DOUBLE DENSITY
INSTALLATION MANUAL

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CHAPTER 1 - Section 1

CIRCUIT MODIFICATIONS

The Double Density Controller Installation Manual contains all information regarding installation of The Digital Group Double Density Disk Controller Board into a system. Included is all CPU modifications, motherboard modifications, and cabling procedures for different systems. Included is a section regarding power supply adjustment for assembled board purchasers.

CHAPTER 1 - Section 2

CPU MODIFICATIONS

The installation of The Digital Group Double Density Controller Board requires slight modification to the Z80 CPU Board.

During data transfer to and from the disk drive, the CPU must be placed in a series of wait states until data is ready. Our present Z80 CPU board (rev. C and earlier), provides only for the ROM to cause wait state generation. To correct this problem, a diode OR circuit will be added to the Z80 CPU wait line. This ORed wait line will be connected to pin BC of the Z80 CPU 100-pin edge connector.

There also is a modification to insure that the Z80 CPU is held in reset until every other board in the system has powered up. This modification requires a resistor change on the Z80 CPU board along with a diode installation. The resistor increases the RC time constant of reset, while the diode allows for quick discharge of the capacitor during power on-off-on conditions.

One other modification should be mentioned here. This is the moving of the front panel reset button from reset to NMI. This modification is required for systems containing dynamic memory. The user who has static memory and intends to use only static memory need not perform this modification.

The last modification to be installed is the running of a wire from the CPU interrupt socket to a spare pin on the CPU 100-pin edge connector.

CHAPTER 1 - Section 3

Installing the CPU Modifications

The user should first check to see if the following modifications have been made to his system. Refer to Figures 1 through 4 and perform the following (to Rev. C and earlier Z80 CPU boards):

1. Identify pin BC on the circuit side of the Z80 CPU card. (4th from end)

2. Cut one trace connecting IC21 pin 6 and IC28 pin 12. See Figure 2 and 3.

   (A) Locate the trace on the circuit side of the Z80 CPU card matching Figure 2.
   (B) Cut the trace between points A and B with a sharp tool like an exacto knife or razor blade.

3. Solder D1 (1N4148) across points A and B. The banded end of the diode should be connected to point B.

4. Solder one end of D2 (1N4148) to point B (also the banded end), leaving the point C end of the diode unsoldered.

5. Cut a 6 inch piece of #30 wirewrap wire provided, and solder it between pin BC of the CPU edge connector and point C end of diode D2.

6. Insulate the connection of the diode D2 and the #30 wire to insure no shorts exist.

Refer to Figure 2 for the following (all Rev. CPU Boards):

1. Cut a 7¼ inch piece of #30 wirewrap wire provided and jumper the following:

   Pin 8 of the CPU interrupt socket and Pin C of the CPU 100-pin edge connector (3rd pin from opposite end as BC).

Refer to Figure 4 for the following (for Rev. C and earlier):

1. Remove the 4.7K resistor, R7 and replace it with the combination of a 22K resistor and a 1N4148 diode.

   (A) Remove the 4.7K resistor, R7.
   (B) Parallel the 22K resistor and 1N4148 diode provided.
   (C) Solder this combination into R7. Orient the banded end of the diode closest to the Z80 IC.
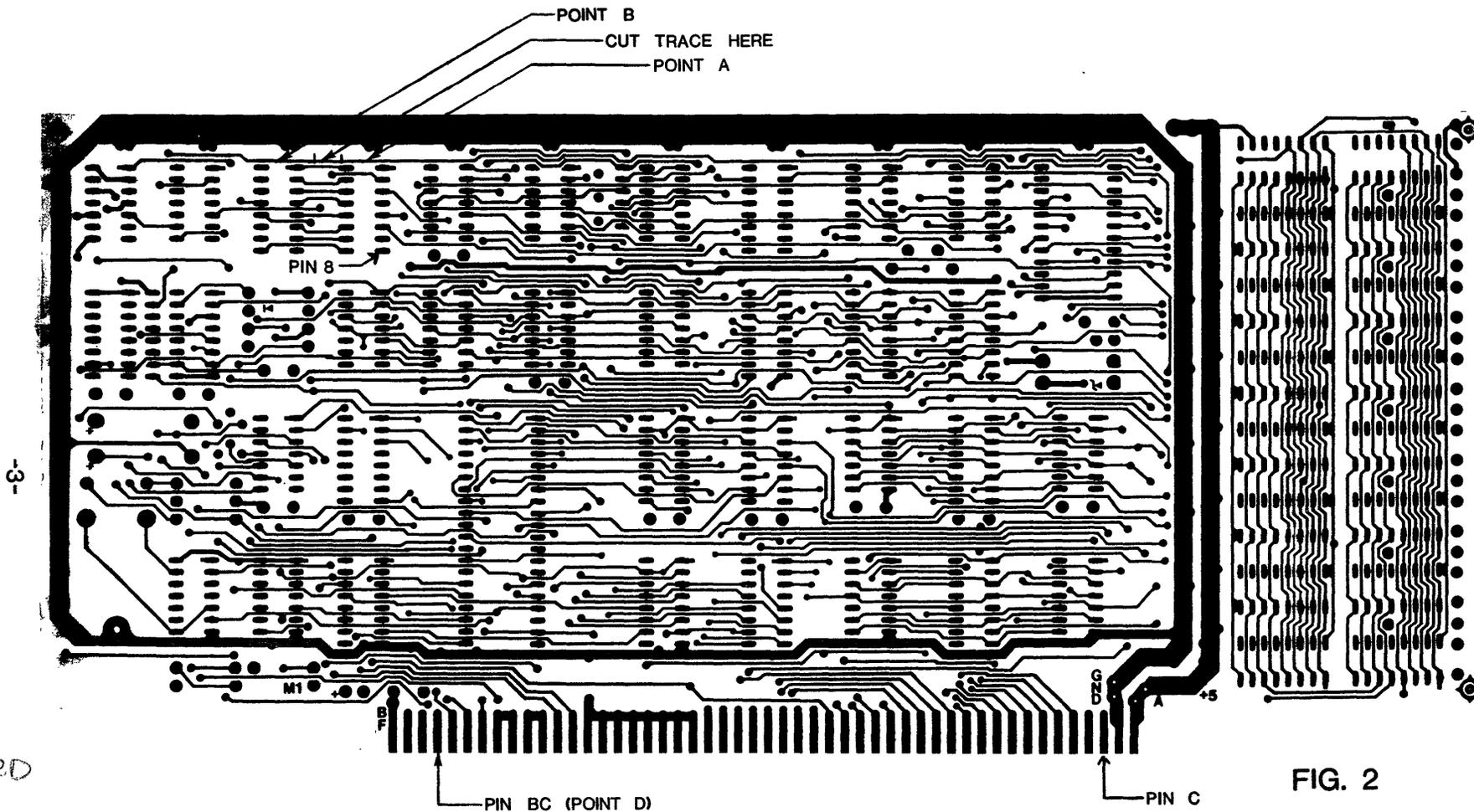
CHAPTER 1 - Section 4

Motherboard Modifications

The Z80 CPU modifications added two additional pins to the Z80 CPU board 100-pin edge connector. To furnish these signals to The Digital Group Double Density Controller Board requires the addition of two wires on the motherboard. *Please note* that there may be a wire connecting one of these signals to the disk controller slot. Your system may also contain additional wiring for the DSS-INT1 Controller. Wiring for both controllers do not conflict with each other, so the user may wish not to remove the extra wiring presently installed.

Refer to Figure 5 and perform the following:

1. Using the #30 wirewrap provided, add a jumper from the Z80 CPU edge connector pin BC to the controller 36-pin edge connector pin 36. (This wire may already be installed.)

2. Again using the #30 wirewrap wire provided, add a jumper from the Z80 CPU edge connector pin C to the controller 36-pin edge connector pin 34.

3. At the users option, remove the following wires:

   (A) Z80 CPU edge connector pin 47 to controller 36-pin edge connector pin 35.
   (B) Controller 36-pin edge connector pin C to I/O board 36-pin edge connector pin 17.

CONNECTION POINTS FOR CPU MODIFICATION

POINT B
CUT TRACE HERE
POINT A

PIN 8

PIN BC (POINT D)

PIN C

FIG. 2

CIRCUIT SIDE OF Z-80 CPU CARD

A BOARD

SMALL JUMP IC8 15,16

74S1зе'

75

IC8 PIN9 8 OR GROUND   PIN 13 14 NOT CONT.

