

Technical Manual

UNDERSTANDING & EXPANDING FLOPPY DISK SYSTEMS

A manual for Ohio Scientific users

M. E. Neally
J. R. Neally
D. J. Wilkie

The contributions made by Rosenberger Associates of Fresno, CA and SounDustrial Electronics of Joshua Tree, CA are gratefully acknowledged.

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Ohio Scientific equipment is designed to encourage expansion. The procedures are not particularly difficult; but, may seem to be a bit formidable to the novice. These pages will strive to be explicit, concise, and thorough enough to assist in the expansion of a cassette-based system and maintenance of an OSI disk-based system.

The printed circuit boards in the computers are essentially the same electronically; however, in each series they are physically divers. The Superboard and the C-1P use the 600 CPU Board, adding a 610 Board for a disk controller. The C2-4P and C2-8P will usually have either a 500 Board or a 502 Board which requires a 470 Disk Controller. The C-4P and C-8P use a 502 CPU. The C-4P MF and the C-8P DF have a 505 Board. The 505 Multi-purpose Board, with both CPU and disk controller onboard, can replace the 500 or 502 Board and eliminate the need for a 470 Board. The C3 Systems use a 510 CPU Board with a 470 Disk Controller.

If an expansion is planned, approach the project with preparation and caution. A few of the pitfalls may be avoided by observing some of the comments and suggestions which follow.

1. Use EXTREME caution when removing existing jumpers AND make careful note of their original positions.

2. Jumper wires should be kept to an absolutely minimum length.

3. Be certain that your disk drives have a data separator.

4. Read, VERY CAREFULLY, the interface specifications manual provided with the Disk Drives.

   a. Some of the older models of disk drives demand that the computer to be interfaced have a -9 Volt power supply. Some of the newer disk drives do not need this -9 Volts; so, check the drive specifications.

5. Check to be sure that:

   a. If necessary, there is a -9 Volt power supply in the computer (See above).

   b. There is sufficient memory in the System to run the Operating System.

      1) OS65D requires a minimum of of 16K.

      2) OS65U must have a minimum of 32K.

   c. There is an adequate 5 Volt supply to accommodate the additional memory.

      1) A 48K system generally will require a minimum of 6 Amps.

         a) The smaller computers are supplied with 3 Amps at the Factory; thus needing at least 3 additional Amps.

6. Browse through the instructions and flag the changes which are applicable to your computer, and to the type of disk drive (or drives) which will become a part of your system.

7. 500 and 502 Boards, if presently operating in cassette mode, must be re-strapped for disk operation.

8. Hard Sector and Double Density strapping are NOT included in the information because OSI does not provide any software support for these options.

ITEMS NECESSARY FOR EXPANSION:

Some of the components mentioned below may already be present on your boards. The notes are made to remind you to install them if they are not present.

1. Disk Controller Board

   a. 470 Board or

   b. 505 Board or

   c. 610 Board

      1) One Disk Controller Board will run up to two disk drives, whether single-sided or dual-sided

2. Disk Ribbon Cable or Twisted Pair with Disk Adapter Board

   a. State size of disk drive (5¼" or 8") when ordering

3. Disk Drive(s) with Data Separator(s)

   a. ONE Separator for EACH DRIVE

   b. See the Disk Drive Section before you leap into a purchase

4. 500 Board Expansion requires an OSI 65F3 Monitor ROM

5. For 5¼" operation, a 74390 chip must be installed in the 470 Board if one is not already in place

6. Appropriate resistor

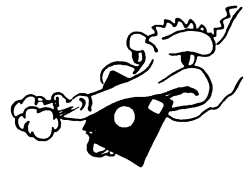
   a. 470/505/610 Boards adding dual-sided drives require a 1K resistor

   b. An 18K resistor is required on Disk Controller Boards to support 5¼ inch drives

   c. A 4.7K resistor is required on Disk Controller Boards to support 8" drives

7. Appropriate power supply

8. Additional plugs, connectors, etc., as required.



DISKETTES

The media used by the Floppy Disk Drives is a 5¼ inch or an 8 inch circular disk of magnetic recording film which is contained in a protective plastic envelope or jacket. The jacket remains stationary in the drive slot while the drive rotates the disk and positions and loads the read/write head of the drive.

The 5¼" diskette has 40 tracks (0 through 39) and the 8" diskette has 77 tracks (0 through 76). These tracks are in concentric circles with the index hole marking the beginning of each track. The index is read optically as the disk rotates.

The data on the disk is accessed by stepping the head of the drive over each track until the requested information is located.

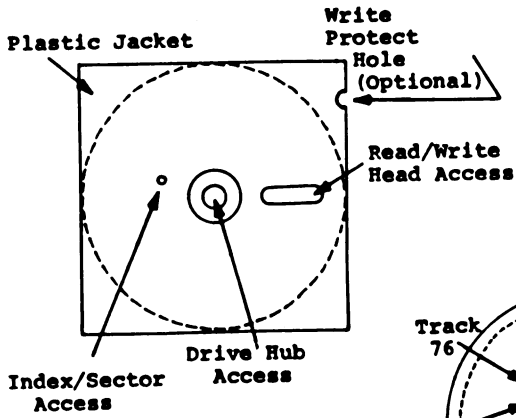


Diagram 1-A: Diskette Jacket

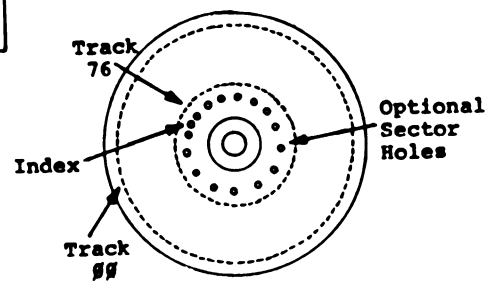
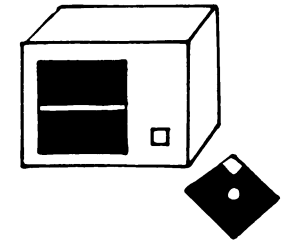


Diagram 1-B: Bare Diskette



DISK DRIVES

Be cautious in your selection of disk drives. Theoretically, almost any brand of drive, using a DATA SEPARATOR, could be connected to your OSI computer; AND, if you have an adventurous spirit, proceed. It will be an interesting experiment. The drives that have been used successfully in prior expansions are Shugart, Siemens, and Qume 8 inch drives; MPI and Tandon 5-1/4 inch drives.

Unless you are contemplating an ambitious investment in hard disk drives (hard disk expansion is different and not included in these instructions), the choice of 8 inch drives over 5-1/4 inch will probably be more economical, overall, in spite of a larger initial investment. The 8 inch diskette, with a storage capacity of 250,000 bytes, holds over 3 times as much data as the 5-1/4 inch diskette, with a storage capacity of 80,000 bytes. The 8 inch floppy will access and transfer data at about twice the rate of a mini. Plus, if PASCAL is in your future, you will avoid finnagling program segments to obtain workspace.

Another point to consider is that OSI's 5-1/4 inch disk software always leaves the READ/WRITE head in contact with the disk surface. This is hard on both disks and disk drives. The 8 inch software and hardware "unloads" the head between disk accesses.

FOOD FOR THOUGHT:

The band actuator head positioning mechanism is very dirt-sensitive and could possibly require more maintenance than the screw-type.

DISK DRIVES (continued)

SPECIAL CONDITIONS FOR 8" DRIVES:

1. Some of the newer boards in the 8" disk drives--such as the Siemens 8D Series--do not need the -9 Volt power supply. The configuration of these boards differs slightly from one series to another; but, the strapping from pin-number to pin-number is exactly the same. See Diagrams 2-A, 2-B, 3-A, and 3-B.)

2. If the -9 Volt supply is needed, installation in the computer cabinet is preferrable; but, the limited space in the C-1P and C-4P cabinets might preclude this. If there is no physical room for the additional supply, it may be installed in the disk cabinet. Unless a person is very ingenious, the supply might have to be hard-wired.

   a. Another plan might be to install it on the back of the computer cabinet and cover it with a small metal box.

   b. In desperation, a small 9 Volt battery, such as Eveready #216 or Panasonic #006P, could be used.

3. Shugart uses two types of stepping motors in their drives

   a. Screw-type b. Metal band-type

   1) The type of stepping motor does not affect the interfacing procedures.

4. Merlin could do no better than Shugart in materializing mechanical contours and board profiles in their SA850/851 Series; but, don't let the numerous configurations deter you. The drives will perform competently, the OEM Manual is comprehensive with instructions for user-installed options, and the PC board in the SA851 phase of the series, has an internal Data Separator.

   a. The multiple formats are mentioned for two reasons:

      1) Some of the drives in the series need the -9 Volt power supply and some do not. CHECK YOUR SPECS.

      2) There are two different Service Manuals. Give the PC Board number and the head actuator part number if it is ever necessary to order one.

