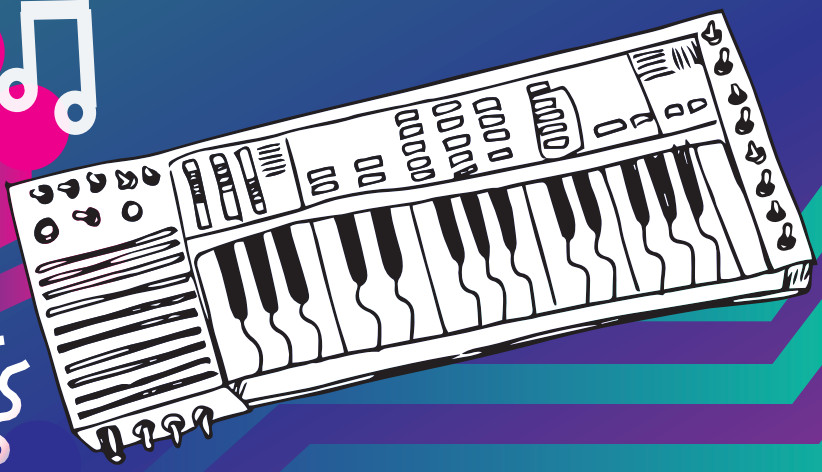
CIRCUIT BENDING



YOU HEAR A GHOSTLY WAIL FROM MARS OVER A DRUMBEAT OF STOMPING ROBOTS... AND THEN A SOUND YOU CAN'T EVEN BEGIN TO DESCRIBE.

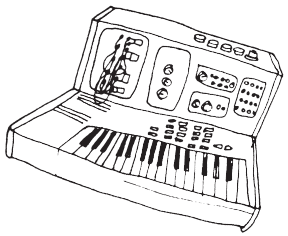
FOR OVER 40 YEARS PEOPLE HAVE TURNED UNWANTED THRIFTSTORE TOYS INTO ONE-OF-A-KIND MUSICAL INSTRUMENTS THAT MAKE SOUNDS LIKE THESE.

"CIRCUIT BENDING" IS THE ART OF EXPERIMENTING WITH THE ELECTRICAL CONNECTIONS IN EVERYDAY DEVICES TO MAKE BRAND NEW KINDS OF MUSICAL INSTRUMENTS.

KNOW NOTHING ABOUT ELECTRONICS? NO PROBLEM!! THAT'S THE *beauty* OF CIRCUIT BENDING: AFTER YOU KNOW A FEW TRICKS, THE PROCESS IS MORE EXPERIMENTATION & CREATIVITY THAN BEING AN ELECTRICAL ENGINEER.

OF COURSE, MANY ELECTRICAL ENGINEERS GOT THEIR START WITH CIRCUIT BENDING PROJECTS!

CIRCUIT BENT INSTRUMENTS CAN BE MADE WITH ALL SORTS OF CRAZY DESIGNS!



CIRCUIT BENT INSTRUMENTS HAVE CONTRIBUTED TO THE UNIQUE SOUNDS OF MANY FAMOUS MUSICIANS INCLUDING:

MIKE PATTON

RADIOHEAD

APHEX TWIN

BLUR

BJORK

PETER GABRIEL

DEVO

THE FLAMING LIPS

THE UNICORNS

REM

NINE INCH NAILS

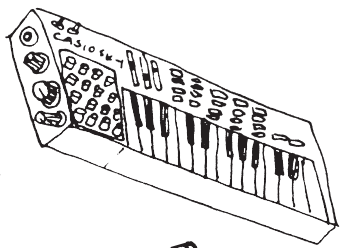
SHPONGLE

THE CHEMICAL BROTHERS

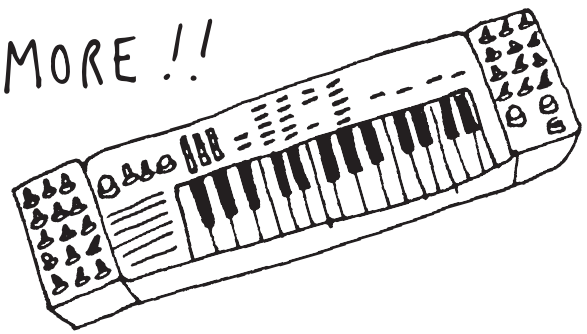
MOUNT EERIE

BLOC PARTY

MICHAEL ANDREWS
featured in the musical score for Me and You and Everyone We Know



