

Heathkit® Manual

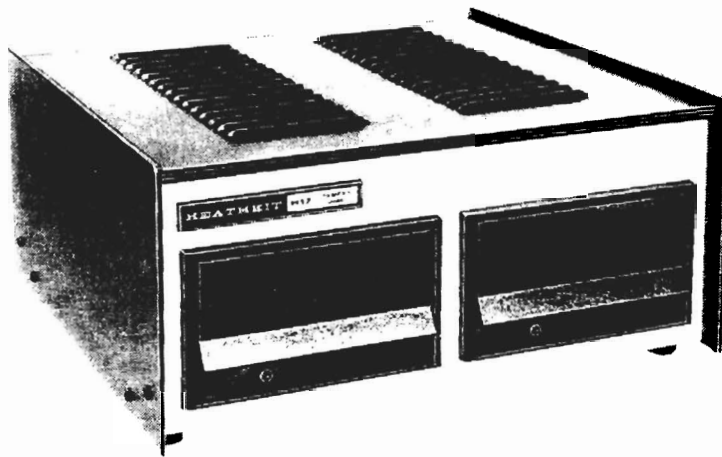
for the

FLOPPY DISK

Model H17

OPERATION

595-2160-03



HEATH COMPANY
LAWSON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heath Model H17 Floppy Disk is a mass storage device that stores programs and other digital information for the Heath H8 Computer.

Information is stored on a 5.25 inch oxide-coated diskette in 40 tracks which equal a total of 102.4k bytes. Two floppy disk drive units can be installed to double the storage capabilities of this device (only one drive unit is supplied).

The recording head is a single Read/Write gap type head. The head carriage is positioned by a lead screw and stepper motor. The controller circuit board, which installs in the computer, is the interface between the computer bus and the Floppy Disk drive unit.

A photosensor in the drive unit detects the presence or absence of a notch in the diskette to insure write protection. If the notch is not detected, a signal is transmitted to the controller to indicate a read only operation. If the notch is detected, the signal indicates a read/write operation.

The diskettes load quickly and easily through the door in the front panel. The controller circuit board installs easily in the computer and connection between the Floppy Disk and the computer is simple.

The Floppy Disk is an ideal accessory for your H8 Computer. It adds another level of capability to an already powerful tool.



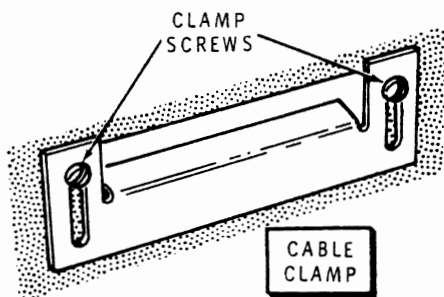
INSTALLATION AND TESTING

NOTE: If you purchased the H17-1 Accessory Drive Unit, it will be installed later.

CONNECTING THE CABLE TO THE H17

Refer to Pictorial 1 (Illustration Booklet, Page 1) for the following steps.

- () Make sure the Floppy Disk unit is turned off and unplugged.
- () If it has not already been done, remove the two screws that hold the top cover on the Floppy Disk unit. Then remove the top cover.
- () Refer to Detail 1A and loosen the screws that hold the cable clamp to the rear panel. Then slide the cable clamp down as far as possible.



Detail 1A

- () Connect either one of the 3-wire cables coming from the power supply circuit board to the corresponding connector on the drive unit circuit board. Note that this plug can be installed only one way.

- () If you have only one drive unit, fold the other 3-wire cable back on itself and install a cable tie around it to hold it together.

- () Locate the flat cable assembly.

NOTE: The flat cable is marked with a contrasting stripe along one side. This is the pin 1 side of the cable.

- () The flat cable has three connectors; two plugs near one end and a single plug at the other. Route the single-plug end of the flat cable through the rear panel opening from inside the chassis. Position the cable so the striped side is toward the right side panel.

- () The end of the flat cable with two connectors has an end-of-cable plug and a mid-cable plug. Refer to the inset drawing and push the end-of-cable plug onto the circuit board of the left drive unit. Position the plug so the striped side of the cable is toward the right side panel.

- () Pull the excess cable out of the rear panel slot until there is only a small loop of excess cable inside the chassis. Then push the cable clamp tightly against the flat cable and tighten the clamp screws.

- () Position all cables away from the stepper motor at the rear of the Floppy Disk unit. It is normal for this motor to get hot to the touch when it is running.

CONTROLLER CIRCUIT BOARD

Refer to Pictorial 2 (Illustration Booklet, Page 1) for the following steps.

- () Make sure the POWER switch (on the rear of the Computer) is in the OFF position.
- () Unplug the computer line cord.
- () If it has not already been done, remove the two screws that hold the top cover on the Computer. Then remove the cover.
- () Remove the tie bracket from the Computer.
- () Position the controller circuit board inside the chassis. Then carefully push the connectors on the edge of the circuit board onto an unused plug on the mother circuit board near the rear of the Computer as shown. Do not use plug P-10. It is reserved for other applications.

H8 MEMORY TEST

NOTE: In the following steps, if you do not get the proper results, immediately turn off the Computer, unplug the line cord, and proceed to the "In Case of Difficulty" section on Page 14.

- () Plug the computer line cord into a proper AC receptacle.
- () Push the computer POWER switch to on. The PWR, RUN, MON, and ION LED's should light, and the nine 7-segment displays should indicate random numbers.
- () Press the REG key.
- () Press the PC key.
- () Press the ALTER key.
- () Enter 030 003.
- () Press the ALTER key.
- () Press the MEM key.
- () Enter 050 000.

- () Press the GO key twice. The DATA/REGISTER display should go to zero and then start counting up.
- () Wait for the display to count from 000 through 377. If the count stops before it reaches 377, a problem exists in the H8 memory. Correct any memory problems before you continue.
- () Simultaneously press the \emptyset and RST/ \emptyset keys. The counting should stop.

NOTE: Perform this "Memory Test" whenever you want to check the H8 memory.

CONTROLLER MEMORY TEST

The following test checks only the memory (RAM) on the Controller circuit board.

- () Press the REG key.
- () Press the PC key.
- () Press the ALTER key.
- () Enter 030 003.
- () Press the ALTER key.
- () Press the MEM key.
- () Enter 200 177.
- () Press the OUT key.
- () Press the GO key.
- () Press the REG key.
- () Press the HL key.
- () Press the ALTER key.
- () Enter 024 000.
- () Press the ALTER key.
- () Press the REG key.
- () Press the DE key.



- () Press the ALTER key.
- () Enter 027 377.
- () Press the ALTER key.
- () Press the MEM key.
- () Enter 025 000.
- () Press the GO key.
- () Wait for the display to count from 000 through 377. If the count stops before it reaches 377, a problem exists in the Controller circuit board memory. If this happens, refer to the "In Case of Difficulty" section on Page 14. Correct any memory problems before you continue.
- () Simultaneously press the \emptyset and RST/ \emptyset keys. The counting should stop.
- () Push the computer POWER to OFF.

NOTE: Perform this "Controller Memory Test" whenever you want to check the controller memory.

CONNECTING THE CABLE TO THE H8

- () Loosen cable clamp AG and route the end of the flat cable coming from the Floppy Disk through the rear panel of the Computer.

NOTE: One edge of the cable is marked with a color stripe. Be sure to position this marked edge properly in the next step.

- () If necessary, temporarily unplug the controller circuit board and remove it part way out of the Computer. Then plug the cable into the circuit board with the stripe of the cable as shown. (Reinstall the circuit board if you removed it.)
- () Position clamp AG down onto the cable and tighten the screws.
- () Secure the controller circuit board in the chassis with a 6-32 \times 1/4" screw.

- () Replace the tie bracket and secure it to the chassis. Install a 6-32 \times 1/4" screw through the tie bracket and into the controller circuit board heat sink.

SYØ: DRIVE INTERFACE TEST

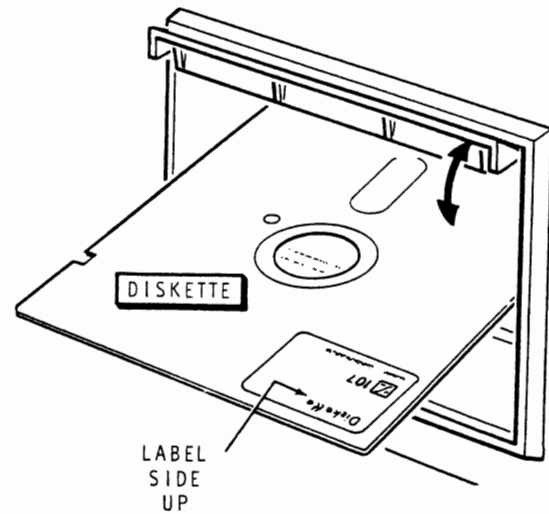
NOTE: Do not install a diskette until you are instructed to do so.

- () Plug in the line cord of the Floppy Disk and turn on both the Floppy Disk and the Computer. The Floppy Disk drive motor should not start and its front panel indicator should not light.
- () Simultaneously press the \emptyset and RST/ \emptyset computer keys.
- () Press the MEM key.
- () Enter 020 177.
- () Press the OUT key. The drive motor should start. Open the front panel door and you should see the diskette drive spindle rotating.
- () Press the MEM key.
- () Enter 000 177.
- () Press the OUT key. The drive motor should stop.
- () Press the MEM key.
- () Enter 002 177.
- () Press the OUT key. You should hear a click (solenoid being actuated) and the front panel indicator should turn on.
- () Simultaneously press the \emptyset and RST/ \emptyset keys. The solenoid should release and the front panel indicator on the Floppy Disk unit should turn off.