COMPLETED CPU MODIFICATION

PIN BC (POINT D)

POINT A

TRACE HAS BEEN CUT

D1

POINT B

POINT C

D2

FIG. 3

REFER TO FIG. 5 FOR LOCATION OF CORRECT TRACE

TO PIN 24 Z-80 CHIP

13

IC 28
1/4
7402

11   12

8

IC 28
1/4
7402

9

10

D1 1N4148

TO PIN 6 IC 21

POINT A

POINT B

D2
1N4148

POINT C

BC

POINT D

FIG. 1

SCHEMATIC OF CPU MODIFICATION

-4-

CPU MODIFICATIONS

1N4148

22K
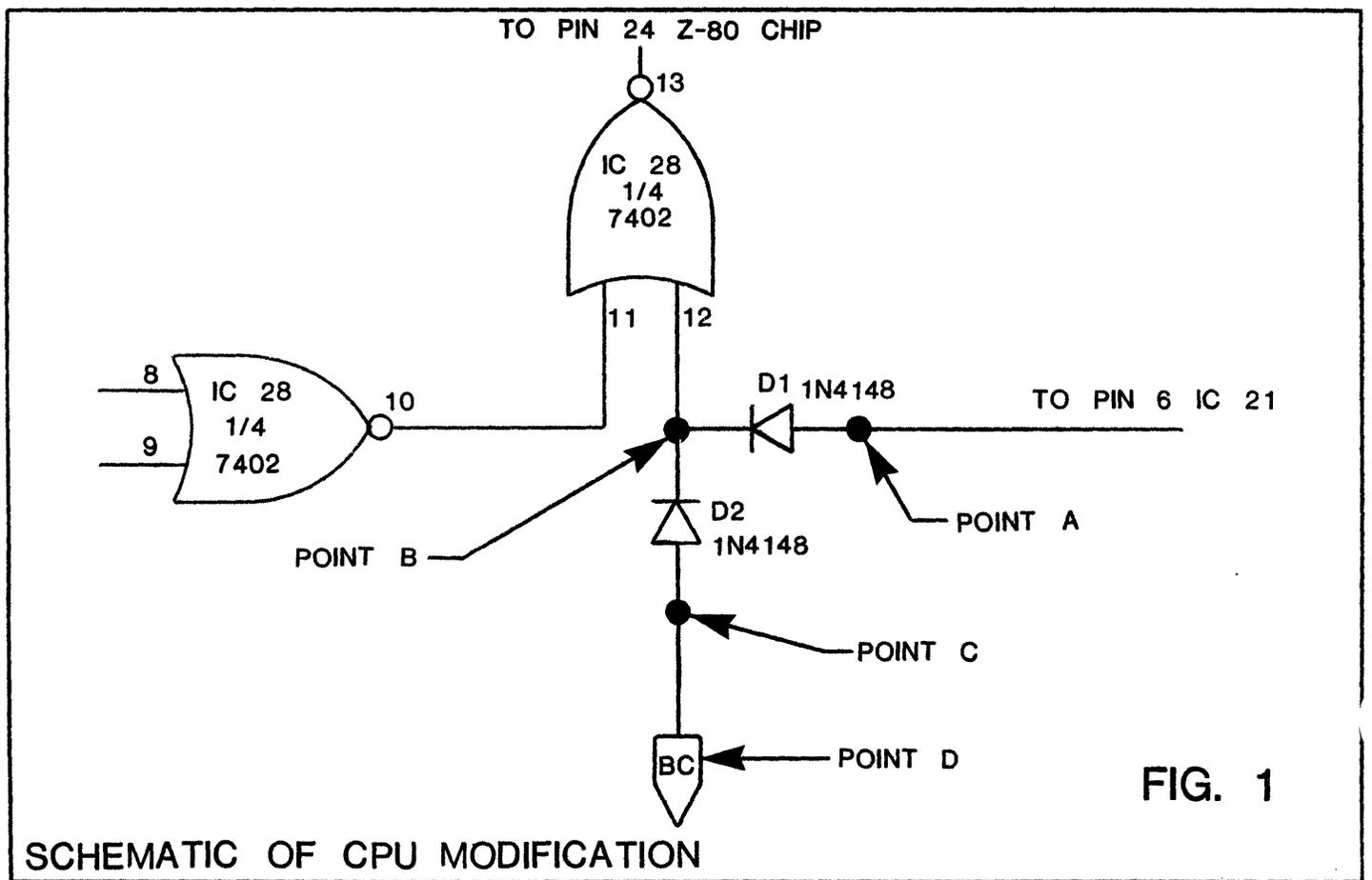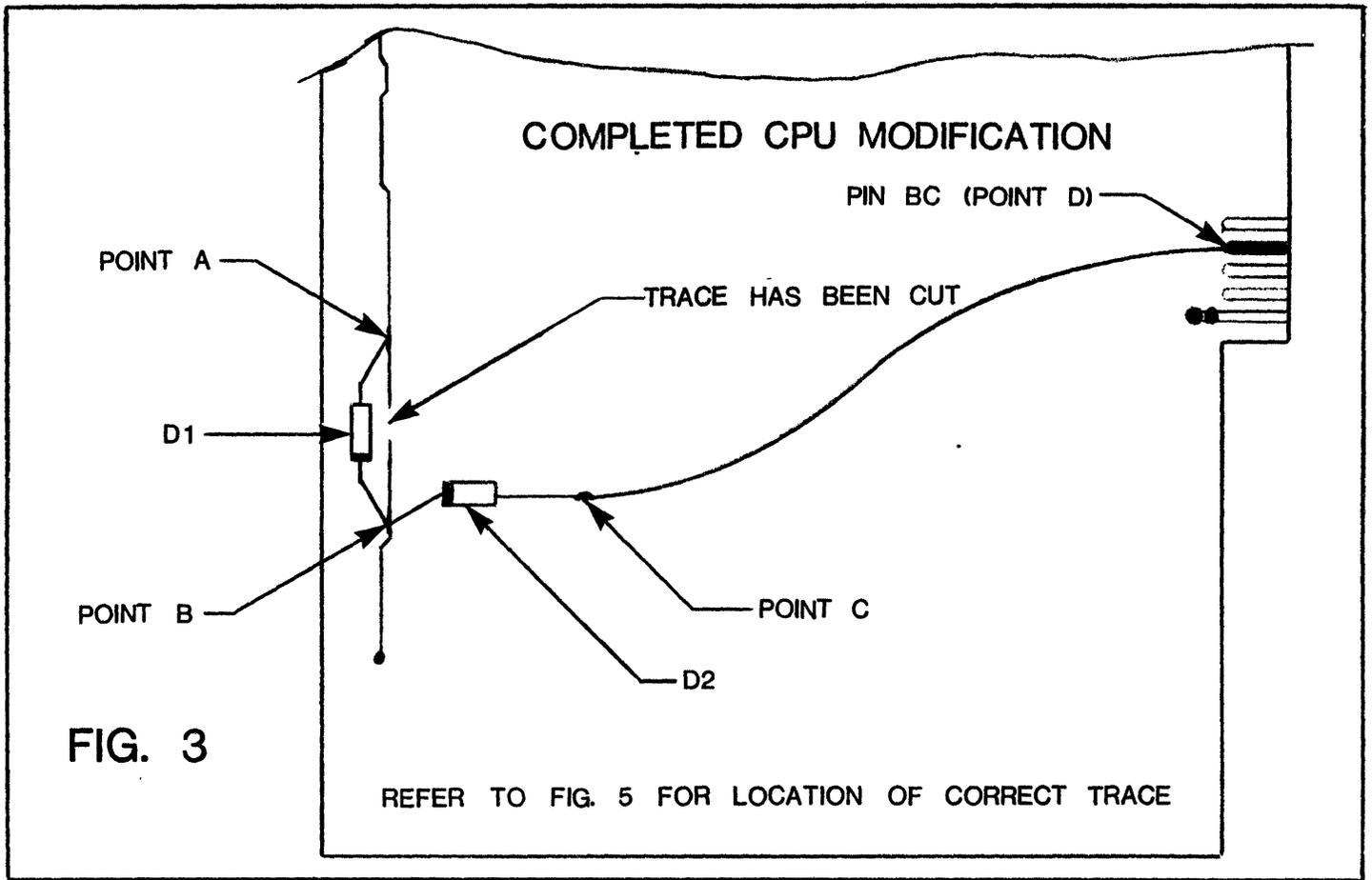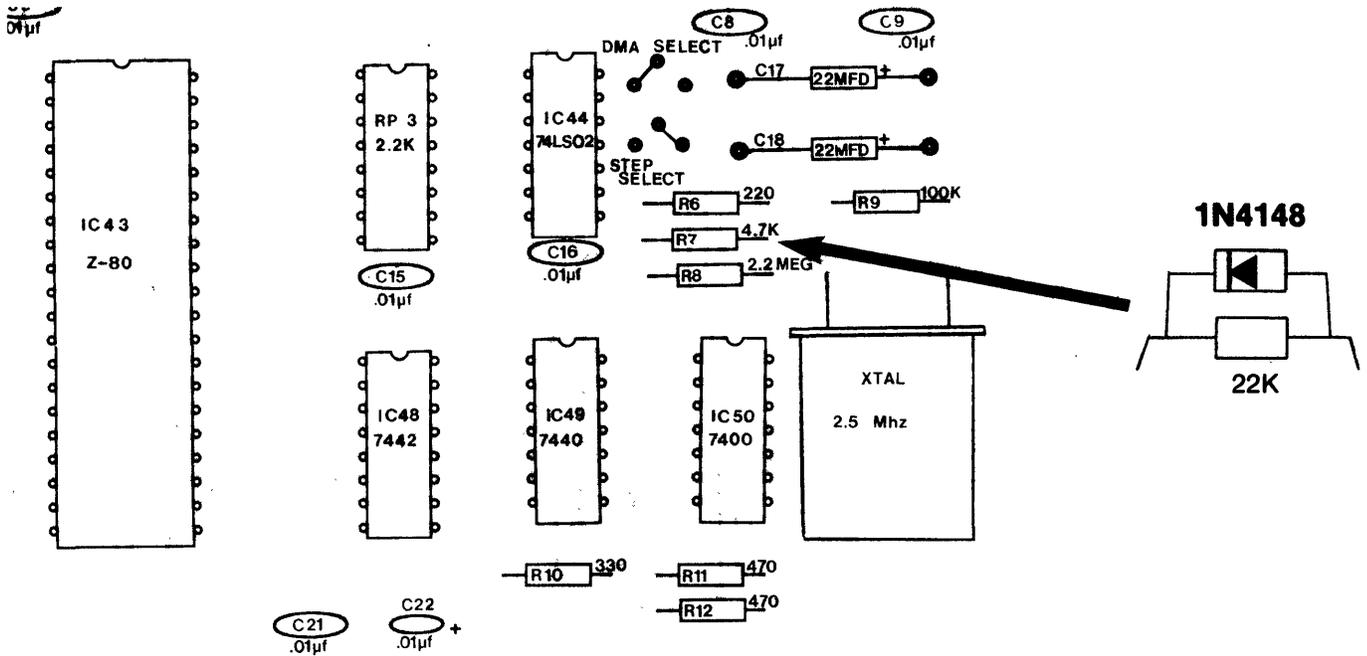
NOTE: These modifications are necessary only on Revision "C" or earlier CPU boards.

