→ set for 30 trk sectors
don't want double side
" " 40 track

9600 baud -

HDS COCO DCB KIT

not my chips
different chips

Set 35 - not 40 tracks.
Single sided not double

30 unless need not 6
more to track

Baud rate

DISCLAIMER

Hard Drive Specialist hereby reserves the right to make changes to any material or any products described herein to improve reliablity, functionalbility, or design. Although the material contained within this manual has been carefully checked, HDS or any subsidaries thereof, does not assume any liablity arising out of applications or use of any circuit described herein.

If, after reviewing this manual and kit, you do not wish to attempt the assembly of this kit, you may return the complete kit in exchange for a preassembled and checked DCB. The cost will be the difference between the kit price and the fully assembled price plus shipping costs. Call for current prices.

WARRANTY

Your HDS Color Computer Drive Controller Kit is covered by a 120 day parts warranty. If you experience a problem please check your installation carefully. Should you need assistance see your Dealer or call us at (713) 480-6002.

Revd 10/16

Hard Drive Specialist warrants this drive controller kit to be in good working order for a period of 120 days from the date of purchase as a new product. Should it fail to perform during that period, HDS will, at its option, repair or replace this DCB at no cost except as set forth in this warranty. Replacemnet parts or products will be furnished on an exchange basis only. Replaced parts and/or products become the property of HDS. No warranty is expressed or implied for products damaged by accident, missuse, improper assembly techniques, natural or personal disaster, or unauthorized modification. Warranty for drive controllers sold in kit form by HDS does not include labor.

Warranty service described herein may be obtained by delivering this product, during the 120 day warranty period, to any authorized HDS Dealer, or to our Factory Service Center located at 16208 Hickory Knoll, Houston, Texas 77059. Whether delivering to a Dealer or to the Factory, the product must be accompanied by proof of purchase date. If shipped by U.S. Mail or common carrier, owner agrees to insure and accept all liability for loss or damage to this product, to prepay all shipping charges, and to use a shipping container equivalent to the original packaging.

COLOR COMPUTER FLOPPY DRIVE CONTROL BOARD
BY HARD DRIVE SPECIALISTS
manual rev C

The HDS drive control board for the color computer is a direct replacement for original equipment. It incorporates the very latest technology and is fully compatible with all existing software and operating systems. It has provisions for installing an additional DOS ROM. Single and double density operation is supported. This board also has gold plated card edge connectors for added reliability.

CIRCUIT DESCRIPTION

The heart of the HDS floppy drive controller is the WD1773. The WD1773 is fully software compatible with the WD1793 and MB8877 controller chips used in original equipment. The WD1773 is a 28 pin DIP, it uses a single +5 volt supply. This chip also features built in data seperation and write precompensation circuits. This greatly reduces the components required for the board thereby increasing reliability, performance, and reducing power consumption.

The HDS controller features two ROM sockets. This allows the installation of two different DOS's simultaneously. The user may simply switch between the two ROM's using the on-board jumper. One of the ROM sockets is a 24 pin socket while the other is a 28 pin. The 24 pin socket will accept the standard Tandy ROM's, MCM68764 EPROM's, or equivalent. The 28 pin socket can be selected to accept these same 24 pin ROM's or lesser priced 28 pin EPROM's such as the 2764.

CLOCK

The HDS controller board uniquely features the latest inovation in clock circuitry. This board does not use the conventional crystal-inverter clock circuit. Instead a clock module is used. The clock module is a one unit device which eliminates the need for discrete components and wasteful inverters. The result is a much more reliable design than the "standard" crystal-inverter clock.

