

DMAF2 Floppy Disk System
Introduction

The Southwest Technical Products Corporation DMAF2 is a dual drive, single and double density, double sided eight-inch disk system. The DMAF2 is designed to operate with the SWTPC 6800 and 6809 SS-50 bus computer systems. Although the DMAF2 is designed to operate with two drives, up to four drives may be used with a special daisy chained interconnection cable.

Although the DMAF2 Disk System was completely assembled and tested at the factory, slight reprogramming of the circuit board may be necessary to operate with your particular computer system. Also, the disk drives may need to be installed in the chassis. It is suggested that this instruction manual be read completely before attempting to use the system. Step-by-step instructions are given for configuring the unit for your particular system to minimize the possibility of errors.

Disk Drive Installation

The two disk drives for the DMAF2 were probably shipped in their original containers rather than being attached to the chassis. Carefully remove each drive from its shipping container. One drive should be clearly marked with a 0 and the other with a 1. The drive marked 0 should be installed in the chassis so that it is the left drive (as viewed from the front). Before attaching drive 0 to the chassis, install the 50-pin ribbon cable connector to its mate on the drive as shown in the DMAF2 wiring pictorial. Be sure the connector is installed so that the side of the cable with the colored band is facing toward the drive motor as shown in the pictorial. The drive marked 1 should have an extra wire with a connector on the end attached to the bottom circuit board of the drive. When installing this drive be sure the wire and connector extends out from the back of the drive so that it may be connected to its proper mate on the motor control board. Both drives should be securely fastened to the chassis using the #8 - 32 screws supplied.

Once the drives have been fastened to the chassis the power and control cables should be installed. Although all connectors are indexed and can only be installed one way, the step-by-step procedure should be followed to avoid any errors. The wiring pictorial should be used to aid in connecting the cables.

- () Be sure that the DMAF2 is not connected to the power line.
- () Connect the longer of the two AC cables from the motor control board to its respective socket on drive 0. Be sure the connector seats firmly in the socket.
- () Connect the other AC cable to its socket on drive 1.

- () Connect the longer DC cable to its respective socket on drive 1. This connector is indexed and can only be installed one way.
- () Connect the remaining DC cable to its socket on drive 0.
- () Connect the motor control cable to its respective socket on the motor control board. Be sure the connector is installed so that the indexing pin in the female portion mates with the clipped or removed connector pin on the board.
- () Install the 50-pin ribbon cable connector on drive 1 as shown in the pictorial. This connector should also be installed so that the banded side of the ribbon cable is nearest the disk drive motor.
- () Route the ribbon cable connector thru the slot along the top edge of the rear panel and install the cover using the #8 - 32 black screws supplied with the unit.

Programming the DMAF2 Controller Board

Before installing the DMAF2 controller in your computer system the jumper options on the board need to be set properly. DO NOT, however, change the adjustment of the three controls near the top of the board. These were pre-set at the factory and should only be adjusted by qualified service personnel. Jumper changes are accomplished by moving the small (probably blue) jumper blocks which look like small connectors. A complete description of each jumper position is given in the DMAF2 Controller Board Jumpers section of the S/09 system documentation manual (if applicable). In most cases the short table on the following page may be used to configure the board for your particular system. Make any jumper changes necessary.

DMAF2 Disk Unit Jumper Requirements

The following tables show the jumper settings to be used with the DMAF2 double density disk controller in various system configurations. In addition to the DMAF2 jumpers, some changes may be required to the MP-09 processor board jumpers when using double density.

Table 1.1 -- DMAF2 Jumpers

<u>DMAF Jumper</u>	<u>6800</u>	<u>/09 SD †</u>	<u>/09 DD</u>	<u>S/09</u>
Halt/Bus Req	Halt		Bus Req	Bus Req
Upper/Lower	Lower	Lower	Lower	Lower
BA/BA & BS	BA	BA	BA & BS	BA & BS
IRQ/Norm	Norm	Norm	Norm	Norm
2 MHz/1 MHz	1 MHz	1 MHz	1 MHz	††
Precomp/Norm	Norm	Norm	Precomp	Precomp
MR/Norm	Norm	MR	MR	MR
56K/32K	32K	56K	56K	56K
Desel/Sel	Desel	Desel	Desel	Sel
Address Select	4	4	4	4

Table 1.2 -- MP-09 Jumpers

<u>6809 Jumper</u>	<u>6800</u>	<u>/09 SD</u>	<u>/09 DD</u>	<u>S/09</u>
BA/BA & BS	N.A.	BA & BS	BA	BA
110/BR	N.A.	110	BR	BR
2S/3S	N.A.	2S	2S	3S

† This configuration is normally not used unless both drives are single density or it is absolutely necessary to use the 110 Baud Rate line.

†† Set to System Clock Frequency.

Installing the DMAF2 Controller Board

Now that the DMAF2 controller board has been jumper programmed correctly it may be installed in the computer system. S/09 system users should follow the instructions given in the S/09 system documentation manual. For other users (/09, 6800, etc.) be sure that power to both the disk and the computer is off before installing the controller. Before installation it is suggested that all memory in the system be checked for proper operation. 6800 users should read the special section Configuring the DMAF2 Disk for the SWTPC 6800 Computer System. 6809 systems require no special modifications, but at least 20K of memory should be installed in the computer. The DMAF2 board should be installed in any of the un-used 50-pin card positions in the computer. The remaining end of the 50-pin ribbon cable coming from the disk drives should now be connected to the 50 pin connector on the DMAF2 board. The cable connector is indexed and can only be installed one way.

This completes the installation of the DMAF2 disk system. The disk may now be used as described in the Operating Instructions section of this instruction set.

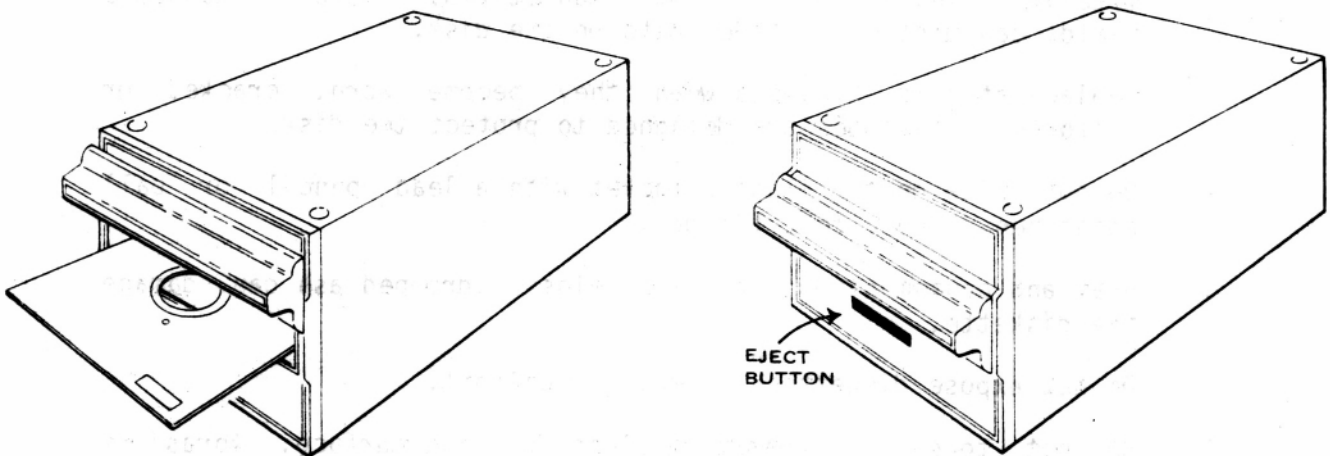
SWTPC DMAF2 Disk System Operating Instructions