FIGURE 4

JUMPERS FROM CONTROLLER CARD CONNECTOR TO CPU BUS CONNECTOR

FIG. 5

NOTE:

DIAGRAM OF PIN SIDE OF MOTHERBOARD

CHAPTER 2 - Section 1
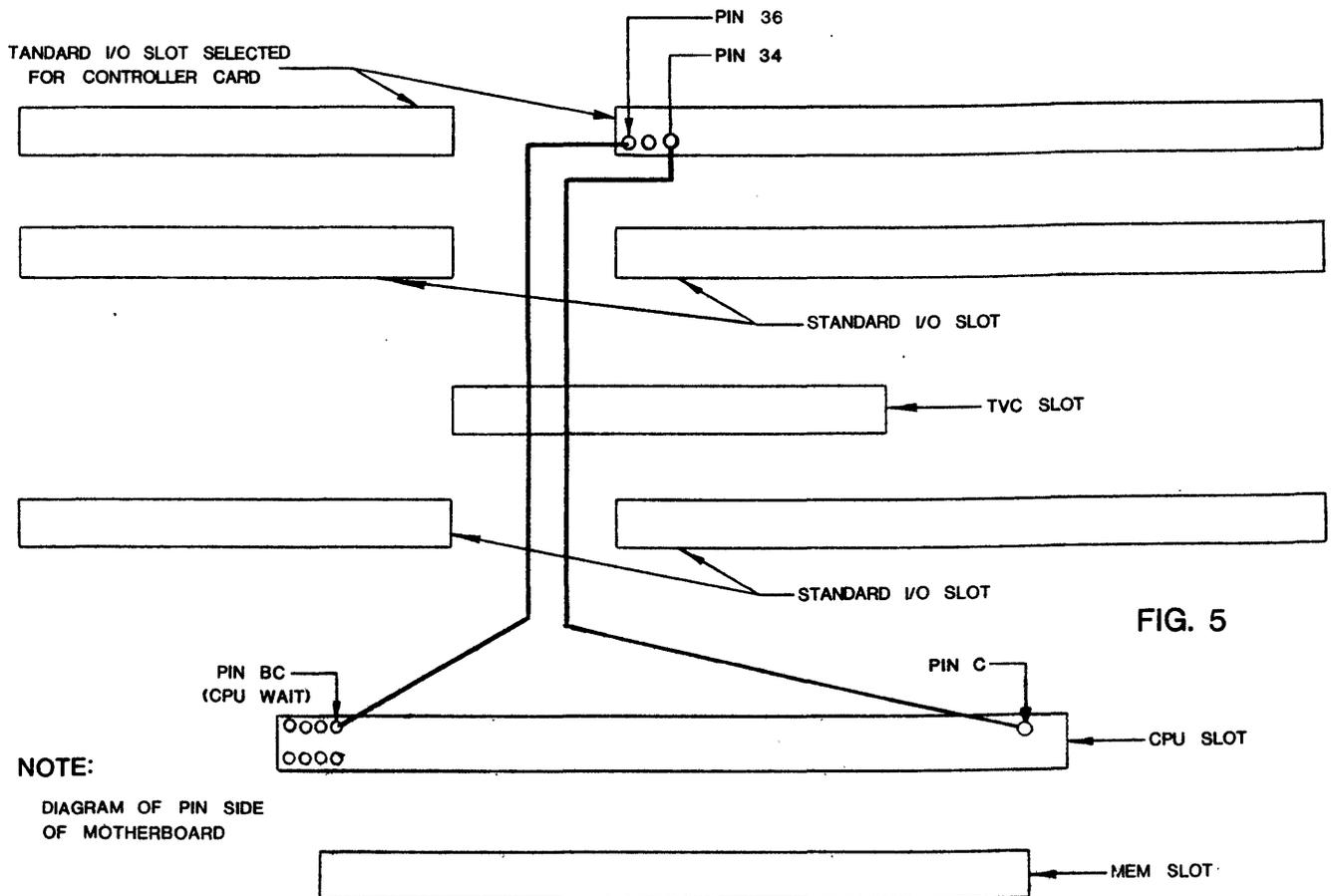
DSS-INT1 Cabling

The cables you have received provide all connections for signals from the Floppy Disk Controller Card, through the backplane of the CPU cabinet, to each of the individual drives. The exact cabling arrangement is determined by the number and types of drives implemented. Figures and tables have been provided for connecting Shugart Drives.
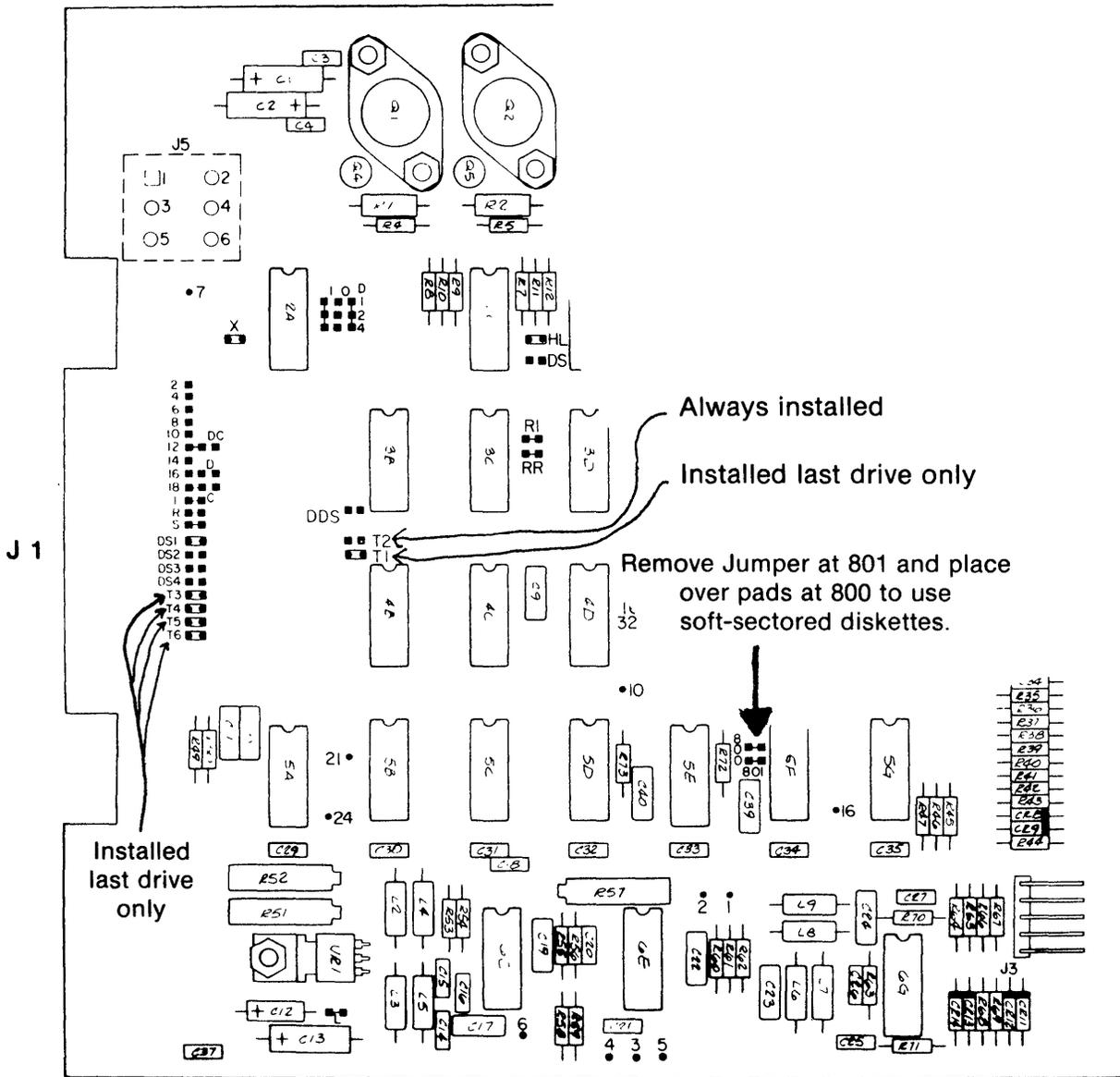
Shugart Cabling Steps

1. Using Figure 2 and Table 1, install the Molex connectors from the back of the motherboard to the CPU cabinet backplane. A 22-pin edge connector is provided for the backplane. Note that optional I/O pins on the drive are connected to grounded pins on the CPU backplane. To use these I/O pins, remove the corresponding wire from the Molex cable.

2. Using an ohmmeter, verify all signal connections to eliminate bad or wrong connections.

3. Connect the flat cable to the CPU backplane and the individual drives. (See Figure 3.) A Shugart PC board connector and sufficient cable are provided for each drive when you order a complete system. You must specify the number of drives in your system when ordering cable to assure getting the right number of drive connections. **Be sure that the drive connector is properly connected to the drive electronics board connector, J1. The label on drive connector pin 2 must face pin 2 on drive electronics PC board connector, J1. Reversing this cable may cause damage to the drive by applying voltage to an incorrect pin.** The CPU backplane paddlecard should be installed by the labeling on the paddlecard. For each drive used set the device select jumper on the Shugart PC board. Jumpering is accomplished through use of a 2-position shorting plug on J1. See Figure 1.

