ZX-100 Parts List

Designator	Old	New	Description	Cost
U241	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U181	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U162	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U163	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U214	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U217	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U126	LS244	ALS244	Non-Inverting Octal Buffer	$0.30
U195	LS240	ALS240	Inverting Octal Buffer	$0.40
U133	LS373	ALS373	Octal Transparent Latch	$0.50
U213	LS373	ALS373	Octal Transparent Latch	$0.50
U196	LS373	ALS373	Octal Transparent Latch	$0.50
U197	LS373	ALS373	Octal Transparent Latch	$0.50
U198	LS373	ALS373	Octal Transparent Latch	$0.50
U227	LS373	ALS373	Octal Transparent Latch	$0.50
U128	LS257A	ALS257	Tri-State Multiplexer	$0.50
U146	LS257A	ALS257	Tri-State Multiplexer	$0.50
Y103	15Mhz	24Mhz	Crystal	$0.00
U149	200nS	125nS	Digital Delay Line	$0.00
U211	8088	8088-2	8/16 Bit Microprocessor	$2.00
U110	PAL16L8	PAL16L8A	Programmable Array Logic	$0.60
U233	ALS74	LS174	Hex D Type Flip-Flop	($0.17)
U161	PAL16L2	PAL16L2A	Programmable Array Logic	$0.60
U190	27128-30	27128-25	EPROM	$1.00
U153	LS280	S280	Parity Generator/Checker	$0.25
U221	LS32	ALS1032	Quad OR Buffer	$0.20
U200	LS368	8T98	Hex Bus driver	$0.25
U180	LS367	8T97	Hex Bus Driver	$0.25
U101	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U102	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U103	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U104	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U105	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U106	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U107	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U108	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U109	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U117	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U118	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U119	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U120	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U121	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U122	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U123	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U124	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60
U125	8264-20	8264A-12	64K x 1 Dynamic RAM	$0.60

TOTAL: $22.28

This is the P.C. Board modification to run a Z-100 at 8 Mhz.   4-18-83

A. Winchester modification. (This may already be done.)
This changes the polarity of the clock in the refresh circuit.

1. Cut the trace going to U168 pin 11
   from U148 pin 13
2. Jumper U130 pin 5 to U130 pin 10
3. Jumper U130 pin 8 to U152 pin 1
4. Jumper U130 pin 9 to U225 pin 3

B. Wait state generator modification.
Adds one extra wait state for I/O.

1. Cut the trace going to U233 pin 5
   from U226 pin 14 (component side)
2. Jumper U233 pin 1 to U234 pin 1
3. Jumper U233 pin 3 to U234 pin 3
4. Jumper U233 pin 4 to U234 pin 4
5. Jumper U233 pin 5 to U234 pin 2
6. Jumper U234 pin 5 to U226 pin 14

```
     HI3
      ¦ modified wait state generator
      *------*-----------+
      ¦      ¦4          ¦4
      ¦    +-+-+       +-+-+    statrom
      +--2¦D Q¦5-----2¦D Q¦5--> U226
           ¦233¦       ¦234¦     pin 14
      +--3¦>  ¦   +--3¦>  ¦
      ¦    +-+-+  ¦    +-+-+
      ¦      ¦1   ¦      ¦1    ___
      ¦      +----+------*---- ALE
      ¦           ¦
 SO---*-----------+
```

C. Ready logic modification.

1. Cut the trace going to U236 pin 4 from U205 pin 9
2. Jumper U236 pin 4 to U206 pin 13
3. Jumper U236 pin 7 to U236 pin 9
4. Pull U236 pin 3 from the socket
5. Jumper U236 pin 3(I.C. leg) to U220 pin 6
6. Jumper U220 pin 5 to U206 pin 1

