```
U    U  DDDD     CCC      1       1
U    U  D   D   C   C    11      11
U    U  D    D  C         1       1
U    U  D    D  C         1       1
 UUU   DDDD     CCCC    111     111
```

MSCP Winchester/Floppy Disk Controller

User's Manual

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UDC11 MSCP Winchester/Floppy Disk Controller User's Manual

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1 Scope

The UDC11 User's Manual covers the Andromeda UDC11 MSCP Winchester/Floppy Disk Controller. The UDC11 controller uses DEC Mass Storage Control Protocol (MSCP) to control Winchester and floppy disk drives using the DU handler. The UDC11 contains a bootstrap ROM. The UDC11 User's Manual is intended to provide enough information for a user to do the following:

Verify/configure jumpers on the UDC11

Install the UDC11 in an LSI-11 backplane

Connect the UDC11 to one or more disk drives

Configure the UDC11 for specific drives

Format and test fixed and removable media

Related documents:

DEC Microcomputers and Memories Handbook

DEC Microcomputer Interfaces Handbook

2 Description and Specifications

The Andromeda Systems UDC11 Winchester/Floppy Disk Controller is a single dual-width card which plugs directly into an LSI-11 computer system. To the system, the UDC11 appears to be an MSCP disk controller and a bootstrap ROM. The disk controller interfaces 5.25" Winchester disk drives and 5.25" or 8" floppy disk drives to the LSI-11 bus. The bootstrap ROM provides for automatic or manual system startup on either Winchester or floppy.

* MSCP Disk Controller

The UDC11 is software compatible with DEC operating systems using the DU or DUDRV handler. Eight DU units are supported. Units 0 thru 3 may be individually write protected via external switches.

Each Winchester disk drive may contain from 1 to 8 DU units. Each floppy disk drive may contain 1 DU unit, which may be single or double sided. Single sided 5.25" diskettes are media compatible with DEC RX50 diskettes.

Formatting of both Winchester and floppy disks is supported.

Transparent bad block replacement is provided for Winchesters, so that the media appears perfect to the operating system.

All data transfers to and from both Winchester and floppy disks are via 22 bit Block Mode Direct Memory Access (DMA).

* Bootstrap ROM

The bootstrap ROM will automatically bootstrap DU1: or DU0: upon power up or system reset. Any DU unit may be manually bootstrapped by entering the device at the console terminal.

Communication to all disk drives is via a single 50-line cable for easy system integration. This cable will interface directly with a single 5.25" Winchester drive. Multiple 5.25" Winchester drives and floppy drives require personality cards. The UDC11 can control up to four Winchester and floppy drives in any combination. Each drive may be individually write protected via a line on the interface.

The UDC11 supports the following types of drives:

* 5.25" Winchester with Seagate Technology ST412 type interfaces-

  Soft-sectored or hard-sectored
  512 or 256 bytes per sector
  Reduced write current line from controller
  Fixed media, removable media, or both on one drive
  Up to 64 512-byte blocks per track
  Up to 16 heads
  Up to 16384 cylinders
  20 us to 25.5 ms step rate

* 5.25" floppy with Shugart SA400 type interfaces, or 8" floppy with Shugart SA800 type interfaces-

  Up to 64 512-byte blocks per track
  Up to 255 tracks
  1 or 2 sides
  20 us to 25.5 ms step rate

Specifications:

Size:	1 dual-width Card, 5.25" x 8.5" x 0.5"
Power consumption:	+5 VDC @ 2.5 A, +12 VDC @ 100 mA
Q-Bus loading:	2 AC loads, 1 DC load
DMA Addressing:	Block mode, 22 or 18 bits
Winchester Format:	9,216 bytes per track, 2:1 interleave, vertical partitioning
Floppy Format:	RX50 compatible
Data Transfer Rates:	276 Kbytes/second, 5.25" Winchester 12.8 Kbytes/second, 5.25" Floppy 24.6 Kbytes/second, 8" Floppy

3 Jumper Options

The UDC11 contains jumper options which determine the bus address, DMA addressing (22 or 18 bits), and interrupt priority of the MSCP disk controller, and the bus address of the bootstrap ROM. Other jumpers change the data rate for floppy drives, and enable write precompensation. Also, the UDC11 has provisions for individually write protecting DU units 0 thru 3.

To determine the locations of the jumpers discussed in this section, refer to the UDC11 Physical Layout Diagram at the end of this manual. A jumper is installed by inserting a jumper plug which connects two wire wrap pins together.

3.1 Address Selection

There are four jumpers on the UDC11 board near U25 labelled 'S3', 'S2', 'S1', and 'S0', which determine the bus addresses of the UDC11 as follows:

S3	MSCP disk controller at 172150 (standard address)
S2	MSCP disk controller at 172144 (alternate address)
S1	Bootstrap ROM at 173000 (standard address)
S0	Bootstrap ROM at 171000 (alternate address)

The UDC11 is factory configured with jumpers S3 and S1 installed. To use the alternate controller address, remove jumper S3 and install jumper S2. To use the alternate bootstrap ROM address, remove jumper S1 and install jumper S0. To disable the bootstrap ROM, remove both jumpers S1 and S0.

Some UDC11 controllers use jumper S0 to enable four maintenance registers that are used during testing. These controllers have an IC labelled 'WADU0' at board position U3. On these controllers, jumper S0 should NEVER be installed by the user. Writing into one of these registers may result in loss of disk data.

3.2 DMA Addressing (22 or 18 bit addressing)

DMA Addressing is determined by a jumper set near U5 labelled '22 18'. The UDC11 is factory configured with jumper 22 installed. To select 18 bit addressing, remove jumper 22 and install jumper 18.

22 bit addressing can cause problems if the UDC11 is installed in a 22 bit backplane with other cards that were not designed for a 22 bit backplane. This is because the four extra address lines (BDAL18, 19, 20, and 21) used to be non-bussed spares. The most common example of this problem occurs when a UDC11 is installed in a 22 bit backplane with an LSI-11/2 processor (which was not designed for a 22 bit backplane). The LSI-11/2 brings some of its internal test points to the same pins that are now used by the UDC11 for extra address lines.

The correct solution to this problem is to cut the traces on the cards which were not designed for the 22 bit backplane. Another solution is

to prevent the UDC11 (and any other 22 bit DMA devices) from driving the extra address lines in systems where 22 bit addressing is not used. Select 18 bit addressing to do this.

