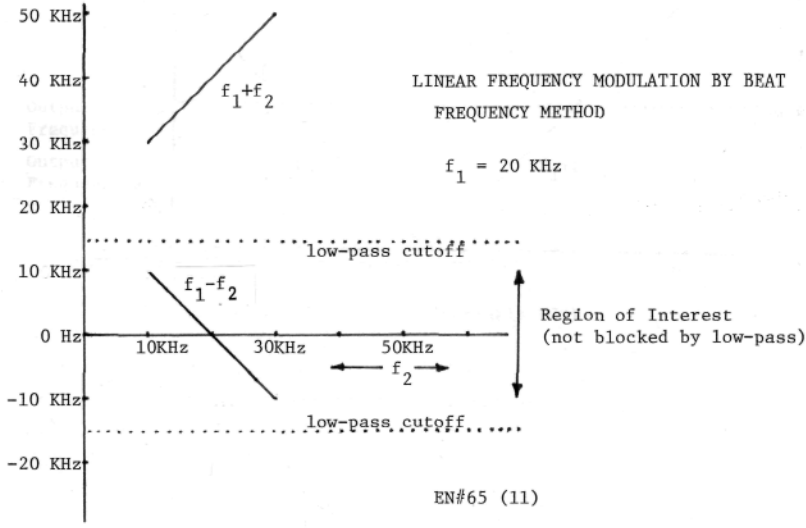
This memory system of groups of memory systems can be used for practically any type of digital storage. Just one system is needed for a rudimentary beginning. In this case, 6 of the eight outputs would be tied to a 5 octave DAC-VCO. One output could be used to define the keyboard gate condition (thereby controlling the ADSR), while the last output could be used to turn a control function on and off. This would require one address location for each beat. A more efficient method would be to use the last two outputs to select one of four time durations (1-2-3-6, 1-2-4-8. etc.) for each note. These two bits also could be used in conjunction with the 4 notes left over from the 5 octave pitch control word to provide up to 16 different code functions. Even without microcomputer control, several of these memory systems used in conjunction with relatively simple output devices can provide the basis for a powerful automated synthesizer system.

