

# 'PuterWare 3X1

## Assembly Instructions

I recommend that you assemble the 3X1 in the order described below. The 3x1 will perform just as well if you don't, but I found that it is easier to construct if you follow these procedures.

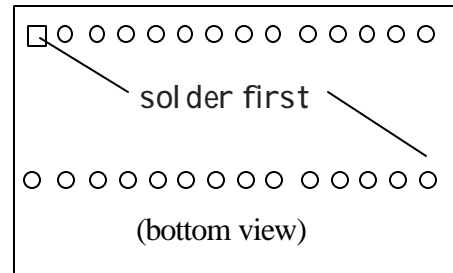
*Note: Due to the close spacing and absence of a solder mask, please be very careful to use only enough solder to fill the component hole and see a wicking action **starting** (solder starting to climb the pin/wire).*

### IC sockets

(Pay close attention to the location of pin 1 on the part placement/location diagram.

Note that pin 1 is always a square solder pad!)

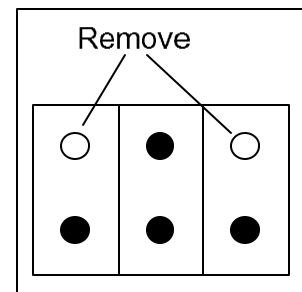
- Unless all of your sockets are the same type, they may extend different heights above the board. Sort them by their heights above the board. Install those that have the least height first, followed by the taller ones. Installing in this order allows you to lay the board on it's back while soldering, which will help keep the sockets flush.
- Soldering one corner of each end insures that the socket will be firmly held in place to solder the rest of the pins.
- U3-Programming socket. This should be a ZIF socket if programming is to be performed on a regular basis, but cannot be the 3M TEXTTOOL. The space available for the ZIF is too small to allow using the TEXTTOOL ZIF. The AIRES LO-PRO socket works quite well, and is less expensive too. This socket location has provisions for adding battery-backup and/or CS (Chip Select) protection. The modifications to the board are on the solder side and may be made after the socket has been installed, so install it now.



### Headers/Jumpers

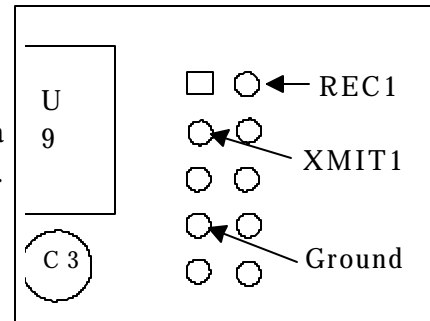
The double row header must be snapped into several sizes for use as jumper pins. A few pins must be removed before soldering them to the board.

- Pick a double row header and snap or cut six 6-pin blocks and a four pin block.
- Five of the six pin blocks must have two pins pulled out (See figure at right.).
- Remove one of the pins on the four pin block.
- Snap or cut a single row header into 12 3-pin lengths.
- Install J1,J9,J14, and J15. Position as shown in the part placement/location diagram, and solder in. Place a shorting jumper over any two of the pins, and hold it in place with a finger during soldering, keeping it flat to the board. (Hint-tack one of the inner pins first)
- Place the block with all six pins in J12 along with one of the 3-pin headers. Placing a shorting jumper over a pin on each piece will let you hold them together, and flush to the board, to solder.
- Place a six pin and four pin block as shown on the placement guide for J17. Use a shorting jumper as in the previous step to hold the two pieces together.



