HDE, INCORPORATED

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*                     *
*   HDE DISK SYSTEMS  *
*                     *
*  INSTALLATION MANUAL *
*                     *
*   (SHUGART SA400)   *
*                     *
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AUGUST 1980

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HUDSON DIGITAL ELECTRONICS, INC.
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CONTENTS

HARDWARE INSTALLATION - SA400 DISK SYSTEMS (MINI-DISK)

Installation of your MINI-DISK system consists of the following steps:

1. Preparation of the disk drive(s)
2. Connection of the power supply(s)
3. Connection of the disk controller
4. Connection of the AC source
5. Connection to the computer
6. Setting the controller address switches
7. Adjustment of the drive speed

Each of these steps is explained below. FIGURE 1 is provided to illustrate the required MINI-DISK system interconnections. Although this manual is sufficient to install and maintain your MINI DISK system, some users may desire additional technical material on the disk drive assembly. These users should consider ordering the following documentation from SHUGART ASSOCIATES:

SHUGART P/N	TITLE
54096-0	SA400 SERVICE MANUAL
54102-0	SA400 OEM MANUAL

The following descriptions cover the installation of both single and multiple drive systems.

PREPARATION OF THE DISK DRIVE(S)

There are two items that must be checked on each drive in your system prior to installation; controller/drive cable termination; and, drive number setting. Observing the printed circuit board (PCB) mounted on each of your disk drives, you will notice that there are two 14 pin integrated circuit (IC) sockets in positions E1 and F1 (the IC designations are marked along the edges of the PCB). The IC socket in position E1 contains a termination resistor IC and the IC socket in position F1 contains a four position switch. In multiple drive systems, remove the termination resistor in position E1 from one, or two drives, as appropriate, (leaving the resistor in one drive).

The four switches in IC socket F1 are labeled HL, DS1, DS2 and DS3. These switches must be set in accordance with the tables given below. Although the drives can be put in any order on the controller/drive cable, the convention is to put drive #1 last (farthest from the controller) followed by drive #2 and then drive #3 (closest to the controller). If this convention is used, drive #1 will always be the only drive to contain a terminator resistor.

SWITCH SETTINGS FOR THREE DRIVE SYSTEMS

	HL	DS1	DS2	DS3
DRIVE #1	ON	ON	OFF	OFF
DRIVE #2	ON	OFF	ON	OFF
DRIVE #3	ON	OFF	OFF	ON

SWITCH SETTINGS FOR TWO DRIVE SYSTEMS

	HL	DS1	DS2	DS3
DRIVE #1	ON	ON	OFF	OFF
DRIVE #2	ON	OFF	ON	OFF

SWITCH SETTINGS FOR ONE DRIVE SYSTEMS

	HL	DS1	DS2	DS3
DRIVE #1	ON	ON	OFF	OFF

CONNECTION OF THE POWER SUPPLY(S)

Connect one of the power supplies to each of the drives using the 18 inch power cables provided. The connectors on each end of the cable are different. The connector with the square openings plugs into the pins clearly labeled J1 on the power supply. This connector has been keyed by blocking one of the holes. Insure that the blocked hole on the cable connector is aligned with the missing pin on the power supply connector before mating the connectors. The connector with the round openings plugs into the drive. The drive connector is located on the bottom side of the PCB mounted on the drive. This connector is keyed by the shape of the connector shell. Observe that the connector shells are properly aligned before mating.

Complete the power supply connection by coupling the frame ground of each drive to its mating power supply using the green ground strap provided. This ground strap has identical connectors at each end. Connect one end to the faston tab located on the PCB mounted on the rear of the drive. Connect the other end to the faston tab mounted to the transformer in the power supply.

CONNECTION OF THE DISK CONTROLLER

The disk controller is connected to the drive(s) using the 34 pin flat cable assembly provided.

The connectors on this cable are different. The 34 pin conductor socket connector mates with the controller. Each of the 34 conductor PCB edge connectors mates with a drive. The 34 conductor socket connector is keyed by one of the slots that are in one of the flat surfaces. The easiest way to insure proper alignment of this connector is to confirm that the triangle molded into the cable connector is mated to the triangle molded into the header on the controller PCB. The 34 conductor PCB edge connector(s) on the cable mate with the edge connector on the PCB mounted on each drive. These connectors are keyed by a plastic bar across the connector face. Insure that this plastic bar is aligned with the slot milled into the PCB before mating the connectors. Remember that in multiple drive systems the last drive (the one farthest from the controller) must contain the terminator resistor.

CONNECTION OF THE AC SOURCE

AC power switches, fuses or circuit breakers are not included and are considered a part of the user's host computer system. It is recommmended that the AC line cord from the power supply(s) be plugged into a protected, commonly switched power strip or connected to your system AC distribution in a manner such that the AC to the power supply(s) is turned on and off simultaneously. If your computer system does not include a suitable AC power distribution, the recommended approach is to use an AC power strip with a self contained switch, pilot light and circuit breaker. These devices are readily available from local electronic supply stores.