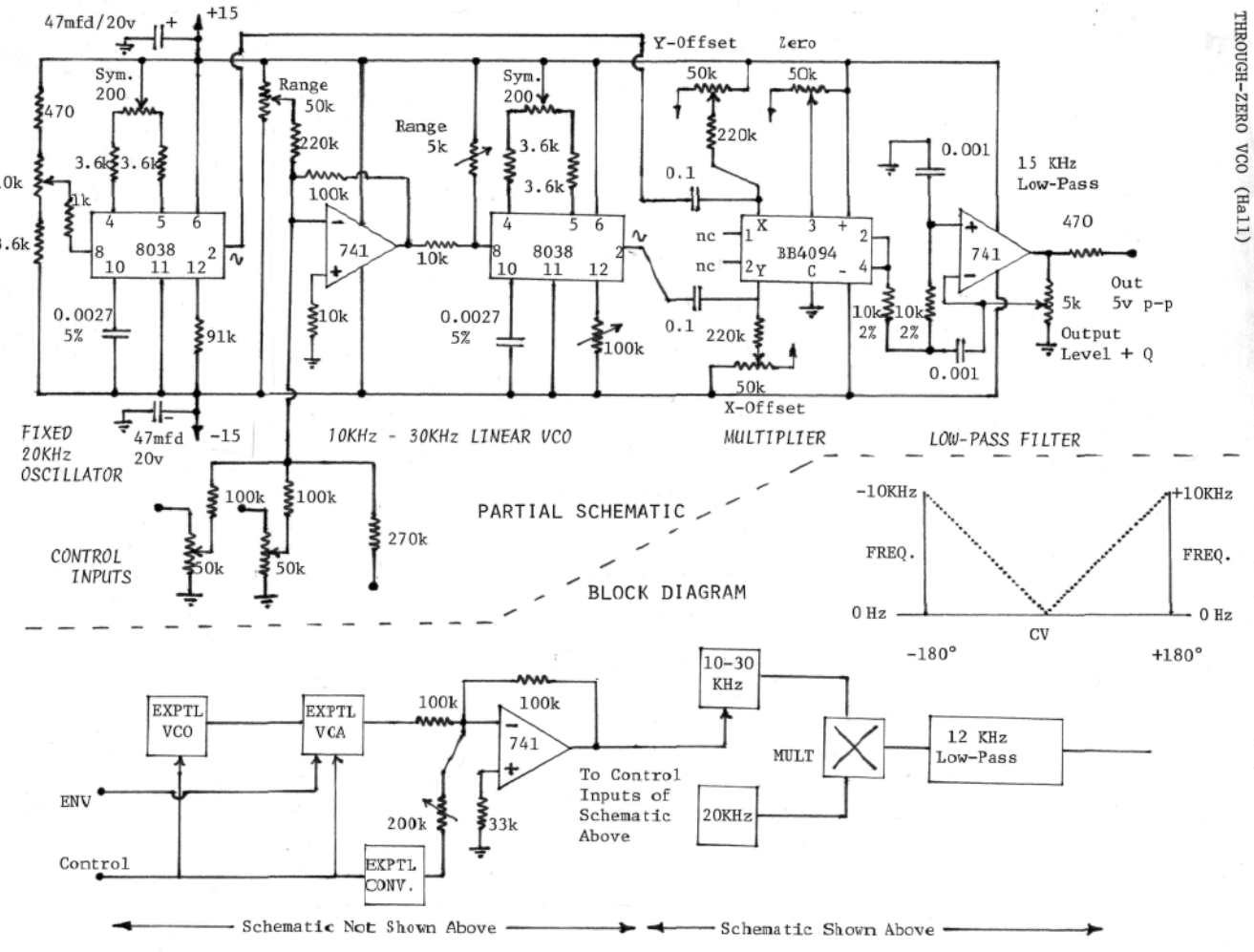
READER'S EQUIPMENT: A ±10 KHz Through-Zero Linear VCO -submitted by Jan Hall

At the Fall 1975 Audio Engineering Society convention, Bob Moog discussed several methods of linear frequency modulation with analog circuitry. We have previously considered various FM methods, and a recent addition with a brief summary of previous work can be found in EN#62, pg. 13. One method that Moog discussed was the "Beat Frequency Method," and it is this basic type of circuit that is used by Jan Hall in the circuit shown on page 12 of this issue. With the beat frequency method, one oscillator is held at a fixed frequency. A second oscillator is voltage-controlled and passes through this fixed frequency. The two signals are multiplied together. A simple trig identity:

$$\mathrm{Sin}(f_1)\cdot\mathrm{Sin}(f_2) = (1/2)[\mathrm{Cos}(f_1-f_2) - \mathrm{Cos}(f_1+f_2)]$$

shows how the sum and difference frequencies appear in the output of the multiplier. This is probably familiar to most readers as the basic equation of a balanced "Ring" modulator. Suppose we make f_1 the fixed frequency, and then add a low-pass filter to the output where the low-pass cutoff frequency is set just a little above half the f_1 frequency, then a through-zero frequency is achieved as can be seen from the diagram below where it is assumed that f_1 = 20 KHz and f_2 can be varied from 10 KHz to 30 KHz.