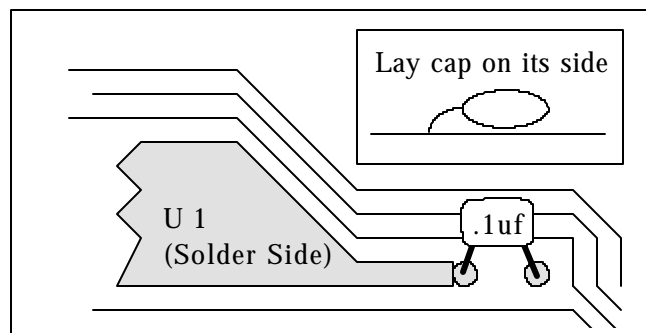
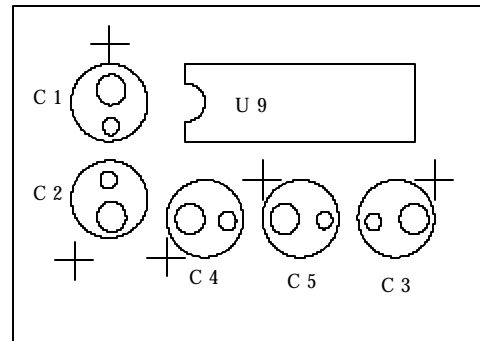
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- Put the remaining three pin blocks in J2-J8, J10, J11, J13, and J16. Be sure to make these as perpendicular to the board as possible. One way to do this is to partially solder the center pin, and then heat it again while aligning it, then solder the other two pins before finishing the middle one.
- Header(s) P1 and/or P2 may be installed at this time, if you wish. If you leave them off, it's easier to attach a ribbon cable or to split the ports with several directly connected wires, because the wires can be attached through the top of the board. If you have cables with the connectors attached, go ahead and install the headers.
- RS-232 interface signals are available between U9 and X1. You may solder directly to the plated-thru-holes, or if you want, install a 10-pin header and obtain a ribbon cable with a header connector on one end and a DB25/DB9 on the other. I found several cables in my junk box from old PC serial boards. If the pins don't match up to your connectors, the traces on the solder side have been widened to make it easier to cut the traces and reroute the signals to other pins. (See board views)



## Capacitors

- Install electrolytic capacitors at C1-5, observing polarities as shown. The diagram has a "+" near the positive lead, and the two holes are different sizes, with the larger hole being the positive lead. Polarity is **NOT** shown incorrectly, here or in the logics, these are charge pump capacitors, and will have boosted voltages or negative voltages present.
- If a +5V regulated power supply is to be used, install C8, again observing the polarity shown in the *Part Placement* diagram. If other than a +5V power supply is to be used, do **not** install C8 at this time, wait until the power plug installation/options section.
- Install the two 30pf caps, C6 and C7 (near the crystal location), as shown in the *Parts Placement* diagram.
- Install 3 blue .1uf bypass caps as shown on the *Parts Placement* diagram.
- Install the last blue bypass cap on the solder side as shown in the figure to the right. The leads should be short enough to **NOT** touch the circuit runs under the cap! (About 1/8-3/16")
- The last electrolytic will be covered at the end of the assembly instructions.



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## ***Power Plug(Vcc)***

Two pairs of power connectors, with pins, were supplied with the board. The three-pin connectors are for the 5V power. The two-pin connectors are for the programming voltages (+21V and/or 12.5V). Extra pins are included.

Several optional methods of supplying power will be described and you may wish to read through all of them before deciding on which one to use. (The lighter shade wires/traces are thru-board views-the traces are on the other side of the board.)

### **Option 1. Regulated +5V power supply without using connectors.**

Route the wires directly from the power supply, or on/off switch to the upper right corner of the circuit board. The +5V wire may be connected to A,B,C or D, and the ground to either of the center pins. C8 should have been installed in a previous step.

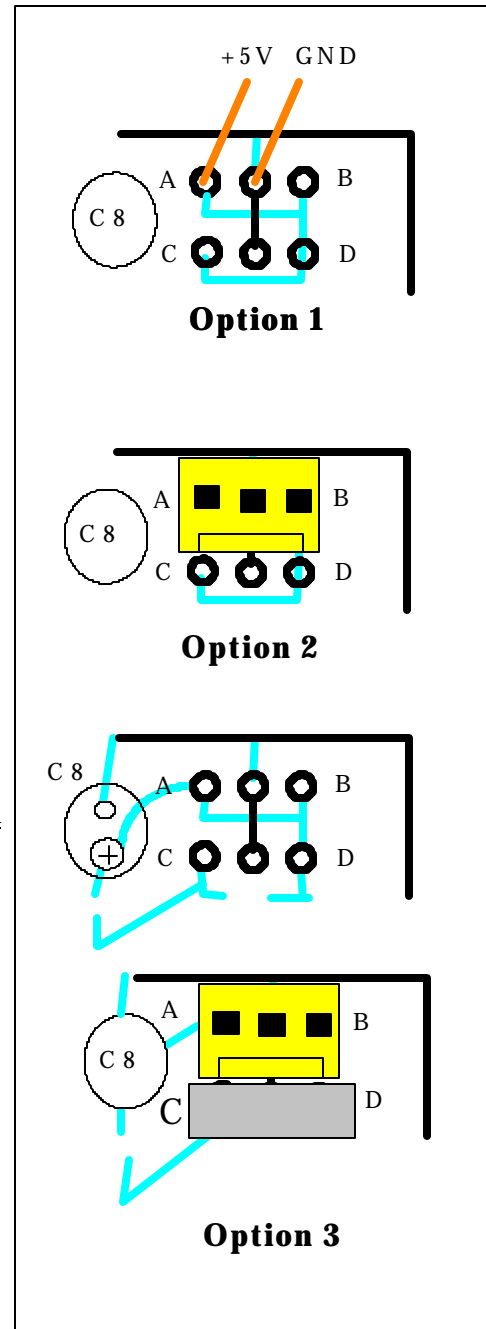
### **Option 2. Regulated +5V power supply with power connector.**