SYØ: READ/WRITE TEST

- Turn off the Floppy Disk unit.
- If not already done, remove the two screws that hold the top cover on the Floppy Disk unit. Then remove the top cover.

The Floppy Disk drive unit supplied to you may have one of two different circuit boards. Parts A and B of Pictorial 3 (Illustration Booklet, Page 2) show portions of these two circuit boards. Examine the circuit board on the Floppy Disk drive unit that you have. If the programming plug has eight (8) jumper strips, refer to Part A of Pictorial 3 for the following steps. If the programming plug has only six (6) jumper strips, refer to Part B of Pictorial 3 for the following steps. It is a good idea to circle or put a check mark beside the appropriate part (A or B) of Pictorial 3 that pertains to your particular drive unit.



PICTORIAL 4

- Refer to the appropriate part of Pictorial 3 (Illustration Booklet, Page 2) and examine the DS1 jumper strip in the programming plug. If it has **not** been cut, proceed to the next step. If it has been cut, very carefully tack solder a wire across the gap in the strip.
- Refer to Pictorial 4 and remove the **blank** diskette from its storage envelope and insert the diskette through the front panel doorway of the Floppy Disk. Install the diskette label-side up and then close the door.
- Turn on the Floppy Disk unit.
- Press the REG key.
- Press the PC key.
- Press the ALTER key.
- Enter 030 000.
- Press the ALTER key.
- Press the GO key. The drive unit should be selected and its front panel indicator should momentarily turn on. After a short delay, the H8 will beep and display 037 127 Pc.

- Press the REG key.
- Press the PC key.
- Press the ALTER key.
- Enter 037 262.
- Press the ALTER key.

NOTE: If you do not obtain proper results in the next step, refer to the "Troubleshooting Chart" on Page 15.

- Press the GO key. The drive unit will turn on. If the system is operating properly, the Computer will display 037 365 Pc. If it is **not** operating properly, the Computer will display 037 306 Pc. If this test does not pass, perform the "Drive Speed Adjustment" on Page 10. Then return and perform this test again. If this test still does not pass, perform the "Write Gate Test" on Page 12. Then return and perform this test again.



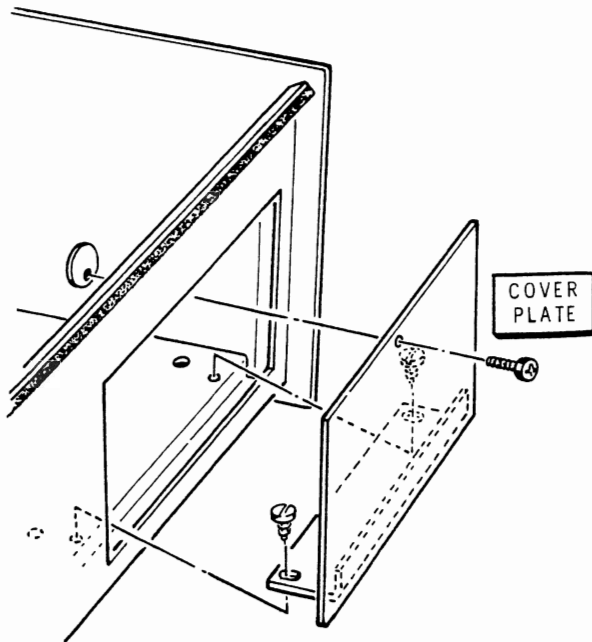
SYØ: PROGRAMMING

- () Turn off the Floppy Drive unit.
- () Use a knife or other suitable tool and cut strips DS1 and DS2 of the programming plug.
- () Examine the circuit board foil labeled "MUX" (shown in Part A of Pictorial 3) or the "MX" jumper strip (shown in Part B). If your drive unit has an uncut foil or jumper strip, use a knife or other suitable tool and very carefully cut a small gap in the foil or jumper strip.
- () Turn on the Floppy Disk.
- () Press the MEM key.
- () Enter 002 177.
- () Press the OUT key. Again the drive unit should be selected and the front panel indicator should light.

NOTE: This drive unit is referred to in software as SYØ.

- () Simultaneously press the Ø and RST/Ø keys.
- () Remove the diskette from the drive unit.
- () Turn off the Computer and Floppy Disk.
- () If you purchased the H17-1 Accessory Drive Unit, proceed with the following steps. If you did not purchase the Accessory Drive Unit, reinstall the top covers on the Computer and Floppy Disk, and proceed to the "Operation" section on Page 13.

ACCESSORY DRIVE UNIT



PICTORIAL 5

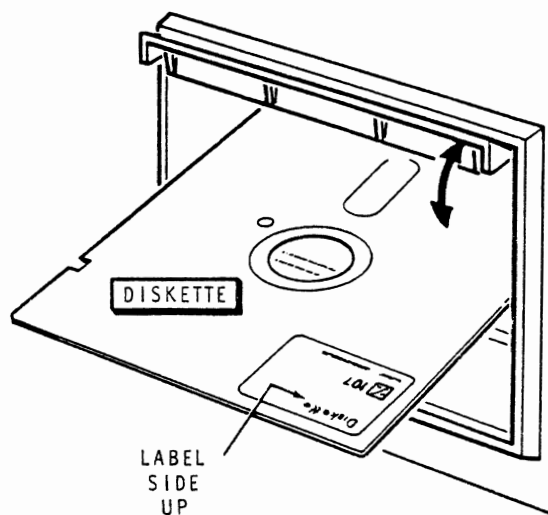
INSTALLATION

- () Be sure the Floppy Disk is turned off.
- () If not already done, remove the two screws that hold the top cover on the Floppy Disk. Then remove the top cover.
- () If not already done, refer to Pictorial 5 and remove the three screws holding the cover plate in place and set the plate aside. It will not be used.
- () Refer to Pictorial 6 (Illustration Booklet, Page 2), slide the Accessory Drive Unit into place, and secure it to the subchassis with four 6-32 studs. DO NOT overtighten these studs.
- () Plug the 3-wire plug into the drive unit.
- () Plug the flat cable into the drive unit. Position the marked edge as shown.
- () Unplug the flat cable from the left drive unit (SY \emptyset).

SY1: DRIVE INTERFACE TEST

NOTE: In the following steps, if you do not get the proper results, immediately turn off the Computer and Floppy Disk, unplug the line cords, and proceed to the "In Case of Difficulty" on Page 14.

- () Turn on both the Floppy Disk and the Computer. The Floppy Disk's drive motor should not start and its front panel indicator should not light.
- () Simultaneously press the \emptyset and RST/ \emptyset computer keys.
- () Press the MEM key.
- () Enter 020 177.
- () Press the OUT key. The drive motor should start. Open the front panel door and you should see the diskette drive spindle rotating.
- () Press the MEM key.
- () Enter 000 177.
- () Press the OUT key. The drive motor should stop.
- () Press the MEM key.
- () Enter 002 177.
- () Press the OUT key. You should hear a click (solenoid being actuated) and the front panel indicator should turn on.
- () Simultaneously press the \emptyset and RST/ \emptyset keys. The solenoid should release and the front panel indicator should turn off.
- () Turn off the Floppy Disk unit.



PICTORIAL 4 (Repeat)

SY1: READ/WRITE TEST

The Accessory Floppy Disk drive unit supplied to you may have one of two different boards. Parts A and B Pictorial 7 (Illustration Booklet, Page 3) show portions of these two circuit boards. Examine the circuit board on the Floppy Disk drive unit that you have. If the programming plug has eight (8) jumper strips, refer to Part A of Pictorial 7 for the following steps. If the programming plug has only six (6) jumper strips, refer to Part B of Pictorial 7 for the following steps. It is a good idea to circle or put a check mark beside the appropriate part (A or B) of Pictorial 7 that pertains to your particular drive unit.

- () Refer to the appropriate part of Pictorial 7 (Illustration Booklet, Page 3) and examine the DS1 jumper strip in the programming plug. If it has **not** been cut, proceed to the next step. If it has been cut, very carefully tack solder a wire across the gap in the strip.
- () Turn on the Floppy Disk unit.
- () Refer to Pictorial 4 and insert a **blank** diskette through the front panel doorway of the Floppy Disk. Install the diskette label-side up.
- () Press the REG key.
- () Press the PC key.
- () Press the ALTER key.
- () Enter 030 000.

- () Press the ALTER key.
- () Press the GO key. The drive unit should be selected and its front panel indicator should momentarily turn on. After a short delay, the H8 will beep and display 037 127 Pc.
- () Press the REG key.
- () Press the PC key.
- () Press the ALTER key.
- () Enter 037 262.
- () Press the ALTER key.

NOTE: If you do not obtain the proper results in the next step, refer to the "Troubleshooting Chart" on Page 15.

- () Press the GO key. The drive unit will turn on. If the system is operating properly, the Computer will display 037 365 Pc. If it is **not** operating properly, the Computer will display 037 306 Pc. If this test does not pass, first check to make sure the flat cable plug to the left drive unit (SY0) was disconnected. Again, if this test does not pass, perform the "Drive Speed Adjustment" on Page 10. Then return and perform this test again. If this test still does not pass, perform the "Write Gate Test" on Page 12. Then return and perform this test again.

SY1: PROGRAMMING

Refer to Pictorial 7 (Illustration Booklet, Page 3) for the following steps.

- () Turn off the Floppy Disk.

NOTE: When you cut the programming strips in the following step, make sure you do **not** cut strip DS2.

