demodulator converts the mark and space signals to on/off currents which mechanically activate the right keys on the printer.

Receiver requirements

Regardless of the decoding system you choose, a good receiving station is essential for utility DX'ing. Since most of the stations broadcasting CW and RTTY are at much lower powers than the shortwave broadcasters, your receiver needs to be as sensitive as possible, with the best possible antenna. Many transmitters operate at power levels much like ham radio rigs (around 1000 watts), so you will want to be sure you can hear the weak ones from afar. You may only need to add a preselector or tuned preamplifier to your existing receiver to make it "hot" enough to pull in the exciting DX.

To receive CW and RTTY, your receiver will also need a BFO (*B*eat *F*requency *O*scillator), which gives the carrier signal a tone you can hear. Tuning across the bands without a BFO, you may think that you don't need it because you can hear audible tones. What you are hearing, however, are tones beating against adjacent signals—total gibberish to the input of a decoder. The BFO provides a constant signal to beat against the desired signal, ensuring stable tone-generation.

Most important of all is the stability of the receiver and BFO. The tones generated by the received signal must be tuned to within a small range of audio frequencies for the decoders to "hear" them. The decoders have that narrow passband built into their input circuits to help reject adjacent signal interference, allowing only the desired signal to pass through to the decoding sections. An unstable receiver will require constant retuning to keep the tones in the passband of the decoder, causing gaps in the copy and considerable inconvenience.

Lastly, a digital frequency readout is strongly recommended. You will probably want to keep a logbook with a listing of frequencies, times, dates, information content, and types of stations heard. You may also want to recheck several stations periodically to see what they are transmitting on a given day. A digital readout will let you retune to the exact spot where you first heard the station, thus saving time in searching around for the one you want to hear. And, like listening to public-service stations on a VHF/UHF scanner, many stations transmit intermittently, so you will want to be sure you're on the exact frequency when their signal comes on the air.

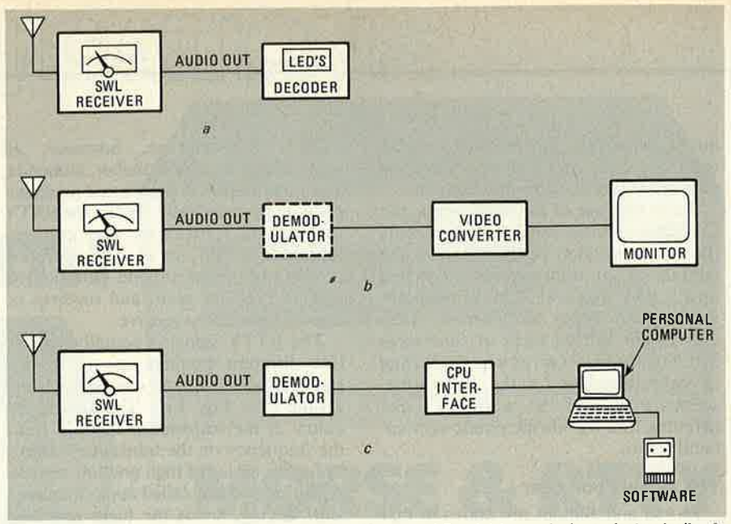


FIG. 2—THREE common systems for decoding Morse and Baudot transmissions electronically. A demodulator or terminal unit is often required in system *b*.

Decoding systems

The three basic choices in decoding systems are a dedicated CW and/or RTTY unit with built-in LED display, a dedicated decoder with video output, and personal computer peripherals. Most systems have ASCII code capability. Though that seven-bit code is the common language of computers, very little of it appears over the air. Hams have recently been authorized to use ASCII, so expect some signals to show up on the amateur bands.

THE INFO-TECH model M200-F video converter does not require a terminal unit.

The dedicated CW and/or RTTY unit with built-in display is the most compact, coming usually in a convenient desk-top size. It is also the simplest system to set up, requiring only a connection from the audio output of the receiver to the unit, and one from the unit to the nearest wall socket (See Fig. 2-a).

With the help of a tuning indicator on the unit, you carefully tune the receiver so the desired signal falls within the passband of the decoder. On CW, that means getting the indicator to flicker in step with the incoming signal. For RTTY, a two-light indicator is preferred with one light each for the mark and space frequencies. They will flicker alternately, as the received signal shifts in frequency. If the shift (narrow, medium, wide) is unknown, you can use the indicators to help you select the correct one as both LED's will flicker only when the demodulator is on the right shift.

From there, you try the different combinations of speed (usually 60, 66, or 100 wpm) and normal or reverse shift until intelligible copy appears on the alphanumeric LED display. At first, the 100-wpm speed seems to race by almost too quickly to read, but with a little practice, it is easily mastered.

Microcraft Corporation offers a low-cost model for CW, the *Morse-A-Word II,* and for Baudot, the *RTTY Reader.* Both are available factory assembled or in kit form. Kantronics combines both RTTY and CW decoders in its *Field Day II* reader, which also comes in a

continued on page 98

TABLE 1

FREQUENCY	SERVICE
7000 - 7150 kHz	Amateur Radio
7300 - 8200 kHz	Fixed Service
8200 - 8800 kHz	Maritime Mobile
10,100 - 11,175 kHz	Fixed Service
12,000 - 12,330 kHz	Fixed Service
12,330 - 13,200 kHz	Maritime Mobile
13,360 - 14,000 kHz	Fixed Service
14,000 - 14,100 kHz	Amateur Radio
14,080 kHz	Ham RTTY calling frequency
14,350 - 14,990 kHz	Fixed Service
15,450 - 16,460 kHz	Fixed Service

BUILD THIS

UNICORN-1 ROBOT

Part 9—This installment of the Unicorn-1 series finishes equipping the robot for remote-control operation with tone-encoder, tone-decoder and latch boards.

JAMES A. GUPTON, JR.