Diagram 2-A: Siemens 8" PCB Edge Connector (old) strapped for "A" Drive

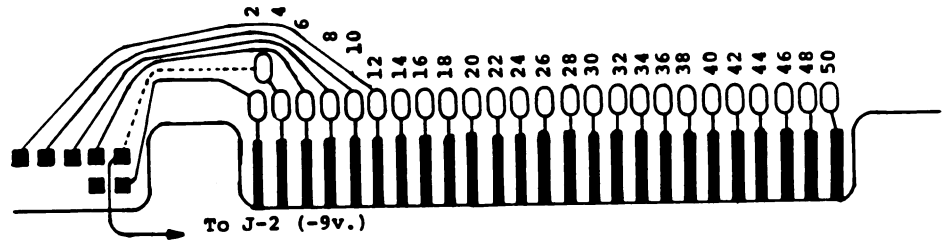


Diagram2-B: Siemens 8" PCB 50-pin Edge Connector (new) strapped for "A" Drive

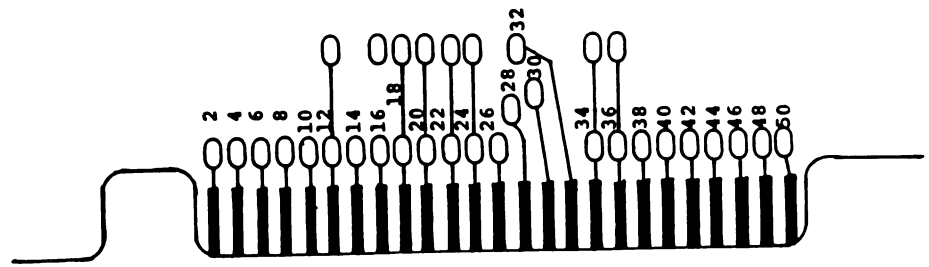


Diagram3-A: Siemens 8" PCB Edge Connector (old)
strapped for "B" Drive

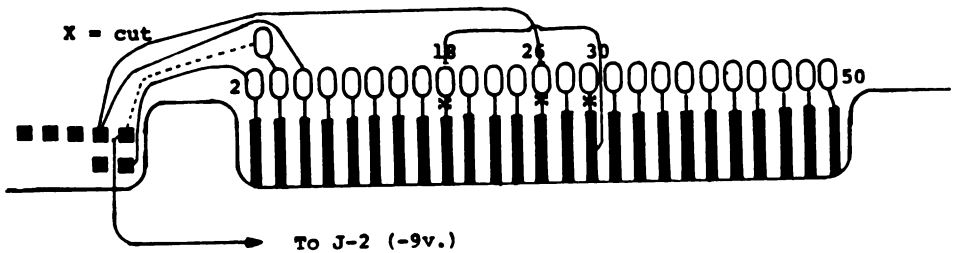


Diagram3-B: Siemens 8" PCB Edge Connector (new)
strapped for "B" Drive

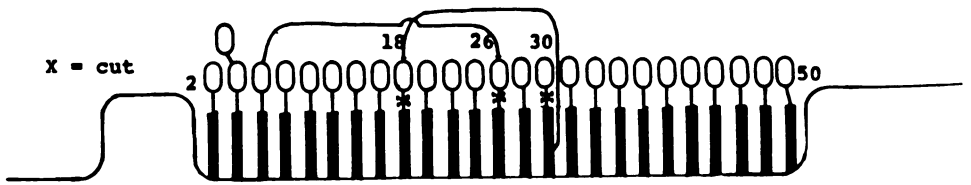
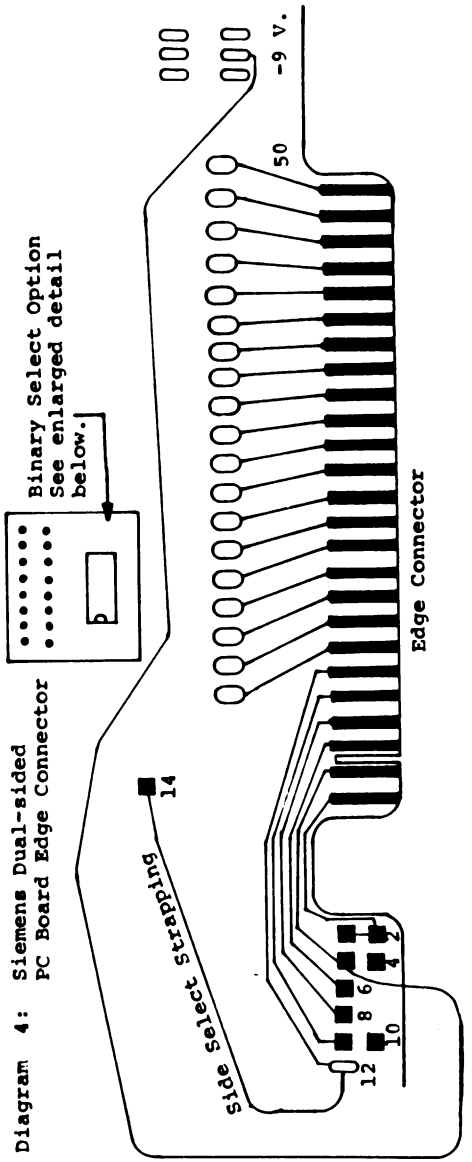
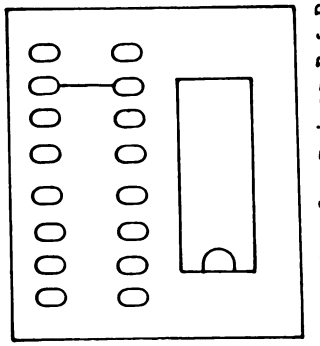
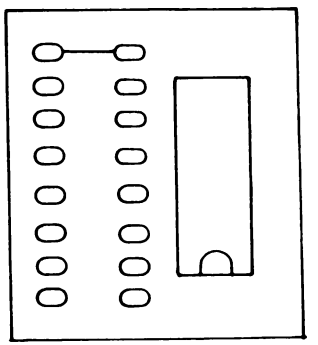


Diagram 4: Siemens Dual-sided PC Board Edge Connector





Strapping for Drives B & D.



Strapping for Drives A & C.

Table 1-A

SIEMENS 8 Inch

AC POWER REQUIREMENTS

Pin No. (P5)	60 Hertz		50 Hertz	
	120 V	220 V	120 V	220 V
1	108-132 VAC	198-242 VAC	108-132 VAC	198-242 VAC
2	Frame Gnd.	Frame Gnd.	Frame Gnd.	Frame Gnd.
3	AC Return	AC Return	AC Return	AC Return
I_{MAX}	0.5 Amps	0.4 Amps	0.6 Amps	0.4 Amps
Frequency Tolerance	±0.5 Hertz		±0.5 Hertz	

Table 1-B

SIEMENS 8 Inch

DC POWER REQUIREMENTS

Pin No. (P4)	DC Voltage	Tolerance	Current	Max. Ripple (p to p)
1	+24 V DC	±1.2 V DC	1.6 A Max.	100 mv
2	+24 V Return			
3	- 5 V Return			
4	- 5 V DC	±0.25 V DC	0.08A Max.	50 mv
	-7 to -16 V DC (optional with -5 V regulator installed	NA	0.10A Max.	NA
5	+ 5 V DC	±0.25 V DC	1.0 A Max.	50 mv
6	+ 5 V Return			

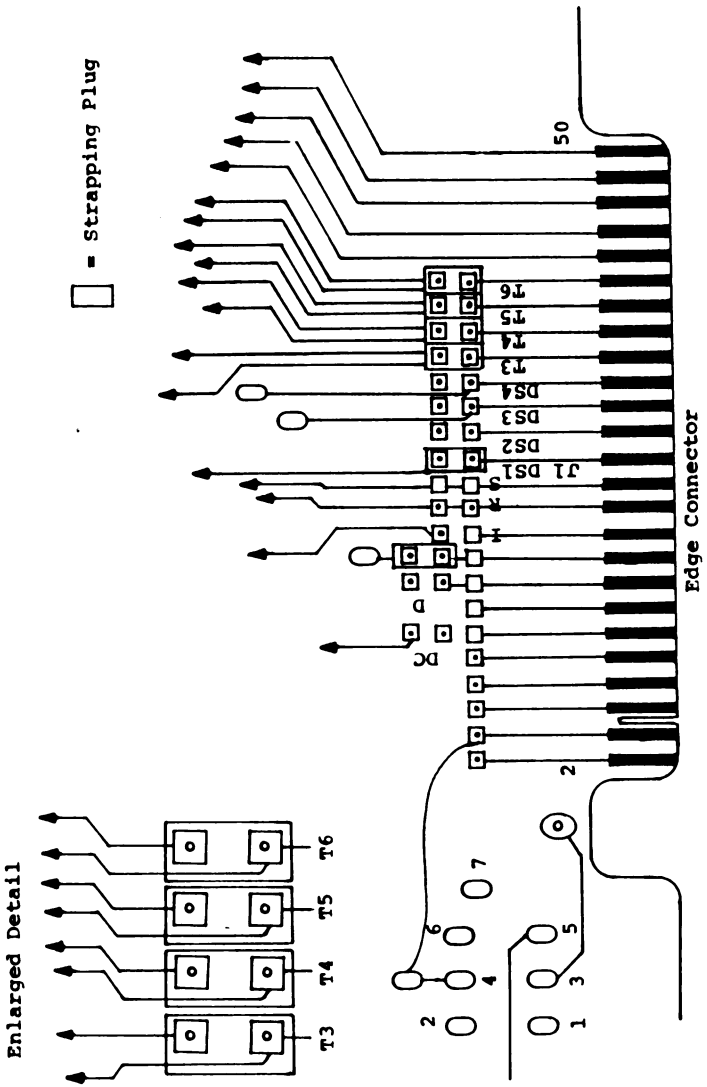


Diagram 5-A: Shugart Printed Circuit Board 50-Pin Edge Connector
Single-sided, strapped for "A" Drive

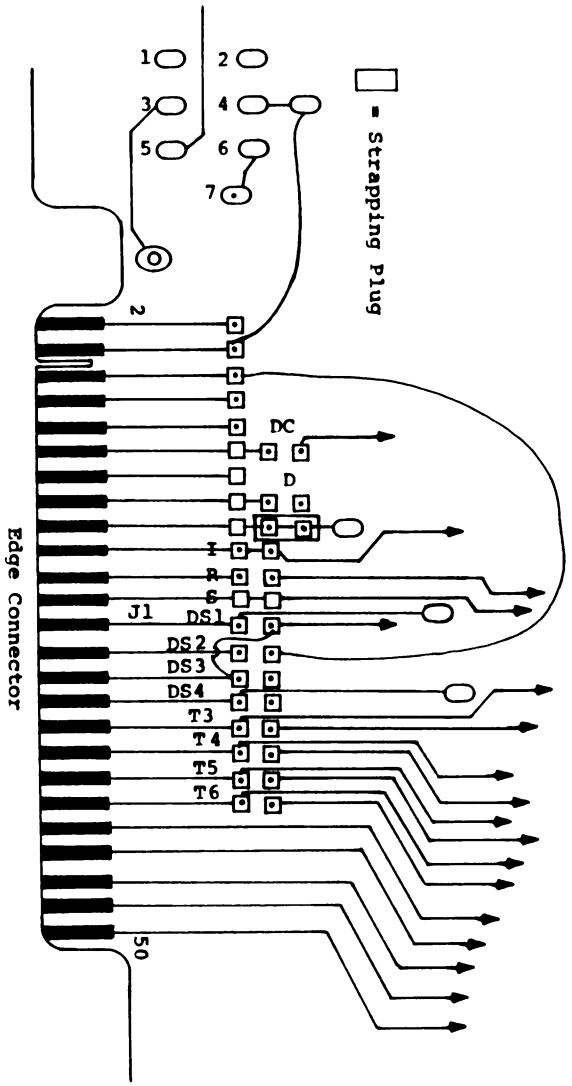


Diagram 5-B: Shugart Printed Circuit Board 50-Pin Edge Connector
Single-sided, strapped for "B" Drive

Table 2-A

SHUGART 8 Inch

AC POWER REQUIREMENTS

Pin No. (P4)	60 Hertz		50 Hertz	
	115 V	230 V	115 V	230 V
1	90-127 V AC	180-253 V AC	90-127 V AC	180-253 V AC
2	Frame Gnd.	Frame Gnd.	Frame Gnd.	Frame Gnd.
3	90-127 V Ret	180-253 V Ret	90-127 V Ret	180-253 V Ret
I_{MAX}	0.5 Amps	0.4 Amps	0.6 Amps	0.4 Amps
Frequency Tolerance	±0.5 Hertz		±0.5 Hertz	

Table 2-B

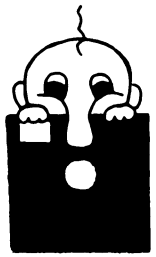
SHUGART 8 Inch

DC POWER REQUIREMENTS

Pin# (P5)	DC Voltage	Tolerance	Current	Max. Ripple (p to p)
1	+24 V DC	±1.2 V DC	1.7 A Max ** 1.3 A Typ	100 mv
2	+24 V Return *			
3	- 5 V Return			
4	- 5 V DC	±0.25 V DC	0.07 A Max 0.05 A Typ	50 mv
	Optional -7 to-16 V DC (Cut Trace 'L')	NA	0.10 A Max 0.07 A Typ	NA
5	+ 5 V DC	±0.25 V DC	1.0 A Max 0.8 A Typ	50 mv
6	+ 5 V Return			

* The +24 V DC requires a separate ground return line. Also the +24 V Return, other Ground Return lines, and Frame Ground must be connected together at the main power supply.

DISK DRIVES (continued)



Special Conditions for 8" Drives (continued)

The newer 8" disk drives, the Siemens 8D Series in particular, will not operate effectively under the 9 millisecond stepping rate. A POKE statement will change the rate to 3 milliseconds, under which they operate very well.

POKE 11895,3 will change the stepping rate on the drives to 3 milliseconds.

POKE 11895,9 will change the rate back to 9 milliseconds.

SPECIAL CONDITIONS FOR 5-1/4" DRIVES

1. About mid-1979, MPI made some circuitry changes.

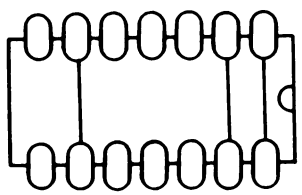
   a. Diagrams 6-C and 7-C will illustrate the obvious way to determine if your drives were manufactured before or after the change.

   b. Diagrams 6-A and 6-B show the correct strapping for the drives before the change (Old).