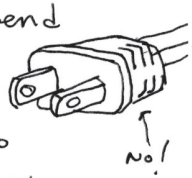
& MANY MORE!!



TWO BIG RULES FOR SAFETY WITH CIRCUIT BENDING

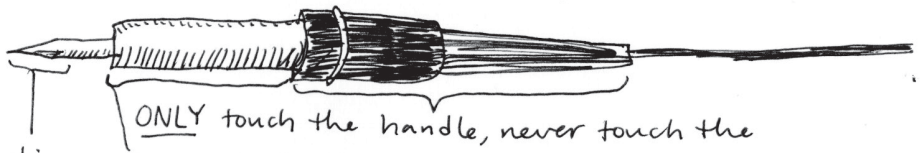
1 BATTERIES ONLY!

Don't circuit bend anything that plugs into the wall This ensures that you are not exposed to dangerous voltages like the voltages inside the outlets in your house. Even the batteries should be small! Don't circuit bend anything with greater than 6V batteries.



2 LEARN HOW TO USE A SOLDERING IRON SAFELY

(check out videos on YouTube!)



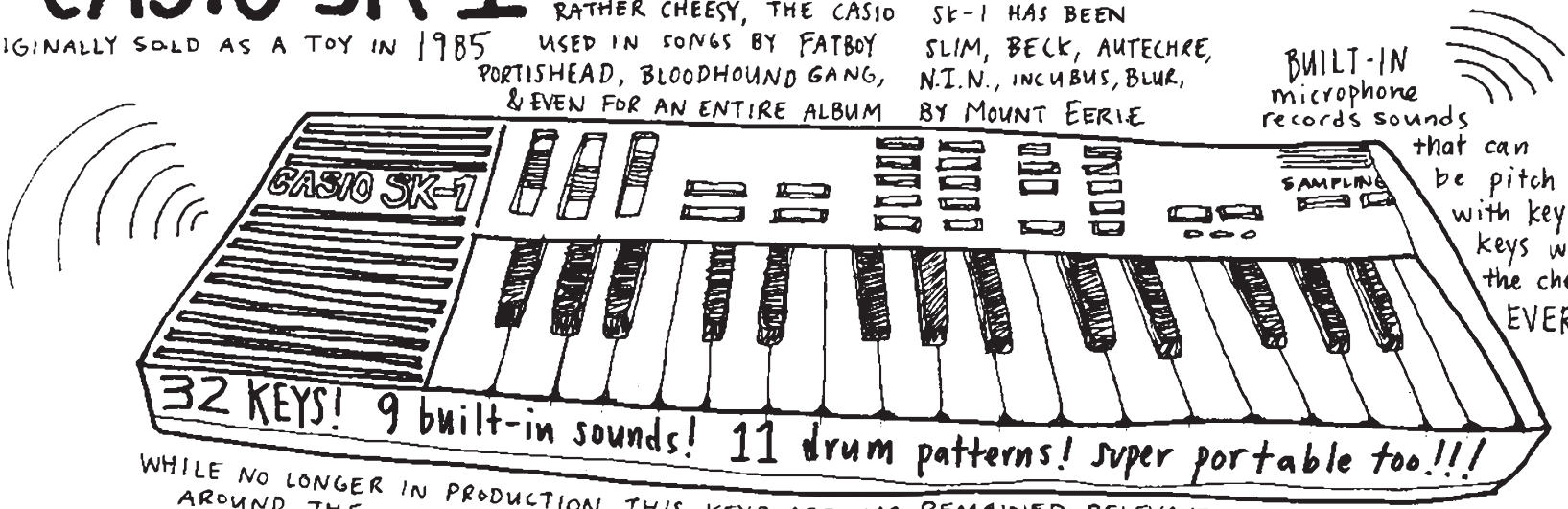
ONLY touch the handle, never touch the tip or shaft which are made of metal and get hot enough to burn you REAL bad, REAL fast.

