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New Horizons

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This newsletter is published jointly by OH-MI-TI and New Horizons TI-99/4A Home Computer Users' Groups. Material may be reproduced without permission provided the author and source are acknowledged. For more information concerning TI Users' Groups in the Northwest Ohio area, contact:

Robert Peters President, OH-MI-TI 225 S. Wheeling Oregon, OH 43616 (419) 693-7934	//////////////////////////////////// (419) 385-7484 TICOMM BBS >>> 24-HRS <<< SYSOPS > TURNER - MILLS <	Don Turner President, New Horizons 5533 Fleet Street Toledo, OH 43615 (419) 537-1454
Meeting; 13 Nov '87 Fri Oregon #2 Fire Station		Meeting; 14 Nov '87 Sat Unity Church Secor Road

THE NEWSLETTER STAFF

Roger & Judy Feinauer

LOCAL CONTRIBUTIONS BY;

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NORTHWEST OHIO



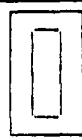
99ER NEWS

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THE PRESIDENTS PAGE

PRESIDENT'S CORNER
OH-MI-TI
By Bob Peters



NEW HORIZON NEWS
By Don Turner

I would like to urge you to attend this months meeting we will be deciding the fate of our club. Should we merge with New Horizons because of the declining memberships in both clubs or should we try to get a larger membership through a drive to do that or should we just have a thing at someones home? We should decide now because if we do want to stay together as a club then we will have nominations from the floor for officers for the next year

We will be having door prizes for the software that the club has bought in the last two months at this meeting Certificate Maker 99, CSGD 5 an 6, and CSGD cataloger. If you want a chance at winning some excellent software dont miss the meeting. You can't win if you are not there. Kent Sheets will demo . Certificate Maker 99.

There will be a report on the Chicago Fair by the various members who went. The meeting will be held at the Oregon Fire-Station #2 at 7:00 pm. on Friday Nov. 13. **SEE YOU THERE!**

IT'S November already, this year has gone by quite fast. This month's meeting will be held on the 14th at 2:00 pm. We will have door prizes to give away this month. (I fixed the drawing program.)

We have a lot to accomplish this month during the meeting, so please attend. Some of the things we have to do is nominate new officers for 1988. We also have to put a Christmas party committee together. We will be hashing out some old business pertaining to joining both users groups together. There are other items that will be worked out at the meeting wich requires your attendance.

This month there will be two new club disks available one of which is an easy to use label maker that utilizes CSGD 5x5 graphics. The label program will have over 90 graphic files to choose from. The second disk will have Extended Basic games and an excellent bar graph program.

In closing I want to remind you that we will be nominating new officers for 1988, it is important that you attend this meeting . This is your organization we need your input. Not to mention there will also be some intresting demo's this month as well.



The Graphic Labeler

Kent Sheets 10/87

OH-MI-TI

The Graphic Labeler program has been named by many as "LABELMAKER". The proper name is found in the LABEL/DOC file. This program written by Steven McWatty of Kinburn, Ont. is so easy to use, anyone, yes, even you, can print fancy custom labels. Anything from return address and address labels to content and identification labels. One of the first uses could be to help identify what program or type of programs are on that disk.

I don't have to give you the details here, except to tell you that it generates one text line of 18 characters that are double emphasized and five text lines of 22 characters. The really neat feature is that it uses the 5x5 graphics of C.S.G.D. to print almost any picture on the label. After you enter the text lines you require, it loads the 5x5 graphic to the screen for your approval. You get to see just how the label will look before you print it. Also you can change the text or the graphics without changing the other. Up to 99 of the same label can be printed with just a key stroke.

It is a FREWARE PROGRAM, and copying is encouraged. Send your donations to either:

STEVEN MCWATTY
RR 1
KINBURN ONT.
KOA 2HO CANADA
or

The OTTAWA TI 99 UG
BOX 2144 STATION D
OTTAWA ONTARIO
CANADA K1P 5W3

Does anyone know were I can get some new fonts such as Christmas or the same size print as stand-ard printer print roger


EDITOR

Well guess what it finally happened . We have a news letter written entirely by our membership. Very good work people keep up the good work. I knew WE could do it together. Ok, let's think what we can write for Decembers newsletter, it will be here before you know it.

The front cover of the news letter was written using a new formatter from a program called Font Writer II. This program allows loading graphics. Ti-Artist, and Graphx picture files. Load Artist and CSGD fonts and images . It also has a TI-Writer editor and formatter. Plus a Graphics formatter that works with TI-Writer editor. Also design both Artist and CSGD fonts. And get this, design Xbasic sprites and give the sprite it's own line number. Also has it's own program image load "E/A OPT #5 loader", and much more; see it at the meeting. roger.



The editor unwinding

 The New Adventure
by
Roger Feinauer

This article will be shorter than the last. First off because my original article was lost not the computers fault but the operator's. Well that's just as well. Because I was kind of hard on Myarc. You see I have about \$180.00 worth TI-Artist related software. And at present my 9640 won't run the paint program.

Well, a call to Myarc they told me TI-Artist uses a different type of file in/out then Texas Instruments specified for there system, what ever this means. All I can say is that Front Writer II lets you use all of TI-Artist files with no problem so what's the problem.

Oh, I found a good deal on My-Paint. From a company call Dheim's I was given a phone # (319) 236-3861 but found the no. was changed to 232-6225 same area code. This is the My-paint and Mouse for \$99.00 plus \$4.00 shp. hand. not bad.

I also found that the 9640 can only have one expansion memory card. This means beyond 512k. you have two options. A modified 512 k. ramdisk for a total of 1 mg. of ram or the soon to be released 1536 k. card which will give you a total 2 mg. memory. The 1536 card should run about \$500.00 to \$750.00. High from the point of view of persons use to the 99/4A but not to the PC. community.

The such wrote about Disk/hard drive controller. Which has the capability to run four 5.25 or 3.5 disks and three 134mg. hard Disk Drives. For a total of 402mg. data storage. This controller will work on both the 99/4A and the 9640. If this wasn't enough there is also an output for tape streamer for any off the shelf tape backup systems to backup your hard drives. For a cost of \$325.00.

As far as the Horizon ram disk I haven't done much. According to Myarc they used J. Peter Roddie from on the Horizon ram disk to use instead of Ros. Well Mike Ballman ROS 7.0 for 1mg. ramdisk and 7.1 ROS will allow use to use any Horizon ram disk on the 9640. For more information call Bud Mills (419) 385-5946. Well so much for this month's article.

MERGER THOUGHTS

by Tim Taylor/M.B.

Since there needs to be some thought and discussion devoted to this topic, and since this newsletter needs new local writers, I have taken to my word processor to plunk down a few words.