The DMAF2 Disk System is designed to be as straightforward and easy to use as possible. The DMAF2 has only one operator control on it--the power switch. This switch is located on the rear of the chassis and is easily accessible to the user when used in table top configurations. When installed in a SWTPC desk, it should be left in the ON position. Power is then controlled by the switch installed on the desk.

Loading Flexible Disks

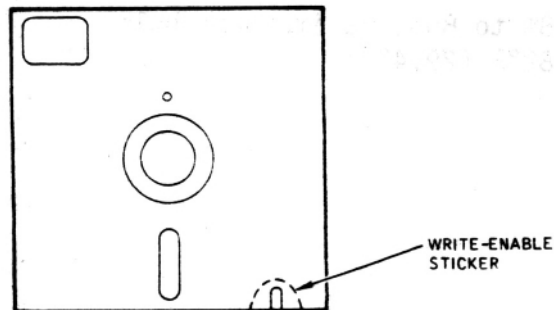
To load a flexible disk, simply depress the pushbutton located on the center of the front panel. The loading handle is spring loaded and will then expose the load aperture.

Insert the flexible disk in the load aperture with the label toward the operator and facing the loading handle (see figure). Be sure that the flexible disk is inserted fully within the drive.



Write Protect Option

Having the write protect notch on a diskette closed with a piece of tape will allow the diskette to be written on. Leaving the notch open will disable write privileges.



The LED's on the drives are drive select/head load lights and are activated only when the head for a particular drive is loaded on a diskette. They are not power indicators.

The disk controller has been designed to load the head and turn on the drive motors only when necessary. When the computer requests data from the disk, both motors will activate and the correct head will load. After the information has been retrieved the head will unload and both motors will turn off approximately 60 seconds thereafter.

Just like cassette tapes, diskettes are made of magnetic materials and can be erased by stray magnetic fields. It is an excellent idea to back-up all important disks on spare diskettes. The following precautions should be followed concerning diskettes:

1. Return the diskette to its storage envelope whenever it is removed from a drive.
2. Keep diskettes away from magnetic fields and ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the disk.
3. Replace storage envelopes when they become worn, cracked or distorted. Envelopes are designed to protect the disk.
4. Do not write on the plastic jacket with a lead pencil or ball point pen. Use a felt tip pen.
5. Heat and contamination from a carelessly dropped ash can damage the diskette.
6. Do not expose diskettes to heat or sunlight.
7. Do not touch or attempt to clean the disk surface. Abrasions may cause loss of stored data.
8. Flexible disks must be in the same temperature and humidity environment as the disk drive for a minimum of 5 minutes before installing the diskette in the disk drive. These environmental requirements are as follows:

Temperature 50° F (10° C) to 80° F (27° C);
maximum gradient of 20°F (11.1°C) per hour

Relative Humidity 8% to 80%, maximum wet bulb
82°F (29.4°C)

Booting the Disk System

After connecting the disk system to the computer an attempt can be made to boot the system. SWTPC S/09 computer users should follow the booting instructions given in the S/09 system documentation manual rather than those given below.

Before booting the system be sure that the computer and disk are both powered up. Next insert a diskette containing the disk operating system into drive 0 and close the door. The boot can then be executed to load the operating system. Computers containing a DISKBUG® or SBUG-E® monitor have an internal disk boot which is executed by entering a D command. Users without those monitors must enter the boot by hand as listed in the disk operating system software documentation.

Problems

If any problems are encountered in booting the disk system, the REGTEST and STEPTEST diagnostics may be used to determine if the disk controller is operating properly. Power up the computer system and the disk system. The disk system is on when the cooling fan runs. If you do run into some kind of problem(s) check the following:

- 1.) Make sure you have at least 12K of contiguous RAM memory from 0000 thru 2FFF (0 - 12K) in 6800 systems or 20K in 6809 systems.
- 2.) Check to see that you also have 8K of contiguous RAM memory from A080 thru BFFF (40K -48K) (6800 systems only).
- 3.) Run the memory diagnostics and verify this memory to be good.
- 4.) Make sure the disk controller board is properly programmed with the shorting blocks.
- 5.) Make sure the DMAF2 disk controller board is plugged onto the computer system and is properly seated.
- 6.) Make sure the flat ribbon cable is plugged on the disk controller board and is oriented correctly.
- 7.) Make sure the flat ribbon cable is plugged onto both disk drives and is oriented correctly. Check the orientation very carefully.
- 8.) Make sure the power connectors are plugged into their mates on the back of both drives.
- 9.) Make sure the miniature connector going to the FD-M motor control board is oriented properly and plugged onto the connector pins as specified in the instruction set.

- 10.) Confirm that the cooling fan on the disk system is running. It should run whenever the disk system is turned on.
- 11.) Make sure you have modified your 6800 computer's MP-A processor and MP-B mother boards if applicable and have flipped the RAM switch OFF on the MP-A2 processor board if applicable.
- 12.) Make sure you have the proper diskette installed in the system. The DOS on the diskette must match the system in which it is installed (6809 109, 6809 S109, 6800, etc.).
- 13.) Run the REGTEST diagnostic (details follow). 14.) Run the STEPTEST diagnostic (details follow).

REGTEST

The REGTEST diagnostic can be used to verify that the various registers on a DMAF2 disk controller board are being accessed properly. REGTEST assumes that the disk drives are connected to the controller and power is applied as described in the checkout instructions.

To use the REGTEST diagnostic, the code must be entered into the computer instruction by instruction using the memory examine and change function of the computer's monitor. Program execution should then be started at hex location 0100 by either setting the program counter to 0100 and typing G or by typing J 0100 depending on your monitor. REGTEST will then check each register and will alternately select drive 0 and then drive 1. Correct drive selection is indicated if the LED on the front of drive 0 lights briefly and if the LED on drive 1 lights briefly when the one on drive 0 goes out. Both LEDs should never be on at the same time. Both drive motors should be running. If any register errors are detected an X will be displayed. If no errors are detected a + will be displayed. The diagnostic should be allowed to run until 256+'s have been displayed.