- Make sure to plug it in directly to the wall (not a power strip) & keep it in the stand as soon as you plug it in.
- AVOID breathing in smoke by working near an open window with a fun BLOWING the smoke out or invest in a solder exhaust fan with a filter.

THE CASIO SK-1

ORIGINALLY SOLD AS A TOY IN 1985

ALTHOUGH THE DEFAULT SOUNDS ARE RATHER CHEESY, THE CASIO SK-1 HAS BEEN USED IN SONGS BY FATBOY SLIM, BECK, AUTECHRE, PORTISHEAD, BLOODHOUND GANG, N.I.N., INCUBUS, BLUR, & EVEN FOR AN ENTIRE ALBUM BY MOUNT EERIE

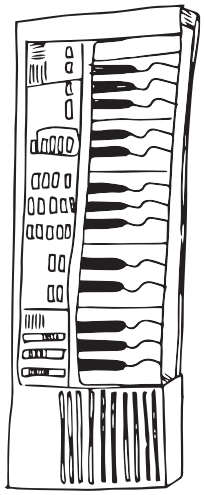


BUILT-IN microphone records sounds that can be pitch shifted with keyboard keys which makes it the cheapest sampler EVER MADE!

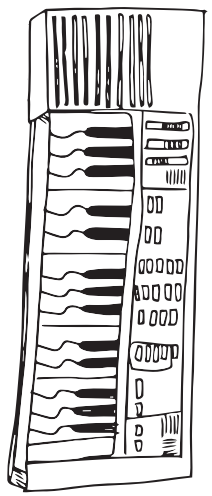
WHILE NO LONGER IN PRODUCTION, THIS KEYBOARD HAS REMAINED RELEVANT TO MUSICIANS AROUND THE WORLD BECAUSE IT IS ONE OF THE EASIEST & MOST REWARDING KEYBOARDS TO CIRCUIT BEND, WHICH IS WHY WE WILL BE LOOKING AT IT IN THIS ZINE!

HOW TO FIND A CASIO SK-1:

KEEP AN EYE OUT AT THRIFT STORES AND GARAGE SALES! ALTERNATIVELY, YOU CAN SEARCH FOR THEM ON EBAY & CRAIGSLIST. ALTHOUGH THE SPECIFIC WIRING ADVICE DESCRIBED IN THIS ZINE WILL APPLY ONLY TO THE CASIO SK-1 (and it's knock-off, the concertmate 500), MANY TOYS FROM THE 80's & 90's MAKE A GOOD CHOICE FOR CIRCUIT BENDING PROJECTS, ESPECIALLY IF YOU'RE WILLING TO EXPERIMENT & **explore!**



↑ CASIO SK-1



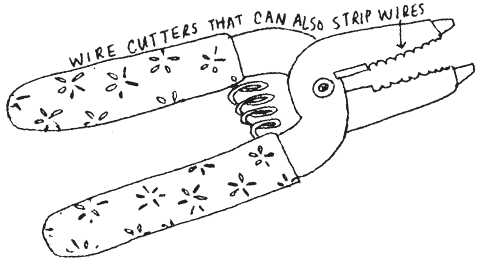
↑ REALISTIC CONCERT MATE 500

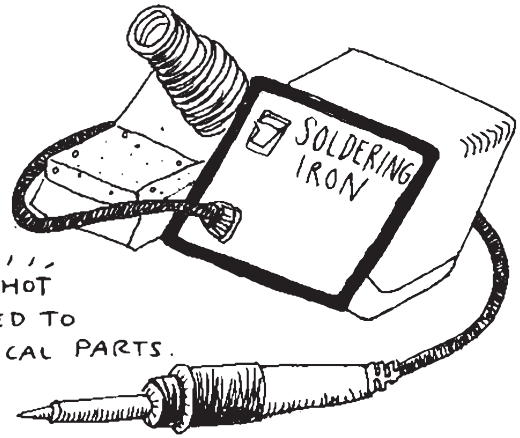
PRO-TIP:

IF YOU'RE SET ON GETTING A CASIO SK-1, TRY RADIOSHACK'S VERSION CALLED THE "REALISTIC CONCERTMATE 500". IT'S IDENTICAL DOWN TO THE CIRCUIT BOARD AND CAN SOMETIMES BE FOUND CHEAPER BECAUSE VERY FEW PEOPLE KNOW THEY ARE THE SAME AS THE CASIO SK-1!!

TOOLS
YOU MAY NEED

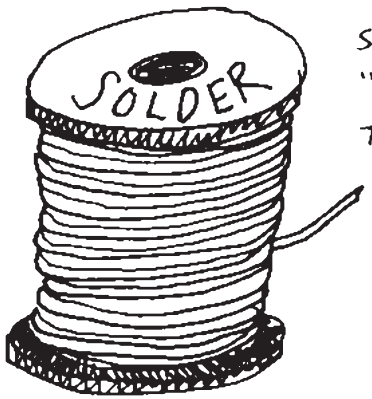
WIRE CUTTERS CAN CUT WIRES (duh!)
AND STRIP THE PLASTIC SHIELDING
OFF WIRES TO EXPOSE THE METAL ENDS.





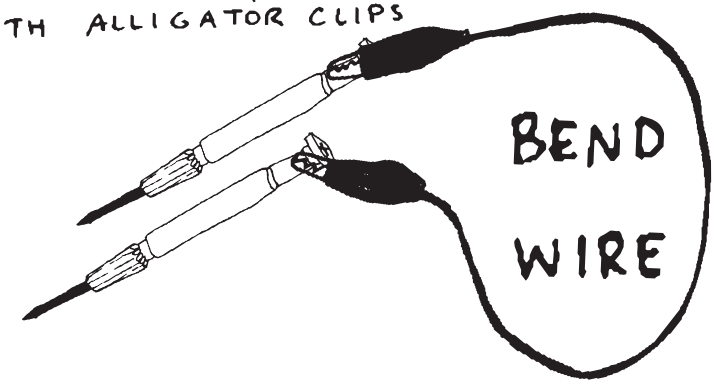
SOLDERING IRONS GET SUPER HOT
TO MELT THE METAL USED TO
CONNECT WIRES AND ELECTRICAL PARTS.

A BASIC SOLDERING IRON COSTS ABOUT $12.



SOLDER IS THE METAL
"GLUE" THAT WE MELT
TO STICK PARTS TOGETHER

A BEND WIRE IS A WIRE
FOR EXPLORING CONNECTIONS.
IT CAN BE AS SIMPLE AS
A LONG WIRE BUT EVEN BETTER
IS TWO SMALL SCREWDRIVERS
CLIPPED TOGETHER
WITH ALLIGATOR CLIPS



WIRE WRAP WIRE
IS A VERY THIN WIRE INVENTED FOR
BUILDING COMPLEX CIRCUITS
BEFORE SILICON CHIPS
WERE INVENTED.

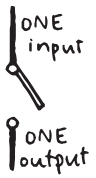
ITS SMALL SIZE ALLOWS US TO PUT
MANY WIRES IN A SMALL SPACE
— LIKE A TOY KEYBOARD!

SWITCHES ALLOW US TO TURN SIGNALS ON & OFF OR CHANGE WHERE A SIGNAL GOES.

