SAMPLING Made Simple

If you've always wanted to buy a sampler, but the maze of features and available models makes you feel like a candidate for 'eeny-meeny-miny-mo,' take heart. Part two of our series offers some guidelines towards intelligent buying. *Text by Chan G. Ling.*

I T'S NO ACCIDENT that practically every drum machine and electronic kit on the market makes use of sampled sounds. The fact is synthesized drums just don't sound like the real thing. Just try and create a *realistic* Chinese gong, bell tree, timpani roll, or quica (to name but a few) with traditional synthesizers and you'll quickly see why sampling sounds is the next best thing to bringing the instrument itself.

When consumer samplers were first introduced back in 1979, they were seen mainly in the company of keyboard players. Today, samplers are found in the equipment racks of almost any drummer looking to expand his or her sonic

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vocabulary. If you're looking for authentic drum and percussion sounds in the electronic domain, you're looking at sampling.

Samplers – from the Casio SK1 on the low end of the price spectrum (about $100) to the Emulator III or the Simmons

SDX (about $13,000) – varied in features, are quite similar in structure and design. The basic idea is to take a sound from the outside world, record it in a digital format, and then play it back through an amplifier and speakers.

In many respects, samplers are like cameras. You can go to a grocery store and buy a little cardboard box with the film already included, or you can go to a camera store and get your hands on a fully automatic single lens reflex with several additional lenses. While both machines will do the job within the limits of their design, they differ in the quality of the output, the ease of use, and the amount of control the user has over their operation. When dealing with samplers these differences translate to sound quality, ease of sampling and sample manipulation, and control of the samples when they are played back.

This month I'm going to take a look at some of the important features drummers should consider before buying a sampler

for an electronic percussion system. Samplers aren't exactly cheap and before you plunk down your hard earned dollars, you want to be certain that you'll be happy with the machine you choose.

Sound Quality

ONE OF THE most important criteria for judging a sampler's quality is its resolution. Sample resolution is measured in bits and is determined by the type of microprocessor inside the unit. While this is not etched in stone, higher resolution can be equated with a higher signal to noise ratio (S/N) and a cleaner sound. As a general guideline, each additional bit of resolution will add 6 db to the S/N ratio. Using this formula, a 12 bit sampler (considered the minimum for professional use) will yield a ratio of 72db. Not too bad when compared to a cassette deck, or even some reel to reel machines. But if you're looking for the highest possible quality, consider a 16 bit sampler. With a S/N ratio of 96db, these samplers have as much dynamic range as a compact disk.

Since the resolution is something that can't be changed without completely rebuilding the entire instrument, don't plan on upgrading your machine at a later date. A sampler with 8 bit resolution just can't

be turned into a 16 bit machine. (However, there is an exception to every rule. Merion systems has released a 'pseudo' 16 bit upgrade for Akai's S900. Pseudo because it compresses the input then expands it again for output, so while the dynamic range is increased, the resolution is not.) When shopping for samplers, your ears will have to serve as the final judge on the machine's accuracy.

Other, more esoteric aspects, like the style of the digital to analog converters and the input filters, also play a large role in the overall quality, while another criteria that goes hand-in-hand with the sample resolution is the sample rate. Look for an instrument that will allow you to vary the sample rate easily. Why? To save memory!

Let's pretend that you own a sampler with a total RAM (Random Access Memory) of 12 seconds of sound using a rate of 44K (44,000 samples per second). If you could sample at a rate of only 22K (22,000 samples per second), then you would be able to fit up to 24 seconds of sample data within the same amount of memory. I know you're probably thinking that sounds like a good deal but what's the catch to getting twice as much sound in the same amount of memory? The trade-off is that lower sample rates output a sound with a lower frequency response.

But this isn't necessarily bad. Yes, it's true that less frequency response means that the higher end of the audio spectrum is cut out; but some percussion sounds don't have much audio information in that range anyway. Why bother depleting memory to record something that doesn't exist? If your sampler has variable rates, use the highest rate only when sampling sounds that contain critical high frequency information – cymbals, shakers, chimes, and snare drums. Use a medium sample rate (say 28K) for those sounds that have a little high end, but not too much. For bass drum and floor tom samples, use the lowest speed that will work. A variable rate sampler allows you to use your memory more efficiently.

