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VOLUME 1 NUMBER 3 JANUARY 1975

Well here it is. Finally! This issue may be late, but we at TCH hope that its size and content make up for the delay. This issue contains four feature articles; Part 3 of the graphics series, Part 2 of the teletypewriter interface article, an article on how to program the graphics display to put a chess board and pieces on the screen, and an article on a cheap way to get card reader input to your system. This issue also contains a special treat, a centerfold, starring our graphics display!

All of the regular columns are included again with the addition of two new ones which will be seen from time to time. They are BOOK REVIEWS, and TRICKS AND TECHNIQUES.

Last issue we promised to take a survey of readers' interests and equipment. You will find the survey questions on the inner side of the mailing cover. Please answer them and fold and staple as indicated, so that our address and pre-paid postage are on the front and the return address blanks for your address are on the back. Results of the survey will be printed in our next issue if answers are returned soon enough.

Now two quick business items. First, several people have asked why we don't go to full size print and 8.5" by 11" paper which can be put in a ring binder. The reason is cost. The only way TCH can bring you this much material for 50¢ per issue, as compared to higher prices for similar journals, is to keep it small. Going to the larger format would double both the cost of paper and postage. Second, a reminder to those of you who have seasonal address changes (students, etc.), please keep us posted on where to send your TCH. We will attempt to follow you around.

LETTERS

TCH will publish a few of our more interesting letters each month along with comments by the staff.

Gentlemen:

I have just read issues 1 and 2 of TCH and find it to be the most exciting prospect I have found in many years. If you can pull together all the disciplines involved in recreational computer development, you will have accomplished a major miracle.

I have been participating in the recreational computer field for many years, but it has never been organized or fermenting as it is right now. It looks as if there will be many exciting years ahead!

I would like to make a few comments on SURPLUS SUMMARY in issue 1. I am an avid Teletype phreak and I have collected hardware, manuals, and literature for more than 20 years. Your column was an excellent tutorial on the various models and their capabilities. There are a few points that should be made, however, so that the neophyte will be prepared. First, the difference between a perforator and a reperforator should be made clear. Not understanding the two could be a major disaster! A perforator can only punch tape from a keyboard input. This means that you can prepare tapes for input, but you cannot punch tapes from your computer. The model 19 perforator, for example, punches tape from mechanical linkages to the keyboard which makes it nearly impossible to utilize as a computer output. A reperforator (abbreviation of receiving perforator) can receive from both keyboard and computer and would obviously be a better deal.

Your survey of equipment left out the Model 37 which is a real gem and might someday fall into the hands of computer hobbyists. It is ASCII oriented, runs at 150 wpm (50% faster than the 33/38), has software tab stop sets, half line spacing forward and reverse, a full 255 graphic character printing set, etc. A most remarkable machine.

An important addition to the model 38 description - it has upper and lower case printing capabilities. It also has two color ribbon capabilities.

There are a plethora of modification kits from Teletype that allow you to do special tricks on the various models. Be sure to investigate this too, since some of the things are fantastic!

Be sure to remember that the model 32, 33, and 38 are light duty machines. They are designed for limited use and will work for reasonably long periods but they do require maintenance and adjustment more often than the other models.

An addition to your literature list: RTTY, Box 837, Royal Oak, Michigan, 48068 is an excellent source of information, technical articles and classified ads on TTY and associated equipment. Subs are $3.00/year and it is an excellent magazine. The November issue has the results of a picture tape contest.

I have a large collection of manuals on Teletype, Kleinschmidt, Western Union, etc. digital devices and would be glad to answer any questions your readers might have,

THE COMPUTER HOBBYIST
Founded October, 1974

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Hal Chamberlin-Contributing Editor
Jim Parker-Contributor
Jerry Ledbetter-Contributor
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Members of the staff of TCH can usually be reached by phone evenings and weekends at either 919/467-3145 or 919/851-7223.

THE COMPUTER HOBBYIST welcomes contributions from our readers. Material to be submitted should be typed or neatly written and must not appear to be soliciting business for any firm. If you wish your material returned, please include a stamped, self-addressed envelope.

but please include a self-addressed stamped envelope. I also have a number of minicomputers at my office and can exchange software on paper tape for various machines.

My company reports on the Government Surplus Sales from the Department of Defense and many times there is digital equipment available to the public. If any of your readers would like further information on buying equipment from the government, they can write to: DOD SURPLUS SALES, Box 1370, Battle Creek, Mich., 49016. Be sure to request a bidder's list application. We have picked up some nice items pretty cheap. You must have patience, however, because sometimes months will go by with nothing but clothing and tent stakes up for bid. We have all the records of past sales and bidders if anyone would like to check on anything.

Fred Hatfield K8VDU
Computer Data Systems, Inc.
1372 Grandview Ave.
Columbus, Oh. 43212
614/486-0677

Thanks for the info and a great letter. Say, how would you like to write for TCH?

Gentlemen:

Thank you very much for the first two issues of "The Computer Hobbyist", which you recently sent me. You're off to a fine start, and I hope these will be the forerunner of many issues to come. I'm enclosing my check for a year's subscription.

I'm pleased to see you have not overlooked us beginners with your article on Logic Symbol Conventions. Although I took a course on Digital Techniques at the University of Maine this past year, your presentation still helped to improve my understanding of the manipulation of logic symbols. Perhaps my appreciation of the article has a bit of malice in it in that I believe you goofed in your answer to your logic design problem. Here's why: With a little manipulation your function

$$\overline{F1}=(\overline{A}+\overline{B})\cdot\overline{C}\cdot\overline{D}$$

becomes

$$\overline{F1}=\overline{\overline{\overline{A}+\overline{B}}+\overline{\overline{C}\cdot\overline{D}}} = \overline{A\cdot B+C+D}$$

Likewise

$$\overline{F2}=\overline{I}\cdot J+J\cdot\overline{K}$$

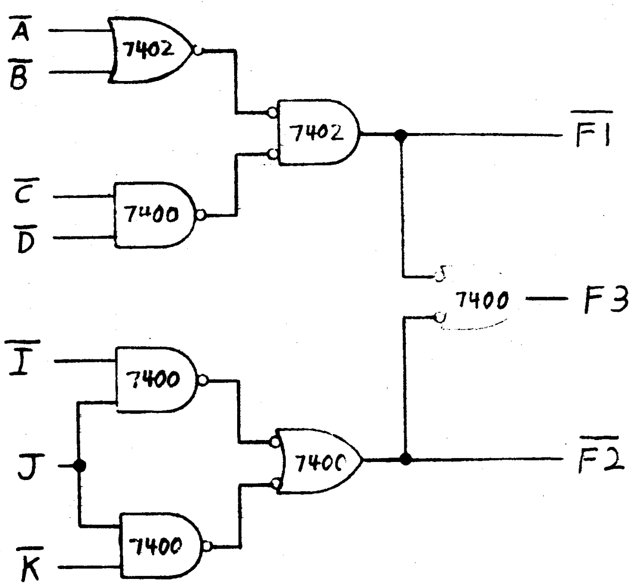
becomes

$$\overline{F2}=\overline{(I+\overline{J})\cdot(\overline{J}+K)}$$

However your logic diagram gives us

$$\overline{F1}=\overline{(A+B)\cdot C\cdot D}$$
$$\overline{F2}=\overline{(I\cdot J)+(J\cdot K)}$$

which are not the same as your starting functions, as a comaprison of truth table will show. I come up with the following solution for inputs A, B, C, D, I, J, K. This is efficient in requiring only seven gates, however five of them are NAND's. At the moment I don't see any way to implement the given functions with only a single 7400 and a 7402.



Norman F. Stanley

You are correct. The given problem and solution was a comedy of errors. The first error was that a list of available input variables was not given. The true form of A through K was intended. Then when the solution was drawn, variables A, B, C, D, I, and K were erroneously supplied in their complemented form. However, even if these corrections are made, the circuit generates F1 and F2 in their TRUE form rather than their complemented form as requested. This then invalidates the method of obtaining F3 and the problem cannot be solved using only two packages of common gates. Your solution is as good as any given the vague statement of the problem, and certainly indicates an understanding of logic symbol manipulation.

A GRAPHICS DISPLAY FOR THE 8008 Part 3 by Hal Chamberlin

In order to get the full usefullness of the graphics display system presented in the last two issues, a large screen X-Y monitor is needed. This article will discuss large screen CRT display technology in general and circuits for a monitor matched to the display generator given in part 2 in particular. The pictures in the centerfold of this issue were photographed directly from the monitor to be described with a 35mm SLR camera. In all cases the program for generating the display was less than 1024 bytes but the applications suggested obviously would require more memory. (See elsewhere in this issue an article describing the chessboard display program.)

Before continuing, the reasons why TV sets are unsuited for computer graphics display should be mentioned. The scanning circuits in a TV receiver are designed to operate at particular frequencies and waveforms only and hence cannot be used for deflection amplifiers in an X-Y graphics display. Alteration of TV scanning circuits is generally out also because their clever design utilizes distributed capacitance, leakage inductance, and other circuit "strays" in developing the scanning waveforms. In order to match the resolution of this X-Y display system with a raster scan display that is TV compatible would require the use of a 512 by 512 dot matrix. Since the 8008 cannot approach the dot-every-120 NS speed required to keep up with the display, a refresh buffer memory is needed. A buffer for 512 by 512 dots would have 262,144 bits or 32K bytes, twice the memory addressable by the 8008. Software for setting bits in the buffer according to lines in a display list can get slow but would be tolerable. An advantage of the dot matrix approach however is the ability to shade in a solid area of the image. It is interesting to note that many commercial systems for raster scan of computer graphics utilize a scan converter storage tube which converts X-Y computer input into TV compatible output.

Cathode ray tubes are of two basic types, electrostatically deflected, and magnetically deflected. The beam in an electrostatic tube is deflected by an electric field between a pair of deflection plates in the tube. Its primary advantage is the ease with which high-speed deflection amplifiers may be built. This is due to the very small amount of energy necessary to change the deflecting field strength between the plates. A typical value is 0.2 microjoules for a full screen sweep. Because of electron optics and physical laws, the beam cannot be deflected very much without severe defocusing. This translates into a large length-to-screen-size ratio and hence small screens for reasonable length tubes. The largest common size is 7 inches but they have been made as large as 19 inches which means the overall length was about 33 inches. A recent development called an expansion mesh now allows effective deflection angles up to 70 degrees peak-to-peak and thus tube proportions roughly that of TV picture tubes in the early '50s. These tubes are extremely expensive (over $1000) however, and while the focus is adequate, it still is not as good as most magnetic tubes.

Magnetically deflected tubes are much more common and can be cheaply made in large sizes. Deflection angles up to 114 degrees peak-to-peak are possible but the upper limit for precision performance is 50 to 70 degrees. Their primary disadvantage is a large deflection energy requirement which results in high power requirements at high frequencies. The deflection energy for the display to be described is about 625 microjoules or a factor of 3,125 higher than the typical O'scope tube.