3.3 Interrupt Priority

LSI-11 processors have a four level interrupt priority scheme. The interrupt request level of the UDC11 is configured via a jumper set near U11 labelled 'I5 I6'. The UDC11 is factory configured to interrupt at level 4 (the normal level for MSCP devices). To interrupt at level 5, install jumper I5. To interrupt at level 6, install jumper I6.

3.4 Floppy Data Rate

The UDC11 is configurable for either 5.25" or 8" floppy drives. This involves two sets of jumpers located near U41 and labelled '5FR' and '5FW'.

The UDC11 is factory congigured for 5.25" floppy drives. To select 8" floppy drives, remove jumpers 5FR and 5FW and install jumpers 8FR and 8FW. Note that all floppy drives must be of the same size.

Some new 5.25" floppy drives use a 500 Kbit/second (8") data transfer rate. To use these drives, configure the UDC11 for 8" data rate. Note that your 5.25" diskettes will NOT be RX50 compatible (but they will hold up to 2560 blocks).

3.5 Write Precompensation

In order to improve data reliability, write precompensation is employed while writing data to both Winchester and floppy disks. Two jumpers labelled 'PCW' and 'PCF' is used to disable write precompensation during testing. The UDC11 is factory configured with these jumpers installed. When thse jumpers are removed, write precompensation is disabled.

3.6 Write Protection

The UDC11 has provisions for individually write protecting DU units 0 thru 3 as well as each Winchester and floppy disk drive. Four spare pins on the UDC11 Q-bus cardedge connector are used to protect DU units 0 thru 3. These pins are normally unconnected, and contain 1K pull up resistors on the UDC11 card. In this state, none of the units are write protected. To write protect a unit, the corresponding cardedge pin must be grounded. The cardedge pins used, and the units they correspond to, are:

AF1	DU0:
AH1	DU1:
AE1	DU2:
BH1	DU3:

Individual drives may be write protected by causing them to assert the WRITE PROTECT line coming from the drive whenever the drive is selected. Floppy drives do this when a diskette with the write protect tab installed (or removed, depending on the type of drive) is inserted into the drive. User-supplied circuitry which parallels this operation (asserts the WRITE PROTECT line whenever the drive is selected and an external switch is closed) would implement write protection for that drive.

Most Winchester disk drives do not have removeable media with a write protect tab. There is no WRITE PROTECT line in the Winchester disk drive interface. However, there is a WRITE FAULT line, which is used to report write errors caused by condidions within the drive. The UDC11 can use this line, in the same way that the WRITE PROTECT line is used by a floppy disk drive, to implement write protecting of the Winchester drives. All logical units within a physical Winchester drive are write protected together.

4 Q-Bus Interface

The UDC11 controller is installed by plugging it into a standard LSI-11 backplane. Since the UDC11 is a device which requests interrupt service and DMA access to the bus, it must be installed so that the the interrupt acknowledge/DMA grant daisy chain is unbroken. Also, the UDC11 should be given a fairly high priority by installing it electrically near the LSI-11 processor. However, if there are DMA devices in your system without sector buffers (such as a magnetic tape controller) they should be at a higher priority than the UDC11. The UDC11 may have other devices installed after it in the daisy chain.

The UDC11 uses the 'position dependant' interrupt priority scheme as described in the DEC Microcomputers and Memories handbook. Therefore, devices with a higher interrupt priority then the UDC11 should also be installed electrically closer to the processor.

The UDC11 uses cardedge pins AF1, AH1, AE1, and BH1 to implement write protection. These pins are normally non-bussed spares. Unless you are using the UDC11's write protection facilities, these pins must be left unconnected.

5 Disk Drive Interface

The UDC11 50-line I/O cable (J1) will interface directly with a single 5.25" Winchester drive. Multiple 5.25" Winchester drives may require, and floppy drives do require, personality cards. The rules for cable termination should be followed.

5.1 Cable Specifications

The following table describes how to connect the UDC11 50-line connector to the 34-line and 20-line card edge connectors on a 5.25" Winchester drive.

Pin 1 of the UDC11 50-line connector is the end near the center of the card. Cables in Andromeda subsystems have pin 1 marked in RED.

UDC11 50-Line Connector

GND	SIGNAL	NAME	5.25" WINCHESTER DRIVE CONNECTION
1	2	REDUCE WCURR	J1-1,2
3	4	HEAD SELECT 2	J1-3,4
5	6	WRITE GATE	J1-5,6
7	8	SEEK COMPLETE	J1-7,8
9	10	TRACK 0	J1-9,10
11	12	WRITE PROTECT	J1-11,12
13	14	HEAD SELECT 0	J1-13,14
15	16	SECTOR	J1-15,16
17	18	HEAD SELECT 1	J1-17,18
19	20	INDEX	J1-19,20
21	22	READY	J1-21,22
23	24	STEP	J1-23,24
25	26	DRIVE SELECT 0	J1-25,26
27	28	DRIVE SELECT 1	J1-27,28
29	30	DRIVE SELECT 2	J1-29,30
31	32	DRIVE SELECT 3	J1-31,32
33	34	DIRECTION	J1-33,34
35	36	F MOTOR ON	(Floppy only, do not connect
37	38	F WRITE DATA	to 5.25" Winchester Drive)
39	40	F READ DATA	
41,42		GROUND	J2-11,12
	43	W WRITE DATA +	J2-13
	44	W WRITE DATA -	J2-14
45,46		GROUND	J2-15,16
	47	W READ DATA +	J2-17
	48	W READ DATA -	J2-18
49,50		GROUND	J2-19,20

Pins 35-40 must be left open. Do NOT connect them to 5.25" Winchester drive pins J2-5 thru J2-10. Note that Winchester drive pins J2-1 thru J2-10 are unused.

5.2 Personality Cards

For systems containing anything other than a single 5.25" Winchester drive, personality cards may be needed to adapt the UDC11 50-line I/O cable to each drive.

Current personality cards include:

WPC5F Personality card for 5.25" floppy drives. The WPC5F rearranges the control signal lines.

WPC5W Personality card for 5.25" Winchester drives in systems with multiple Winchester drives. The WPC5W performs the radial data multiplexing (not required with many new Winchesters).

Each personality card plugs directly on to the back of its drive without extending beyond the drive envelope, and contains a 50-line flat cable connector which interfaces directly with the UDC11 50-line I/O cable.