The drive and/or power supply should never be turned on or off with a diskette in place.

CONNECTION TO THE COMPUTER

The disk interface PWB (HDE DM816-FC1) is designed to plug into either an HDE supplied computer system or a KIM, TIM, AIM or SYM system that has been expanded to include a KIM-4 or S-100 (KIMSI or KEM) motherboard. Before the disk interface board is plugged in, insure that the address switches have been properly set as described below. In addition, in SYM based systems, it is required that SY6522 VIA #2 (U28) be removed to avoid address conflict with the controller card.

SETTING THE CONTROLLER ADDRESS SWITCHES

The disk controller/interface board contains 12 switches that must be set properly to select the board address. These switches determine the 12 most significant bits of the 16 bit binary address. The switch that is closest to the top of the board (switch #1 in the four switch array) is the most significant bit and corresponds to bit 15. The switches continue in sequence to the bottom switch (switch #8 in the eight switch array) which is the least significant bit and corresponds to address bit 4. This correspondence between switch locations and address bus bits is shown below in TABLE 1.

	SWITCH NUMBER	ADDRESS BUS BIT NUMBER
4 SWITCH ARRAY	1	15
	2	14
	3	13
	4	12
8 SWITCH ARRAY	1	11
	2	10
	3	9
	4	8
	5	7
	6	6
	7	5
	8	4

TABLE 1

Setting a switch to the "on" position as marked on the switch corresponds to a binary "0" for that address bus bit. Your HDE system uses the hexadecimal addresses shown below in TABLES 2A-C. Ascertain that the address for your particular system corresponds to the address shown.

HEXADECIMAL ADDRESS	6	D	6	0
BINARY ADDRESS	0110	1101	0110	0000
SWITCH DESCRIPTION	4/SW ARRAY	8 SWITCH ARRAY		NO SWITCHES
SWITCH NUMBER	1234	1234	5678	XXXX
SWITCH POSITION (ON OR OFF)	0000 NFFN FF	0000 FFNF FF F	0000 NFFN FF	XXXX

TIM BASED SYSTEMS - TABLE 2A

HEXADECIMAL ADDRESS	1	0	6	0
BINARY ADDRESS	0001	0000	0110	0000
SWITCH DESCRIPTION	4/SW ARRAY	8 SWITCH ARRAY		NO SWITCHES
SWITCH NUMBER	1234	1234	5678	XXXX
SWITCH POSITION (ON OR OFF)	0000 NNNF F	0000 NNNN	0000 NFFN FF	XXXX

AIM/KIM BASED SYSTEMS - TABLE 2B

HEXADECIMAL ADDRESS	A	8	8	0
BINARY ADDRESS	1010	1000	1000	0000
SWITCH DESCRIPTION	4/SW ARRAY	8 SWITCH ARRAY		NO SWITCHES
SWITCH NUMBER	1234	1234	5678	XXXX
SWITCH POSITION (ON OR OFF)	0000 FNFN F F	0000 FNNN F	0000 FNNN F	XXXX

SYM BASED SYSTEMS - TABLE 2C

1) Module Insertion in HDE Systems

Now that the address switches have been properly set as des-
cribed above,
                *** TURN OFF ALL POWER TO YOUR SYSTEM ***

and then insert your disk interface module into any unused card
slot oriented so pin 22 is near the top of the chassis and the
components face to the right, looking from the rear.

                CAUTION - IF YOU INSERT THE MODULE
                WITH THE COMPONENTS FACING IN THE
                WRONG DIRECTION, THE MODULE WILL
                BE SEVERELY DAMAGED WHEN POWER IS
                APPLIED.

It is adviseable to recheck the orientation of the module
before turning on the power.

If you are inserting multiple modules into your system, or
expanding your system, you must check two items. First be sure
that the address switches of all modules are set to a different
address range and second, insure that your system has enough power
to supply all of the modules. For use in determining the power
requirements, the disk controller requires 1 amp nominal at +8V,
0.02 amps at +15V and 1 milliamp at -15V (all may be unregulated).

