

## EQUIPMENT REPORTS

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you a direct readout of the percentage of 3rd harmonic distortion in the receiver audio stage.

This is important in two ways. Practically all of these transceivers use the receiver audio stages for the modulators. This test can be very helpful in finding the cause of distortion in the transmitted signal. For example, if you read the normal 4 watts of RF power, unmodulated, but the audio stages show a maximum output of only 2 watts audio, you will not have enough audio power to produce full modulation. This will cause a clear but weak signal. The reverse is also true. If

you read only 2 watts RF and 4 watts audio, the transmitter is being overmodulated and will garble.

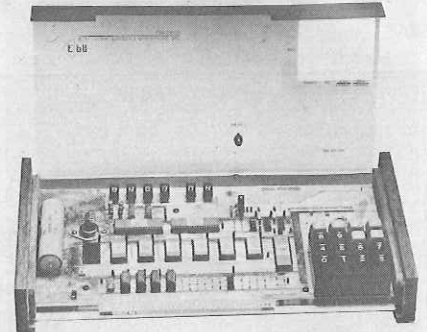
To check for sensitivity, an RF signal generator can be connected to the BNC RF GENERATOR jack on the back panel. It will feed directly into the receiver antenna. You can check for calibration and RF sensitivity if the signal generator has a calibrated RF attenuator.

The third BNC jack on the back panel can be connected to a frequency counter. Just push the mike button and read the channel frequency directly.

This is a very complete "package" for servicing of CB radios, either on the bench, car, boat, mobile home or what have you. With only a few other test instruments, usually already on the bench,

you can get into the CB radio service business in a big way for not too much money. While checking the prototype out, we had a chance to make direct comparisons with some far more expensive types of equipment, and found that the accuracy of the 1040 compared very well with these! **R-E**

## EPA Micro-68 Computer



Circle 120 on reader service card

ELECTRONIC PRODUCT ASSOCIATES' ANSWER to microcomputer fever is a self-contained system complete with power supply and a wood and smoked plastic 9 x 12 x 2 inch (229 x 305 x 51 mm) case. Plug it in and you're ready to start programming.

The Micro 68 is built around the Motorola M6800 microprocessor. It has a six-digit seven-segment display and a 16-key hexadecimal-input keyboard. The display is seven-segment, not a true hexadecimal format, so B and D are indicated by lower case representations using the seven segments. The decimal point is lit when "b" is displayed to help distinguish it from a "6."

The system is controlled by the John-Bug PROM monitor, one of the most sophisticated of the keyboard-display kind. In its basic form, the kit is intended as a learning tool or prototyping system for engineers, scientists, and laymen.

The monitor system is contained on four 1K bit PROM's for a total of 4K bits or 512 8-bit words of firmware. The lettered keys on the input keyboard double as control keys for the system. Keys A through F have been assigned the functions AUTO, BACK, CHANGE, DO, EXAMINE, and FORWARD.

To get started, press the one remaining button, the RESET button, and the display lights up with EPA uP . . . very cute. Pressing EXAMINE lights up dashes in the four leftmost places. Punching in an address puts the address in the first four digits and the two remaining digits, which are slightly separated from the rest, light up with the contents of that memory location in hexadecimal. The FORWARD key increments the address one location each time the button is depressed. BACK is an unusual feature not found in most similar systems. It decrements the address and displays memory contents. It is particularly convenient to have the address displayed simultaneously so you don't have to worry about losing your place or getting confused when sequential memory locations are loaded with the same instruction or data.

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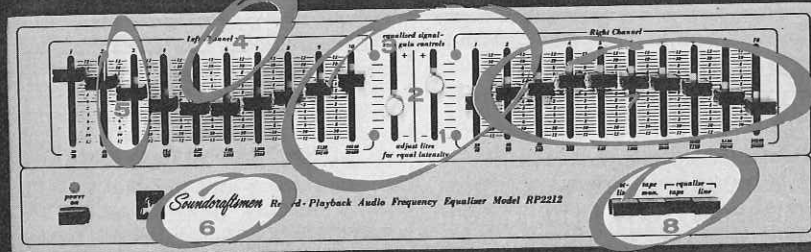
# Soundcraftsmen THE EQUALIZATION LEADER...