TO COMPLETE CONVERTING YOUR ROBOT to radio control, using the method outlined previously, three more circuits have to be added. They are: a *Touch-Tone encoder board,* a *decoder board,* and a *latch board.* Those, together with the boards constructed earlier, will allow the robot to be controlled remotely.

Encoder board

The *Touch-Tone* encoder board is designed for use with a 16-key *Touch-Tone* keypad. In addition to the numbers zero through nine and the "#" and "*" signs, that pad also has keys labeled "A" through "D."

The keys are arranged in an array of four rows by four columns. Each row and column has a particular tone frequency assigned to it, as shown in Table 1. Pressing any key causes a unique tone pair to be generated. Those tone pairs are generated by the encoder board, whose schematic is shown in Fig. 72.

The encoder IC, a 7206JPE, is designed to take a "row" input and a "column" input and to output the appropriate tone pair, deriving those tones by dividing down the output of a 3.579545-MHz TV color-burst crystal. The tone pair appears at pin 15 of the IC.

An LED is included in the circuit to indicate visually that tones are being generated. Similarly, Q1, a medium-gain NPN transistor, can be used to drive a speaker so the tones can be heard. The speaker can be eliminated if desired, or, as shown in the schematic, you can insert a resistor in the circuit to reduce the volume of the audio output.

The signal fed to the FM transmitter described in the previous part of this series is taken from the base of Q1. A dropping resistor (whose value may range from several hundred kilohms to several megohms) may be necessary between this point and the transmitter input to avoid overdriving the transmitter.

A 9-volt battery operates the encoder very nicely. If the encoder and transmitter are packaged together, use a separate battery for each one.

The foil pattern for the small, single-sided, encoder board is in Fig. 73. Component placement is in Fig. 74.

TABLE 1

ROW	1	697 Hz
"	2	770 Hz
"	3	852 Hz
"	4	941 Hz
COLUMN	1	1209 Hz
"	2	1336 Hz
"	3	1477 Hz
"	4	1633 Hz

Decoder board

The transmitted tones are picked up at the robot-end of the radio link by a standard portable FM receiver. It can be mounted inside the robot's body with a whip antenna mounted externally.

Output to drive the decoder board can be taken from the radio's earphone jack or, if you want the tones to be heard coming from the robot, from the speaker terminals. The audio can also be fed to the robot's on-board amplifier. Again, a dropping resistor may be required.

Figure 75 is the schematic of the decoder. The tone pair is fed to resistor R9, the level control, and from there to eight 567 PLL tone-decoders. Each 567 is set to respond to one of the eight tones that can be produced by the encoder board. Each tone pair causes the output lines (pin 8) of *two* of the 567's—one for each of the two tones—to go to a logic-low state.

Those outputs are NOR'd by IC9 through IC12, producing a logic-high at the IC output-pin corresponding to the key pressed.

Because of its complexity, that circuit is designed around a double-sided PC board. Figure 76 shows the "foil" side of the pattern, while Fig. 77 shows the pattern for the "component" side of the board. (For those who do not have the facilities to make double-sided boards, sources have been provided—see the note at the end of the parts list.) Parts placement is shown in Fig. 78 and an assembled board in Fig. 79.

The board requires a well-regulated

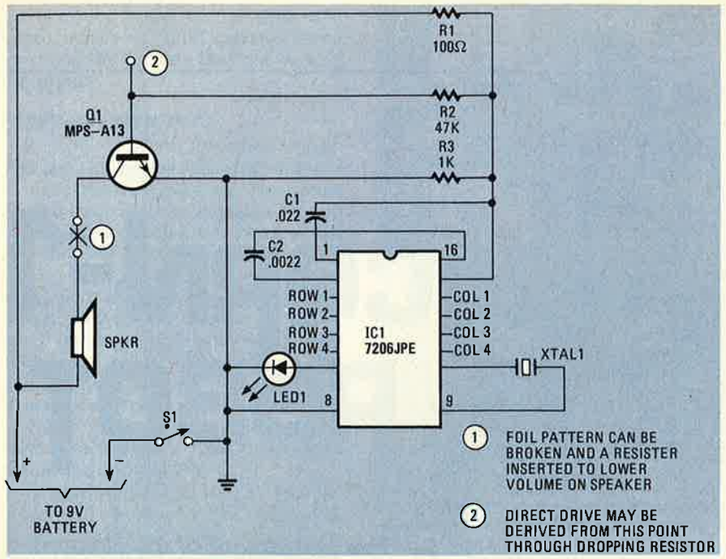


FIG. 72—HEART OF THE *Touch-Tone* encoder is the ICM7206JPE IC that converts "row" and "column" inputs into tone pairs. Speaker shown is optional.

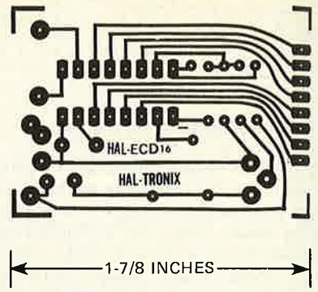


FIG. 73—ACTUAL-SIZE PC board foil pattern for *Touch-Tone* encoder. Eight pads at right are for connection to keypad.