Initially, when I heard how few people attend OH-NI-TI now and when I heard how many at one time attended both clubs back in the heyday of TI, I thought a merger made perfect sense.

Now, I am not so sure. Here are some of the factors influencing me away from merger:

1. Two different meeting times and days are a good benefit to preserve for people with busy schedules. As was pointed out at last month's M.B. meeting, some can only meet on a Saturday due to Friday night obligations and some work on Saturdays and can only come on a weeknight.

2. One is west side of Toledo...the other east. This is a nice option to have as well, depending on where you live.

My only suggestion is to try moving M.B. meeting to 10 AM Saturday to free up more of the day for other activities.

I would like to see regular times of joint meetings between the two clubs and joint cooperation on both software and hardware.

Whether or not you have one larger club with two meeting sites, times, and days or leave things as they are now seems immaterial to me.

It probably matters more to the officers of both clubs who may have vested interests, like maybe ego needs, to remain autonomous and independent, but cooperative.

So, the key question to me is: Could we accomplish more for the combined membership of both clubs if we merged or would that just make us too large, too rigid, or too inflexible as to doing joint projects together?

I'm not really sure what the answer to that question is, but I suspect all would be happier with two autonomous clubs and with each club then making individual alterations in their meeting times and places as their members indicate a preference by majority vote.

I didn't intent to really settle this issue in this column, but to merely provoke thought and discussion.



OH-MI-TI

Webster defines PANIC as demoralizing terror.

When is the last time you experienced panic?

The other week I sat down at my reliable TI99/4A System to write a letter. I plugged in the power strip. (I always leave it unplugged in case of lightning). Next, I switched the power strip on. I then turned on the TV, pushed the button on the PEB, and turned on the computer. Other than a little static from the TV, there was a calm quiet in the room. I had extended basic in, so I pushed the number two key twice to auto load TI-Writer.

Nothing happened!

I hit function quit and tried it again. Nothing!

All of a sudden PANIC filled that quiet room. That annoying sound of the PEB fan was not to be heard. Quickly I flipped the switch again. Quiet.

Talk about demoralizing, here the work horse of my computer system, Dead.

Still, in a panic, I called anyone from the users group that I could find at that late hour. I was hoping someone could give me a quick fix over the phone. No such luck. The recommendation was to start with the fuse and go from there

Several days later, I found 1.25 fuses and tried them in my system. Pop, three more blown fuses.

Thanks to a fellow users group member, my system is up and running again. I'm not a techie at all. There was a blown part on the card in the PEB. In less than two hours the system was fixed.

Being a member of a TI users group has many advantages.

Thanks Bud.

OH-MI-TI

An article appeared in last months newsletter with the same title as above. Did you read it? If not, go back to last months newsletter and read it before you continue here. Did you attend either TI users group meeting in October? Do you remember the appeal to consider the merger / combination / unification or whatever you want to call it of the two TI99/4A users groups in Toledo? Well, have you given it any thought?

As in all volunteer organizations, your input / feedback will determine the course of the user group. What commitments are you willing to make for your own benefit for computer knowledge and use? What days can/will you attend a users group meeting? What time of day? How far are you willing to drive? Do you prefer the 2nd or 3rd or 4th Saturday of the month? Another day of the week? Can you make it at 10:00 A.M. or 3:00 P.M. on Saturday?

If you don't care about the time or day of the week, let "SOMEONE ELSE" decide for you.

DRAWING

Kent Sheets 11/87
OH-MI-TI

OH-MI-TI users group has purchased several software packages in the last few months. These packages have either been shown or will be shown in the next few meetings. It has been decided that after the package has been shown, it will be given away at the meetings. Starting with the November meeting, several prizes will be given away. A drawing of all paid member present will be held.

Some of the recent purchases are: WRITERase, X-10 controller software, C.S.G.D. 5 and 6, and Certificate 99.

Be there, YOU could win.

THE COMPUTER CRASH

by PAUL SNEIDER
NEW HORIZONS

THIS IS NOT ABOUT A COMPUTER PROGRAM CRASHING. THE MOST AMAZING CRASH IN THE HISTORY OF THE STOCK MARKET HAPPENED ON MONDAY, OCTOBER 19, 1987 AND IT IS BEING BLAMED ON COMPUTERS.

COMPUTERS CAN MAKE LIFE MORE COMFORTABLE AND EASIER. THEY MAKE MANY TEDIOUS TASKS FASTER, MORE EFFICIENT, AND AUTOMATICALLY, WITHOUT HUMAN INTERVENTION.

COMPUTERS MONITOR THE COMPLEX AND VOLUMINOUS SPACECRAFT DATA AND CONSTANTLY ADJUST IN ORDER TO ACCOMPLISH A PREDETERMINED GOAL—SAY, LANDING ON THE MOON. COMPUTERS CAN MONITOR COMPLEX HEATING, COOLING AND SECURITY SYSTEMS IN LARGE BUILDINGS AND THEN AUTOMATICALLY ADJUST THE SYSTEM FOR COMFORT AND EFFICIENCY.

CALCULATIONS, DECISIONS, AND RESPONSE TIMES FROM A COMPUTER ARE FASTER THAN HUMANS ARE CAPABLE OF ACHIEVING. THAT IS THE MAIN REASON WE DEVELOPED COMPUTERS.

COMPUTERS DO NOT THINK OR REASON. THEY COMPLETE AUTOMATIC, PROGRAMMED RESPONSES TO CERTAIN SITUATIONS—THEY FOLLOW INSTRUCTIONS EXACTLY. THEY ARE MACHINES DOING ONLY WHAT THEY ARE PROGRAMMED TO DO.

SO IT WAS AN EASY TRANSFORMATION TO HAVE COMPUTERS MONITOR THE STOCK MARKET, FUTURES MARKET, AND THE OPTIONS MARKET AND THEN RESPOND TO PREDETERMINED GOALS. PROGRAMMED ACTIVITY IS WHEN BUY AND SELL DECISIONS ARE MADE AUTOMATICALLY BY COMPUTERS PROGRAMMED TO REACT TO CONDITIONS AND VARIOUS ACTIVITIES. FOR EXAMPLE, IF THE PRICE OF SUGAR "FUTURES" IS CHEAPER THAN THE CURRENT MARKET PRICE OF SUGAR, A PROGRAMMED TRADER MIGHT SELL THE

WHICH IS ROUGHLY LIKE OWNING THE STOCK. THIS MIGHT GIVE RELATIVELY QUICK LOW-RISK PROFIT.