D. Swap logic modification.

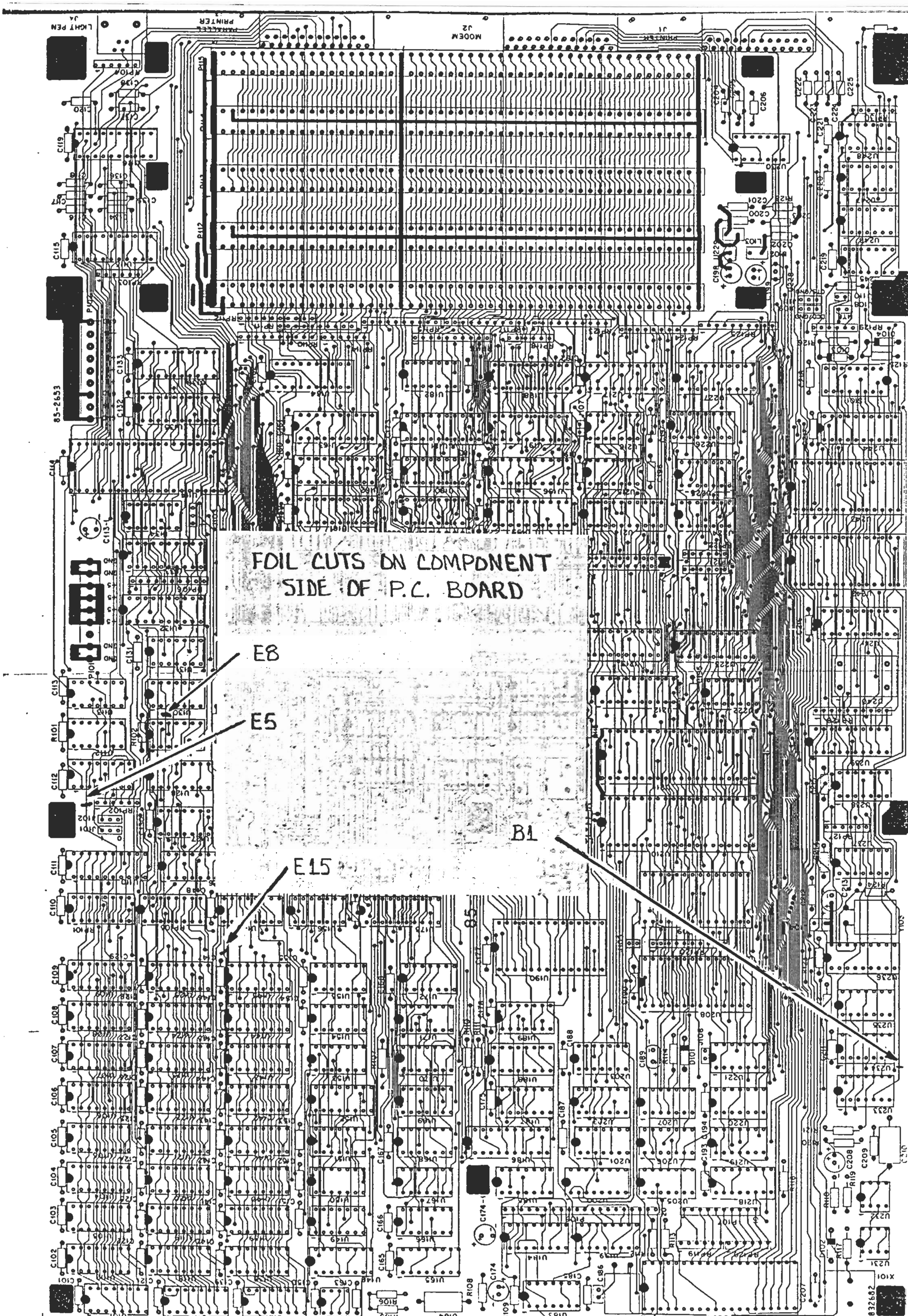
1. Cut the trace going to U171 pin 10 from U155 pin 8
2. Jumper U155 pin 8 to U156 pin 13
3. Jumper U156 pin 12 to U171 pin 2
4. Jumper U156 pin 11 to U171 pin 10