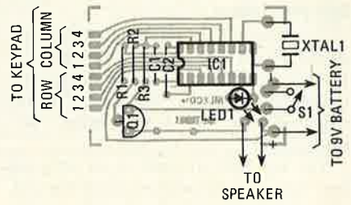
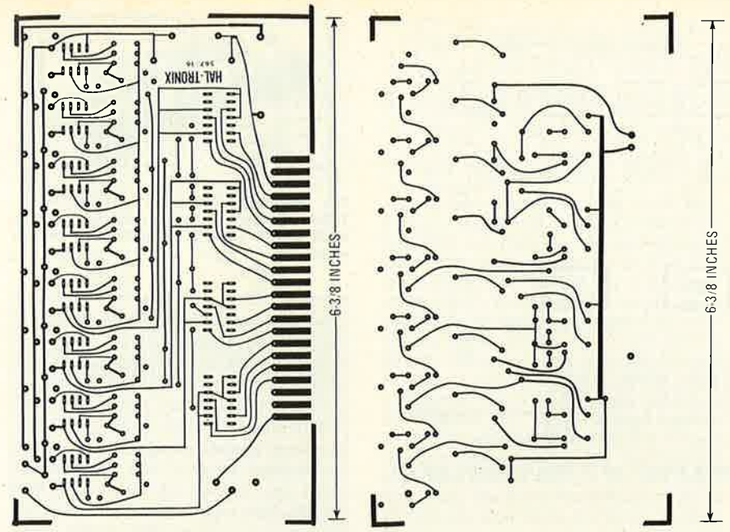


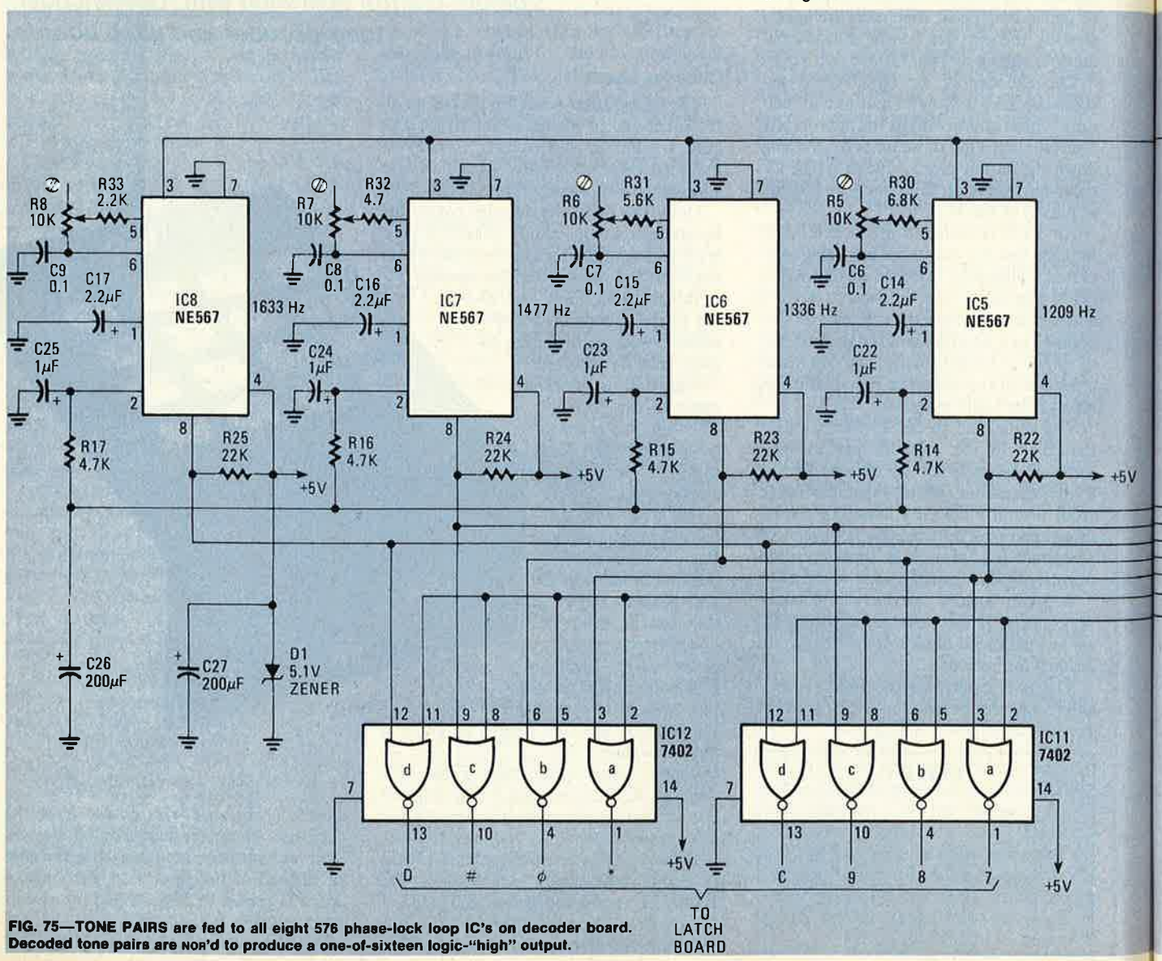
FIG. 74—WHEN CONNECTING encoder board to FM transmitter, make sure that battery polarities agree.



FIGS. 76 & 77—DECODER BOARD is double-sided. Pattern at left is for bottom; pattern at right for top (component side). If you make your own board, holes that go to foil traces on both sides must either be plated through, or jumpers run from one side of board to the other.

PARTS LIST—DTMF ENCODER BOARD

All resistors ¼ watt, 5%
R1—100 ohms
R2—47,000 ohms
R3—1000 ohms
Capacitors
C1—0.022 μF, ceramic disc
C2—0.0022 μF, Mylar
C3—39 μF, tantalum
Semiconductors
IC1—7206JPE DTMF tone generator
Q1—MPSA-13 or equivalent NPN-type
LED1—jumbo red LED
XTAL1—3.579545 MHz TV color-burst crystal
S1—SPDT push button switch
Miscellaneous: PC board, IC socket, 8-ohm speaker, 16-key keypad (Digitran KL0049 or equivalent), cabinet, battery clip, etc.