2) Interconnection of HDE Modules

All types of HDE memory and I/O modules are designed to plug
into a simple universal bus (which is popularly called the S 44
bus). This bus is implemented using standard 44 pin connectors
with 0.156" pin spacing. These connectors are available from many
manufacturers. Since these are the same connectors used on many
VECTOR plug boards, they are commonly available in many local el-
ectronic parts stores in solder or wire wrap versions. You should
plan to space your connectors 3/4 inch apart. This will allow in-
sertion of HDE modules into adjacent positions, while your wire-
wrap modules can be inserted into alternate positions. The entire
length of the bus should be limited to about 18", thus limiting
the number of connectors to 24. The interwiring required is shown
in TABLE 3. When you perform the interwiring, you should select
the power and ground wire sizes to accomodate the current required
for the total number of modules in your system. Each module
should be connected either to an unregulated (8vdc to 12vdc) sup-
ply u9ing pins 19 and 20, or to 0 regulated 5 volt supply using
pins 21 and Y;

                *** BUT NEVER TO BOTH! ***

With the power wiring complete, the signal wiring consists of connecting all remaining same numbered pins together except pin 16

CONNECTOR #1		CONNECTOR #2		....	CONNECTOR #N		
1		1		GND	1		
	A		A	GND		A	
2		2		BSYNC	2		Note 3
	B		B	BAB0		B	
3		3		BRDY	3		Note 3
	C		C	BAB1		C	
4		4		BIR	4		Note 3
	D		D	BAB2		D	
5		5		-15vdc	5		
	E		E	BAB3		E·	
6		6		BNMI	6		Note 3
	F		F	BAB4		F	
7		7		RST	7		
	H		H	BAB5		H	
8		8		BDB7	8		
	J		J	BAB6		J	
9		9		BDB6	9		
	K		K	BAB7		K	
10		10		BDB5	10		
	L		L	BAB8		L	
11		11		BDB4	11		
	M		M	BAB9		M	
12		12		BDB3	12		
	N		N	BAB10		N	
13		13		BDB2	13		
	P		P	BAB11		P	
14		14		BDB1	14		
	R		R	BAB12		R	
15		15		BDB0	15		
	S		S	BAB13		S	
16		16			16		BDSEL N/1
	T		T	BAB14		T	
17		17		+15vdc	17		
	U		U	BAB15		U	
18		18		DMA*	18		Note 3
	V		V	B02		V	
19		19		+8vdc	19		Note 2
	W		W	BR/W		W	
20		20		+8vdc	20		Note 2
	X		X	B02*		X	
21		21			21		5vdc N/2
	Y		Y			Y	5vdc N/2
22		22		GND	22		
	Z		Z	GND		Z	

Note 1 - No connections should be made
Note 2 - Wire as shown for unregulated power
Note 3 - N/R for module, suggest interconnection for universality

TABLE 3

3) Connection to a KIM-4 Motherboard.

A set of card guides may be ordered for use with connectors on the KIM-4 motherboard. These card guides should be installed on the motherboard connectors selected for the disk interface module. The card guides are installed by positioning the notch in the foot of each card guide over the end foot of the 22 pin connector on the motherboard and threading the 4-40 screw supplied from the bottom of the motherboard and 22 pin connector end foot into the hole in the foot of the card guide. Once the card guides have been installed, the disk interface module is inserted using the instructions given in your KIM-4 manual. The proper orientation for HDE modules is the same as for MOS TECHNOLOGY modules (i.e., the component side of the module faces away from the KIM-1 board, toward the KIM-4 power connector.)

ADJUSTMENT OF DRIVE SPEED

Normally no adjustments are required. The drive speed has been precisely set by HDE at the factory. The drive speed may be checked by running the disk format program (*FM). A "24" status error indicates that the drive speed is out of tolerance. If the system can format diskettes THEN NO ADJUSTMENT IS NECESSARY. To adjust the speed, start the disks running (using the + key) and then adjust the motor control potentiometer on the motor control PCB located on the drive. This adjustment is accomplished under fluorescent light by watching the strobe disk on the motor pulley. The strobe disk will appear to stand still when the adjustment is proper. You may find that you have to readjust the speed slightly to compensate for the effects of head drag. This last adjustment is done using a "trial and error" approach.

HARDWARE INSTALLATION - DRIVE EXPANSION KIT

Prior to beginning, please reread the installation instructions for installation of the single drive system.

1) Turn off all power to your system

2) Remove the existing 34 wire flat cable assembly (A2 on the disk system schematic

3) Interconnect your existing controller to all drive assemblies using the new 34 wire cable assembly provided. The cable assembly is keyed to preclude improper installation. However, visually check that the cable connector keys are aligned on the controller and drive assemblies before mating the connectors.

4) Connect the drive DC power cable from J1 on your new power supply to J2 on the new drive assembly. The connectors are keyed to preclude improper installation.

5) Connect the new AC power cable to the AC power source. The precautions stated in the corresponding instructions for the single drive system apply.

6) The drive addresses should be set so that the old drive is now drive #1, and the new drive is drive #2.

7) Only the last drive should contain a resistor dip in the dip socket. Check that this is the case.