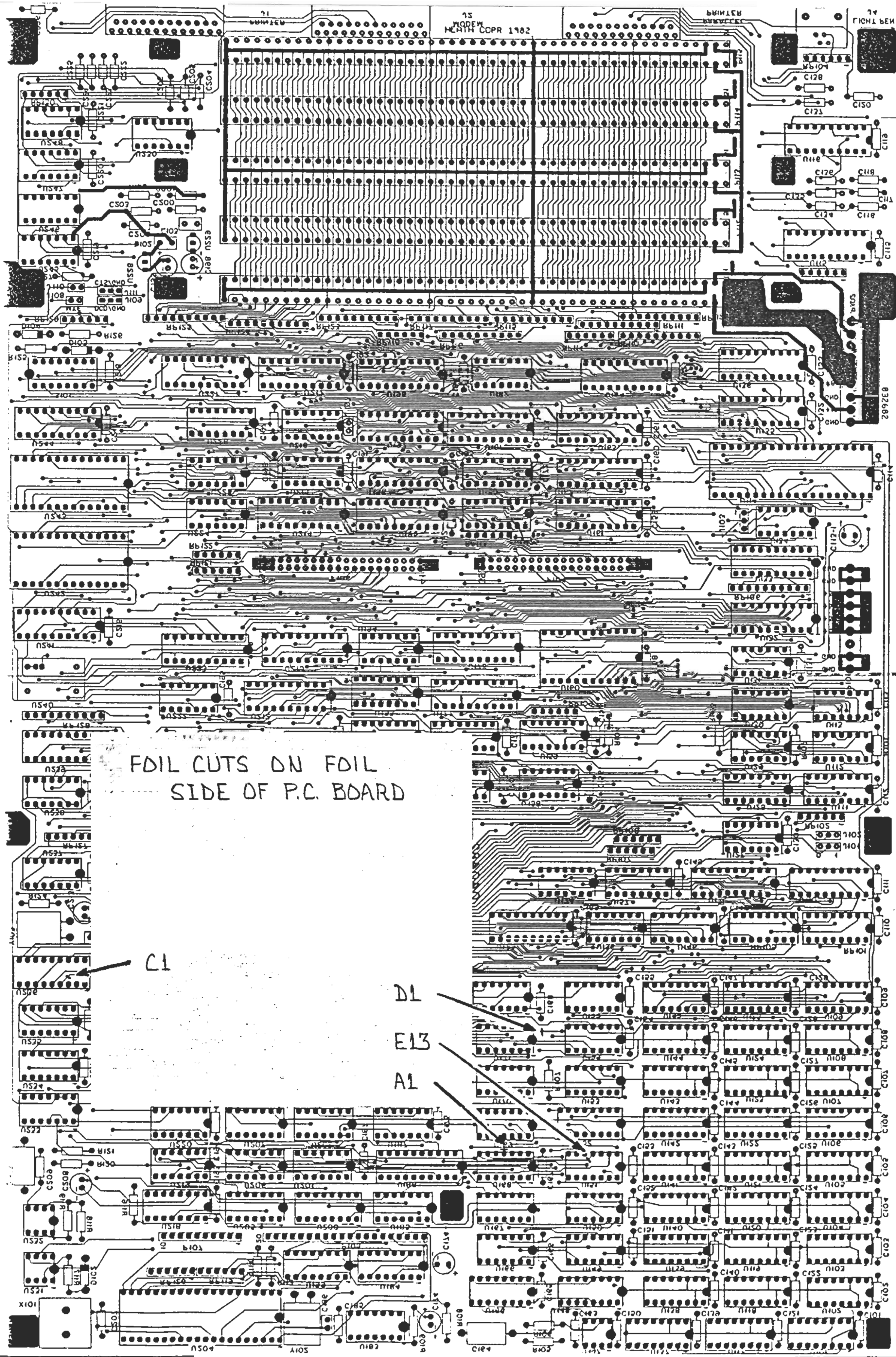
E. Memory modification.