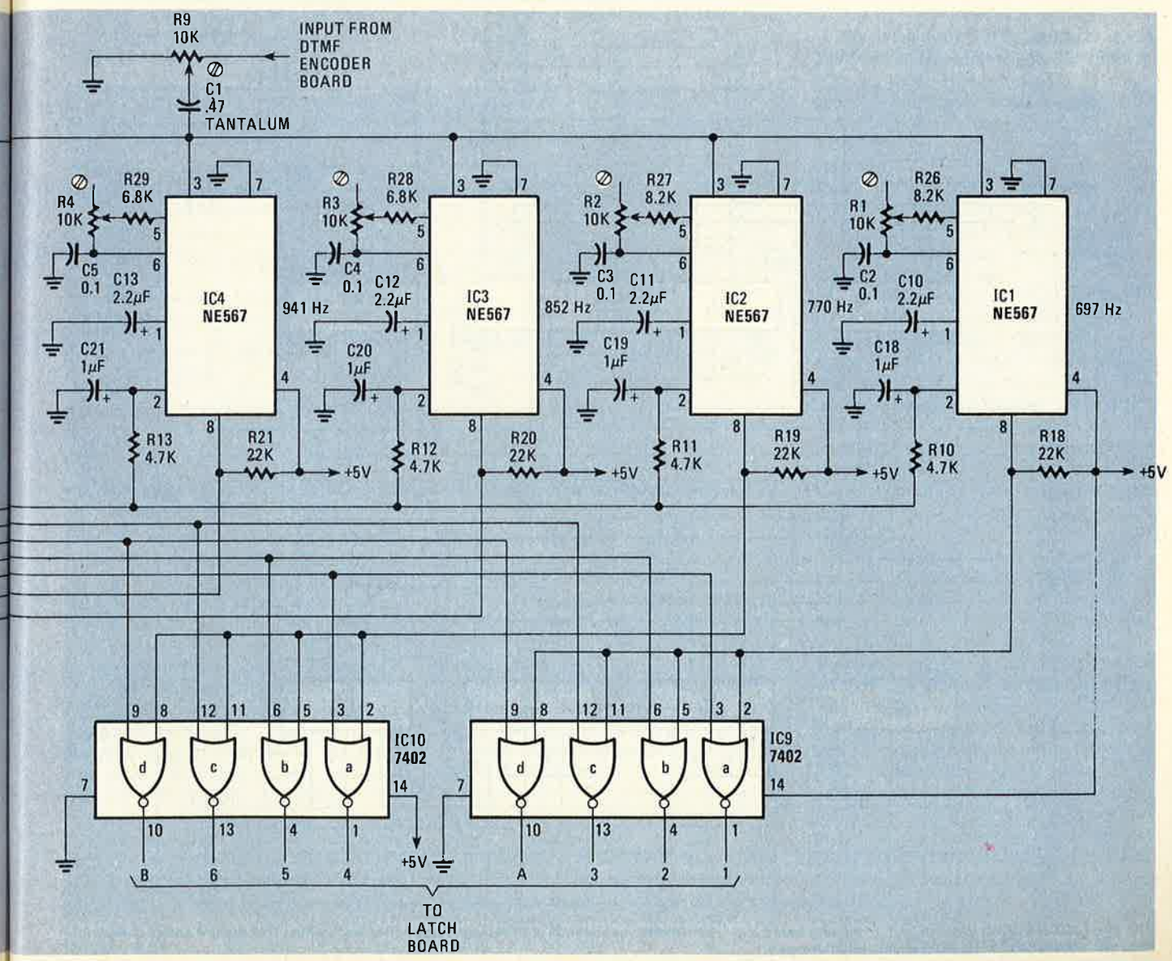


FIG. 75—TONE PAIRS are fed to all eight 576 phase-lock loop IC's on decoder board. Decoded tone pairs are NOR'd to produce a one-of-sixteen logic-"high" output.

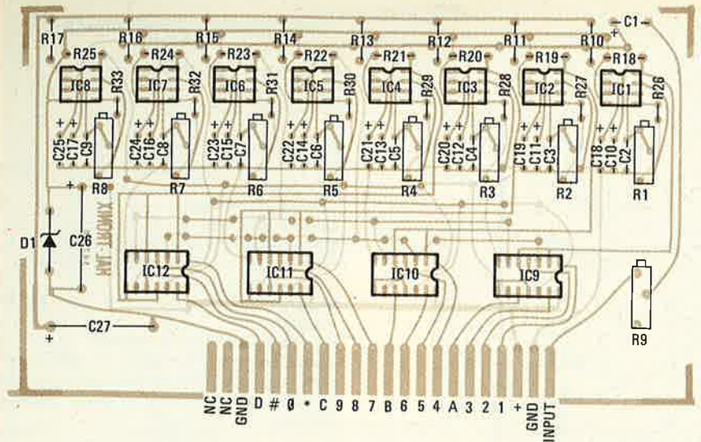


FIG. 78—THE DTMF DECODER BOARD has all signals brought out to edge connector and also available on the board itself.

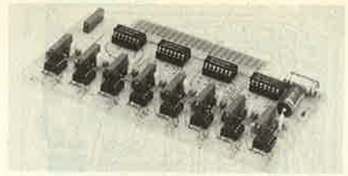


FIG. 79—WHEN MOUNTING POTENTIOMETERS make certain to allow clearance between them and IC sockets for screwdriver adjustment.

We've been receiving a lot of correspondence from readers who are building—or contemplating building—their own versions of Unicorn-1. We'd like to see more, along with nice sharp photographs, so we can publish a segment showing off those robots and presenting some of the innovations that you've come up with. Write to **Radio-Electronics,** 200 Park Avenue South, New York, NY 10003 and mark your envelope "ROBOT UPDATE."