CPU HALT AND INTERRUPT LOGIC

Floppy disk drives are mechanical devices which run much slower than the computer which operates them. For this reason there are two control signals provided to the CPU to make it in effect "wait" for the floppy controller. These signals are

called HALT and NMI. The term used for This type of manipulation of data is called "tight read" or "tight write" loops. The way it works is as follows. During a disk read operation, the CPU loads the WD1773 command register with the desired read operation. Next, the CPU enables the double density and halt enable control bits. Immediately the CPU is halted until the data register (in the WD1773) contains the first byte of data. When this occurs, the data request line (DRQ) of the WD1773 is asserted, thus removing the CPU from the halt state. The CPU then loads the byte into computer memory. The CPU then repeats the read operations until the entire file is transfered into memory. The NMI control signal is asserted at the completion of the read command. This breaks the CPU out of the tight read loop. Tight write loops occur similarily except that the halts occur after data has been written into the data register of the WD1773.

COMPUTER INTERFACE

The controller is interfaced to the computer via command and status registers. All of these registers are internal to the WD1773 except for one. This is the control register. It absolutely selects one of four drives, double density, write precompensation, and turns the drive motors on and off. The function of each bit of this control register is shown in figure 1.1. The WD1773 contains four registers which are directly accessed by the CPU. These are the status/command register, the track register, the sector register, and the data register, Please refer to the Western Digital 1773 data sheet for information on these registers.

HEX ADDRESS	DISK CONTROLLER USAGE
FF40	BIT 0 = DRIVE SELECT 1 BIT 1 = DRIVE SELECT 2 BIT 2 = DRIVE SELECT 3 BIT 3 = MOTOR ON BIT 4 = START PRECOMPENSATION BIT 5 = DOUBLE DENSITY ENABLE BIT 6 = DRIVE SELECT 4 BIT 7 = WAIT ENABLE
FF48	1793 STATUS/COMMAND REGISTER
FF49	1793 TRACK REGISTER
FF4A	1793 SECTOR REGISTER
FF4B	1793 DATA REGISTER

Figure 1.1

DISK COMMUNICATION

The WD1773 performs all of the read, write and step functions of the interface to the disk drives. The only additional components required are high current drivers (7416's) and input termination (150 Ohm) resistors.

STAKING PINS

The HDS board has three "flea clips" which fit over staking pins. These flea clips perform two functions. The first function is to choose which ROM is to be selected. The second function is to configure the 28 pin socket to accept either a 28 pin ROM or a 24 pin ROM. The A-B-C pins select the ROM's while the D-E-F-G-H pins configure the 28 pin ROM socket. To select ROM A (the 24 pin socket labeled Z6), put the flea clip over pins A-B. To select ROM B (the 28 pin socket labeled Z7), put the flea clip over pins B-C. To configure the ROM B socket to accept a 28 pin ROM (2764's), short pins E-f and G-H with the flea clips. To configure the ROM B socket to accept a 24 pin ROM (68364's), short pins D-E and F-G with the flea clips. Also note that when using a 24 pin ROM in the 28 pin socket, pin 1 of the ROM goes into pin 3 of the socket. See figure 1.2.