A magnetically deflected tube may have either magnetic or electrostatic focus. The former usually has a better center-of-screen focus than the latter but quickly defocuses near the edge unless dynamic focus correction is applied. It also requires a focus coil or focus magnet with the former allowing front panel adjustment of focus. An electrostatic focus tube has an internal focus electrode which is connected to a variable focus voltage. Better uniformity of focus over the entire screen is usually obtained without dynamic correction in tubes of this type and thus is recommended for the display monitor.

Some older tubes require an ion-trap magnet near the base of the tube. These can be recognized by examining their gun structure. If the gun elements are not all concentric with a line from the center of the screen to the center of the base or do not have perfect radial symmetry, an ion-trap magnet will be needed.

The type number of most CRT's ends in the letter P followed by a one or two digit number. This is the phosphor type which determines the color and persistance of the screen. Long persistance phosphors especially suited for this display are P7, P14, P19, and P39. The first three are yellow-orange in appearance and P7 requires an amber filter to screen out its short persistance blue component. P39 is a new, very desirable type that is green in color and used in the newer commercial displays. Common short persistance phosphors that will work but provide little flicker filtering are P1, P4, and P31. The first and last of these are green while P4 is white and used in all television picture tubes. P4 may be improved somewhat with an amber filter. Avoid P11 and P16 which are blue or purple in color and of extremely short persistance.

The best CRT to use in building the display is a 10" or 12" round faced radar tube. These are readily available surplus for $20 or less, have a 52 degree deflection angle, and utilize long persistance phosphors. The screen size is large enough to fully utilize the system resolution but small enough to be convenient. The appendix lists some tube types that will work satisfactorily in the monitor.

The most important component of a magnetic deflection monitor is the deflection yoke which slips onto the tube neck and is pushed up against the bulb. The two primary parameters of the yoke are the winding inductance and the maximum deflection angle without the beam hitting the tube neck. In addition there are a number of construction methods for the magnetic core. Older television sets invariably used the saddle construction in which preformed coils are positioned like saddles inside a ring-shaped core. Newer sets use toroidal construction for the vertical axis in which two seperate coils are wound toroidally but are connected so that their fields oppose. This causes the field to jump accross the diameter of the core rather than circulate around it. The construction used for precision yokes is called stator construction because the core and windings are just like those found in the stator of larger AC motors.

Precision performance of deflection yokes depends on careful distribution of coil turns so that the magnetic field lines passing through the tube neck are straight, parallel, and uniformly spaced. Non-uniform deflecting fields result in geometric distortion of displayed patterns and astigmatic defocusing of the beam near the edges. Attaining the correct distribution by hand is easiest with stator construction because it is necessary only to get the proper number of conductors in each slot. TV manufacturers have not used this method however because of its higher cost and because the scanning circuits were too poor to take advantage of the greater precision possible.

In an X-Y monitor of this type the horizontal and vertical coils should be identical. Also low inductance coils are required for wide deflection system bandwidth. These requirements are not even approached by replacement yokes for TV sets. For this reason, the author, in cooperation with TCH, will make deflection yokes meeting the specifications in the monitor schematic available. See the appendix for details.

The schematic for one of the two identical deflection amplifiers is shown in Fig. 1. Basically the circuit is a power op-amp with current feedback so that yoke current is proportional to input voltage in spite of the yoke inductance. A 748 with light compensation is used for voltage gain and a two stage complementary symmetry transistor amplifier is used for current gain. The overall amplifier can provide up to + or - 6 amps of current continuously into a short circuit (the yoke is essentially a short at low frequencies), slew 10 amps in the yoke load in about 20 microseconds (fast full screen jump), accurately follow ramps up to .35 amp per microsecond (fast drawing), and respond to small signals up to 140 kHz (fast character drawing without character yoke). In addition the step response is smooth and essentially free of overshoot. Minimal compensation on the 748 is possible because at high frequencies the loop gain is small due to the high impedance of the yoke. A damping resistor is placed across the yoke for critical damping of the resonant circuit formed by the yoke inductance and distributed capacitance.

Each amplifier should be constructed inside a large, seperate heat sink at least 4 inches wide, 9 inches long, and 2 inches thick with fins. The 4 power transistors should be mounted with thin mica or mylar washers and white thermal grease onto the polished heat sink surface. The two large transistors are especially critical because at times one of them may be dissipating close to 100 watts. The 748 and associated components may be placed on a small piece of vectorboard mounted on short standoffs in the heat sink. The four bias diodes in the output stage should be glued directly to the center of the heat sink for thermal compensation. Each heat sink should be connected to ground and the bypass capacitors shown in the schematic connected between the indicated points and heat sink ground. When complete the two amplifiers may be bolted together with short standoffs and cooled with a whisper fan mounted on the end of the assembly so that air is blown parallel with the fins along their entire length.

The power supply in Fig. 2 is a conventional center-tapped bridge providing nominally + and - 15 volts under load. Each side is capable of supplying up to 10 amps continuously provided the other side is lightly loaded. The zener regulators prevent too much voltage from reaching the 748's when the supply is lightly loaded. Optimum performance is achieved with the 28 volt transformer specified although 24 volts will work with a small reduction in amplifier performance. The primary voltage of high quality 24 volt transformers can be boosted 18 volts with small filament transformers to provide 28 volts at the secondary. Don't use this though if the transformer gets hot with no load or if a significant external magnetic field can be felt with a screwdriver. The filter capacitors should not be skimped on or the ripple may be too much for the amplifiers to reject. Using two or three smaller capacitors in parallel is generally preferable to using a single large capacitor due to high ripple current under full load. The diodes should be of at least 15 amp rating or a 25 amp bridge can be used. Ten amp bridges seem to develop opens after a couple hundred hours in this circuit.

The Z-axis amplifier and CRT biasing circuits are shown in Fig. 4. The voltage applied to the first anode (G2) of the CRT is approximately 500 volts which is somewhat higher than usual. Although the control grid sensitivity is reduced, the focus is materially improved due to a smaller beam diameter in the neck region. There is 500 volts accross the focus control so a high quality molded control is advisable. The case of the focus control should be grounded to protect the user from arc-over should it occur. If a magnetic focus tube is used, the circuit in Fig. 5 will work with most focus coils from old TV's if their DC resistance is between 20 and 300 ohms. The 10KV power supply for the second anode is about right for tube sizes from 10" to 17". A 21" tube should be given about 15 KV for optimum focus and brilliance. The higher voltage reduces deflection sensitivity and as a result the overall picture size may be only slightly larger than that obtained on a 17" tube. It is possible however to beef up the deflection amplifiers and power supply to compensate if desired.

The Z axis amplifier uses a cascode circuit. This configuration has an inherently wide bandwidth because the collector-to-base capacitance of the output stage does not feed back into the input. The 2N3904 input transistor provides the current gain and the MPSU04 provides the voltage gain and high breakdown voltage capability. The contrast control determines the amount of local feedback in the input stage and hence its transconductance. The brightness control operates by injecting a variable bias current into the output stage. The input impedance is several K ohms and the circuit is fully DC coupled. As shown, response is flat to about 4 mHz but could be extended to over 20 mHz with minor modification. The voltage gain with full contrast is about -30 allowing a TTL level signal to fully modulate the beam. The Z axis amplifier should be mounted close to the CRT socket to avoid stray capacitance from the cathode lead which would reduce the bandwidth. Also, the leads to the brightness and contrast controls should be kept short. The filter capacitor for the Z-axis amplifier has been made large to prevent a bright spot on the CRT when power is turned off. It maintains cutoff potential between the control grid and the cathode until the filament has cooled. The 5 volt logic supply should shut down quickly however in order for this scheme to be effective.

The CRT should be mounted securely around the faceplate so that it will stay put with no additional support around the neck. The round radar tubes can be pressed into a round hole cut in soft, 1/2 inch fiberboard that is a teensy bit smaller than the maximum tube diameter. Shims may be needed inside the yoke to keep it snug against the neck and concentric around it. Additional support under the yoke will be needed to prevent stress on the front mounting when the unit is moved. If a TV picture tube is used, it should be fairly easy to salvage the mounting hardware from an old set that used that size tube.

This concludes the series on the graphics display. Builders are encouraged to send in photographs of their displays and descriptions of the software used.

APPENDIX

1. Some CRT's suitable for display

TYPE	FOCUS	SIZE	SHAPE	ANGLE	
7ABP	Elec	7"	Round	50	
7BP	Mag	7"	Round	50	
10FP	Mag	10"	Round	50	
10KP	Mag	10"	Round	52	
12ABP	Elec	12"	Round	52	
12AGP	Elec	12"	Round	42	*
12KP	Mag	12"	Round	54	
12DP	?	12"	Round	52	
12SP	Mag	12"	Round	52	
14EP	Mag	14"	Rect	70	
14QP	Elec	14"	Rect	70	
16AP	Mag	16"	Round	53	*
16RP	Mag	16"	Rect	70	
16STP	Elec	16"	Round	53	
16TP	Mag	16"	Rect	70	
16WP	Mag	16"	Rect	70	
17BP	Mag	17"	Rect	70	
17Cp	Mag	17"	Rect	70	*
17GP	Elec	17"	Rect	70	*
17HP	Elec	17"	Rect	70	
17LP	Elec	17"	Rect	70	
17QP	Mag	17"	Rect	70	
17TP	Elec	17"	Rect	70	*

* These are metal shell tubes. The majority of the tube envelope will be exposed high voltage. An insulated mounting is required.

NOTES: The Screen will not be fully utilized on 70 degree tubes. The letter A or B following the phosphor number indicates aluminized screen, very desirable.

CORRECTION: The + and - input pin connections on the 748 op-amps in the vector generator in last issue are reversed. If you have a January, 1974 copy of the National Semiconductor Linear Integrated Circuits data book, open it to page 2-179 and make a similar correction.

2. Sources of major components

7BP7A ($9.95), 12DP7 ($15), 12SP7 ($15), 16STP4A ($10) See Surplus Summary in this issue.

Power Transformer #28-4 ($20.22) Signal Transformer Co., 1 Junius St., Brooklyn, N.Y. 11212 Check also with Delta Electronics, Box 1, Lynn, Mass 01903 for possible substitution.

Transistors, Circuit Specialists Co., Box 3047, Scottsdale, AZ 85257

10KV Power Supplies (approx $10) B&F Enterprises, Box 44, Hathorne, Mass 01937. Also Meshna, Box 62, East Lynn, Mass 01904.

Deflection yoke ($15) Hal Chamberlin, Box 5985, Raleigh, NC 27607, Ph. 919/851-7225 Write or call for details. CELCO, 78G Constantine Dr., Mahwah, NJ 07430; and Syntronic Instruments Inc., 100G Industrial Rd., Addison, IL 60101 are commercial suppliers of precision and custom deflection yokes.