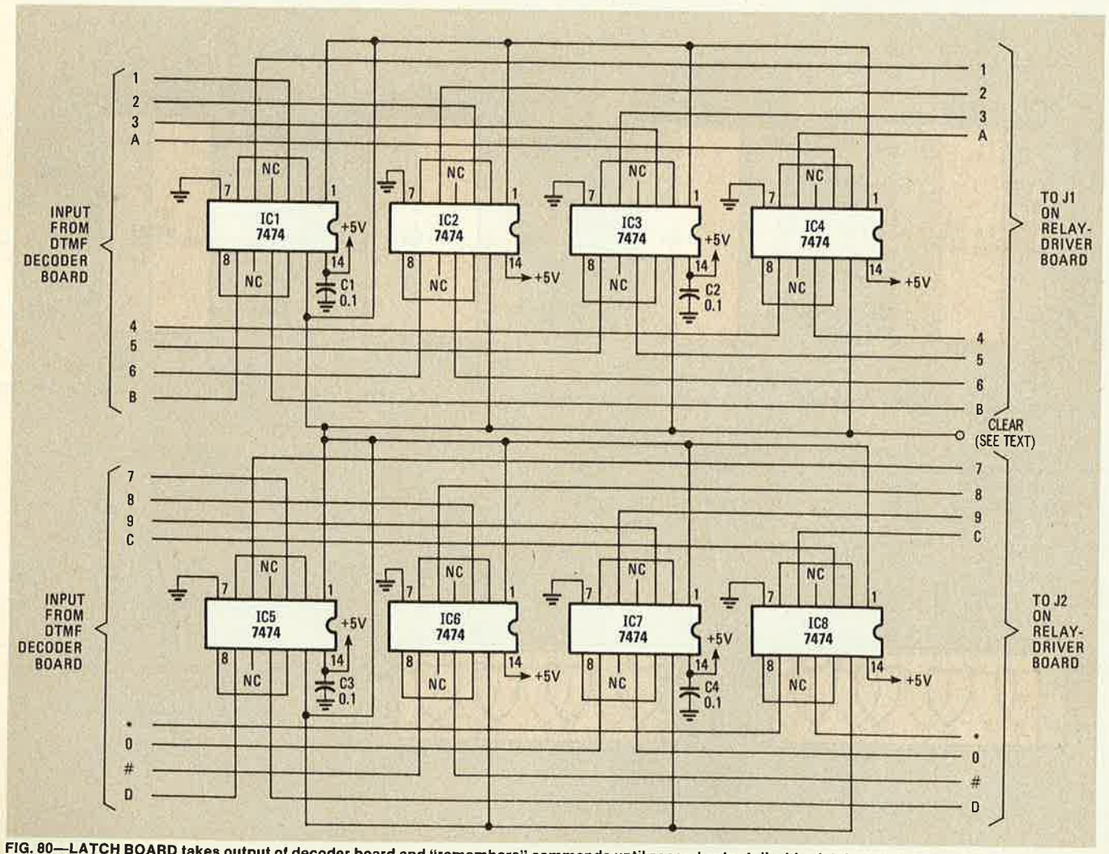


FIG. 80—LATCH BOARD takes output of decoder board and "remembers" commands until second output disables latches. This feature allows commands sent out sequentially to be carried out simultaneously.

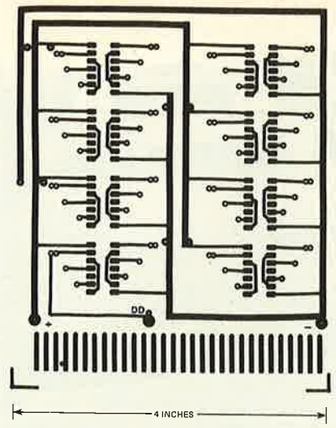


FIG. 81—IF "DROP-DEAD" feature is desired, "double-donut" pads must be jumpered together.

PARTS LIST—LATCH BOARD

Capacitors
C1-C4—0.1 μF, ceramic disc
Semiconductors
IC1-IC8—7474 dual "D" edge-triggered flip-flop
Miscellaneous: PC board, IC sockets, ribbon cable, etc.
The following are available from: Hal-Tronix, PO Box 1101, Southgate, MI 48195, Tel. (313) 285-1782: encoder kit, including case (ECD-16DL), $39.95; encoder kit less case (ECD-16K), $29.00; PC board only (ECD-16PC), $8.00. Decoder kit (no case) (567-16K), $69.95; double-sided, plated-through PC board only (567-16PC), $21.00. Latch board kit (LB-16K), $18.95; PC board only (LB-16PC), $11.95. Also available from the same source: ICM7206JPE IC, $8.95; 16-key keypad, $11.95. Please add $2.00 shipping & handling on orders under $20.00. Visa and MC accepted. Boards and kits are also available from: The Robot Mart, Room 1113, 19 W. 34th St., New York, NY 10001 (catalog $3.00).

PARTS LIST—DTMF DECODER BOARD

All resistors ¼ watt, 5% unless otherwise specified
R1-R9—10,000 ohms, ten-turn trimmer potentiometer (Bourns 3006P or equivalent)
R10-R17, R32—4700 ohms
R18-R25, R33—2200 ohms
R26, R27—8200 ohms
R28-R30—6800 ohms
R31—5600 ohms
Capacitors
C1—0.47 μF, tantalum, or ceramic disc
C2-C9—0.1 μF, Mylar or monolithic
C10-C17—2.2 μF, tantalum or aluminum electrolytic
C18-C25—1 μF, tantalum or aluminum electrolytic
C26, C27—200 μF, electrolytic
Semiconductors
IC1-IC8—NE567 PLL tone decoder
IC9-IC12—7402 quad NOR gate
D1—5.1 volts, 1 watt, Zener
Miscellaneous: double-sided, plated-through PC board, IC sockets, ribbon cable, etc.