Speaking of memory, it seems that no matter how much RAM the machine contains, you never have quite enough.

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Although memory is expensive, 'more is better' certainly applies here. Buy as much memory as you can afford, and find out if the internal RAM is expandable. Some samplers are more open-ended than others and a few will let you add more memory as you find more money. Eight megabytes of memory might let you sample a little more than 135 seconds of 16 bit sound at 44K. But eight megs can set you back almost three grand, which could easily be more than you paid for the entire instrument! Also, more memory means longer saving and reloading times, so you may end up designing your set around sound loading delays.

Third Party Sounds

BEFORE WE CONSIDER how easy it is to make your own samples and manipulate digital data, let's take a look at using other people's data. It's a known fact that most musicians who own samplers rely on factory or 'third party' disks for most of their sampling needs ('third party' refers to anyone other than you or the manufacturer of the instrument).

If you're not too interested in doing your own sampling but still want the great sounds that samplers provide, look for an instrument that has a large variety of sound disks available. In this regard, you're a little better off with an instrument that has been around for a while, rather than being the new kid on the block with the latest model. ▶

► In fact, if you have a friend who owns a sampler, you may want to buy the same model so you can trade disks and sounds – kind of like baseball cards. And don't forget that most popular samplers are supported by user's groups with people who are willing to share sounds, tips, and advice that will make your sampling life easier.

Sampling Sounds

SAMPLING YOUR OWN sounds consists of several steps, the first of which is getting the sound inside the unit. Let's say that you're going to sample a crash cymbal. Set up the cymbal, place a mic nearby, and plug the mic into the sample input jack in the back of the sampler. How does the machine know when to begin the sampling process? Most samplers allow the user to set an arbitrary trigger level. As long as the audio input is below this level, the unit will not begin sampling. As soon as the input reaches the designated level, sampling begins. For this example, you would set the trigger level just above the ambient noise level in the room, walk over to cymbal and give it a good whack.

Another method for starting the sampling process is forcing the sample. In other words, the sampler will begin as soon as a specific button or pedal is pushed. This can be very useful if you only want to sample the middle portion of a sound, or sample a sound which has a fairly continuous signal.

You say that your samples sound terrible? It could be a result of the sample input's gain control. If your sample contains audible background noise, the input gain might be set too low so that the signal isn't loud enough to make full use of the instrument's dynamic range. If the sample sounds distorted, then the gain is probably too high, which means that the signal is too strong for the dynamic range and clipping results (bad news). Check out how much control you have over the sample threshold and the input gain on any particular instrument. Less control means more guesswork and frustration.

Digital Editing

ASSUMING THAT EVERYTHING went as planned and the sample sounds good, it's time to do a little digital editing. Digital editing can be defined as altering or manipulating the bits and bytes that make up the sample's information. Perhaps the unit started sampling a little before the crash so that there is some dead time before the initial attack, or the noise level increases as the cymbal sound decays. Must you sample again? No.

Almost all samplers allow you to cut a certain amount of information off the front and back ends of the sample (called truncating). This way, you can cut out any extra, unwanted data and reclaim precious memory.

In addition to truncation, many samplers have a few more digital aces up their sleeve. If the sampler has a command called 'backward', all the digital data is reversed, making it quite easy to create any backward special effects.

Taper is another option which can be used to create a smooth fade in or fade out. Taper differs from using an envelope generator in that the data itself, not the audio output, is altered.

Some units allow you to splice two different samples together. If you've got a burning desire to create a sound which has the attack of a cymbal that changes to the decay of a timpani stroke, splicing sounds is the ticket.

Another popular feature is combining samples. When two samples are combined, they are mixed together to form a new sample. How about taking a sample of an acoustic snare and mixing it with an electronic snare? Now you've got a single sample of the composite sound.

While these features may prove to be both fun and useful, the most important digital process is looping. Whenever sounds are looped, a small section of the sound's data is played over and over. With this feature, a sampled crash cymbal that uses only one second of memory can be

made to decay over several seconds. Looping lets you create long, sustained sounds without using a lot of memory.

