

IC-3d is high or low under quiescent conditions.) The only problem encountered in getting the unit to work was caused by the input trigger pulse being too short. This pulse has to be longer than the time it takes IC-3d to respond to the gate, which seems to be about 0.1 to 0.2 msec.

The final ADSR output is obtained in the usual manner, as a weighted sum of the AD and AR envelopes, buffered by IC-2d.

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### A QUASI-DIGITAL BI-N-TIC FILTER

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The figure on page 15 shows my version of an article\* in a 1974 issue of Electronic Design on a Biquart Filter (not Biquad, but Biquart, twice the order).

By sequentially switching eight 0.047 mfd capacitors across the 356 op-amp, multiple bandpass integrators are formed giving a filtered quantized analog output with multiple passbands (comb filter).

The damping control sets decay times to a pulsed input, and the filter can be made to ring for 2-3 seconds. It is very hard to describe the sound quality of this filter. Due to the very high Q's and  $f_0$ ,  $2f_0$ ,  $3f_0$ , etc. passbands, a very complex dynamically changing output can be obtained. By simply sweeping the clock frequency, at times sounds similar to voices having human features are heard, only to decay into ringing bells.

Anyone wishing to hear this filter or obtain help in building it can reach me at the address above.

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\*Allan Lloyd, "Transform the Biquad into a Biquartic", Electronic Design, Jan. 4, 1974, pg. 120. EDITOR'S NOTES: This paper is mainly concerned with filters of the more standard RC type rather than the switched capacitor type Jan uses. The starting point is the Biquad circuit we call the "state variable". A low-pass to bandpass transformation is achieved by adding inductors in parallel with the capacitors, forming resonators, and transforming zero frequency to this resonant frequency, and reflecting the response on both sides. The remaining task of the paper is to realize the inductors by capacitors and op-amps. Some interesting practical circuits result. The switched capacitor version, which Jan follows, is referred to as a "bi-n-tic" filter, and does not seem to draw much on the main part of the paper, but is rather closely related to other filter techniques of the switched capacitor type or the "commutating" type. It is good to see these filters being used for electronic music. --Bernie

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### DIGITAL KEYBOARD REVISITED:

-by Richard Curcio

I have constructed a digital keyboard similar to the ENS-76 design in EN#68, and have made a few changes in the circuitry which is shown in the schematic diagrams on pages 16 and 17.

Figure 1 (page 16) shows the gate, trigger, and D/A circuitry. The upper part of Fig. 1 is the gate and trigger circuitry. Instead of going to ground, the keyboard