Every floppy drive in a system requires a WPC5F.

Some Winchester drives disable their READ DATA lines when they are not selected and some leave them enabled always. If you are using two drives of the first type, they may be daisy-chained without using 2 WPC5W cards if your cable is fairly short (3 feet or less). Winchester drives have non-removable terminators for the WRITE DATA lines but the UDC11 is capable of driving multiply terminated lines.

Details of installing personality cards are in an appendix at the end of this manual.

5.3 Termination

When more than 1 drive is connected to a UDC11, the termination of the cable should be carefully considered. This is tricky because the UDC11 can connect to both Winchester and floppy drives. Some lines are terminated by the Winchester, some by the floppy, and some by both. Here are some examples:

1) In a system with only 1 drive (Winchester or floppy) the terminators must be installed.

2) In a system with 2 Winchesters, put the drive with the most heads at the end of the cable and install the terminators on that drive only. This is done so that all of the head lines that are used will be terminated.

3) In a system with a Winchester and a floppy, put the Winchester at the end of the cable and install the terminators on the Winchester. If the floppy has separate jumpers for each termination, install the terminators for WRITE DATA and MOTOR ON (HEAD LOAD) only. Otherwise, install all the terminators. If you do this, SIDE SELECT, DIRECTION, STEP, and WRITE GATE will be doubly terminated but the UDC11 is capable of driving multiply terminated lines.

4) In a system with 2 Winchesters and 2 floppies, terminate the Winchesters as in 2) above. Floppy WRITE DATA and MOTOR ON (HEAD LOAD) may be terminated on the WPC5W at the end of the cable. In this case, remove the terminators from both of the floppies. Otherwise, terminate the last floppy as in 3).

In any case, never install more than two terminators (one on a Winchester and one on a floppy) in any one system.

6 Online Configuration Tool (OCT)

OCT is used to describe the Winchester and floppy disk drives in your system to the UDC11 controller. This information is stored in non-volatile RAM on the UDC11. You need to run OCT only when you first install your UDC11, or when you want to change the unit assignments or drives connected to the UDC11. OCT is an RT-11 program which directly access the LSI-11 I/O page and must be run under an operating system which supports this. To run OCT, enter:

```
.R OCT
```

OCT will ask if you want to configure a UDC11 at the alternate CSR address (172144). If you answer NO, the standard address (172150) will be used.

OCT will list your current system configuration. The configuration consists of one set of unit assignments and four sets of drive parameters. OCT will ask if you want to change the configuration. Answer YES to change the assignments or parameters.

6.1 Unit Assignments

The UDC11 supports up to 8 DU units and can control up to 4 Winchester and floppy disk drives. Unit assignments describe which DU units are assigned to which physical drive. Units are numbered 0 to 7 and drives are numbered 0 to 3. If you have a Winchester or floppy disk drive that labels its drive select lines 1 to 4, you will have to transpose.

If you want to change the unit assignments, OCT will prompt you for a list of DU units to be assigned to each drive. Enter all the units for each drive on 1 line. If you do not assign any units to a drive, that drive will remain unused. If you do not assign a unit to any drive, that unit will be considered offline by the controller.

You may assign more than 1 DU unit to a Winchester drive. Tha available data storage is divided evenly between all of the units on that drive. OCT uses the drive parameters for each drive to calculate the unit size of each unit.

DO NOT assign more than 1 DU unit to a floppy drive.

If your Winchester is greater than 20 Mbytes, it is usually a good idea to have at least 2 units per drive.

If you are using a removable+fixed drive (DMA 5/5 or 11/11), you must assign 2 DU inits to that drive.

Drive 3 remains selected when the UDC11 is idle. If you have 3 drives with removable media and 1 fixed Winchester, configure the fixed Winchester as drive 3.

If you are using the UDC11 as the system device, make sure to reassign the same logical units to that drive. If you modified the unit size

for that drive (see Unit size? below), you must access the drive parameters for that drive and modify it again.

Some typical unit assignments are shown:

Drive 0= DU0:	Drive 0= DU0:, DU3:	Drive 0= DU1:
Drive 1= DU1:	Drive 1= DU1:	Drive 1= DU2:
Drive 2= DU2:	Drive 2= DU2:	Drive 2= DU0:
Drive 3= (unused)	Drive 3= DU4:, DU5:	Drive 3= (unused)

RT-11 supports up to 8 DU units. Drives containing more than 65535 blocks must be broken up into separate units. This can be done either with OCT (by assigning multiple units to 1 drive), or by using SET options on the DU handler. If partitioning is done with OCT, all the units will be the same size. If partitioning is done with SET commands, all the units will be 65535 blocks except 1, which may be smaller. See the SET command in the RT-11 User's Guide.

Micro/RSX supports only 4 DU units. To use more requires a SYSGEN. DO NOT assign any unit numbers greater than 3 unless you have generated a system that will support them.

Micro/RSTS supports only 4 DU units. The system will crash if unit numbers greater than 3 are assigned. DO NOT assign any unit numbers greater than 3.

6.2 Drive parameters

The UDC11 can control many different types of Winchester and floppy disk drives. Drive parameters are the relevant specifications the UDC11 must know to be able to control each drive.

OCT will display a list of drives. If your drive is on the list, enter the manufacturer and model. If your drive is not on the list, you may enter the drive parameters one by one.

The relevant parameters are:

Is the drive a Winchester or a floppy?

> Enter W or F.

Is the drive hard-sectored?

> Some Winchester drives are hard-sectored and use pin J1-16 on their interface as a SECTOR line. These drives include Iomega Beta-5, DMA 5/5, and DMA 11/11. If you select hard-sectored, 256 byte sectors are selected automatically.
>
> Soft-sectored drives always use 512 byte sectors because more data can be stored on each track.

Does the drive require reduced write current?

Early drives used pin J1-2 to reduce write current on the inner tracks (e.g. ST506). Answer YES if your drive requires this. Many manuals lebel this pin REDUCED WRITE CURRENT even if the drive does not use it. Check the text which describes this pin.

Does the drive have BOTH a removable AND a fixed platter?

DMA 5/5 and 11/11 fit this description.

How many 512-byte blocks per track?