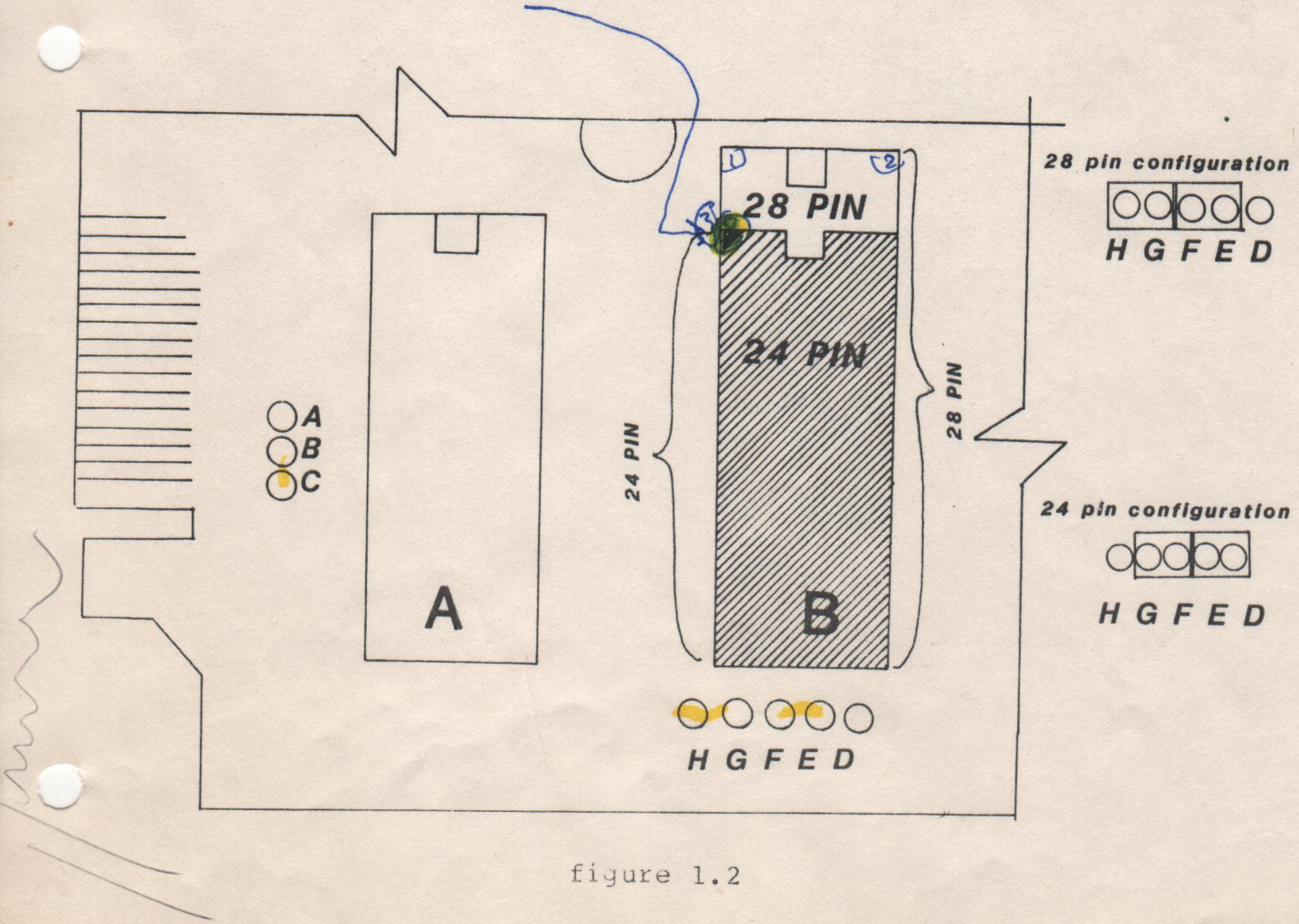


figure 1.2

PARTS LIST REV C

QTY RCV'D	QTY NEEDED	PART NUMBER	DESCRIPTION
(1)	1		Printed circuit board
(2)	2	Z7,Z8	28 Pin IC sockets
(1)	1	Z2	20 Pin IC socket
(6)	6	Z1,Z3, Z4,Z5 Z9,Z10	14 Pin IC sockets
(1)	1	Z6	24 Pin IC socket
(2)	2	R5,R6	470 ohm resistors
(4)	4	R1-R4	150 ohm resistors
(2)	2	R7,R8	10K ohm resistors
(10)	10	C2-C11	.1uf Capacitors
(1)	1	C12	47pf cap
(1)	1	C1	35uf Electrolytic cap
(1)	1	A-B-C	3 pin header (staking posts)
(1)	1	H-G-F-E-D	5 pin header
(3)	3		flea clips
(1)	1	Z1	74LS00
(1)	1	Z2	74HC273
(2) 7406	2	Z3,Z9	7416 7406 needed
(1)	1	Z4	74LS04
(1)	1	Z5	74LS02
(1)	1	Z8	WD 1773 FDC
(1)	1	Z10	74HC74
(1)	1	Y1	16Mhz Clock module
(1)	1		Case top
(1)	1		Case bottom
(3)	3		Case screws

yellow, violet, brown
brown, green, brown
brown, black, orange

polarized

OPTIONAL PARTS, INCLUDED ONLY IF SPECIAL ORDERED

( )	1 or 2	Z6,Z7	ROM(s) or EPROM(s)
( )	1		Shield

HARD DRIVE SPECIALIST COLOR COMPUTER DRIVE CONTROLLER BOARD ASSEMBLY INSTRUCTIONS

CHECKING PARTS

Immediately upon receiving the HDS COCO DCB kit, you should check the contents against the parts list. Be sure that all parts required are included. Please notify Hard Drive Specialist immediately if you find discrepencies. HDS will not be responsible for missing or incorrect items if we are not notified within 10 days after you receive your kit.