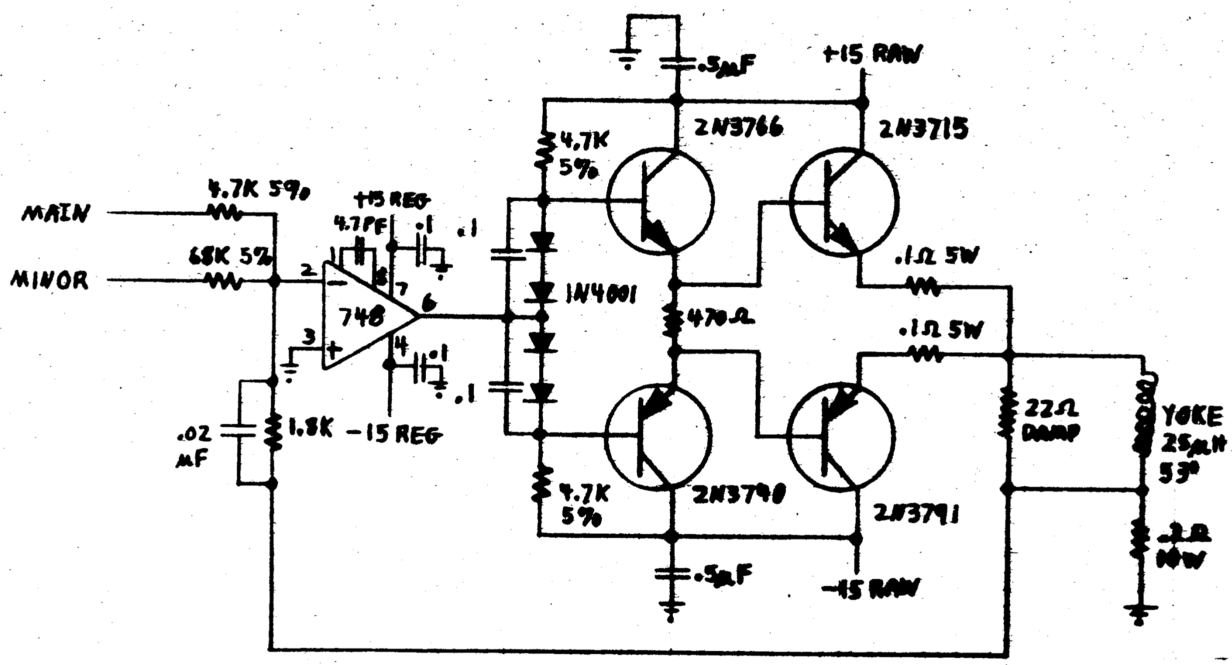


Fig. 1 Deflection Amplifier

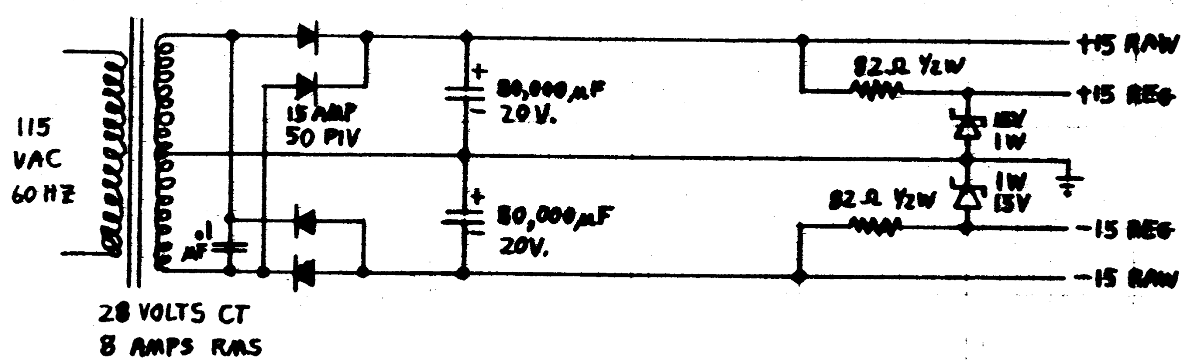


Fig. 2 Deflection Amplifier Power Supply

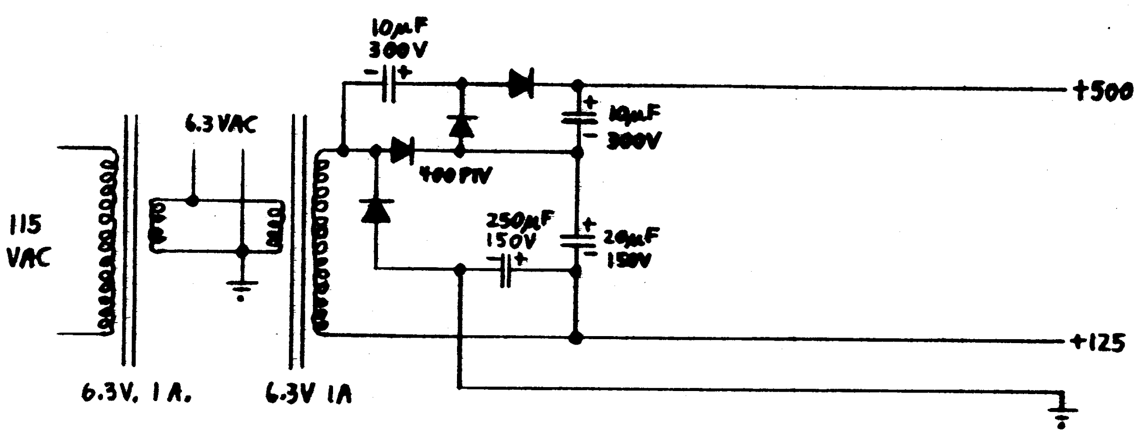


Fig. 3 CRT and Z Axis power Supply

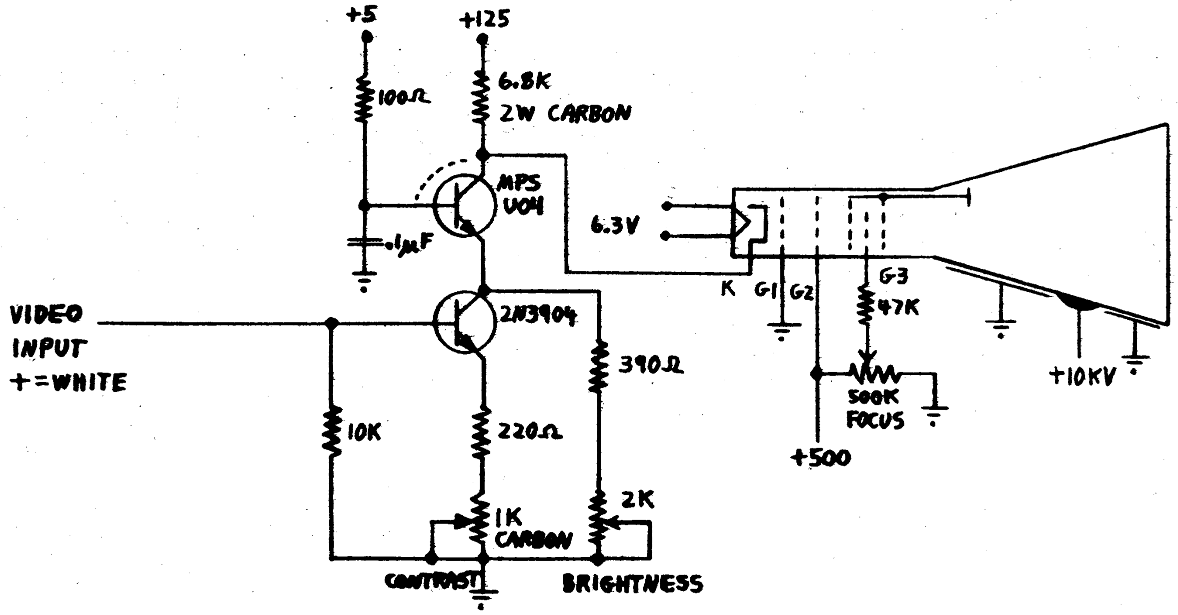


Fig. 4 CRT Biasing and Z Axis Amplifier

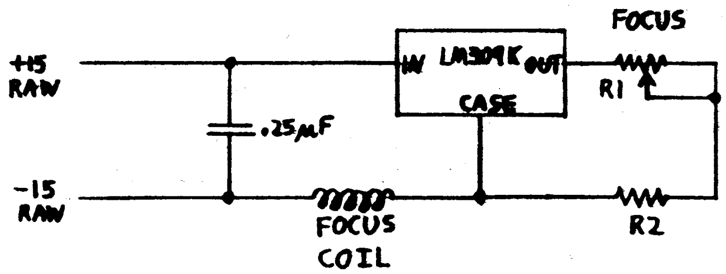
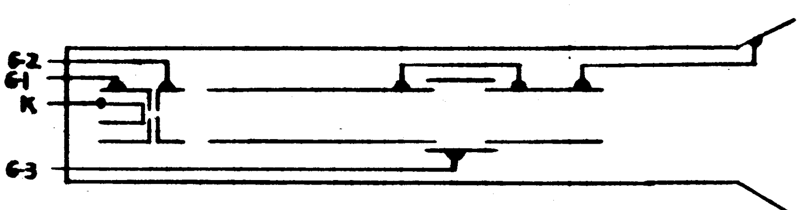
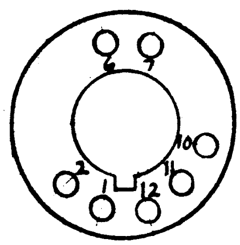


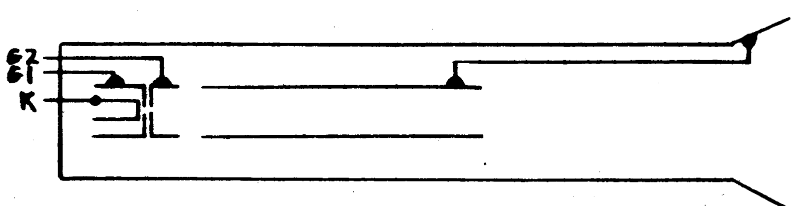
Fig. 5 Regulator for Magnetic Focus Coil

BOTTOM VIEW



ELECTROSTATIC FOCUS GUN





MAGNETIC FOCUS GUN

TYPICAL CRT BASE

PIN	FUNCTION
1	FILAMENT
2	G1 CONTROL GRID
6	G3 FOCUS ELECTRODE
7	OFTEN MISSING
10	G2 FIRST ANODE
11	K CATHODE
12	FILAMENT

BOOK REVIEW BY Hal Chamberlin

Microcomputer Design, Martin, Donald P., Martin Research LTD., 1825 S. Halsted St., Chicago, IL 60608

The industrial world, like the hobbyist world, has been caught relatively off-guard by the rapid introduction of microprocessor chips. The problem has not been a lack of desire to put the new devices to use but a lack of knowledge and the failure of traditional educational means in this interdisciplinary area. This book is an attempt to provide an understandable how-to-do-it reference manual on building microcomputers from microprocessor chips. The overwhelming emphasis is on the 8008 microprocessor but the 8080 is mentioned occasionally.