Install the 3-pin header as shown in the diagram, with the locking key towards the center of the board. The mating connector should be wired with the +5V on either outside pin and ground in the middle. C8 should have been installed in a previous step.

### **Option 3. Regulated/Unregulated power supply with on-board regulator (TO-220 case).**

This method requires cutting a few traces on the bottom of the board, re-routing a trace, and adding a new capacitor to the *bottom* of the board. If battery power is used, see option 4.

- Cut the large trace between C and D.
- Cut the large trace just below C8's positive terminal hole.
- Jumper C8's Positive lead to A.
- Install a 7805 regulator with its input pin at D, ground at the center, and the output at C.
- Connect a small (.1-.22uf) cap between C and the center pin (Not shown)



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Note insure that the power applied is greater than the drop-out voltage of the 7805  
(2.5-4.0+5V=7.5-9V)

## **Option 4.** Low voltage (+6.x V) battery operation.

Identical to option 3 except:

- The 7805 should be replaced with a National 2940CT-5.0 or equivalent, and the leads should be cut as short as possible.
- Two small caps ( .1-.22uf) should be attached directly to the pins of the 2940 on the solder side (bottom) of the board. The leads should be kept as short as possible, with each cap being wired from an input/output pin(C & D) to the center pin(ground). The 2940 contains very high gain amplifiers and if not bypassed correctly, it will not regulate!

If a case style other than a TO-220 is used, use option 5.

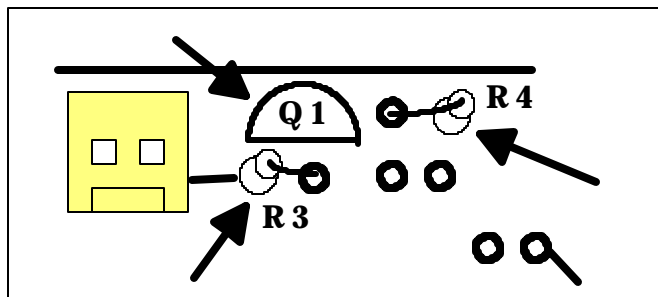
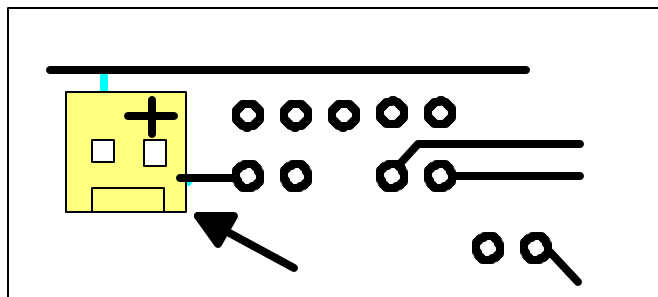
## **Option 5.** On-board regulator installed in breadboard area.

If another regulator type is to be used (or the power plug area is too cramped for your taste), The +5V buss is brought out to the breadboard area next to pins 1 and 2 of U3. The power plug, if used, and regulator components may be installed in the breadboard area. A .1uf cap could be installed at C8, and the 10uf cap may be used in the regulator circuit.