Please examine all packing material before discarding it to make sure you are not throwing away any parts. Some items are very small and fragile. Do not handle any of the IC's unless you are properly grounded.

PART SUBSTITUTIONS

It is possible that certain parts may not correspond exactly to the values called for on the parts list. In this case, you were probably shipped substitute part(s). This simply means that the part called for in the parts list was not available at the time your order was shipped. Instead of sending an incomplete kit or delaying you order we will ship the kit with substitute parts that we know will work without affecting the circuit or final operation of the system in any way. If you have any questions regarding substitute parts please call HDS so we may verify the part is an approved substitute. Examples of part substitutions could be as follows:

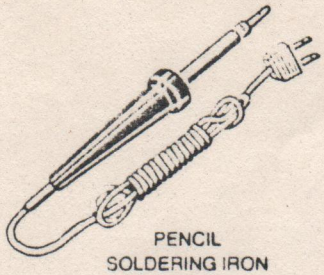
a) Parts list shows a 74LS00
   and a 7400 is shipped

b) Parts list shows a 150 ohm resistor
   and a 160 ohm resistor is shipped

NOTE: HDS does not make substitutions for critical components and will never ship a component that has not been thoroughly tested.

TOOLS NEEDED

DIAGONAL CUTTERS



PENCIL SOLDERING IRON (22 to 25 WATTS)

DESOLDERING BULB

DESOLDERING BRAID

Diagonal side cutters

Solder Iron (25 Watt)

Fine Gage Solder

Desoldering tool and/or desoldering braid may be usefull

HANDLING INTEGRATED CIRCUITS (IC's)

Integrated circuits can be damaged by static electricity discharges. To prevent your chips from being ruined follow these guidlines:

a) Do not handle the chips any more than necessary, ie. leave them in their protective foam or tubes until you are ready to install them.

b) When you do handle them, avoid touching the pins with your fingers.

c) In areas and climates where static electricity is prevelant, use one of the anit-static wrist straps such as is available through Radio Shack under their catalog number 276-2399.

CHECK PC BOARD

Before doing any soldering to the PC board check it over to defects. All boards are individually inspected at manufacture but it is possible for defects to slip by. Check for holes not drilled, good plate thru's, hairline shorts between traces, and overall appearance. Again, defective boards are very rare but the couple of minutes taken now to look the board over could save a lot of trouble snooting time.

IDENTIFYING RESISTORS

All resistors supplied with this kit are 1/4 Watt. Their values are identified by reading the color bands on them. Each color represents a number as shown in the chart. The first and second bands give the first two digits while the third is a multiplier. There may be a fourth band to indicate the resistor's tolerance. To read a resistor's value hold it in the orientation shown with the first color band to the left. Read the resistor left to right.

RESISTOR COLOR CODE

COLOR	1st DIGIT	2nd DIGIT	MULTIPLIER
BLACK	0	0	1
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
VIOLET	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	1,000,000,000
GOLD	–	–	1
SILVER	–	–	01

Resistor Chart

CAPACITORS

There are two types of capacitors supplied with this kit. One is a 35uf electrolytic and the rest are nonelectrolytic. The electrolytic cap must be installed with the correct polarity. The cap will usually be marked with a (-) sign and arrow pointing to the (-) lead. It may also be marked with a dot or (+) sign near the (+) lead. Also the (+) lead will usually be slightly longer than the (-) lead. It is very important to install this capacitor on the PCB such that the (+) lead goes into the hole marked (+) on the PCB. The .1uf and 47pf caps are not polarized.

