

CB REPORT—CIRCUITS TO BUILD—HI-FI TESTS

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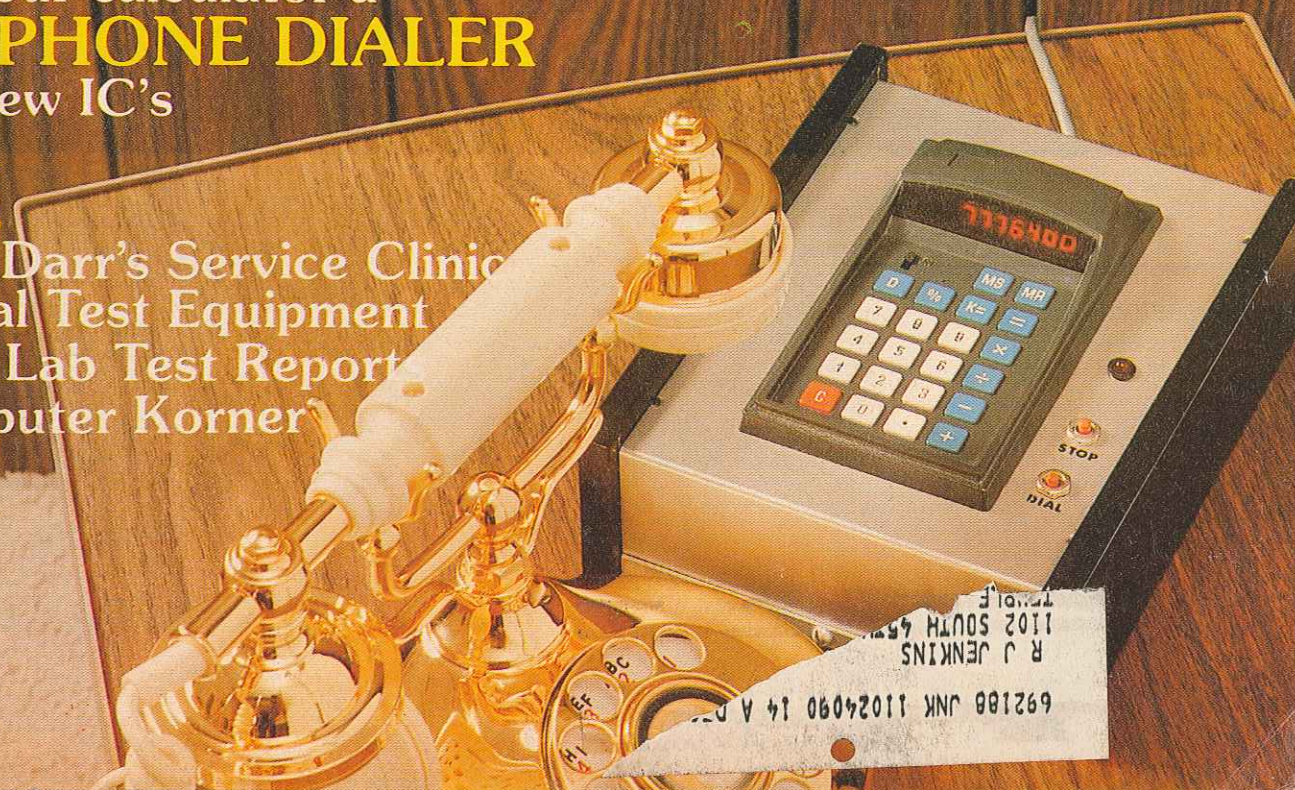
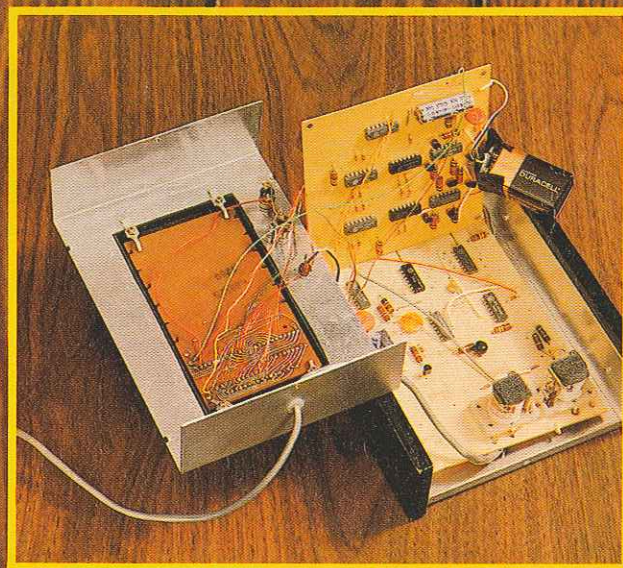
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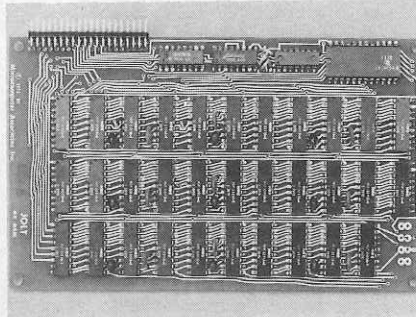