The book is sold in a manner that makes its price hard to pin down. For $100 Martin Research will supply the 300 pages looseleaf bound in two notebooks, a Microsystems International 8008 manual, and an 8008 chip. The chip supplied is tested for speed at 70 degrees C case temperature and packed in an individual envelope with the maximum speed stated to within a tenth microsecond for state time. The one supplied with this copy ran at 2.5 microseconds which is 8008-1 speed. For an additional $10, the 8008 will be replaced by an 8008-1 which is also tested for speed. With surplus 8008 prices running $50 to $80 and the difficulty of getting the manufacturer's manuals, the package seems to be a pretty good deal. The printing is of high quality but is difficult to read because it is on blood-red woven texture paper and done with a 10-pitch type size compressed to 12-pitch thus crowding the characters.

The leadoff chapters provide a tutorial explanation of sequential machines and basic computer concepts assuming only a knowledge of TTL logic design. Later the need for and design of the external logic necessary to make the 8008 function is developed. The remainder of the book is devoted to special topics such as I/O techniques, interrupts, direct memory access, expanding 8008 capabilities, and three complete microcomputer designs. One of the ideas that was new to us at TCH was the possibility of detecting the register self-load instructions (LBB, LCC, etc.) and picking off the register contents from the CPU bus at the proper time and latching them externally. Another was a method of clearing interrupt levels in a multilevel interrupt system using other valid variations of the RET instruction. Software discussion was limited to an interrupt save-restore routine and a few common programming techniques required for effective use of the microcomputer.

This book is directed mainly to industrial users of microcomputers who wish to use them as dedicated controllers or random logic replacements. As a result, many of the simplifying techniques presented may be of limited value in systems intended for general purpose use such as a hobbyist would require. Also, a large portion of the apparent simplicity of the designs presented is due to the extensive use of just-released, multifunction, low power Schottky MSI IC's. While industrial buyers may have little difficulty in obtaining these at reasonable prices, it may be some time before they are available mail order to hobbyists.

One possible objection that hard-nosed engineers might have is the lack of correlation between information stated or developed in the book and parameters stated by the manufacturers in their data sheets. A prime example is the allowable CPU bus loading which is specified as .44 mA maximum but is allowed by the author to reach 1.40 mA. Another is the use of a symmetrical clock waveform in violation of the manufacturer's recommended waveform (also done in the MARK-8 design). The author seems to be quite competent however and claims a detailed knowledge of the inner workings of the 8008 chip. The hobbyist should not experience any difficulty with these violations provided the microcomputer is kept at room temperature and the supply voltages are kept tightly regulated.

In summary, Microcomputer Design is a veritable computer-education-in-a-notebook and well worth considering.

SUBSCRIBER LIST

Each month TCH will publish the names and addresses of new subscribers who so desire. however the list will be limited to one page per issue to conserve space. We hope this service will aid people in finding assistance and friends with a common interest.

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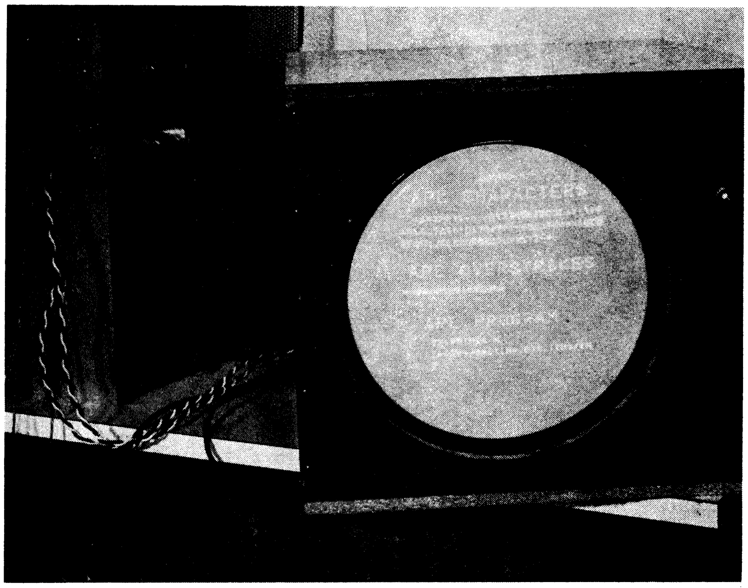
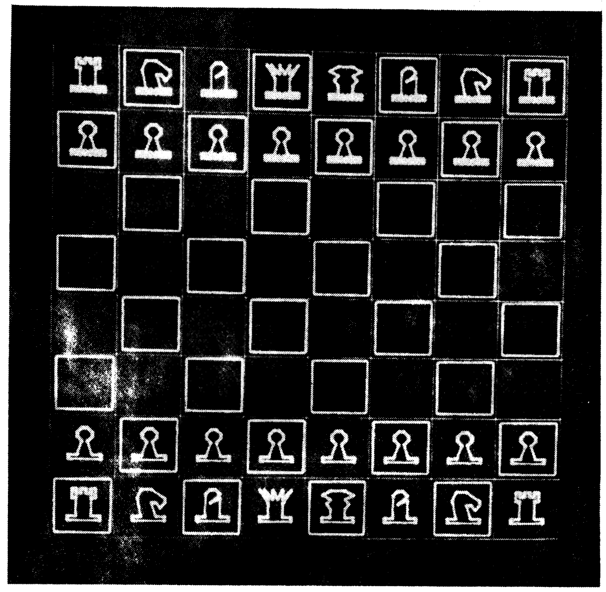
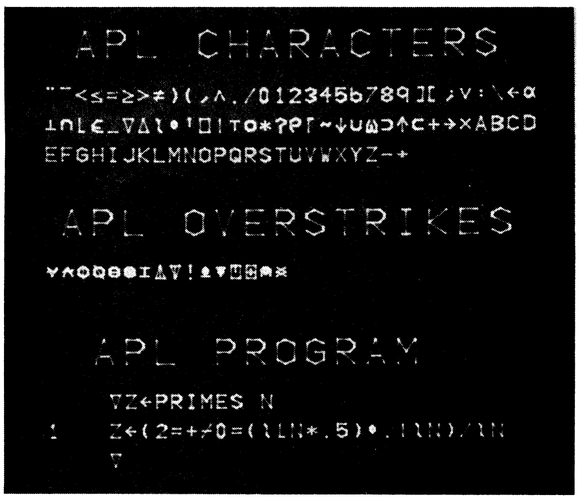
Sample Photographs of What TCH Has Done and
What You Can Do With a Graphics Display



TCH's Graphics Display System



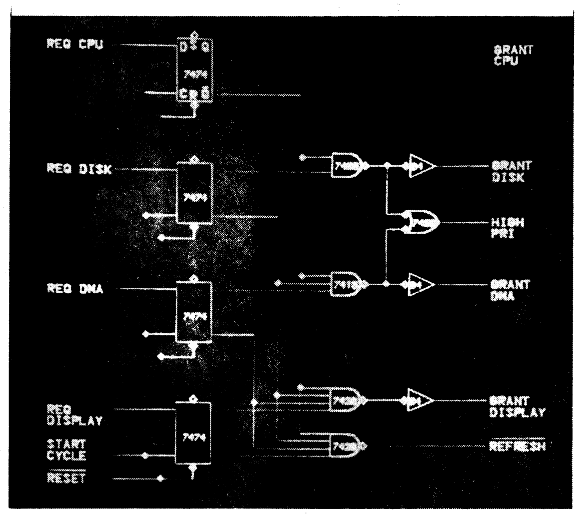
Chess Board Display
See article on page 14.

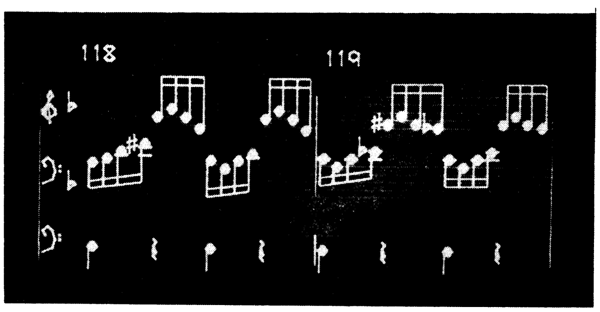


APL Character Set

Photos by Edwin Tripp

Logic Diagram





Music Notation

CHESS BOARD DISPLAY by Jim Parker

A chessboard display is quite effective in demonstrating the versatility of one's computer system. The program discussed in this article displays a chessboard in the opening position using an 8008 microprocessor with at least 512 bytes of memory and the vector graphics display system presented in the first three issues of TCH. Although this program does not allow movement of the pieces by keyboard entry, such a program could be adapted since changing a single data table allows any chess position to be displayed. Two full pages of memory are required although they need not be consecutive. A discussion of the program itself follows. The author hopes that the ideas shown may help other programmers in coding similar display programs.

The program may be divided into two independent parts. One part uses the main deflection system to draw the checkerboard graphically and the other part uses the minor deflection system or character generator to draw the chessmen. The minor system saves on memory and refresh time. Subroutines are kept fairly general so that most of the work is specified by the four data tables. Taking a closer look, one should begin with the graphics routines. Note that the 8 X 8 grid is represented with octal coordinates as shown in Figure 1. The decision was made to specify all coordinates as positive since this simplifies keypunching data cards. Dark squares are indicated by alternately inscribing smaller squares on the board.

GRAPH is the fundamental graphics routine. It is a more general form of the DRAW routine discussed in the first issue of TCH. One provides it with a list of XY pairs, such as HORZ or CHK, headed by the number of pairs in that list. 200B is a reserved coordinate which instructs the routine to jump to the following XY pair without drawing a line. Thus 3 disjoint horizontal lines are drawn by the list HORZ. Registers DE are set before calling GRAPH to any desired XY displacement. Thus the nine horizontal lines are drawn by calling GRAPH to draw HORZ 3 times; each time with a different vertical displacement.

EDGRPH is the graphics edit routine. It is entered once to draw the entire board. One enters with HL set to GDISPT, the graphics displacement table. This table lists corresponding graph sets and displacements. Hence, the checks cover the board by calling GRAPH to draw a row of checks (as in Figure 1.) eight times. Each time the row is moved up and left or right one square. 377B is a reserved address which flags the end of the table. It is necessary that GDISPT and the graph sets be in the same page of memory since only the low order address of the graph sets are specified in GDISPT. Note that EDGRPH could be called additional times with other GDISPT tables and graph sets in order to draw the chess pieces but the inefficiency could cause more flicker and moving chess pieces on the board would be difficult unless the routine was modified.