SA400 INSTALLATION MANUAL (MINI-DISK)

SCHEMATICS, LAYOUTS, PARTS LIST

This section contains:

TABLE 4 - SA400 DISK SYSTEM PARTS LIST (MINI-DISK)

ITEM	DESIG	QTY	DESCRIPTION
1	A1	1	DISK CONTROLLER, HDE MODEL # DM816-FC1
2	A2	1	34 WIRE FLAT CABLE ASS'Y (NOTE 1)
3	A3	1	DRIVE POWER SUPPLY ASS'Y
4	A4	1	DRIVE POWER CABLE
5	A5	1	DRIVE GROUND STRAP
6	A6	1	DRIVE ASS'Y
7	A7	1	DRIVE POWER SUPPLY ASS'Y (NOTE 2)
8	A8	1	DRIVE POWER CABLE (NOTE 1)
9	A9	1	DRIVE GROUND STRAP (NOTE 2)
10	A10	1	DRIVE ASS'Y (NOTE 2)
11	A11	1	DRIVE PWR SUPPLY ASS'Y (NOTE 3)
12	A12	1	DRIVE POWER CABLE (NOTE 3)
13	A13	1	DRIVE GROUND STRAP (NOTE 3)
14	A14	1	DRIVE ASS'Y (NOTE 3)
15		1	SYSTEM MANUAL
16		1	5 1-4" DISKETTE WITH SOFTWARE

Notes:

    Note 1 X=1 for single drive
           X=2 for dual drive
           X=3 for triple drive

    Note 2 Included only with dual and triple drive systems
    Note 3 Included only with triple drive systems

TABLE 5 - SA400 DISK EXPANSION KIT (DR 2)

ITEM	DESIG	QTY	DESCRIPTION
1	A2	1	34 WIRE FLAT CABLE ASS'Y
2	A7	1	DRIVE POWER SUPPLY ASS'Y
3	A8	1	DRIVE POWER CABLE
4	A9	1	DRIVE GROUND STRAP
5	A10	1	DRIVE ASS'Y
6		1	5 1-4" DISKETTE WITH SOFTWARE

TABLE 6 - SA400 DISK EXPANSION KIT (DR 3)

ITEM	DESIG	QTY	DESCRIPTION
1	A2	1	34 WIRE FLAT CABLE ASS'Y
2	A11	1	DRIVE POWER SUPPLY ASS'Y
3	A12	1	DRIVE POWER CABLE
4	A13	1	DRIVE GROUND STRAP
5	A14	1	DRIVE ASS'Y
6		1	5 1-4" DISKETTE WITH SOFTWARE

TABLE 7 - DM816-FC1 PARTS LIST

ITEM	PART	QTY	DESCRIPTION
1	U1	1	4-SPST SWITCH ARRAY
2	U2	1	8-SPST SWITCH ARRAY
3	U3,U6	2	IC 8131
4	U4	1	IC 8T98
5	U5	1	RESISTOR PACK #899-1-R
6	U7	1	IC 74145
7	U8	1	IC 74279
8	U9	1	IC 7432
9	U10	1	IC DM8090
10	U11	1	IC FD1771
1	U12	1	IC 74LS157
12	U13	1	IC 74LS175
13	U14	1	8 MHZ XTAL OSC K1115A
14	U15,U21	2	IC 74LS245
15	U16	1	IC 6522
16	U17,U18	2	IC 74LS161
17	U19	1	IC 74161
18	U20	1	IC 9602
19	Q1	1	LM323 5V REGULATOR
20	Q2	1	uA78M12HM REGULATOR
21	Q3	1	uA79M05AHC REGULATOR
22	J1	1	CONNECTOR 34 PIN
23	C1,C2,C6	3	CAPACITOR, 2.2 uf
24	C3,C5	2	CAPACITOR, .1 uf
25	C4	1	CAPACITOR .3 uf
26	C7	1	CAPACITOR 10 uf
27	C8	1	CAPACITOR .01 uf
28	C9	1	CAPACITOR .047 uf
29	R1,R2,R3,R4,R5	5	RESISTOR, 150 OHM, 14 W
30	R6,R7	2	RESISTOR, 10K OHM, 14 W
31	R8	1	RESISTOR, 27K OHM, 14 W
32	R9	1	RESISTOR, 20K OHM, 14 W
33			HEAT SINK
34			CABLE CONNECTOR
35			BASE PWB
36		2	KEYPIN - 3M 3518