Example I shows two possible looping procedures. When using a forward loop, samples play from their beginning until the loop end point. At this time, they quickly jump back to the loop start position and are at zero slope points (the peaks of compression or rarefaction). If the loop points aren't accurately placed, a pop or a click will be heard.

So how do you get an accurate loop? Use the features inside the machine. Some samplers offer an 'auto loop' button. When pushed, the processor inside the unit will

Example No. 1
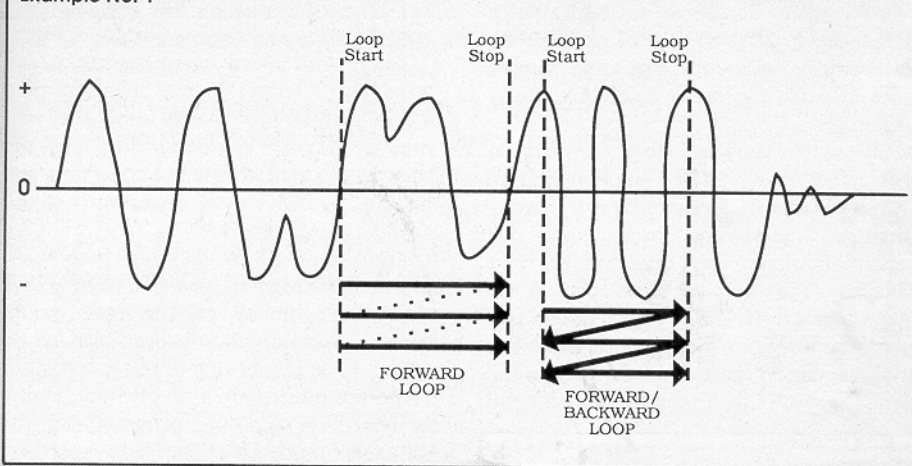
replay the data (imagine saying the word 'digital' as 'digitaltaltaltal'). This loop continues until the sampler receives a message to turn the note off.

The second loop in the example is called a forward/backward loop. Samples using this style will play through to the loop end point, reverse, and play the data backwards to the loop start point, then reverse again (imagine saying the word 'digital' as 'digitalatalatal'). Like the forward loop, the sound will continue until instructed to stop.

In addition to sustain loops (those that are activated when a note is held), some samplers also allow you to set release loops. Release loops come into action when the sampler is instructed to release the note. They can be used to extend the decay of a sample past the note off message. If you plan to trigger a sampler's sounds from a drum machine, acoustic drums, or pads, using a release loop can cure a lot of headaches. Why? Because as far as a drum machine or most trigger pads are concerned, they never 'sustain' a note, and, therefore, the sustain loop won't get a chance to play anyway.

Looping is probably the trickiest part of sample editing. If your sampler isn't very friendly, finding a good sounding loop point is almost impossible. In order to achieve a great loop, the start and stop points are critical. Notice in the example that the two styles of loops begin in different portions of the wave. Forward loops work best when the start and stop positions are at 'zero crossing points.' Zero crossings occur when the sample is at zero pressure (just as a wave is changing from compression to rarefaction). Forward/backward loops work best when start and stop positions

search out the best loop points near the ones that were manually selected. Another time-saving feature is the cross-fade loop. Cross-fades work just like forward loops, except that the start and stop points overlap a little, creating a smoother transition.

And by the way, a large visual display makes sample editing a *lot* easier. A few samplers have video ports so that you can hook it up to a computer-style monitor. In the absence of a large screen, look for a large LCD display on the sampler's front panel.

Sample Assign

LET'S ASSUME THAT you've created several perfect samples and found flawless loops for any that needed them. Now you're ready to lay your samples into a patch. Different companies may call them by different names, but a patch is a floor plan of sample assignments. In other words, which notes are going to fire which samples? You may not like the idea, but all samplers revert to traditional keyboard jargon when creating presets. You can't tell a sampler to play a cymbal sound whenever you strike a certain pad. Instead, you tell the sampler to fire the cymbal when a 'D#' is played. Then, if your pad is sending the MIDI note number for D#, you'll hear the cymbal.