LEAD CLIPPING

When clipping the leads of the capacitors and resistors, be very careful, as the leads will have a tendency to fly away.

!!!HOLD
THE LEADS WHEN CUTTING THEM SO THAT THEY WILL NOT FLY
AWAY AND INJUR YOUR EYE'S PRECIOUS FLUIDS!!!

Worse yet, a lead could fly into your computer and short it out.

PROPER ORIENTATION OF IC SOCKETS AND CHIPS

IC's must be installed with proper polarity. Each chip has pin 1 marked. There are several methods used for marking pin 1. These are illustrated in figure 2.1.

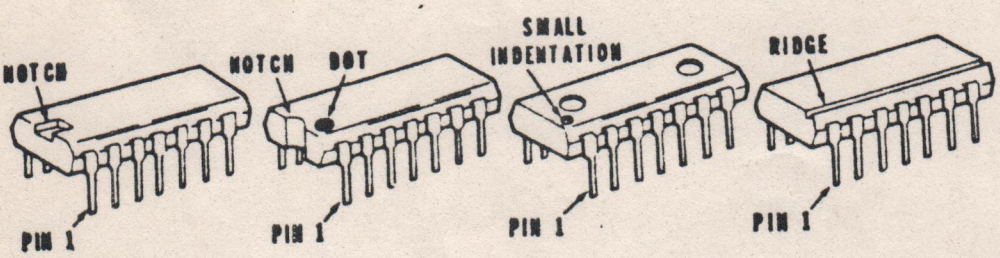


figure 2.1

The PCB will have an index mark for pin 1 and the solder pad for pin 1 for each chip on the board is shaped with a point. When installing the chips it is essential to get pin 1 of the chip orientated with pin one of the PCB.

In addition the sockets are also indexed. Although it is not nexessary to install the sockets with proper orientation, it will make for a more professional looking end result if you do orientate the sockets. It will also make it easier to identify pin 1 when installing the chips. See figure 2.2.

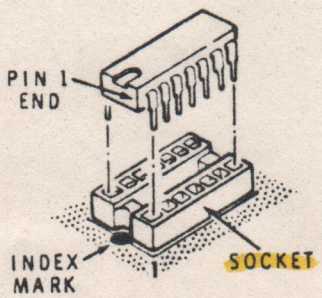


figure 2.2

SOLDERING HINTS

Soldering is probably the most important operation in building this kit. Bad solder joints can be difficult to troubleshoot. Soldering is actually very simple once you get the "hang of it". If you are unsure of your soldering skills, find a scrap board to practice with. Use the following hints as a guidline:

a) Use the right type of iron. A 22 to 25 Watt pencil type iron with a 1/8" or 3/16" chisel or pyramid tip works best.

b) Keep the tip of the iron cleen. Wipe it often on a damp sponge or cloth. Then apply a bit of solder to the tip to keep it looking wet.

When soldering a resistor, first bend the leads straight down as shown in figure 2.3. Then push the leads through the PCB holes, press the resistor against the board and bend the leads out to hold it in place - see figure 2.4.

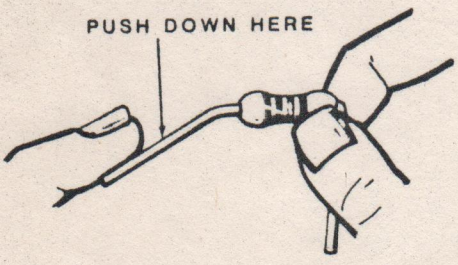


fig 2.3

fig 2.4

Capacitors should also be installed close to the board with their leads bent out to hold them in place.

Solder joints as follows:

a) Hold the tip of the iron against both the lead and the solder pad. Heat both of these for a second or two. fig 2.5.

b) Apply the end of the solder to the heated joint by touching it to the lead, pad, and iron tip simultaneously.

c) Allow aproximately 1/4" of solder to be used per joint.