TABLE 8   KIM-4 BUS PINOUT

| COMPONENT SIDE			WIRING SIDE
GROUND	1	A	GROUND
SYNCH	2	B	ADDRESS BIT 0
$\overline{RDY}$	3	C	ADDRESS BIT 1
$\overline{IRQ}$	4	D	ADDRESS BIT 2
-16 V. UNREGULATED	5	E	ADDRESS BIT 3
$\overline{NMI}$	6	F	ADDRESS BIT 4
$\overline{RST}$	7	H	ADDRESS BIT 5
DATA BIT 7	8	J	ADDRESS BIT 6
DATA BIT 6	9	K	ADDRESS BIT 7
DATA BIT 5	10	L	ADDRESS BIT 8
DATA BIT 4	11	M	ADDRESS BIT 9
DATA BIT 3	12	N	ADDRESS BIT 10
DATA BIT 2	13	P	ADDRESS BIT 11
DATA BIT 1	14	R	ADDRESS BIT 12
DATA BIT 0	15	S	ADDRESS BIT 13
BDSEL *** (N/C)	16	T	ADDRESS BIT 14
+16 V. UNREGULATED	17	U	ADDRESS BIT 15
$\overline{DMA}$	18	V	Ø2 CLOCK
+8 V. UNREGULATED	19	W	$R/\overline{W}$
