

INSTALLATION AND OPERATION MANUAL

Models D100Q and D100U

For RT-11 and TSX+

DECIMATION

16-May-83

REVISION NOTICE

This is the May 1983 edition intended for use with software version 1.5 and later.

ABSTRACT

This manual provides installation, configuration, and daily operation information for the Decmation D100Q and D100U models, running under RT-11 or TSX+

TRADEMARKS

CP/M is a registered trademark of Digital Research, Inc.

DEC, Unibus, and PDP are registered trademarks of Digital Equipment Corporation.

Copyright 1982, 1983 DECMATION
All rights reserved. Printed in the USA.

All specifications subject to change without notice.

DECMATION

3375 Scott Blvd. Suite 422
Santa Clara, California 95051
(408) 980-1678

CONTENTS

CHAPTER 1.	INTRODUCTION	4
CHAPTER 2.	HARDWARE INSTALLATION	5
2.1	D100Q Installation for Q-Bus computers	5
2.2	D100U Installation for Unibus computers	9
CHAPTER 3.	SOFTWARE INSTALLATION	
3.1	Distribution Kit	11
3.2	Backing Up the Distribution Media	14
3.2.1	Systems with Floppy Disk Drives	14
3.2.2	Systems without Floppy Disk Drives	14
3.3	Configuring the Software	15
3.3.1	With Factory-configured Card	15
3.3.2	With Re-Jumpered Card	16
3.3.3	Using the TSX+ Operating System	16
CHAPTER 4.	RUNNING UNDER CP/M	
4.1	Setup Mode	17
4.2	Defining CP/M Disks and Devices	19
4.2.1	Rules for Disk and Device Assignments	19
4.3	Creating CP/M Pseudo Disks	21
4.4	Console Keyboard	22
4.5	Using the Line Printer with CP/M	24
4.6	Copying CP/M Disks	25
4.7	RT-11 and CP/M File Interchange	25
4.8	Command Files	26
4.9	Miscellaneous Commands	27
APPENDIX A.	USING THE D100QU UNDER TSX+	28
APPENDIX B.	CUSTOM SOFTWARE PATCHES	29
APPENDIX C.	BOARD JUMPERS	33
APPENDIX D.	COMMAND SUMMARY	36
APPENDIX E.	ELECTRICAL SCHEMATICS	37

CHAPTER 1. INTRODUCTION

This manual provides installation and operation information for the following DECMATION products:

1. **D100U:** A Z80 processor card which provides CP/M capability to the Unibus based PDP-11 computers. The Unibus computers include the PDP-11/05 /10 /15 /20 /24 /34 /40 /44 /45 /60 and /70 computers.
2. **D100Q:** A Z80 processor card which provides CP/M capability to the Q-Bus based PDP-11 computers. These computers are also commonly referred to as LSI-11 computers. **For simplicity we use PDP-11 to refer to the entire DEC 16 bit microcomputer series which includes both Q-Bus and Unibus systems.** The Q-Bus computers include the PDP-11/23 or LSI-11/23, 11/2, 11/03, and the Micro PDP-11

References to the D100QU apply to both the D100Q and D100U models.

This manual is complete for the D100QU on computers running the RT-11 and TSX+ operating systems. Separate manuals are provided for RSX-11M and other operating systems when appropriate.

When the Z80 processor is running CP/M, all I/O requests generated by CP/M are serviced by the PDP-11 operating system. The standard CP/M format eight-inch floppy disks may be used if your system has a RX01 or RX02 compatible floppy drive. Also, you can create files on any RT-11 or TSX file structured device which can serve as CP/M disks. These files, called CP/M "pseudo disks", may co-exist on the same device with your current RT-11 biased software.

This manual uses standard command syntax notation. All text to be typed at the console terminal is boldfaced and indented. Acceptable abbreviations are denoted by upper-case letters, and entries may be done in any mixture of upper and lower case.

It is recommended that you read the entire manual before beginning installation and configuration to familiarize yourself with the system.

CHAPTER 2. HARDWARE INSTALLATION

This chapter tells how to select a bus address in the PDP-11 I/O page for your D100QU, how to change the factory-set bus address, how to insert the card, and how to test it with the diagnostic program.

The D100QU circuit card is configured at the factory so that the bus address does not usually need to be changed, except in the case of multiple cards installed on the same system. Hardware installation normally consists of simply plugging the card into the computer backplane, in the proper position. Appendix C details how to reprogram the card for a different bus address when this is required.

The actual hardware installation process is quite simple, but if you are not sure that you have the technical skill and experience, please seek assistance. Your best source of assistance may be the person who services your computer.

2.1 D100Q Installation for Q-bus computers

The D100Q, as shipped from the factory, is jumpered to respond to bus addresses within the range 777160-777166. These addresses are not used by any standard device supplied by Digital Equipment Corporation, but it is still possible that some device in your system uses these addresses. You can perform the following test under console ODT to make sure that the addresses are unused:

1. Turn on the computer and enter the following under the console ODT:

777160/

2. If after typing the "/" the computer responds with a question mark "?", continue to check the other three addresses in the same manner by entering:

777162/

777164/

777166/

If the "?" response occurs for all four of these addresses, there is no conflict between the factory set address of the D100Q and all other devices in your system.

3. If the response to the "/" for any of these addresses was a six-digit octal number, there is some other device using that address, and you must reprogram the D100Q to a different address as follows:
 - a. Choose four consecutive word addresses whose last digits are 0, 2, 4, 6 and lie within the range 760000-777776. Make sure that the addresses you choose are

not also conflicting with some other device by using the same procedure described above.