CHAR is concerned with the second part of the program; drawing the chessmen. One enters the character routine with HL set to the address of the stroke list defining the chess piece or black base. A negative number in the list flags the end as described in the first issue of TCH. Expanding the loop into straight code to remove the inefficient jump instruction makes the called routine about 40% faster. However, the observable difference may not be worth the extra memory used.

EDCHAR is the character edit routine which determines the placement and color of each chess piece. The associated data table, CDISPT, lists a displacement and character address in that order for each chess piece. Since only the low order address is specified, CDISPT and the character set must be in the same page of memory. This subroutine is somewhat specialized in that it expects all character addresses to be in the lower half of a memory page. A low address greater than 200B tells the routine that a black chess piece is specified whose address is actually 200B less than indicated in the CDISPT table. BK must be aligned on the page boundary as EDCHAR addresses it absolutely. The chess pieces may be moved around by rearranging the entries in

CDISPT. Note the standard white side chess notation associated with each XY displacement. Squares not listed may have their displacement computed by adding (10B, 10B) to the lower left hand coordinates of any squares shown in Figure 1. If the pieces are not centered, one may have to adjust MINSIZ or reposition the chess piece by changing the displacement. If the list is shortened, the first entry in CDISPT must be decreased to indicate the number of chessmen in the list.

That covers the main ideas in the program. Readers are encouraged to develop programs that use this program to display a chess game between two players who enter their moves by keyboard. A more compatible notation may need to be developed. Other possibilities include a program that understands the game rules and flags checks and illegal moves. As a final challenge, the 8008 could play a human in a game where just a King and a Rook try to force a lone King into checkmate. In the future, supplementary programs may be published so please submit ideas.