1. Pull U154 pin 2 and U154 pin 9 from the socket
2. Jumper U154 pin 2(I.C. leg) to U154 pin 9(I.C. leg)
3. Jumper U154 pin 9(I.C. leg) to U173 pin 17
4. Jumper U173 pin 17 to U174 pin 10
5. Cut the trace going to U111 pin 14 from U173 pin 17 (component side)
6. Jumper U111 pin 14 to U111 pin 13
7. Jumper U174 pin 9 to U154 pin 10
8. Cut the trace going to U130 pin 13 from U111 pin 11 (component side)
9. Jumper U174 pin 8 to U130 pin 12
10. Pull U173 pin 9 and U173 pin 18 from the socket
11. Jumper U173 pin 9 (I.C. leg) to U173 pin 18(socket)
12. Jumper U173 pin 18(I.C. leg) to U168 pin 1
13. Cut the trace going to U151 pin 11 from U170 pin 10
14. Jumper U151 pin 11 to U151 pin 13
15. Cut the trace going to U146 pin 1 from U166 pin 2 (component side)
16. Jumper U110 pin 12 to U128 pin 1

F. Clock modification.

1. Replace Y103 15Mhz. crystal with 24Mhz. crystal.


FOIL CUTS ON COMPONENT
SIDE OF P.C. BOARD
E8
E5
E15
B1
85-2653


FOIL CUTS ON FOIL SIDE OF P.C. BOARD
C1
D1
E13
A1

by Dave Koehler

A). Static Considerations:

1). The person performing the work should be static free. Do no wear any
clothing such as wool or nylon that is renowned for its stati

retention.
Ground yourself by wearing an anti-static wrist band that is connecte to your
work station ground. If such a band cannot be purchased, improvis with a band
of wire.

2). The work station where the mods are to be performed must b considered as
well. Work only on a antistatic mat such as the foam cushions that came with
the motherboard. Never work on an cloth or bare plastic surface. Either
surface retains static.

3). Connect the board's ground plane via a flexible strap to th work station
ground. This will put board and a likewise grounded worker at th same
potential, eliminating the static discharge possibility.

4). Place any chip that is removed from the board, when it i removed from
the board, in some antistatic carrier.

5). The soldering iron used should have its tip grounded internall through
the tool itself to the work station ground.

6). In case of a mistake which necessitates desoldering, try to us a
desoldering vacuum tool that is MOS safe. These look and function th same as
their all plastic relatives, but are made of metal.

B). Soldering:

1). Use a low wattage soldering pencil, somewhere around 25 to 4 watts
power. Install a small chisel tip no larger than 1/16th inch i width.
Keeping the tip clean and well tinned will insure maximum hea transfer into
the soldering area, thereby minimizing the iron's contact time on th board.

2). Each solder composition has a heat range that defines it MELTING point
and its MELTED point. This temperature span is called the solder' plastic
range. Almost all solder compositions will begin MELTING around 36 degrees

Fahrenheit. Depending on the particular composition, the solder wil not be completely MELTED until it has reached the high end of its plasti range (The temperature best for soldering as the solder is in its most flui state.) In the case of 50% tin/50% lead compositions, this upper MELTED point i around

420 degrees. In the everyday 60% tin/40% lead solder, the MELTE point is reached at 375 degrees. In a 63% tin/37% lead composition o 'eutectic' solder, the MELTED point is exactly the same as its MELTING poin of361 degrees. The wider the plasticity range of the solder, the mor cautious the worker should be not to disturb the connection until the solder ha cooled off below its MELTING point. Eutectic solder is the solder of choice fo almost all board level repair work. Because it solidifies almos instantaneously after removal of heat, cold solder joints common to lead movemen during cooldown are virtually eliminated. Another advantage is that th lower MELTED point shortens the time the iron has to deliver heat into th connection, thereby minimizing the chance of heat damage to the board itself.