THE SIMPLEST SWITCH IS THE "SINGLE-POLE, SINGLE-THROW" SWITCH (SPST)

refers to # inputs to switch

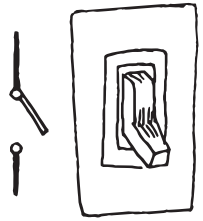
# of outputs



WHEN YOU FLIP THIS SWITCH, A SINGLE INPUT CONNECTS TO A SINGLE OUTPUT, CLOSING THE GAP BETWEEN INPUT & OUTPUT WIRES WHICH ALLOWS & AN ELECTRICAL SIGNAL TO FLOW.

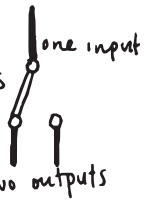
OTHERWISE, THE GAP BETWEEN INPUT & OUTPUT IS "OPEN"

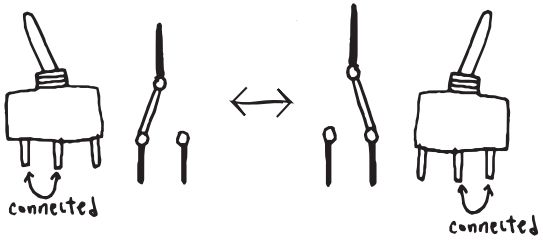
ON
connected wires so electricity can flow



OFF
wires not connected

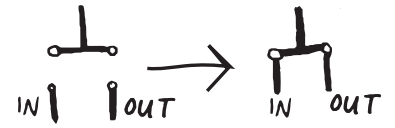
FOR CIRCUIT-BENDING, WE USE "SINGLE-POLE, DOUBLE-THROW" (SPDT) SWITCHES





BUTTONS ARE A LOT LIKE SWITCHES IN THAT THEY CONNECT AN INPUT TO AN OUTPUT.

BUTTONS COME IN TWO COMMON VARIETIES:
"NORMALLY OPEN" WHICH MEANS THERE IS NORMALLY A GAP BETWEEN INPUT & OUTPUT SO NO SIGNAL FLOWS. PUSHING THE BUTTON WILL CONNECT THE WIRES AND CAUSES SIGNAL TO FLOW.

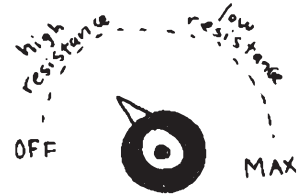


"NORMALLY CLOSED" BUTTONS WILL DISRUPT A SIGNAL BETWEEN THE INPUT AND OUTPUT AND STOP SIGNAL FROM FLOWING.

KNOBS, also called "POTENTIOMETERS" CAN CONTROL HOW MUCH SIGNAL FLOWS BETWEEN CONNECTIONS.

BY CHANGING SOMETHING CALLED "RESISTANCE", THE AMOUNT OF SIGNAL CHANGES.

POTENTIOMETER (KNOBS)