4. In order for the drive to function properly in a multi-drive system, the last drive on the interface must have five lines terminated. As shipped from the factory, drives have jumpers on terminator posts, T1, T3, T4, T5, and T6. Remove these shorting plugs from all drives except the last one on the interface.

5. Using a ohmmeter, verify all signal connections between the CPU backplane and the drive connector using Table 1 as a guide.

Whenever additional drives are added to your system, additional cables will be required. An upgrade kit that enables you to daisy chain from your existing cable is available. Assembly instructions for the additional cable(s) is provided with the upgrade kit.

Soft-Sectored Disk Jumpering — SHUGART

FIGURE 1

Always installed

Installed last drive only

Remove Jumper at 801 and place over pads at 800 to use soft-sectored diskettes.

Installed last drive only

▣ Jumper Plug Installed as Shipped

• Test Point

SA800/801 PCB Component Locations

Figure 2 — Molex Wiring Detail
(Assembled Molex Connectors)

CPU Backplane Connector
(Viewed from inside cabinet)

Bottom Row of Connector Pins Shown Offset for Clarity

1 ... 22

A

1 A

MOTOR ON Modification
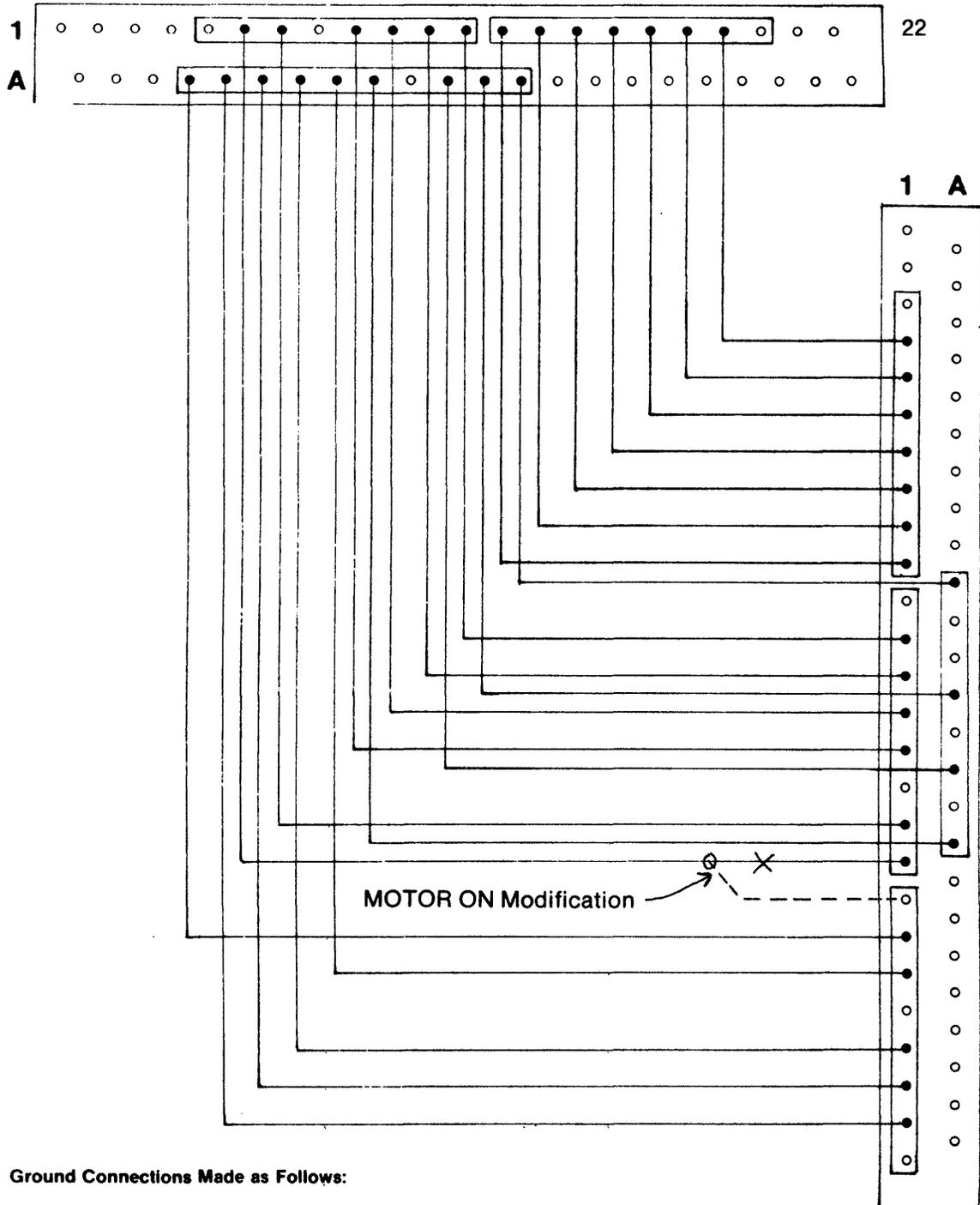
Controller Card

Ground Connections Made as Follows:

CPU Backplane	Controller Card
Pin K	Pin U
Pin M	Pin S
Pin N	Pin P
Pin P	Pin L

Note: This drawing shows the controller card as it would be viewed through the motherboard. (Top View)

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TABLE 1 — SHUGART

CONTROLLER CARD

CPU BACKPLANE DRIVE CONNECTIONS
(See Figure 9 in the Shugart OEM Manual
and Figure 2 in the Floppy Disk documentation)

CONTROLLER PIN	FUNCTION	CPU BACKPLANE PIN	SHUGART PCB CONNECTOR J1
5	Index	18	20
6	Step	17	36
7	Write Gate (Write Current Enable)	16	40
8	A Ready	15	22
*** 9	Write Protect	14 ***	44 ***
10	Write Data	13	38
12	Track 00	12	42
13	DS1	11	26
14	Not Used	10	24
15	Direction	9	34
17	Read Data (Raw Data)	7	46
18	Head Load	6	18
* 19	Mini Motor On	*	*
20	-5V DC	D	2 & 4
** 21	Side	*	*
23	DS2	H	28
24	DS3	F	30
25	DS4	E	32

DC POWER SUPPLY, CONNECTOR J5

Device selection provided by installation of an appropriate shorting plug.