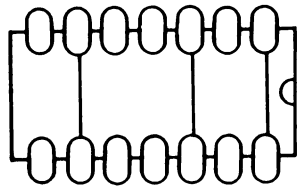
   c. Diagrams 7-A and 7-B show the strapping after the change (New).

2. Try to obtain disk drives with the Data Separator Option installed on the PC board. It is much more satisfactory than attaching the separate board to the drive.

3. The circuitry of the 5 inch drives makes it extremely difficult to connect more than one dual-sided drive to an OSI computer. It can be done; but, the disk drive PC board must also be modified.



STRAPPING FOR DRIVE A



STRAPPING FOR DRIVE B

NOTE: The diagrams above show the jumper SOCKETS, not the chips.

Diagram 6-A

Diagram 6-B

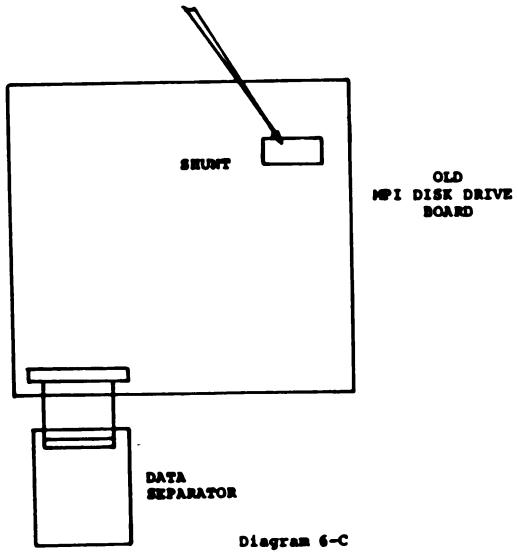
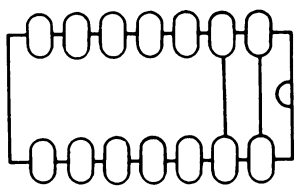
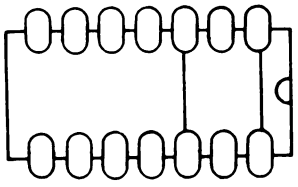


Diagram 6-C



STRAPPING FOR DRIVE A

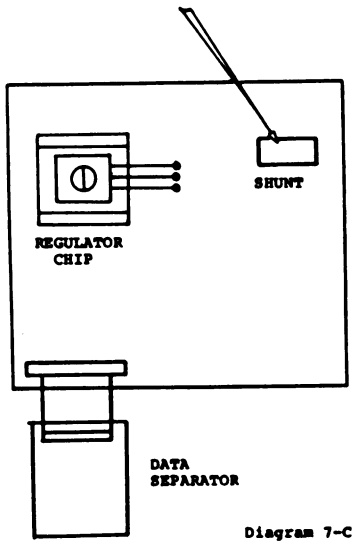
Diagram 7-A



STRAPPING FOR DRIVE B

Diagram 7-B

NOTE: The diagrams above show the jumper SOCKETS, not the chips.



NEW MPI DISK DRIVE BOARD

Diagram 7-C

MPI 5-1/4 Inch

DC Power Requirements

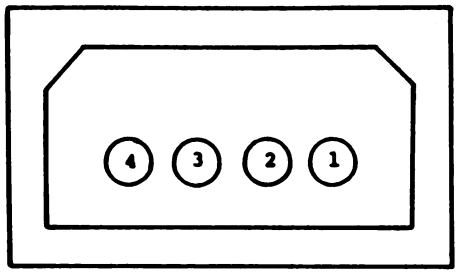
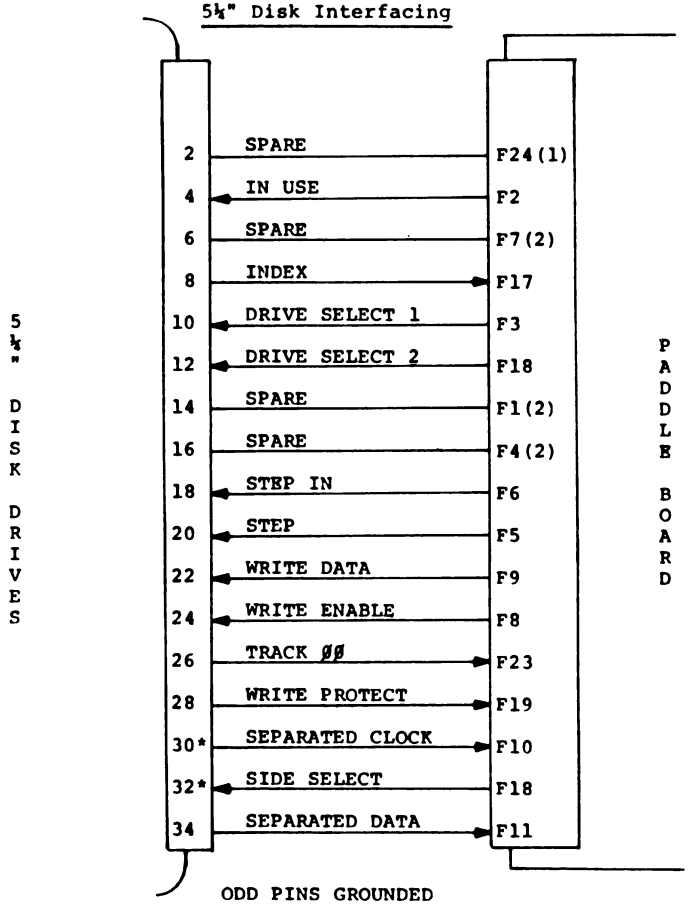


Diagram 8. DC Power Connector, J2. Located on the non-component side of the MPI Drive's printed circuit board. The recommended mating connector is AMP P/N 1-48024-0 using AMP pins P/N 60619-1.

Pin No. (J2)	DC Voltage
1	+12 V DC
2	12 V Return
3	5 V Return
4	+5 V DC

Table 3.

DIAGRAM 9:
5¼" Disk Interfacing



* 30 and 32 are tied together for Separated Clock on the old style drives.

(1) Grounded at the Paddle Board

(2) Connections at Paddle Board not jumpered to Disk Drive.

DATA SEPARATOR

This module provides separate READ DATA and READ CLOCK which the OSI Disk Controller Boards require.

All Disk Drives shipped from the OSI Factory will arrive with a Data Separator. If you purchase your Disk Drives elsewhere, designate that they MUST have the Data Separator Option and that they will be used with an Ohio Scientific computer.

The Data Separator function on Siemens and Shugart 8 inch drives, is an option which can be factory-installed on the Disk Drive's internal electronics.

On the 5-1/4 inch MPI Drives, the Data Separator is a small P.C. Board which plugs into the Main Drive internal electronics.

If you already have MPI 5-1/4 inch drives WITHOUT the Data Separator, the Data Separator may be ordered from MPI. Mark prominently on the order that the drives will be used with Ohio Scientific equipment.

A DATA SEPARATOR IS ABSOLUTELY NECESSARY FOR OHIO SCIENTIFIC EXPANSIONS



CABLES

1. Either a flat ribbon or a braided cable may be used to connect the drives to the Disk Controller Board via the Disk Adapter Board (Paddle Board).

2. Only one Disk Adapter Board is needed, but each drive requires a separate cable.

   a. Both cables may be wired to the Paddle Board.

   b. One cable may be wired to the Paddle Board with the second cable extending on from the connection at the first drive.

3. The cable must NEVER be more than ten feet in length. Four to five feet is recommended for stability.

4. Be sure grounds are connected to both the drive and the computer.

Cable Type	Manufacturer	Connector P/N	Contact P/N
50-CONDUCTOR CABLE FOR 8 INCH DISK DRIVES			
Braided Cable #26 (crimp or solder)	AMP	1-583717-1	583616-5(Crimp)
Braided Cable #26 (solder terminal)	VIKING	3VH25/1JN-5	NA
Flat Cable (Scotchflex)	3M AMP	3415-0001 88083-1	NA NA
Cable Type	Manufacturer	Connector P/N	Contact P/N
34-CONDUCTOR CABLE FOR 5¼ INCH DISK DRIVES			
Braided Cable #26	AMP	583717-S	1-583616-1
Flat Cable	3M "Scotchflex"	3463-0001	NA

Table 4: Connectors

DISK DRIVES (continued)

Cables (continued)

5. FOR 8 INCH DRIVES: The cable carries all control signals, signal ground, and, if necessary, -9 Volts to the drive.

   a. The user must supply +24 V. and 110 V. AC. See Tables 1-A and 1-B on page 10 and 2-A and 2-B on page 13.

6. FOR 5¼ INCH DRIVES: This cable transports all control signals, and signal ground to the drive.

   a. The user must supply +5 Volts and +12 Volts as well as 110 Volts AC. (See Table 3 and Diagram 8).

DISK ADAPTER BOARD

The etched circuit adapter board (Paddle Board) is the channel which OSI uses to pass signals between the computer and the disk drive(s). It is an integral part of the cable and plugs directly into the 24-pin Molex connector on the back of the Disk Controller Board.

1. This device is available in two sizes:

   a. With a 34-conductor cable for 5¼ inch drives

   b. With a 50-conductor cable for 8 inch drives.

2. The Factory wires and tests the cables for specific drives; but, both boards provide the option to jumper the drive control signals for various drive requirements.

3. Each signal has a ground and all grounds terminate at the disk drive and the G connectors on the Disk Controller Board.

4. Power connections can alternately be directly to the disk drives.

   a. When two drives are used, all lines except READY and SELECT are simply fed to both drives.

The Floppy Signal Connections are listed in Table 5.