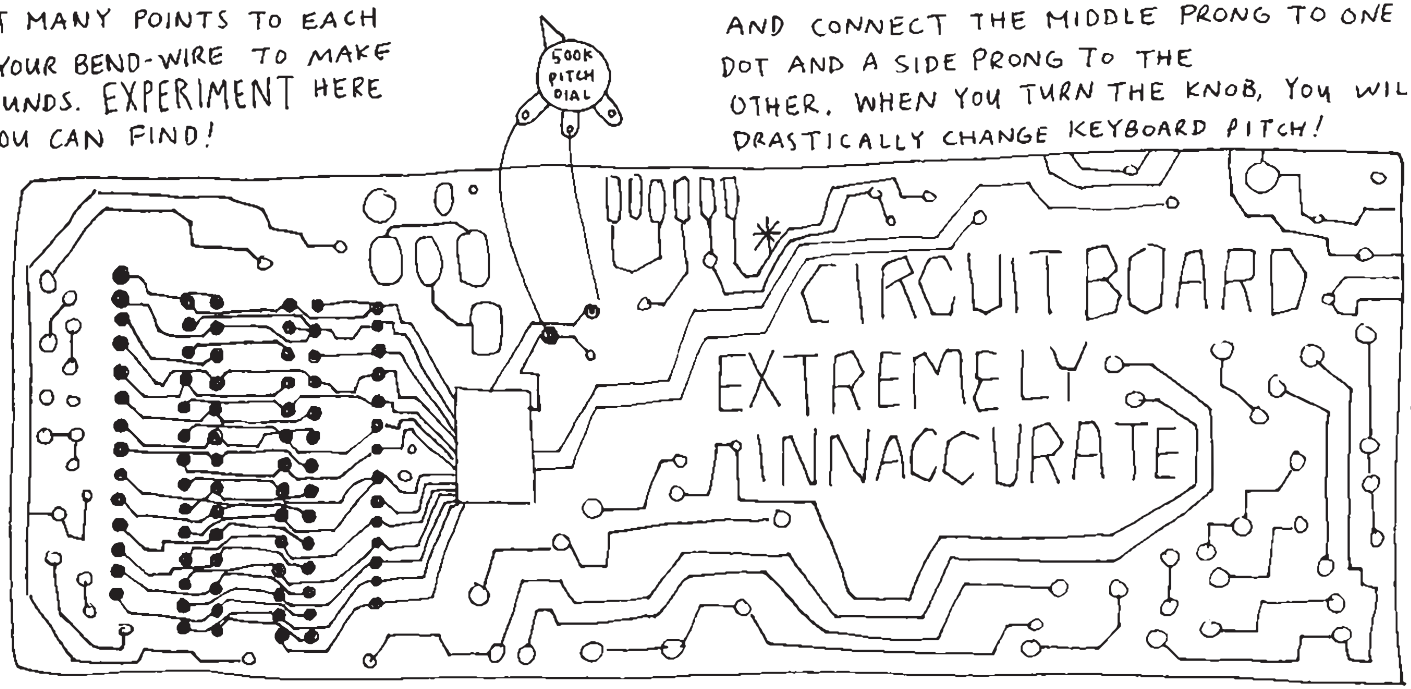


high resistance = less flow
low resistance = more flow

CASIO SK-1 BENDS

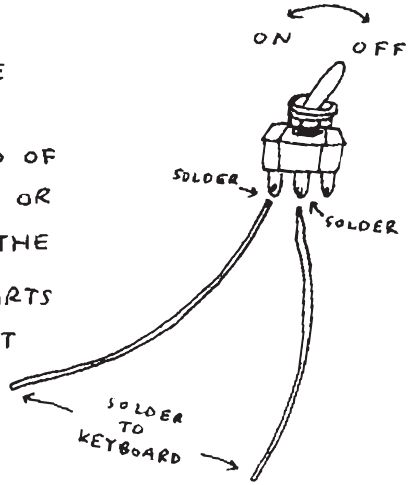
A GREAT PLACE TO START BENDING IS ON THE LEFT SIDE OF THE CIRCUIT WHERE THERE ARE 6 COLUMNS OF 14 PIN SOLDER POINTS. THIS IS THE EXPERIMENTATION ZONE! YOU CAN SAFELY CONNECT MANY POINTS TO EACH OTHER USING YOUR BEND-WIRE TO MAKE CRAZY NEW SOUNDS. EXPERIMENT HERE & SEE WHAT YOU CAN FIND!

ANOTHER GREAT BEND WITH THE CASIO SK-1 IS INSERTING A KNOB TO CONTROL THE PITCH AND TEMPO OF THE ENTIRE KEYBOARD. HERE WE TAKE A 500K POTENTIOMETER (KNOB) AND CONNECT THE MIDDLE PRONG TO ONE DOT AND A SIDE PRONG TO THE OTHER. WHEN YOU TURN THE KNOB, YOU WILL DRASTICALLY CHANGE KEYBOARD PITCH!