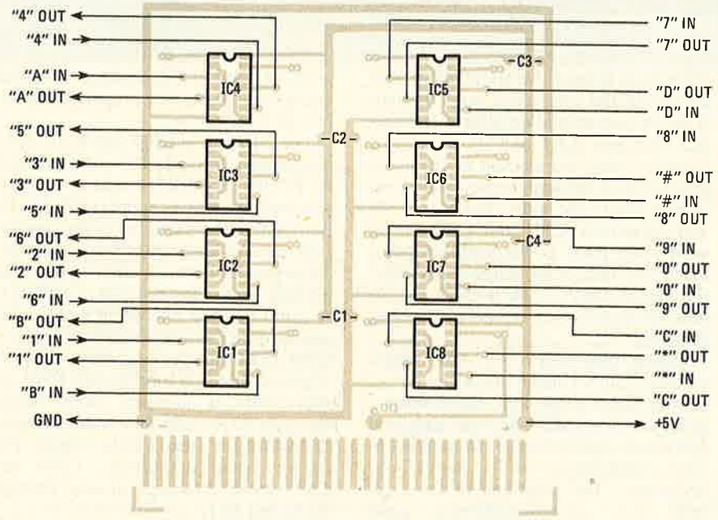


FIG. 82—LATCH BOARD SIGNALS *are not* brought out to edge connector. Connections must be made to pads on board. The use of multicolored ribbon cable is suggested.

five-volt supply to operate properly. Alignment is simple: Starting with IC1, connect a frequency counter to pin 5 of the 567 (no signal input is necessary). Adjust the 10K potentiometer associated with the IC until the frequency indicated on the schematic for that IC is obtained.

Proper tone-decoding can be verified by applying a tone pair to the input of the board and checking for a logic-high at the corresponding output pin of the 7402 NOR gates with a logic probe.

If the probe's HIGH LED does not stay on steadily, it indicates that one or both of the 567's associated with that tone pair is not quite on frequency and needs a slight adjustment. If you have to make such an adjustment, proceed carefully—remember, each 567 is responsible for *four* individual outputs and you must check them all.

Latch board

While it is possible to operate the robot without the latch board, there are two important reasons why it should be included.

Firstly, it eliminates the need to keep a function key depressed. With the latch board, the key is pressed once to initiate the function desired, and pressed again to stop it. Not only does that save wear and tear on the batteries (and fingers) but it also brings us to the other reason for using the latch board.

Without it, only one function at a time could be carried out by the robot. With it, however, as many functions as desired can be operated at the same time and they can be switched on and off at will.

The latch board (Fig. 80) uses eight 7474 dual D, edge-triggered, flip-flop IC's to form 16 latches. The latching action is handled by cross-coupling each gate's inverting output (pin 6 or 8) to the "D" input (pin 2 or 12) of the IC. The status of the "D" input determines the status of the outputs. If it is "high," the normal (non-inverting) output (pin 5 or 9) is also "high," and the inverting output is "low." If it is "low," the status of the outputs is reversed.

The 7474 triggers on a "low" to "high" transition of the input (clock) signal (pin 3 or 11). When a signal from the decoder board is applied, a "high" to "low" transition takes place and the normal (non-inverting) output of the gate goes "high" and stays "high." Simultaneously, the inverting output goes "low." That forces the "D" input "low," which means that the next "high" to "low" transition at the input will cause the output to go "low," and so on.

That means that the first time a function key is pressed, a function will be called into play. The next time it is pressed, that function will stop. And since, once the latch has been set, the function continues, another key can be pressed and another function called up while the first is running.

The CLEAR inputs of the IC's (pins 1 and 13) are also brought out to the board (the double donut pads in Fig. 81—if used they should be jumpered together) for future use. If the CLEAR inputs are grounded, the latches immediately go to a "low" state. That feature can be used as a "drop dead" switch to completely disable the robot by pushing a single key, if it becomes necessary.

The "drop dead" feature could also be

continued on page 88

UNICORN-1 ROBOT

continued from page 69

tied into the FM receiver. Now, if the carrier from the transmitter were lost, the robot would immediately stop functioning—a nice safety feature for long-range work.

This board also requires a good five-volt power supply. Connect it directly to the board—the fingers at the edge are intended for mounting purposes (there aren't enough of them on a single-sided board for all the inputs and outputs).

The connections are called out in Fig. 82. Use ribbon cable to connect the decoder and latch boards and to connect the latch board to jacks J1 and J2 on the relay-driver board.

With these three boards installed, the conversion to radio control is complete. In the next installment we'll discuss what would be involved in interfacing the robot to a computer. **R-E**

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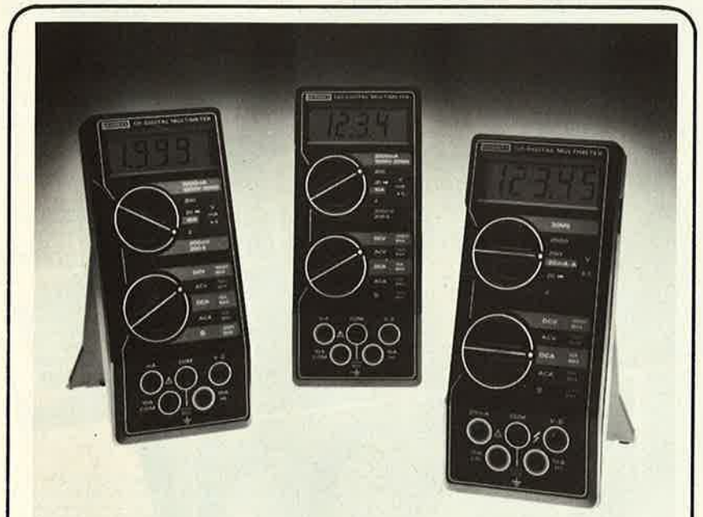

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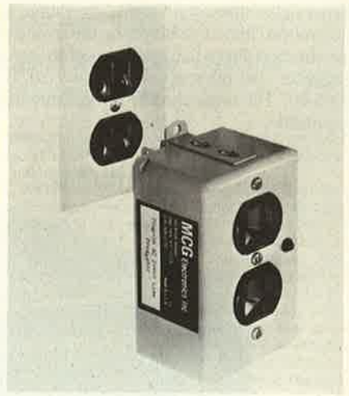
continued from page 86

computers, terminals, modems, and printers, as well as office, laboratory, and communications equipment. It incorporates a wall-socket type fixture, so that all equipment can be plugged in easily and any 117-volt AC wall outlet is thus converted into a "dedicated" line.

