advanced

Jameco

Extensive catalog of electronics parts

Digikey and Mouser

Very cheap electronics parts but hard sites to navigate if you don't know what you need

Parts Express

An excellent company specializing in speaker building – lots of connectors and other parts

McMaster Carr

The most amazing website ever with every piece of hardware ever made

SPECIAL THANKS to PAiA for generously donating their excellent, nearly solderless ribbon-controller kits for the students of this workshop.

The kit, and really great modifications (including using the kit with a VCR tape as the controller), can be found on their website, www.paia.com.



REMEMBER while you can ruin a device, the fun is in experimenting. With almost no knowledge of how a device works you can make some really cool stuff. The four basic rules should cover everything but be careful and use common sense.