WHEN YOU GET ENOUGH TRADER DOING THIS "PROGRAMMED TRADING" IT CAN AMOUNT TO MANY TRANSACTIONS IN LARGE AMOUNTS IN A SHORT TIME WHEN YOU HAVE INSTITUTIONS PENSION FUNDS, ETC, WITH LARGE SUMS OF STOCKS MAKING VERY FAST COMPUTER TRANSACTIONS AND IF ALL THE TRANSACTIONS ARE TO SELL, THEN THE PRICES OF THE STOCKS CAN GO DOWN.

ON MONDAY, OCTOBER 19, THE DOW-JONES INDUSTRIAL AVERAGE DROPPED OVER 500 POINTS OR ABOUT 22 PERCENT. ACTUALLY, IN A FOUR DAY PERIOD THE AVERAGE DROPPED FROM ABOVE 2500 TO 1738 OR ABOUT 30 PERCENT. IN A TEN DAY PERIOD IT WENT FROM A HIGH OF ABOUT 2650 TO 1738 OR ABOUT A 35 PERCENT DROP.

THE REAL PROBLEM WAS THAT IN THE LAST FEW YEARS SINCE PROGRAMMED TRADING STARTED, THERE WERE NO RESTRAINTS OR CONTROLS ON PROGRAMMED TRADING. AFTER "BLACK MONDAY", ALL TRADING BY PROGRAMMED TRADERS WAS STOPPED AND THERE WILL PROBABLY BE NEW REGULATIONS IN THE FUTURE BY THE SECURITY AND EXCHANGE COMMISSION CONCERNING COMPUTER TRADING. MAYBE THIS WILL HELP IN PREVENTING ANY "COMPUTER CRASHES".

P L A T O

Kent Sheets 11/87

OH-MI-TI

Several members have indicated their interest in Plato software, Supercart, and the Supercart plato loader.

If you want a Supercart, contact Paul Martin. Anyone who is interested in the Plato learning series just give me a phone call or drop me a note indicating your interest.

KENT SHEETS 1673 N. Curtice Rd.

INTERFACING TO THE REAL WORLD PART 1: EXTENDING THE BUS OUT OF PEB TO A MOTHER BOARD

by Rod Cook
OH-MI-TI

A computer typically has only one means by which data can be input, the keyboard. Oh sure a modem and barrowed disks are other ways but somebody had to type in the data they contain. In this sense, the only link to the outside world is through the keyboard and you are the interface.

If I wanted to use my existing computer to control a model train layout the control scheme would flow like this. I would key in some data about the status of the trains, the computer would analyse the data (based on rules I have defined in the software) and output a list of instructions for me to do. I would then go flip the switches on the control panel. Although this control scheme is functional it should be obvious it has its limitations. The flow of information is slow and is subject to error.

This is the first part of a series of four articles that deals with the construction and use of an interface to connect the computer to the outside world. This article deals with the construction of the bus extender card and the mother board. A second article will deal with the construction of the I/O cards that plug into the mother board. The third article will deal with connecting real world signals to the interface and the final article will be about control and control algorithms.

The foundation for this project was a series of sixteen articles that appeared in "MODEL RAILROADER" magazine from February, 1985 thru August of 1986 titled "The C/MRI: A computer/model railroad interface". The author was Bruce Chubb. The focus of his articles is directed at running a model train layout, but the techniques presented are fundamental to connecting a computer to the outside world. I can not offer a set of these articles because they are copyrighted material. I suggest you look up a group of model railroad enthusiasts in your area for back issues of the magazine. You can also contact the publisher for back issues or copies of the articles. The publisher is Kalmbach Publishing Co., 1027 N. Seventh Street, Milwaukee, WI. 53233 (414) 272-2060. Following is a list of issue dates with titles for your reference.

Month	Title
02/85	HOW TO CONNECT YOUR HOME COMPUTER TO YOUR LAYOUT
03/85	BUILDING THE UNIVERSAL BUS EXTENDER CARD
04/85	CONNECTING THE UBEC TO YOUR COMPUTER
05/85	BUILDING THE I/O CIRCUITS
06/85	TESTING THE SYSTEM WITH SOFTWARE
07/85	CONNECTING YOUR RAILROAD TO THE I/O CARDS.
08/85	THE OPTIMIZED DETECTOR
10/85	COMPUTER CAB CONTROL - HARDWARE
11/85	COMPUTER CAB CONTROL - LAYOUT WIRING & I/O CONNECTION
12/85	COMPUTER CAB CONTROL - SOFTWARE
02/86	COMPUTERIZED SIGNALS - PROTOTYPE & MODEL SYSTEMS
03/86	COMPUTERIZED SIGNALS - SOFTWARE
04/86	SIMPLIFIED WIRING & AUTOMATED DIAGNOSTICS
06/86	SERIAL INTERFACE HARDWARE
07/86	SERIAL INTERFACE SOFTWARE
08/86	DIGITAL/ANALOG & ANALOG/DIGITAL CONVERTERS

Physically, this system consists of a card that plugs into the P-box that extends out the rear of the box (like the disk controller card) for connection to a ribbon cable. The other end of the ribbon cable connects to a mother board. Various I/O (Input/Output) cards plug into the mother board. Field connections are made to the I/O cards. An external power supply provides power to the I/O cards through the mother board. The card that goes into the P-box can be called the bus extender card and has the sole purpose of extending the data lines, address lines and control lines from the bus inside the P-box through the ribbon cable to the external electronics.

The bus extender card turns out to be the only TI P-box specific circuit card in the system. The mother board and I/O cards can be connected to any computer provided an extender card is made for that computer to interface its bus to the bus on the mother board (I have not confirmed this though). For this reason the value of this project extends beyond the 99/4A. The interface and I/O techniques are fundamental to the connection of a computer to the outside world for the purpose of data acquisition and process control. In this regards this project can be viewed as a learning experience, it certainly was for me.

This project parallels the project presented by Bruce Chubb in the "MODEL RAILROADER" articles, but it is not an exact duplication. Chubb presents designs for bus extender cards for several different computers, but the 99/4A was not one of them. It was at this point I had to deviate from the design presented by Chubb. The circuits are similar though. The pinouts of the various connectors used in this project do not match those in the article.

A word of caution. This is an advanced construction project. If you are a novice at constructing electronic hardware it is strongly recommended you get the assistance of someone with experience. This is an ideal project for a special interest group where several people can learn about construction techniques and the electronic theory of the interface.

Now for the all important disclaimer. I do not accept any liability whatsoever as a result of any damages associated with the construction, connection and use of the electronics described in these articles. Construction, connection and use are done solely at your own risk.