- b. Try the following addresses as the first alternate:

777360-777366

These addresses are also not used by any standard DEC device, and the D100Q is easily rejumped to this range. Consult appendix A for instruction on how to change the interface address by rejumping the card.

- c. To change the factory address of 777160 to 777360 it is only necessary to change one jumper, J-12-7, from +5 to ground.
4. Open up the panel for access to the backplane.
 5. The card may be inserted into any Q-bus slot in the backplane, without regard to grant continuity. This is possible because interrupts are not used.

On many backplanes, all slots are wired as Q-bus slots. However, in the backplanes designed to be compatible with the RLV11 disk controller (namely the H9273, H9275 and H9276), only connector A/B is wired for the Q-bus (see figure 1). If there are no dual width cards installed in connector C/D, it is likely that you have this type of backplane. In this case, the D100Q must be installed in the A/B connector. If there are no free Q-bus slots remaining in your backplane, either remove a device which is no longer needed, or purchase a Q-bus expansion backplane.

To install the card in the computer backplane, follow these steps:

1. Turn off the electrical power to the computer.
2. Orient the card so that the components are on the same side as they are on the rest of the cards in your backplane.
3. Carefully line up the card with the connector and card guides, and push the card into the chosen slot.
4. Turn on the computer. Under ODT, inspect the four registers of the D100Q. For the standard address, type:

777160/

The computer should respond with a six-digit octal number.

5. Press the line-feed key two times. After each line-feed, the computer should again respond with a six-digit number.
6. To check that the installation has been done correctly, run the diagnostic program supplied: D100QU. Copy the file D100QU.SAV on to your RT-11 or TSX system device.

7. Type:

.RUN D100QU

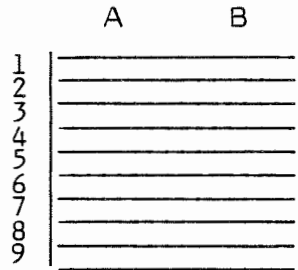
If you have rejumped the D100Q for an address other than the standard alternate address (777360) the following message is displayed:

The D100QU is not found at the standard address or the standard alternate address. Enter the six-digit octal address--->

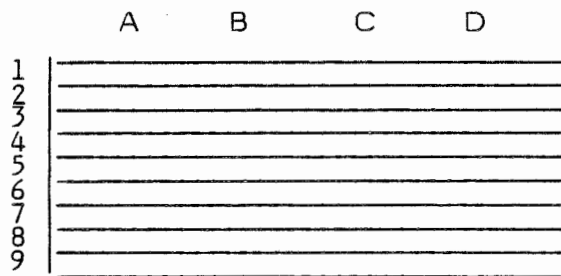
8. Assuming the diagnostic finds the D100Q at one of the standard addresses or at the address specified in response to the above question, and assuming that the D100Q is operating properly, the following message is printed every few seconds:

D100QU OK! Address=177160 Pass Number=1

9. After one or two passes, you may abort the diagnostic program (via a cntrl-C).



Two Wide Backplane Layout



Four Wide Backplane Layout

(Components face toward slot 1.)

FIGURE 1 - TYPICAL Q-BUS BACKPLANE LAYOUTS

2.2 D100U Installation for Unibus computers

The D100U is jumpered at the factory to respond to bus addresses within the range 777160-777166. This is the standard address used by the CR11 card reader. Most systems without a card reader will have no conflict using the factory-set address. If your computer is equipped with a console emulator, you can check for conflicting I/O bus addresses by the following procedure:

1. Turn on your PDP-11 and enter the following under the console emulator:

```
L 777160
E
```

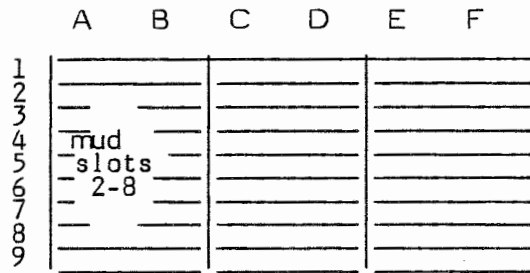
If after typing the "E", the computer responds with a six-digit octal number, there is a conflict with some other device in the system and you must jumper the D100U to a different bus address. If no device responds to this address, there is no conflict. If your PDP-11 has a switch register, rather than a console emulator, you can check the bus addresses using the switch register. A bus error results when a vacant address is examined.

2. In the event of an address conflict, choose four consecutive word addresses whose last digits are 0, 2, 4, 6 and lie within the range 760000-777776. Make sure the addresses you choose are not also conflicting with some other device by using the same procedure described above. Try the following addresses as the first alternate:

```
777360-777366
```

The D100U is easily rejumped for this range of addresses. Consult appendix C for detailed instructions.

3. The D100U may be inserted into connector A/B of any standard unibus slot or any MUD (Modified Unibus Device) slot. The best place to insert the D100U on a PDP-11/04 or 34 processor is in connector A/B rows 5 through 8, of the backplane unit which also holds the processor cards. These positions are always MUD slots. The DD11-CK and DD11-DK backplanes are often used on PDP-11 models 04, 34, 24 and 44. These backplanes contain MUD slots in positions A/B except at the first and last stations, which are unibus slots and must be used for the unibus connector or terminator. Figure 2 shows the layout of the DD11-DK backplane. The DD11-CK is similar, except that it has only four, instead of nine positions. If you are unsure about the locations of the MUD slots in your backplane, consult the engineering drawings of your system.



DD11-DK Backplane Layout

(Components face toward slot 1.)