REGTEST may be exited by depressing the RESET switch on the computer. A diskette need not be installed in the drive.

STEPTEST

The STEPTEST diagnostic can be used to verify that the track selection circuitry of the system drive and the controller are working properly. If desired, a blank diskette may be used in place of the supplied system diskette.

To use the STEPTEST diagnostic, it should first be entered into the computer instruction by instruction using the memory examine and change function of the computer's monitor. A diskette (preferably blank or at least write protected) should then be installed in drive 0 and the door closed. Program execution should then be started at hex location 0100 by setting the program counter to 0100 and typing G or by typing J 0100 depending on the computer's monitor. STEPTEST will then select drive #0 and check to see if the index hole sensing and motor control circuitry is working properly. If so, the disk drive heads will be moved back and forth between track 00 and track 76. STEPTEST outputs no information to the user--if the heads move back and forth across the diskette, proper operation is assumed.

STEPTEST 6809 Version

```
*
* HEAD STEPTTEST-STEPPING PROGRAMS
*
          F020 COMREG EQU    $F020    1791 COMMAND REGISTER
0100                                ORG    $0100
0100 8E  F020  START  LDX    #COMREG  LOAD THE COMMAND ADDRESS
0103 C6  FE                                LDB    #$FE    SELECT DRIVE #0
0105 E7  04                                STB    4,X    STORE IN DRYREG
0107 E6  84                                LDB    0,X    MOTORS ON, WAIT UNTIL READY
0109 C5  80                                BITB   #$80
010B 26  F3                                BNE    START
010D C6  08  LOOP  LDB    #$08    RESTORE THE HEADS
010F 8D  0C                                BSR    EXEC   EXECUTE THE COMMAND
0111 C6  4C                                LDB    #76    TRACK 76
0113 E7  03                                STB    3,X    STORE IN DATA REGISTER
0115 8D  11                                BSR    DEL28  WAIT FOR 1791
0117 C6  18                                LDB    #$18   SEEK COMMAND
0119 8D  02                                BSR    EXEC   EXECUTE THE COMMAND
011B 20  F0                                BRA    LOOP   RE-DO THE STEPPING

011D E7  84  EXEC  STB    0,X    EXECUTE THE COMMAND
011F 8D  07                                BSR    DEL28  WAIT FOR 1791
0121 E6  84  WAIT  LDB    0,X    LOOP UNTIL NOT BUSY
0123 C5  01                                BITB   #1
0125 26  FA                                BNE    WAIT
0127 39                                RTS

0128 8D  00  DEL28 BSR    DEL14
012A 8D  00  DEL14 BSR    DEL
012C 39  DEL    RTS

                                END    START
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REGTEST - 6809 Version

```

*
* DMAF2 REGISTER TESTING PROGRAM
*
      F00D  ADDRREG  EQU    $F00D    START OF DMAC REGISTERS
      F80A  OUTCH   EQU    $F80A    CHARACTER OUTPUT ROUTINE
      F024  DRVREG  EQU    $F024    DRIVE SELECT LATCH

0100
0100 8E  F00D    START  LDX    #ADDRREG  LOAD ADDRESS OF REGISTERS
0103 F6  016A           LDB    BYTE
0106 E7  84           STB    0,X      STORE IN REGISTERS
0108 E7  01           STB    1,X
010A E7  02           STB    2,X
010C E7  03           STB    3,X
010E E7  88 21       STB    $21,X
0111 E7  88 22       STB    $22,X
0114 E7  88 23       STB    $23,X
0117 E6  84           LDB    0,X      START READING DATA
0119 8D  39           BSR    TEST
011B E6  01           LDB    1,X
011D 8D  35           BSR    TEST
011F E6  02           LDB    2,X
0121 8D  31           BSR    TEST
0123 E6  03           LDB    3,X
0125 8D  2D           BSR    TEST
0127 E6  88 21       LDB    $21,X
012A 8D  28           BSR    TEST
012C E6  88 22       LDB    $22,X
012F 8D  23           BSR    TEST
0131 E6  88 23       LDB    $23,X
0134 8D  1E           BSR    TEST
0136 7C  016A         INC    BYTE    INCREMENT THE PATTERN
0139 C6  FE           LDB    #$FE    SELECT DRIVE 0
013B F7  F024         STB    DRVREG
013E 8D  20           BSR    DELAY   WAIT AWHILE
0140 C6  FD           LDB    #$FD    SELECT DRIVE 1
0142 F7  F024         STB    DRVREG
0145 8D  19           BSR    DELAY
0147 C6  FF           LDB    #$FF
0149 F7  F024         STB    DRVREG    DESELECT ALL DRIVES
014C 86  2B           LDA    #' +
014E AD  9F F80A      JSR    [OUTCH] PRINT A +
0152 20  AC           BRA    START   RE-DO THE TEST

0154 F1  016A    TEST  CMPB   BYTE    COMPARE THE DATA
0157 27  06           BEQ    OK
0159 86  58           LDA    #'X    OUTPUT A X IF ERRORS
015B AD  9F F80A      JSR    [OUTCH]
015F 39              OK     RTS

0160 8E  FFFF    DELAY  LDX    #$FFFF
0163 30  1F      DEC    LEAX   -1,X
0165 8C  0000           CPX    #0
0168 26  F9           BNE    DEC     RTS