Note that J5, pin 4 is connected to J1, pins 2 and 4.

*   Mini Single Only
**   For 2 sided drives only
*** Not implemented (user optional)

Pin 2 — +24V RETURN LINE
Pin 1 — +24V DC
Pin 5 — +5V DC
Pin 3, Pin 6 — GND

FIGURE 3

DRIVE CABLE ASSEMBLY

MOTHERBOARD
CONTROLLER

(DUAL 36 PIN
EDGE CONNECTOR)

CPU CABINET
BACKPLANE
(DUAL 22 PIN
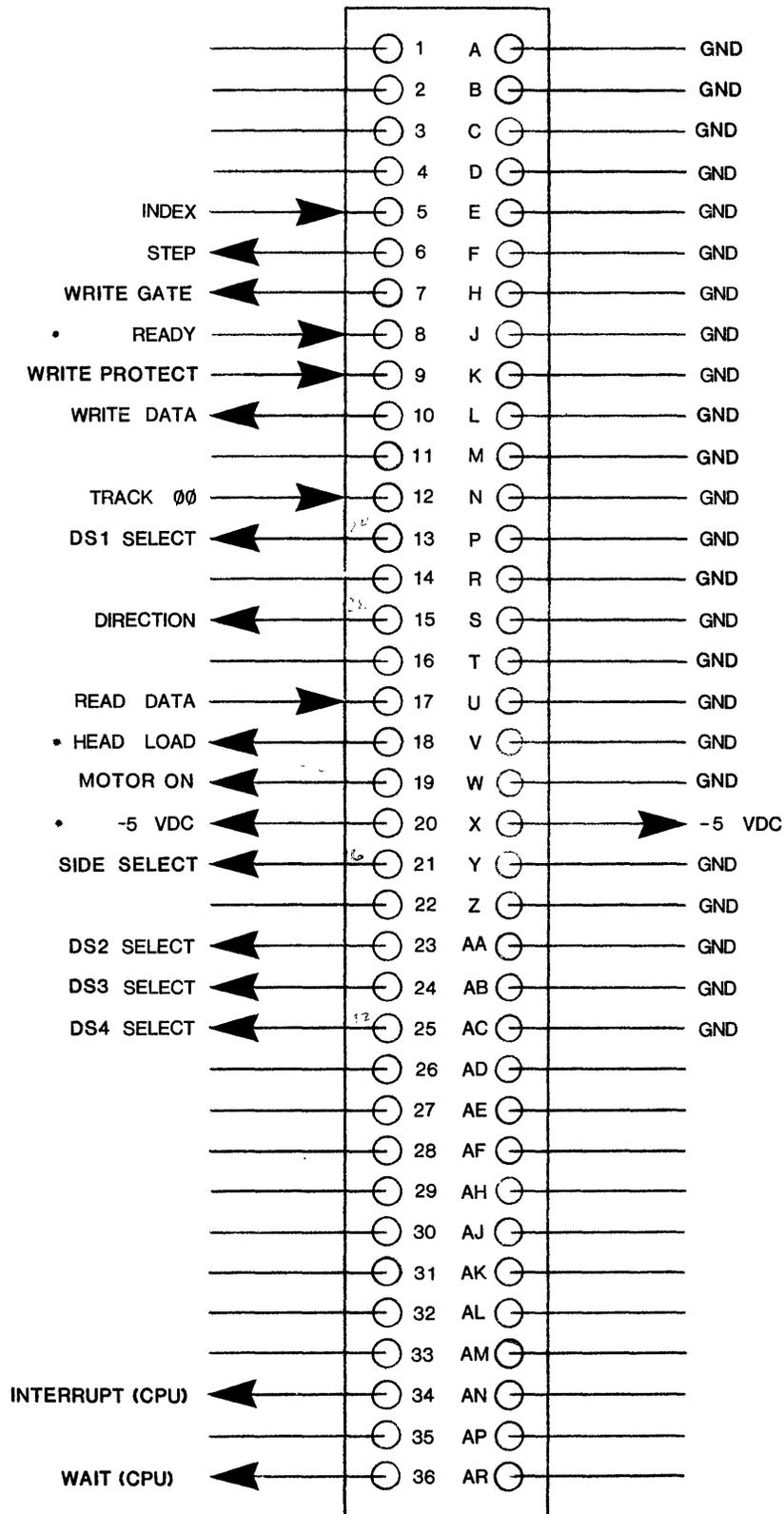EDGECARD)

DC POWER
CONNECTIONS

50 PIN P.C.B. DRIVE CONNECTOR

+24V RETURN
+24V
GND
+5V

MATCH LABEL
ON PLUG
WITH BOARD
LABEL "PIN 2"

DETAIL 1

J1

DETAIL 2

DETAIL 3

3'

2'
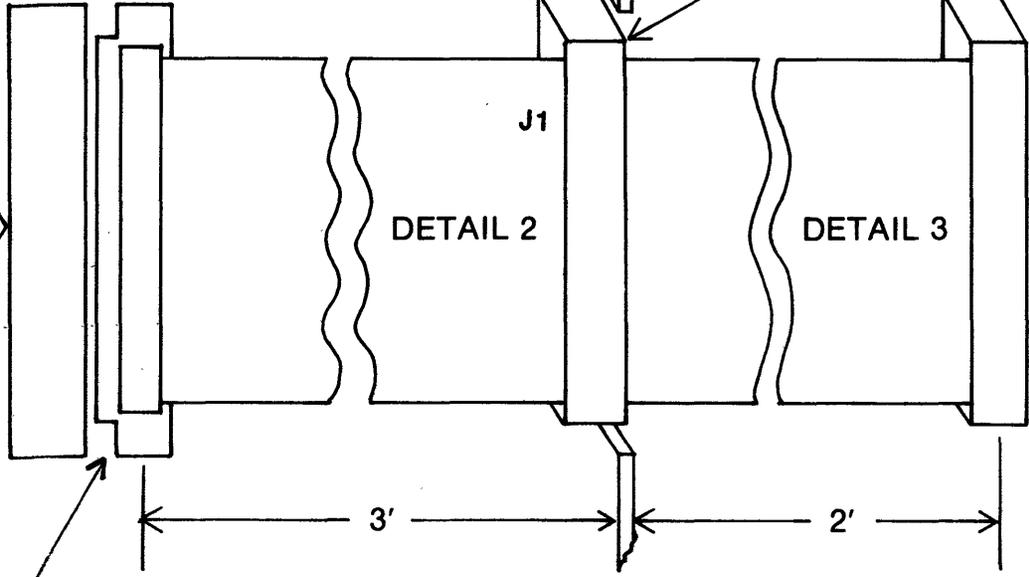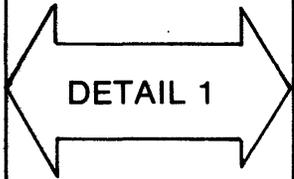
CPU PADDLEBOARD
(DUAL 22 PIN EDGE
CONNECTOR (090-050)

FLOPPY CONTROLLER CARD 36-PIN CONNECTOR PINOUT

Pin			Pin		
	1	A		GND
	2	B		GND
	3	C		GND
	4	D		GND
INDEX →	5	E		GND
STEP ←	6	F		GND
WRITE GATE ←	7	H		GND
• READY →	8	J		GND
WRITE PROTECT →	9	K		GND
WRITE DATA ←	10	L		GND
	11	M		GND
TRACK 00 →	12	N		GND
DS1 SELECT ←	13	P		GND
	14	R		GND
DIRECTION ←	15	S		GND
	16	T		GND
READ DATA →	17	U		GND
• HEAD LOAD ←	18	V		GND
MOTOR ON ←	19	W		GND
• -5 VDC ←	20	X	→	-5 VDC
SIDE SELECT ←	21	Y		GND
	22	Z		GND
DS2 SELECT ←	23	AA		GND
DS3 SELECT ←	24	AB		GND
DS4 SELECT ←	25	AC		GND
	26	AD		
	27	AE		
	28	AF		
	29	AH		
	30	AJ		
	31	AK		
	32	AL		
	33	AM		
INTERRUPT (CPU) ←	34	AN		
	35	AP		
WAIT (CPU) ←	36	AR		

Floppy Disk Controller Card

Introduction

The Digital Group now offers all the capabilities of rapid access mass storage. With the addition of a floppy disk subsystem, the Digital Group system user can now have at his disposal 90K to 512K bytes/disk in IBM compatible format, with a worst case access time of one second.