FIGURE 2

To install the card follow these steps:

1. Turn off the electrical power to the computer.
2. Remove the top or side covers, as may be required, to gain access to the card file.
3. Orient the D100U card so that the components face in the same direction as they face on the other cards installed in the computer.
4. Push the card into the correct connector in the backplane.
5. Turn the computer electrical power back on and check to see that the D100U responds to the interface address for which it is jumpered. If the D100U does not respond, recheck your installation procedure.
6. The last step of the installation procedure is to run the diagnostic program. Run the program D100QU supplied on the distribution disk. If the diagnostic program does not find the D100U card at 777160 or 777360, it will ask you to enter the interface address at the terminal. If the card is operating properly a message "D100QU OK!" will print. After this prints, you may abort the diagnostic program.

CHAPTER 3. SOFTWARE INSTALLATION

This chapter describes the software distribution materials, procedures for backing up these materials for safekeeping, and configuration instructions. For the remainder of the manual all references to RT-11 apply to both RT-11 and TSX+ unless TSX is specifically excluded.

3.1 Distribution Kit

Three single-sided, single-density, eight-inch floppy disks with the following files are supplied:

- Disk #1 Decmation RT-11 files

- Disk #2 Digital Research CP/M operating system
 Digital Research CP/M utilities
 DECMATION CP/M utilities
 Palantir word processor

- Disk #3 Additional Palantir files

Disk #1 contains a standard RT-11 directory and can be read on either an RX01 or RX02 (or equivalent) floppy disk drive. You will find disk #2 in a sealed envelope labeled "Digital Research" along with the CP/M license agreement. Disks #2 and #3 are in standard CP/M format, and therefore, do not contain valid RT-11 directories.

Below is a list of the files contained on Disks #1 and #2 of the distribution media. Consult the supplied Palantir manual for a description of the files on Disk #3.

CONTENTS OF DISK #1

FILE NAME	DESCRIPTION
CP.SAV	RT-11 program for running CP/M (Will not run under TSX)
CP.MAP	Link map for CP.SAV
CPFB.SAV	Program to run CP/M in the background under the RT-11 foreground-background monitor
CPFB.MAP	Link map for CPFB.SAV
CPT.SAV	TSX+ program for running CP/M; Supplied only if TSX+ option was purchased
CPT.MAP	Link map for CPT.SAV
CCOPY.SAV	RT-11 program for duplicating a CP/M compatible 8-inch floppy disk (Requires an RX01 or RX02 drive)
PCOPY.SAV	RT-11 program to copy a CP/M format, 8-inch, floppy disk to a 502-block, "pseudo disk" file on a different type of mass storage device
D100QU.SAV	Hardware diagnostic program for the D100Q and D100U
CPMDSK.CDK	CP/M Pseudo disk file

CONTENTS OF DISK #2

FILE NAME DESCRIPTION

(The following files are from Digital Research.)

PIP.COM	File copy utility program
STAT.COM	File status utility
ED.COM	A CP/M line editor
ASM.COM	An 8080 assembler
LOAD.COM	Utility to convert hex files to load files
DUMP.COM	File dump utility
XSUB.COM	Program used for CP/M command files

(The following are files supplied by DECMATION.)

GENSYS.COM	Utility program for transferring the CP/M system from one CP/M disk to another; Similar in function and operation to the Digital Research program SYSGEN
REC.COM	CP/M program used to receive a file from the PDP-11 operating system
SEN.COM	CP/M program used to send a file to the PDP-11 operating system
INITFL.COM	CP/M program used to initialize a single-density floppy for use with the standard CP/M format
XDIR.COM	CP/M public domain program used to give expanded directory listings of CP/M disks
BIOS64.ASM	Source code for the "BIOS" used by DECMATION for the D100QU

(The following files are from Palantir)

WP.COM	The Palantir word processor, pre-configured for the VT-100 terminal
*.WPO	Several overlay files required by WP.COM
HELP.WPH	Help message file used by WP.COM

3.2 BACKING UP THE DISTRIBUTION MEDIA

Before using the distribution disks, make backup copies. The following sections tell how to do this for systems with and without floppy disk drives.

3.2.1 Systems with Floppy Disk Drives

If your system has an eight-inch floppy disk drive, proceed through the following steps. If you have an RX01, replace DY with DX in the following entries.

Note: The RT-11 COPY/DEV command does not copy track 0 of the floppy disk, so you must use the CCOPY program to make copies of CP/M floppies. CP/M floppies use track 0 as a system track.

1. Obtain three blank, single-density floppy disks.
2. Boot RT-11 on DY0: or your usual system device.
3. Copy disk #1 by entering:

```
.COPY/WAIT/DEVICE/VERIFY DY0: DY1:
```
4. Insert disk #1 DY0 and a blank, formatted disk in DY1. The COPY/WAIT will wait for you to do this.
5. Leave the Disk #1 copy in DY1. Copy disk #2 by entering:

```
.RUN DY1:CCOPY
```
6. Insert disk #2 in DY0 and a blank, formatted diskette in DY1. The CCOPY program will tell you how to proceed. If the CCOPY program aborts prematurely you may have re-assigned the terminal unit (in the RT-11 startup file) to other than the default unit.
7. CCOPY will let you repeat step six to copy disk #3 and to make as many copies of these disks as you like.
8. Put appropriate labels on the backup copies, and put the originals in a safe place. Note the instructions for labeling disk #2 in your license agreement with Digital Research.

3.2.2 Systems without Floppy Disk Drives

You can use the D100QU on a system that does not have a floppy drive. However, to copy the distribution media, borrow a system which has a floppy disk drive and some other RT-11 compatible media, which can also be read on your system. You will have to use this same procedure to copy CP/M software which you may purchase on standard, 8-inch CP/M disks.