There are two ways to connect peripherals to the 99/4A, the CRU method and the direct memory access method. CRU access to peripherals is TI specific and has the advantage that it does not use CPU memory. Direct Memory Access (DMA) is more common but has the disadvantage of using CPU memory that could otherwise be used for something else. The DMA method was chosen for this project for several reasons: 1. the similarity to the system to Chubb's system is maintained, 2. the external electronics are compatible to other computers and 3. the CALL LOAD and CALL PEEK commands in E/A BASIC can be used to access the peripheral. There is no device service routine required. You write the software to access the peripheral in whatever language available, BASIC, FORTRAN or Assembler.

The heart of the interface is a 40-pin 8255 programmable peripheral interface (PPI) chip. One of these chips is located on each I/O card. The 8255 has 24 I/O lines configured in three groups of 8 bits, one I/O line per bit. Each group of 8 bits can be thought of as an 8-bit I/O port. Each port corresponds directly to a byte (8 bits) and this is how the computer will view the interface; each port will be located at a specific address in CPU memory. Each port can be programmed by the software as either an input port (data into the computer) or an output port (data out of the computer). Eight other pins of the 8255 are connected to the data lines of the computer bus. If you have been keeping track, this accounts for 32 of the 40 pins of the chip. Of the remaining pins, two are for power and ground and a third is called RESET. The remaining five pins are for control of the PPI. There are two mode select pins, a write enable pin, a read enable pin and a chip select pin.

The trick is to connect the control lines of the PPI to the appropriate lines on the computer bus so that when the computer performs a memory operation at a specific address, a specific PPI is selected and enabled properly. This is not as hard as it sounds. The 99/4A bus has write enable and read enable signals that will be used for the corresponding control pins on the PPI. The remaining three control signals are derived by decoding the address lines. Partial decoding of the address lines is performed on the bus extender card with the remaining done on the I/O cards.

A block of CPU memory must be assigned as the area where the interface will reside. The addresses within this block can not be used for anything else. I chose the block of memory

between >9000 and >97FF, (hex numbers are always preceded by a ">" symbol in these discussions). This is the block of memory normally assigned to the speech synthesizer. So the synthesizer can not be connected to the computer while using the interface. This is a big sacrifice I realize, but I was willing to pay the price, anything to run my trains!

ADDR	BINARY EQUIVALENT
>9000	1001 0000 0000 0000
>97FF	1001 0111 1111 1111
	1-----1-----1 11
	A AA A AA
	0 45 1 11
	1 34

Notice in the above diagram, address lines A0 thru A4 have the same bit pattern throughout the complete block of memory. No other block of memory has this bit pattern and thus these five address lines are decoded by the logic gates on the bus extender card to generate a SELECT signal that is supplied to the I/O cards, see the schematic for the bus extender card. In addition to the five address lines, the MEMEN line is used as an additional criteria to determine whether to generate the SELECT signal. The MEMEN line identifies when the computer is performing a memory operation, either a read or a write.

Addresses A5 thru A11 will be decoded on the individual I/O cards. Thus the purpose of the bus extender card is to pass these signals, unaltered, onto the I/O cards. These addresses should be thought of as the card select digits of the complete address.

ADDR	BINARY EQUIVALENT	CARD SELECTED
>900x	1001 0000 0000 xxxx	card 0
>901x	1001 0000 0001 xxxx	card 1
>902x	1001 0000 0010 xxxx	card 2
...
>90Fx	1001 0000 1111 xxxx	card 15
>910x	1001 0001 0000 xxxx	card 16
...
>97Ex	1001 0111 1110 xxxx	card 126
>97Fx	1001 0111 1111 xxxx	card 127

The above diagram shows how the 2nd and 3rd digits of the address are used to designate which card is selected. The addresses at which each card is selected is set on a dip switch on each card, but more on this in the next article. Note the first digit is always a "9". The "x" in the 4th digit means it has nothing to do with card selection. So, we can select up to 128 separate I/O cards and each card has three ports. This computes to 384 8-bit I/O ports or 3072 bits of digital input (DI) or digital output (DO). The significance of the terms DI and DO will be discussed elsewhere. Needless to say, this is a lot of DI/DO.

The A13 and A14 address lines are connected to the mode select lines of the 8255 PPI. There are four combinations of these two addresses, 00, 01, 10 and 11 and they select port A, port B, port C and the program register respectively. Addresses A12 and A15 are not used. A13 and A14 are passed by the bus extender card onto the I/O cards where they are connected directly to the mode select pins of the 8255. Thus the last digit of the address specifies the mode of the PPI. This is summarized as follows:

ADDR	BINARY OF 4TH DIGIT	CARD AND PORT SELECTED
>9000	0000	card 0 port A, Read or Write
>9002	0010	card 0 port B, R or W
>9004	0100	card 0 port C, R or W
>9006	0110	card 0 program register, write only
>9010	0000	card 1 port A, R or W
>9012	0010	card 1 port B, R or W
...
>97F4	0100	card 127 port C, R or W
>97F6	0110	card 127 program register, write only

It is possible to expand the system further by using address lines A12 and A15. Address lines A14 and A15 would be used for the mode select lines of the 8255. Lines A12 and A13 would be used in addition to lines A5 thru A11 to select the proper I/O card. This would allow selection of 512 separate I/O cards or 1536 bytes or 12288 bits of information. Well this is a lot. Certainly more than I need to run my trains. But depending on the information to be gathered, this expanded system may be needed.

The program register is internal to the 8255 and is always written to, you can not read the contents of this register. The byte value written to this register sets up the three I/O ports as input or output or any combination of the eight possibilities. A value of >80 written to address >9006 would set up all three ports of card 0 as output ports. A value of >98 written to address >9056 would set up all three ports of card 5 as input ports. A value of >92 written to address >9156 would set up card 21 with ports A and B as input and port C as output. The table below lists the eight values that can be written to the program register and the resulting set up of the ports. The data in the program register is maintained as long as the 8255 is powered. Thus the first function of the software will be to initialize the I/O cards to the desired configuration. For the sake of discussion in these articles the I/O cards will be configured as either all input or all output.