- () Use a knife or other suitable tool and cut strips DS1 and DS3 of the programming plug.
- () Examine the circuit board foil labeled "MUX" (shown in Part A of Pictorial 7) or the "MX" jumper strip (shown in Part B). If your drive unit has an uncut foil or jumper strip, use a knife or other suitable tool and very carefully cut a small gap in the foil or jumper strip.

- () Plug the flat cable into the left drive unit.
 - () Turn on the Floppy Disk.
 - () Press the MEM key.
 - () Enter 002 177.
 - () Press the OUT key. The left drive unit should be selected and the front panel indicator should light.
 - () Press the MEM key.
 - () Enter 004 177.
 - () Press the OUT key. The left drive unit should turn off and the right drive unit should now be selected with its front panel indicator turned on.
 - () Simultaneously press the \emptyset and RST/ \emptyset keys. Both drives should now be turned off.
 - () Remove the diskette from the drive unit.
 - () Turn off the Computer and Floppy Disk.
- NOTE: Software refers to the left drive unit as SY \emptyset ., and the right drive unit as SY1:.
- () Reinstall the top covers on the Computer and Floppy Disk.

Proceed to the "Operation" section on Page 13.

SPECIAL TESTS AND ADJUSTMENTS

Perform the tests and adjustments in this section of the Manual only if you were directed to do so in one of the Read/Write Tests.

DRIVE SPEED ADJUSTMENT

NOTE: A listing of this program is contained in the Appendix.

- () Make sure the DS1 jumper strip in the programming plug has not been cut. If it has been cut, very carefully tack solder a wire across the gap in the strip.

Enter the following program. Do not enter the numbers listed under the "Address" column. Those numbers are addresses for reference only as you enter the program.

This test will check the rotational speed of the floppy disk drive. After the test starts, it will display the disk drive speed on the H8 front panel data display.

The rotational speed tolerance is one percent. The displayed value should be between 166 and 212 (remember, octal numbers jump from 177 to 200). Do not adjust the speed unless it is out of tolerance.

Your drive unit has a control labeled R30 or R7 (depending on which drive unit you received), which is used to vary the drive speed. This control is located near the lower edge of the circuit board as shown in Pictorial 8, or on the other side of the drive if your drive is like the one shown in Detail 8A. This adjustment may be extremely sensitive so, if an adjustment is necessary, do not turn it far in either direction. Less than one degree of rotation in either direction should bring the drive speed into tolerance. Turn the control clockwise to decrease the speed or counterclockwise to increase it.

You may have to perform this test again at some future time, depending upon how heavily your floppy is used. As the drive bearings wear, the speed may change slightly. Fluctuations within the tolerance are normal and may be attributed to variations in temperature and humidity.

- () Press the GO key.
- () If the drive is less than 166 or greater than 212, carefully adjust R30 or R7 with a small screwdriver until the speed is within tolerance and as close to 200 as possible.
- () Remove the diskette from the drive unit.



<u>Program</u>	<u>Address</u>	<u>Program</u>	<u>Address</u>
MEM		040	
040		006	
100		000	
ALTER		014	
076	040 100	171	
022		376	
323		012	
177		302	040 160
052		125	
033		040	
040		052	
174		033	
057	040 110	040	
127		031	
175		021	
057		030	040 170
074		374	
137		031	
322		021	
122		200	
040	040 120	000	
024		031	
001		042	
000		205	040 200
000		040	
333		303	
177		104	
346		040	
001	040 130	ALTER	
312		REG	
125		PC	
040		ALTER	
333		040	
177		100	
346		ALTER	
001		MEM	
302	040 140	040	
134		205	
040			
004			
170			
376			
013			
302			
125	040 150		

WRITE GATE TEST

NOTE: You will need a voltmeter to perform the following steps.

Refer to Pictorial 9 for the following steps.

1. () Connect the common lead of the voltmeter to the bracket of the controller circuit board as shown.
2. () Set the voltmeter to measure +5 volts.

3. () Measure the voltage at U8 pin 3. The voltage should be between 2.4 volts and 5 volts. This voltage **must** be correct before you proceed.
4. () Disconnect the voltmeter and set it aside.

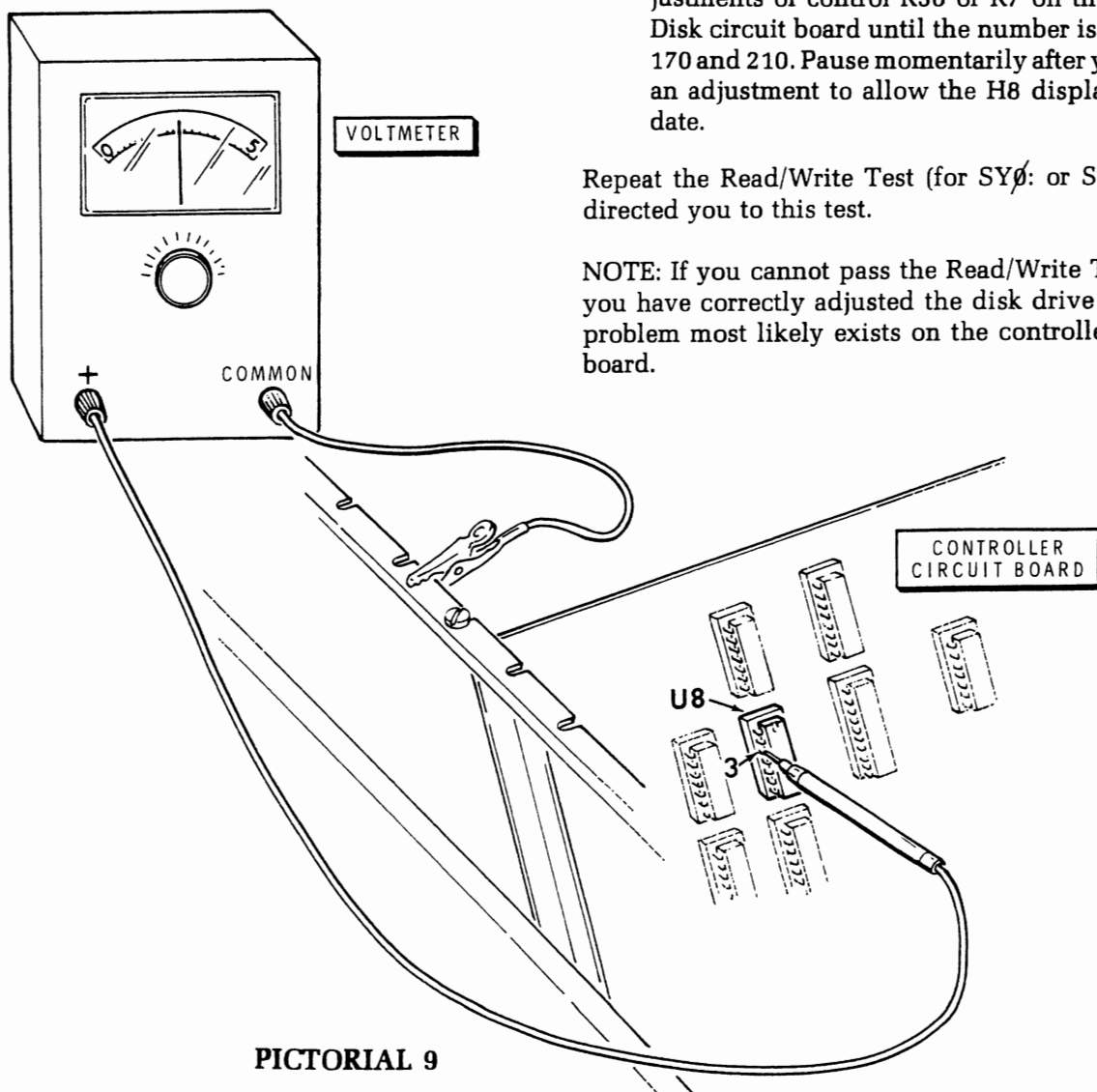
Repeat the Read/Write Test (for SY0: or SY1:) that directed you to this test.

- () Install an unformatted (new) diskette in the drive unit and close the door.

- () Press the GO key. The Floppy Disk unit will start and a number will appear in the three right-hand digits of the H8 display. This octal number should be between 170 and 210 (200 nominal). Refer to Pictorial 8 or Detail 8A (Illustration Booklet, Page 3) and make small adjustments of control R30 or R7 on the Floppy Disk circuit board until the number is between 170 and 210. Pause momentarily after you make an adjustment to allow the H8 display to update.

Repeat the Read/Write Test (for SY0: or SY1:) that directed you to this test.

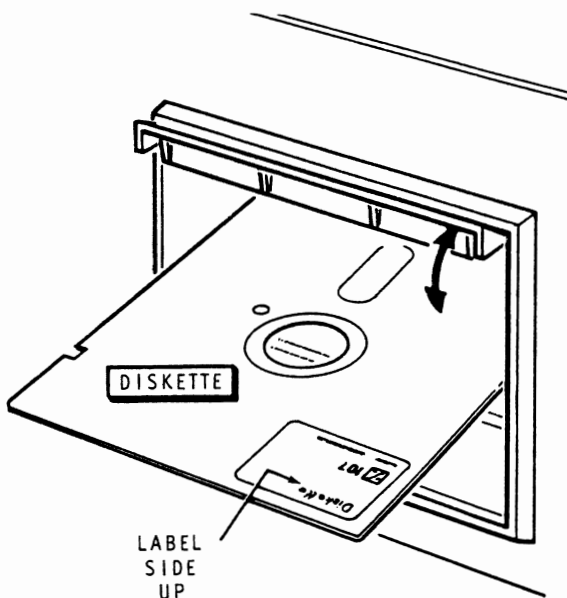
NOTE: If you cannot pass the Read/Write Test after you have correctly adjusted the disk drive speed, a problem most likely exists on the controller circuit board.