3). Heat damage to a board is more a function of time than it is o heat. Take for example your own flesh. Passing your finger quickly over th flame of a match will barely singe you, but holding it over that flame wil provide you with an ugly, painful burn. Likewise, the longer a soldering iro contacts a connection, the more heat that is radiated into the surrounding area. This results in a higher average heat which takes the material longer t dissipate, giving the heat time to do its damage. Any solder connection to a P board, no matter matter its size or shape, should not take any longer than 2 t 3 seconds to perform. Anything longer than that and the worker runs the risk o damaging the component/mounting system. In the case of multilayer PC boards. this includes the ugly reality of warping internal layers. Most seasone board repair techs will test their soldering skills before project wor begins. Practice your technique on a junk board of similiar composition to ge your timing down to the 2 to 3 second margin. If you are unable to achiev a quality connection, you can make adjustments and will have spared yoursel real misery.

possible,
adjustments to the delivery end of soldering are the most efficient. The
larger the tip size, the faster the heat is released into the connection.
Match the tip size to the size of the work. ALWAYS clean and tin that tip both
before and after soldering, to prevent the slowdown of the heat

transfer due to
oxide buildup on an exposed heat tip (Discard as useless any scratched or
untinnable tip.) Tinning also provides the crucial thermal connection necessary to delivering the tip's heat uniformly throughout the work. Make
these adjustments first before you even consider increasing power. Then if you
must increase power, do so in small increments, retesting yourself at the
higher heat level. Proceed with caution!!!!

NOTE: When contacting the board, do not press the iron down into the connection
point. Excessive downward pressure can cause pad damage and/or the lifting of
the pad away from the base material.

C). Trace cutting:

1). Use a very sharp, pointed hobby style knife. This will allow access to
traces on very dense boards.

2). When cutting a trace, use a very short sawing action and minimal downward
pressure. Too much pressure can result in slicing through the internal layers
of a multilayer board, making the board almost impossible to repair.
Especially avoid using the knife's point in a digging action.

D). Jumpering:

1). When working with thin wire gauges such as 30 AWG be very careful to
avoid stretching the wire. Do not stretch Kynar as the wire is easy to break,
and can do so invisibly beneath its insulation. Use a wire stripper that
removes the insulation by pressure or heat rather than by cutting. Cut style
wire strippers tend to nick the copper, weakening it. In the case of 30 gauge,
the exposed wire end will usually break off. Strip the wire as little as
possible and solder quickly and efficiently. Too much heat will cause insulation meltback.

2). When routing jumper wires across the board, cross all major power and
signal traces at right angles to minimize signal interaction due to

insulation.
As with any modifications, there are several caveats.

WARNING - WARNING - WARNING

These modifications are distributed without any sanction, official or otherwise, from Zenith Data Systems. No connection between Zenith and this information is expressed or implied. Any modifications performed on the motherboard of your computer are made at your own risk and will probably void the guarantee on your computer. It is also likely that authorized Zenith Data Systems dealers and/or service centers may refuse to service an altered machine. This information is distributed only for the technical enlightenment of advanced hobbiests, any use of this information is entirely at your own risk. The possible penalty is the demise of a perfectly good motherboard, a replacement for which will cost in the vicinity of $800.

Although the author has made every effort to ensure that the information in this article is correct, there is still the possibility of error. If you attempt these modifications, you do so entirely at your own risk. Neither the author nor any other person or company on the face of the earth will accept any liability as a result of your attempts to use this information.
If you still wish to proceed in spite of the warnings, and in full realization of the possible dire consquences, read these instructions carefully to acquaint yourself with the modifications before you begin. The general section on board level repair and alteration should also be read carefully before you start.

Modifications for 256K Dynamic Ram Chips

Note that you will no longer be able to use any 64K chips on your motherboard.
No mixing is allowed with this mod, although you need only populate one row with 256K chips. Additional rows can be added at any time with no additional mods up to the full three row, 768K, capacity of the motherboard.

STEP 1: Obtain an 18 pin low profile socket, the lower the better.
Modify the socket by bending pins 9, 10, 15 and 16 in toward th

center of the socket. Solder a small jumper joining pins 9 and 10 and connecting them to pin 8. Be sure that you solder to pin 8 just where it enters the body of the socket and use a minimum of solder.

The socket must be able to be seated flush without interferance from

any lumps of solder on the pin. Make two jumper wire about 4 inches long. Solder one to pin 15 and the other to pin 16 where the pins are bent under. Again, be sure to allow clearance for the socket to seat fully. Set the socket aside.