Winchesters with 10416 bytes per track (unformatted) can fit 18 blocks per track. 5.25" floppies can fit 10 blocks per track. 8" floppies can fit 16 blocks per track. For hard-sectored Winchesters with 256 bytes per sector, blocks per track is equal to sectors per track divided by 2. If sectors per track is odd, subtract 1 before dividing. For example, a DMA 11/11 with 35 256-byte sectors per track can store 17 blocks per track.

How many heads?

For Winchesters, enter the number of data surfaces (don't count the servo surface if your drive has one). Get this from the drive specifications. For removable+fixed drives, use the number of heads per unit. For example, a DMA 11/11 drive with 1 removable platter and 1 fixed platter has 2 heads per unit.

How many cylinders?

For Winchesters, enter the number of cylinders. Get this from the drive specifications.

Unit size?

OCT calculates the unit size from the unit assignments and drive parameters for that drive. All units on a drive are the same size. You can make each unit smaller (and waste some of the storage capacity) by not using the calculated value here. This is useful to make drives with different amounts of storage contain DU units of the same size.

How many tracks?

For floppies, enter the number of tracks per side, usually 80 for 5.25" floppies or 77 for 8" floppies. Get this from the drive specifications.

How many sides?

This is the number of heads on the drive. Get this from the drive specifications. If you have double sided floppy drives, the number of sides on a disk is determined when the disk is formatted.

What is the step rate?

This is usually described in the drive manual in the section about interface line J1-24 (STEP). For Winchesters, use the buffered step rate, usually 20 us or 100 us. CMI Winchesters require 200 us. Winchesters which do not support buffered seek use 3000 us (3 ms). Floppies use 3000, 5000, 6000, or 8000 us. Your drive should use one of the above step rates.

If you are using the UDC11 as the system device, DO NOT change the parameters on that drive (except to re-modify the unit size as discussed above).

You may modify the unit assignments and drive parameters as many times as you wish. The data has not yet been programmed into the non-volatile RAM on the UDC11. If you exit OCT, the original configuration will remain unchanged.

If you are finished modifying assignments or parameters, OCT will ask if you want to program the new parameters into the non-volatile RAM on the UDC11. If you answer YES, the current configuration will become permanent.

You may use OCT at any time to inspect the current configuration. The non-volatile RAM chip on the UDC11 can be re-programmed more than 10,000 times. The data retention of the RAM is greater than 10 years.

7 UDCT Diagnostic/Formatter

UDCT is used to format floppy media, to qualify fixed and removable Winchester media (format, verify, and replace bad blocks), and to test the UDC11 system for data reliablility. UDCT is an RT-11 program which directly access the LSI-11 I/O page and must be run under an operating system which supports this. To run UDCT, enter:

```
.R UDCT
```

UDCT will ask if you want to test a UDC11 at the alternate CSR address (172144). If you answer NO, the standard address (172150) will be used.

UDCT will describe the 4 physical drives in your system and ask for a list of drives to be formatted or tested. Enter all of the drives on 1 line. UDCT can perform the following functions:

F	Format floppy (floppy only)
Q	Qualify media (format and verify)
V	Verify (write random data, read)
B	Bad block scan (read only)
R	Replace a block manually (Winchester only)

7.1 Formatting Floppies

The UDCT Format function is used to format floppies. If your system has double sided floppy drives, the UDCT Format function determines whether a floppy will be single or double sided.

Unit size is determined by an operating system at the time a unit is initialized. If you Format a floppy single sided, your operating system will never try to use the second side. In this way, single sided RX50 compatible floppies can be generated on double sided drives.

If you format a floppy double sided, your operating system will use the second side automatically. This way, you can store twice as much data on each floppy.

7.2 Qualifying Winchester Media

Winchester media typically has bad areas on the disk which should not be used for data storage. Winchester drives must be tested after they are formatted to replace these bad blocks. The UDCT Qualify function performs this task. Floppies may be qualified also (although their bad blocks are not replaced).

If you have a new Winchester drive, or a new removable Winchester cartridge, it's a good idea to Qualify the media overnight. In the morning, you should find an error log with several errors in the early passes and many passes which are error free.

7.3 Verifying System Reliability

The Verify function can be used to continue a Qualify operation. The bad blocks already replaced will remain replaced.

7.4 Bad Block Scan

The UDCT Bad Block Scan can be used to check for possible trouble spots on a working system. You may elect to replace bad blocks or just list them in the error log. If you leave bad block replacement enabled, UDCT will attempt to read any block in error 256 times before replacing it. If the block can be read, the data is saved and written to the new replacement block.

7.5 Replacing Bad Blocks

The UDCT Replace function is used to manually replace a block. For example, if you have a Winchester with one known bad block, you can format it, abort the testing, and replace the block yourself. This function is also useful when you bad block scan a working system with replacement inhibited. If a bad block is found, you can decide whether or not to attempt to replace it.

You do NOT have to replace all of the blocks on the manufacturers bad block list. If UDCT can't find an error in a block overnight, that block is usable by the UDC11.

7.6 UDCT Operation

Depending on the drives and function selected, UDCT asks various questions. These include:

Inhibit bad block replacement on Winchesters?

> Normally, UDCT attempts to replace all blocks which have errors. Answer YES to this question to leave the bad block mapping unchanged.

Test fixed platter on removable+fixed Winchesters?
Test removable platter on removable+fixed Winchesters?

> These types of drives can format or test only one of the platters if you desire. For example, you can be running on the fixed platter and Qualify the removable platter. If you answer NO to the first question, the second question is not asked.

How many sides on floppies?

> If your system includes double sided floppies, you can elect to format or test only 1 side.

Generate an error log file?
Error log file name?

Functions Q, V, and B can generate an error log file. If you answer YES to this question, you will be prompted for the file name. Do not store the file on the same drive you are testing unless unless you are doing a Bad Block Scan. The unit containing the error log file must NOT be write-protected.

Are you sure?

The drives and functions requested are displayed and you are asked for confirmation. This question does not appear for Bad Block Scans with replacement inhibited.

While UDCT is formatting or testing, the current pass, drive, and cylinder are displayed. A pass is defined as reading every block on every drive once. If an error occurs, the error number and description are displayed along with the pass, drive, cylinder, head, and sector. The sector is the physical sector on the drive. Sectors are numbered from 0 on Winchesters and from 1 on floppies. If you are testing a Winchester with replacement enabled, the results of the replacement operation are also displayed.

On even passes, Qualify and Verify functions write and read, and the cylinder number increases. Odd passes are read only, and the cylinder number decreases. This checks for hysteresis in the positioner.