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equipment reports

Jolt 4K RAM Module



CIRCLE 87 ON FREE INFORMATION CARD

I WAS INTRODUCED TO THE EXCITING REALM OF microcomputers and machine language programming through the JOLT CPU board, and I continue to have great respect for the system. For some time, I have been eager to expand the system's memory and get on to bigger and better things. And that is what the 4K RAM board is all about—a nice large chunk of additional programming space.

Packaged onto the 4.25 × 7-inch JOLT board are a total of 36 integrated circuits, of which 32 are the memory devices. The only other components are 18 bypass-capacitors and three jumper wires. Each memory IC is organized as 256 4-bit words. Multiplying 256 by the 32 IC's gives 8192 4-bit words. Converting to the 8-bit word length of the 6502 μ P, the number of words is halved to 4096, or 4K for short.

There are 8 input-address leads to each memory IC to address the 2^8 (256) words, and 4 output lines. The eight least-significant address lines (A0-A8) originating from the CPU card, feed the eight memory-address terminals of all the memory IC's in parallel. CPU address lines A8 through A11 are the inputs for a 74154 4-line to 16-line decoder. Each output from this IC connects to the enable pins on a pair of memory IC's. The four input/output data leads on one of the pair connects to the RAM board data lines D0 through D3, and the other circuit to D4 through D7.

This leaves the upper four address lines A12 through A15. In the JOLT scheme of

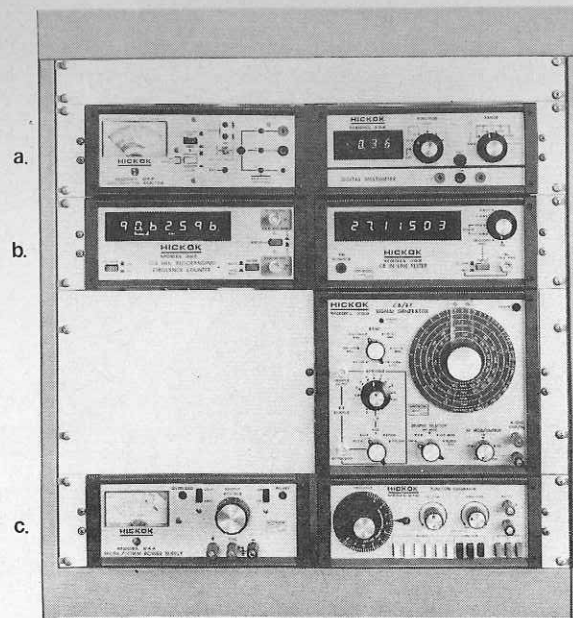
things, one-half the total memory space has been reserved for user RAM and the other half for inputs, outputs and other peripheral functions such as the interval timer on the MOS Technology 6530 IC. The A14 input is permanently wired to the chip-enable pins of all the 32 memory circuits, which blocks off two 16K blocks from 4000_{16} to $7FFF_{16}$ and $C000_{16}$ to $FFFF_{16}$.

Address lines A12, A13, and A15 or their complements are connected to assign the 4K board to a segment of the remaining 32K memory space. Two gates of a 7400 quad 2-input NAND gate are wired as a three-input gate that connects to the two enable pins of the 4-to-16 line decoder. As an example, when A12, A13 and A15 are all complemented, and since A14 is permanently complemented, the most significant hex address digit of 0 would enable the decoder and the memory will respond to addressing from 0000 to 0FFF.

The basic CPU board comes with 512 words of RAM assigned to 0000 to 01FF, if the 4K board is assigned 0000 to 0FFF, the

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EQUIPMENT REPORTS

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first 512 words would overlap the CPU memory space and the memory on the CPU board would have to be removed. Microcomputer Associates recommends that additional memory space be filled starting at 1000. That makes good sense and that is precisely where I wired it by inverting A15 and A13, while using the noninverted A12 lead. Two CMOS circuits (a 4050 non-inverting hex-buffer and a 4049 inverting hex-buffer) buffer these high-order address lines as well as A8 through A11.