**WHY? Because we CARE about HOW an equalizer does its job BEST!**  
That's why we provide our customers with our exclusive...

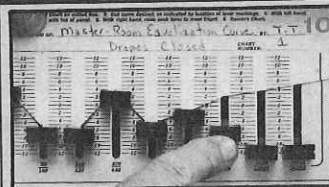
### 10-POINT "TOTAL-SYSTEM EQUALIZATION"

**YOU NEED MORE THAN JUST AN EQUALIZER . . . FOR OPTIMUM EQUALIZATION BENEFITS, HERE ARE THE TEN ESSENTIAL ELEMENTS YOU NEED:**

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- 2. YOU NEED FULL-SPECTRUM BOOST OR CUT CONTROLLABILITY:** SOUNDCRAFTSMEN'S "zero-gain" circuit provides an additional 18 dB control-range over the full spectrum 20 to 20,480 Hz on each channel for instantaneous input-output zero-distortion signal matching. . .
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- 4. YOU NEED A POSITIVE METHOD OF READING 1 dB SETTINGS. . .**
- 5. YOU NEED AT LEAST 24 dB TOTAL CONTROL OF EACH OCTAVE . . .**
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**9. YOU NEED AN ACCURATE, EASY-TO-USE INSTRUCTIONAL TEST RECORDING FOR ENVIRONMENTAL EQUALIZATION:** SOUNDCRAFTSMEN includes Test Record recorded and designed exclusively for SOUNDCRAFTSMEN equalizers. Without any expensive test equipment or technical knowledge, you can quickly tune the acoustics of your room, just by following the announcer's step-by-step directions.



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**PE2217 inc. Cabinet or Rack Mounts \$499.50**

### GUARANTEED SPECIFICATIONS

FREQUENCY RESPONSE: ±0.5 dB 20-20,480Hz  
THD: Less than 1% @ 2 v., Typ. 0.5% @ 1 v.  
S/N RATIO: Better than 105 dB @ full output.  
Better than 96 dB @ 2 v. RMS  
FILTER TYPE: Toroidal and Ferrite-core.  
INDIVIDUAL OCTAVE-CONTROL RANGE: Minimum ±12 dB (Typ. ±14 dB), each octave centered at 30, 60, 120, 240, 480, 960, 1920, 3840, 7680, and 15,360Hz.

**RP2212 . . . . . \$349.50**  
(Includes Cabinet or Rack Mounts)

**20-12A . . . . . \$299.50**

(Same as 2212, except no LED's and Tape Eq thru rear panel patching)

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THE "WHYS AND HOW'S OF EQUALIZATION."

an easy to understand explanation of the relationship of acoustics to your environment. This 6 page booklet also contains many unique ideas on "How the Soundcraftsmen Equalizer can measurably enhance your listening pleasures." "How typical room problems are eliminated by Equalization," and a "10-point self-rated Equalization Evaluation Check-List," plus Specs and Reviews.

## EQUIPMENT REPORTS

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To load a program or alter something at a particular address, first get to that address using the E, F, and B keys and then press CHANGE. The rightmost display digits

are extinguished and become loaded with the new data that is keyed in. Another unusual feature is the A key that automatically enters the data, increments the address and awaits the next entry. By using the AUTO function, you can quickly enter a program by continuously keying in the instructions in hexadecimal without the

nuisance of hitting any additional keys. If you hit a wrong key or make a mistake, you can immediately correct it by pressing RESET and using the other functions to backtrack, or you can continue on and go back later. It is probably wise to examine the program when you are finished entering it and make the corrections then.