To copy the distribution disk, follow these steps:

1. Boot RT-11 on the borrowed system. The D100QU does not have to be installed on the borrowed system.
2. Copy all the files on disk #1 to your alternate media as you would copy any RT-11 files.
3. Use the program PCOPY to copy disk #2 to a 502-block file named DISK2.CDK on your alternate media. The PCOPY program prompts you to perform the necessary actions.
4. Use PCOPY to copy any CP/M application software packages which you intend to use. All CP/M software is available in 8-inch, standard CP/M format.

3.3 CONFIGURING THE SOFTWARE

Use the appropriate configuration instructions below, depending on whether you have installed a factory-jumpered card, a re-jumpered card, or a card to run under TSX+.

(Note: Ignore instructions in CP/M documentation for reconfiguring the CP/M system. This has already been done for you.)

3.3.1 With Factory-Jumpered card

If you have installed the D100QU processor card with the factory-jumpered base address, use the executable file CP.SAV without modification. Proceed as follows:

1. Copy CP.SAV from the copy of disk #1 to your RT-11 system disk.
2. Insert the copy of disk #2 into DY1: (or DX1:)
3. Type:

```
.R CP
-->A: DY1:
-->GO
A> (CP/M starts)
```

After typing the GO command, CP/M will boot to the disk in DY1:. For more details on running CP/M, consult chapter 4.

Errors: A Fortran start-fail error indicates that there is insufficient memory or that you have RT-11 earlier than version 3. Insufficient memory may be corrected by unloading I/O drivers or using CPFB.SAV, which uses less memory. Error 61 indicates that the card is not responding or that the address in the program and on the card do not agree.

If you have non-DEC floppy disk drives and are experiencing problems in reading CP/M format diskettes, see appendix B.6. If PCOPY or CCOPY fail to run, you may be making logical reassignments in the file STARTS.COM in your RT-11 system.

3.3.2 With a Re-jumpered Card

If you have re-jumpered the D100QU card to a different base address, follow the directions given in appendix B to patch the common area IBASEI for a different interface address. Then follow the instructions in section 3.3.1.

3.3.3 Using the TSX+ Operating System

If you are using the D100QU under TSX+, refer to the configuration notes in appendix A.

CHAPTER 4. RUNNING UNDER CP/M

Assuming that you have completed the hardware and software installations described in chapters 2 and 3, you are now ready to run CP/M.

4.1 Setup Mode

To run CP/M you must first run the DECMATION control program (CP, CPF, CPT, etc.). The control program will type a log-on message and then an arrow prompt:

```
-->
```

The arrow prompt indicates that the control program is in setup mode, and it is waiting for you to type commands to specify how CP/M will operate.

Note: The message "no CPM.INI file present" is not an error.

In order to run CP/M, you have to tell the control program how the CP/M disks and devices are to be realized using the disks and devices of your 11-computer system. Later on, you will be able to skip the setup mode by using a command file, named CPM.INI, to enter the setup commands for you. (See section 4.8.)

To be able to boot CP/M you must, at least, specify the location of CP/M disk A:. CP/M disk A: can be realized on your PDP-11 by either a file under your PDP-11 operating system which is used as a CP/M disk, or by a floppy disk in CP/M format mounted in an RX01 compatible floppy disk drive. Commands you can use to specify disk A: would look like the following:

```
-->A: DY1:
```

or:

```
-->A: dev:filnam
```

The first command (A: DY1:) declares CP/M disk A: to be a floppy disk in drive #1. When a device name is specified without a file name, this indicates that the device contains a CP/M format disk. This is only allowed for floppy disk drives. The second command above (A: dev:filnam) declares that CP/M disk A: is to be realized by an RT-11 file which has been previously set up to be a "pseudo disk," or a file formatted internally as a CP/M disk. The default file extension is .CDK. It is not necessary to specify the extension unless a different extension is being used.

When you type the command specifying CP/M disk A:, an entry is made in an internal program table. If the CP/M disk A: is a pseudo disk, the control program will read the first block of the file when you type the command. The first block of a pseudo disk file is a header block. For this

reason, the physical device containing the pseudo disk file must be mounted or the command will be rejected with an error message.

When you specify a CP/M disk to be a floppy, in CP/M format, the floppy disk does not have to be physically inserted in the drive until CP/M attempts to access it.

Once you have defined disk A:, you can boot CP/M by typing "GOcpm". (The lower case letters in commands are optional.)

```
-->GO  
A>
```

When CP/M boots it will type its prompt: "A>". If instead you receive an error message, then you do not have a properly configured CP/M disk defined as disk A:. Start out using a copy of the distribution disk #2 to be sure that you have a valid CP/M disk.

After you have booted CP/M, you can print the directory of the CP/M disk as follows:

```
A>DIR
```

(The directory will print on the terminal.)

We will cover other CP/M commands later in this chapter. For detailed information on the operation of CP/M consult the CP/M documentation supplied in the distribution kit.

It is important to know how to exit from CP/M. Everything you can type at your terminal potentially means something to CP/M, or to a CP/M application program. To provide a means of entering a few commands, which are not passed to CP/M, one key on your terminal is considered a special shift key. By default, this is the caret key (^). If you don't want the caret key to be the special shift key, then you can change it to something else. To escape from CP/M and return to the setup mode of the control program, type: ^C. This is caret-C, not control-C. We will always write cntrl-C when we mean control-C in this manual. When you type ^C the result will be:

```
A>^C  
-->
```

You will be kicked out of CP/M and the arrow prompt of the setup mode of the control program will return. Although we have printed the ^C above, it does not echo on your terminal. At this point you could change the setup of the CP/M disks and then type GOcpm again to re-boot CP/M. If you want to exit back to RT-11, then type:

```
-->BYE
```

The command BYe causes the control program to terminate. The "." prompt of RT-11 then types. If your RT-11 system disk is a floppy, and you have removed it so that you could use the drive for a CP/M disk, then be sure to replace your system diskette before typing BYe.