To abort the testing, type control-C twice. The current pass is diaplayed and the error log file is closed.

7.7 Error Codes

The following error codes can be displayed by UDCT:

NOT RDY	Drive is not ready or no floppy
WPROT	Drive or media is write protected
FORCED	Sector written with forced error
HNF	Correct header not found in 1 revolution
DMNF	Data mark not found after correct header
BAD HDR	Incorrect header format
CRC	Data CRC error
SEEK	Seek error (wrong cylinder)
NO DATA	Unformatted track or data cable unplugged
WFAULT	Drive reports a write fault

8 Bootstrap ROM

The UDC11 contains a bootstrap ROM which responds to Q-Bus addresses 17773000 thru 17773776 (if jumper S1 is installed). LSI-11 processors can be jumpered to always execute this code upon power up or system reset. The UDCBR program can bootstrap DU devices or DL devices. When the code is executed, it enters a loop which waits for one of four events to occur:

DU1, DU0, or DL0 becomes ready

any key is pressed on the console terminal

If DU1, DU0, or DL0 becomes ready, the UDC11 will automatically bootstrap that unit. If a key is pressed on the console terminal, the program will prompt the operator with:

Device?

The operator then enters a two letter device name, optional unit number, and optional colon (:). When RETURN is pressed, the program scans the line for correct syntax. If the syntax is correct, the program will wait for the specified unit to become ready, and bootstrap that unit. If the syntax is incorrect, the device prompt will be repeated.

The first key pressed (the one that initiated the prompt) is used as the first character of the line. Lower case letters are permitted, and function just like upper case letters. Also, syntax is scanned from the end of the line to the beginning. If you make a mistake, just start over.

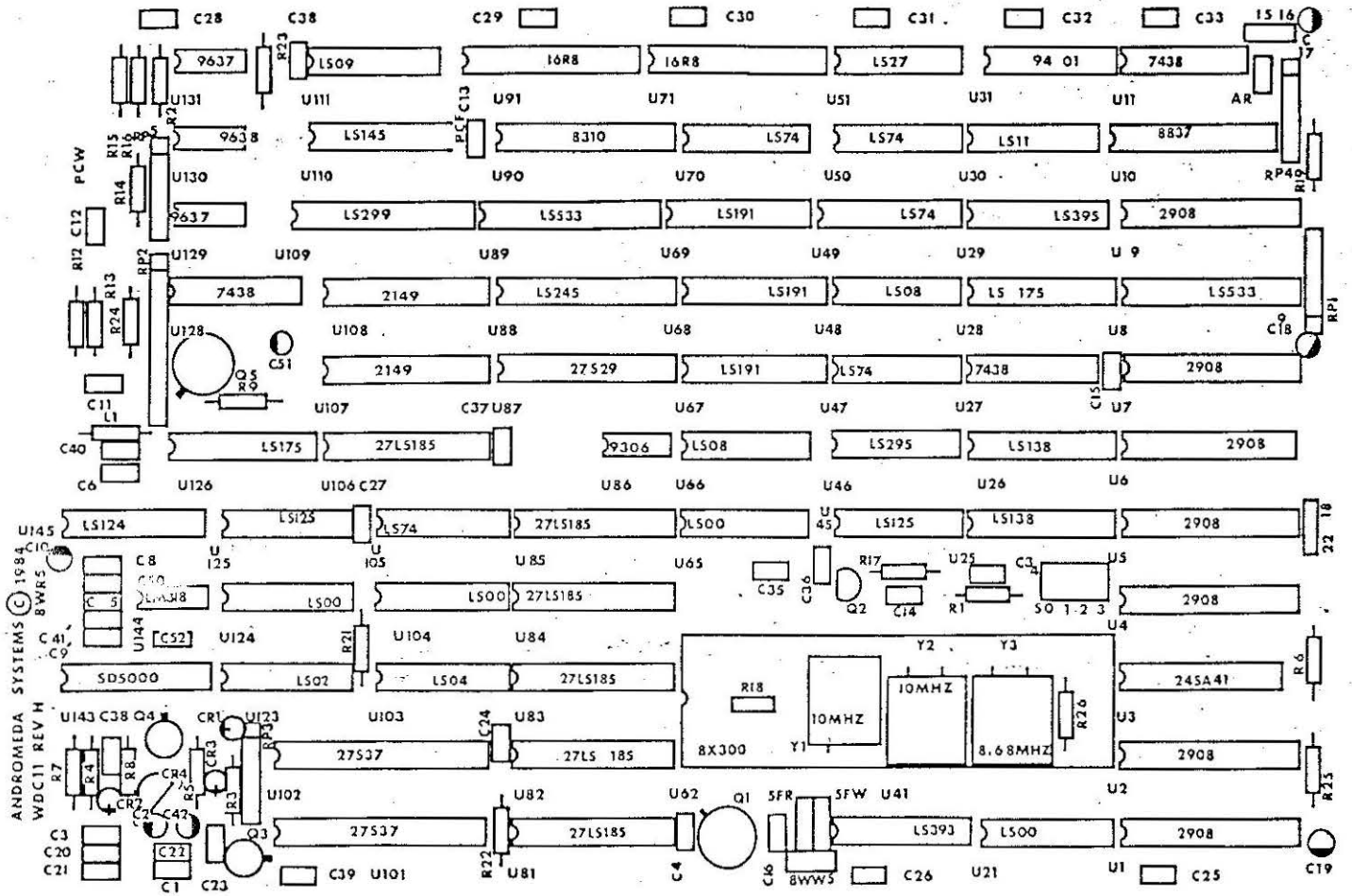
Examples of valid input are:

du DU DL: DL0: dl1

this is a mistakeDU1:

One more operator convenience feature is incorporated. When the code is first executed, there is a short delay (less than 1 second) before the loop begins. This gives an operator time to press a key in case an undesired disk is already ready.