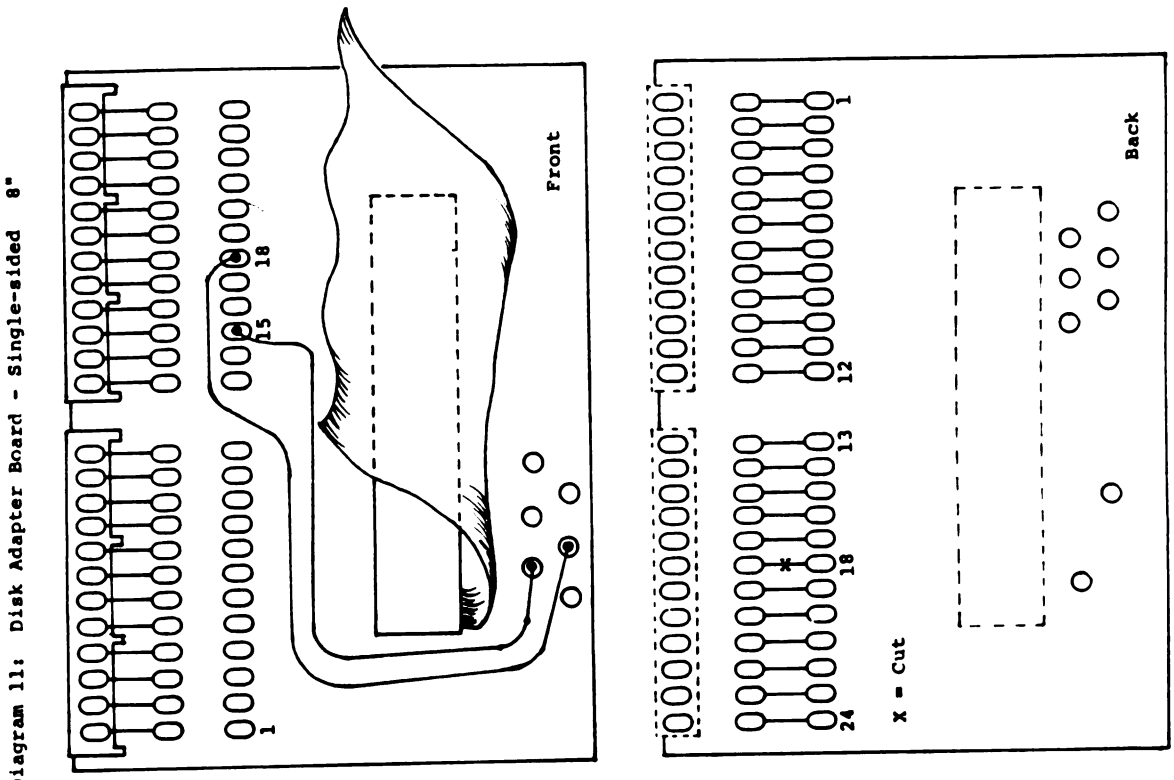
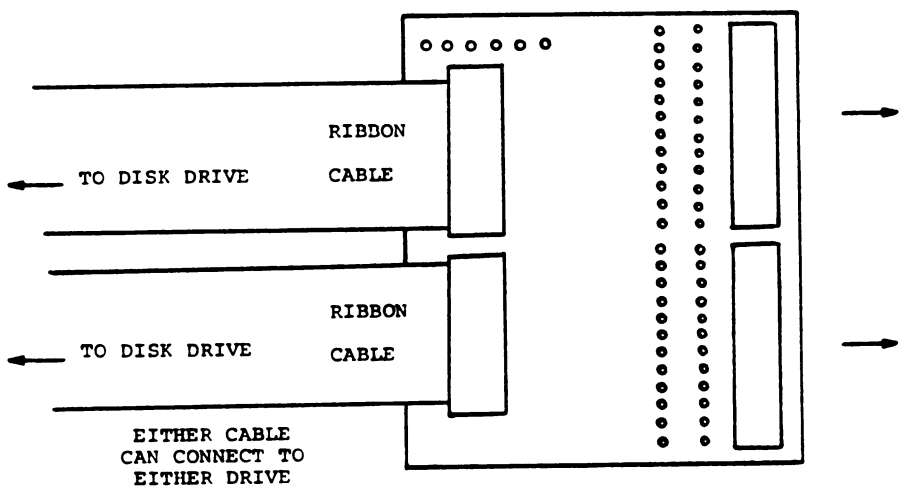


Diagram 11: Disk Adapter Board - Single-sided 8"

NOTE: All signal lines on the two ribbon cables are in parallel.



DISK ADAPTER BOARD

5-1/4 Inch

Diagram 10.

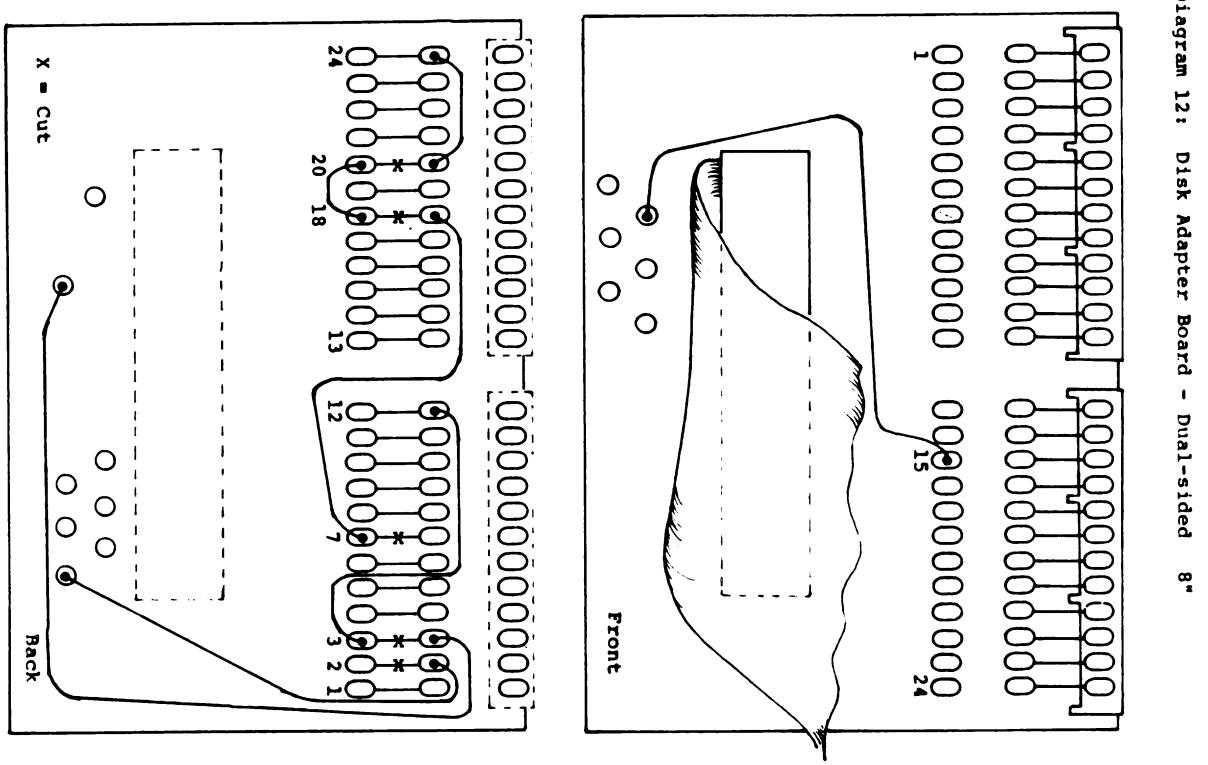


Diagram 12: Disk Adapter Board - Dual-sided 8"

FLOPPY DISK ADAPTER BOARD CONNECTIONS

470 Board (610/505) J3 Pin #	PIA Assign-ment	Signal Name	MPI-B51(old) J1 Pin #	MPI-B51(new) J1 Pin #	8-Inch Single Sided	8-Inch Dual Sided
F 1	PB7	Head Load	14	14	18	18
F 2	PB6	Low Current	4	4(2)	16	2
F 3	PB5	Select (Drive 1)	10	10	26	
		Drive Select				32
F 4	PB4	Fault Reset	16(1)	16(1)	N/C	N/C
F 5	PB3	Step	20	20	36	36
F 6	PB2	Step In	18	18	34	34
F 7	PB1	Erase Enable	6	6(2)	N/C	N/C
F 8	PBØ	Write Enable	24	24	40	40
F 9	-	Write Data	22	22	38	38
F10	-	Separated Clock	30+32	30	50	50
F11	-	Separated Data	34	34	48	48
F12	-	Ground	1-33 odd	1-33 odd	1-49 odd	1-49 odd
F13	-	Ground	1-33 odd	1-33 odd	1-49 odd	1-49 odd
F14	-	+5	N/C	N/C	N/C	N/C
F15	-	-5 or -9	N/C	N/C	4	4
F16	-	+24	N/C	N/C	N/C	N/C
F17	PA7	Index	8	8	20	20
F18	PA6	Select (Drive 2)	12	12	28	
		Side Select				14
F19	PA5	Write Protect (*)	28	28	44	44
F20	PA4	Ready (Drive 2)	N/C(1)	N/C(1)	30	22
F21	PA3	Sector (*)	N/C	N/C	24	24
F22	PA2	Fault	N/C	N/C	N/C	N/C
F23	PA1	Track ØØ	26	26	42	42
F24	PAØ	Ready (Drive 1)	2(1)	2(3)	22	22

(1) Grounded at the Paddle Board.
(2) Connections at Paddle Board not jumpered from 470 Board to the Disk Drive.
(3) J3 Pin 24 is grounded at the Paddle Board but not jumpered to Pin 2 of the Disk Drive at the Paddle Board.

(*) Optional

Table 5.

500 BOARD

Although the 500 Board is now considered obsolete, it will still work like a charm in a disk system after simple modifications.

Obtaining the 65F3 Monitor ROM may be the most difficult part of this conversion. From time to time, they become as scarce as hen's teeth.

Before taking iron and cutters in hand, a DECISION MUST BE MADE regarding dual use (cassette/disk). If cassette capabilities are to be retained, the BASIC-in-ROM System must also be retained. This will limit the expansion of the memory to 32K because of memory allocations.

If disk use only is desired, the system can be expanded to 48K by removing the four BASIC-in-ROM chips. Since OS65D and OS65U both have their own BASIC, the BASIC-in-ROM is no longer necessary.

There are three configurations in which the Monitor ROMs will operate:

The IC-A4 may always be installed.

Because modifications to IC-A5 and IC-A6 are necessary to implement the different operations, attention will be directed to the second and/or the third configurations.

1. One PROM at IC-A5, Address FEXX+FFXX

   For cassette operation only.

2. Two PROMs at IC-A5 and IC-A6, Address FEXX, FFXX Respectively

   For disk operation only.

3. Two PROMs at IC-A5 & IC-A6, switchable, Address FEXX+FFXX Both

   For cassette or disk operation, switchable.

500 BOARD (continued)

If the second configuration is your choice, you will disable IC-A5 and cancel cassette operation.

Cut at K1 and Jumper at J3 and J4.

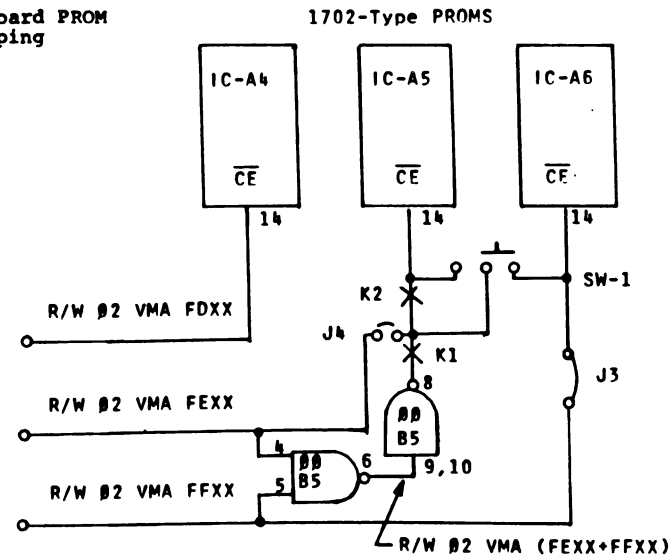
If you choose the third configuration, you will have the option of operating with cassette interface OR disk interface.

Cut at K2, Jumper J3 and J4, and install SW-1.

At the back of the computer cabinet, there are holes that will accept a toggle switch.

Mount a single-pole, double-throw switch and connect as shown in Diagram 4 below.

Diagram 13:
500 Board PROM Strapping



REMEMBER TO KEEP WIRING ABSOLUTELY AS SHORT AS POSSIBLE!

502 BOARD

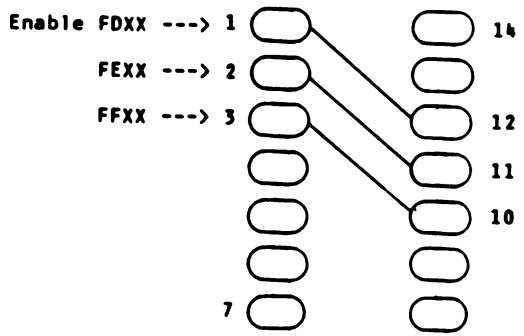
Because of the versatility of Ohio Scientific's Monitor ROMs, the conversion to disk mode is relatively simple. On the 502 Board, there are only three jumper positions to change.