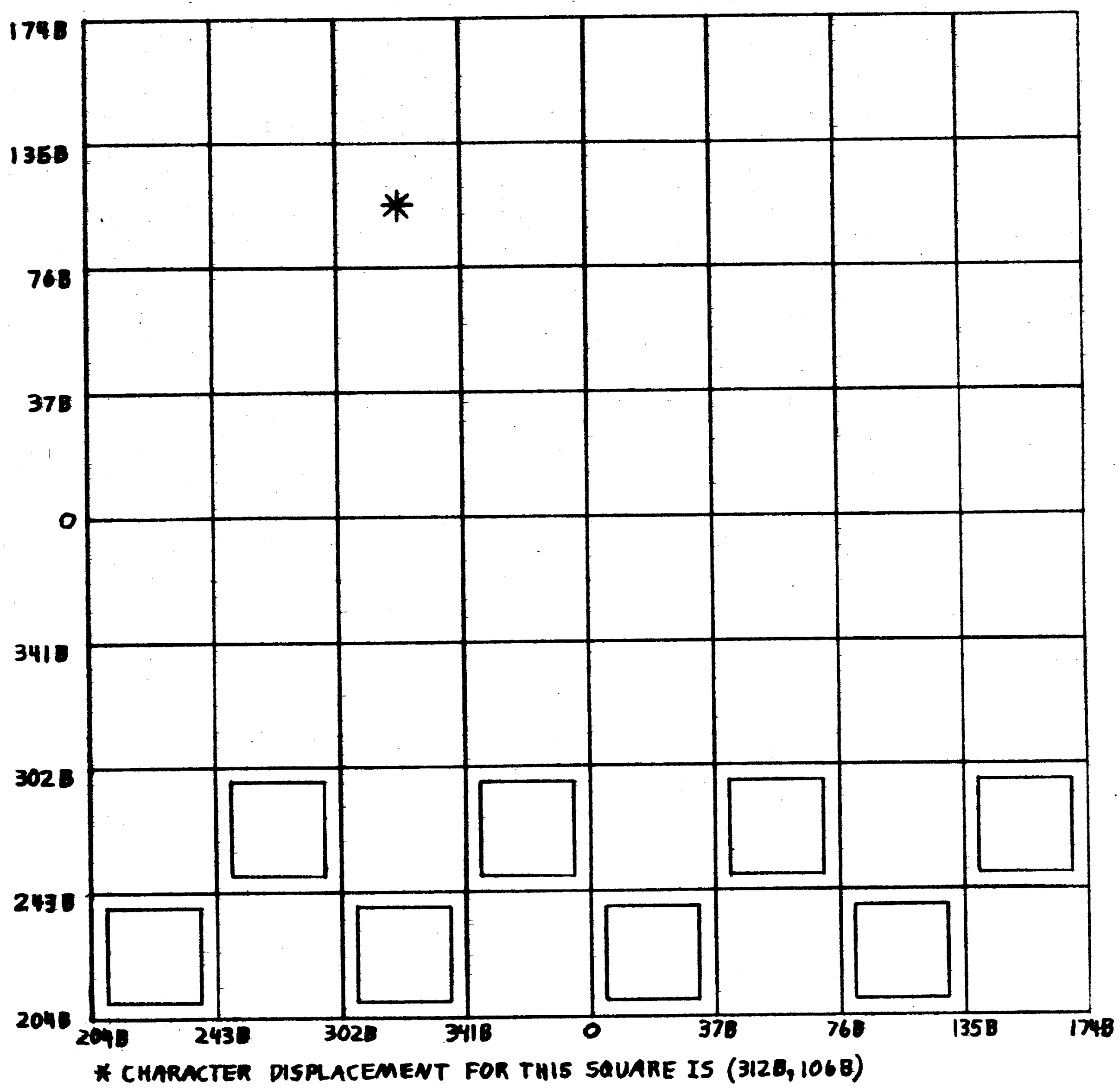


Fig. 1 Chess Board Display Coordinates

```
*       CHESSBOARD DISPLAY

XMOV    EQU 10B
YMOV    EQU 11B
XSTOR   EQU 12B
YDRAW   EQU 13B
MINXY   EQU 14B
MINSZ   EQU 15B

        ORG 30000B

CHESS   LAI 377B         SET MINOR SYSTEM
        OUT MINSZ         FOR MAX DEFLECTION
LOOP    SHL GDISPT       GRAPH EDIT TABLE
        CAL EDGRPH       DRAW BOARD
        SHL CDISPT       CHAR EDIT TABLE
        CAL EDCHAR       DRAW PIECES
        JMP LOOP         REFRESH DISPLAY

*                        ENTER WITH HL SET
*                         TO GDISPT
EDGRPH  LAM              A=GRAPH ADDRESS
        CPI 377B         CHECK FOR END FLAG
        RTZ              RETURN IF SO
        INL              BUMP TABLE INDEX
        LDM              LOAD X DISPLACEMENT
        INL              BUMP TABLE INDEX
        LEM              LOAD Y DISPLACEMENT
        LBL              SAVE TABLE INDEX
        LLA              SET L TO GRAPH
*                         ADDRESS
        CAL GRAPH        DRAW GRAPH
        LLB              RESTORE TABLE INDEX
        INL              BUMP INDEX
        JMP EDGRPH       REPEAT

*       GRAPHICS DRAW SUBROUTINE
*       ENTER WITH XY DISPLACEMENT IN DE
*       ENTER WITH GRAPHICS ADDRESS IN HL

GRAPH   LCM              GET COORD COUNT
MOVE    INL              BUMP TO NEXT BYTE
        LAM              GET X COORD
        ADD              ADD X DISPLACEMENT
        OUT XMOV         MOV X WITH BEAM OFF
        INL              BUMP TO NEXT BYTE
        LAM              GET Y COORD
        ADE              ADD Y DISPLACEMENT
        OUT YMOV         MOV Y WITH BEAM OFF
DRAW    DCC              DECREMENT COUNT
        RTZ               AND RETURN IF DONE
        INL              BUMP TO NEXT BYTE
        LAM              GET X COORD
        CPI 200B         CHECK BEAM OFF FLAG
        JTZ MOVE         JUMP ON FLAG
        ADD              ADD X DISPLACEMENT
        OUT XSTOR        STORE X IN BUFFER
        INL              BUMP TO NEXT BYTE
        LAM              GET Y COORD
        ADE              ADD Y DISPLACEMENT
        OUT YDRAW        DRAW LINE TO (X,Y)
        JMP DRAW         LOOP
```

```
*               ENTER WITH HL SET TO
EDCHAR  LBM              GET TABLE C
CTOP    INL              BUMP TABLE
        LAM              LOAD CHAR X
        OUT XMOV         SET X POSIT
        INL              BUMP TABLE
        LAM              LOAD CHAR Y
        OUT YMOV         SET Y POSITI
        XRA              A=0
        INL              BUMP TABLE I
        LDL              SAVE TABLE I
        ADM              LOAD CHAR AD
        JFS CNX          JUMP IF L<20
        XRI 200B         SUBTRACT 200
        LLI 0            BLACK BASE AI
        LCA              SAVE A
        CAL CHAR         DRAW BLACK BA
        LAC              RESTORE A
CNX     LLA              LOAD CHAR ADD
        CAL CHAR         DRAW CHAR
        LLD              RESTORE TABLE
        DCB              DECREASE TABLE
        JFZ CTOP         GET NEXT CHAR
        RET              RETURN

*       ENTER WITH HL SET TO CHARACT
CHAR    XRA              A=0
        OUT MINXY        SET MINOR TO 0
        DCL              CANCEL NEXT STI
CHAR1   INL              BUMP LIST INDEX
        ADM              FETCH STROKE, I
        OUT MINXY        OUTPUT IT
        JFS CHAR1        LOOP IF NO FLAG
        RET              RETURN IF END O
*                         LIST

*       GRAPHICS SET
HORZ    DEF 6            3 HORIZONTAL LIN
        DEF 204B,204B,174B,204B
        DEF 200B
        DEF 204B,243B,174B,243B
        DEF 200B
        DEF 204B,302B,174B,302B
VERT    DEF 6            3 VERTICAL LINES
        DEF 204B,204B,204B,174B
        DEF 200B
        DEF 243B,204B,243B,174B
        DEF 200B
        DEF 302B,204B,302B,174B
CHK     DEF 20           1 ROW OF CHECKS
        DEF 002B,002B,002B,035B
        DEF 035B,035B,035B,002B
        DEF 002B,002B
        DEF 200B
        DEF 100B,002B,100B,035B
        DEF 133B,035B,133B,002B
        DEF 100B,002B
        DEF 200B
        DEF 176B,002B,176B,035B
        DEF 231B,035B,231B,002B
        DEF 176B,002B
        DEF 200B
        DEF 274B,002B,274B,035B
        DEF 327B,035B,327B,002B
        DEF 274B,002B
```

```
*       EDGRPH DATA TABLE
GDISPT DEF L(HORZ),000B,000B
       DEF L(HORZ),000B,135B
       DEF L(HORZ),000B,272B
       DEF L(VERT),000B,000B
       DEF L(VERT),135B,000B
       DEF L(VERT),272B,000B
       DEF L(CHK),204B,204B
       DEF L(CHK),243B,243B
       DEF L(CHK),204B,302B
       DEF L(CHK),243B,341B
       DEF L(CHK),204B,000B
       DEF L(CHK),243B,037B
       DEF L(CHK),204B,076B
       DEF L(CHK),243B,135B
       DEF 377B       END OF TABLE FLAG

       ORG 30400B     NEXT PAGE OF MEMORY
*                     CHARACTER SET
BK     DEF 111B       BLACK BASE
       DEF 120B-111B,131B-120B
       DEF 140B-131B,151B-140B
       DEF 160B-151B,171B-160B
       DEF 070B-171B,161B-070B
       DEF 150B-161B,141B-150B
       DEF 130B-141B,121B-130B
       DEF 110B-121B,301B-110B
PN     DEF 101B       PAWN
       DEF 121B-101B,134B-121B
       DEF 125B-134B,126B-125B
       DEF 137B-126B,147B-137B
       DEF 156B-147B,155B-156B
       DEF 144B-155B,151B-144B
       DEF 171B-151B,170B-171B
       DEF 300B-170B
BP     DEF 101B       BISHOP
       DEF 121B-101B,126B-121B
       DEF 137B-126B,147B-137B
       DEF 156B-147B,134B-156B
       DEF 155B-134B,151B-155B
       DEF 171B-151B,170B-171B
       DEF 300B-170B
RK     DEF 101B       ROOK
       DEF 121B-101B,125B-121B
       DEF 115B-125B,117B-115B
       DEF 127B-117B,126B-127B
       DEF 136B-126B,137B-136B
       DEF 147B-137B,146B-147B
       DEF 156B-146B,157B-156B
       DEF 167B-157B,165B-167B
       DEF 155B-165B,151B-155B
       DEF 171B-151B,170B-171B
       DEF 300B-170B
QN     DEF 101B       QUEEN
       DEF 121B-101B,124B-121B
       DEF 107B-124B,125B-107B
       DEF 117B-125B,135B-117B
       DEF 137B-135B,145B-137B
       DEF 157B-145B,155B-157B
       DEF 177B-155B,154B-177B
       DEF 151B-154B,171B-151B
       DEF 170B-171B,300B-170B
NT     DEF 101B       KNIGHT
       DEF 121B-101B,115B-121B
       DEF 127B-115B,147B-127B
       DEF 175B-147B,174B-175B
```

```
       DEF 163B-174B,154B-163B
       DEF 144B-154B,151B-144B
       DEF 171B-151B,170B-171B
       DEF 300B-170B
KG     DEF 101B       KING
       DEF 121B-101B,123B-121B
       DEF 114B-123B,125B-114B
       DEF 106B-125B,127B-106B
       DEF 157B-127B,176B-157B
       DEF 155B-176B,164B-155B
       DEF 153B-151B,151B-153B
       DEF 171B-151B,170B-171B
       DEF 300B-170B

       ORG 30600B     NEXT HALF-PAGE
*                     EDCHAR DATA TABLE
CDISPT DEF 32
       DEF 214B,253B QR2
       DEF L(PN)      WHITE PAWN
       DEF 253B,253B QN2
       DEF L(PN)      WHITE PAWN
       DEF 312B,253B QB2
       DEF L(PN)      WHITE PAWN
       DEF 351B,253B Q2
       DEF L(PN)      WHITE PAWN
       DEF 010B,253B K2
       DEF 1(PN)      WHITE PAWN
       DEF 047B,253B KB2
       DEF L(PN)      WHITE PAWN
       DEF 106B,253B KN2
       DEF L(PN)      WHITE PAWN
       DEF 145B,253B KR2
       DEF L(PN)      WHITE PAWN
       DEF 214B,106B QR7
       DEF L(PN)+200B BLACK PAWN
       DEF 253B,106B QN7
       DEF L(PN)+200B BLACK PAWN
       DEF 312B,106B QB7
       DEF L(PN)+200B BLACK PAWN
       DEF 351B,106B Q7
       DEF L(PN)+200B BLACK PAWN
       DEF 010B,106B K7
       DEF L(PN)+200B BLACK PAWN
       DEF 047B,106B KB7
       DEF L(PN)+200B BLACK PAWN
       DEF 106B,106B KN7
       DEF L(PN)+200B BLACK PAWN
       DEF 145B,106B KR7
       DEF L(PN)+200B BLACK PAWN
       DEF 214B,214B QR1
       DEF L(RK)      WHITE ROOK
       DEF 145B,214B KR1
       DEF L(RK)      WHITE ROOK
       DEF 214B,145B QR8
       DEF L(RK)+200B BLACK ROOK
       DEF 145B,145B KR8
       DEF L(RK)+200B BLACK ROOK
       DEF 253B,214B QN1
       DEF L(NT)      WHITE KNIGHT
       DEF 106B,214B KN1
       DEF (NT)       WHITE KNIGHT
       DEF 253B,145B QN8
       DEF L(NT)+200B BLACK KNIGHT
       DEF 106B,145B KN8
       DEF L(NT)+200B BLACK KNIGHT
       DEF 312B,214B QB1
```

```
DEF L(BP)     WHITE BISHOP
DEF 047B,214B KB1
DEF L(BP)     WHITE BISHOP
DEF 312B,145B QB8
DEF L(BP)+200B BLACK BISHOP
DEF 047B,145B KB8
DEF L(BP)+200B BLACK BISHOP
DEF 351B,214B Q1
DEF L(QN)     WHITE QUEEN
DEF 351B,145B Q8
DEF 1(QN)+200B BLACK QUEEN
DEF 010B,214B K1
DEF L(KG)     WHITE KING
DEF 010B,145B K8
DEF L(KG)+200B BLACK KING

END CHESS
```

TRICKS AND TECHNIQUES

This month's programming technique was submitted by Terry F. Ritter, Vice President, DANTCO, 2524B Glen Springs way, Austin, TX. 78741. Readers are encouraged to submit their own techniques or to comment on others that have been published.

In Vol. 1 No. 1, you invited submission of programming tricks and techniques; this is in response to that invitation, although it is more on the order of a systems technique than a trick.

I know from your examples that most, if not all of you are Assembly Language oriented. I, on the other hand, am quite convinced that assemblers, in general, are the most inefficient languages known, and are far less efficient even than machine language in program development. Let me save the detailed arguments for later, but one advantage that machine-language programming has over assembler is the availability of redundant machine codes. Examination of the 8008 instruction set will show several redundant codes; i.e., the 1X4 JMP, the 1X6 CAL, the 0X7 RET, and the 3XY (X=Y=7) NOP.

The principle problem with any machine code program, whether assembler-produced or directly coded, is that it must be located at a particular position in memory for proper operation. That is, there is no particular problem in loading the program anywhere desired; the problem is in changing the jump addresses for the program to correspond to the new location. This problem is partially solved by use of a relocatable system, but still lingers during program modification.

My approach is to use a particular machine code to indicate: 1) the start of a program, 2) where it was last correctly located in memory, and 3) a two or more byte program ID. Another redundant return code, of course, indicates the end of a particular program, group of programs, or programs and data which are desired to be grouped. The RETURN code is standardized so that an executive may call the program, then resume control after termination.

This approach allows complex keyboard editing of the machine code. A particular Executive command could cause a software system to insert a NOP and bubble up the program(s) until the end-of-program code was reached being careful not to bubble into another program without moving it also. It would then search from the beginning of the program (or all of memory if desired) for jumps pointing to the affected (moved) program area and suitably modify each. A similar command could cause deletion of a machine-code step (something not easily accomplished in certain delays where any NOP would still constitute a machine-cycle delay).

Labelling and structuring of variables also seems possible by using redundant codes, as well as the passing of variables through high-level language subroutine calls.

Example:

```
  ┌── 124  Indicates start of pro-
  │        gram system.
  │   AAA  Identifies valid starting
  │   AAA  location.
JUMP  LLL  Program label (ID bytes)
  │   LLL
  └─> XXX  Program system
      XXX
       .
      XXX
      027  Indicates end of program
           system
```

INTERFACING A 5 LEVEL TELEPRINTER Part 2 by Steve Stallings

In our last issue we described the hardware needed to interface a five level teleprinter to your 8008 system. This article completes the interface with the needed running and testing software (courtesy of Richard Smith). The program consists of six parts.

The first part, Equates, must be custom tailored to your system. CNTREG is the equate for the output port that the teleprinter is to use. CNTTO designates which bit of the eight data bits is to be used. Setting CNTTO to 001B corresponds to using bit 0 (least significant bit). Other bits in the same port may be used for other purposes, however, one must realize that the teleprinter routine must be modified so that it does not cause problems with the devices using the other bits and vice-versa. TTDY1 specifies the delay count for one bit time. The value shown, 316B, corresponds to the use of an 8008-1 running with a state time of 2.5 microseconds and a 100 word per minute teleprinter. TTDY2 sets the delay time for the fractional stop bit. See the chart in Fig. 1 for the values of TTDY1 and TTDY2 needed for typical systems. PGAR and DTAR tell the assembler what memory areas to use for the program and temporary data storage.

Teletype Demo Program calls the initialization routine and then generates the ripple pattern text. If other patterns are desired, they may be put at MSG in place of the ripple pattern data. This routine works entirely with ASCII.

Teletype Initialization Rountine is used to get the teletype case shift in a known state, and to hold the teletype in a mark state until further data is sent.

Baudot Teletype Output Routine accepts Baudot characters and does the actual timing and transmission of the characters. If you wish to write your other programs to converse in Baudot rather than ASCII, you may call this routine directly.

ASCII Teletype Output Routine For Baudot Machine is a special routine to compensate for the differences between ASCII and Baudot other than character codes. It takes care of the case shifts on characters and suppressing unneeded case shifts for dual case commands (space, CR, LF, and NULL). This routine accepts Baudot with an extra bit to specify case. You may call the routine directly for output if you wish to use the special 6 bit code it requires.

ASCII to Baudot Translate Routine does just what its name says. Its input is ASCII and its output is the special 6 bit code required by the ASCII output routine.

Figure 2 shows a sample of the ripple pattern output produced by all of the above routines used together.