So far, we have described the commands you absolutely must know to run CP/M. These are: GOcpm, ^C, and BYe. If you forget commands, you can type HElp, while in the setup mode, and a list of all the commands will be printed on the terminal. In the next section we will describe the commands to setup the CP/M system in more detail.

4.2 DEFINING THE CP/M DISKS AND DEVICES

The control program can define up to eight possible CP/M disks:

A: B: C: D: E: F: G: H:

and you can define five possible devices:

LST: PTP: RDR: SEN: REC:

The first three device names stand for printer (list), punch and reader. SEN: stands for a device to send files to RT-11, and REC: stands for a device to receive files from RT-11.

A CP/M device is an I/O port which transmits data sequentially. The devices LST:, PTP:, and RDR: are the standard CP/M devices for printer, punch and reader. These devices transmit data one character at a time. The devices SEN: and REC: are devices added to the CP/M system by DECMATION. They transmit data sequentially, in 128-byte sectors. SEN: transmits data from CP/M to RT-11. REC: receives data from RT-11.

The assignments for the CP/M disks and devices are kept in a table in the control program. The assignments currently in effect may be displayed on the terminal by using the SHow command in the setup mode of the control program.

4.2.1 Rules for Disk and Device Assignments

To make a disk assignment, type the CP/M disk name followed by the RT-11 file name. For example:

```
-->A: DY1:  
-->B: RK0:MYFILE  
-->C: DL0:YOURFL.ABC
```

To delete an assignment, type the disk name without the RT-11 file specification. For example:

```
-->C:
```

The following rules apply:

- * Disks must be assigned consecutively, without any gaps. If you delete B:, then C:, D:, etc. will also be deleted. Use A: to clear the disk table.
- * If no file name is present, then the disk is considered to be in CP/M format. Only device names DX0:, DX1:, DX2:, DX3:, DY0:, DY1:, DY2:, and DY3: will be accepted as CP/M format disks. (The program may be patched to accept other device names.)
- * When specifying a pseudo disk file, the default file extension is .CDK. If no device name is specified, the default device (DK:) is used.
- * The physical device containing the pseudo disk file must be mounted when the pseudo disk is specified. The device driver for the disk will be fetched, if necessary, the first time the device is mentioned in a specification. This will result in a reference to the system device for the device driver.

To define the RT-11 equivalent of a CP/M device, type the device name, followed by the RT-11 file specification or device specification. For example:

```
-->LST: LP:  
-->PTP: DY1:PUNCH  
-->SEN: YOURFI.ABC
```

To delete an entry from the device table, type the device name without an RT-11 specification. For example:

```
-->LST:
```

The following rules apply to the CP/M devices and their RT-11 counterpart devices and files:

- * When an RT-11 **device** (no file name) is entered in the table, the specification remains in effect until you explicitly delete or change it. An RT-11 **file** name entered in the table is deleted from the table when the file is closed. This means that you can specify the RT-11 printer to take CP/M list output and run all day without changing the specification. If you specify an RT-11 file to receive the CP/M list output, then the specification will only remain in effect until CP/M logically ends the print output.
- * The devices LST:, RDR: and PUN: treat cntrl-7 in the data stream as an end of file. CP/M ASCII files use cntrl-Z as an end of file marker. For the LST: device, cntrl-Z following within two characters of an escape character in the data stream is ignored.

It is considered to be part of a printer control sequence. The reader device transfers data from RT-11 to CP/M. A null encountered in the RT-11 file is considered an end of file and is translated to a control-Z for CP/M.

- * An end of file condition is forced for the LST: output by typing ^Z on the terminal, or whenever CP/M performs a warm boot. Most CP/M program do a warm boot whenever they exit.

All CP/M devices, except the console, communicate with RT-11 devices or files by reading and writing 512-byte blocks of data. You will normally use the device LST: as your CP/M printer. The devices SEN: and REC: are supported by CP/M programs SEN and REC. These are used to pass data between RT-11 and CP/M. You will probably have little occasion to use the devices PTP: and RDR:. SEN: and REC: transmit data efficiently in 128-byte sectors. The other devices transmit one byte at a time. (See section 4.7.)

To CP/M a disk is a mass storage device divided into 128-byte sectors. CP/M allocates space on the disk by units called logical blocks. A logical block is fixed for a particular disk between 1024 and 16384 bytes. A disk is partitioned into three functional areas: system tracks, directory and data area. The system tracks hold the CP/M operating system and require a total of 52, 128-byte sectors. The directory contains a list of the files on the disk. Thirty-two bytes are required for each potential directory entry. The directory area is fixed in size. On standard, CP/M, 8-inch floppy disks, the directory is 2048 bytes. This allows up to 64 named files. On pseudo disks the size of the disk is specified when the pseudo disk is created. Pseudo disks can be up to eight megabytes in size and hold hundreds of directory entries. The remaining storage, in the data area of the CP/M disk, is allocated to files stored on the disk in units of logical blocks. The logical blocks assigned to a file may be physically scattered on the disk. There is no operation in CP/M corresponding to the RT-11 squeeze operation.