Diagram 14 below shows the strapping for Cassette.

On the following page, Diagram 6 shows the strapping for a Polled Keyboard and Diagram 7 shows the strapping for a Serial Terminal.

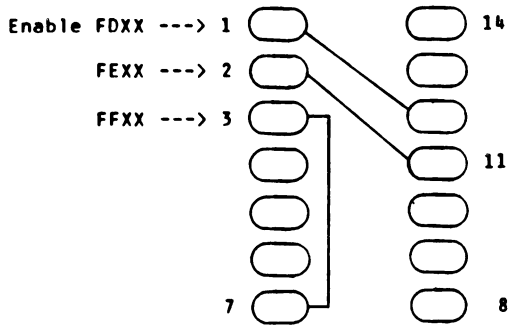
For flexibility and convenience, install a 14-pin socket in the 502 Board; then construct a plug to go in this socket:

1. Take a loose 14-pin socket
2. Insert the jumpers shown in the appropriate diagram. After this has been done, plug the second socket in the installed socket.



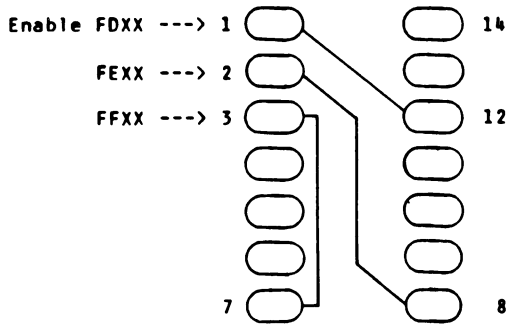
U15

Diagram 14. 502 Polled Keyboard Cassette Strapping.



U15

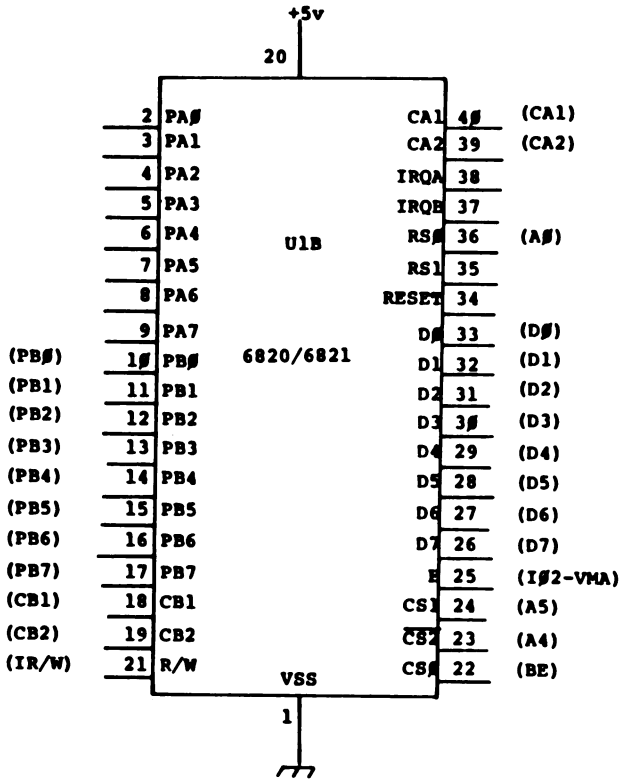
Diagram 15. 502 Polled Keyboard Disk Strapping

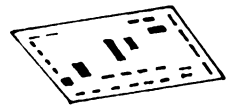


U15

Diagram 16. 502 Strapping for Serial Terminal with Disk.

Diagram 17: Pin Detail of: U1B (470 Board)
U1 (505 Board, Rev.A)
U1A (505 Board, Rev.B)
U72 (610 Board)





DISK CONTROLLER BOARDS

The concept of the Ohio Scientific disk controller boards is to provide a simple, flexible, and reliable interface in which all possible disk control functions are performed by software instead of hardware.

Basically, the disk control hardware consists of a 6850 ACIA for disk data and a 6820 PIA for drive commands.

The circuits and procedures included in this section will cover the 470 Board, the 505 Multi-purpose Board, and the 610 Board.

The strapping options described are by no means the only ones available. Only the ones pertinent to fundamental disk operation will be examined.

TEST POINTS FOR WAVE FORMS (See Tables 6 and 7)

470 Board

Separated Clock.....U4F (74123) Pin 1
Separated Data.....U4F (74123) Pin 10
Rx Clock.....U1C (6850) Pin 3
Rx Data.....U1C (6850) Pin 2
250KHz Clock (Tx C).....U1C (6850) Pin 4
Transmitter Clock Signal (TCS).U4E (74123) Pin 5
Transmitter Data Clock (TDC)..U4E (74123) Pin 4
Transmitter Data (Tx Data)....U1C (6850) Pin 6
Transmitter Data Signal (TDS).U4C (7400) Pin 3
Transmitter Signal (TS).....U4C (7400) Pin 6

505 Board, Rev. A

Separated Clock.....U26 (74123) Pin 1
Separated Data.....U26 (74123) Pin 10
Rx Clock.....U3 (6850) Pin 3
Rx Data.....U3 (6850) Pin 2
250KHz Clock (TxC).....U3 (6850) Pin 4
Transmitter Clock Signal (TCS).U17 (74123) Pin 5
Transmitter Data Clock (TDC)..U17 (74123) Pin 4
Transmitter Data (Tx Data)....U3(6850) Pin 6
Transmitter Data Signal (TDS).U18 (7400) Pin 8
Transmitter Signal (TS).....U18 (7400) Pin 11

505 Board, Rev. B

Separated Clock.....U4C (74123) Pin 1
Separated Data.....U4C (74123) Pin 10
Rx Clock.....U1C (6850) Pin 3
Rx Data.....U1C (6850) Pin 2
250KHz Clock (TxC).....U1C (6850) Pin 4
Transmitter Clock Signal (TCS).U3C (74123) Pin 5
Transmitter Data Clock (TDC)..U3C (74123) Pin 4
Transmitter Data (Tx Data)....U1C (6850) Pin 6
Transmitter Data Signal (TDS).U5D (7400) Pin 3
Transmitter Signal (TS).....U5D (7400) Pin 11

TEST POINTS FOR WAVE FORMS (See Tables 6 and 7)

610 Board

Separated Clock.....U70 (74123) Pin 9
Separated Data.....U70 (74123) Pin 2
Rx Clock.....U71 (6850) Pin 3
Rx Data.....U71 (6850) Pin 2
250KHz Clock (TxC).....U71 (6850) Pin 4
Transmitter Clock Signal (TCS).U68 (74123) Pin 13
Transmitter Data Clock (TDC)..U68 (74123) Pin 12
Transmitter Data (Tx Data)....U71 (6850) Pin 6
Transmitter Data Signal (TDS).U67 (7400) Pin 11
Transmitter Signal (TS).....U67 (7400) Pin 8

Table 6. Wave Forms

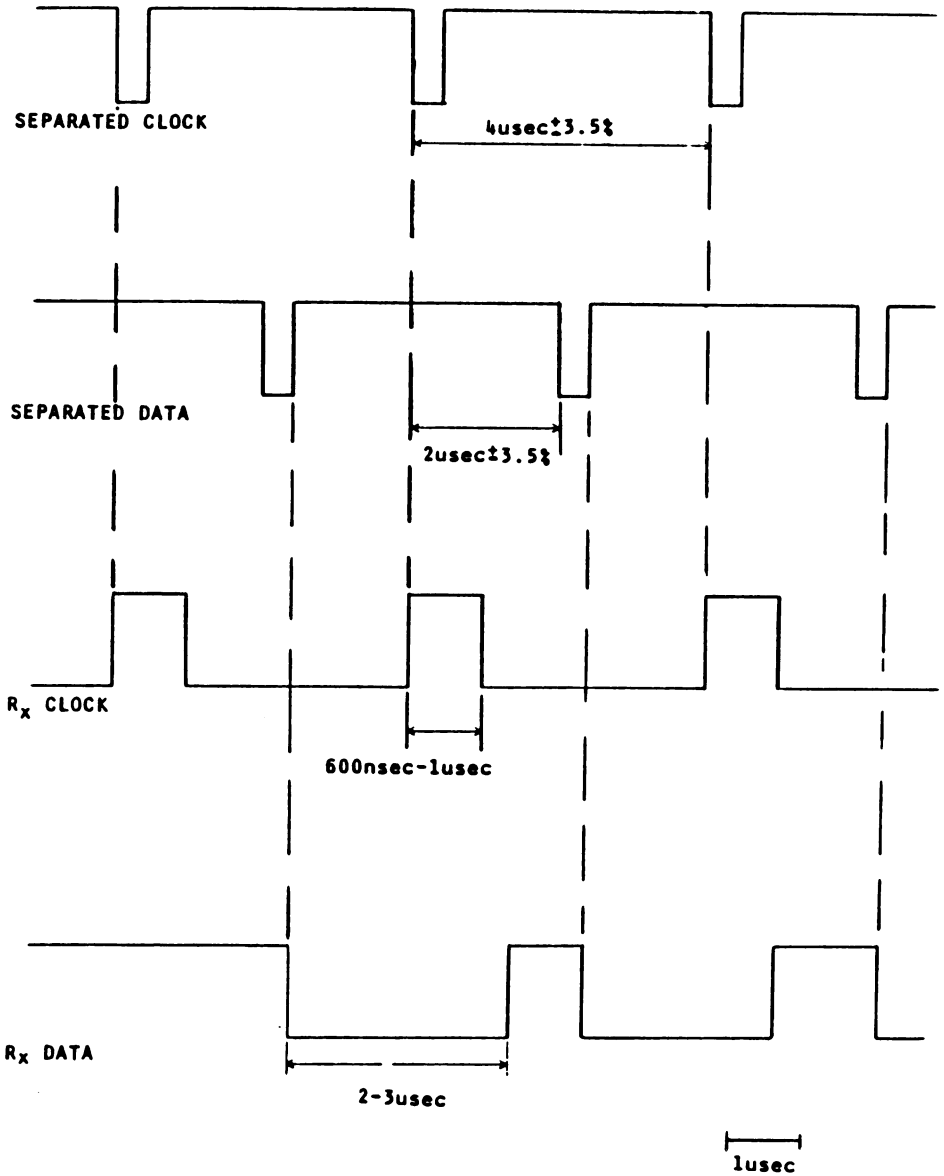
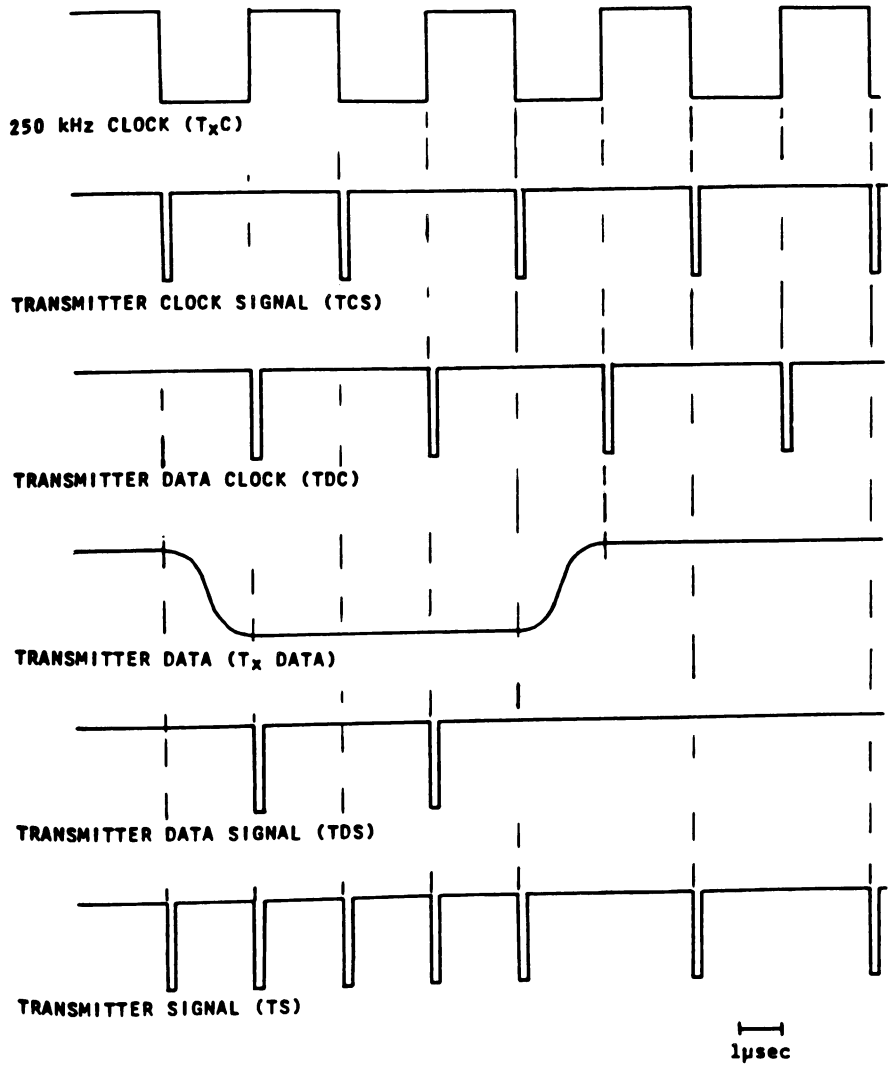