TABLE 1—COUNT SIX PROGRAM

0000 DE LDX THREE	001B 48	0036 DE LDX THREE
0001 45	001C 84 ANDA OF	0037 45
0002 4F CLRA	001D OF	ADD 0038 A6 LDAA NBR,x
ZRONBR 0003 A7 STAA NBR,x	001E BD JSR LDDSPY	0039 48
0004 48	001F F1	003A A9 ADCA INCR,x
0005 09 DEX	0020 A5	003B 4B
0006 26 BNE ZRONBR	0021 DE LDX STORE	003C 19 DAA
0007 FB	0022 47	003D A7 STAA NBR,x
NXTCNT 0008 BD JSR CLRDSY	0023 08 INX	003E 48
0009 F1	0024 9C CPX FOUR	003F 09 DEX
000A BA	0025 4F	0040 26 BNE ADD
000B DE LDX ONE	0026 26 BNE LDTWO	0041 F6
000C 4D	0027 E5	0042 7E JMP NXTCNT
LDTWO 000D A6 LDAA, NBR,x	0028 CE LDX 15	0043 00
000E 48	0029 00	0044 08
000F 44 LSRA	LOOP 002A 15	THREE 0045 00
0010 44 LSRA	002B DF STX STORE	0046 03
0011 44 LSRA	002C 47	STORE 0047 00
0012 44 LSRA	002D BD JSR DSPLY	0048 00
0013 DF STX STORE	002E F1	NBR+1 0049 00
0014 47	002F C7	004A 00
0015 BD JSR LDDSPY	0030 DE LDX STORE	004B 00
0016 F1	0031 47	INCR+1 004C 00
0017 A5	0032 09 DEX	ONE 004D 00
0018 DE LDX STORE	0033 26 BNE LOOP	004E 01
0019 47	0034 F6	FOUR 004F 00
001A A6 LDAA NBR,x	0035 0C CLC	0050 04

# Money Generator

PAT. PEND.

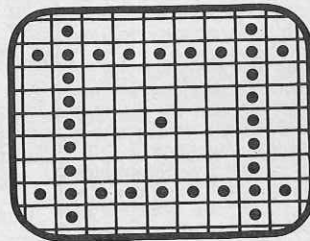


## ATC-10 COLOR BAR PATTERN GENERATOR

- Extra wide range RF/IF attenuator for testing receiver sensitivity.
- GRAY QUAD pattern for gray scale tracking checks/adjustments.
- COLOR BARS pattern with 6th bar marked to make your job easier.
- 3.58 MONITOR pattern for oscillator frequency checks with no need to short the AFPC test point.
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- 2 year factory warranty.
- 30 day money back guarantee.

# Versatile

Next time you're repeatedly switching static and dynamic convergence patterns, think how much easier the composite HATCH-DOTS pattern below would make your job. It can also perform size, linearity, pincushion and centering checks. It's only one of several unique patterns produced by the ATC-10 that can save you time, trouble and most important - money. We'd love to show you how. Write us



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When the program is entered and ready to go, press D and "do" lights up in the rightmost two digits. Entering the starting address starts the program as soon as the last key is released.

One more feature is the shared function of the "8" key. Next to it is printed RTI (Return To Interrupt). It is very useful for debugging programs by inserting software interrupt instruction—in your program. Each time the program encounters the instruction, the system is interrupted. The monitor dumps the MPU registers into assigned memory locations that can then be examined as well as any other memory locations. Depressing the RTI key will resume the program from where it left off or from a new condition set up by the programmer. If there is a loop in the program, it is possible to circle the loop each time the button is pressed and recheck the system status each time around.

As with most ROM or PROM monitor systems, the subroutines in the monitor can be used by the programmer. This is particularly helpful in using the display. The Micro 68 display is multiplexed (the segment lines to the six digits are all in parallel.) The software and the monitor program is used to scan the display. One assigned memory location is used as a digit mask. Setting one of the bits to a logic 1 enables a corresponding display digit. Another memory slot is loaded with the character pattern to be displayed.

I have some suggestions for the programmer, particularly the beginner, when approaching this system. Make a numeri-

(continued on page 30)

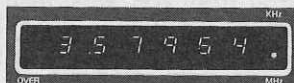


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- Automatic ranging, 20 Hz to 40 MHz is guaranteed...readout to 60 MHz is typical
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Circle 15 on reader service card

## EQUIPMENT REPORTS

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cally increasing listing of all the M6800 instructions so you can quickly analyze a program and then using the monitor, display its own contents in locations F000 through FFFF. EPA does not include a monitor listing and it will be useful to get an insight into programming techniques and to really understand what is happening when you use the subroutines in the monitor PROM.

Two Motorola/AMI 6820 Peripheral Interface Adapters are wired into the Micro 68 and are used to scan the keyboard and operate the display. The keyboard input port is wired in parallel to 16 connector pins and are also hooked to pull-up resistors. I haven't tried it, but these can probably be used as external device control outputs or inputs by the user.