PICTORIAL 9



OPERATION



PICTORIAL 4 (Repeat)

1. Keep the diskette in its storage envelope whenever it is not in the Floppy Disk.
2. Keep the diskette away from magnetic fields. Magnetic fields can distort the recorded data on the diskette.
3. Replace damaged or worn storage envelopes.
4. Write on the plastic jacket only with a felt-tip pen. Do not use a lead pencil or ball-point pen.
5. Keep the diskette away from hot or contaminating materials.
6. Do not expose the diskette to sunlight.
7. Do not touch or clean the surface of the diskette. Abrasions can alter stored data.

DISKETTE LOADING

Refer to Pictorial 4, open the front panel door, and insert the diskette label-side up. Then close the door.

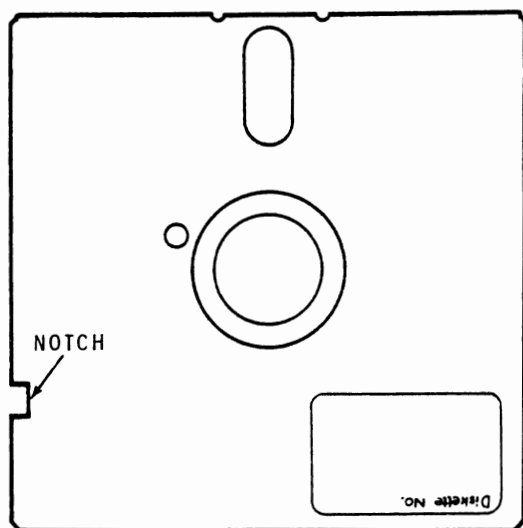
DISKETTE HANDLING

The diskette can be easily damaged. Handle it carefully as follows:

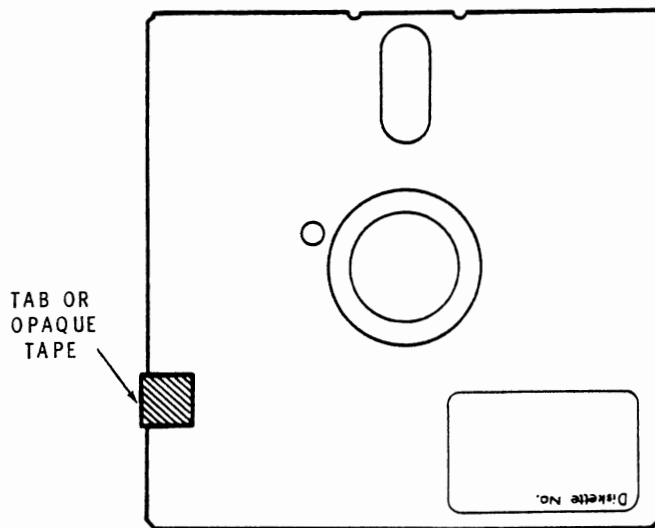
WRITE-PROTECT

This diskette can be write protected so that it cannot be written on. To do this, cover the side notch with a tab or opaque tape. See Pictorial 10.

Proceed to the "System Start-Up Procedure" in the "Software Reference Manual."



UNPROTECTED



WRITE PROTECTED

PICTORIAL 10

IN CASE OF DIFFICULTY

This section of the Manual is divided into three parts. The first part, titled "General Troubleshooting Information," only pertains to your Floppy Disk if you built it from a kit. It describes what to do about difficulties that may occur during or right after you assemble the Floppy Disk.

The second part, titled "Troubleshooting Charts," lists problems or conditions that might occur. The

"Possible Cause" column lists the components associated with the problem. This will help you relate a problem to the Schematic and Circuit Description.

The third section, titled "Troubleshooting Waveforms," provide several important waveforms.

Refer to the "X-Ray Views" (Illustration Booklet, Page 4) for the physical location of parts on the circuit boards.

General Troubleshooting Information

This section of the Manual applies to your Floppy Disk only if you assembled it from a kit.

NOTE: The following checks will be most effective if you apply them to one part of the kit at a time.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Some one who is not familiar with the unit may notice something you have consistently overlooked.
2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by careful inspection of the connections to make sure they are soldered as described in the "Soldering" information at the beginning of the Assembly Manual. Reheat any doubtful connections. Be sure all wires are soldered at places where several wires are connected.
3. Check each circuit board foil to be sure there are no solder bridges between adjacent connections. Remove any solder bridges by holding a clean soldering iron tip between the two points that are bridged until the excess solder flows **down** onto the tip of the soldering iron.
4. Check each resistor value carefully. A resistor that is discolored, or cracked, or shows any sign

of bulging would indicate that it is faulty and should be replaced.

5. Be sure each diode is carefully installed with the banded end positioned correctly.
6. Check all component leads connected to the circuit boards. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts.
7. The components listed in the "Possible Cause" column of the "Troubleshooting Chart" are the most likely causes (but not necessarily the only causes) of a problem. When you check these components, look first for the following items:
 - Parts installed incorrectly or backwards. This pertains especially to diodes, electrolytic and tantalum capacitors, and integrated circuits.
 - Unsoldered or inadequately soldered parts. Reheat the connections in the area of a problem.
 - Incorrect or interchanged parts. Check the part numbers on the diodes and integrated circuits.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service Information" inside the rear cover of the Manual. Your "Warranty" is located inside the front cover.



Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
Voltage at U8 pin 3 is incorrect.	1. A problem exists on the Controller circuit board that causes the <u>WRITE GATE</u> signal to be low. Correct this condition before you insert a diskette as it can change (or destroy) the data on the diskette.
H8 memory test fails.	1. H8 memory problem. Refer to the H8 Operation manual.
Controller memory test fails.	1. Check U16 and U17.
H8 does not operate properly after the controller circuit board is installed.	1. Check U27. 2. Check the I/O decoder, memory address decoder, data bus and data direction control.
Drive motors will not start or the drives will not select.	1. Faulty drive. 2. Check the I/O decoder, I/O function decoder, and drive control output.
Read/write test fails (display shows 037 306 Pc).	1. Faulty drive. If the test is performed successfully with one drive, but not the other, one drive is faulty. Return it for repair. 2. Faulty controller. Proceed to the "Troubleshooting Waveforms." 3. DS1 programming strip is cut. 4. Flat cable plug to left drive unit (SY0:) has not been disconnected.

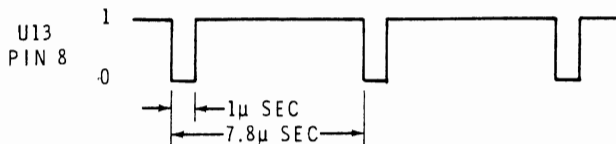
Troubleshooting Waveforms

If you encounter a problem, use a high quality, triggered oscilloscope to check the following waveforms.

CONTROLLER WRITE CIRCUITRY

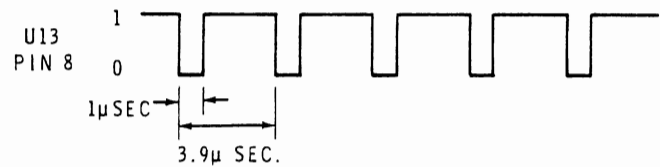
NOTE: Make sure the Floppy Disk drive unit is connected to the controller circuit board when you perform the following steps.

1. Make sure the Floppy Disk and the H8 Computer are turned on.
2. Simultaneously press the RST/⏏ and the ⏏ keys.
3. Press the MEM key.
4. Enter 000 175. This fills the transmit buffer with 0's.
5. Press the OUT key.
6. The signal at U15 pin 6 should be continuously low. If it is not, U15 may be defective.
7. Press the MEM key.
8. Enter 001 177.
9. Press the OUT key.
10. The signal at U13 pin 8 should look like the waveform shown below. If it does not, a problem exists in the data encoding circuitry.



11. Press the MEM key.
12. Enter 377 175. This fills the transmit buffer with 1's.
13. Press the OUT key.

14. The signal at U15 pin 6 should be continuously high. If it is not, U15 may be defective.
15. The signal at U13 pin 8 should look like the waveform shown below. If it does not, a problem exists in the write data circuitry.



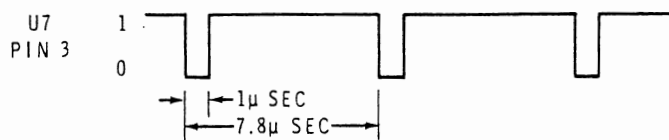
If you obtained the proper results in the above tests, the controller circuit board write circuitry is functioning properly.

WRITE-READ TEST

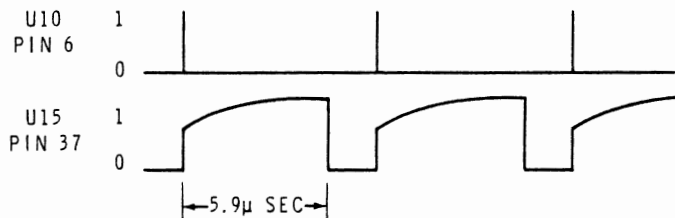
In four of the following steps (6, 8, 19, and 21), you will be instructed to enter a 6-digit number. Enter the number given in the step, not the one in parentheses. The first number checks the drive unit on the left (SY0:). The number in parentheses will be used later to check the drive unit on the right (SY1:); if you have this accessory drive unit.