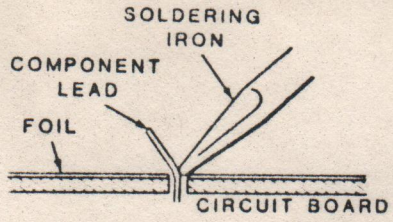


figure 2.5

Good solder connections will be evident by the solder flowing evenly onto the pad and the lead, see figure 2.6. Poor connections can happen when the joint is not heated properly or sufficiently, see figure 2.7 for bad soldering habits.

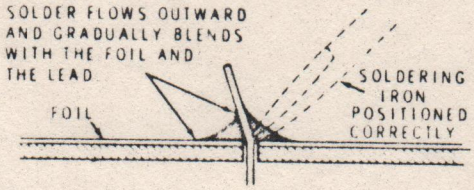
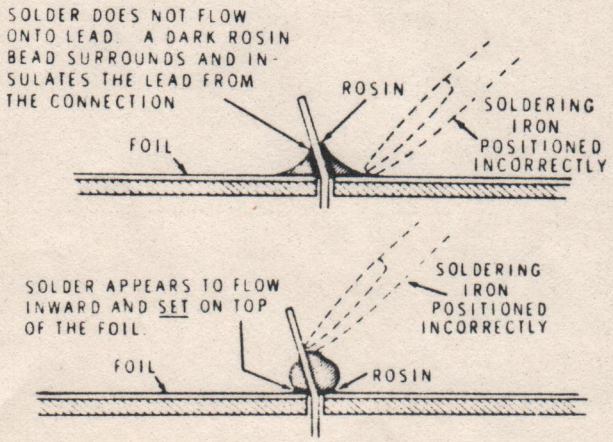


figure 2.6



figures 2.7

SOLDERING IC SOCKETS

Use care when soldering the IC sockets. Since the leads of the sockets are smaller than resistors and capacitors, they will not need as much heat, so be careful. One problem with IC sockets is that since the socket is upside down, the solder naturally flows from the bottom of the socket towards the top.

Too much heat when soldering will cause the solder to flow into the pin opening and fill it. If this happens to just one pin, the entire socket will be useless. If you were to fill a socket pin with solder, you would have to remove and replace the entire socket. HDS supplies closed bottom solckets where-ever possible to minimize this hazard. See figure 2.8 for an illustration.

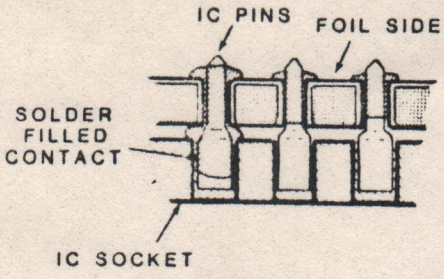


figure 2.8

SOLDER BRIDGES

Sloppy soldering can result in solder "bridges". A solder bridge is solder shorting adjacent traces. A good rule to follow is to inspect the area around each lead before you solder it. Then when you do solder this connection, make sure the solder remains in this area and does not bridge to other foil areas. To remove a solder bridge, hold the board solder side down. Touch the iron tip between the bridged points. The solder will flow down the tip to clear the bridge. See figure 2.9.

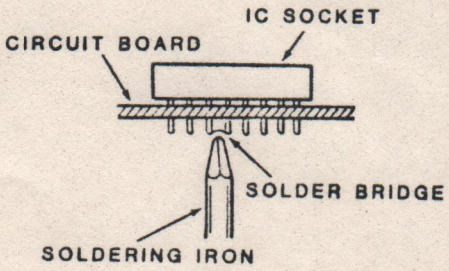


figure 2.9

STEP BY STEP ASSEMBLY

(1) Install and solder all of the IC sockets. Socket installation is made easier if you do the following:

A) Find a flat board (plexiglass, rigid cardboard, etc.) that is slightly larger than the DCB.

B) Place all of the sockets in their places, noting orientation.

C) Place the flat board on top of the sockets.

D) Pinch the sockets between the two boards and flip the assembly over so the socket leads are now upwards so they can be soldered.