016A 00              BYTE  FCB    0      TEMPORARY STORAGE LOCATION
                                END    START

```

Technical Information

The following sections contain a limited amount of technical information on the DMAF2. This information is not supplied to serve as a repair manual. Service should only be performed by qualified personnel. Some information may be useful in configuring the DMAF2 for your particular system.

How it Works

The DMAF2 disk system can be broken down into four major parts: disk controller board, motor control board, power supply and the disk drives.

Disk Controller Board

The purpose of the disk controller board is to interface the disk drives to the computer system. The DMAF2 Controller Board is very complex and field service should not be attempted. Component layout drawings, schematics and parts lists for this board are not available.

FD-M Motor Control Board

The motor control board turns AC power to the disk drives motors on and off as determined by the timer on the controller board. Integrated circuit IC1 on the board is an optically coupled triac which in turn drives Q1, a larger triac. The optical coupling is required to isolate the disk system's ground from the AC power line. NOTE: The motor control signal from the disk controller board is fed to two unused pins on both of the disk drives thru the flat ribbon cable. The miniature three-pin connector on the motor control board must be plugged onto these unused pins on one of the two drives otherwise the drive motors will not turn on. The orientation of the connector is important. Check the instruction set for complete details. Some of the components on this motor control board are connected to one side of the AC power line whenever the disk system's line cord is plugged into an AC receptacle regardless of whether or not it is turned on or running. Therefore, exercise extreme caution and never put your hands or tools near the board while the disk system is plugged into an AC receptacle.

P-20 DF Power Supply

The power supply on the disk system is just about as simple as you can make it. The secondaries of the transformer are wired to provide 7 VAC and 32 VAC outputs. These in turn are rectified by separate full wave bridge rectifier circuits providing +9 VDC and +30 VDC outputs. These outputs are then run thru separate integrated regulators Q3 and Q4 to yield the +5 VDC and +24 VDC outputs required by the disk drives. Power for the disk controller board is supplied by the computer system.

DMAF2 Controller Board Jumpers

The DMAF2 contains a number of jumper programmable options as described below.

HALT/BUS REQ

When in the HALT mode, DMA transfers will take place by halting the 6800 or 6809 processor. When in the BUS REQ position, transfers will be made by utilizing the bus request feature of the 6809. This jumper should normally be in the HALT position.

PRE COMP/NORM

When in the PRE COMP position the DMAF2 controller board will automatically pre-compensate (shift) certain bits written to disk by 250 nS on inner tracks while in the double density mode. Most disk drives require write pre-compensation and this jumper should be left in the PRE COMP position.

BA/BA & BS

When in the BA position the controller will respond to the processor's DMA acknowledge by looking at only the BA (bus available) line. For 6809 systems with the DMAF2 jumper in the BA & BS position, the controller will respond only when BA and BS are high. Normally a jumper on the 6809 processor board automatically puts the BA & BS status on the BA line so the DMAF2 jumper should be left in the BA position.

