Piezo Disks, Audio Schematics and a Condenser Mic

The schematics and diagrams here are provide the basis for sonic investigations using piezo disks and mics along with the construction of practical preamps and flexible compact audio mixers.

The diagram for making a 'plinky' describes the process for soldiering a piezo disk and attaching to it harpsichord wire which when plucked or heated will release an astonishing array of sounds. By choosing to not attach the small pieces of harpsichord wire to the disks, one will make a very sensitive contact microphone.

Piezo disks are available for many sources and have the virtue of being inexpensive, rugged and sensitive. They are incredible contact devices--they're use is limited only by imagination, and ingenuity. They may be taped to any surface--use care when attaching to instruments so as not to damage finished surfaces.

I have used them for more than twenty years to amplify (in live performances) and/or to record:

- automobile antennae
- bamboo
- barbed wire fences
- bowed bamboo tubes
- bicycle wheels
- boat gunwales
- bridges
- burning adhesive on metal tape
- cactus thorns
- credit cards
- floppy disks
- heartbeats and pulse
- heated metal
- insects
- raindrops
- plants
- skateboards
- slinkys
- snowfall on grass mats
- spider webs
- toys
- trees
- tuning forks through steel wire
- voices through paper
- voices through metal cans
- wind blowing over rocks
- wind harps
- window screens
- ............

The condenser Microphone is small, fairly rugged and good for putting inside of small objects, guitars, violins, etc. When using them inside of instruments, I strongly advise to keep the levels low--just a bit above line level can be very effective. The diagrams and schematics may be freely shared. I would appreciate the acknowledgment when they have proven useful. rlerman 'at' SonicJourneys.com

How to Solder a Piezo Disk and make a Contact Microphone

Note: Piezo Brass Disks or 'benders' are often available as surplus.

In the US, the best current sources are Digi-Key, Mouser Electronics, Electronic Goldmine, Marlin Jones, Jameco.

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Try to find KBI 4410 or KBI 3013 from Projects Unlimited.

Shielded wire [ca. 3 m. long]

NOTE: if you make this wire longer than it needs to be, there will be less stress on this solder connection, which is weaker than the other.

SOLDERING DETAILS

1. Tin both the inside or "hot" wire and shield.
2. Apply a small pool of solder about 12mm x 4 mm (1/2" x 1/4") to the brass for the shield wire.
3. Hold tinned shield wire on this pool with a soldering iron. Tinned shield will flow into the solder pool making both a very strong solder connection and strain relief.
4. To solder onto piezo ceramic, you must use a very clean soldering iron—about 20 watts maximum.
5. Apply very small pool of solder to the piezo disk.
6. While holding insulated wire, reheat solder pool and put tinned end of wire into pool.

strip wire about 1/4 " or 6mm.

leave insulation on inside wire

shield wire soldered to brass of piezo disk

shielded audio cable

This drawing may be distributed and shared. If cited, please credit the author.

http://www.sonicjourneys.com or

http://www.public.asu.edu/~rlerman/
This is a good, and quiet preamp for any piezo disk applications. There are other variations and combinations that work better. A preamp made in a single stage will be quieter, but usually, electronic noise is not a factor in working with Piezo materials. The buffer stage here is basically an impedance changer. Because the gain is kept relatively low, the slew rate, (how fast the preamp can respond) works well with little distortion. Because the impedance has been changed by the first stage, the larger gain of the second stage is less of a problem.

Use any power supply from ±9 volts to ±18 volts. This can be run from two 9 volt batteries. Some of the newer chips on the market can be run with only one battery. Explore

**BUFFER STAGE**

- Gain: \( \frac{220K}{100K} = 2.2 \)

**SECOND STAGE**

- Gain: \( \frac{100K}{10K} = 10 \)

**INPUT**

- IC = TL072 or equivalent

**OUTPUT**

- \( \text{TOTAL MAXIMUM GAIN is } 2.2 \times 10 = 22 \)

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**Legend:**

- \( \square \) = pin number of chip
- \( \uparrow \) = positive voltage
- \( \downarrow \) = negative voltage

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**Notes:**

- **IC** = TL072 from Texas Instruments.
- 5532 chips from Signetics are quieter, but the large voltage input from some piezo applications can destroy the inputs of these chips.
Preamp/Mixer
Richard Lerman
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= pin number of chip
= positive voltage
= negative voltage

INPUT

10 mf 100 K

470 K .1 mf

2 8 1

3 4

.1 mf

220 pf

10 mf 100 K

470 K .1 mf

2 8 1

3 4

.1 mf

220 pf

Summing or Mixing Stage

IC = TL072 or equivalent

10 K up to 30 K

higher value gives more gain--careful

Use 50 K or 100 K audio taper pots

You can add as many of these as you like but be reasonable
HOW TO MAKE A small CONDENSER MIC
Richard Lerman  © 1998

Soldering Details

-- Tin both shield wire and hot wire, then cut to same length
-- Carefully heat solder pool for the hot wire on the mic capsule and insert hot wire—allow to cool
-- Carefully heat solder pool for the ground, and insert shield wire—allow to cool
-- Apply hot glue or epoxy around mic capsule and wire

mic capsules available from
Digi-Key:  Part # P-9932
call  1-800-DIG-IKEY

35 mm. plastic film can for wire, 2 electronic parts, and 3 to 9 volt battery to power mic capsule

bottom view of mic capsule showing the 2 solder pools
the side with tab is the ground
side without tab is both the audio and battery connection
and, this is about 4 times life-size

3 or 9 volt battery
- goes to shield
+ goes to 2.2K Ω resistor

wire from mic capsule inserted thru small hole near edge of film can lid

wire to plug inserted thru small hole near edge of film can bottom

tape or hot glue solder connections inside film can

small microphone capsule—others also available
Each input has 4 voltage followers for isolation from the other op amps in the matrix.

The 10Ω resistor is optional—it protects against a chip failure.

The cue out for each channel is independent of the summing amps below.

It is also wise to place a 0.1µf capacitor from voltage to ground near each chip for bypass.

Each voltage follower is 1/4 of a TL074 chip.

Positive 9 to 15 volts

Negative 9 to 15 volts

6 In 4 Out Matrix Mixer
Richard Lerman © 1983, 92

The output can drive a 600 Ω line.