1. Insert a blank diskette, label-side up, into drive unit SY0: (the drive on the left).
2. Press the MEM key.
3. Enter 000 175.
4. Press the OUT key.
5. Press the MEM key.
6. Enter 023 177 (025 177).
7. Press the OUT key. The drive motor should start. It is writing a stream of zeros on the diskette.
8. Wait at least 5 seconds. Then press the MEM key and enter 022 177 (024 177).
9. Press the OUT key. This changes the drive from the write mode to the read mode.

10. The controller read-signals at U7 pin 3, U10 pin 6, and U15 pin 37 should appear as follows:



If you do not obtain the above waveform, the drive mechanism may be defective.

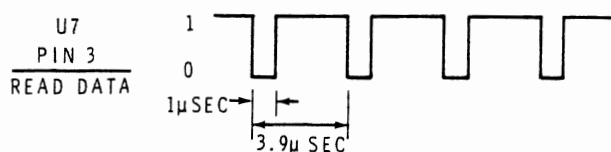


11. The signal at U15 pin 25 should be continuously low. If it is not, U4 may be defective.
12. Press the MEM key.
13. Enter 000 174.
14. Press the IN key. The display should show 000 174 XXX (XXX represents any number). If it does not, U15, U24, or U27 may be defective.
15. Press the MEM key.
16. Enter 377 175. This enters 1's in the transmit buffer.
17. Press the OUT key.
18. Press the MEM key.
19. Enter 023 177 (025 177).
20. Press the OUT key. This causes 1's to be written on the diskette.
21. Wait at least 5 seconds. Then enter 022 177 (024 177).

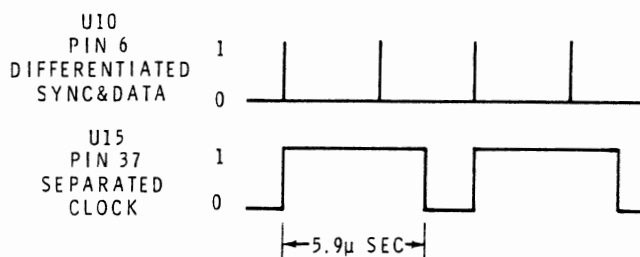
22. Press the OUT key.
23. Press the MEM key.
24. Enter 000 174.

25. Press the IN key. This reads the contents of the diskette (all 1's) into port 174. The display should show 377 174 XXX. If it does not, U15 or U27 may be defective.

26. The controller READ DATA and SEPARATED CLOCK signals should appear as follows:



If you do not obtain the above waveform, the drive mechanism may be defective.



27. Simultaneously press the RST/ ϕ and the ϕ keys.
28. Remove the diskette from the drive unit.

NOTE: If your Floppy Disk has two drive units, insert the blank diskette in drive unit SY1: (the drive on the right) and perform steps 2 through 28 above. Be sure you enter the numbers in parentheses to test drive unit SY1:.



SPECIFICATIONS

Number of Tracks	40.
Sectors Per Track	10.
Formatted Bytes Per Sector	256.
Spindle Motor Speed	300 RPM \pm 1%.
Data Transfer Rate	128 kHz.
Motor Start Time	1 Sec.
Power Requirements:	
Controller Circuit Board	+8 VDC @ 500 mA.
Drive Unit	120 VAC (100-135VAC), 50/60 Hz, 75 watts. 240 VAC (200-270VAC), 50/60 Hz, 75 watts.
Operating Temperature	0° to 40°C.
Dimensions	13-1/4" W \times 13-1/4" D \times 6-1/8" H. (33.7 cm W \times 33.7 cm D \times 15.6 cm H)
Weight	25-1/4 lbs. (11.45 kg).

NOTE: Refer to the Manufacturer's manual for more detailed specification on the drive unit.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.



CIRCUIT DESCRIPTION

INTRODUCTION

The Floppy Disk drive, controller circuit board, and software allow the H8 computer to store and retrieve large quantities of data and programs. The drive unit houses the Floppy Disk drive(s) and provides the necessary power for its operation. The controller circuit board selects the correct drive when two drives are used for a write or a read operation and properly handles the flow of data to or from the drive. The controller also includes 2K bytes of read only memory that operates the system and 1K bytes of random access memory that serve as a buffer memory. The RAM memory is write protected to prevent inadvertent damage to its contents. All data and address exchanges between the controller circuit board and the H8 bus are buffered to protect the H8 bus from spurious signals.

DRIVE UNIT

The drive unit is designed to operate with either one or two Floppy Disk drives. Each drive requires both +5-volts DC and +12-volts DC. These voltages are provided by the drive unit power supply. Transformer T201 converts primary voltage to 20 volts AC. A bridge rectifier, formed by diodes D101, D102, D103, and D104 produces two unregulated DC voltages; +9-volts, which is filtered by capacitor C105, and +18-volts, which is filtered by C101. Integrated circuit U102, a 5-volt regulator capable of sourcing five amperes, regulates the output voltage at +5-volts DC. Bypass capacitors C106 and C107 insure stability of the regulator. This regulated +5-volt DC source provides logic power for the Floppy Disk drives. Integrated circuit U101, a +12-volt regulator also capable of sourcing five amperes, regulates the output voltage at +12-volts DC. Bypass capacitors C102 and C103 insure stability of this regulator. Since this 12-volt DC source powers the drive motors, capacitor C104 is used to filter the transients generated when the motors start and stop.

All of the control and data signals between the Floppy Disk drive and the controller circuit board are carried by a 34-conductor ribbon cable. A ground wire be-

tween each signal-carrying wire in the ribbon cable provides signal isolation and a low impedance ground path between the disk drives and the controller circuit board.

CONTROLLER CIRCUIT BOARD

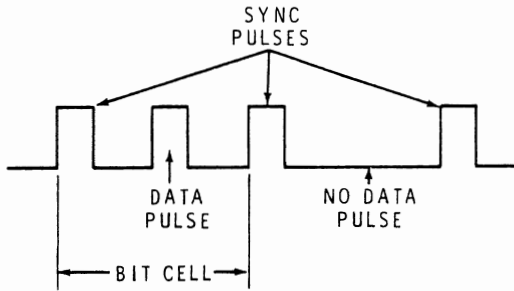
The controller circuit board selects drive SY0 or drive SY1, and starts and stops the main drive motors, engages and disengages the read/write head, positions the head over the correct track, and formats synchronous serial communications to and from the drive electronics circuits. The controller circuit board also provides nonvolatile ROM to the H8 computer for the system software bootstrap and RAM that buffers the operating system data. Drive select lines allow the controller to communicate with either drive 0 or drive 1 when two drives are used.

Floppy Disk Format

The Floppy Disk uses a storage format similar to a 45 RPM record. Each diskette is divided into 40 concentric tracks with the outermost track labeled track 0 and the innermost track labeled track 39. See Pictorial 11 (Illustration Booklet, Page 3). Each track is further divided into ten sectors. Each of the sectors can store 256 bytes of data plus check and address information. The check character allows the system software to be confident of data integrity. The address information confirms that the head was moved to the desired track and that the desired sector has been found for a read or a write operation.

There are eleven holes spaced around the center of the diskette for sector and index identification. Ten of the eleven holes are spaced evenly to indicate the start of a new sector. The eleventh hole is space halfway between the sector 9 hole and the sector 0 hole. This uneven spread is recognized by the controller. Whenever the controller detects the two short spaces, it knows that the next hole is sector hole 0. This method of sectoring is called hard sectoring. Since the diskette rotates at 300 RPM, the index hole is encountered every 200 milliseconds.

Information is stored on the diskette as serial magnetic flux changes. To prevent variations in rotational speed from impairing data accuracy, each serial data bit lies between two synchronizing bits. These two synchronizing bits form a bit cell. See Pictorial 12. A data pulse occurs if the data bit equals one. No data pulse occurs if the data bit equals zero.



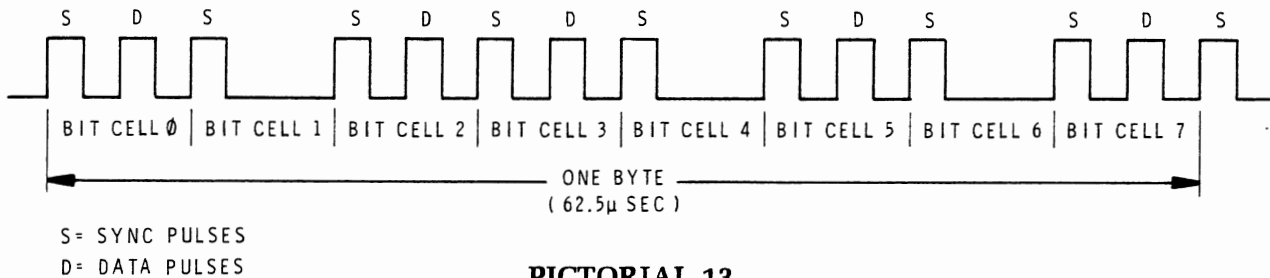
PICTORIAL 12

A byte of serial data written onto or read from a sector of the disk is defined as eight (8) consecutive bit cells. See Pictorial 13. The most significant bit cell is defined as bit cell 0 and the least significant bit cell is defined as bit cell 7. When a specific data bit (such as bit 3) is referred to, it is with respect to the corresponding bit cell (bit cell 3).