REDUCE TO 7.550



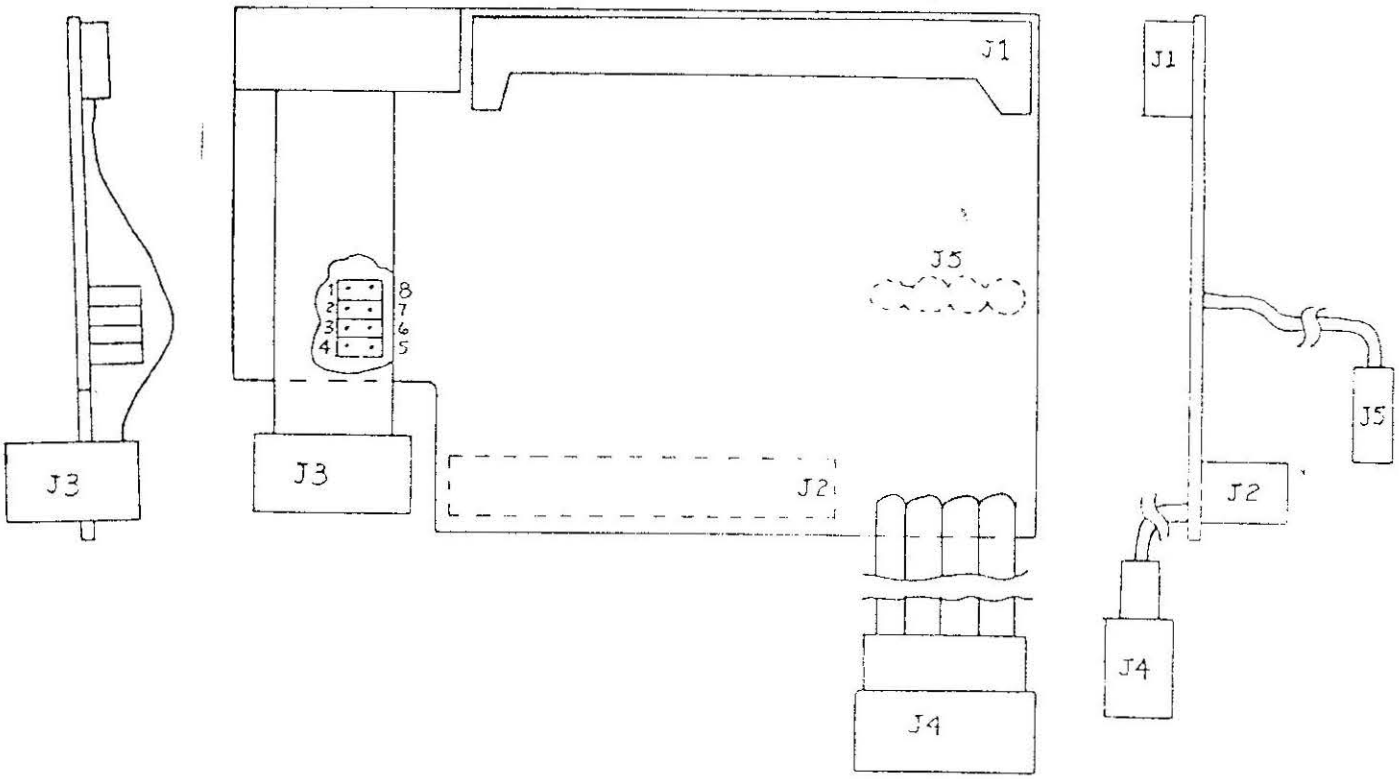
* WPC5W

The WPC5W personality card is used to connect the UDC11 50-line cable to 5.25" Winchester disk drives in systems that contain more than one 5.25" Winchester drive. Each 5.25" Winchester drive in a multiple drive system requires a WPC5W. The WPC5W contains four pairs of jumpers that enable the termination of specific signal lines when installed.

1-5	W READ DATA +, -
2-6	W WRITE DATA +, -
3-7	F WRITE DATA
4-8	F HEAD LOAD

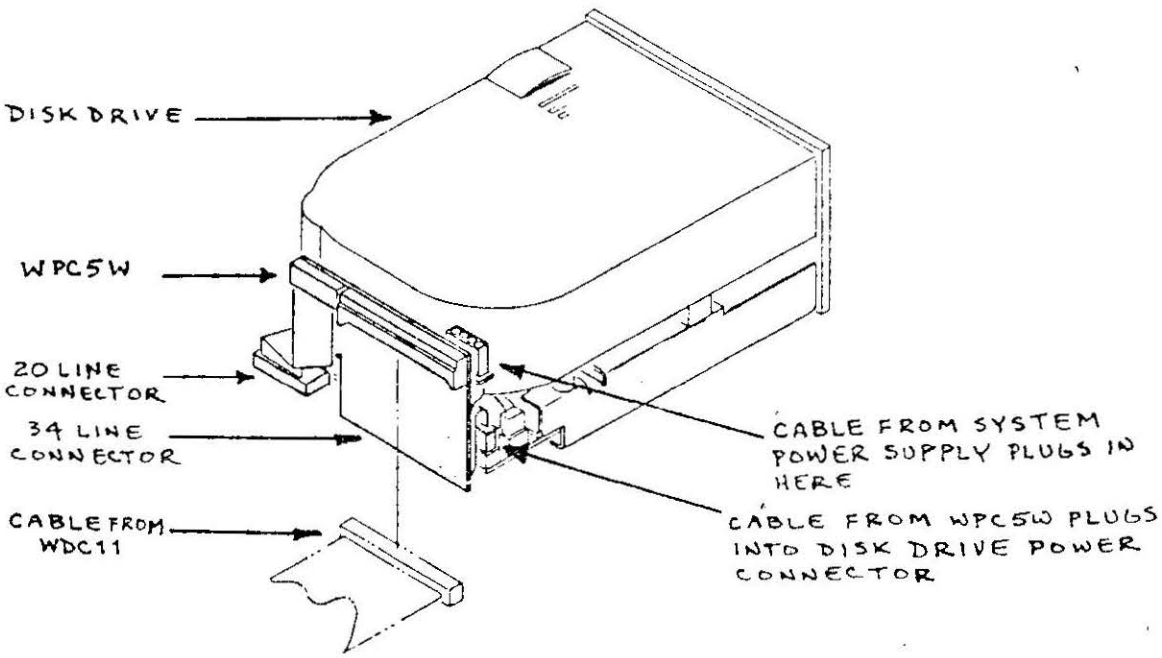
These jumpers should be installed on the last WPC5W only.

