HARD TIPS

BUILD YOUR OWN AUDIO DIGITIZER FOR USE WITH DIGIMASTER

By Mark Fellows and Chris Brenner

The Digimaster software package (reviewed elsewhere in this issue of *Commodore World*) can edit and play 8-bit digitized sounds on a Commodore 64 or 128. Digimaster comes with a library of sounds, and can also convert Amiga IFF sound samples so that they can be used on your Commodore. However, if you want to sample your own sounds, a hardware digitizer (audio sampler) must be employed. Although Digimaster will accept input from a standard Amiga sampler, these devices are getting hard to find and a special cable is also required to attach the sampler to the C-64. As a result, we felt that it would be helpful to present these plans for a do-it-yourself, simple, low-cost quality sampler.

Important

This project requires some dexterity and knowledge of proper soldering techniques. An error made in the assembly of the audio sampler can cause damage to your computer and/or the sampler. In no event will Commodore World or Creative Micro Designs be liable for any direct, indirect, or consequential damages resulting from the use or misuse of the audio sampler or any of the information given in this article.

Parts

Most of parts required for this project are readily available from electronics supply stores, including Radio Shack. If you cannot obtain the parts locally, they can all be ordered from Digi-Key Corporation in Thief River Falls, Minnesota. We've included the Digi-Key part number in the parts list below to aid you in ordering the correct components. The full address and phone number for Digi-Key and other well-known mail-order parts outlets are given in the "SOURCES" sidebar.

AUDIO DIGITIZER PARTS LIST

Qty	Description	Schematic Key	Digi-Key Part Number	Approx. Cost/Qty
1	ADC0804 A to D conv.	U1	ADC0804LCN-ND	$ 5.00/1
1	LM358 Op-Amp	U2	LM358-ND	.84/1
3	1kΩ 1/4W Res. 5%	R1, R2, R3	1.0KQ	.26/5
1	39kΩ 1/4W Res. 5%	R4	39KQ	.26/5
1	33kΩ 1/4W Res. 5%	R5	33KQ	.26/5
2	24kΩ 1/4W Res. 5%	R6, R7	24KQ	.26/5
1	4.3kΩ 1/4W Res. 5%	R8	4.3KQ	.26/5
1	910Ω 1/4W Res. 5%	R9	910Q	.26/5
1	820Ω 1/4W Res. 5%	R10	820Q	.26/5
1	68Ω 1/4W Res. 5%	R11	68Q	.26/5
1	100KΩ Potentiometer	VR1	3386P-104-ND	1.07/1
2	10uF Tantilum Cap, 16V	C1, C2	P2038	.62/1
2	.001uF Poly Cap, 50V	C3, C4	P3102-ND	.48/1
1	47pf Ceramic Cap, 100V 5%	C5	P4845-ND	.18/1
1	12/24 User Port Conn.	P1	EDC305240-ND	2.14/1
1	Phono jack	P2	SC1133-ND	1.23/1
1	Perfboard, 0.1"x 0.1"grid, w/pads, min. size 2"x2.5" (Radio Shack 276-1395)			2.19/1
Approx. total cost:				**$16.93**

Required Tools

You'll need the tools and supplies given in the following list to begin this project. All should be commonly avilable from local hobbyist stores.

15 Watt soldering iron
Rosin-core electrical solder
Bus wire
Wire-wrap wire and strippers
Cutting pliers
Needle-nose pliers
1/4" drill (to make a hole in the perfboard for the phono jack)

Assembly

The first thing to do is to find a clean, uncluttered, static-free work area. Once you have set up your tools and organized the parts, you are ready to begin. The first step is to solder the edgeboard connector (P1) directly to the perfboard. If this is not possible because of the type of perfboard you are using, you will have to use wires to make the necessary connections between the edgeboard connector and perfboard.