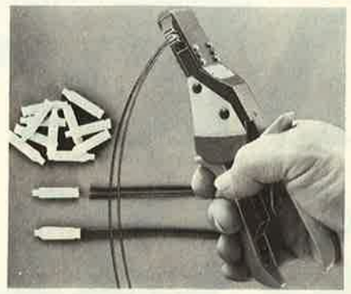


CIRCLE 154 ON FREE INFORMATION CARD

The *model 300* clamps high-energy transients and filters RFI (*R*adio *F*requency *I*nterference) from the AC line. Should a severe transient take place, the device will "fail safe," protecting the equipment without interruption of service or loss of data. The status of the protection is continuously monitored by a LED.

Both low and high-impedance loads are protected from common- and transverse-mode transients. The *model 300* holds down voltage spikes to safe levels, absorbing up to 80 joules of transient energy. It is easily portable, weighing only one pound. Price $135.00—**MCG,** 160 Brook Avenue, Deer Park, NY 11719.

"D" CONNECTOR TOOL, *model CP-200,* is designed to crimp "B"-type insulated wire connectors onto the ends of unstripped wires. Metal "teeth" within the connector penetrate the wire insulation and engage the conductor when the connector is crimped. A built-in ratchet assures that a complete pressing cycle is made before the handles are released. A factory-set mechanical stop prevents over-pressing, thus assuring a high-quality conductive joint.



CIRCLE 155 ON FREE INFORMATION CARD

"B" connectors are available both plain and "jelly"-filled. The latter features "silicone-type grease packing" which wards off contamination of the connection and inhibits oxidation. Both types of connectors are available in packages of 250, 500, and 1000 pieces. Prices: *CP-200*—$55.00; 250 "B" Connectors—$12.00 for the plain, $17.33 for the jelly-filled.—**OK Machine and Tool Corporation,** 3455 Conner Street, Bronx, NY 10475. **R-E**

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Level "A" With Hex Keypad/Display.

LEVEL "A" SPECIFICATIONS

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an advanced 8155 RAM I/O . . . all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

PC Board: Glass epoxy, plated through holes with solder mask. • **I/O:** Provisions for 25-pin (DB25) connector for terminal serial i/O, which can also support a paper tape reader . . . cassette tape recorder input and output . . . cassette tape control output . . . LED output indicator on SOD (serial output) line . . . printer interface (less drivers) . . . total of four 8-bit plus one 6-bit I/O ports. • **Crystal Frequency:** 6.144 MHz. • **Control Switches:** Reset and user (RST 7.5) interrupt . . . additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard. • **Counter/Timer:** Programmable, 14-bit binary. • **System RAM:** 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems . . . RAM expandable to 64K via S-100 bus or 4k on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F800, leaving 0000 free for user RAM/ROM. Features include tape load with labeling . . . examine/change contents of memory . . . insert data . . . warm start . . . examine and change all registers . . . single step with register display at each break point, a debugging/training feature . . . go to execution address . . . move blocks of memory from one location to another . . . fill blocks of memory with a constant . . . display blocks of memory . . . automatic baud rate selection to 9600 baud . . . variable display line length control (1-255 characters/line) . . . channelized I/O monitor routine with 8-bit parallel output for high-speed printer . . . serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Keypad/Display Version): Tape load with labeling . . . tape dump with labeling . . . examine/change contents of memory . . . insert data . . . warm start . . . examine and change all registers . . . single step with register display at each break point . . . go to execution address. Level "A" in this version makes a perfect controller for industrial applications, and is programmed using the Netronics Hex Keypad/Display. It is low cost, perfect for beginners.

HEX KEYPAD/DISPLAY SPECIFICATIONS

Calculator type keypad with 24 system-defined and 16 user-defined keys. Six digit calculator-type display, that displays full address plus data as well as register and status information.

LEVEL "B" SPECIFICATIONS

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards, and includes: address decoding for onboard 4k RAM expansion selectable in 4k blocks . . . address decoding for onboard 8k EPROM expansion selectable in 8k blocks . . . address and data bus drivers for onboard expansion . . . wait state generator (jumper selectable), to allow the use of slower memories . . . two separate 5 volt regulators.

LEVEL "C" SPECIFICATIONS

Level "C" expands Explorer/85's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and card are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card, gold plated S-100 extension PC board that plugs into the motherboard. Just add required number of S-100 connectors.

Explorer/85 With Level "C" Card Cage.

LEVEL "D" SPECIFICATIONS

Level "D" provides 4k of RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

LEVEL "E" SPECIFICATIONS

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for 2k x 8 RAM IC's (allowing for up to 12k of onboard RAM).

DISK DRIVE SPECIFICATIONS

- 8" CONTROL DATA CORP. professional drive.
- LSI controller.
- Write protect.
- Single or double density.
- Data capacity: 401,016 bytes (SD), 802,032 bytes (DD), unformatted.
- Access time: 25ms (one track).

DISK CONTROLLER/ I/O BOARD SPECIFICATIONS

- Controls up to four 8" drives.
- 1771A LSI (SD) floppy disk controller.
- Onboard data separator (IBM compatible).
- 2 Serial I/O ports
- Autoboot to disk system when system reset.
- 2716 PROM socket included for use in custom applications.
- Onboard crystal controlled.
- Onboard I/O baud rate generators to 9600 baud.
- Double-sided PC board (glass epoxy.)

DISK DRIVE CABINET/POWER SUPPLY

- Deluxe steel cabinet with individual power supply for maximum reliability and stability.

ORDER A COORDINATED EXPLORER/85 APPLICATIONS PAK!

Beginner's Pak (Save $26.00!) — Buy Level "A" (Terminal Version) with Monitor Source Listing and AP-1 5-amp Power Supply: (regular price $199.95), now at SPECIAL PRICE: **$169.95** plus post. & insur.