Table 7. Wave Forms



DISK CONTROLLER BOARDS (continued)

TIMING ON ALL DISK CONTROLLER BOARDS:

The timing should not have to be adjusted in the course of a conversion, as the adjustments are made at the Factory when the boards are ordered separately. For maintenance purposes, the specifications for both the 5 and 8 inch are given in Table 6.

Wave forms of the signals are given in Tables 6 and 7, with Test Point locations given on pages 34 and 35.

TABLE 8. DISK TIMING ADJUSTMENTS

POTENTIOMETER ADJUSTMENTS	INSTRUCTIONS	5"	8"	
TX DATA	Scope pin #9 of board's male Molex connector	350 NS negative	250 NS negative	Remove ACIA & PIA before all adjustments!
TX CLOCK	Ground pin #6 of the ACIA socket, slightly off-trigger scope & continue scoping pin #9	350 NS negative	250 NS negative	Image in phase and super-imposed above setting
RX CLOCK	Tie male Molex connectors #9 & #10 together, & scope pin #3 of ACIA socket	1 uS positive	1 uS positive	
RX DATA	Tie male Molex connectors #9 & #11 together, & scope pin #2 of ACIA socket	6 uS negative	2.5 uS negative	*** 5": one shot resistor = 18k 8": one shot resistor = 4.7k

*** Locations for the 1-shot resistor:

470 Board = R42
505 Rev.A = R57
505 Rev.B = R60
610 Board = R20

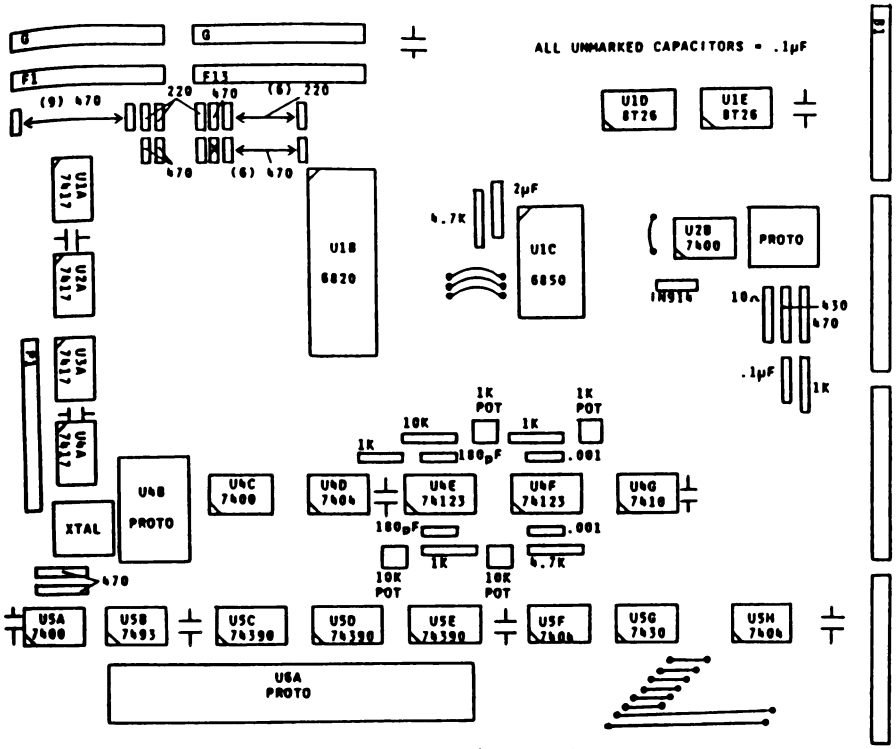


Diagram 18: 470 Board Layout

470 BOARD

I. This Disk Controller Board is used with the 500 or 502 CPU Board.

A. It normally comes from the Factory strapped for use with 8" single-sided, soft-sectored diskettes; therefore, it is not necessary to modify the board for this type of operation.

1. Diagram 19 shows the pin-out and Factory Strapping.

B. The Board has provisions for hard sector format and double density drives; but, making these modifications would be an exercise in futility since there is no software support for them.

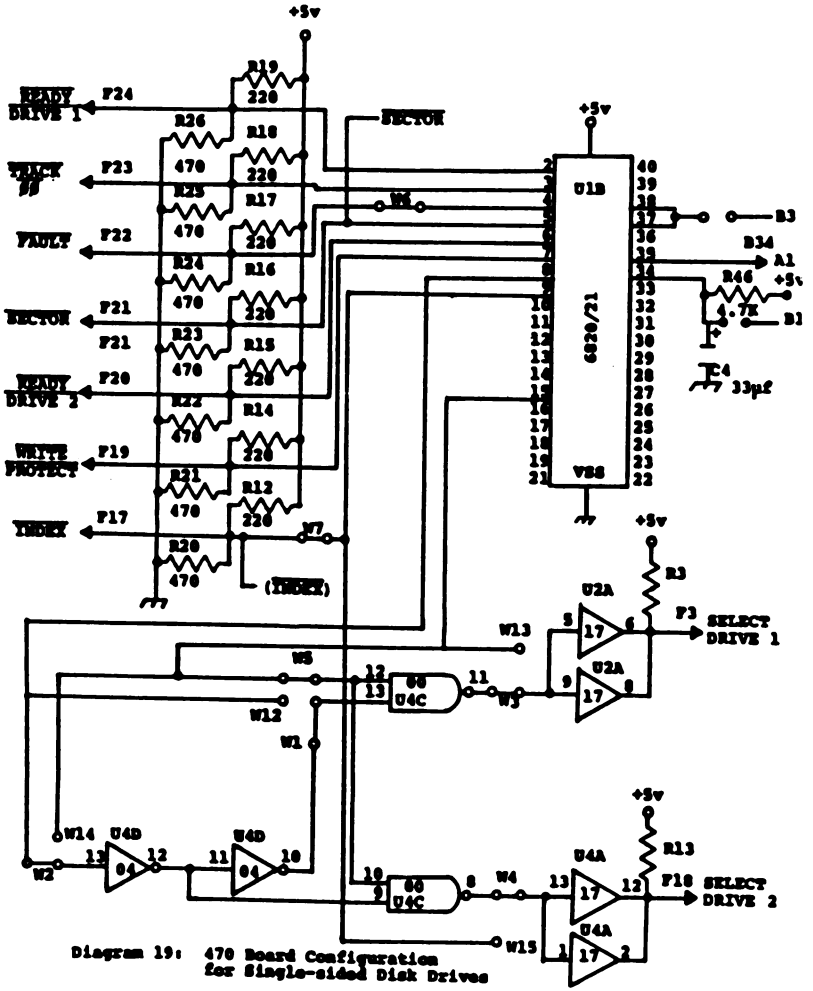


Diagram 19: 470 Board Configuration for Single-sided Disk Drives

470 BOARD (continued)

C. Dual-sided Operation

Note: Diagram 20 below and Diagram 21 on page 43 illustrate the procedures given on the following page and should be used in conjunction with those instructions.

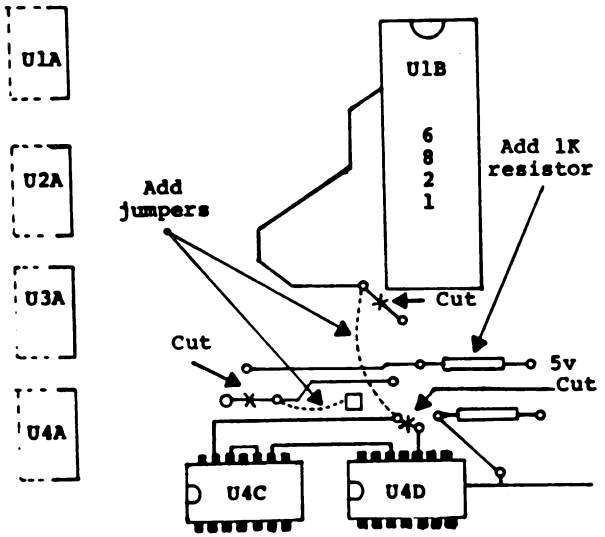


Diagram 20: 470 Board Rev.B
Shows changes necessary to convert from single to dual-sided disk operation.

470 BOARD (continued)

C. Dual-sided Operation (continued)

1. At point W-2, cut the connection between Pin 8 of U1B (6820/21) and Pin 13 of U4D(7404).

2. At point W-14, place a jumper between Pin 15 of U1B and Pin 13 of U4D.

3. At point W-5, cut the connection between Pin 15 of U1B and Pins 10 and 12 of U4C (7400).

4. At point W-1, cut the connection between Pin 13 of U4C and Pin 10 of U4D.

5. At point W-12, place a jumper between Pin 8 of U1B and Pin 13 of U4C.

6. Install a 4700 Ohm resistor at R44 between the +5 Volt slot, next to R33, and to the Buss between Pins 10 and 12 of U4C.

7. There are also modifications to the Disk Adapter Board which must be made for dual-sided operation. See the Disk Adapter Section.