PROGRAM REG. VALUE	PORT SETUP		
	A	B	C
>98	IN	IN	IN
>92	IN	IN	OUT
>99	IN	OUT	IN
>90	IN	OUT	OUT
>8B	OUT	IN	IN
>82	OUT	IN	OUT
>89	OUT	OUT	IN
>80	OUT	OUT	OUT

Back to the bus extender card. Earlier it was stated the sole purpose of the card was to extend the address, data and control lines from the P-box to the external electronics. Well it certainly does this and a little more. It does a partial decoding of the address lines and generates a SELECT signal for the I/O cards. This eliminates four signals that would otherwise be sent down the ribbon cable. But more importantly, this SELECT signal is used to enable the three chips U1, U2 and U3 on the extender card. These chips are only enabled when the address on the address lines is between >9000 and >97FF and the CPU is doing a memory operation, either read or write. At all other times the chips are disabled, and the ribbon cable is effectively disconnected from the bus inside the P-box and the signals on the ribbon cable are pulled to ground by the 2.2K resistors. So what you say!! Well the bus in the P-box is a busy place, a lot of signal changes on all the different lines. When you combine all the different lines together, it looks like noise to a TV. When I first breadboarded the extender circuitry, I brought the bus directly out of the P-box with only a 2-foot piece of ribbon cable, that's all. Yet this nearly wiped out the image on the TV I use with the TI and caused disturbing interference to the TV in the family room. After the extender card was installed, I was amazed at the difference. Even if I would write or read to the I/O cards as fast as I could (in FORTH), I could not detect a flake of interference on the TVs.

Chips U1 and U2 are called octal buffers and aside from isolating the ribbon cable when not in use, they also drive the ribbon cable. The reason for this is perhaps a little beyond this discussion but this directly affects how long the ribbon cable can be. The one I'm using is 6-foot long. I'm sure it could be longer but I don't know what the limit is. Chip U3 is called an octal transceiver and it does exactly the same thing as U1 and U2 with regards to driving and isolating the ribbon cable except that depending on the signal on pin 1 of the chip the direction of data flow is either to or from the interface. Two lines pass directly through the extender

card, ground and RDBENA. Ground needs no explanation. RDBENA is a signal generated at the I/O cards that must be provided to the P-box by an external peripheral to enable chips in the P-box.

In addition to the schematic of the bus extender circuit, there's a bill of material for the parts, a sketch of the card dimensions that I used, a diagram of the card edge that plugs into the P-box (60-pin connector) and the card edge that extends out the back of the P-box (34-pin connector). The numbers on the lefthand side of the schematic correspond to the 60-pin card edge and the righthand numbers correspond to the 34-pin card edge. Note that the location of pin 2 is shown for both card edges of the circuit card in the sketch.

This circuit card will have to be hand made, unfortunately. I dislike making circuit cards with a passion, but in this case there was no other choice. I recently read of a source of a proto-typing board for about \$35. This would save alot of time (and headache) compared to making your own. I strongly recommend you check this board out. My only concern has to do with the part of the board that projects out the rear of the FEB. I don't know what kind of socket/connector would be used here. An old disk controller card would work but doubt it would save any time. The size of the card in the sketch was determined by the size of double clad card material I had on hand, the 6 15/16ths dimension. Otherwise I used the disk controller card as a model. Use double clad circuit board material with a 1 mil copper cladding. Thicker cladding takes too long to etch. Cut the card a little oversized initially. Then after etching, file down to size. Hand fit the card edge connectors into their respective sockets to assure the foils are centered on the socket pins. There should be minimal slop of the fit into the socket so the correct pins always are in contact with the correct foil. To lay out the foils for the card edge connectors, use graph paper with 10 squares per inch as a guide for laying out the etch resist tape. I wire wrapped the components on the circuit board. The card edge foils were connected to round pads where wire wrap pins were soldered. The only circuit traces etched into the board were for the +5 volts and ground to the ICs and bypass capacitors. Also note the spot on the bottom of the 34-pin edge connector indicated by "no foil". Foil traces from the card edge must be routed around this area. There is a clip at the back of the P-box that will short any signal foils that may be in this area. Finally, since copper will oxydize with time, the card edge foils will have to be tinned with solder to assure good electrical contact with the socket pins. Use a minimal amount of solder and hot solder gun to flow the solder out smoothly. Then carefully file any points of solder that have formed and slightly bevel and round the edge of the board so the connector will smoothly slide into the sockets. Checkout of the extender card is rather tough until the mother board and an I/O card is available. But a 74LS7474 latch driving an LED wired as shown in the sketch can be connected to the SELECT line. Then every time an address between >9000 and >97FF is CALL LOADED or CALL FEEDED, the LED will indicate the SELECT signal was generated. One time the LED will be latched on, the next off, the next on, etc.

The mother board is quite simple functionally. The ribbon cable plugs into one end of the mother board. The pins of the ribbon cable socket are connected to the appropriate pins on the card edge sockets. The I/O cards plug into these sockets, so the mother board must have as many sockets as I/O boards you plan to use. The same pin on each socket are connected in series. I used point to point soldering to connect the sockets together. Wire wrapping would have been faster yet, but the price on wire wrap card edge sockets is outrageous. Both methods are faster than laying out and etching the circuit board. Two binding posts are mounted on the mother board and are the +5 volts and power supply ground to the I/O cards, see the schematic. The power supply I used was a TI console power supply bought from Radio Shack. Since the +12 volts and -5 volts are not used, a 10K resistor is soldered from the +12 volt pin to ground and another from the -5 volt pin to ground to slightly load these two voltage sources. The mounting of the card edge sockets for the I/O cards should be strong and rigid because these sockets will be supporting the I/O cards. It may be desirable to fabricate a card cage to

support the I/O cards with the mother board at the bottom.

Note on the schematic for the bus extender card that pin 2 of the 34-pin connector is line D0 and that pin 2 of the 34-pin header that connects to the mother board at the other end of the ribbon cable is labeled D7. In fact the data lines are all reversed. This reversal is because of a difference in numbering convention between TI and the rest of the computer electronics industry (at least I think TI is alone on this). The TI convention labels the MSB (Most Significant Bit) of the data lines as line 0 and the LSB (Least) as line 7. On the otherhand the rest of the industry is just the opposite. The data line numbering on the 8255 chip is per the industry standard and so to avoid confusion, I've made the conversion of numbering schemes at the mother board ribbon cable connector. The numbering convention that TI uses for address lines is also reversed from the rest of the industry. At the expense of being inconsistent, the address line numbers shown on the ribbon cable connector at the mother board is per the TI convention. This simply was more convenient for me since I've learned to think of address lines per the TI convention. If the mother board is to be connected to a different computer, the bus extender card for this computer must reverse the address lines accordingly.

The next article will deal with the construction of the I/O cards and the testing of the cards and system with software.



"I'd like a word with you about your work station."