Experimenter's Pak II (Save $53.40!) — Buy Level "A" (Hex Keypad/Display Version) with Hex Keypad/Display. Intel 8085 User Manual, Level "A" Hex Monitor Source Listing, and AP-1 5-amp Power Supply: (regular price $279.35), all at SPECIAL PRICE: **$219.95** plus post. & insur.

Special Microsoft BASIC Pak (Save $103.00!) — Includes Level "A" (Terminal Version), Level "B", Level "D" (4k RAM), Level "E", 8k Microsoft in ROM, Intel 8085 User Manual, Level "A" Monitor Source Listing, and AP-1 5-amp Power Supply: (regular price $439.70), now yours at SPECIAL PRICE: **$329.95** plus post. & insur.

ADD A TERMINAL WITH CABINET, GET A FREE RF MODULATOR: Save over $114 at this SPECIAL PRICE: **$499.95** plus post. & insur.

Special 8" Disk Edition Explorer/85 (Save over $104!) — Includes disk-version Level "A", Level "B", two S-100 connectors and brackets, disk controller, 64k RAM, AP-1 5-amp power supply, Explorer/85 deluxe steel cabinet, cabinet fan, 8" SD/DD disk drive from famous CONTROL DATA CORP. (not a hobby brand!), drive cabinet with power supply, and drive cable set-up for two drives. This package includes everything but terminal and printers (see coupon for them). Regular price $1630.30, all yours in kit at SPECIAL PRICE: **$1499.95** plus post. & insur. Wired and tested, only **$1799.95.**

Special! Complete Business Software Pak (Save $625.00!) — Includes CP/M 2.0, Microsoft BASIC, General Ledger, Accounts Receivable, Accounts Payable, Payroll Package: (regular price $1325), yours now at SPECIAL PRICE: **$699.95.**

Please send the items checked below:

- ☐ **Explorer/85 Level "A" kit** (Terminal Version) . . . **$129.95** plus $3 post. & insur.
- ☐ **Explorer/85 Level "A" kit** (Hex Keypad/Display Version) . . . **$129.95** plus $3 post. & insur.
- ☐ **8k Microsoft BASIC** on cassette tape. **$64.95** postpaid.
- ☐ **8k Microsoft BASIC in ROM kit** (requires Levels "B", "D" and "E") . . . **$99.95** plus $2 post. & insur.
- ☐ **Level "B" (S-100) kit** . . . **$49.95** plus $2 post. & insur.
- ☐ **Level "C" (S-100 6-card expander) kit** . . . **$39.95** plus $2 post. & insur.
- ☐ **Level "D" (4k RAM) kit** . . . **$69.95** plus $2 post. & insur.
- ☐ **Level "E" (EPROM/ROM) kit** . . . **$5.95** plus 50¢ p&h.
- ☐ **Deluxe Steel Cabinet** for Explorer/85 . . . **$49.95** plus $3 post. & insur.
- ☐ Fan For Cabinet . . . **$15.00** plus $1.50 post. & insur.
- ☐ **ASCII Keyboard/Computer Terminal kit:** features a full 128 character set, u&l case; full cursor control; 75 ohm video output; convertible to baudot output; selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator) . . . **$149.95** plus $3.00 post. & insur.
- ☐ **Deluxe Steel Cabinet** for ASCII keyboard/terminal . . . **$10.95** plus $2.50 post. & insur.
- ☐ **Newl Terminal/Monitor:** (See photo) Same features as above, except 12" monitor with keyboard and terminal is in deluxe single cabinet; kit . . . **$399.95** plus $7 post. & insur.
- ☐ **Hazeltine terminals:** Our prices too low to quote — **CALL US**
- ☐ **Lear-Sigler terminals/printers:** Our prices too low to quote: **CALL US**
- ☐ **Hex Keypad/Display kit** . . . **$69.95** plus $2 post. & insur.
- ☐ **AP-1 Power Supply Kit** +8V @ 5 amps) in deluxe steel cabinet . . . **$39.95** plus $2 post. & insur.
- ☐ **Gold Plated S-100 Bus Connectors** . . . **$4.85** each, postpaid.
- ☐ **RF Modulator kit** (allows you to use your TV set as a monitor) . . . $8.95 **postpaid.**
- ☐ **16K RAM kit** (S-100 board expands to 64k) . . . **$199.95** plus $2 post. & insur.
- ☐ **32k RAM kit** . . . **$299.95** plus $2 post. & insur.
- ☐ **48k RAM kit** . . . **$399.95** plus $2 post. & insur.
- ☐ **64k RAM kit** . . . **$499.95** plus $2 post. & insur.
- ☐ **16k RAM Expansion kit** (to expand any of the above in 16k blocks up to 64k) . . . **$99.95** plus $2 post. & insur. each.
- ☐ **Intel 8085 cpu Users' Manual** . . . **$7.50** postpaid.
- ☐ **12" Video Monitor** (10MHz bandwidth) . . . **$139.95** plus $5 post. & insur.
- ☐ **Beginner's Pak** (see above) **$169.95** plus $4 post. & insur.
- ☐ **Experimenter's Pak** (see above) . . . **$219.95** plus $6 post. & insur.
- ☐ **Special Microsoft BASIC Pak Without Terminal** (see above) . . . **$329.95** plus $7 post. & insur.
- ☐ Same as above, plus **ASCII Keyboard Terminal With Cabinet, Get Free RF Modulator** (see above) . . . **$499.95** plus $10 post. & insur.
- ☐ **Special 8" Disk Edition Explorer/85** (see above) . . . **$1499.95** plus $26 post. & insur.
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- ☐ **Intel 8085 cpu User Manual** . . . $7.50 **postpaid.**
- ☐ **Level "A" Monitor Source Listing** . . . **$25** postpaid.

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