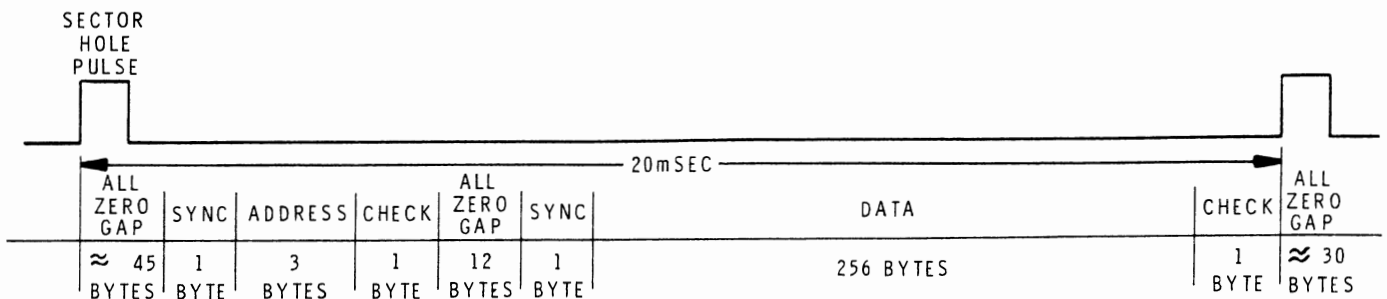
During a write operation, bit cell 0 of each byte is transferred to the disk drive first, while bit cell 7 is transferred last. Whenever data is read back from the disk drive, bit cell 0 of each byte is transferred first and bit cell 7 last. Pictorial 14 shows the information written on a sector.

Power Supply

All circuits on the controller circuit board are powered by 5-volts DC. The 8-volt unregulated input from the H8 bus is regulated by two 5-volt regulators, U29 and U30. Capacitors C1, C2, C3, and C4 insure that the regulators remain stable.



PICTORIAL 13



PICTORIAL 14



Bus Buffers and Address I/O Decoder

The address bus and the data bus on the H8 mother board use inverted logic signals. Inverters U24 and U25 complement and buffer address lines A₀ through A₉. The controller circuit board uses I/O ports 174, 175, 176, and 177 octal for control.

The $\overline{I/O\ EN}$ signal from U18 (pin 8) occurs whenever the lower half address bus (A₀-A₇) contains the address for I/O ports 174, 175, 176, and 177. The inverted signal I/O EN from U19A (pin 3) is ANDed in U19D with the I/O RD signal from the H8 CPU to form read signal $\overline{I/O\ RD\ I}$. The I/O EN signal is also ANDed in U19C with the I/O WR signal from the H8 CPU to form write signal $\overline{I/O\ WR\ I}$.

The $\overline{I/O\ RD\ I}$ signal enables the read section of U6 (pins 9, 10, 11, 12, 14, and 15). The next positive transition of $\overline{\emptyset}2R$ latches a low in read buffer latch U28A. This latch will be reset by the first positive transition of $\overline{\emptyset}2R$ after the $\overline{I/O\ RD\ I}$ signal returns high (true). This delayed signal from U28B turns on U22 which turns on U27, the data read buffer, and allows the H8 CPU to read the controller circuit board data bus.

The $\overline{I/O\ WR\ I}$ signal from U19C sets U28A, the I/O write latch, on the first positive transition of $\overline{\emptyset}2R$ after $\overline{I/O\ WR\ I}$ goes true (low). The delayed output from U28A (pin 5) enables the I/O write section of U6 (pins 1, 2, 4, 5, 6, and 7) and turns on the data write buffer, U26 through U19B and U24A. This lets the controller circuit board data bus see the H8 data bus.

The first 8K bytes (0 through 7) of memory space in the H8 computer are allocated to non-user functions. The first 1K slot (000 000 to 003 377) is used by the H8 front panel control ROM. The controller circuit board RAM (U16 and U17) is assigned the 5K slot (024 000 through 027 377) and the controller ROM (U14) is assigned the 6K and 7K slots (030 000 through 037 377).

Signals $\overline{A15}$, $\overline{A14}$, and $\overline{A13}$ are NANDed in U22B to produce a logic low signal when the address bus is anywhere within the lowest 8K block. This 8K block window and the complements of $\overline{A12}$ (U23C pin 6), $\overline{A11}$ (U23B pin 4), and $\overline{A10}$ (U23A pin 2) are inputs to decimal decoder U21. The outputs of U21, 0 through 7, decode each of the 1K segments in the lowest 8K block. Since the ROM (U14) requires a 2K block, outputs 6 (U21 pin 7) and 7 (U21 pin 9) are negative ORed in U20A to form a logic high signal that occurs whenever 6K or 7K is decoded. This signal is

NANDed with CPU MEM RD in U20B to produce $\overline{ROM\ EN}$ (pin 6). This signal goes low whenever the CPU wants data or programs from the controller ROM. Output 5 (pin 6) from decimal decoder U21 is complemented by inverter U9B and NANDed with CPU MEM RD in U20D to form $\overline{RAM\ RD}$. This output goes low when the CPU wants to read data from the controller RAM. The $\overline{RAM\ WR}$ signal also enables the data bus write buffer, U26, through U19B and U24A. The complemented output 5 (U9, pin 8) is also NANDed in U22C with CPU MEM WR and the write-protected signal RAM WR EN. RAM WR EN must be set high to allow the CPU to produce a $\overline{RAM\ WR}$ signal at U22C pin 8 when it desires to write into the buffer RAM (U16 and U17). The $\overline{ROM\ EN}$ and $\overline{RAM\ RD}$ signals are ORed in U22A to turn on the data read buffer, U27, through inverter U24B. This protection circuit prevents user program crashes or other errors from damaging floppy disk file control data. The two RAM request signals are ORed by U20C and U23E to produce a composite $\overline{RAM\ EN}$ signal that goes low whenever the CPU wants to communicate with the buffer RAM.

There are a total of eight I/O control functions associated with the controller circuit board, four are inputs and four are outputs. Each of these functions requires individual output strobe or input enable lines. U6, a two-input four-output multiplexer generates these eight control lines. A₀ and A₁ select the specific port, read or write, from the windowed group (174, 175, 176, or 177). $\overline{I/O\ EN}$ and I/O EN allow output strobes or input enables only from the windowed group.

Drive Control Latch

Drive control and RAM write-protect data (RAM WR EN) are latched in octal latch U12, which is addressed at port 177. All outputs from this port are reset to zero by a power-up reset or when master clear occurs on the H8 bus. With the exception of RAM write-protect (RAM WR EN), which comes directly out of the latch, all drive control signals are inverted and buffered by open-collector buffers U8 and U13. These buffers provide a low impedance source to the cable running to the floppy disk drives. Bit 0, the write gate signal, is also NANDed and U8A with the write-protect signal from the drive to prevent an inadvertent write on a protected diskette. Bits 1 and 2 select drives \emptyset and 1 respectively. Bit 4 turns on the main drive motors. Bit 5 selects whether the read/write head will move in or out when bit 6 is pulsed.

Drive Control Input

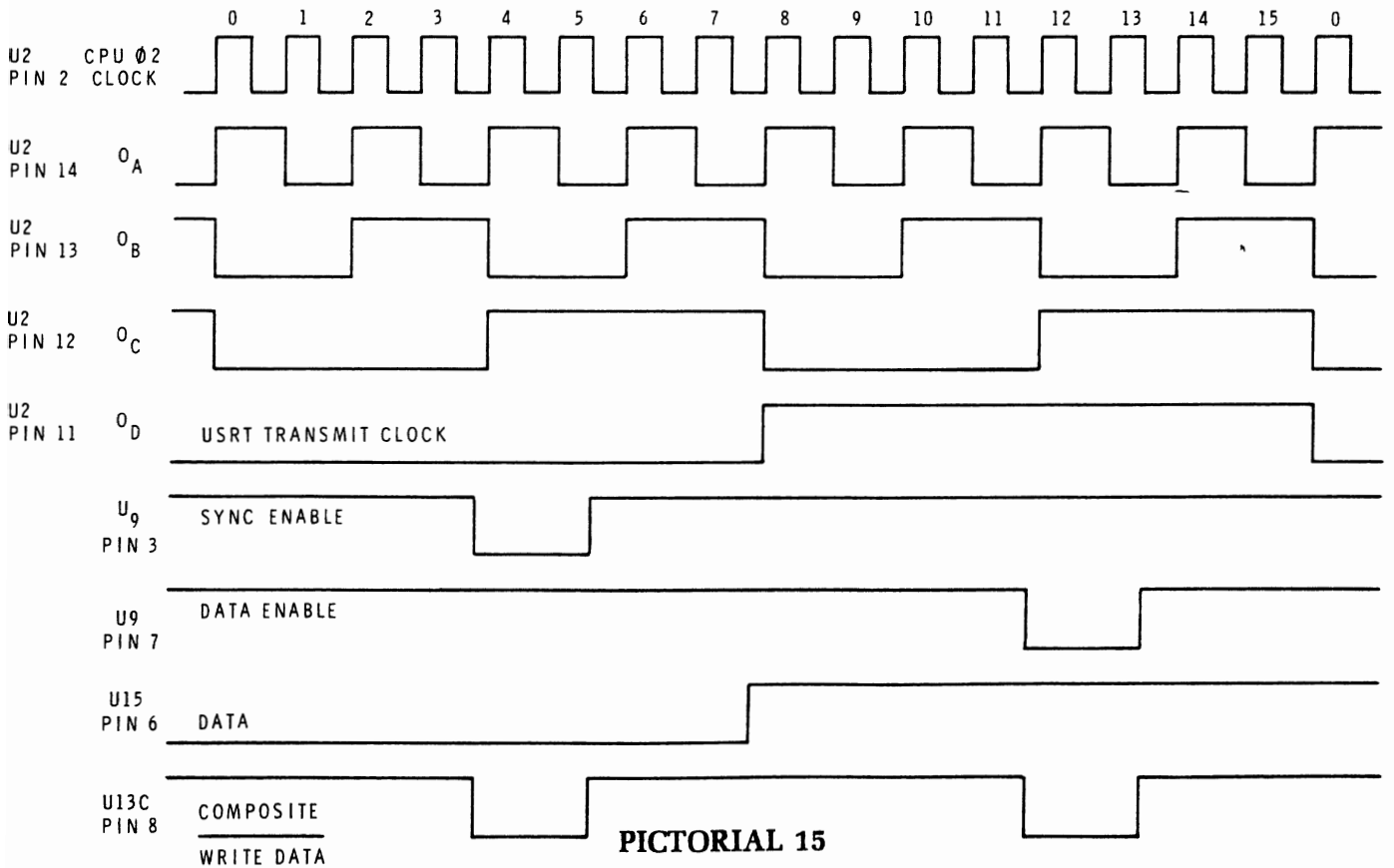
Drive status is sampled at input port 177 by hex three-state buffer U11. Bit 0 looks at the complemented index/sector pulse from the drive. Bit 1 looks at a signal from the drive that occurs whenever the read/write head is over track 0. Bit 2 determines if the present diskette is write protected.