PARTS LIST

- U1, U2 74LS244
- U3 74LS245
- U4 74LS02
- U5 74LS00
- U6 7805 w/heat sink
- C1, C2 .01µF MYLAR
- C3 47µF, 10V ELECTROLYTIC
- C4-C8 .1µF MYLAR (BYPASS)
- R1-R20 2.2K ohm 1/4W

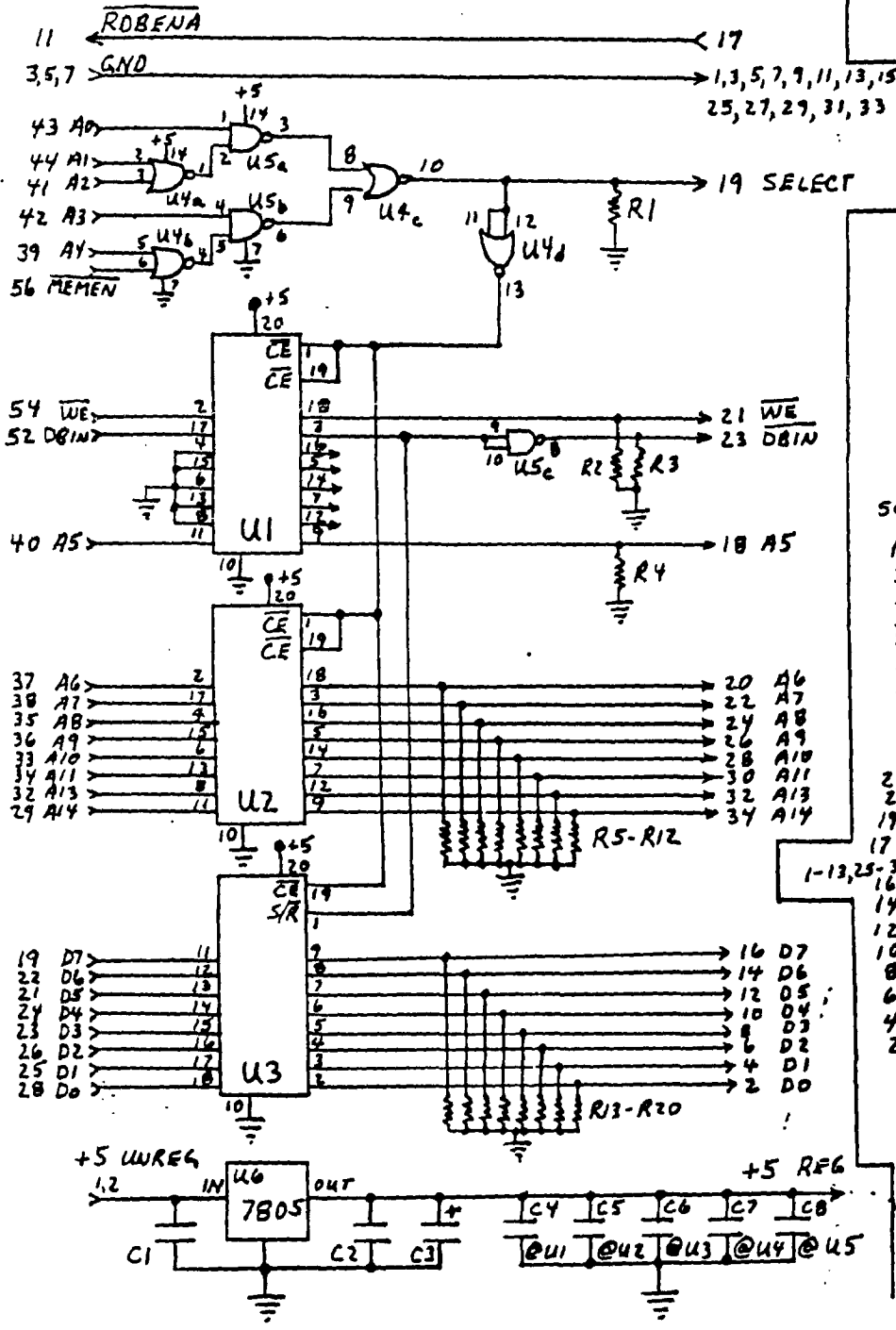
PARTS SOURCES

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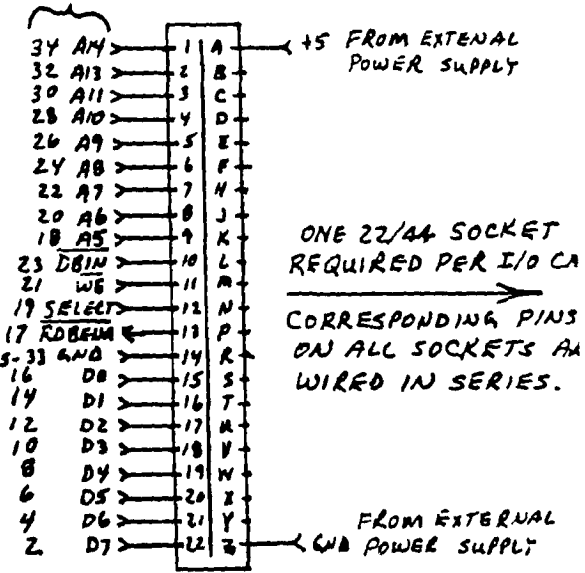
BUS EXTENDER SCHEMATIC