A CP/M program reads or writes disks or devices by making calls to the CP/M operating system. The higher-level (BDOS) part of the CP/M operating system calls upon the lower level I/O routines (BIOS) to actually send the data to the disk or device. The BIOS, which is supplied by DECMATION, communicates I/O requests to the control program running on the PDP-11. The control program has to know what file or device to send or receive data from. If a CP/M program tries to read or write an undefined disk, an error message results. If a CP/M program tries to read or write an undefined device, the control program prompts you to supply a file or device name under your PDP-11 operating system.

4.3 Creating CP/M Pseudo Disks

A pseudo disk is a file under the PDP-11 operating system which is formatted internally as a CP/M disk. It is created by the OPEN command given in the setup mode of the control program. For example:

```
-->OPEN RK1:MYFILE[size]
```

The OPEN command will check for the largest contiguous space on the RT-11 disk, and then ask several questions concerning the specification of the pseudo disk to be created. If you already know the size of the pseudo disk file to be created, you can specify the size, in RT-11 blocks, in square brackets following the file name. The file size you specify is always rounded down to the next lowest number of RT-11 blocks which is a multiple of 32 plus 1. The default directory size depends on the size of the pseudo disk. The program allows you to double this directory size up to two times. The only reason for not making the directory very large is that it is read on each CP/M warm boot. If the directory is excessively large, the operation of CP/M may be slowed.

The OPEN command assigns a CP/M logical block size which is a function of the size of the pseudo disk created:

Size (RT-11 blocks)		CP/M logical block size
32	to 511	1024 bytes
510	to 7501	2048 bytes
7500	to 15001	4096 bytes
15001	to 16000	8192 bytes

For the best utilization of disk space a small logical block is favorable. For execution speed a large logical block is favorable. Each logical block on a disk requires 1 bit of storage space from a table in the CP/M BIOS. This limits the total, online storage under CP/M to about 25 megabytes. A CP/M disk cannot be larger than eight megabytes.

The OPEN command creates the RT-11 file and zeros the CP/M directory. After the OPEN command, you will usually use the CP/M utility GENSYS to copy the CP/M system to the system tracks of the new disk created. Files may be copied to the new disk by using CP/M PIP.

4.4 Console Keyboard

RT-11 attaches special meaning to certain console keyboard characters. CP/M has its own special assignments, which differ from those of RT-11. Some of the similarities and differences are discussed below:

- CNTRL-U Same function in RT-11 and CP/M. Deletes current input line.
- CNTRL-C Causes a "warm boot" in CP/M. Causes an exit from an application program to the monitor in RT-11. The DECMATION control program suppresses the RT-11 cntrl-C function. Under CP/M a cntrl-C will not generally cause an exit from an application program, although some application programs do use this convention.
- DEL (Rubout on some keyboards). This deletes the last character typed in CP/M and RT-11. Under CP/M it is better to use the backspace or left arrow key. The delete key echoes the character deleted. Some

application programs support the use of the delete key under CP/M, in a manner identical to its use under RT-11.

CNTRL-S Under Rt-11 cntrl-S stops output to the terminal. The same thing happens under the CP/M monitor, but not necessarily under CP/M application programs. Under the DECMATION implementation of CP/M cntrl-S may follow CP/M convention or RT-11 convention, depending upon user setup. (Details below.)

CNTRL-Q Under RT-11 cntrl-Q causes output stopped by cntrl-S to be resumed. Under CP/M, any character including cntrl-Q, will resume the stopped output. This applies in general only to the CP/M monitor. Under the DECMATION implementation, cntrl-Q may follow the CP/M convention or the RT-11 convention, depending upon user setup. (Details below.)

Most terminals used on PDP-11 systems implement the Xon/Xoff communications protocol. This is also known as DC1/DC3 or cntrl-S/cntrl-Q protocol. When the terminal's input buffer is nearly full, it will, of its own accord, send a cntrl-S to the computer to stop further output. When it has printed enough characters from its buffer to make some space, the terminal will send cntrl-Q to tell the computer to resume output. If the terminal does not follow this protocol, there is the possibility of losing data which is sent from the computer faster than the terminal can absorb it. This would happen if the terminal was in smooth scroll mode, a mode in which it can absorb new data only very slowly. The problem created by the Xon/Xoff protocol under CP/M is that the cntrl-S and cntrl-Q keys on the terminal are pre-empted for the protocol. Some application programs under CP/M use these keys for data entry. WordStar is a well-known program that does this.

There are three approaches for avoiding a problem with the cntrl-S and cntrl-Q keys. The first is to patch the CP/M application programs which use the cntrl-S or cntrl-Q keys to use other keys. In the case of WordStar, the auxiliary keypad on the VT100 can be used to control WordStar. It is actually much easier to use WordStar from the auxiliary keypad than from the control keys.

A second approach is useful if it is only necessary to occasionally send a cntrl-S or cntrl-Q to a CP/M program. The sequence ^S or ^Q can be typed. This will send the appropriate control character to CP/M, without the PDP-11 operating system seeing a cntrl-S or cntrl-Q. Also the sequence ^X where X is any character will send a cntrl-X to the CP/M program.

The third approach is to turn off the protocol so that all cntrl-Ss and cntrl-Qs are simply passed to CP/M application programs. This means that the terminal must be able to absorb data at the maximum rate the computer can send it. The rate at which the computer can send data depends upon the baud rate of the line to which the terminal is connected. This can be easily changed and adjusted downward if necessary. Smooth scroll mode should never be used under CP/M in this case. VT100

terminals are able to absorb data at a high baud rate provided that smooth scroll is not used. This is not true of VT125 terminals. There are two commands which may be entered in the setup mode of the control program to enable and disable the Xon/Xoff protocol:

```
-->NOPAGE          (Disables Xon/Xoff protocol)
-->PAGE            (Enables Xon/Xoff protocol)
```

These commands are effective only under the CP.SAV version of the control program. For the version CPFB.SAV or CPT.SAV (foreground-background and TSX+) use the system commands:

SET TT NOPAGE or SET TT PAGE.