Resistors R3, R4, and R5 terminate the cable and inverters U7D, U7E, and U7F buffer and invert these input signals. A special synchronizing character-received signal, SCR, (U15, pin 8) is also input to the CPU on this port at bit 3. Bits 4 through 7 are not used.

Data Format Control

The remainder of the controller circuitry formats data for recording during write operations and it decodes formatted data into bytes during a read operation. Universal synchronous receiver/transmitter (USRT) U15 converts bytes of data into synchronous serial bit streams of NRZ (non return to zero) data.

CPU clock 02 is buffered by inverter U23F and then divided by sixteen in counter U2. The three most significant counter bits (O_B , O_C , and O_D) are decoded by decimal decoder U9 producing eight 1-microsecond time pulses. The repetition of this 7.8 microsecond loop represents one data cell time. Output 2 is the synchronizing pulse and output 6, which is exactly one-half cell bit away, is the data gating pulse. The most significant output (O_D) from counter U2 clocks data from the USRT. The write data output from the USRT is ANDed with the decoder bit 6 to produce a data pulse at U1C pin 8. Composite SYNC and data are formed by ORing data and SYNC pulses in U1D and then NANDing that signal with the write gate signal in U13C. This limits crosstalk on the cable when data is not being written. Open-collector buffer U13C provides a low impedance source to the floppy disk drive cable. Pictorial 15 shows how the sync enable, data enable, and data are combined to form the composite WRITE DATA signal. The READ DATA signal from the drive unit is terminated by R2 and complemented by U7B. It is then differentiated by U10. The output (pin 6) of monostable U10 is a very



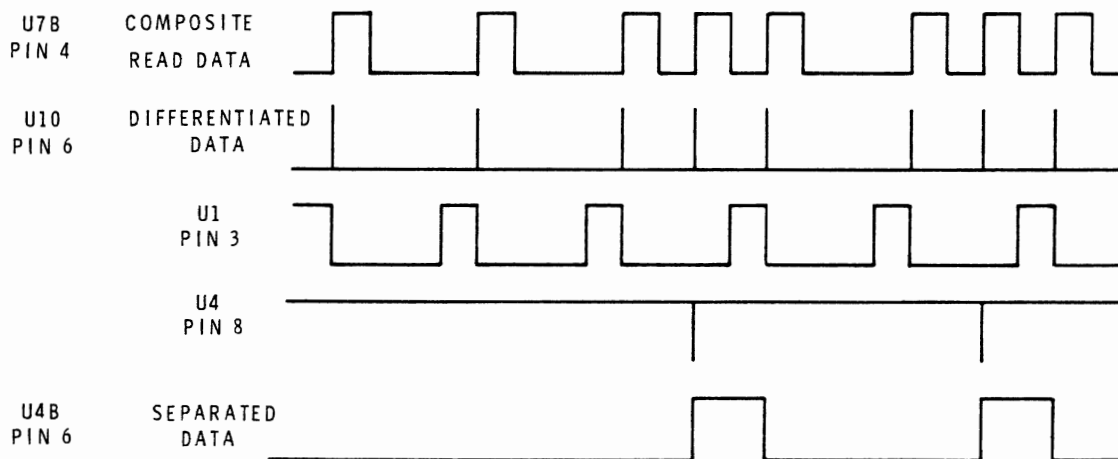


short (50 nS) active high pulse that occurs at the leading edge of both data and SYNC pulses coming from the drive unit. U3 is a divide-by-twelve counter that separates the data from the SYNC pulses. Assume, as a starting point, that U3 has counted to twelve and the Ent and Enp inputs are both low, preventing any further count. At this point, the output of U1A is high. This allows the next differentiated SYNC pulse to reset the counter through NAND gate U4D. Since all data strings start with a number of consecutive zero bytes (no data pulse), the counter will synchronize on the SYNC pulses and not on data pulses. During the time between reset and count 12 (5.9 microseconds), data pulses are rejected. Pictorial 16 shows how data is separated from the composite READ DATA signal.

Cross coupled gates U4A and U4B form an RS flip-flop that stores data bits until the next SYNC pulse. This flip-flop is repeatedly reset by separated SYNC

pulses and set by separated data pulses. The trailing edge of the 5.9-microsecond data window from pin 11 of U5D clocks serial data into the USRT receiver.

The USRT, in addition to converting serial bytes to parallel bytes during a read operation and parallel bytes to serial bytes during a write operation, also searches for a synchronizing byte at the beginning of each data and address block on each sector. A pulse at port 176 (the read line) resets the receiver circuitry to a sync search mode, where each bit is input and the accumulated byte is compared to a special character stored in the sync character holding register. When a match is made, the USRT receiver returns to the byte mode and forms eight serial bits into a byte and then alerts the CPU that a character is ready. Before it continues the sync search mode, the desired search character is loaded into port 176, the receiver sync register. Data is then transmitted and received from port 174. USRT status is read at port 175.



PICTORIAL 16

SEMICONDUCTOR IDENTIFICATION

This section is divided into two parts; Component Number Index and Part Number Index. The first section provides a cross-reference between semiconductor component numbers and their respective Part Numbers. The component numbers are listed in numerical order. The second section provides a lead configuration detail (basing diagram) for each semiconductor Part Number. The Part Numbers in the second section are also listed in numerical order.

COMPONENT NUMBER INDEX

This index shows the Part Number of each semiconductor in the Floppy Disk.

Diodes

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER
D101-D104	57-42

Integrated Circuits

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER
U1	443-728
U2	443-757
U3	443-757
U4	443-728
U5	443-728
U6	443-728
U7	443-858
U9	443-807
U10	443-22
U11	443-857
U12	443-805
U13	443-77
U14	444-19
U15	443-856
U16	443-764
U17	443-764
U18	443-732
U19	443-792
U20	443-792
U21	443-807
U22	443-797
U23	443-858
U24	443-858
U25	443-858
U26	443-754
U27	443-754
U28	443-730
U29	442-54
U30	442-54
U101	442-650
U102	442-651



PART NUMBER INDEX

This index shows a lead configuration detail (basing diagram) of each semiconductor Part Number.

Diodes

HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
57-42	3A1	SI RECT 3A. 100V	<p>NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES.</p>

Integrated Circuits

HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
442-54	7805	5-VOLT REGULATOR	
442-650	78H12	12-VOLT REGULATOR	
442-651	78H05	5-VOLT REGULATOR	

Integrated Circuits (cont'd.)

HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
443-22	74121	MONOSTABLE MULTIVIBRATOR	
443-77	7438	QUADRUPLE 2-INPUT POSITIVE-NAND BUFFERS WITH OPEN-COLLECTOR OUTPUTS	
443-728	74LS00	QUADRUPLE 2-INPUT POSITIVE-NAND GATE	
443-730	74LS74	DUAL D-TYPE POSITIVE-EDGE TRIGGERED FLIP-FLOP WITH PRESET AND CLEAR	
443-732	74LS30	8-INPUT POSITIVE-NAND GATE	



Integrated Circuits (cont'd.)

HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
443-754	74LS240	OCTAL BUFFERS/LINE DRIVERS/ LINE RECEIVERS INVERTED 3-STATE OUTPUTS	
443-757	74LS161	SYNCHRONOUS 4-BIT BINARY COUNTER	
443-764	2114	4K (1024 x 4BIT) STATIC RAM	
443-782	74LS155	DUAL 2-TO-4-LINE DECODER	

Integrated Circuits (cont'd.)

HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
443-792	74LS132	QUADRUPLE 2-INPUT POSITIVE-NAND SCHMITT TRIGGERS	
443-797	74LS10	TRIPLE 3-INPUT POSITIVE-NAND GATE	
443-805	74LS273	OCTAL D-TYPE FLIP-FLOPS	
443-807	74LS42	BCD-TO-DECIMAL DECODER	



Integrated Circuits (cont'd.)