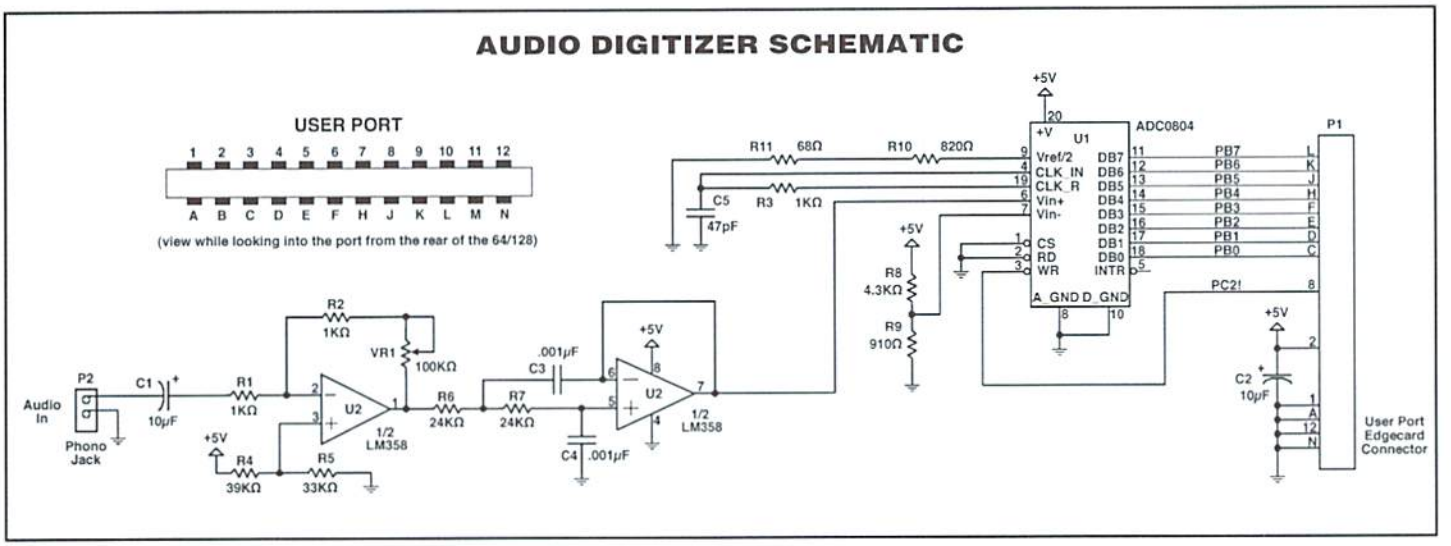
Next, use the bus wire and form a robust ground plane around the perimeter of the board,

Sources

Digi-Key Corporation
P.O. Box 677
Thief River Falls, MN 56701-0677
1-800-344-4539

JDR Microdevices
1850 South 10th St.
San Jose, CA 95112-4108
1-800-538-5000

Mouser Electronics
12 Emery Ave
Randolph, NJ 07869-1362
1-800-346-6873



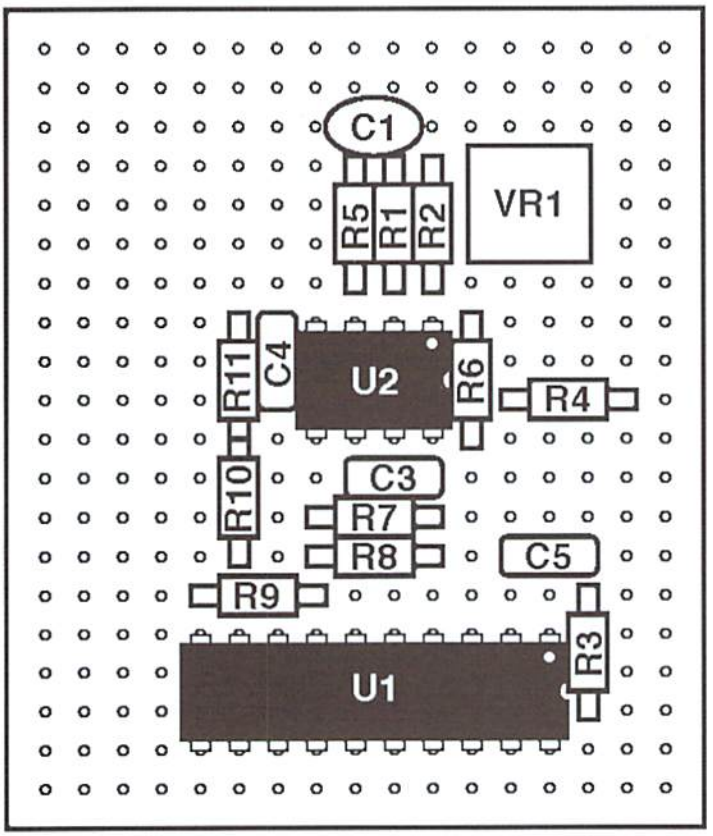
connecting it to Pins 1, A, 12, and N of the edgeboard connector. A solid ground plane is a must to ensure the proper, noise-free operation of this or any other electronic circuit.

Without soldering anything in place yet, arrange the remaining components on the perfboard so that the distance between connections and components is kept to a minimum (see layout diagram). This will help reduce noise in the audio circuit and result in cleaner-sounding samples later on. Once all the components are where they belong, solder them in place, and then make the necessary connections by using the wire-wrap wire. Follow the schematic carefully, and check your work carefully.

You'll notice that we left P2 (the Phono Jack) off of our layout diagram. It should be located close to C1, but your specific wiring connections may dictate exactly where it will go. You might also opt to use a phono cable instead of an actual jack, or mount then entire project in a small case.