Generally, sounds can be assigned to a single key or set of keys. The current trend is to specify an original key, a low limit, and a high limit for each sample. When assigned to more than one key, the pitch of the sample will be shifted up or down from the original. Assigning a single tom sample ▶
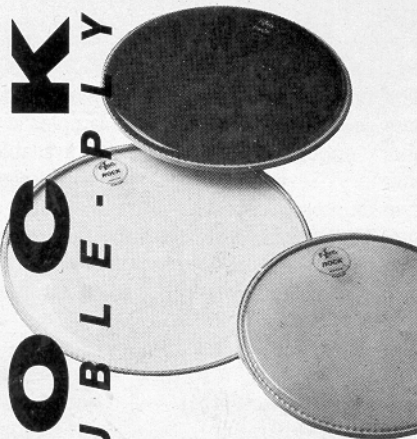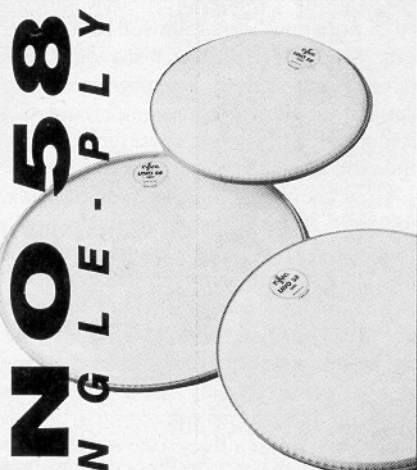
to the range of an octave, for example, will effectively give you twelve toms to play. The sampler you choose should have a painless way of letting you copy samples, erase samples, and even re-assign them if you should later change your mind about the assignments.

How many samples can you assign to a single preset? That depends on the machine. When using a sampler as a percussion sound generator, it's important to pick a machine that doesn't limit you. The unit should let you place a different sample under each note if the samples are short enough to fit within the available memory. Several will even let you assign two or more samples to a single note or a specified range of notes. In short, you want to have a machine that will leave all the doors wide open when assigning samples to presets.

After samples are assigned to the different notes, it's time to set up additional aspects that will control the sampler's operation. Several machines present the user with a full range of analog-style processing. Typical features include an envelope generator in charge of the VCA (voltage controlled amplifier), a set of basic tone controls or filters (hopefully with its own envelope generator), a control to alter the tuning of the sample, a way to control the stereo placement, and a set of controls for real time performance. Real time features will give you the most control over your sound while you are playing. Let's take a quick look at some of the possibilities.
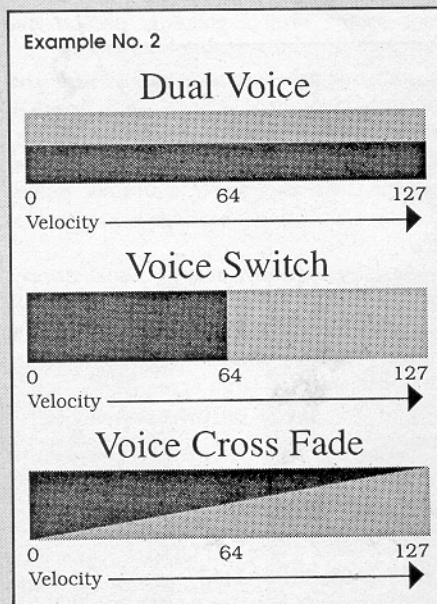
Mapping and MIDI

ONE OF THE MOST flexible controls at your disposal is velocity. When you strike a MIDI drum pad or drum machine, the MIDI note number is followed by a hunk of data which tells the receiving device the velocity of that note. By programming the sampler to interpret the velocity level as something other than dynamics, you can alter the sampled sounds in real time.