+8 V. UNREGULATED	20	X	$\overline{Ø2}$ CLOCK
+5 V. *** (N/C)	21	Y	+5 V. *** (N/C)
GROUND	22	Z	GROUND
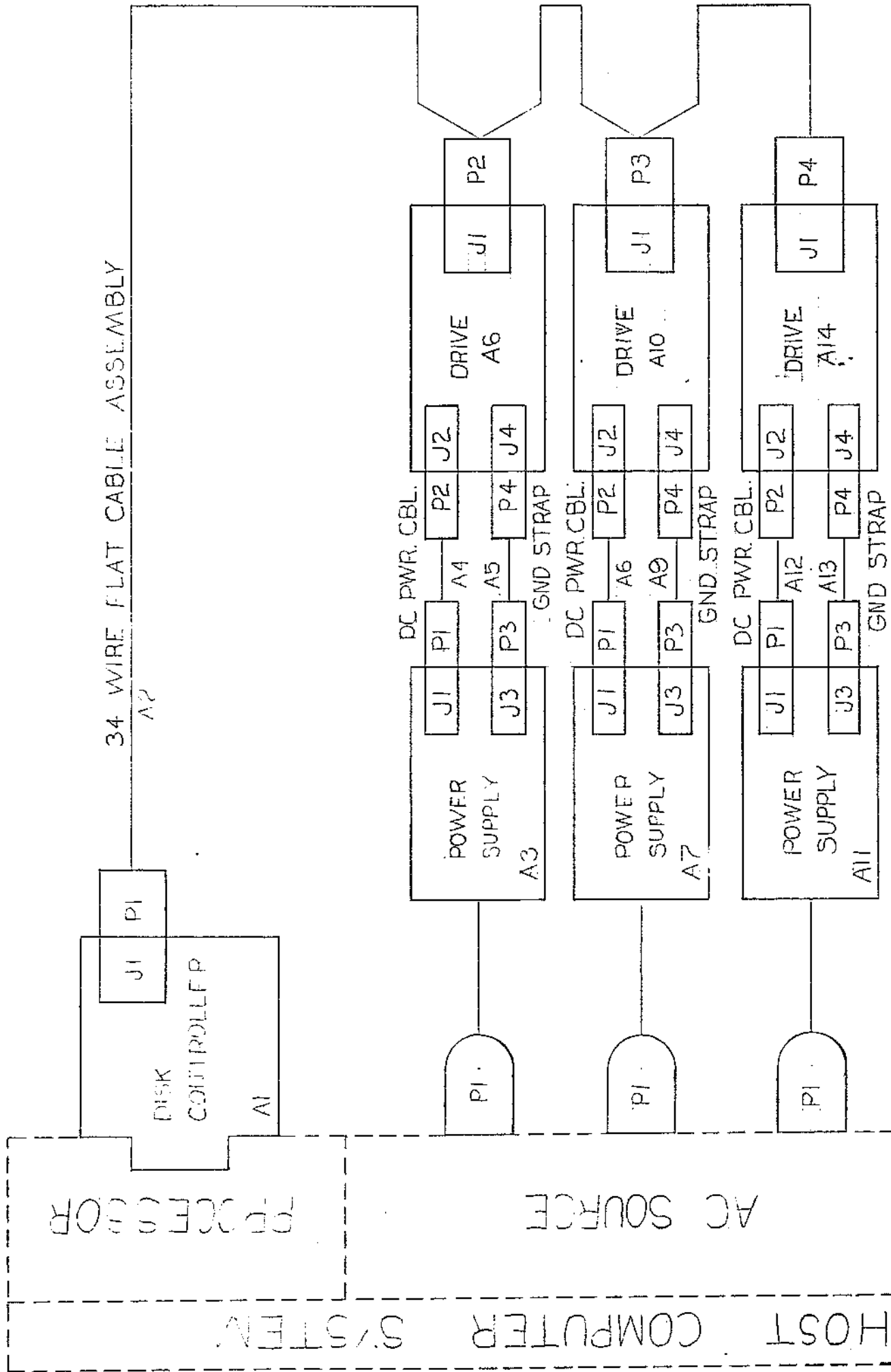
FIGURE 1
DISK SYSTEM SCHEMATIC (MINI DISK)
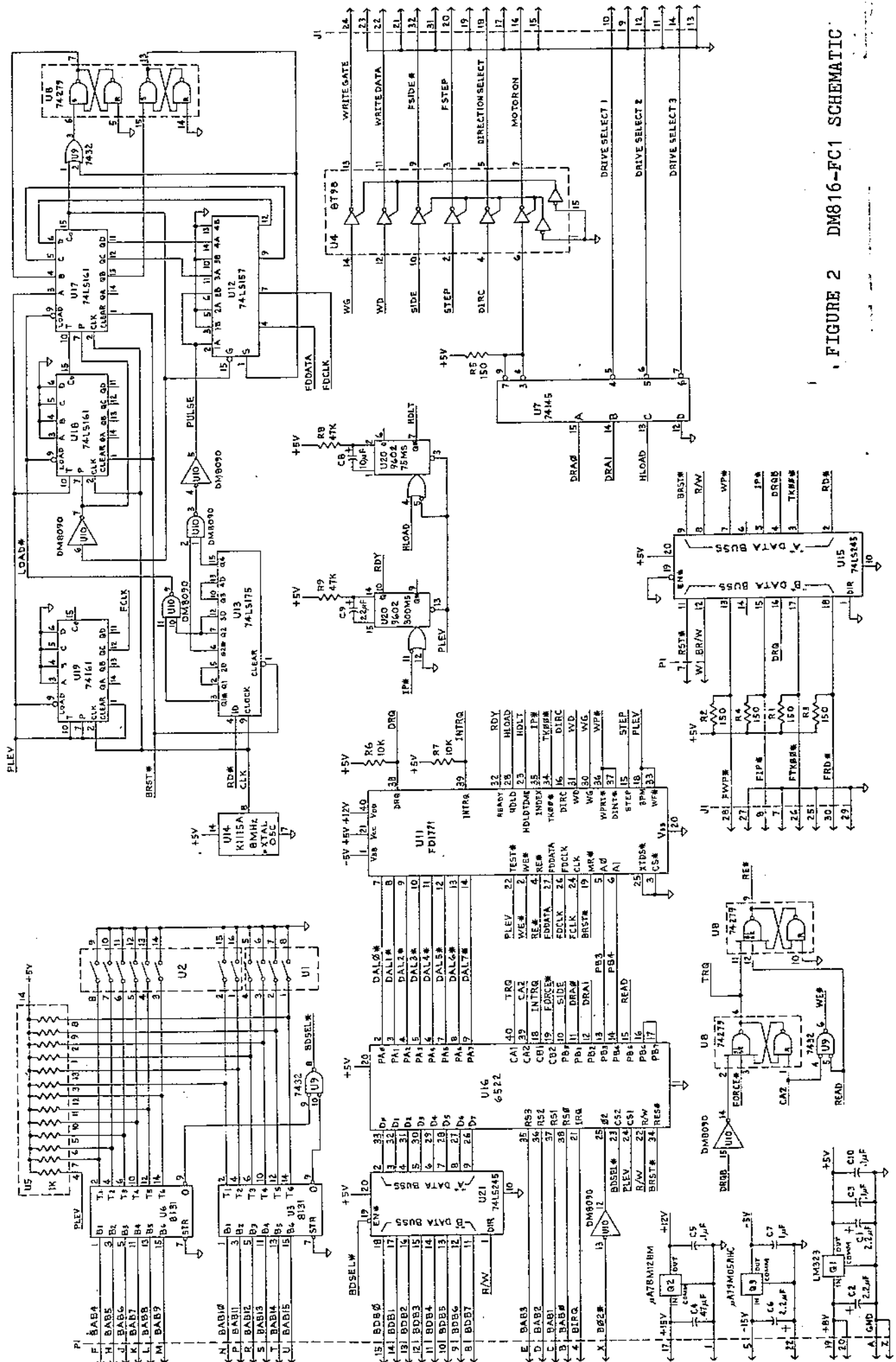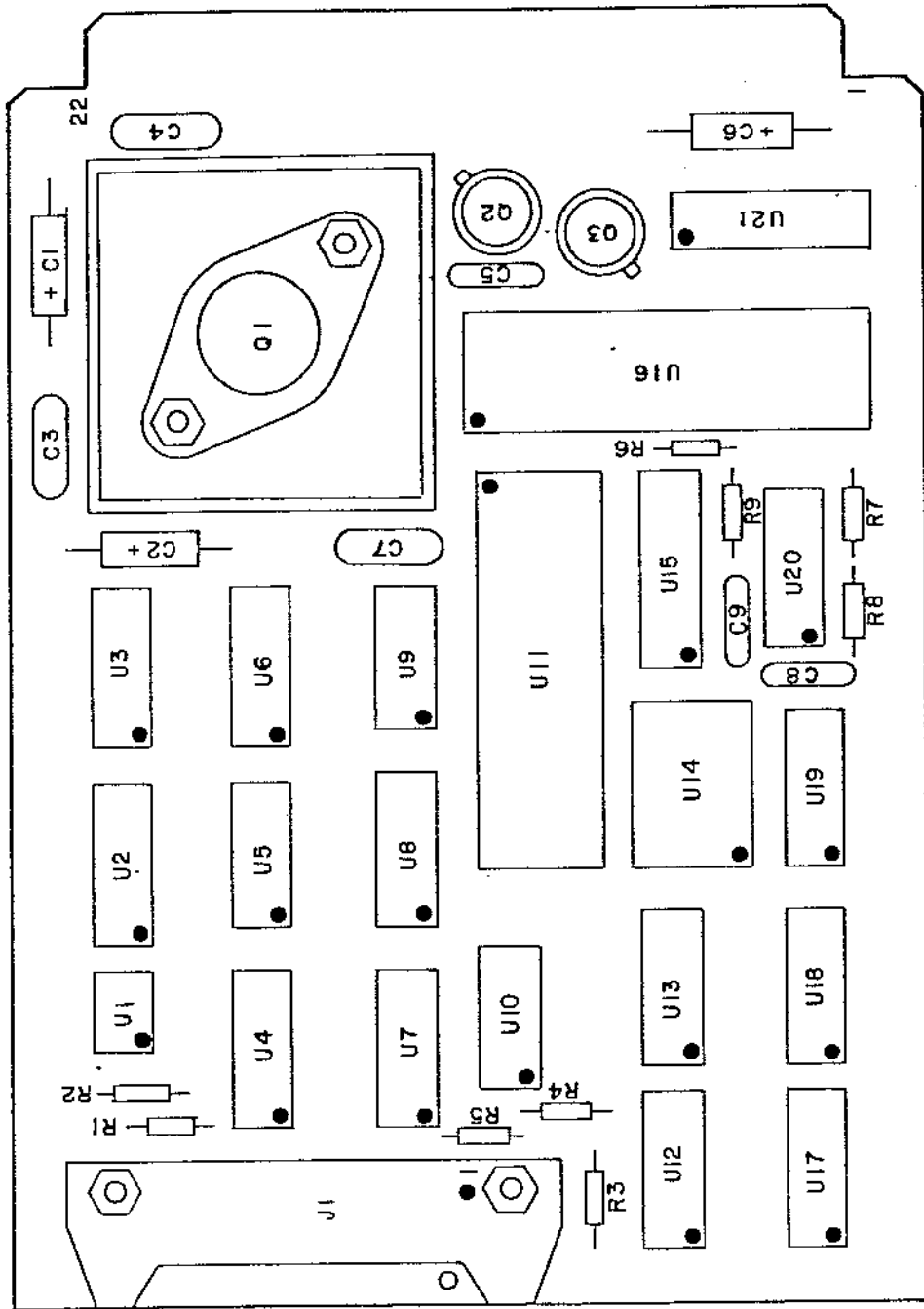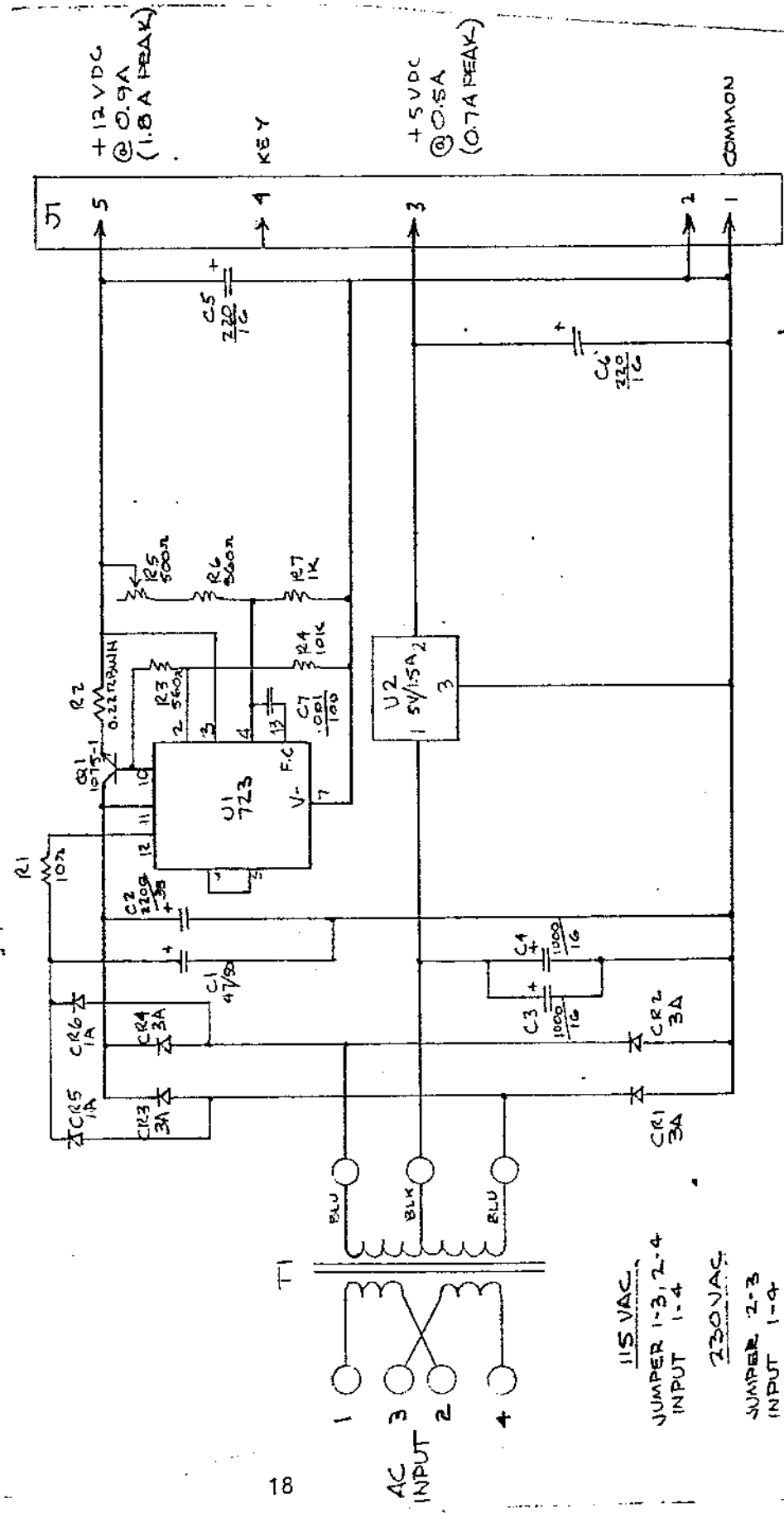
FIGURE 2   DM816-FC1 SCHEMATIC