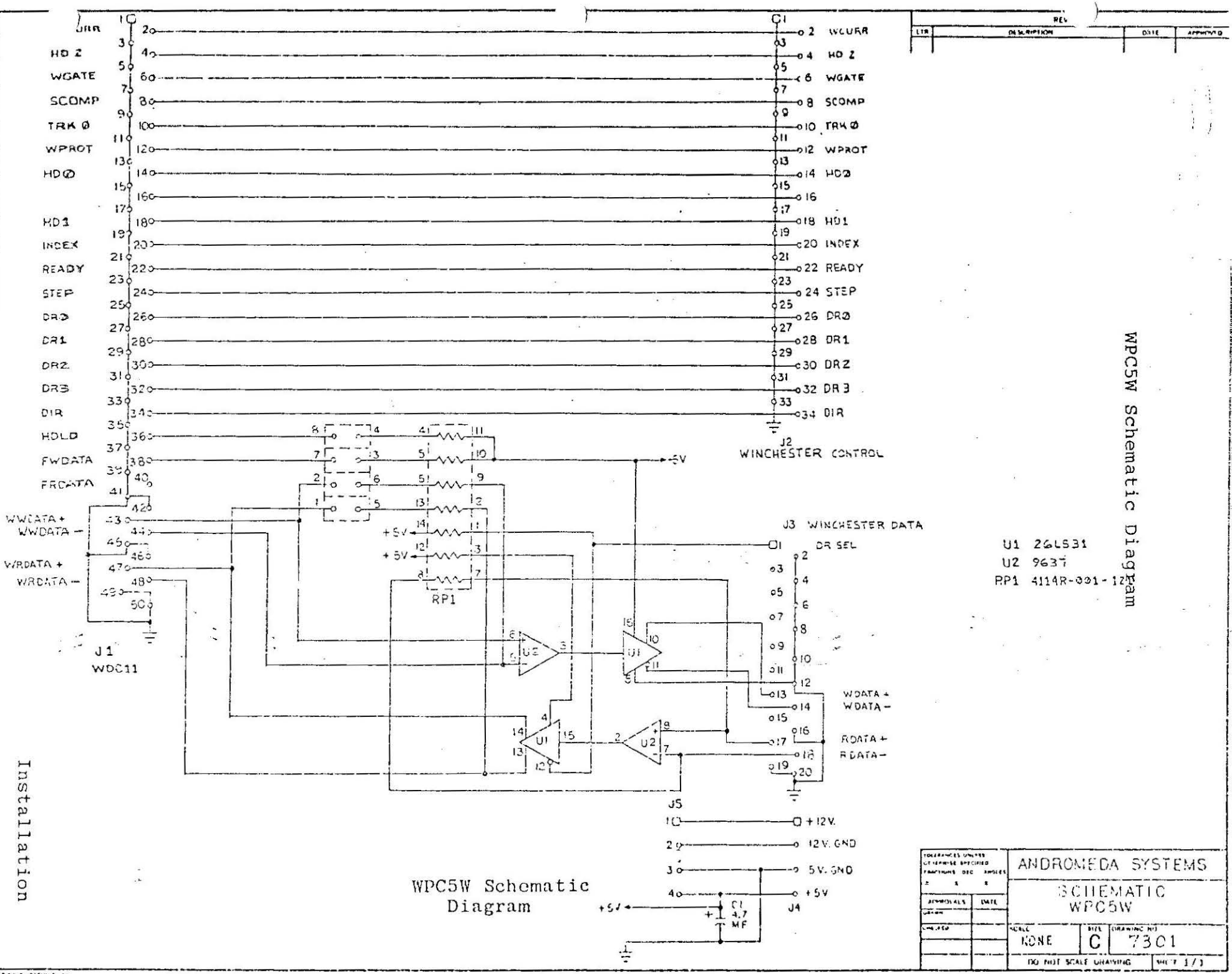
WPC5W Physical Board Layout



Attach the WPC5W to the disk drive as shown below. The 34-line PC edge connector of the WPC5W attaches to the 34-line connector of the disk drive. The 20-line PC edge connector attaches to the 20-line connector. The WPC5W requires +5 Volts DC for its terminators and active components. It gets its power from the cable that would normally plug directly into the disk drive. Plug the male power connector of the WPC5W into the female power connector of the disk drive. Plug the 50-line cable from the UDC11 into the 50-line connector of the WPC5W and plug the male power connector from your system's power supply into the female power connector of the WPC5W.

WPC5W Installation



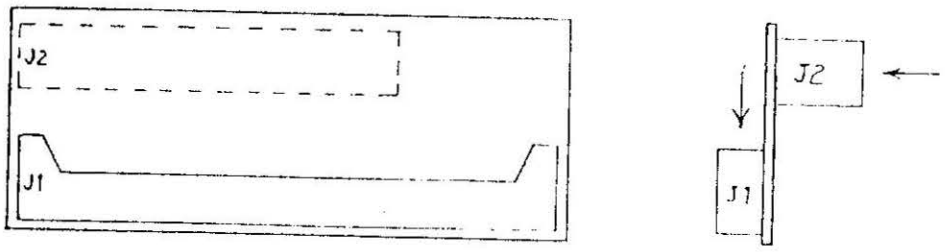

J2
WINCHESTER CONTROL
J1
WDC11
J3 WINCHESTER DATA
J4
J5
RP1
U1 26LS31
U2 9637
RP1 4114R-001-122
WPC5W Schematic Diagram
WPC5W Schematic Diagram
Installation
ANDROMEDA SYSTEMS
SCHEMATIC
WPC5W
NONE
C
7301
DO NOT SCALE DRAWING
SHEET 1/1

WPC Winchester/Floppy Personality Cards

* WPC5F

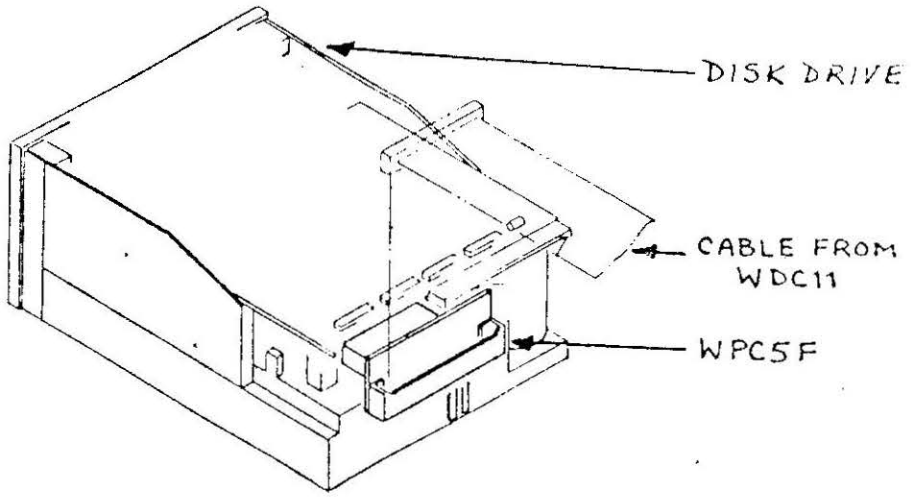
The WPC5F personality card is used to connect the UDC11 50-line cable to 5.25" floppy disk drives. The WPC5F contains no user configurable options.