**NOTE:** Do **not** attempt to supply the regulator from the 12.5/21V programming voltage power plug. To save on cost and board space, the 3X1 does not provide power-on EPROM write protection. The *User's Guide* contains a suggested circuit, and the protection may be added in the breadboard area, but as designed, the 3X1 **must** be powered up **before** the programming power is applied!

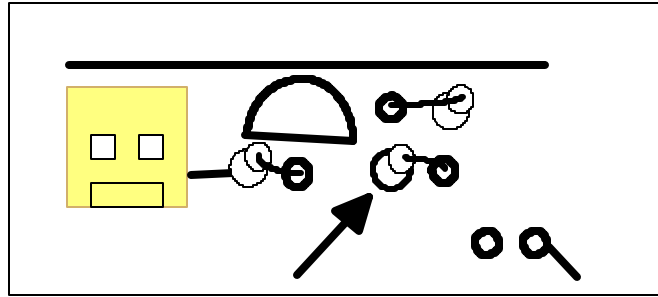
### ***Power Plug (Vpp) and programming circuit. (If programming is to be used)***

- The programming power (21V or 12.5V) plug is installed at the upper left of the board, as seen on the *parts placement* diagram. The locking key should be oriented toward the center of the board. The mating connector should be wired with the +VPP wire on the right, and ground on the left.

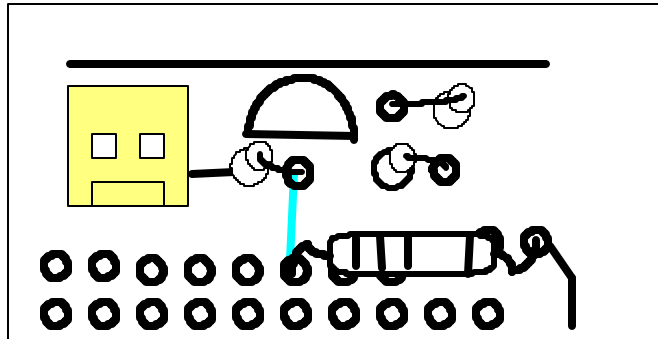


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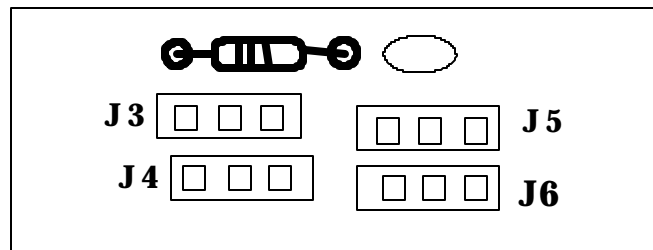
- Two 10K resistors(R3 & R4) should be installed as shown in the diagram at the right. the resistors should be mounted vertically. Also, Q1, a 2N2907 should be installed as shown.



- Next, D1, a 1N270 should be installed as shown, with the banded end at the bottom (next to the board).



- Because of the ZIF socket locking bar, the last resistor(R2-4.7K) cannot be mounted vertically. Install the resistor in a horizontal position, routing the left lead under the board to the right lead of the previously installed resistor. The right hand lead can just be soldered to the right-most hole of the pair as shown.



- Install resistorR2 ( 4.7K) above J3 & J5.