1 MHz/2MHz

This jumper selects the MEMORY READY line timing in 6809 systems. The jumper should be in the 1 MHz position for 1 MHz computer systems and in the 2 MHz position for systems operating at 2 MHz.

MR/NORM

When in the MR position the system's slow memory line will be pulled low-each time an access is made to the DMAF2 board. This jumper should be in the MR position for all 6809 systems running at 2 MHz or when using the Motorola MMS 3509 memory system. It should be in the NORM position for all 6800 systems.

32K/56K

This jumper changes the decoding so that the DMAF2 will respond to different addresses. It should be in the 32K position for 6800 operation and the 56K position for 6809 systems.

UPPER/LOWER

This jumper selects which 512 byte block that the DMAF2 will respond to of the 1K block selected by the 0 - 7 jumper. This jumper should normally be in the LOWER position.

0-7

This set of jumpers is used to change the DMAF2's addressing in 1K byte segments. The jumper should normally be left in the 4 position.

IRQ/NORM

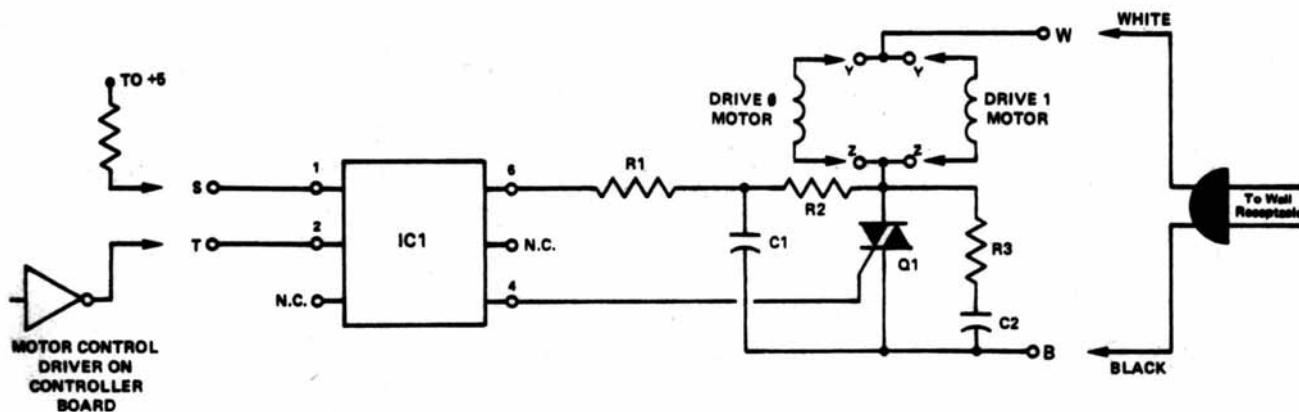
When in the NORM position no interrupts generated by the DMAF2 will be passed to the computer system. This jumper when in the IRQ position will enable interrupts. The jumper should normally be in the NORM position but should be in the IRQ position when installed in S/09 computer systems.

32K/56K	UPPER/LOWER	0 - 7	PHYSICAL DMAF2 ADDRESS RANGE
32	L	0	8000-81FF
32	U	0	8200-83FF
32	L	1	8400-85FF
32	U	1	8600-87FF
32	L	2	8800-89FF
32	U	2	8A00-8BFF
32	L	3	8C00-8DFF
32	U	3	8E00-8FFF
32	L	4	9000-91FF
32	U	4	9200-93FF
32	L	5	9400-95FF
32	U	5	9600-97FF
32	L	6	9800-99FF
32	U	6	9A00-9BFF
32	L	7	9C00-9DFF
32	U	7	9E00-9FFF
56	L	0	E000-E1FF
56	U	0	E200-E3FF
56	L	1	E400-E5FF
56	U	1	E600-E7FF
56	L	2	E800-E9FF
56	U	2	EA00-EBFF
56	L	3	EC00-EDFF
56	U	3	EE00-EFFF
56	L	4	F000-F1FF
56	U	4	F200-F3FF
56	L	5	F400-F5FF
56	U	5	F600-F7FF
56	L	6	F800-F9FF
56	U	6	FA00-FBFF
56	L	7	FC00-FDFF
56	U	7	FE00-FFFF

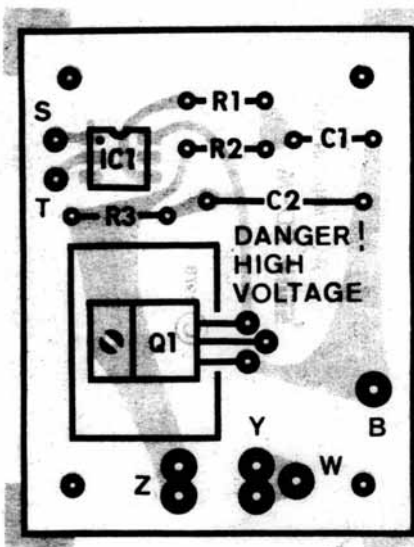
DESEL/SEL

With this jumper in the SEL position, additional addresses on lines A16 - A19 will be output on the bus during DMA transfers. This jumper should be in the SEL position only in 6809 systems utilizing memory boards that use the A16 - A19 address lines such as the S/09 system.

FD-M Motor Control Board



Parts List FD-M Motor Control Board



Resistors

- R1 180 ohm 1/2 watt resistor
- R2 220 ohm " " "
- R3 4.7K ohm 1/2 watt resistor

Capacitors

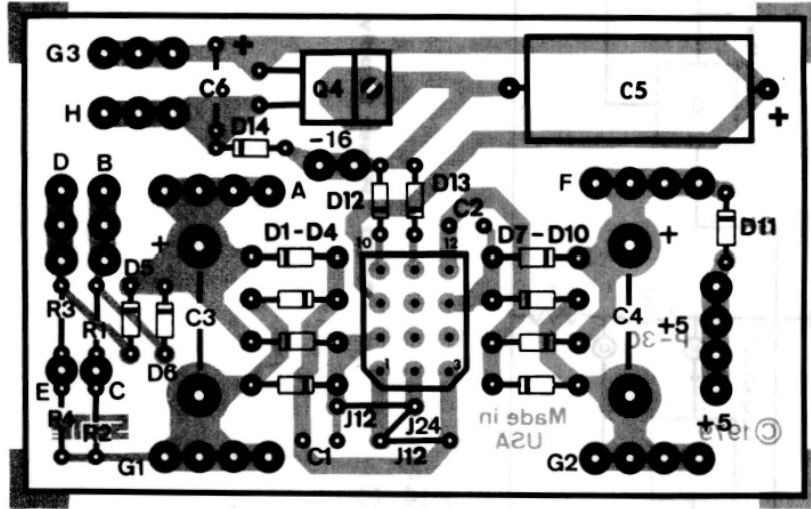
- C1 0.01 mfd @ 400 V capacitor
- C2 0.1 mfd @ 400 V capacitor

Semiconductors

- Q1 TIC206D or TIC216D 400 V triac
- IC1 MOC3011 optically coupled driver

Note: All voltage specifications are minimums.

P-30 DF Power Supply



Parts List P-30 DF Power Supply

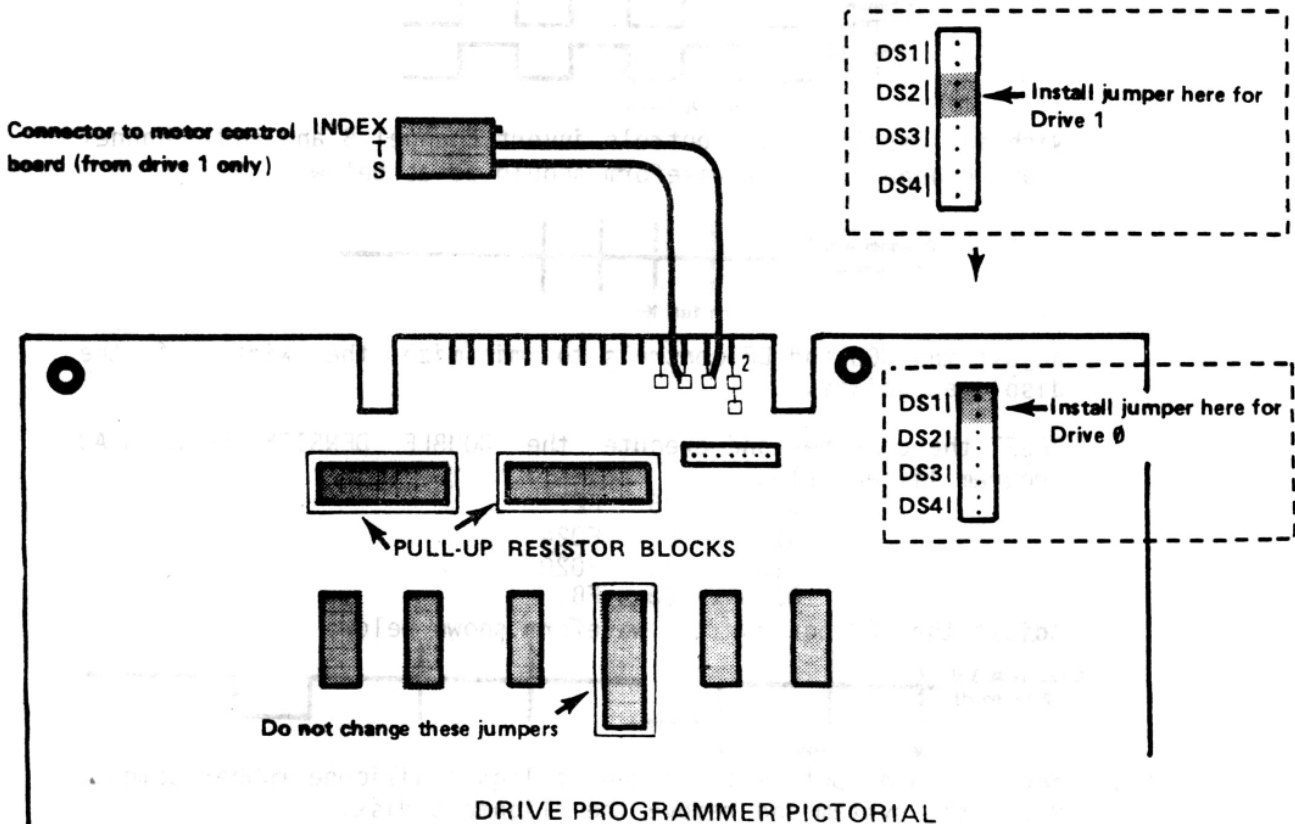
	Resistors		Diodes
R1	243 ohm 1% resistor	D1*	1N5402 high current diode
R2	4320 ohm 1% resistor	D2*	
R3	not used	D3*	
R4	not used	D4*	
	Capacitors	D5*	not used
C1	0.1 mfd capacitor	D6*	
C2	0.1 mfd capacitor	D7*	1N5402 high current diode
C3*	10,000 mfd @ 40 VDC electrolytic capacitor	D8*	"
		D9*	
C4*	29,000 mfd @ 15 V DC electrolytic capacitor	D10*	"
C5*	1,000 mfd @ 25 VDC electrolytic capacitor	D11*	1N4003 diode
C6	not used	D12*	1N4003 diode
	Regulators	D13*	1N4003 diode
Q1*	LM323 +5 VDC regulator	D14*	not used
Q2*	LM317 adjustable regulator	Q3*	not used
Q2*	LM317 adjustable regulator	Q4*	not used
	Miscellaneous	Q4*	not used
T1*	Power transformer 50-60 Hz Primary: 120/240 VAC Secondaries: 12 VAC @ 1.5 amp 12 VAC @ 1.5 amp 7 VAC @ 3 amp 24 VAC @ 200 ma	F1	2 1/2 amp slo-blo fuse