Fig. 1	8008 Standard 4 uS per state 500 kHz clock		8008-1 2.5 uS per state 800 kHz clock	
	TTDY1	TTDY2	TTDY1	TTDY2
60 WPM	322B	132B	Requires program delay loop change	
100 WPM	176B	066B	312B	127B

Fig. 2

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0A
BCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0A
CDEFGHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0AB
DEFGHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0ABC
EFGHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0ABCD
FGHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0ABCDE
GHIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0ABCDEF
HIJKLMNOPQRSTUVWXYZ0123456789-?:$!&'().,;/"A1B2C3D4E5F6G7H8I9J0ABCDEFG
```

```
*       BAUDOT TELETYPE RIPPLE
*       PATTERN DEMO PROGRAM

*       EQUATES-SEE TEXT FOR DETAILS
CNTREG EQU 026B       CONTROL REGISTER
CNTTO  EQU 001B       TTY SERIAL OUT BIT
TTDY1  EQU 316B       DELAY CNT FOR 1 BIT
TTDY2  EQU 130B       DELAY CNT FOR .42
*                      BIT
PGAR   EQU 30000B     PROGRAM AREA
DTAR   EQU 31000B     DATA AREA

*       TELETYPE DEMO PROGRAM

       ORG PGAR       SET THE ORIGIN
DEMO   LDI H(MSG-1)   SET D AND E TO ADDR
       LEI L(MSG-1)    THE MESSAGE-1
       LHI H(DTAR)    SET H TO ADDRESS
*                      THE DATA AREA
       CAL TTINT      INITIALIZE THE TTY
DEMO1  CAL INCR       POINT DE TO NEXT CH
       LBI MSGLEN     SET LOOP COUNT IN B
DEMO2  LHD            TRANSFER D AND E TO
       LLE             H AND L
       LAM            LOAD THE CURRENT CH
       LHI H(DTAR)    RESTORE HL TO ADDR
*                      THE DATA AREA
       CAL TTOUT      OUTPUT THE CHAR
       CAL INCR       POINT DE TO NEXT CH
       DCB            DECR LOOP COUNT
       JFZ DEMO2      GO FOR NEXT CH IF
*                      NOT ZERO
       LAI 015B       OUTPUT A CARRIAGE
       CAL TTOUT       RETURN
       LAI 012B       OUTPUT A LINE FEED
       CAL TTOUT
       JMP DEMO1      GO FOR NEXT CHAR

INCR   INE            DOUBLE INCREMENT D
       JFZ *+4         AND E BY 1
       IND
       LAE            RETURN IF NOT END
       SUI L(MSGEND)   OF MESSAGE
       LAD
       SBI H(MSGEND)
       RTC
       LDI H(MSG)     RESET D AND E TO
       LEI L(MSG)      THE START OF MSG
       RET             AND RETURN

MSG    DEF 'ABCDEFGHIJKLMNOPQRSTUVWXYZ'
       DEF '0123456789-?:$!&''().,;/"'
       DEF 'A1B2C3D4E5F6G7H8I9J0'
MSGEND EQU *
MSGLEN EQU MSGEND-MSG

*       TELETYPE INITIALIZATION ROUTINE

TTINT  LLI L(TTCSF)   SET THE CASE SHIFT
       LMI 0           FLAG TO LTRS
       LAI CNTTO      SEND A STOP BIT TO
       OUT CNTREG      THE TELETYPE
       LAI 8          DELAY FOR ONE CHAR
TTINT1 LLI TTDLY1      TIME
TTINT2 LAA
```

```
       LAA
       DCL
       JFZ TTINT2
       SUI 1
       JFZ TTINT1
       LAI 037B       OUTPUT A LTRS CODE
       CAL TTOUX
       RET            RETURN

*       BAUDOT TELETYPE OUTPUT ROUTINE

TTOUX  NDI 037B       ISOLATE THE BAUDOT
       ADA             CHAR AND SHIFT
       ADA             IT INTO POSITION
       ORI 002B       ADD A STOP BIT TO
*                      THE CHARACTER
       LHI 7          SET BIT CNT IN H
TTOUX1 ADA            SET THE CURRENT BIT
       LLA             IN THE CARRY AND
*                      SAVE THE OTHER
*                      BITS IN L
       SBA            OUTPUT THE CURRENT
       NDI CNTTO       BIT TO THE SERIAL
       OUT CNTREG      TELETYPE LINE
       LAL            RELOAD THE OTHER
*                      BITS INTO A
       LLI TTDLY1     LOAD THE DELAY CNT
TTOUX2 LAA             INTO L AND DELAY
       LAA             ONE BIT TIME
       DCL
       JFZ TTOUX2
       DCH            DECREMENT THE BIT
       JFZ TTOUX1      CNT AND LOOP IF
*                      NOT ZERO
       LLI TTDLY2     LOAD THE DELAY CNT
TTOUX3 LAA             INTO L AND DELAY
       LAA             FOR THE REMAINDER
       DCL             OF THE STOP BIT
       JFZ TTOUX3
       LHI H(DTAR)    RESTORE H TO ADDR
       RET             THE DATA AREA AND
*                      RETURN

*       ASCII TELETYPE OUTPUT ROUTINE FOR
*       BAUDOT MACHINE

TTOUT  CAL CHATB      TRANSLATE ASCII IN
*                      A TO BAUDOT IN A
       ORA            BRANCH IF IT IS A
       JTZ TTOUT3      NULL
       CPI 002B       BRANCH IF IT IS A
       JTZ TTOUT3      LINE FEED
       CPI 004B       BRANCH IF IT IS A
       JTZ TTOUT3      SPACE
       CPI 010B       BRANCH IF IT IS A
       JTZ TTOUT3      CARRIAGE RETURN
       LLI L(TTSAV1)  SAVE CHAR IN TTSAV1
       LMA
       LLI L(TTCSF)   BRANCH IF TTY IS IN
       XRM             CORRECT CASE SHIFT
       NDI 040B
       JTZ TTOUT2
       LAM            FLIP THE CASE SHIFT
       XRI 040B        FLAG
```

```
        LMA
        LAI 037B        LOAD THE CORRECT
        JTZ TTOUT1       SHIFT CODE INTO A
        LAI 033B
TTOUT1  CAL TTOUX       OUTPUT THE SHIFT
*                        CODE
TTOUT2  LLI L(TTSAV1)   RELOAD THE CHAR
        LAM              INTO A
TTOUT3  CAL TTOUX       OUTPUT THE CHAR
        RET              AND RETURN

*       ASCII TO BAUDOT TRANSLATE ROUTINE

CHATB   NDI 177B        ZAP THE PARITY BIT
        CPI 177B        REPLACE A RUB-OUT
        JFZ CHATB1       WITH A NULL
        XRA
CHATB1  CPI 'A'+040B    CONVERT A LOWER
        JTC CHATB2       LETTER TO UPPER
        CPI 'Z'+040B     CASE
        JFC CHATB2
        SUI 040B
CHATB2  LHI H(BDTAS-1)  SET HL TO ADDRESS
        LLI L(BDTAS-1)   BAUDOT TO ASCII
*                        TRANSLATE TABLE-1
CHATB3  INL             BUMP UP HL TO THE
        JFZ *+4          NEXT TABLE ENTRY
        INH
        XRM             BRANCH IF MATCH
        JTZ CHATB4       BETWEEN ENTRY
*                        AND ASCII CHAR
        JTS CHATB5      BRANCH IF END
        XRM             RESTORE A AND LOOP
        JMP CHATB3
CHATB4  LAL             LOAD L INTO A AND
        SUI L(BDTAS)     COMPUTE THE BAUDOT
*                        CHARACTER
        LHI H(DTAR)     RESTORE H TO ADDR
        RET              THE DATA AREA AND
*                        RETURN
```

```
CHATB5  XRM             RESTORE THE ASCII
        LHI H(DTAR)      CHARACTER IN A AND
*                        H TO ADDR THE DATA
*                        AREA
        CPI 040B        LOAD A BAUDOT NULL
        LAI 0            INTO A AND RETURN
*                        IF THE ASCII CHAR
        RTC              WAS A CONTROL CODE
        LAI 063B        LOAD A BAUDOT '?'
        RET              INTO A AND RETURN

*       BAUDOT TO ASCII TRANSLATE TABLE

BDTAS   EQU *           SET ADDR OF BDTAS
        DEF 000B,124B,015B,117B  00  LTRS
        DEF 040B,110B,116B,115B  04
        DEF 012B,114B,122B,107B  10
        DEF 111B,120B,103B,126B  14
        DEF 105B,132B,104B,102B  20
        DEF 123B,131B,106B,130B  24
        DEF 101B,127B,112B,000B  30
        DEF 125B,121B,113B,000B  34

        DEF 000B,065B,015B,071B  00  FIGS
        DEF 040B,043B,054B,056B  04
        DEF 012B,051B,064B,046B  10
        DEF 070B,060B,072B,073B  14
        DEF 063B,042B,044B,077B  20
        DEF 007B,066B,041B,057B  24
        DEF 055B,062B,047B,000B  30
        DEF 067B,061B,050B,000B  34