Using the Sampler

Plug the sampler into the User Port, connect your audio source to the sampler's input (Phono Jack P2), and turn your computer on. If your computer does not power up normally, or acts strangely, shut it off immediately, remove the sampler and check your connections against the schematic. If your computer behaves normally, boot the Digimaster editor and try sampling a sound. Follow the instructions in the Digimaster manual and adjust your audio source and potentiometer VR1 on the sampler for the best sound quality before you begin sampling. If you have problems getting any sound through the sampler, or if the sound quality is poor, you may need to shut down and double check the audio source and your connections on the sampler. If all goes well on the other hand, you can begin the enjoyment of capturing your own high-quality, 8-bit digital audio samples on your Commodore.



SOFTWARE IN REVIEW

Digimaster

An all-new program for processing digital sound samples on your Commodore 64 or 128 in 64 mode, Digimaster uses new techniques to reproduce eight-bit digital sound samples, previously considered impossible on a 64/128 without additional hardware. Eight-bit digitized audio is sixteen times more accurate that four-bit, and produces sound with less noise and distortion.

The package includes an editor, a utility to convert Amiga IFF sound files into a Digimaster-compatible format, relocatable machine-language player modules for both 64 and 128 modes, and sample BASIC programs to demonstrate how to use digitized sounds in your own programs.

The Digimaster Editor is mouse or joystick driven, and uses an intuitive graphical point-and-click user interface with pull-down menus, dialog boxes, and requesters. This makes the operation of the program a breeze, especially while editing the sound files.

After the program loads, the screen displays a menu bar across the top of the screen, and a "scope" window. The scope window contains buttons for playing all or a portion of the current sound file. A digitized sound file is loaded into the program by selecting "Load" from the File menu, then choosing the desired file from the directory list. While the file requester will display all files on the disk, only the "dff" sound files can be loaded. After the sound file loads, the program will display the entire sampled waveform in the scope window. A section of the waveform display can be highlighted (or "marked") for use with the various editing and sound effect tools.

The Edit menu contains six selections, five of which are used to manipulate portions of the sample. The sixth selection allows you to choose your default and "clip" file disk drive, and select a low pass filter cutoff frequency. The filter control allows you to adjust the "tone" to remove aliasing or quantization noise during playback. Aliasing noise occurs when frequencies above half the sampling rate are present in the digitized sound. Quantization noise occurs when portions of the sound are very soft.

The editing functions generally require that you highlight a portion (or all) of the waveform. This is done by moving the pointer across the waveform while holding the mouse or fire button down. Four buttons on the scope window allow you to fine-tune the beginning and end of your highlighted range. This range can then be copied or cut to the clip file, erased, or mixed with a previously saved clip. It's also possible to insert a previously saved clip into the current waveform data. The editing functions can be used to trim silence or noise from the beginning or end of the sound sample, or even jumble the words of a sentence around. It's also possible to create new sound samples from pieces of other samples.

The Sound/EFX menu contains six selections. *Volume* changes the volume of a highlighted range. This lets you create fade-in and fade-out effects, or increase or decrease the overall volume of the entire sample. It's also possible to use this function to change the volume of a portion of the sample, which may be necessary when overlaying or combining clips.

Resample alters the sampling rate of the entire sound sample; this can be used to decrease the size of a sound file, and is also useful when combining clips of samples that were recorded at different sampling rates.

Backwards will flip the marked range of data so that it will play backwards. While this feature has little practical use, it can be used to create interesting sound effects.

Loop Range will simply play the highlighted range in a continuous loop.

Sample Audio lets you record live sound directly into the computer with the help of an audio digitizer. The manual provides some information on obtaining and attaching such devices. [*Also note the hardware digitizer plans elsewhere in this issue -Ed.*] Digimaster has three sampling rates, labeled Slow, Medium and Fast, which translate to 8K, 10K, and 12K respectively.

All in all, the sound quality of Digimaster competes well with some of the sound boards designed for newer computers, especially at the medium and fast sample rates. I found the program's user interface intuitive and easy to use, and best of all, I had it up and running very quickly.

One of the best features of Digimaster is the ease with which you can use the sound samples in *your own* BASIC or ML programs. This raises the status of this package from a quickly-forgotten novelty item to a truly useful programmer's tool. Even the novice 64 or 128 programmer should be able to incorporate eight-bit digital sound into his or her own programs with the supplied routines.

I really don't have any negative comments about Digimaster, although I'd like to see a few more on-board sound effects functions such as echo, chorusing, and flanging. While these effects can be accomplished manually using the copy and paste editing functions, it's difficult and time consuming getting exactly the correct delay time, volume, and number of repeats. Producing a simple echo effect on a short sample required repeatedly reducing the volume of the sample, cutting the entire sample to a clip file, loading the original sample, then overlaying the clip at the right point. Hopefully, the author will include such functions in a future version.

Another nice addition would be the ability to have multiple clip files to ease constructing sounds from a number of different samples. These minor shortcomings aside, Digimaster is sure to please and amaze anyone interested in editing digital sounds.

- John Serafino