47mfd/20v
+15
Y-Offset
Zero
Sym.
200
Range
50k
Range
5k
Sym.
200
50k
50k
470
220k
220k
0.001
15 KHz
Low-Pass
10k
3.6k
3.6k
3.6k
3.6k
100k
0.1
1k
4 5 6
8 8038 2
10 11 12
741
10k
nc
nc
X 3 +
1 2
2 Y C - 4
BB4094
470
Out
5v p-p
0.0027
5%
91k
0.0027
5%
100k
0.1
220k
10k
2%
10k
2%
5k
Output
Level + Q
0.001
50k
X-Offset
FIXED
20KHz
OSCILLATOR
47mfd
20v
-15
10KHz - 30KHz LINEAR VCO
MULTIPLIER
LOW-PASS FILTER
100k
100k
270k
CONTROL
INPUTS
50k
50k
PARTIAL SCHEMATIC
BLOCK DIAGRAM
-10KHz
+10KHz
FREQ.
FREQ.
0 Hz
0 Hz
CV
-180°
+180°
EXPTL
VCO
EXPTL
VCA
100k
100k
741
10-30
KHz
MULT
12 KHz
Low-Pass
ENV
Control
200k
33k
To Control
Inputs of
Schematic
Above
20KHz
EXPTL
CONV.
Schematic Not Shown Above
Schematic Shown Above

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The full scheme in which the through-zero VCO is used is shown in the block diagram on page 12 while the schematic in the upper portion of the diagram shows how the circuit is constructed. The first 8038 VCO chip serves as a fixed oscillator at 20 KHz. The second 8038 chip is variable from 10 KHz to 30 KHz. Jan used a Burr-Brown type 4094 for the multiplier, but indicates that any 4-quadrant multiplier could be used. The final op-amp is the basis of the low-pass filter. Jan indicates that the average frequency should not vary by more than about 1 Hz during modulation.

This looks like a fairly simple and reliable circuit, and one which would make it possible for the user to explore the basic types of sounds that can be generated using the linear frequency modulation technique. Jan reports that the circuit dominated the signal sources that were actually being used in the Electronic Music Studio at Hunter College. It seems that the technique yields new sounds that capture the imagination of musicians for extended periods of time.

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RECORD REVIEW:

-by Craig Anderton

Synergy, by Larry Fast (Passport Records PPSD-98009)

When I first heard about Switched-On Bach, I immediately went out and bought a copy...mostly because I was interested in the synthesizer aspects of the disc. But making a value judgement on the music was quite another matter; there certainly were a lot of whiz-bang sounds on there, but the end result was Bach interpretations, not some new kind of music. What's more, I didn't particularly like the interpretations using these new sounds, because they lacked a certain subtlety and warmth that I found in recordings using acoustical instruments. Yet, despite these reservations, I could see that the synthesizer was a marvelous instrument indeed...all I had to do was wait for a breed of musicians who could compose on the synthesizer, not just play on it.

As time went on, the synthesizer stayed pretty much in the hands of players (and almost exclusively keyboard players, at that). As a result, and also due to the quirky success of Switched-On Bach, we ended up with a glut of switched on this and switched on that. This lead to an inevitable dead end; the only successful "switched-on" record recently was Tomita's version of Debussy (and I think that Debussy is much of the reason for the record's success). Apart from the "switched-on" school of synthesizer, there also evolved the "another-keyboard in-the-keyboard-performer's-bag-of-tricks" approach, used mostly in jazz and rock music. In this application, the synthesizer performed two useful functions: it could synthesizer truly weird and/or unique sounds, thus adding a certain newness to any musical ensemble; or it could give a reasonably good imitation of, say, a trumpet for the bands that didn't have trumpet players.

As far as I can see, synthesizers have integrated themselves into the mainstream of music over the years, under the guise of being just another keyboard. That's fine, but where does the strength of synthesis really lie? Surely the synthesizer was destined for more than being a souped up Farfisa combo organ... and the fool thing doesn't even make chords.

All this time, I wondered why synthesizers hadn't clicked with the person it could benefit the most: the composer. Indeed, the synthesizer has the potential to put the composer back in the spotlight that has been trained on performers for the past several decades. Think of the classical era---mostly an era of composers. As the classical tradition broke down, and as single-handed monarchies gave way to multi-handed democracies, musical trends changed. In the early part of this century up to the cold war the spotlight was on band leaders, sort of a cross between the composer's and performer's functions. When rock and roll entered, the focus shifted almost exclusively to the performer (personality?). No one is called a songwriter/singer; it's always singer/songwriter.