(2) Install all of the resistors and solder them. Refer to the parts list and figure 3.2 for correct placement of the resistors.

( )R1 ( )R2 ( )R3 ( )R4

( )R5 ( )R6 ( )R7 ( )R8

(3) Clip the resistor leads close to the board.

(4) Install and solder the .1uf capacitors. Refer to the parts list and figure 3.2 for proper placement.

( )C2 ( )C3 ( )C4 ( )C5 ( )C6

( )C7 ( )C8 ( )C9 ( )C10 ( )C11

(5) Install and solder the 47pf capacitor. See figure 3.2 for proper placement.

( )C12

(6) Install and solder the 33uf capacitor. Refer to the text for proper orientation instructions.

( ) C1

(7) Clip the capacitor leads close to the board.

(8) Install and solder the 3 pin and 5 pin headers (staking pins) in A-B-C and H-G-F-E-D holes, respectively.

( ) 3 pin header ( ) 5 pin header

(9) Install and solder the clock module. Note the dot in one of the corners of the module, this indicates pin one. As a further marking this corner is also squared off instead of rounded. Make sure pin one of the module goes in pin one of the PCB. Clip the module leads close to the board. See figure 3.1.

( ) Y1

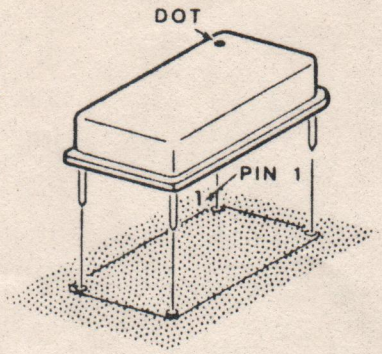


figure 3.1

(10) -OPTIONAL STEP- Before installing the IC's you may wish to clean the board. Use rosin stripper and a stiff brush (toothbrush is o.k.). Follow the instruction that come with the solvent you use.

(11) Install the IC's. Use care so that all of the pins go into the sockets. Make sure none of the pins are bent out of the sockets or underneath the chips. Refer to the parts list and figure 3.2 for proper placement.

( ) Z1,74LS00 ( ) Z2,74HC273 ( ) Z3,7416

( ) Z4,74LS04

( ) Z5,74LS02 ( ) Z6,ROM A ( ) Z7,ROM B

( ) Z8,WD1773

( ) Z9,7416 ( ) Z10,74HC74

(12) Install the A-B-C flea clip to select the ROM you wish to use. Install the H-G-F-E-D flea clips to configure the 28 pin socket according to the type of ROM you are using. Refer to the text for flea clip placement information.

(13) This completes assembly. You are now ready to mount the board in the case, plug it in and check it out.

CHECKING THE BOARD OUT

(1) With the computer's power off, plug the DCB into the computer.

(2) Plug the drive cable onto the DCB.

(3) Turn the computer on. There should be a slight delay and then the DOS header should come up on the screen.

(4) With a blank disk properly mounted in the disk drive, type the command DSKINIØ. The disk should format and verify.

(5) Type in a simple basic program. Save this program on the disk. Turn the computer off, wait a couple of seconds and turn the computer back on. Load the program into the computer from the disk. List the program and check to see that it is the same as when you typed it in (no errors, garbage, etc.).

(6) If any of these checks fail, procede to the trouble shooting section.

TROUBLESHOOTING NOTES

If your DCB does not function properly, follow these steps:

(1) Check all solder joints. Make sure you did not miss any. Make sure there are no solder bridges. Correct as necessary.

(2) Check for bent pins on chips. Also check that no pins of the SOCKETS were not bent before soldering.

(3) Check for proper placement of the chips, resistors, and capacitors.

(4) Check that all the chips are not backwards.

(5) Make sure the clock module is installed correctly.

(6) Check to make sure the drive cable is installed Correctly and that it is good.

(7) Check to make sure that your disk drive(s) are configured properly. Check to make sure that there is a terminator resistor installed in one and only one drive on the system, preferably in the last drive on the cable.

(8) If all these check O.K., call HDS for an R.M.A. number so you may send your board in for service.