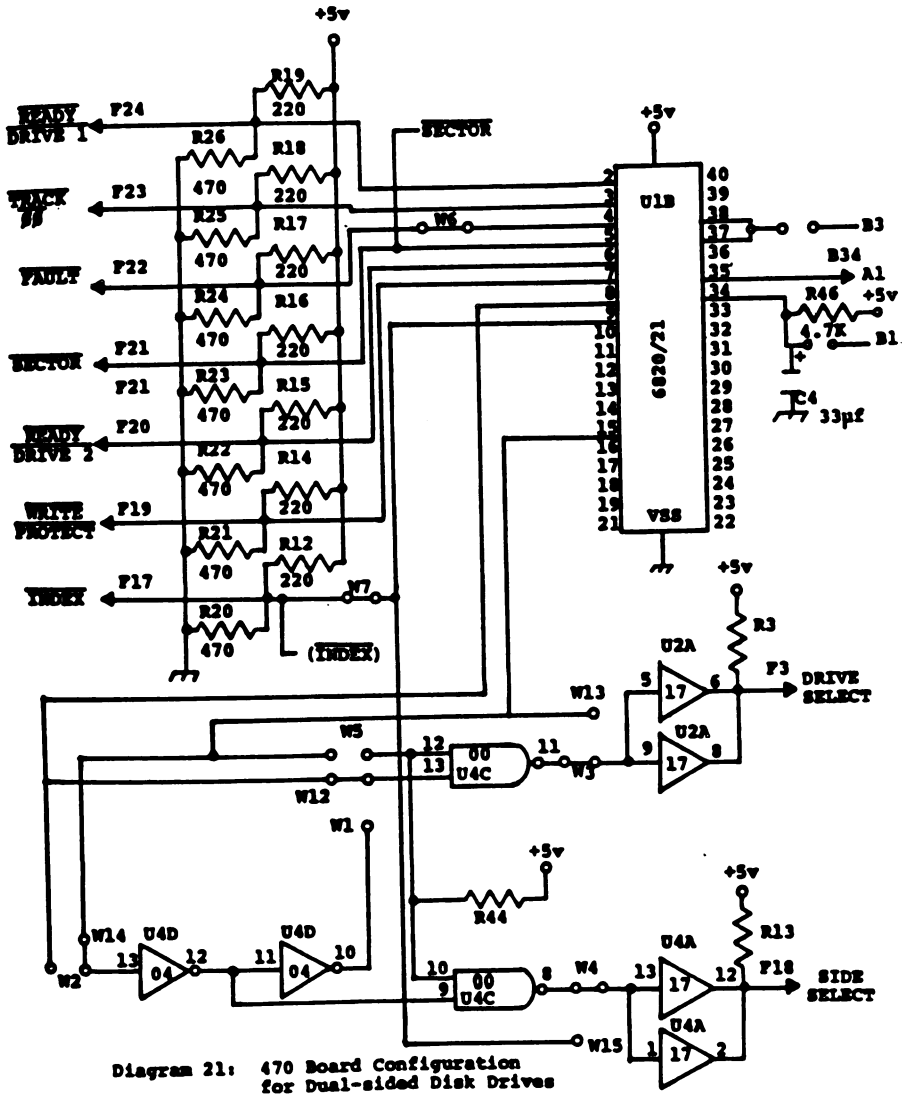


Diagram 21: 470 Board Configuration for Dual-sided Disk Drives

D. Write Clock Frequency

1. The System Clock is not used for disk control on the 470 Board. The crystal oscillator, which runs at 4.00MHz, is the source for counting and timing. This is divided down to secure Read and Write Clocks, dependent upon the jumper position at U5B (7493).

   a. 8 inch drives = 250KHz

      1) No modifications required.

   b. 5¼ inch drives = 125KHz

      1) If the board does not have a 74390 at U5C, install one.

      2) Strap Pin 3 of the 74390 to Pin 4 of the 74390 (U5C)

      3) Strap Pin 1 of the 74390 to Pin 9 of the 7493 (U5B)

      4) Strap Transmit Clock to Pin 3 and 4 of the 74390.

      Diagram 22 shows the strapping of the board as it comes from the Factory plus the changes which must be made to operate the 5¼" drives.

For 5¼ inch strapping:

1. Cut between J1 and J2

2. Add a jumper between J1 and J3.
   (Change the clock from 250 KHz to 125 KHz.)

IMPORTANT NOTE: For 5¼" drives, remember to change the R42 resistor from 4.7K to 18K (¼ Watt, 5%).

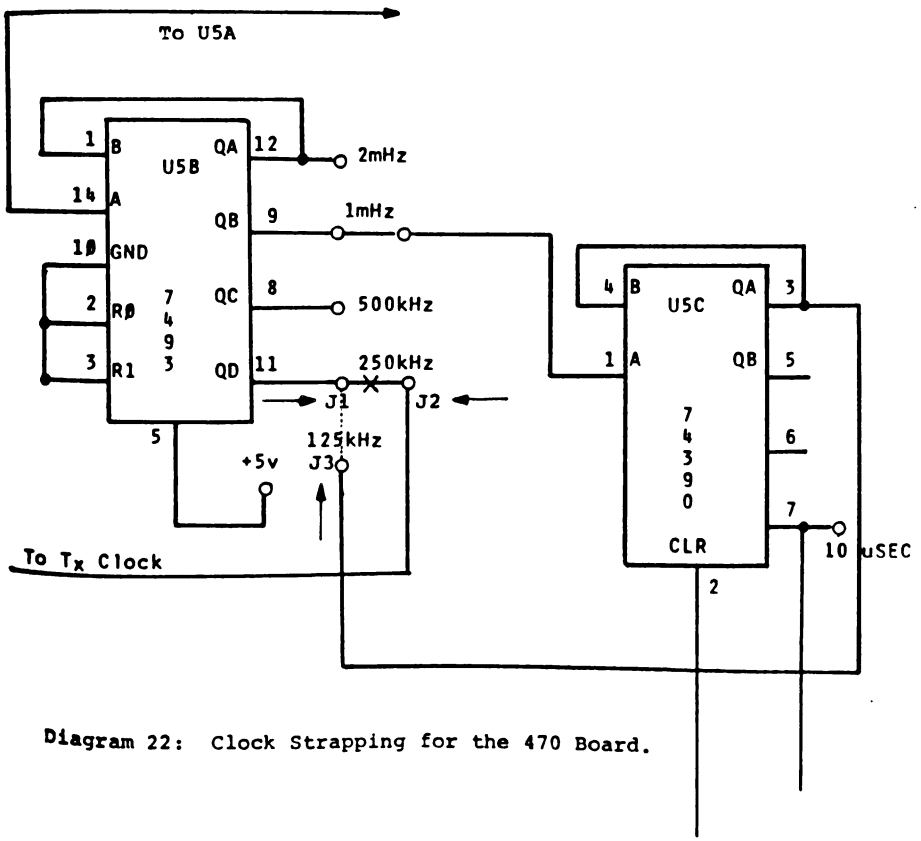


Diagram 22: Clock Strapping for the 470 Board.

E. Disk Controller Adjustments

1. The locations for the four one-shot pulse length adjustment potentiometers are given below.

   a. TX Clock (R34)

   b. RX Data (R36)

   c. TX Data (R39)

   d. RX Clock (R41)

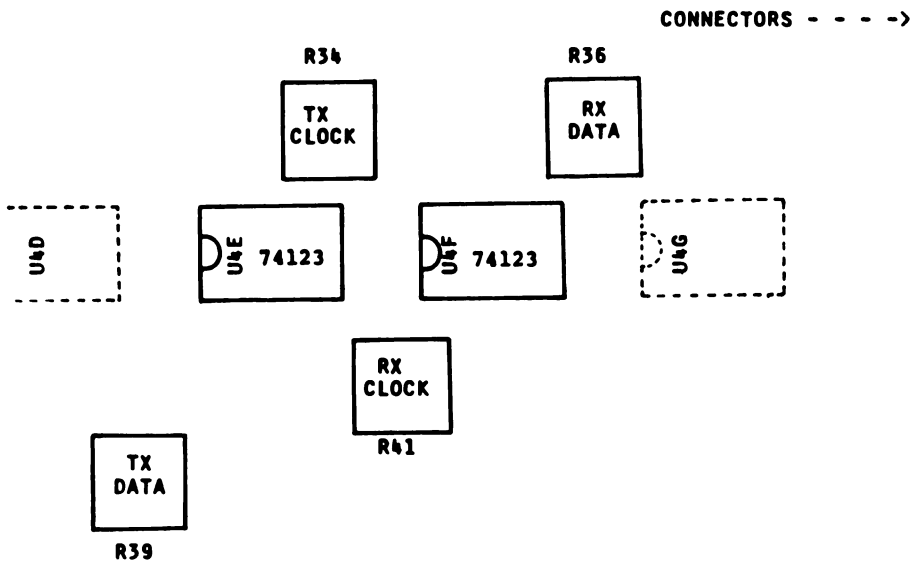


Diagram 23. Timing Adjustment Locations for the 470 Board



505 BOARD

II. Using the 505 multi-purpose board, with CPU and Disk Controller functions on the same board, has the added attraction of releasing an extra card connector in the backplane for installing additional capabilities in your system.

A. Revision A and Revision B are physically dissimilar; therefore, the boards are dealt with on an individual basis where necessary.

1. The Board is normally strapped for:

   a. 8" operation in a C-8P DF

   b. 5¼" operation in a C-4P MF

B. No modification is necessary to obtain the single-sided and soft-sectored portion of the operation.

505 BOARD (continued)

C. Dual-sided, Soft-sectored Operation

1. Revision A

a. Cut between Pin 2 of U19 and Pin 5 of U18

b. Cut between Pin 8 of U1 and Pin 13 of U19

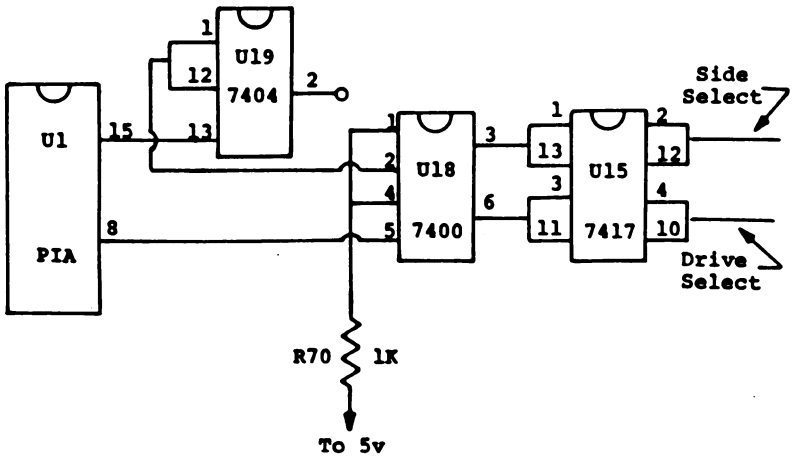
c. Cut between Pin 15 of U1 and Pin 1 of U18 and Pin 4 of U18

d. Strap Pin 8 of U1 to Pin 5 of U18

e. Strap Pin 15 of U1 to Pin 13 of U19

f. Connect a 1K resistor at R70 from the Buss between Pins 1 and 4 of U18 to +5v

Diagram 24: 505 Rev.A Dual-sided Strapping



505 BOARD (continued)

C. Dual-sided, Soft-sectored Operation (continued)

2. Revision B

a. Cut between Pin 8 of U1A and Pin 3 of U4B

b. Cut between Pin 6 of U4B and Pin 13 of U5A

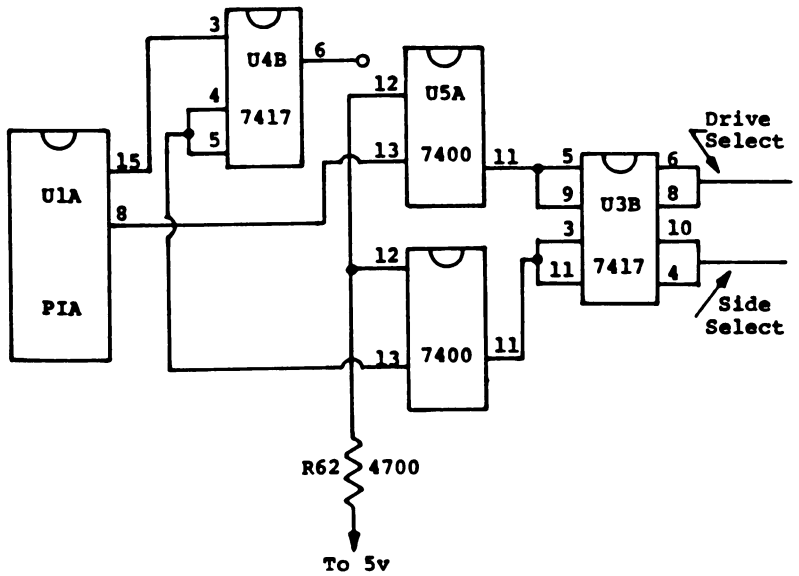
c. Cut between Pin 15 of U1A and Pin 12 of U5A and Pin 12 of U5C

d. Strap Pin 15 of U1A to Pin 3 of U4B

e. Strap Pin 8 of U1A to Pin 13 of U5A

f. Install a 4700 Ohm Resistor at R62 from the Buss between Pins 12 of U5A and 12 of U5C to +5v

Diagram 25: 505 Rev.B Dual-sided Strapping



505 BOARD (continued)

D. Write Clock Frequency

1. The Read and Write Clocks are determined by the jumper position at U20 on Rev.A. and at U6D on Rev.B. (7493).

2. Diagram 26 shows the board strapped for 8 inch operation with the the changes necessary for 5¼ inch operation indicated.

   a. 8 inch drives = 250KHz

      1) If strapped for 5¼"

         a) Cut between J2 and J3

         b) Add a jumper between J1 and J2

         c) Change the resistor from 18K to 4.7K. (R57 on Rev.A/R60 on Rev.B)

   b. 5¼ inch drives = 125KHz

      1) If strapped for 8" drives

         a) See Diagram 26 for instructions.