A fully operational Digital Group floppy drive system is based on a Digital Group computer with a recommended memory size of 26K and a Z80 based processor. The complete floppy disk subsystem has a floppy disk controller card, one to four drives, power supplies for the disk drive, necessary cabling and system interconnect wiring, and cabinet(s).

System Description

The controller card is the interface between the CPU and the floppy drive(s). The controller card documentation includes a complete technical description of the controller and the controller chip, assembly instructions (including CPU card modifications), software description, listing, and tape, and diagnostic testing procedures.

To complete your floppy drive system, several additional items are required. These items are all included when ordering a complete system and may be purchased separately from The Digital Group at any time.

1. **Power Supply**. Each drive requires both AC and DC power sources as shown in Figure 1. AC connections for each drive are supplied with the drive. DC connections (+24V, 24V ground, +5V, 5V ground) to each drive are provided with the Digital Group floppy power supply. Be sure all power sources are properly fused and grounded. Complete documentation is provided with each power supply.

2. **Cabling**. Cables from the controller card 36-pin connector to the floppy drive(s) 22-pin connector(s) are required to transfer the proper signals. Included in the standard Digital Group cable-pack are Molex connections from the back of the motherboard to the CPU backplane and a flat cable from the backplane to the drive(s). A different cable-pack is required depending on the number of drives in your system and an upgrade kit is available if you add drives at a later date. Complete documentation is provided for cabling your system with each cable-pack.

3. **Drives**. Floppy disk drives are available in standard format from Shugart. Up to four drives may be used with the floppy controller card. Each drive includes a short AC line for connection to a power source and a complete technical manual from the drive manufacturer.

4. **Cabinets** that match the rest of your Digital Group system are available for single or dual drives in both standard and mini formats. Each cabinet has space for two drives and a power supply. Cabinets include AC line cord, fan, and switch, as well as assembly documentation.
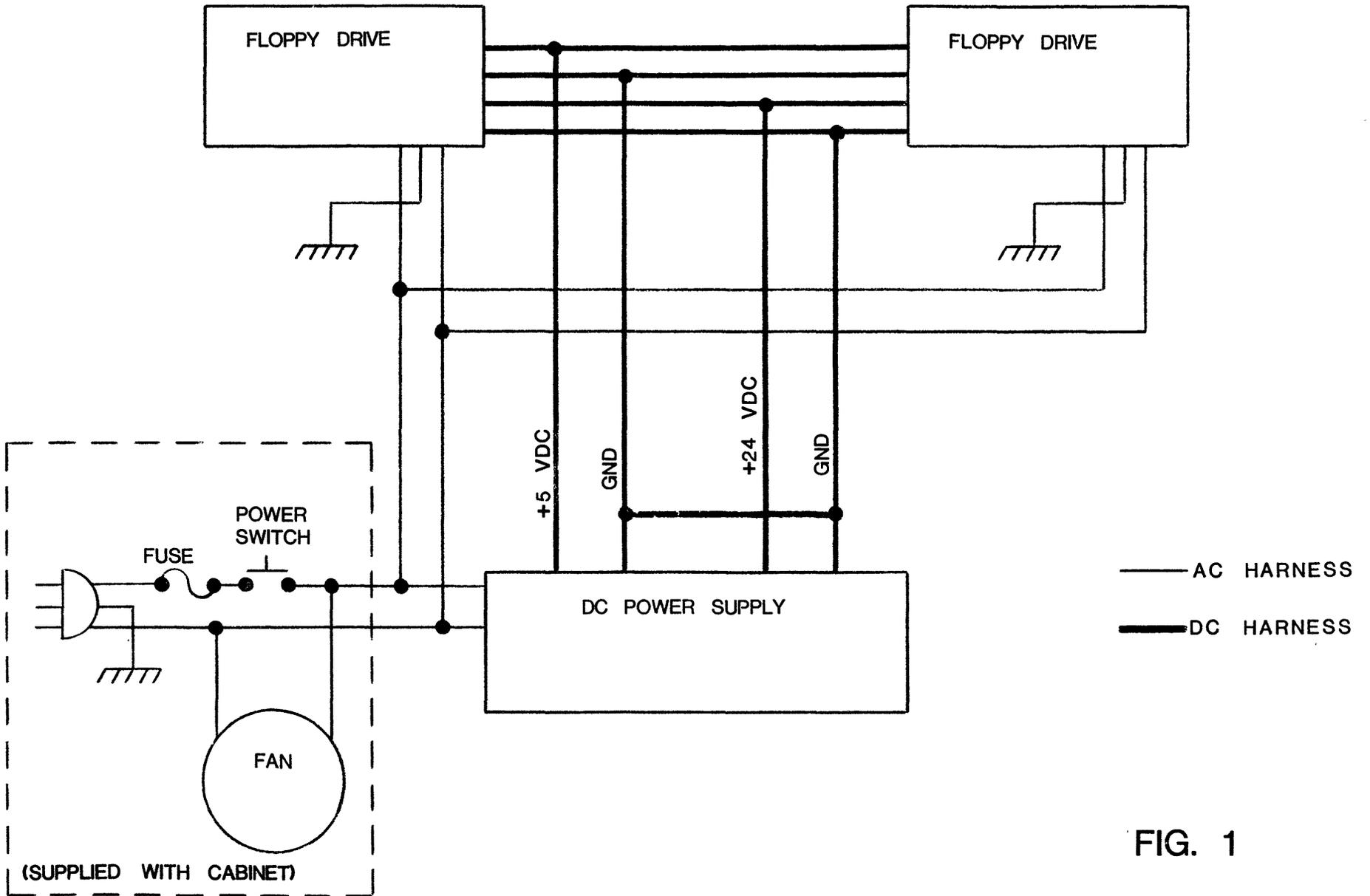
AC AND DC WIRING DIAGRAM

FLOPPY DRIVE

FLOPPY DRIVE

+5 VDC

GND

+24 VDC

GND

POWER
SWITCH

FUSE

DC POWER SUPPLY

AC HARNESS

DC HARNESS

FAN

(SUPPLIED WITH CABINET)

FIG. 1

CHAPTER 2 - Section 2

DSM-INT1 Cabling

Installation of Termination Jumpers on the Mini-Floppy Drive

Before the drives are installed in the cabinet you need to install line termination jumpers on each drive. The jumpers required to operate in a Digital Group system are a drive select jumper and a head solenoid jumper. To use four mini-drives in a system you need to make a modification to the drive. Page 7 of the drive manual details the line termination jumpers that can be used. Figure 3 details the modification to the drive PC board and the jumpers that are used in a Digital Group system.