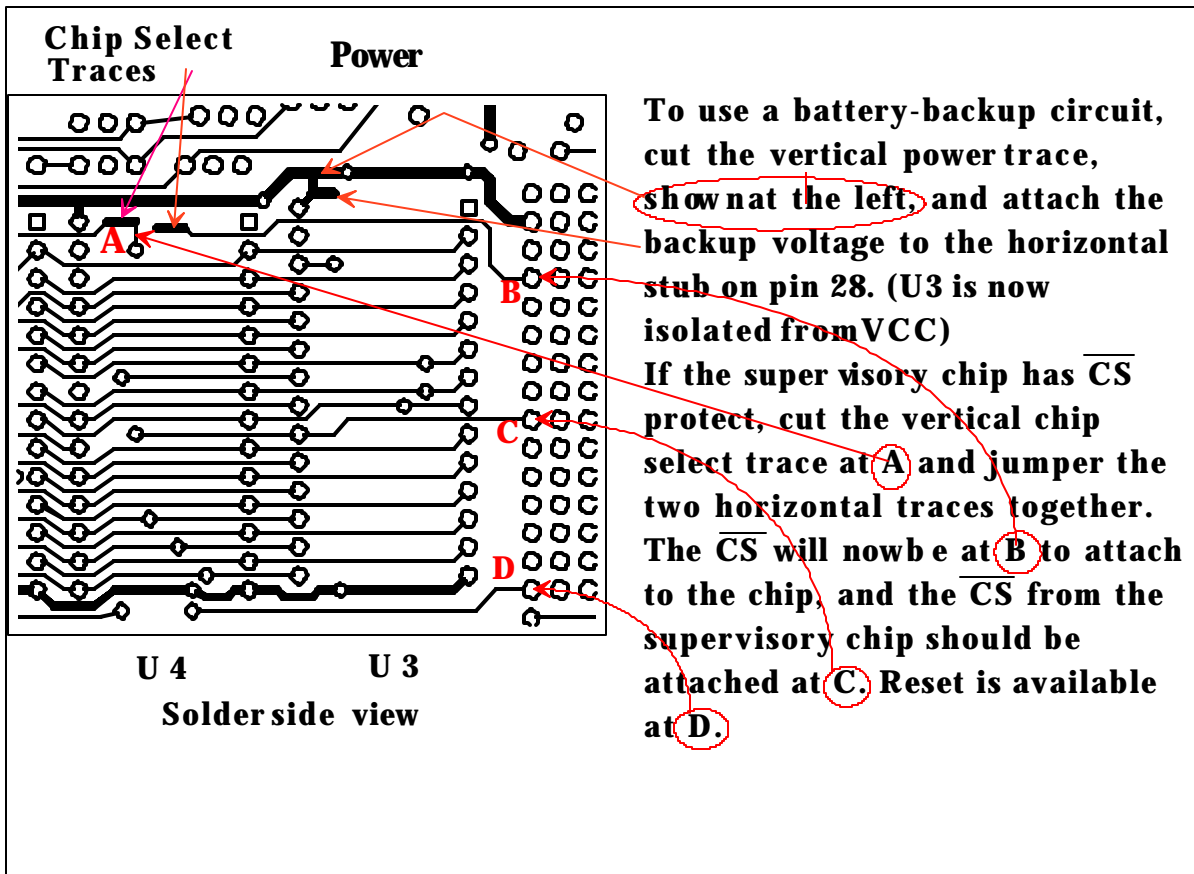
## *Programming not used*

If programming is not to be used, simply do not install the components in the previous section.

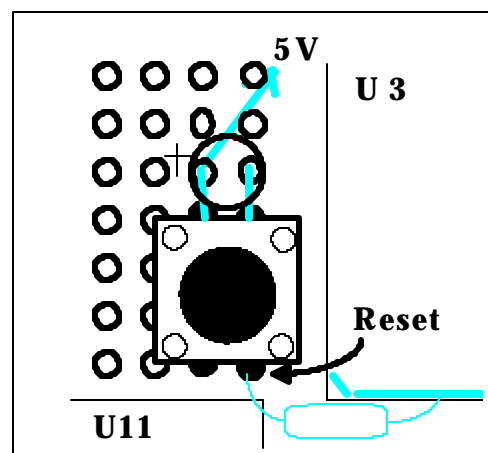
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## Reset Circuit(s) and battery-backup

The logic diagram shows the suggested (default) reset circuit from the User's Manual. Depending on your usage of the 3X1, you may opt for a supervisory chip which may contain battery backup, chip select protection, and reset. Below is a partial board view, showing the traces which may be used to add battery-backup and/or CS protect. Note that you do not need a supervisory chip to add battery-backup, and the provisions on the board may be used independently of each other. U3 is the only memory device with these provisions.



If you just want to install the default reset circuit, you can put it anywhere in the breadboard area. At the right is where I have put the parts on several of mine. Reset for the MPU and 8255 are joined at the lower right hole in the breadboard area. The switch supplied will fit with one of its 4 pins through the reset hole. Note the polarity of the 10uf cap when installing it, and route a wire up to the +5V buss (above point B in above diagram). The resistor was just tacked between the switch (common to the neg. side of the cap) and the ground buss nearest the switch on the solder side as shown.