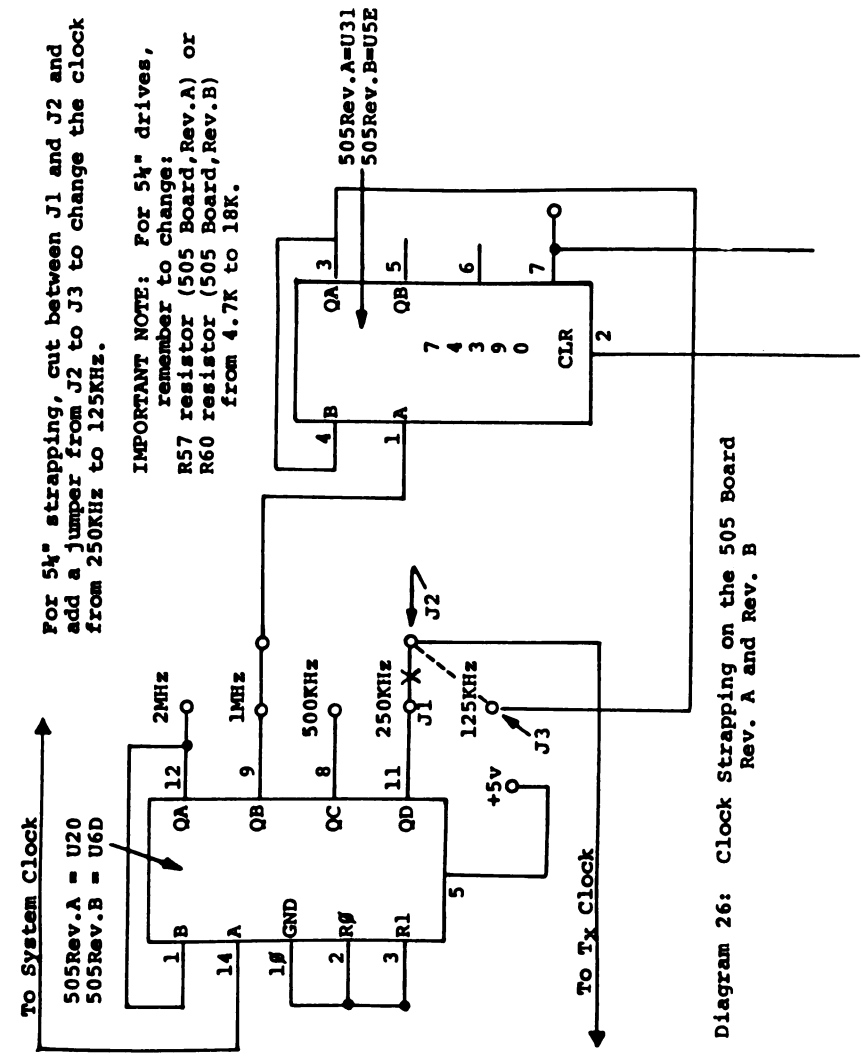


Diagram 26: Clock Strapping on the 505 Board Rev. A and Rev. B

D. Disk Controller Adjustments

1. The locations for the four one-shot pulse length adjustment potentiometers are given below.

a. 505 Rev.A

1) TX Clock (R46)

2) RX Data (R56)

3) TX Data (R49)

4) RX Clock (R59)

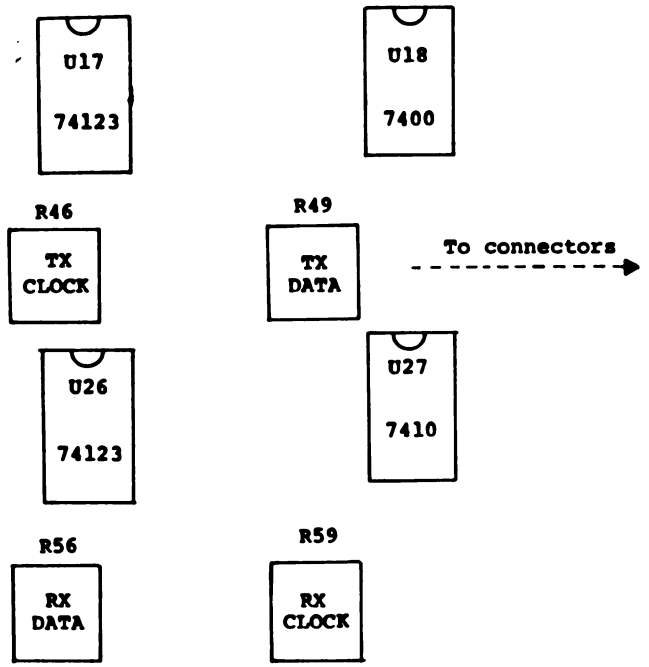


Diagram 27: Timing Adjustment Locations
505 Rev.A

D. Disk Controller Adjustments (continued)

1. Potentiometer Locations (continued)

b. 505 Rev.B

1) TX Clock (R56)

2) RX Data (R58)

3) TX Data (R52)

4) RX Clock (R57)

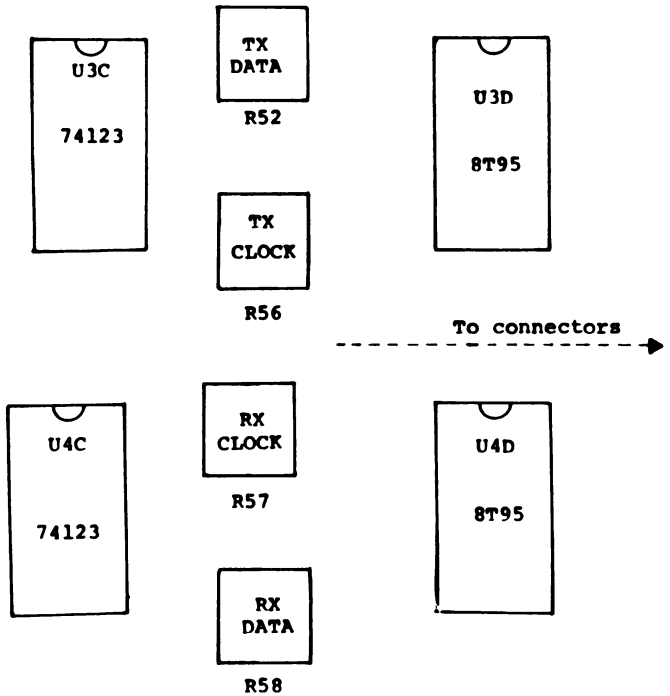


Diagram 28: Timing Adjustment Locations
505 Rev.B

610 BOARD

III. The 610 Board, when interfaced with a 600 Board CPU, will convert a Superboard or C-1P from cassette to disk operation.

A. The Board is strapped at the Factory to accommodate 5¼ inch single-sided, soft-sectored disk drives.

B. Dual-sided Operation

1. Cut between Pin 15 of U72 and Pin 2 of U67
2. Cut between Pin 8 of U72 and Pin 3 of U69
3. Cut between Pin 6 of U69 and Pin 5 of U67
4. Jumper from Pins 1 and 13 of U73 to Pin 6 of U67
5. Jumper from Pins 3 and 11 of U73 to Pin 3 of U67
6. Jumper between Pin 8 of U72 and Pin 5 of U67
7. Jumper from Pin 15 of U72 to Pin 3 of U69
8. Connect a 1,000 Ohm resistor at R7 from the Buss between Pins 2 and 4 of U67 to +5v.

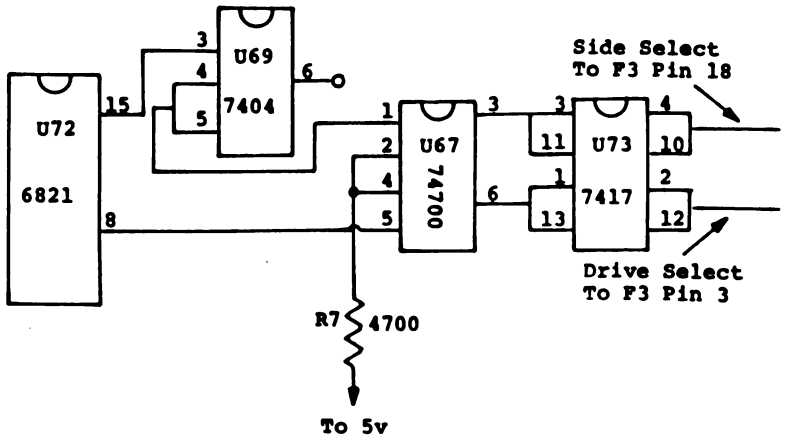


Diagram 29: Dual-sided Strapping for 610 Board

610 BOARD (continued)

C. Write Clock Frequency

1. The Read and Write Clocks are determined by the jumper position at U12. See Diagram 30.

a. The board is strapped for 5¼" operation at the Factory as shown in the Diagram.

b. For 8" operation:

1) Cut between J1 and J2

2) Add a jumper between J2 and J3. This changes the clock from 125KHz to 250KHz.

3) Change the resistor at R20 from 18K to 4.7 (½ Watt, 5%).

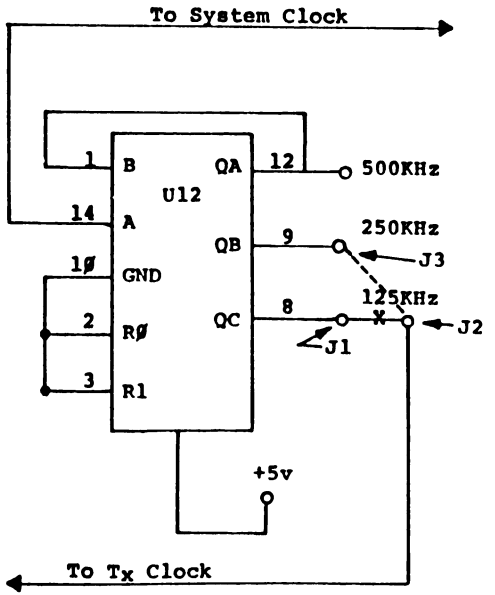


Diagram 30: Clock Strapping for 610 Board

DB5002

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