Don't get worried by all this; the documentation is excellent and there is a simple chart

telling where to connect the three jumpers for all possible memory space allocations.

Also interconnecting the CPU and RAM boards are the eight D0 through D7 data leads and the RW (read-write) and WRITE signals. The data lines are bi-directional for both reading and writing data. RW is wired to the 32 output-disable pins in parallel. When the signal is at a logical 1—a read condition—the data lines become high-impedance inputs. The R/W memory IC pins connect to the CPU WRITE lead; when it is low the memory is in its write state. Only the pair of memory IC's selected to write at any time will present a low drive impedance to the data lines.

Construction of this board calls for the same care as all computer boards. The right

tools are a must and should include a first-class soldering iron and a magnifying glass.

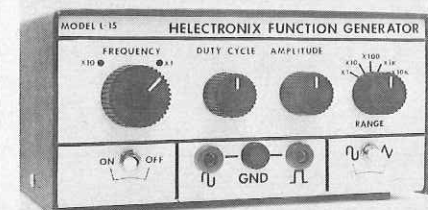
The 4K memory board can be stacked with the CPU, PIA, power supply, and future options using connectors for the address, data, and control lines, or with simple wire loops.

Typical current drain is 1-amp from a single 5-volt power supply. And typical boards do exist since our sample took just about 1 amp. The maximum current drain is 1.9 amps. You must evaluate your power-supply situation and may have to beef up its capacity. The standard JOLT supply will support a CPU, 4K RAM, and an I/O card.

Just what does 4K of memory do for you? A mathematical operating system easily fits. I have just finished writing a floating point package that uses a little more than 1K of memory.

The JOLT 4K RAM card sells for \$199 in kit form and \$249 assembled. It is available from Microcomputer Associates, 2589 Scott Boulevard, Santa Clara, CA 95050. Also available are cards for the Intel 8080A and the Motorola 6800. The Signetics 2650 system is on the drawing board. **R-E**

Helectronix L-15 Pulse-Sweep Function Generator



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THE FUNCTION GENERATOR IS RAPIDLY REPLACING the audio-signal generator on the service bench. It is actually an audio-signal generator, but much more versatile and covers a wider range of frequencies and waveforms. With modern IC's, it can do many tricks not before possible. A good example of this is the model L-15 Pulse-Sweep Function Generator made by Helectronix, 8100 St. Clair Av., North Hollywood, CA 91605.

This is an extremely compact little instrument, only 6 x 2 x 4 inches (16 x 8 x 10 cm.) It has all of the standard function generator outputs—sine, square and triangle waveforms. We've used squarewaves for audio testing for quite a while and they're still good. You'd be surprised, though, at how handy a triangle wave really is! It will show up any tendency of the equipment to clip (when the wave form peaks flatten). Any other kind of distortion will show up as a curvature of the straight (sloping) sections of the waveform.

The frequency coverage of the L-15 is wide—from 1 Hz to 100 kHz in 5 switched ranges. A variable control calibrated from x1 to x10 is also provided for fine-tuning the frequency, if needed. An AMPLITUDE control sets the output level of the sine and triangle waveforms. The waveforms can be selected by a switch. The squarewave has its own output jack on the front panel. All outputs have an impedance of 600-ohms and are short-circuit proof.

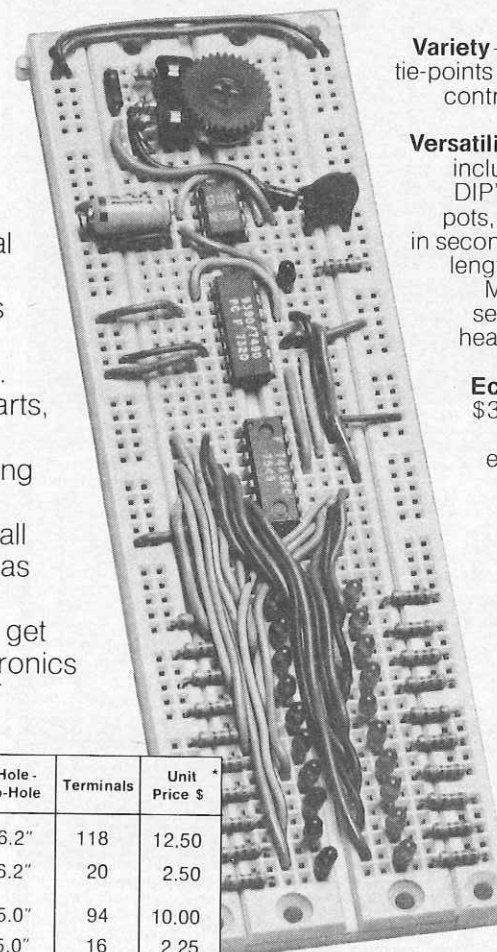
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4.1"	4.1"	3.8"	12	2.00					
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EQUIPMENT REPORTS