HEATH PART NUMBER	MAY BE REPLACED WITH	DESCRIPTION	IDENTIFICATION
443-856	S2350	UNIVERSAL SYNCHRONOUS RECEIVER/ TRANSMITTER (USRT)	
443-857	74LS367	HEX BUS DRIVERS	
443-858	7414	HEX SCHMITT-TRIGGER INVERTERS	
444-19		16,384 BIT STATIC ROM	<p>PIN NAMES</p> <p>A₀-A₁₀ ADDRESS INPUTS D₇-D₀ DATA OUTPUTS CS₁-CS₃ CHIP SELECT INPUTS</p>

PARTS LISTS

NOTE: To order a replacement part, always include the part number and use one of the "Parts Order Forms" at the rear of this Manual. If a Parts Order

Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

Controller Circuit Board

CIRCUIT	HEATH	DESCRIPTION
Comp. No.	Part No.	

RESISTORS

(All resistors are 5%.)

R1	1-62-12	220 Ω
R2	1-103-12	150 Ω
R3	1-103-12	150 Ω
R4	1-103-12	150 Ω
R5	1-103-12	150 Ω
R6	6-680-12	68 Ω
R7	6-680-12	68 Ω

CAPACITORS

C1	25-221	2.2 μ F tantalum
C2	25-221	2.2 μ F tantalum
C3	25-221	2.2 μ F tantalum
C4	25-221	2.2 μ F tantalum
C5	21-95	.1 μ F ceramic
C6	21-95	.1 μ F ceramic
C7	20-99	22 pF mica
C8	21-140	.001 μ F ceramic
C9	21-95	.1 μ F ceramic
C10	NOT USED	
C11	21-95	.1 μ F ceramic
C12	21-95	.1 μ F ceramic
C13	21-95	.1 μ F ceramic
C14	21-95	.1 μ F ceramic
C15	20-101	47 pF mica
C16	20-101	47 pF mica

INTEGRATED CIRCUITS

U1	443-728	74LS00
U2	443-757	74LS161
U3	443-757	74LS161

CIRCUIT	HEATH	DESCRIPTION
Comp. No.	Part No.	

Integrated Circuits (cont'd.)

U4	443-728	74LS00
U5	443-728	74LS00
U6	443-782	74LS155
U7	443-858	7414
U8	443-77	7438
U9	443-807	74LS42
U10	443-22	74121
U11	443-857	74LS367
U12	443-805	74LS273
U13	443-77	7438
U14	444-19	2316
U15	443-856	2350
U16	443-764	2114, 4045, 40L45, or 6614
U17	443-764	2114, 4045, 40L45, or 6614
U18	443-732	74LS30
U19	443-792	74LS132
U20	443-792	74LS132
U21	443-807	74LS42
U22	443-797	74LS10
U23	443-858	7414
U24	443-858	7414
U25	443-858	7414
U26	443-754	74LS240
U27	443-754	74LS240
U28	443-730	74LS74
U29	442-54	UA7805
U30	442-54	UA7805

MISCELLANEOUS

85-2204-1	Controller circuit board
134-1025	Cable assembly



Power Supply Circuit Board

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
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CAPACITORS

C101	25-904	2200 μ F electrolytic
C102	25-221	4.7 μ F tantalum
C103	25-221	2.2 μ F tantalum
C104	25-870	100 μ F electrolytic
C105	25-903	6800 μ F electrolytic
C106	25-221	2.2 μ F tantalum
C107	25-221	2.2 μ F tantalum

DIODES

D101	57-42	3A1
D102	57-42	3A1
D103	57-42	3A1
D104	57-42	3A1

CIRCUIT Comp. No.	HEATH Part No.	DESCRIPTION
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INTEGRATED CIRCUITS

U101	442-650	78H12
U102	442-651	78H05

MISCELLANEOUS

85-2107-1	Power supply circuit board
448-258	Blank diskette

CHASSIS PARTS

T201	54-940	Power transformer
SW201	60-619	Rocker switch
SW202	60-54	120/240 switch
SW203	60-608	LOW/NOR switch
	150-71	Floppy drive unit
S201	434-148	AC socket
F201	421-23	1-ampere slow blow fuse



APPENDIX



3 *** ROT17.H8A -- ROTATIONAL SPEED TEST FOR WH17/H17 DISK DRIVE
 4 * COPYRIGHT 1978 BY HEATH COMPANY
 5 *
 6 * WRITTEN BY K. N. BORCHARDT ON AUGUST 25, 1978

8 * *ROT17* IS USED ONLY FOR GROSS ADJUSTMENT OF DRIVE ROTATIONAL
 9 * SPEED IF THE FIRST READ/WRITE TEST OF THE UNIT FAILS DURING SET UP.
 10 *
 11 * USE OF *ROT17* IS AS FOLLOWS:
 12 *
 13 * 1. ENTER FOLLOWING PROGRAM AT ADDRESS 040 100
 14 * 2. SET PROGRAM COUNTER TO 040 100
 15 * 3. SET MEMORY TO 040 205
 16 * 4. PRESS 'GO'.
 17 * 5. ADJUST DRIVE SPEED UNTIL DATA AT DISPLAYED
 18 * MEMORY ADDRESS EQUALS 200
 19 * A. IF SPEED < 200, TURN ADJUSTMENT CLOCKWISE
 20 * B. IF SPEED > 200, TURN COUNTERCLOCKWISE.
 21 *
 22 * THE ABOVE TEST ADJUSTS SY01 TO ADJUST SY11; CHANGE MEMORY LOCATION
 23 * 040 101 TO 024 AND REPEAT STEPS 1 THROUGH 5.
 24 *

USE OF *ROT17* IS AS FOLLOWS:

1. ENTER FOLLOWING PROGRAM AT ADDRESS 040 100
2. SET PROGRAM COUNTER TO 040 100
3. SET MEMORY TO 040 205
4. PRESS 'GO'.
5. ADJUST DRIVE SPEED UNTIL DATA AT DISPLAYED MEMORY ADDRESS EQUALS 200
 - A. IF SPEED < 200, TURN ADJUSTMENT CLOCKWISE
 - B. IF SPEED > 200, TURN COUNTERCLOCKWISE.

THE ABOVE TEST ADJUSTS SY01 TO ADJUST SY11; CHANGE MEMORY LOCATION
 040 101 TO 024 AND REPEAT STEPS 1 THROUGH 5.

LABEL EQUIVALENCES

000.177 I/O PORTS
 000.178 OF,DC ERU 1770 DRIVE CONTROL OUTPUT PORT
 000.179 IF,DS ERU 1770 DRIVE STATUS INPUT PORT
 000.180 MASKS

000.001 DS,HOLE.ERU.....00000001B.....DRIVE STATUS SECTOR/INDEX HOLE

040.033 JICENT.ERU.....040033A.....2.MSEC.TICK.COUNTER

CONSTANTS

000.022 ONDR0.ERU.....0220.....TURN ON SY01
 000.024 ONDR1.ERU.....0240.....TURN ON SY11



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040.100 ..... DRG 040100A
47 .....
48 .....
49 ROT A,ORR00 TURN ON DRIVE ZERO
50 OP,DC
51 ROT0 GET TICK COUNTER
52 MOV A,H FORM TWO'S COMPLEMENT OF TICK COUNTER
53 CHA (D,E) = NEGATIVE TICK COUNTER
54 MOV D,A
55 MOV A,L
56 CHA
57 INR A
58 MOV E,A
59 JNC ROT1 IF NO CARRY FROM LSB
60 .....
61 INR D ELSE, INCREMENT MSB
62 LXI B,0 ZERO REV COUNTERS
63 ROT2 INR IF DS INPUT DISK STATUS
64 ANI DS,HOLE MASK FOR SECTOR/INDEX PULSES
65 JZ ROT2 IF NO HOLE PRESENT
66 .....
67 * HOLE PRESENT, WAIT FOR IT TO LEAVE
68 *
69 ROT3 IN IF DS GET DISK STATUS
70 ANI DS,HOLE GET HOLE PULSES
71 JNZ ROT3 WAIT UNTIL HOLE IS GONE AND WE HAVE MEDIA
72 .....
73 INR B INCREMENT HOLE COUNTER
74 MOV A,B TEST FOR A FULL REVOLUTION
75 CFI 11
76 JNZ ROT2 NOT A FULL REV. WAIT FOR NEXT HOLE
77 .....
78 MVI B,0 ELSE, RESET HOLE COUNTER
79 INR C INCREMENT REV COUNTER
80 MOV A,C TEST FOR 10 REVS (2 SECONDS)
81 CFI 10
82 JNZ ROT2 IF NOT TEN REVS YET, COUNT ANOTHER
83 .....
84 * HAVE TEN REVS, DISPLAY DIFFERENCE OF TICK COUNTER AND EXPECTED TIME DIF
85 *
86 LHL D TICKNT GET CURRENT TICK VALUE
87 DAD D SUBTRACT START VALUE
88 LXI D,377377A-1000H1 SUBTRACT 1000 (EXPECTED COUNT)
89 DAD D
90 LXI D,2000 MAKE 200 THE TARGET VALUE
91 DAD D
92 SHLD DISPLAY STORE AT DISPLAY WINDOW
93 JMF R0TO PERFORM ANOTHER SAMPLE
94 DISPLAY DS 2 DISPLAY ADDRESS
95 END
ASSEMBLY COMPLETE
95 STATEMENTS
0 ERRORS DETECTED
15778 BYTES FREE
    
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XREF VI.1
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CROSS REFERENCE TABLE

DISPLAY 040209	82	74L
DC-HOLE 000001	84	70
IP-PS 000177	30E	69
UNDR0 000022	43E	49
ONDR1 000024	43E	
OP-DC 000177	29E	50
ROT	040100	49L
ROT0	040104	51L
ROT1	040122	57
ROT2	040125	63L
ROT3	040134	68L
TICCN1	040033	38E

32008 BYTES FREE