STEP 2: Perform the following traces changes to the motherboard:

Important Note: All references to U111 pin numbers are to the existing 16 pin configuration. References to pin numbers on the socket to be installed at U111 are to the socket's 18 pin configuration.

1. Jumper all pin 1s of U101 thru U109 together
2. Jumper all pin 1s of U117 thru U125 together
3. Jumper all pin 1s of U137 thru U145 together
4. Jumper U109 pin 1 to U125 pin 1 and U145 pin 1
5. Jumper U125 pin 1 to RP101 pin 8
6. Jumper RP101 pin 9 to U155 pin 6
7. Jumper U155 pin 11 to U155 pin 5
8. Jumper U155 pin 3 to U155 pin 4
9. Jumper U155 pin 12 to U111 pin 10
10. Jumper U155 pin 13 to U146 pin 1
11. Cut the trace going to U166 pin 2 on the bottom (foil) side
12. Jumper U110 pin 12 to U146 pin 1
13. Cut the trace from U111 pin 9 on the bottom (foil) side between the pin and the feed-thru hole. Jumper the hole to U173 pin 17
14. Jumper U111 pin 9 to U155 pin 1
15. Cut the traces from U173 pins 7 and 8 on the top (component) side between U173 and the feed-thru holes near C170
16. Jumper U173 pin 7 to U111 pin 3
17. Jumper U173 pin 8 to U111 pin 2
18. Cut the trace on the bottom coming from U173 pin 18
19. Cut the trace on the bottom coming from U110 pin 4
20. Cut the trace on the top coming from U173 pin 9
21. Cut the trace on the bottom coming from U151 pin 10
22. Jumper U110 pin 4 to U149 pin 12
23. Jumper U110 pin 5 to U173 pin 9
24. Jumper U173 pin 9 to U149 pin 4
25. Jumper U173 pin 18 to U149 pin 10
26. Jumper U155 pin 2 to U166 pin 8
27. Jumper U166 pin 9 to U146 pin 1
28. Install the 18 pin socket in U111, inserting pin 1 into pin 1. The jumper coming from pin 16 should be fed thru the hole under the socket and the one from 15 thru the hole near the bottom of

from

pin 15 to U173 pin 2

29. Jumper the remaining wire from pin 16 of the socket to U17 pin 1

In addition to the above trace changes, you will need to replace fiv chips.
Three of the chips are only available from Software Wizardry at th

present time, although most of the Heathkit store will be stocking th Software Wizardry chip set. Ask for the RAMPAL 100 kit to install 256K DRAM into a Z-100. Eventually, Heathkit will be selling the chips needed t upgrade the new type motherboards to 256K chips. The Heathkit chip set should be functionally identical and should work with the modifications show above on the early motherboards. The parts that need to be changed are:

Component	Old	New	Comments
U155	74LS00	74ALS37 (or 74S00)	NAND gate
U166	74LS14	74ALS1004 (or 74S04)	Inverter
U111*	256x4	1024x4	Memory decode prom
U110*	PAL16L8	PAL16L8B	Decode PAL
U173*	PAL14L4	PAL14L4	Decode PAL

* These chips contain different logic than th standard chips used with 64K RAMs

If you are running at 8 MHz, you may also want to make th following changes to minimize any chance of problems at the higher speed:

U126	74LS244	74F244	
U133	74LS373	74AS373	
U128	74LS257	74F257	
U146	74LS257	74F257	
U155	74LS00	74AS00	Instead of ALS3 above

Once you have completed the modifications, install your 256 Dynamic Ram Chips and test the system. The latest version of the Disk-based Diagnostics (Rev 3.1) for the Z-100 can be configured for either 64 or 256K chips. If you have one of the early diagnostics that doesn't kno about 256K chips do not run the parity check. That check assumes that bank three (3) and above live on Z-205 cards and will always fail since it will attemp to check the parity circuit on a card that doesn't exist. If you have th later version, the problem doesn't occur.

GENERAL TIPS ON BOARD REPAIR AND MODIFICATION