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The squarewave output of the L-15 is fixed-amplitude (4.5-volts minimum) and TTL compatible. The risetime and falltime are 1.0 microsecond. Beside this, a DUTY CYCLE control can be used to give pulses of either polarity, from a 5% to 98% duty-cycle. (This controls the pulse-width. In tests on a scope, we found that we could make stable pulses that were very close to only 1.0 microsecond wide!)

You can also use one of my pet quick-check tests, an audio-frequency sweep with the L-15. All you have to do is apply a variable voltage to a jack that is provided on the back panel. The voltage-controlled oscillator will give sweep ranges from 100:1 to 1000:1. Sweep width depends on the amplitude of the applied voltage, which can be from 0.5 volt to 10 volts maximum. Excessive sweep voltage will make the output clip, so watch it!

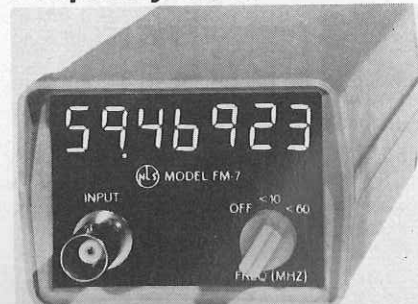
The design looks simple. It is built around the Intersil 8038 VCO IC. Its sinewave and triangle wave outputs are fed into a high slew-rate op-amp for buffering. This op-amp also provides a short-proof output with a low impedance. The TTL squarewave is derived from the triangle wave and fed into another op-amp. The other input of this op-amp is pulse-width modulated between the + and - voltage supplies. This lets you get either a logic "1" or "0" by adjusting the duty-cycle control either fully clockwise or counter clockwise. Because all signals have a common source, the VCO, all of them can be swept if the need arises.

The sinewave output can be varied from 0 to 20 volts P-P, at a distortion of 0.5% typical. The triangle wave's amplitude varies over the same range, and its nonlinearity is 2% maximum.

The L-15 sells for \$75.00 fully assembled and tested. You can also get it in kit form for \$55.00 plus \$2.00 for postage and insurance. The PC board, a complete schematic and parts list can be had for \$10.00. A wide range of choices!

This is a versatile little instrument and one that you'll be seeing on more and more service benches pretty soon. It can be used for a great many tests on all kinds of home entertainment electronics and for testing digital circuitry, which is going to be showing up in our shops pretty soon. R-E

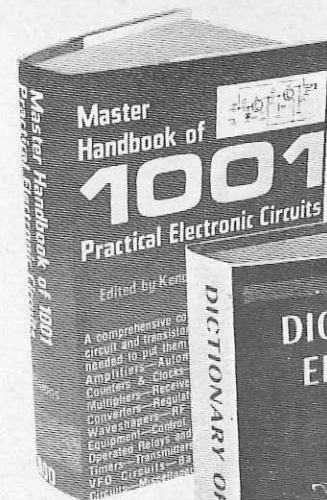
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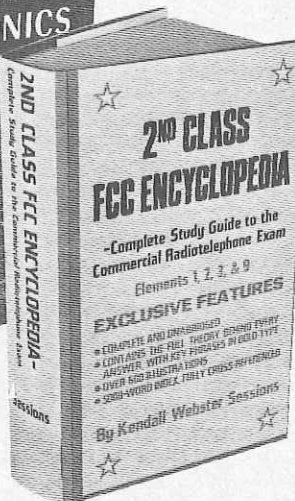
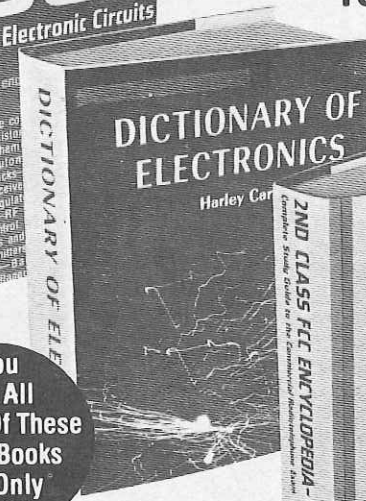
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