If you get serious about this microcomputer, take a good look at my COUNT SIX program listing in Table 1.

The program starts with zeros displayed in all six display digits and then increments the count in steps of 1. The count is stored in the three memory locations starting at 0049, 004A, and 004B. The first eight instructions in the program are a loop that is traversed three times to load these three memory locations with their initial zero values. The bulk of the remaining instructions read these numbers out on the display. The three words consist of two digits each.

The display is set up to begin scanning from the left by the CLRDSPLY subroutine. The next loop is used three times, once for each 2-digit word. Each time around the loop displays two digits. First the left four bits of the memory word are shifted right and entered into the digit-display memory words by the LDDSPY routine. Then the same number word is recalled and the right four-bits are stored in the next memory word.

Once this procedure is complete, the actual display takes place in the next loop. The initial setting of the x register to 15 in the program determines the number of times around the loop and the rate of the display count. DSPLY does the actual scan of the six digits and includes a loop of its own, so there is a multiplication effect in the time it takes to finish this part of the program.

Finally the last part of the program increments the number by one. It is a multi-word addition that adds the 00 00 01 increment in locations 4C, 4D, and 4E.

I'm sure there are some tricks that can be pulled to shorten this program somewhat, but the display system demands some intricate programming.

As you can see, quite a few steps are taken to perform this simple exercise so the standard memory of 128 words does not go very far. Additional memory will probably be an early consideration.

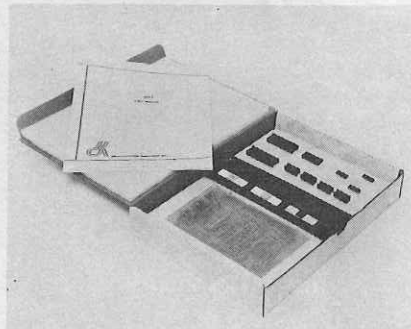
The Micro 68 documentation includes the *Motorola M6800 Systems Reference and Data Sheets Manual* and the *Micro 68 User's Manual*. Edge connectors are provided for memory expansion up to 64K words.

This system is not available as a kit.

The price of the fully assembled system is \$430. A maximum of 768 words of RAM can be contained on the main circuit board and goes for \$5.50 per 128 words. When you are ready for a data terminal, the Motorola MIK-BUG TTY monitor can be purchased for \$28.50. You will also need the \$40 TTY/RS-232C adapter in that case. An optional 8K static memory board sells for \$270.

Descriptive literature is available from Electronic Product Associates, Inc., 1157 Vega Street, San Diego, CA 92110. R-E

## Microcomputer Associates JOLT Microcomputer



Circle 89 on reader service card

JOLT IS AN IMPRESSIVE MICROCOMPUTER designed for the serious application engineer and yet is a viable learning tool for the beginner. A fully equipped JOLT system can have as much as 32K of RAM and 128 bidirectional input/output lines. JOLT is a modular series of 4.25 x 7 inch (108 x 178 mm) PC boards that can be vertically stacked.

The minimum system configuration consists of a single \$159 CPU board. Microcomputer Associates has taken the MOS Technology NMOS MCS6502  $\mu$ P and surrounded it with a powerful complement of 12 other IC's. The JOLT CPU comes equipped with an R-C timing network that runs the on-the-chip clock oscillator at 750 kHz. A crystal can be mounted on the board for applications that call for that kind of accuracy.

Power up the CPU with a 5-volt supply and hook it to a video or printing terminal, and you have a highly usable system. It is one of the most sensible approaches I have seen so far.

How can a single small uncrowded board do such a superb job? By a rational balance between hardware and firmware. The JOLT CPU takes advantage of the family of 6500 devices. The MCS6530 Interface/Memory chip contains many of the vital system components. Some of its input/output pins are dedicated to the terminal, high-speed tape reader and other system functions, but there are still ten left over for user control. The mask programmed DEMON monitor is located in 1024 words of memory on this same chip. DEMON is allocated the top 1K of the first 32K of memory from 7000 to 73FF. It decodes the serial input from the terminal and controls the entire system operation with a minimum of added switches. . . . no control panel is needed.

Sixty-four words of RAM used as in (continued on page 66)