WPC5F Physical Board Layout

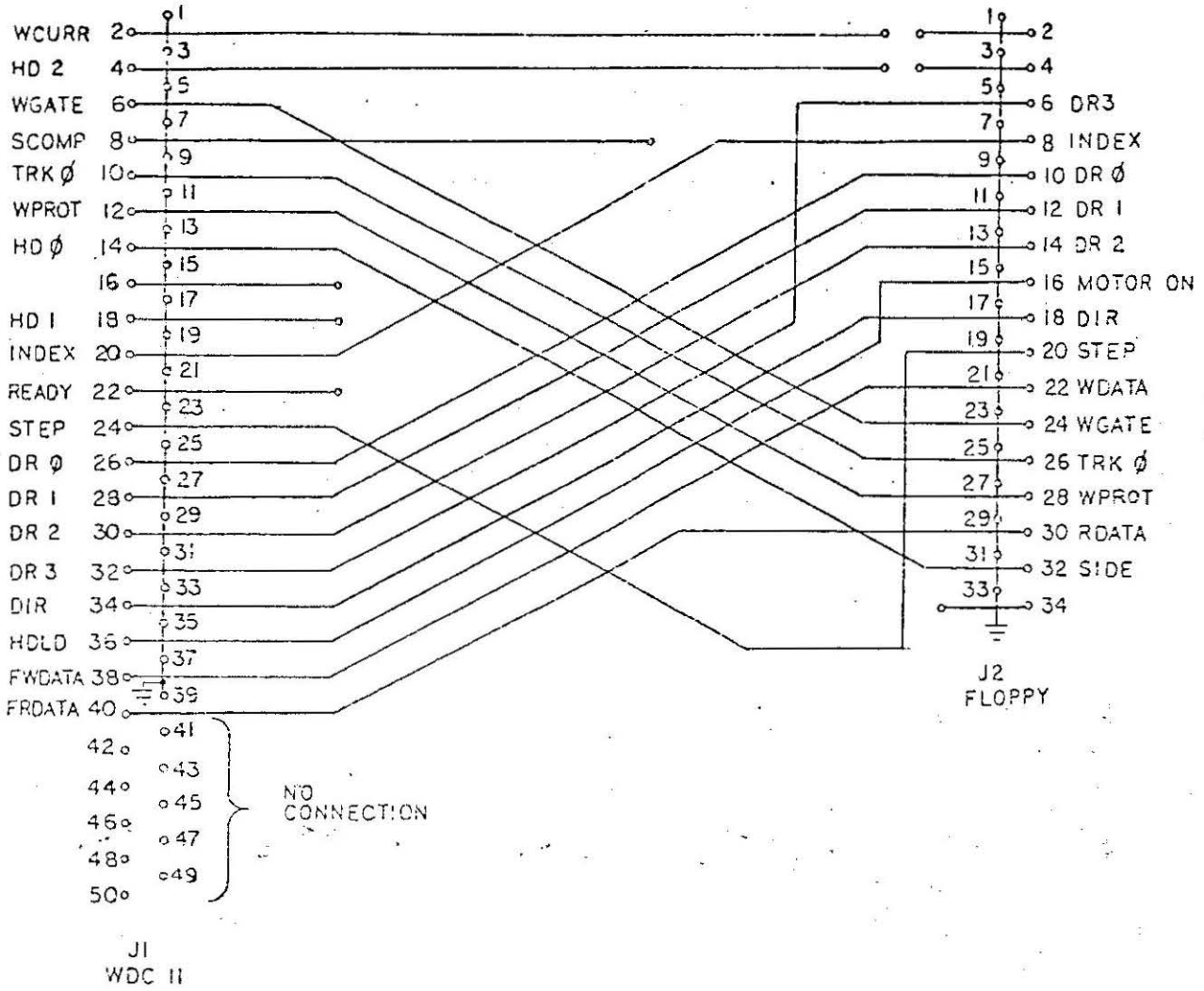


Attach the WPC5F to the disk drive as shown below. The 34-line PC edge connector of the WPC5F attaches to the 34-line connector of the disk drive. Plug the 50-line cable from the UDC11 into the 50-line connector of the WPC5F.

WPC5F Installation



REV			
LTR	DESCRIPTION	DATE	APPROVED



WPC5F Schematic Diagram

WPC5F Schematic Diagram

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES	ANDROMEDA SYSTEMS	
APPROVALS / DRAWN V3 / CHECKED	DATE	WPC5F SCHEMATIC
	SCALE NONE	SIZE C / DRAWING NO. 7001
	DO NOT SCALE DRAWING	SHEET 1/1

UDC11 Configuration Sheet

P/N UDC11 S/N _____ S/O _____

Customer _____ Date Shipped _____

JUMPERS:	LABEL	SHIPPED	CURRENT	DESCRIPTION
Select:	S3	IN	___	standard address (172150)
	S2	OUT	___	alternate address (172144)
	S1	IN	___	standard boot ROM (173000)
	S0	OUT	___	alternate boot ROM (171000)
DMA:	22	IN	___	22 bit DMA addressing
	18	OUT	___	18 bit DMA addressing
Interrupt:	I5	OUT	___	interrupt at priority level 5
	I6	OUT	___	interrupt at priority level 6
Precomp:	PCW	IN	___	Winchester write precomp
	PCF	IN	___	floppy write precomp
Other:	WW5	IN		DO NOT REMOVE
	5FR	IN		DO NOT REMOVE
	5FW	IN		DO NOT REMOVE
	AR	IN		DO NOT REMOVE

PROMS:	INSTALLED TYPE
Microcode:	UDC _____
Address:	WADU ____
Bootstrap:	_____