*       DATA STORAGE

        ORG DTAR        SET THE ORIGIN TO
*                        THE DATA AREA
TTCSF   DST 1           TELETYPE SHIFT FLAG
*                        0=LTRS 40B=FIGS
TTSAV1  DST 1           TELETYPE TEMPORARY
*                        STORAGE
        END DEMO
```

A CHEAP MARK SENSE CARD READER

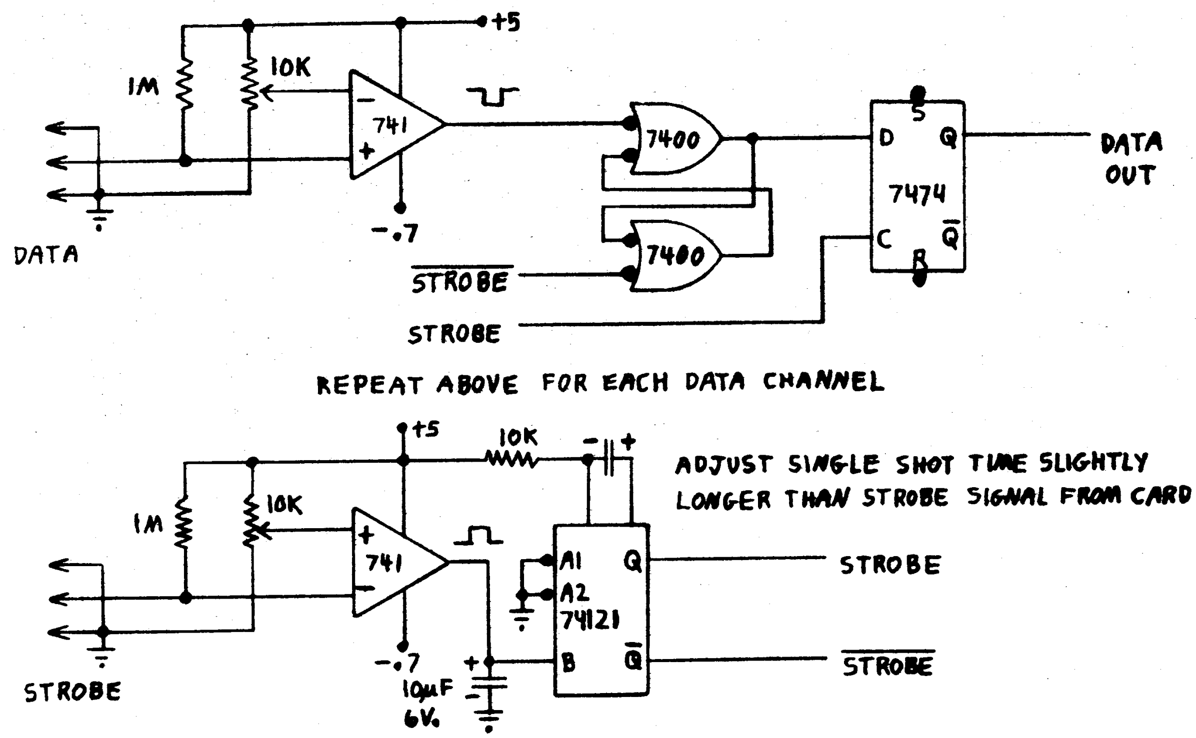
by Joe Tolbert

John B. Kramer, 3400 Old Jonesboro Road, Hapeville, GA 30354 (Ph. 761-6030 after 5 PM.) is selling a card reader made for Western Union for $5 plus shipping for 12 pounds (your post office can tell you how much that will be). What you get for your money is a new card transport assembly driven by a 110 volt 60Hz motor with a set of switches to indicate things like "cards in hopper" etc., a couple of indicator lamps and pushbuttons, all brought out to a minature connector. These can be wired together with a 110 volt relay to give "start reading when start switch is operated", and "run until out of cards or reset is operated". A pair of gears, not supplied, set the speed of the reader. If you can't find gears to fit in your junk box, try rubber tires from a child's toy. With one inch diameter gears, it reads about 10 cards a minute.

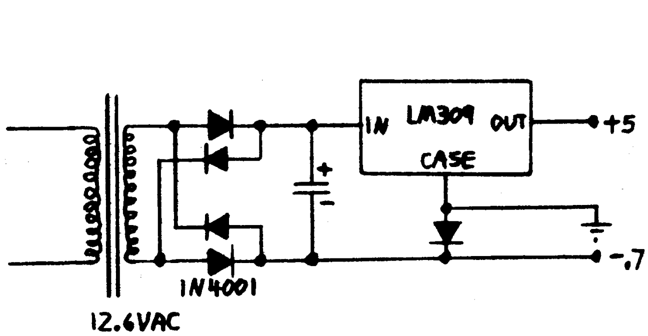
The reader comes with a "stylus assembly" of 40 spring loaded contacts brought out individually to another minature jack. These contacts could be used to sense holes in the card by allowing them to contact the frame below the card. Although the brush centers don't exactly match IBM card hole centers, you are assured of at least one of them making good, solid contact through each hole. I have designed a system to use the reader for reading homemade mark-sense cards. It converts answers on a test (any number out of 5) into valid ASCII characters which are sent to a tape punch so that a "call-a-computer" terminal can be used to grade tests. This same idea could be used for 8 data channels for loading programs, or possibly up to 16 without too much problem.

The sensing circuit shown in the figures can be adjusted to work with up to a light line from a #2H pencil. An IBM electrographic pencil is not needed. This also means that you can't use carbon base ink to print the card forms.

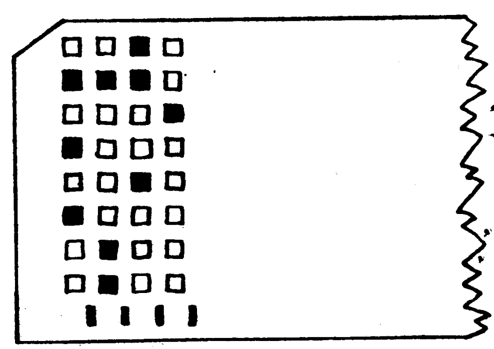
When a card starts into the reader a strobe pulse clears the 7400 S-R flip-flops and transfers what was in them to the 7474's and output lines. As marks are sensed in the data channels the + input of the op-amp goes low. When the voltage at the + input goes lower than that at the - input as set by the sensitivity control, the output voltage swings from about 5 volts to about 0 volts, pulling down the input of the 7400 cross connected gates and storing the information until a strobe pulse comes along. Please note that the op-amp is tied from +5 volts to -.7 volts. The -.7 volts can be obtained by passing current through a silicon diode. The -.7 volts is required so that the op-amp is guaranteed to pull down the TTL.



Mark Sense Circuitry



Example Power Supply



Sample Mark Sense Data

Card for 8 Bits Plus Strobe

SURPLUS SUMMARY

This month surplus information abounds. To lead off we have a special report contributed by Jerry R. Ledbetter.

Surplus In East Texas

Those readers of TCH who live in east Texas are fortunate in that there are many surplus places around Dallas and Houston. The unfortunate part is that not all of them are easy to find. Even though I had time for only a few of them I bought more useful electronic parts than I could cram in my suitcase. Here are several places that are worth looking up if you're in the area.

Special Sales Co.
12400 N. Central Expressway
Dallas, Texas 75208

This is the most commercial of the places that I have visited, but Frank Robertson (the owner) does keep a good stock of electronic surplus. There are no great buys here, but many good ones such as alpha-numeric keyboards with ASCII encoding for $25 and used but good MAN-3 displays for 30¢ each. Frank does back up his stock with a replacement guarentee, but doesn't like to "bargain". He carries many transistors and IC's both new and used and one of the largest selections of nuts and bolts hardware I've seen. One catch is that he does not do mail order business.

The next place is not a surplus house, but a scrap disposal agency for the Collins Radio Company. They have no address and about all I can tell you is that they are on Hilltop Rd. in Richardson, Texas which is a north suburb of Dallas. I stumbled upon this place one normal day when I was hopelessly lost. They have lots of parts (on circuit boards) and had some disk surfaces. I found plenty of usable parts there including some keyboard keys.

Another place in Dallas that's worth checking into is:

Altaj Electronics
Box 38544
Dallas, Texas 75238
Ph. 214/271-6440

They advertise in some of the larger magazines and have some very good prices. They will mail items but will not accept COD orders.

In Houston:

Radio Electronics & Supplies
1508 McKinney Ave.
Houston, texas

have some good buys from time to time. When I was there they didn't have very much that would have been useful to TCH readers except the usual assortment of resistors and caps, etc. Although they lean primarily toward HAMs this is one of those places where you never know what will turn up. Look into them if you're in Houston.

There are many more places in this area of Texas, but no single place would satisfy every need. Some great buys turn up in unpredictable places, like an Augat prototype board with 300 wirewrap IC sockets that I bought for $10 from a guy who didn't know what it was. Personally I miss the days of scrounging around in the rain in a dirty scrap yard and finding only one single 2N3055 under 4 tons of metal. Now that's surplus hunting!

Now some mail-orderable items which we have run accross during the past month.

Mini-Micro Mart
C/O syracuse Management Services
1618 James Street
Syracuse, N.Y. 13203
Ph. 315/422-4467

Maury Goldberg of the Mini-Micro Mart has two exceptional offerings, however both are sold as OEM-type assemblies and require a fair amount of knowledge to fully interface. The first item is a digital cassette tape drive made by ICP. The second is a 132 column 30cps printer made by Univac (same as in 727 terminal). Both units are either new or very slightly used and both are available for about $200. Contact Maury for details.

Tri-Tek, Inc.
Box 14206
Phoenix, ariz. 85063
Ph. 602/931-6949

Tri-Tek's latest catalog contains two things of potential interest to a computer hobbyist. The first is a fine selection of large electrolytic filter caps.

Example: 60,000 mFd at 20 volts for $2. Four of these would make an excellent filter bank for a power supply for a graphics display like TCH's. Also available are General Instrument UART's (Universal Asynchronous Receiver-Transmitter) for $13.95. While this price is not fantastic, it is reasonable and UART's aren't advertized often.

Fair Radio Sales
1016 East Eureka Street
Box 1105
Lima, OH. 45802
Ph. 419/223-2196

Fair Radio is a good source of CRT's for a graphics display. You can get a 12SP7 CRT for $15 or a radar display assembly which nets you a 12DP7A, a nice chassis, and the orange filter needed for the P7 phosphor, all for 22.95. Unfortunately the yoke is not suitable for graphics.

Bill Godbout Electronics
Box 2673
Oakland Airport, CA 94614
Ph. 415/357-7007

Corky Deeds of Godbout Electronics called TCH to let us know of a special offer he would make to TCH subscribers. The offer is one 8008 CPU by Intel, eight 2102 RAM's, one 5203 U.V. erasable PROM, all for $100. Thats all the makings of a great system! Be sure to mention TCH.

PEOPLE'S COMPUTER COMPANY

We at TCH are printing the following special offer from People's Computer Company to our subscribers in return for similar mention in the PCC newspaper.

Send a letter mentioning TCH and $3 cash, check, or money order for a one-year subscription to People's Computer Company, our newspaper about computers for FUN! PCC is 28 pages tabloid (11"X17") published 5 or more times a year. It contains programming tips, book reviews, and lots of computer games. Regular subscriptions are $5 so here is your chance to save two bucks. Send to PCC, Box 310, Menlo Park, CA 94025. This offer expires March 1, 1975.

CLASSIFIED ADS

There is no charge for classified ads in TCH but they must pertain to the general area of computers or electronics, and must be submitted by a non-commercial subscriber. Feel free to use classified ads to buy, sell, trade, seek information, announce meetings, or for any other worthwhile purpose. Please submit ads on seperate sheets of paper and include name and address and/or phone number. Please keep length down to 10 lines or less.

WANTED: Game and puzzle software for computers. Will exchange picture tapes also. Fred Hatfield, 1372 Grandview Ave, Columbus, OH 43212

FOR SALE: Keyboards, by Microswitch, with documentation and cover $25. 74S181's $2.50. I gotta clear out my room. I have a lot of stuff to sell, send a SASE for a list. I have some memories, 2602's @ $8, core, and other types. Gary Coleman, 530 Glaser Bldg., 11900 Carlton Rd., Cleveland, OH 44106

WANTED: Source of P C boards for the TV Typewriter, also need information on Western Electric 202-C Dataphone. Have 15 National MM5058 shift registers at $5 each. Ed Lankford, 511 Purnell Dr., Nashville, TN 37211

WANTED: Digital Equipment Company modules for PDP/8 series computers. Also, software, manuals for obsolete machines. I am interested in obtaining cryptographic items and publications. Fred Hatfield, Computer Data Systems, Inc., 1372 Grandview Ave., Columbus, OH 43212, Ph. 614/486-0677

THE POWER OF AN 8008

Last month in this space we described the system that is currently being used to prepare TCH. What we failed to mention is the fact that the system belongs to and was designed by the employer of one of the staff members. Since the system will be a commercial product, it will not be possible to elaborate on the design, software, or capabilities of the system at this time. TCH will be developing its own system soon and may publish some aspects of it if interest warrants.