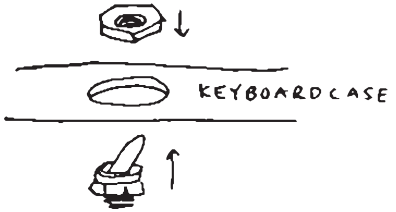


*DOUBLE CHECK INSTRUCTIONS FROM OTHER MORE COMPREHENSIVE SOURCES BEFORE TRYING ANY CIRCUIT-BENDING!

TO ATTACH SWITCHES AND BUTTONS, CUT TWO PIECES OF WIRE-WRAP WIRE AND SOLDER ONE END OF ONE WIRE TO THE MIDDLE PRONG AND ONE END OF THE OTHER WIRE TO EITHER THE LEFT OR MIDDLE PRONG. CAREFULLY SOLDER THE OTHER ENDS OF THE WIRES TO THE PARTS OF THE CIRCUIT BOARD THAT YOU WANT TO CONNECT.



THEN, DRILL A HOLE IN THE KEYBOARD CASE WHERE YOU WANT TO MOUNT YOUR SWITCH, STICK THE SWITCH THROUGH THE HOLE FROM THE INSIDE AND TIGHTEN A NUT OVER THE WASHER ON THE SWITCH FROM THE OUTSIDE.



NOW YOU HAVE A KEYBOARD WITH SOME SHINY NEW SWITCHES & BUTTONS. THE FUN HAS JUST BEGUN! YOU NOW HAVE A COMPLETELY UNIQUE INSTRUMENT TO PLAY & EXPERIMENT WITH.

KEEP IN MIND THAT FLIPPING YOUR NEW SWITCHES WITH DIFFERENT SOUNDS OR MELODIES WILL OFTEN HAVE DIFFERENT EFFECTS.

TRY FLIPPING THE SWITCHES BEFORE OR AFTER RECORDING A SAMPLE, AND WHILE PLAYING NOTES OR IN BETWEEN NOTES.

RESULTS CAN BE UNPREDICTABLE AND HARD TO REPLICATE BUT THERE CAN BE SOME METHOD TO THE MADNESS. IF YOU DRAW A DIAGRAM OF YOUR SWITCHES AND TAKE CAREFUL NOTES, YOU WILL BE ABLE TO RECREATE YOUR FAVORITE SOUNDS.

IF A SERIES OF SWITCHES & SOUNDS PUSH YOUR DEVICE INTO STUBBORN SILENCE, TRY FLIPPING THE POWER SWITCH OFF & ON TO RESET THE DEVICE. SOME PEOPLE ADD A "NORMALLY CLOSED" BUTTON ALONG ONE OF THE WIRES TO THE BATTERY PACK TO MAKE RESETTING THE DEVICE AS EASY AS ONE QUICK BUTTON PUSH.

LET THE SONIC EXPERIMENTATION BEGIN!

WHERE TO START?

PICK A TOY! THE CASIO SK-1, SK-5 OR SIMILAR 80's KEYBOARD WILL BE A GOOD PLACE TO START.

MAKE SURE TO BE FAMILIAR WITH ELECTRONIC & SOLDERING BASICS AND TAKE THE PROPER SAFETY PRECAUTIONS.

CHECK OUT THE SOURCES BELOW TO GET STARTED!

"Circuit Bending: Build Your Own Alien Instruments" by Reed Ghazala

-While out of print, copies of this book can be found online. Written by a circuit-bending pioneer, this book goes into much greater detail about the ideas introduced in this zine

Sparkfun is a great online resource for broader concepts like circuits, soldering, and switches.

https://learn.sparkfun.com/tutorials/what-is-a-circuit

https://learn.sparkfun.com/tutorials/how-to-solder---through-hole-soldering

https://learn.sparkfun.com/tutorials/switch-basics

For more by co-author of this zine: www.brianisett.com

www.TwoPhotonArt.com