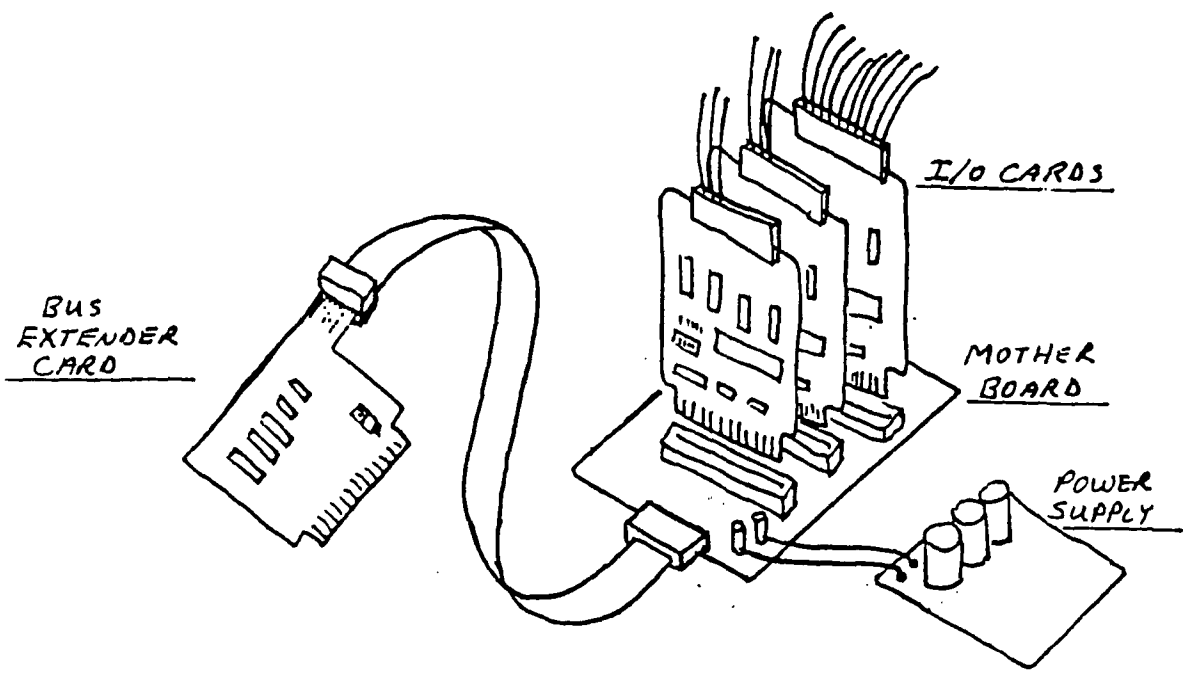
PARTS LIST

- 1 - 34 CONDUCTOR RIBBON CABLE
 - 1 - 17/34 CARD EDGE SOCKET, .1" CENTER, - JAMECO C34
 - 1 - 34 CONTACT RIBBON CONNECTOR, .1" GRID - JAMECO 534
 - 1 - 34 CONTACT HEADER -.1" GRID - DIGIKEY R230-NA
 - X - 22/44 CARD EDGE SOCKET, .156 CENTERS - JAMECO 22/44SE (ONE PER I/O CARD)
 - 1 - TI CONSOLE POWER SUPPLY
 - 2 - BINDING POSTS - RADIO SHACK 274-661
- MOTHER BOARD SCHEMATIC

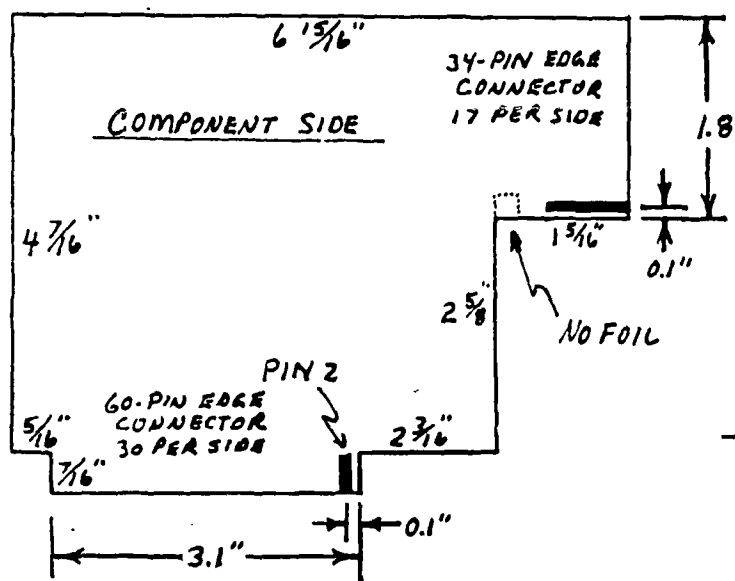
34-PIN RIBBON SOCKET CONNECTOR



22/44 CARD EDGE SOCKET



EXTENDER CARD



COMPONENT SIDE		BACK SIDE	
A14	34	33	GND
A13	32	31	GND
A11	30	29	GND
A10	28	27	GND
A9	26	25	GND
A8	24	23	5V
A7	22	21	SELECT
A6	20	19	RDBENA
A5	18	17	GND
D7	16	15	GND
D6	14	13	GND
D5	12	11	GND
D4	10	9	GND
D3	8	7	GND
D2	6	5	GND
D1	4	3	GND
D0	2	1	GND

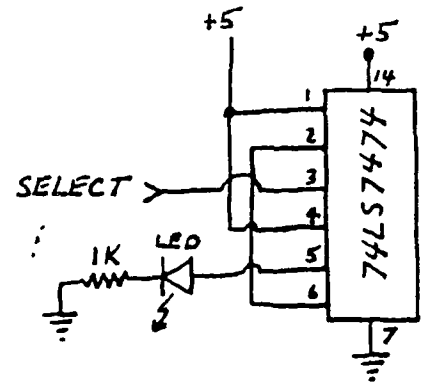
17/34 EDGE CONNECTOR PINOUT

COMPONENT SIDE	
MEMEN	59
MEME	58
MEME	57
MEME	56
MEME	55
MEME	54
MEME	53
MEME	52
MEME	51
MEME	50
MEME	49
MEME	48
MEME	47
MEME	46
MEME	45
MEME	44
MEME	43
MEME	42
MEME	41
MEME	40
MEME	39
MEME	38
MEME	37
MEME	36
MEME	35
MEME	34
MEME	33
MEME	32
MEME	31
MEME	30
MEME	29
MEME	28
MEME	27
MEME	26
MEME	25
MEME	24
MEME	23
MEME	22
MEME	21
MEME	20
MEME	19
MEME	18
MEME	17
MEME	16
MEME	15
MEME	14
MEME	13
MEME	12
MEME	11
MEME	10
MEME	9
MEME	8
MEME	7
MEME	6
MEME	5
MEME	4
MEME	3
MEME	2
MEME	1
MEME	+5

30/60 PIN EDGE CONNECTOR PINOUT

BACK SIDE	
59	A0
57	A2
55	A4
53	A6
51	A8
49	A10
47	A12
45	A14
43	A16
41	A18
39	A20
37	A22
35	A24
33	A26
31	A28
29	A30
27	A32
25	A34
23	A36
21	A38
19	A40
17	A42
15	A44
13	A46
11	A48
9	A50
7	A52
5	A54
3	A56
1	A58
	+5

BACK SIDE



TEST CIRCUIT - LATCH W/LED

PARTS LIST

- U1, U2 74LS244
- U3 74LS245
- U4 74LS02
- U5 74LS00
- U6 7805 Heat sink
- C1, C2 .01µF MYLAR
- C3 47µF, 10V ELECTROLYTIC
- C4-CB .1µF MYLAR (BYPASS)
- R1-R20 2.2K ohm 1/4W