NOTE: Normal jumpering required is a head solenoid jumper and a single drive select jumper (1 thru 4). Remove the resistor pack (RP150 as shown on page 31 in the drive manual) on all but one drive operating in a system.
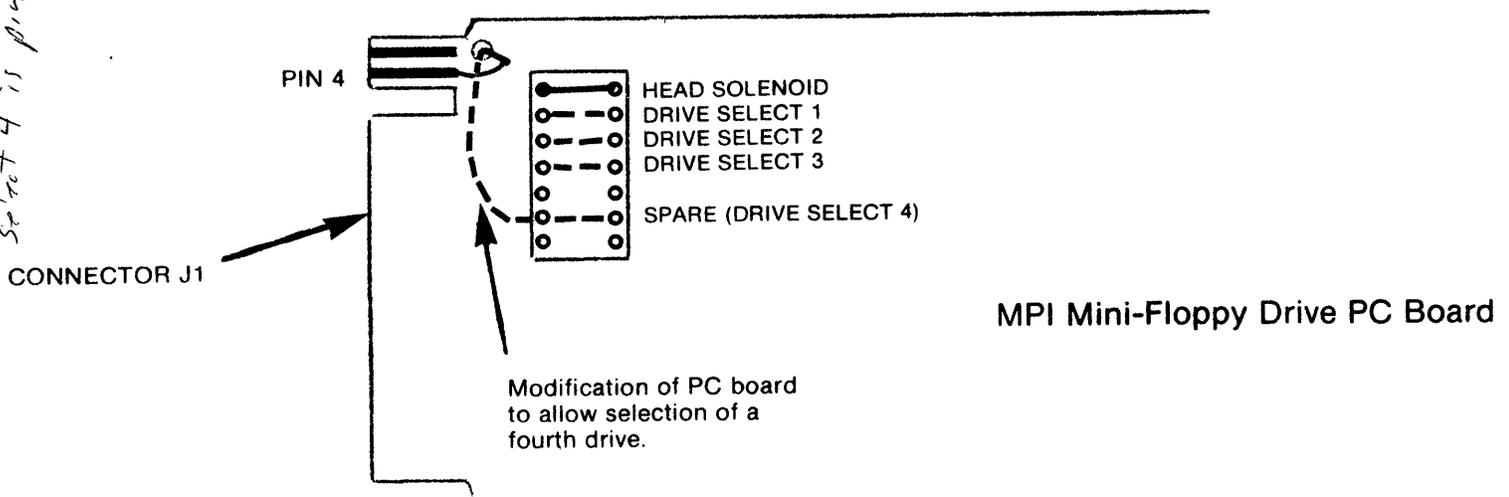

FIGURE 3 — MINI-FLOPPY DRIVE JUMPERING

On Bytemaster systems a jumper wire must also be connected between the floppy controller card, pin 25, and pin 4 of the floppy I/O connector (on the motherboard).

On standard mainframe systems a jumper wire must be installed on the CPU paddlecard connecting pin E (corresponding to the CPU backplane) to pin 4 of the 34 conductor header.

DRIVE CONNECTIONS FROM MINI FLOPPY POWER SUPPLY
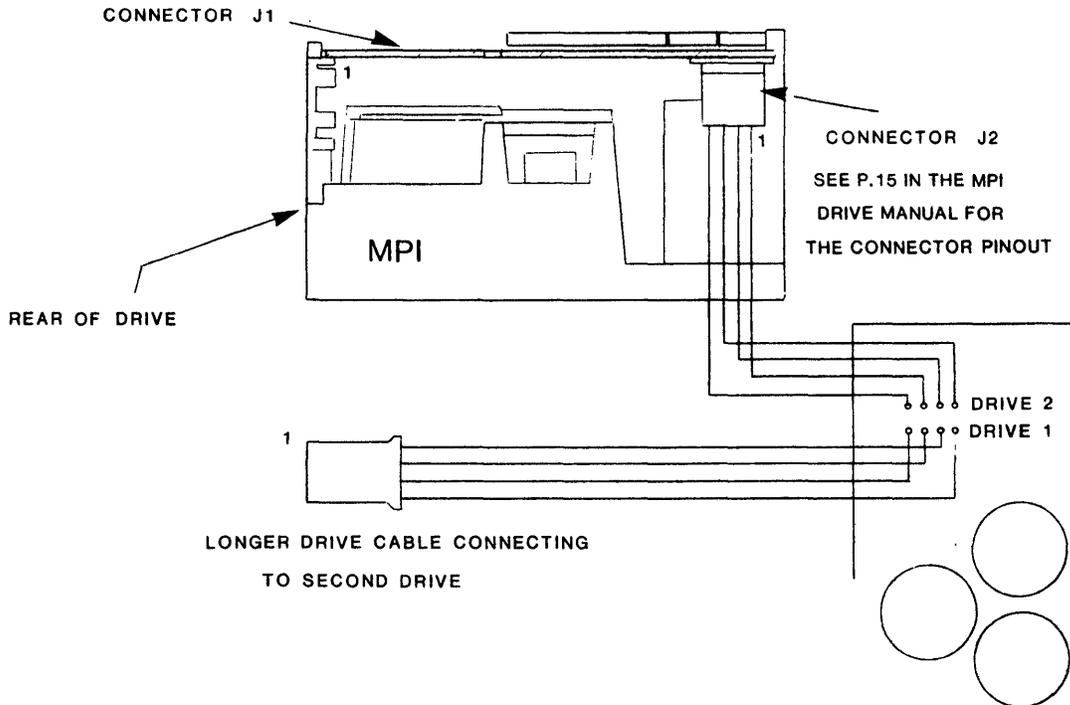
☐ Install the 34-conductor cable in the cabinet matching pin 1 of each cable plug end to the pin 1 end of connector J1 on each drive. Connect the paddlecard end of the cable to the CPU backplane slot designated for the mini-floppy. The backplane of the CPU is wired identically for mini-floppies as for standard floppy drives with the exception of the MOTOR ON line, pin 10. Remove Molex pin from pin 18 and move it to pin 19 of 36-pin edge connector.

JUMPER ADDITION TO MINI-FLOPPY PADDLECARD

A JUMPER IS REQUIRED ON THE BACK SIDE

OF THE PADDLECARD CONNECTING PIN 4 TO PIN E
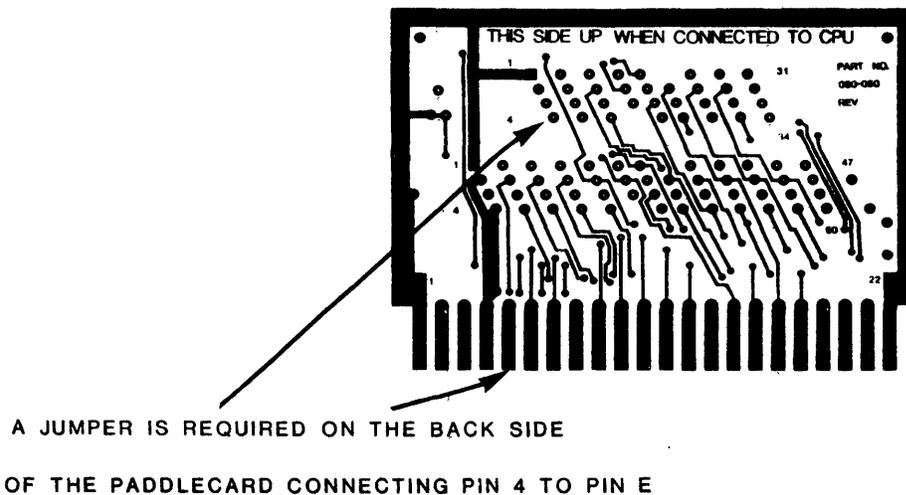
☐ After installing the jumper, plug the paddlecard into the CPU backplane and, using a disk operating system diskette, run the drives through reading and writing tests. Each time the drive is selected the front panel LED will light, the head will load the diskette, and the drive and stepper motor will operate.

TABLE 1 — MPI

CONTROLLER CARD

CPU BACKPLANE DRIVE CONNECTIONS
(See Figure 9 in the Shugart OEM Manual
    and Figure 2 in the Floppy Disk documentation)

CONTROLLER PIN		FUNCTION	CPU BACKPLANE PIN		MPI PCB CONNECTOR J1
5	←	Index	18		8
6	→	Step	17		20
7	→	Write Gate (Write Current Enable)	16		24
8		A Ready	15		Not used
9	←	Write Protect	14	***	28 ***
10	→	Write Data	13		22
12	←	Track 00	12		26
13	→	DS1 Select	11		10
14		Not used	10		Not used
15	→	Direction	9		18
17	←	Read Data (Raw Data)	7		30
18	→	Head Load	6	*	Not used
19	→	Motor On	6	*	16
20	→	-5V DC	D		Not used
21	→	Side			32
23	→	DS2 Select	H		12
24	→	DS3	F		14
25	→	DS4 Select	E		6

DC POWER SUPPLY, CONNECTOR J2

Pin 2 — +12V Return
Pin 1 — +12V DC
Pin 3 — +5V DC
Pin 4 — +5 Return

* Modify molex on motherboard for this connection
** Needs paddlecard & MPI PCB modification
*** Not implemented (user optional)

CHAPTER 3 - Section 1

Power Supply Adjustment

The VCO Section of the Digital Group Double Density Disk Controller is referenced to the +5 Volt power supply. The free running Frequency of the VCO is set at the factory with the +5 Volt power supply set to +5.0 Volts. In order for your controller to function properly, the user needs to adjust his +5 Volt supply. This may be done as follows:

1. Remove the ROM from the system.

2. Install the controller into its intended slot.

3. Adjust the computer +5 Volt supply for +5.0 Volts at the TOP of the controller board.

4. Reinstall the ROM previously removed.

POWER CONNECTOR CONNECTIONS FOR

5¼" FLOPPY DISK DRIVE

SHUGART & MPI COMPATIBLE
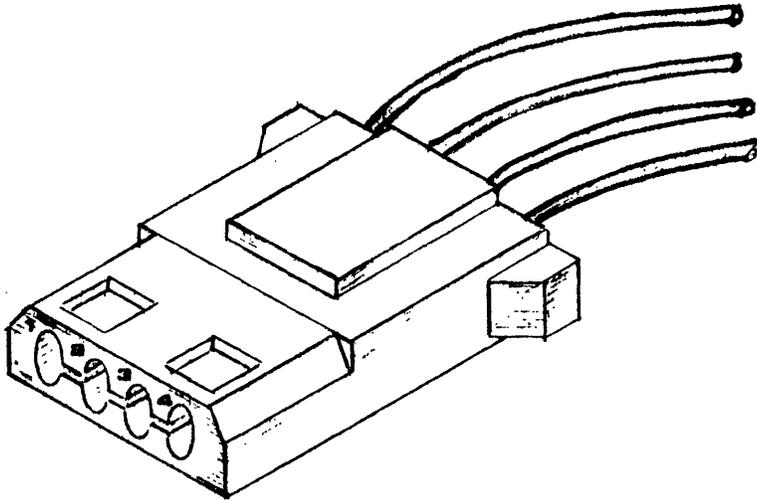
#1 Orange, +12 Volts

#2 Black, +12 Volt Return

#3 Black, +5 Volt Return

#4 Red, +5 Volts

AMP PART NUMBER 1-480424-0
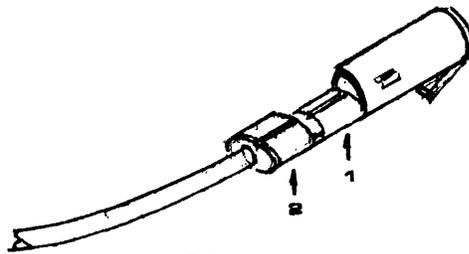
PIN
AMP PART NUMBER 60619-1

STRIP WIRE 1/8 INCH.
CRIMP STRIPPED WIRE IN #1.
CRIMP INSULATION IN #2.
WIRE CRIMP MAY BE SOLDERED.
INSERT INTO HOUSING FROM REAR.
CONTACT WILL SNAP IN.

*CAUTION: PINS ARE VERY DIFFICULT
TO REMOVE. BE SURE YOU ARE INSERT-
ING THE CONTACT INTO CORRECT POSITION.

MOTHER-
BOARD
(Pin Side)

REAR

BACK-
PLANE
(Pin Side)

(2-Sockets)

CABLE TO DISKS

(This cable can be
inverted (ie red
wire on top.) if both
ends are inverted)

CONNECTOR(S)
TO DISK
DRIVE
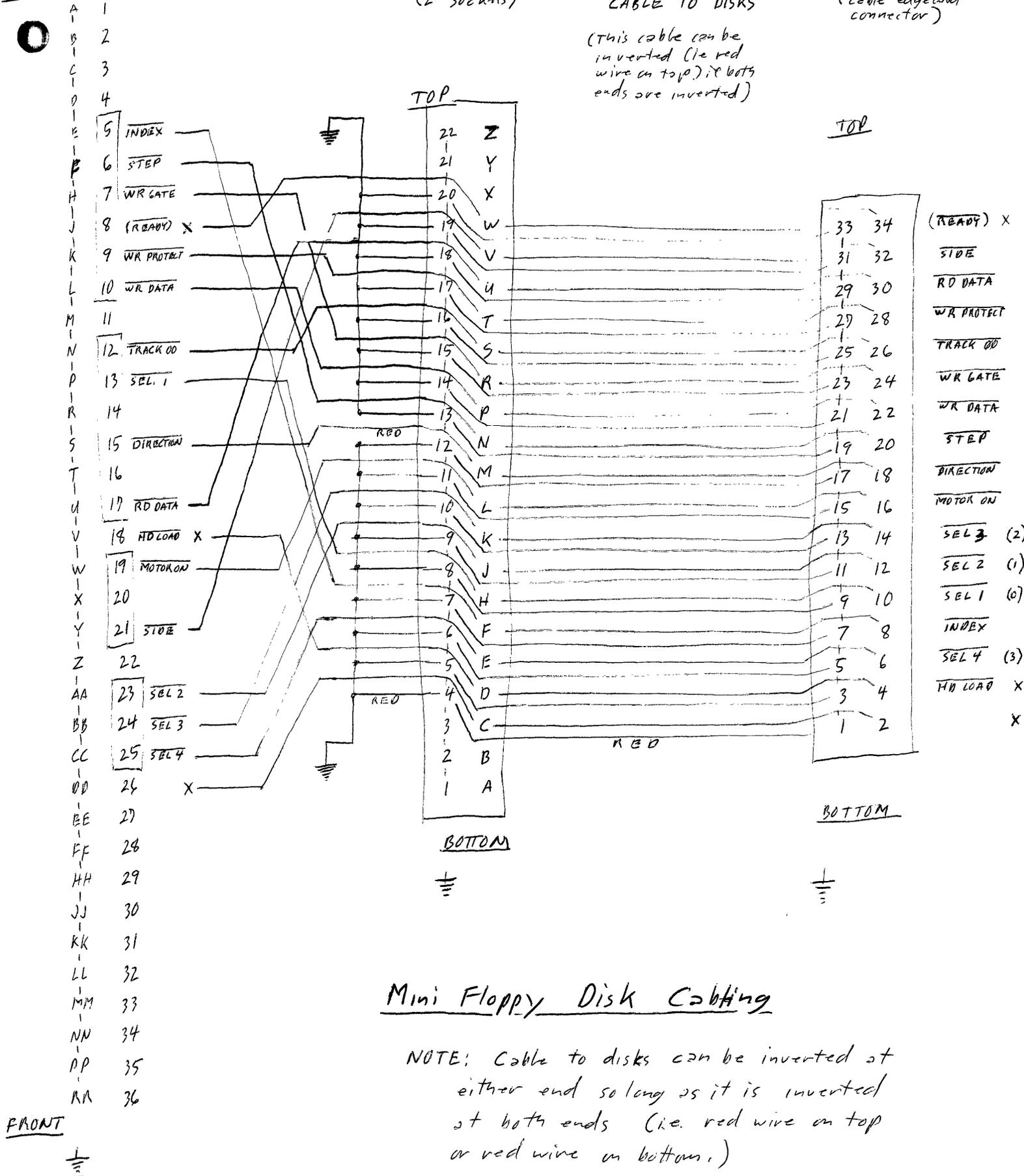
(view facing
cable edgecard
connector)

TOP

A	1	
B	2	
C	3	
D	4	
E	5	INDEX
F	6	STEP
H	7	WR GATE
J	8	(READY) X
K	9	WR PROTECT
L	10	WR DATA
M	11	
N	12	TRACK 00
P	13	SEL. 1
R	14	
S	15	DIRECTION
T	16	
U	17	RD DATA
V	18	HD LOAD X
W	19	MOTOR ON
X	20	
Y	21	SIDE
Z	22	
AA	23	SEL 2
BB	24	SEL 3
CC	25	SEL 4
DD	26	X
EE	27	
FF	28	
HH	29	
JJ	30	
KK	31	
LL	32	
MM	33	
NN	34	
PP	35	
RR	36	

FRONT

TOP

22	Z
21	Y
20	X
19	W
18	V
17	U
16	T
15	S
14	R
13	P
12	N
11	M
10	L
9	K
8	J
7	H
6	F
5	E
4	D
3	C
2	B
1	A

RED

RED

RED

BOTTOM

TOP

33	34	(READY) X
31	32	SIDE
29	30	RD DATA
27	28	WR PROTECT
25	26	TRACK 00
23	24	WR GATE
21	22	WR DATA
19	20	STEP
17	18	DIRECTION
15	16	MOTOR ON
13	14	SEL 3 (2)
11	12	SEL 2 (1)
9	10	SEL 1 (0)
7	8	INDEX
5	6	SEL 4 (3)
3	4	HD LOAD X
1	2	X

BOTTOM

Mini Floppy Disk Cabling

NOTE: Cable to disks can be inverted at
either end so long as it is inverted
at both ends (i.e. red wire on top
or red wire on bottom.)