		J24	Jumper Installed

All components flagged with a (*) must be oriented as shown in the component layout drawing and pictorials.

Drive Programming-- Qume Disk Drives

In order to use the supplied disk drives they must first be programmed to enable the functions required by the system. The following description should be used in conjunction with the DRIVE PROGRAMMING PICTORIAL to program the Qume disk drives.

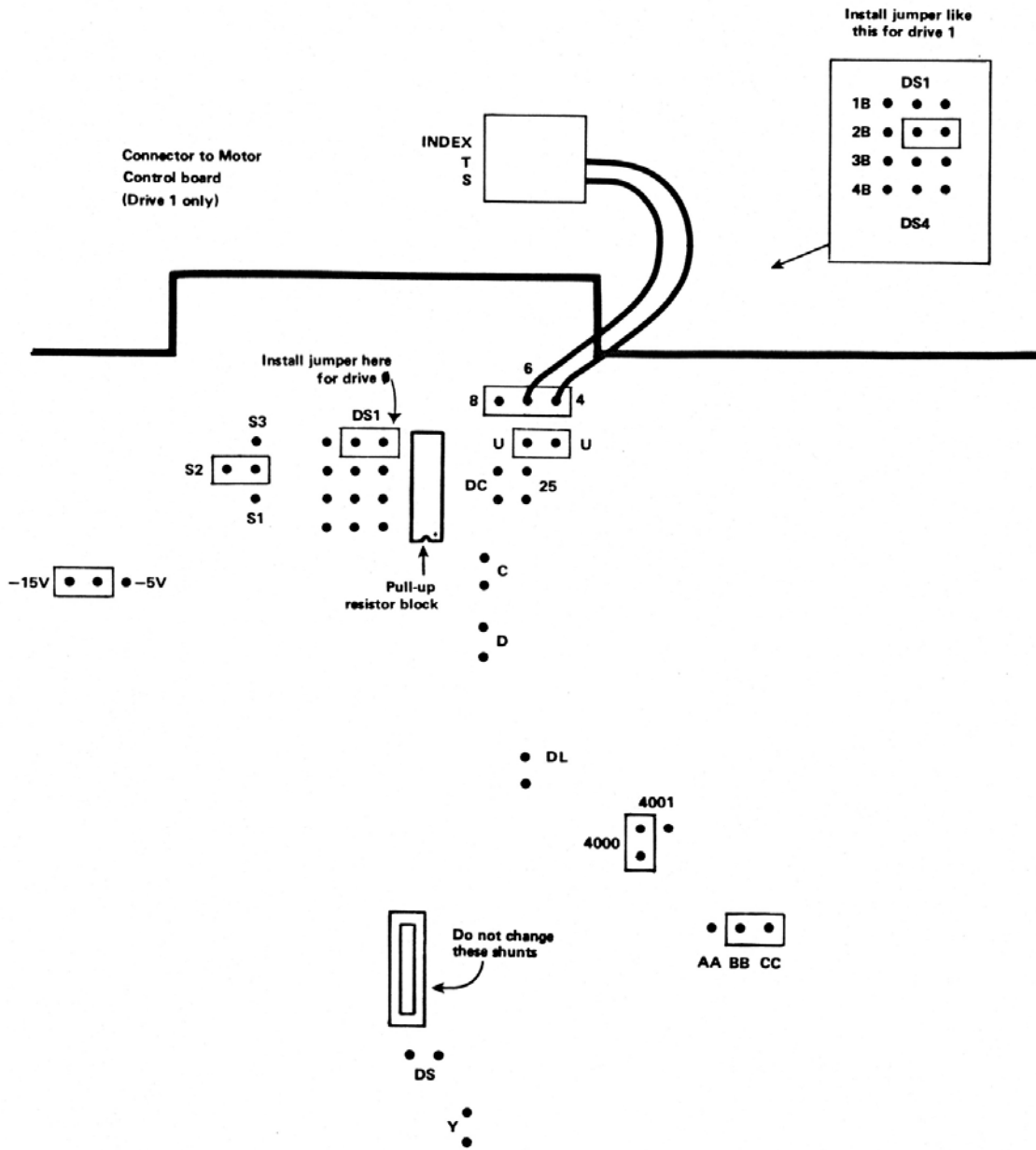
- () Turn one drive upside down so that the door is toward you and so that you are looking at the component side of the circuit board. Jumper selections are made on these drives by small shorting blocks which look like connectors without any wires attached.
- () Install the DRIVE 0 jumper as shown on the pictorial below.
- () Using a flat blade screwdriver or IC puller carefully remove the two pull-up resistor blocks as shown on the pictorial. This drive is now programmed as DRIVE 0. A small notation should be marked on the back or top of the drive labeling it as drive 0.
- () Turn the other drive upside down and install the jumper block in the DRIVE 1 location as shown in the pictorial below. Do not remove the pull-up resistor blocks from this drive. The drive is now programmed as DRIVE 1.



Drive Programming - Remex Disk Drives

In order to use the supplied disk drives they must first be programmed to enable the functions required by the system. The following description should be used in conjunction with the DRIVE PROGRAMMING PICTORIAL to program the Remex disk drives.

- () Turn one drive upside down so that the door is toward you and so that you are looking at the component side of the circuit board. Jumper selections are made on these drives by small shorting blocks which look like connectors without any wires attached.
- () Install the DRIVE 0 jumper (DS1) as shown in the pictorial.
- () Remove the jumper labeled "DL" if it is installed.
- () Using a flat blade screwdriver or IC puller, carefully remove the pull-up resistor block as shown in the pictorial. This drive is now programmed as DRIVE 0. A notation should be marked on the back or top of the drive labeling it as drive 0.
- () Turn the other drive upside down and install the jumper block in the DRIVE 1 location (DS2) as shown in the pictorial below. Do not remove the pull-up resistor block from this drive.
- () Remove the jumper labeled "DL" if it is installed. This drive is now programmed as DRIVE 1.
- () Be sure that on BOTH drives the only other jumpers installed are as follows:
 - 4000
 - S2
 - U-U
 - BB-CC
 - 15V
- () R67 on the disk drive should be changed from a 10K to a 100K for the power up-RESET circuit to function properly.



Remex Drive Programming Pictorial

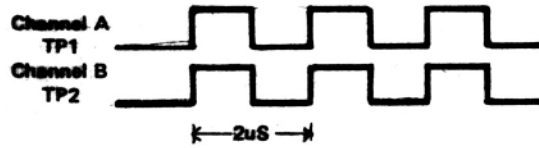
Data Separator Adjustment Procedure--DMAF2 Disk Controller

Adjustment of the data separator on the DMAF2 disk controller board requires some special equipment including a good dual channel oscilloscope and a disk formatted with all "1's". This adjustment requires a technical ability and should only be done by qualified personnel.

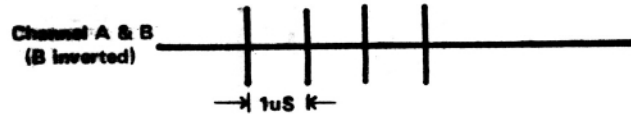
- 1.) Connect channel A of an oscilloscope to test point TP1 and channel B to TP2. The scope should be set on 1 uS/div. and 2 volts/div. The scope should be set to trigger on channel A.
- 2.) Install the special "All ones" alignment disk in drive 0 and execute the SINGLE DENSITY LOAD HEAD program below: (if the controller board has a jumper in the 32K position rather than the 56K position, use addresses 9020 and 9024 rather than F020 and F024 in all the following programs:)