Under the RT-11 foreground-background monitor the system command **SET TT NOFB** should also be given if it is desired to pass the control characters for B, F and X. The command **SET TT NOCRLF** should be given to prevent the terminal driver from printing spurious carriage returns under some CP/M application programs. Even after these commands have been given, the terminal driver will not pass cntrl-O. If you need to enter cntrl-O, type ^O. The SET TT system commands do not have any effect on the CP.SAV version, since it uses its own terminal driver, rather than the system driver.

4.5 Using the Line Printer with CP/M

If you define the CP/M LST: device to be your RT-11 printer, then output to the CP/M printer will be directed to your RT-11 printer. Since data is sent to the printer in 512-byte buffers, there must be a method to ensure that the last buffer of a listing, which is in general partially full, will be sent to the printer. The last buffer will be printed if the CP/M program sends a cntrl-Z, which signals an end of file. The last buffer will also be printed if the CP/M program terminates with a "warm boot." Most CP/M programs terminate in this manner. If neither of these conditions are met, then you can type ^Z to force the end of text to be printed.

Many CP/M programs, especially including wordprocessors, have provision to send a closing character string to the printer. This can be patched to send a cntrl-Z. Under PIP the end of file signal EOF: can be placed in a command string to send a cntrl-Z.

In the RT-11 versions (CP and CPFB), assigning the LST: device to a non-file structured device (such as LS: or LP:) is treated as a special case. In this case the LST: buffer is emptied whenever a carriage-return linefeed combination is encountered or whenever a form-feed character occurs. Since most text sent to the LST: device will end in one of these characters, you will not have the need to send a cntrl-Z when the LST: device is assigned to your printer. This special case does not apply to TSX, since most systems will be using a print spooler file for the line printer output.

Some CP/M wordprocessors may send an initial formfeed to the line printer. If the RT-11 printer driver also sends an initial formfeed, one too many formfeeds will be sent. Use the RT-11 command **SET LP: NOFORM0** or **SET LS: NOFORM0** to eliminate one of these formfeeds.

CP/M has a printer echo feature which allows you to get a record on the LST: device of all characters that CP/M sends to the terminal. This feature is alternately enabled and disabled by typing cntrl-P while in CP/M. You can send this record to your PDP-11 printer or to a PDP-11 file by assigning the LST: device as desired.

4.6 Copying CP/M Disks

To copy CP/M disks which are implemented as pseudo disks (RT-11 files), the easiest way is to use the RT-11 copy command. To copy a floppy in CP/M format, use the CCOPY program. In both of these cases, the CP/M system is copied onto the system tracks so that GENSYS will not be required to make the disks CP/M bootable if the source disk was CP/M bootable. You must use GENSYS however, on a pseudo disk created by the OPEN command, or on a CP/M floppy not created by CCOPY, if you want the disk to be used as disk A:. It is not necessary to have a CP/M system on the system tracks of any disk not used as disk A:. You can also use the RT-11 COPY/DEVICE command to copy standard CP/M format floppies if you do not desire to use them as disk A:

4.7 RT-11 and CP/M File Interchange

If you want to transfer a file between CP/M and RT-11 formats, use the CP/M programs SEN and REC. For example, if you have a CP/M file named ADDRESS.FIL and you want to copy it to an RT-11 file to be called ADR.LST, use the following command:

```
A>SEN ADDRESS.FIL[B]
```

After you type the above command, the system will query you for the RT-11 file name, unless you have pre-defined an RT-11 equivalence for the SEN: device. Answer with the name of the RT-11 file: ADR.LST. The file will then be copied. The [B] indicates that the transfer is to be in binary mode. If you omit the [B], then the transfer will be in ASCII mode.

To transmit a file from RT-11 to CP/M, use the CP/M program REC in a similar manner:

```
A>REC THISFIL.ABC[B]
```

The above command will cause a CP/M file named THISFIL.ABC to be created. The system will query you for the name of the RT-11 file, unless you have pre-defined an RT-11 equivalence for the device REC:. If the [B] is not present, then the transfer will be in ASCII mode.

The difference between an ASCII and binary file in CP/M is that an ASCII file is considered to be terminated by a cntrl-Z, while a binary file always has an integral number of 128-byte sectors and ends at the end of the last sector. Under RT-11 there is no difference between an ASCII and a binary file. An ASCII file is padded with enough null characters at the end to fill an integral number of 512-byte, RT-11 blocks. In the ASCII mode of transfer for the SEN command, data transfer ends at the first cntrl-Z encountered in the CP/M file. Any leftover space in the last RT-11 block is filled with nulls. In the binary mode of transfer, all data is transferred and any leftover space in the last RT-11 block is filled with

nulls. If you fail to use [B] for a binary file, you will lose all data after any cntrl-Z which may happen to be in the file. If you use [B] for an ASCII, file the RT-11 file created will contain the cntrl-Z terminating the CP/M file and any random data which may follow the cntrl-Z.