FIGURE 3 COMPONENT LAYOUT
DISK CONTROLLER BOARD
DM-816-FCI

FIGURE 4   POWER SUPPLY SCHEMATIC

WARRANTY AND SERVICE

GENERAL

Your HDE, inc. DM816-DI flexible disk system has been completely assembled and thoroughly tested prior to release, including an operational test of all components. In the unlikely event you have difficulty with your disk system and cannot diagnose or correct the problem, you may return the unit to HDE, inc. for repair.

IN-WARRANTY SERVICE

All DM816-DI series disk systems are warranted by HDE, inc. against defects in workmanship and materials for a period of 90 days from date of delivery. During the warranty period, HDE, inc. will repair, or at its option, replace at no charge, components that prove to be defective provided that the module is returned, shipping prepaid, to:

> HDE, INC., CUSTOMER SERVICE
> KERR'S CORNER ROAD
> BOX 270, RD #3
> BLAIRSTOWN, NEW JERSEY   07825

This warranty does not apply if the unit has been damaged by accident or misuse, or as a result of repairs or modifications made by other than authorized personnel at the above captioned service facility.

No other warranty is expressed or implied and HDE, inc. is not liable for consequential damages.

OUT-OF-WARRANTY SERVICE

Beyond the 90 day warranty period, a reasonable fee will be charged for repair service. All service work performed by HDE, inc., beyond the 90 day period is warranted for an additional 90 day period after shipment of the repaired unit.

POLICY OF CHANGES

All HDE DM816-DI systems are sold on the basis of descriptive specifications in effect at the time of sale. HDE, inc. shall have no obligation to modify or update products once sold. HDE, inc. reserves the right to make periodic changes or improvements to any DM816-DI series flexible disk system.

SHIPPING INSTRUCTIONS

It is the customer's responsibility to return the affected unit with shipping charges prepaid to the above captioned service facility. Prior to shipment of any component, call or write the above captioned service facility for the proper procedure and shipping information. Do not return a component without prior contact with HDE, inc.

For in-warranty service, the repaired unit will be returned shipping prepaid by the fastest economical carrier.

For out-of-warranty service , the customer will pay shipping charges both ways. The repaired DM816-DI unit will be returned to the customer C.O.D. unless the repairs and shipping charges are prepaid by the customer.

Please be certain that your DM816-DI unit is safely packaged when returning it to the above captioned service facility.