```
0100 86 DE
0102 B7 F024
0105 B6 F020
0108 20 FB
```

- 3.) Adjust the DF pot for 1 uS pulses on channel A. Adjust the VCO pot for the waveform shown below:



- 4.) With the oscilloscope controls invert channel B and add channel A and channel B. The waveform should be as below:

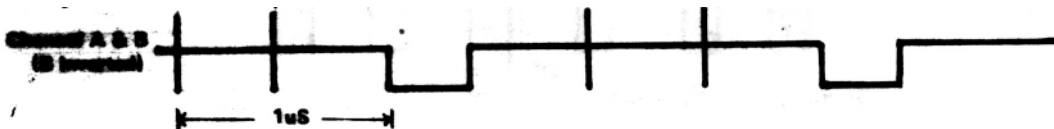


Adjust the VCO and DF controls to minimize the width of the displayed spikes.

- 5.) RESET the computer and execute the DOUBLE DENSITY LOAD HEAD program listed below:

```
0100 86 FE
0102 B7 F024
0105 B6 F020
0108 20 FB
```

Adjust the MFM pot for the waveform shown below:



- 6.) Secure each pot with a dab of liquid silicone rubber cement. RESET the system and remove the alignment disk.

Configuring the DMAF2 Disk for the SWTPC 6800 Computer System and Vice-Versa

If you are using the DMAF2 Disk Controller Board with a SWTPC 6800 Computer System having a MP-B2 mother board and MP-A2 processor board, no modifications the computer system other than the one of the memory board(s) are necessary. Check to see which boards are being used in your computer. The nomenclature for each board is printed on the "TOP" side of the board.

Modifying the MP-B Mother Board

If your computer system has a MP-B mother board, power down the system, unplug the connector going to the power supply board and remove the board. Make the following modifications:

- 1.) Cut the foil conductor connecting pin 10 to pin 12 of IC4, the 7400 NAND gate, on the "BOTTOM" side of the mother board.
- 2.) Attach and solder an insulated jumper between pin 11 of IC4 (7400 NAND gate) to pin 6 of IC6 (74S138 decoder) on the "BOTTOM" side of the board.
- 3.) Attach and solder a separate insulated jumper between pin 12 of IC4 (7400 NAND gate) and address line A12 on the "BOTTOM" side of the board.
- 4.) Tape the two jumper wires to the "BOTTOM" side of the board so they do not break off or get pinched.
- 5.) Reinstall the mother board and reconnect the connector going to the MP-P power supply board.

Modifying the MP-A Processor Board

If your computer system has a MP-A (not MP-A2) processor board, power down the system and carefully remove the MP-A processor board and make the following modifications.

- 1.) First, check to see that integrated circuit IC15 (second IC from the left on the bottom row as viewed from the "TOP" side) is a DM8098 or 74368. If it has a DM8096 74366 substituted the IC will have to be replaced with a DM8098 or 74368.
- 2.) Carefully cut pin 15 of IC15 from the "TOP" side of the board very close to the surface of the board. Bend the IC pin 15 up and away from the foil trace.
- 3.) Attach and solder an insulated jumper from the now unconnected pin 15 to pin 8 of IC15 on the "TOP" side of the board. This effectively grounds pin 15.

- 4.) Now cut the foil trace connecting pin 10 to pin 13 on IC16 from the "TOP" side of the board. IC16 is the third IC from the left on the bottom row as viewed from the "TOP" side. It is a 7420.
- 5.) Attach and solder an insulated jumper from the now unconnected pin 13 on IC16 to pin 3 of IC7 on the "BOTTOM" side of the board. IC7, is the third IC from the right on the bottom row as viewed from the "TOP" side. IC7 is a DM8097 or 74367.
- 6.) Cut the foil trace connecting to pin 13 of IC3 on the "BOTTOM" side of the board. IC3 is the 6810 RAM memory on the board. Now run a jumper from pin 13 of IC3 to pin 12 of IC3. This effectively grounds pin 13 of IC3.
- 7.) Reinstall the modified MP-A processor board on the computer system. NOTE: the previous modifications have disabled the 6810 scratchpad RAM memory on the processor board. This was necessary so that an external 8K byte contiguous block of memory from A000 thru BFFF (40K thru 48K) may be installed in the computer system for the DOS. The processor board will not now function at all without this extra memory installed. The ROM monitor will not work without RAM memory at memory locations A000 thru A07F. The DOS is loaded into locations A080 thru BFFF.

Memory Board Modification

Regardless of which processor/mother board your system uses, one of the MP-8M 8K or two of the MP-M 4K memory boards will have to be modified for operation from A000 thru BFFF (40K thru 48K) where the scratchpad and disk operating system (DOS) reside. The MP-A processor board should have already' been modified for external memory from A000 thru BFFF. If you are using the MP-A2 processor board, it will be necessary to switch OFF the RAM dip switch on the processor board once the modified memory boards are plugged onto the computer system.

Modifying the 4K MP-M Memory Board

To modify the MP-M memory board for operation above 32K break the conductor foil between pin 6 of integrated circuit IC22 and pin 1 of IC24 as well as the conductor foil between pin 4 of IC22 and connector pin A15. Break the conductors near IC22 using a small screwdriver or knife to scribe a small line across the trace deep enough to break the conductive path. Using a piece of light gauge hookup wire connect pin 6 of IC22 to connector pin A15. Using a separate piece of hookup wire connect pin 4 of IC22 to pin 2 of IC24. Check your modifications and wiring for accuracy. This completes the modification. Use the table below to determine the proper position for the address select programming Jumper which must be installed on the memory board. One 4K board must be modified and jumper programmed for #2. Another 4K board must be modified and programmed for #3. This will provide RAM memory from A000 thru BFFF.