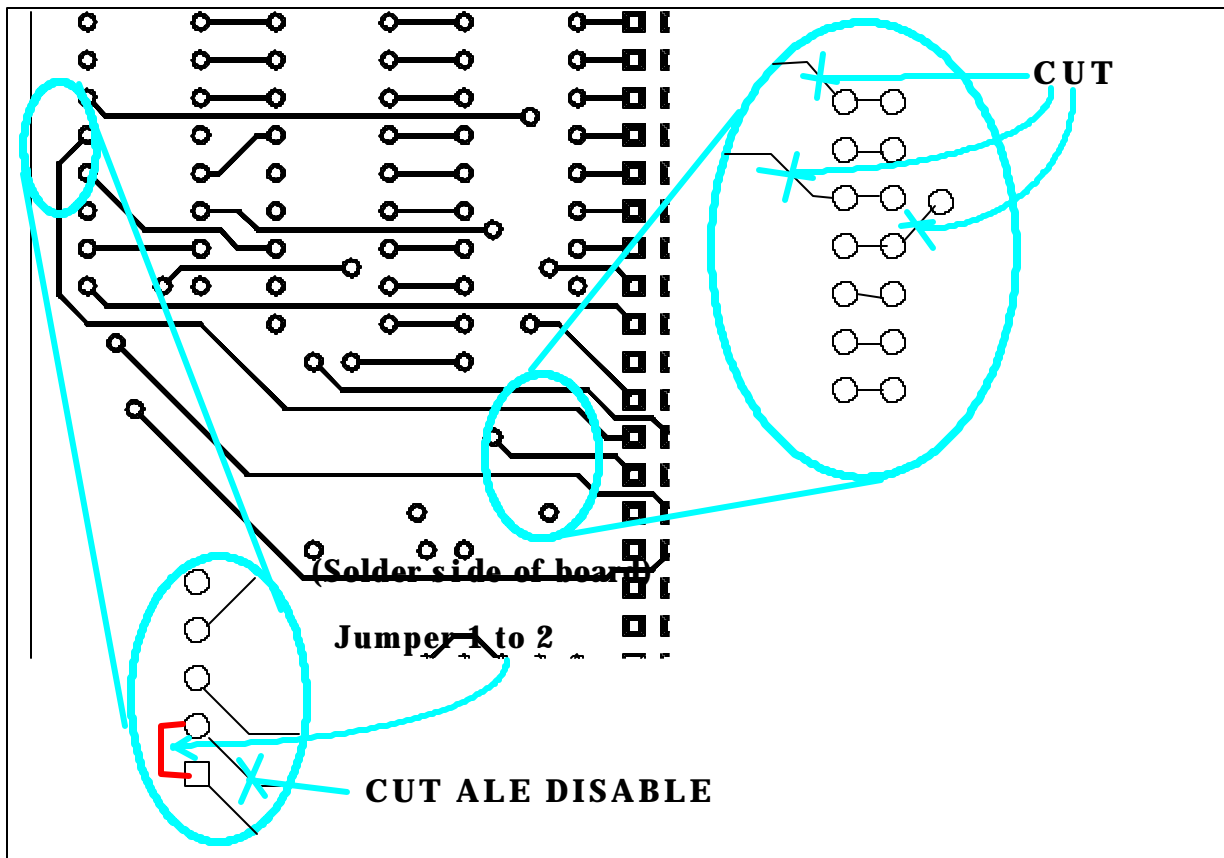


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## *Port 1 operation`*

If the board is not to be used for programming, the ALE Disable, Program Pulse, and Program Enable signals must be removed from operation to allow Port 1 to be used for I/O, without affecting the operation of the remainder of the board.

Removing U10 will disable the Program Pulse and Enable. If U10 or another 14 pin chip is to be used, the traces should be cut as shown below, and care should be taken not to use the Vpp pin of J1.



The ALE Disable can only be removed by cutting the trace somewhere, and to keep ALE working correctly, jumper pin 1 and 2 of U7, as shown above.

If this is not done, whenever a low is output on P1.3, BASIC will not be able to read memory and will display errors!