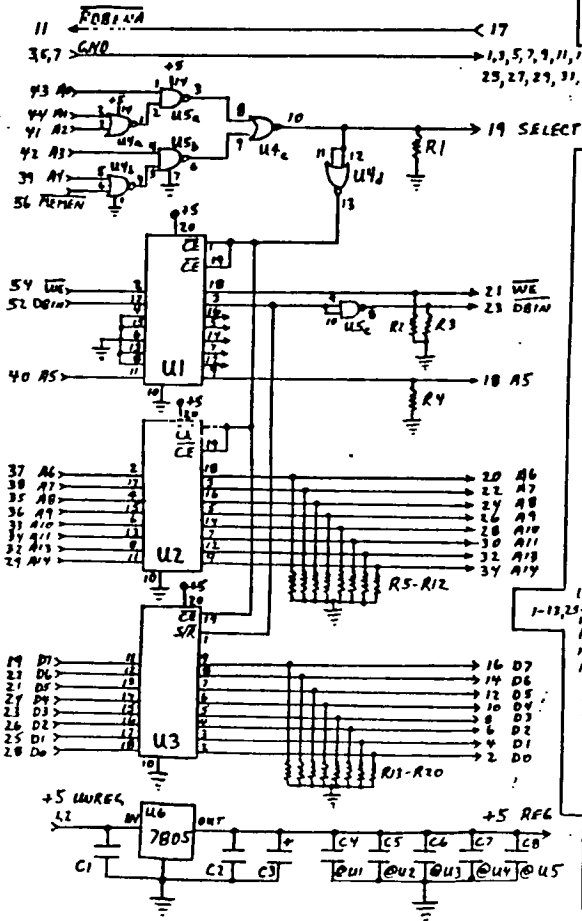
PARTS SOURCES

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BUS EXTENDER SCHEMATIC

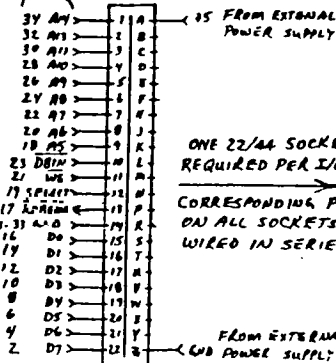


PARTS LIST

- 1-34 CONDUCTOR RIBBON CABLE
- 1-17/34 CARD EDGE SOCKET, 1" CENTER, - JAMECO C34
- 1-34 CONTACT RIBBON CONNECTOR, 1" GRID - JAMECO S34
- 1-34 CONTACT HEADER - 1" GRID - DICKKEY Z230-NA
- X-22/44 CARD EDGE SOCKET, .156" CENTERS - JAMECO Z2/44SE (ONE PER I/O CARD)
- 1- TI CONSOLE POWER SUPPLY
- 2- BINDING POSTS - RADIO SHACK 274-661

MOTHER BOARD SCHEMATIC

34-PIN RIBBON SOCKET CONNECTOR



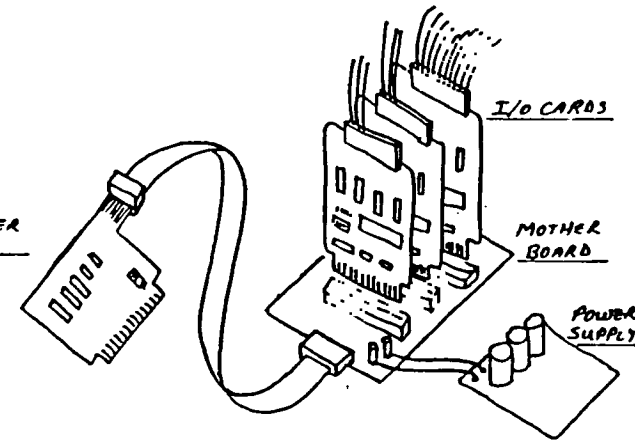
22/44 CARD EDGE SOCKET

ONE 22/44 SOCKET REQUIRED PER I/O CARD.

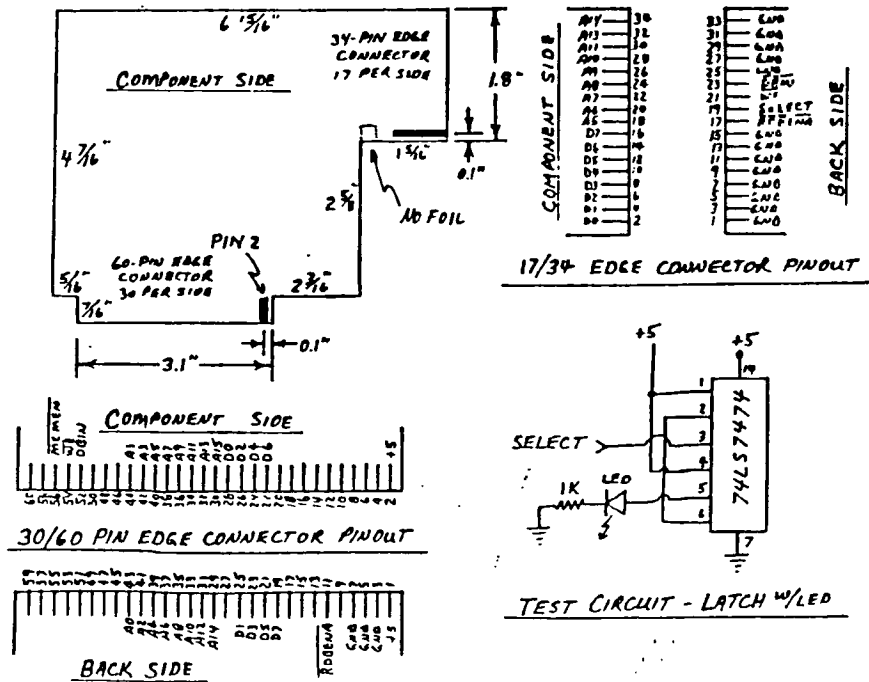
CORRESPONDING PINS ON ALL SOCKETS ARE WIRED IN SERIES.

FROM EXTERNAL GND POWER SUPPLY

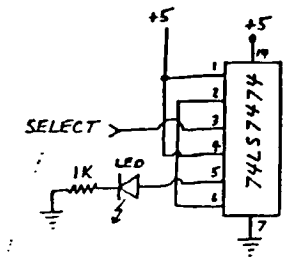
BUS EXTENDER CARD



EXTENDER CARD



17/34 EDGE CONNECTOR PINOUT



TEST CIRCUIT - LATCH W/LED

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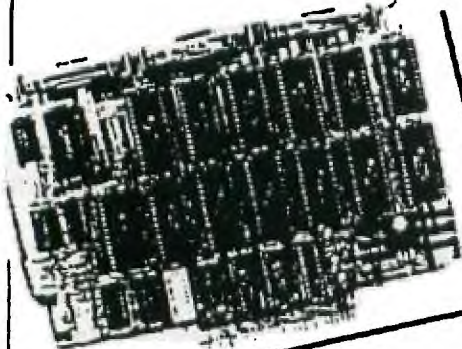
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