How about sending the velocity reading to the attack portion of the VCA amplifier's envelope? Lower velocities would cause the sound to fade in while higher velocity readings would force the sound to begin at its fullest volume. You can map the velocity to the stereo outputs so that softer strokes come out the left side and harder strokes come from the right. Even though these two examples are somewhat basic, think about the possibilities that are available if you map velocity to the sample's pitch, the filter's cutoff frequency, or the attack portion of the filter's envelope. In fact, think about mapping velocity levels to several of these parameters at once!

One of the most popular uses for mapping velocity is to choose between two entirely different samples. As shown in example 2, the sampler will play both samples in normal dual voice mode, no matter what the dynamic. But if your sampler supports this feature, you can perform a velocity voice switch. In other words, one sample will fire when the velocity reading is at 64 or below (the actual velocity should be programmable) and the second sample would fire at any velocity above 64. Or, instead of a voice switch, how about a voice cross fade? As the velocity level increases, one sample fades in while the other fades out. Pretty slick, huh?

Of course, you want to get a machine that has full MIDI implementation (whatever that is). Since MIDI is a growing language, something that has full implementation today may not by next Thursday. Your best bet is to open up the user's manual (I know you thought this would be easy . . .) and check the MIDI implementation chart. Look for a lot of 'X' symbols which mean that the sampler can

Example No. 2

Dual Voice

0   64   127
Velocity ——————→

Voice Switch

0   64   127
Velocity ——————→

Voice Cross Fade

0   64   127
Velocity ——————→

send or respond to certain messages, and very few 'O' symbols (meaning it can't). Pay special attention to the section of the chart called controls.

In the early days of MIDI, controllers were 'hard wired.' In other words, the modulation wheel only sent and received messages as controller number one. Today, the general trend is that all controllers should be assignable to any controller number. If you want the modulation wheel to respond to controller 17, you should be able to get away with it without blowing up the sampler. While it's a little difficult to move wheels while playing drums, it's not too hard to hit footswitches or move pedals. If all the sampler's controllers are assignable, you may be able to program a pedal to control any function.

Another important consideration for drummers is dynamic voice allocation. Let's say that you're firing a cymbal crash sample from one of your drum pads. If you hit the pad twice in quick succession, some samplers will cut off the first sound as it starts the attack of the second. This creates an unnatural 'stuttering' effect. But if the sampler has dynamic allocation, each stroke will play through the entire sample. On the other hand, make sure there is a fixed allocation mode available so that a closed hi-hat sample can cut off an open hi-hat sample, for example. Or a slap bass can cut off a sustained bass sound.

Along with all this technical stuff, there are a few practical things to consider about a potential sampler. We all know that rack mount units are wonderful. Just stick the thing in the rack, throw the covers on, and hit the road. But even if you don't play a keyboard instrument, you may want to consider buying a sampler with a keyboard attached. First of all, you don't really save that much money on the rack mount version. Secondly, if you ever plan to do any melodic sequencing or use a computer to notate music, you'll be glad you own a keyboard. In addition, programming the sampler is much easier from a keyboard (at least you can check to see if your sounds are assigned to the proper note numbers). The bottom line? Spending $250 to $350 extra for the keyboard may save you several hundred dollars if you decide you want one in the future.

In addition to the standard stereo outputs, look for a sampler with individual audio outputs for each voice. In other words, an eight voice sampler should have eight and a sixteen voice machine should have sixteen individual outs. Why do you need so many? If you plan to do any recording, it is to your advantage to send certain sounds to discreet audio channels. If your sampler will let you specify output assignments for each sample or group of samples, then you can add different types and amounts of audio processing to each.

Do you already own a dedicated sequencer, or use your personal computer for software-based sequencing? If you don't currently own any type of MIDI sequencer, then consider samplers that offer one inside the box. Some internal sequencers are quite sophisticated, offering almost all the features that are available in dedicated units.

As you might expect, quality, memory, flexibility, and control aren't free. You get what you pay for and often have to decide between the features you want and the features you can afford. The good news is that excellent samplers can be bought for less money than a high-quality drumset. The drumset is going to give you six drums, the sampler can give you six thousand.

Next month . . . practical applications for using a sampler with your electronic percussion system: How to get a three thousand dollar drum machine for two bucks and other tips and tricks. Don't miss it!   ®