MP-M Memory Address Assignment Table (Hex above 32K)

Programming Jumper #	Memory Quadrant (K of memory)	Starting Address	Ending Address
2	1	A000	A3FF
	2	A400	A7FF
	3	A800	ABFF
	4	AC00	AFFF
3	1	B000	B3FF
	2	B400	B7FF
	3	B800	BBFF
	4	BC00	BFFF

Modifying the 8K MP-8M Memory Board

To modify the MP-8M memory board for operation above 32K, first flip all of the address select slide switches on the memory board to their OFF position. For operation from 40K to 48K (8000 to 9FFF) solder a piece of light gauge hookup wire from pin 1 of IC 22 to pin 10 of IC18. Check your wiring for accuracy. This completes the modification. All of the switches must be left "OFF". The board is now configured for operation for A000 thru BFFF.

Parts List - DMAF2 Disk Controller

Resistors

R1	1K ohm 1/4 watt resistor	R29	150 ohm 1/4 watt resistor
R2	1K ohm 1/4 watt resistor	R30	150 ohm 1/4 watt resistor
R3	10K ohm potentiometer	R31	150 ohm 1/4 watt resistor
R4	10K ohm potentiometer	R32	10K ohm 1/4 watt resistor
R5	140 ohm 1% resistor	R33	470 ohm 1/4 watt resistor
R6	806 ohm 1% resistor	R34	10K ohm 1/4 watt resistor
R7	2.2K ohm 1/4 watt resistor	R35	10K ohm 1/4 watt resistor
R8	2.2K ohm 1/4 watt resistor	R36	10K ohm 1/4 watt resistor
R9	5K ohm potentiometer	R37	10K ohm 1/4 watt resistor
R10	270 ohm 1/2 watt resistor	R38	10K ohm 1/4 watt resistor
R11	10K ohm 1% resistor	R40	10K ohm 1/4 watt resistor
R12	1.1K ohm 1% resistor	R41	10K ohm 1/4 watt resistor
R13	3.48K ohm 1% resistor	R42	10K ohm 1/4 watt resistor
R14	3.48K ohm 1% resistor	R43	10K ohm 1/4 watt resistor
R15	1.1K ohm 1% resistor	R44	10K ohm 1/4 watt resistor
R16	10K ohm 1% resistor	R45	10K ohm 1/4 watt resistor
R17	1K ohm 1/4 watt resistor	R46	7.5K ohm 1/4 watt resistor
R18	1K ohm 1/4 watt resistor	R47	6.8K ohm 1/4 watt resistor
R19	150 ohm 1/2 watt resistor	R48	10K ohm 1/4 watt resistor
R20	1K ohm 1/4 watt resistor	R49	10K ohm 1/4 watt resistor
R21	4.7K ohm 1/4 watt resistor	R50	470K ohm 1/4 watt resistor
R22	10K ohm 1/4 watt resistor	R51	10M ohm 1/4 watt resistor
R23	10K ohm 1/4 watt resistor	R52	1K ohm 1/4 watt resistor
R24	100K ohm 1/4 watt resistor	R53	10K ohm 1/4 watt resistor
R25	47K ohm 1/4 watt resistor	R54	4.7K ohm 1/4 watt resistor
R26	330 ohm 1/4 watt resistor	R55	10K ohm 1/4 watt resistor
R27	150 ohm 1/4 watt resistor	R56	10K ohm 1/4 watt resistor

Integrated Circuits

IC1	4558 dual operational amp	IC21	78L12 12-volt regulator
IC2	96S02 dual one shot	IC22	4024 voltage controlled osc.
IC3	74S112 dual J-K flip-flop	IC23	4049B or 14049 hex CMOS inverter
IC4	74LS123 dual one shot	IC24	74LS86 quad EXCLUSIVE-OR gate
IC5	14541 timer (MOS)	IC25	74LS08 quad AND gate
IC6	74LS166 shift register	IC26	74LS32 quad OR gate
IC7	74LS02 quad NOR gate	IC27	74LS33 quad open collector NOR gate
IC8	74LS240 octal buffer	IC28	6844 DMA controller
IC9	74LS04 hex inverter	IC29	74LS273 octal latch
IC10	74LS02 quad NOR gate	IC30	74LS273 octal latch
IC11	74LS240 octal buffer	IC31	74LS74 dual D flip flop
IC12	74LS240 octal buffer	IC32	79L12 -12 volt regulator
IC13	7805 5-volt regulator	IC33	74125 quad tri-state buffer
IC14	74S112 dual J-K flip-flop	IC34	74LS32 quad OR gate
IC15	74LS00 quad NAND gate	IC35	74LS138 decoder
IC16	74LS00 quad NAND gate	IC36	74LS00 quad NAND gate
IC17	74LS74 dual D flip flop	IC37	74LS245 octal bi-directional transceiver

IC18	96502 dual one-shot	IC38	74LS138 decoder
IC19	74LS08 quad AND gate	IC39	74LS244 octal buffer
IC20	1791 disk controller	IC40	74LS245 octal bi-directional transceiver

Capacitors

C1	200 pf poly capacitor	C22	0.1 mfd capacitor
C2	0.47 mfd tantalum capacitor	C23	0.1 mfd capacitor
C3	0.047 mfd film capacitor	C24	0.1 mfd capacitor
C4	1300 pf poly	C25	0.1 mfd capacitor
C5	0.047 mfd film	C26	0.1 mfd capacitor
C6	1300 pf poly	C27	0.1 mfd capacitor
C7	110 pf poly	C28	0.1 mfd capacitor
C8	470 pf poly	C29	0.1 mfd capacitor
C9	0.1 mfd disc	C30	0.1 mfd capacitor
C10	0.022 mfd film	C31	0.1 mfd capacitor
C11	0.1 mfd capacitor	C32	0.1 mfd capacitor
C12	470 pf poly	C33	0.1 mfd capacitor
C13	0.22 mfd film	C34	0.1 mfd capacitor
C14	62 pf capacitor	C35	0.1 mfd capacitor
C15	20 pf disc capacitor	C36	0.1 mfd capacitor
C16	160 pf poly	C37	0.1 mfd capacitor
C17	470 pf poly	C38	0.1 mfd capacitor
C18	470 pf poly	C39	0.1 mfd capacitor
C19	62 pf poly	C40	0.1 mfd capacitor
C20	470 pf poly	C41	1 mfd @ 15 volt tantalum capacitor
C21	0.1 mfd capacitor	C42	220 mfd @ 10 v electrolytic

Semiconductors

Q1	2N4402 PNP transistor	D4	1N4198 silicon diode
Q2	2N4400 NPN transistor	D5	1N4734 5.6 volt zener diode
D1	1N4735 6.2 volt zener diode	D6	1N4148 silicon diode
D2	1N4148 silicon diode	D7	1N4148 silicon diode
D3	1N4148 silicon diode		

Miscellaneous

Y1 4.00 MHz crystal