The REC function copies an RT-11 file to a CP/M file. In binary mode the copy is a byte-by-byte image. In ASCII mode the first null encountered in the RT-11 file is considered to be an end of file and is transmitted to CP/M as a cntrl-Z. Nulls embedded in an ASCII RT-11 file are legal, but do not usually occur. They may be removed by copying the file with the RT-11 copy command. The concatenation of two RT-11 files by RT-11 PIP can create nulls in the middle of an RT-11 resultant file. They are removed by re-copying the file.

It is also possible, but slower, to use the devices LST:, RDR: and PTP: to interchange data between RT-11 and CP/M. The main reason for using this method is to take advantage of the formatting switches offered by CP/M PIP. The following commands are examples of this method of copying files:

```
A>PIP LST:=CPMFIL.ABC
A>PIP CPMFIL.ABC=RDR:
A>PIP PRN:=CPMFIL.ABC           (inserts page breaks and line
                                numbers)
```

If the RT-11 equivalent file name has not been defined, the program will prompt you for the information.

4.8 Command Files

The DECMATION control program allows switching keyboard input to an RT-11 file. Commands are read from the file and treated exactly as if they had been typed at the keyboard by the operator. To switch the input to a command file, give the command:

```
-->@ filnam           (default extension .CMD)
```

A command file can also contain "@" commands to transfer control to another command file, but nesting is not implemented. That is to say that control will never return to the statement following @ filnam in a command file. Execution of a command file continues until end of file is reached, or another @ command is encountered, unless a key is struck on the keyboard, which immediately cancels the command file.

Because it is difficult to prepare ASCII command files with imbedded control characters, the following special conventions apply to the interpretation of text in the command file:

```
^C is interpreted as cntrl-C
^^C is interpreted as ^C
```

This convention applies to any letter, not just "C". For example ^A in the command file will be interpreted as cntrl-A.

Note: The maximum length allowed for a command file is 512 bytes.

When the control program CP.SAV is started, it looks for a command file with the name CPM.INI on the default device (DK:). If it finds this command file, it starts executing the file without further prompting from the operator. This allows a command file to be prepared which will immediately start CP/M. For example, if CPM.INI contained the following:

```
A: DL0:CPMDSK
LST: LS:
GO
```

then CP/M would automatically start after CP.SAV is run.

4.9 Miscellaneous Commands

The following provides descriptions of several additional commands.

Three commands (only in CP.SAV): EXAm, DEp and ZHalt, aid in debugging Z80 software. EXAm and DEp allow Z80 memory to be examined and changed. ZHalt stops the Z80 and prints the registers.

The CONTinue command allows you to re-enter CP/M after escaping with a ^C command. CP/M is not re-booted and execution continues where it left off. You cannot change the disk assignments and correctly continue execution.

The SETcaret command allows you to assign a different keyboard character to have the special role of the caret. For example, to use the backslash instead:

```
-->SET \
```

This assignment can also be changed by patching the control program.

APPENDIX A - USING THE D100 UNDER TSX+

A.1 Features Required in the TSX+ System

Two optional features must be included in your TSX+ system: 1) real-time program support, and 2) shared file record locking. If you don't have these features, do a TSX+ system generation to generate a system with these options. To install these options edit your TSGEN.MAC file. (See the TSX+ documentation for more information.)

- 1) If RTVECT is non-zero, you are already using the real-time support feature and no change is necessary. If RTVECT is zero, you should change it to a one.
- 2) If MAXSF, MAXSFC and MXBLK are all zero, change all three parameters to a 1. If they are already non-zero, than shared file support is already being used. In this case it would be a good idea to increment MAXSF and MAXSFC by one.

The DECMATION control program requires a 34K-byte partition.

A.2 Operating Procedure

A number of D100 cards can be installed in one TSX+ computer system. In order to allocate the use of individual cards to users, a shared file named SY:CPT.DAT is used. This file contains a table showing which cards are in use at a given time. If this file should be corrupted, due to a system crash or abnormal exit from the D100 control program, users could be given false messages that no cards are available, when cards are available. The solution is to delete the file at a time when no users are running CP/M. The file will be correctly regenerated when the first user logs on to CP/M. It is recommended that CPT.DAT is deleted by STARTS.COM or other cold start command file.

In order to run CP/M under TSX+ use the same procedures as for RT-11, except use the program CPT.SAV, rather than CP.SAV. (Use the command: RUN CPT.) You will have this file on your distribution disk if you purchased the TSX+ option. If you have only one D100 card installed in the system, and the card is jumpered for the factory interface address of 777160, then you can run CP/M without any special preparation except installing the card. If you are installing several cards, the program CPT.SAV must be patched so it will know the interface address of each card installed. Each card must be jumpered to an independent interface address. Instructions for patching CPT.SAV are given in appendix B.1.

APPENDIX B - CUSTOM SOFTWARE PATCHES

The executable control program files, CP.SAV, CPT.SAV AND CPF.B.SAV, can be permanently modified to change certain characteristics of the programs. This is done by patching the file. You can use the RT-11 utility program, SIPP, or the RT-11 commands GET, EXAMINE, DEPOSIT and SAVE, to actually modify the files. In order to know what address in the file to modify, you will have to consult the memory map associated with the program file. For example, the file CP.MAP is the memory map associated with the program file CP.SAV. Each location subject to patching is identified by a symbolic name, IBASEI for example. The octal address of this symbolic name is found by finding the name in the left-most column of the memory map and reading the location printed next to it.

To patch using GET, EXAMINE, DEPOSIT and SAVE use these commands as shown below:

.GET CP.SAV	(Puts file in memory)
.E 72614	(Examines address 72614)
177160	(Computer types current contents)
.D 72614=177360	(Inserts new value, 177360, at 72614)
.SAVE CP.SAV	(Save the modified program)

Be sure to keep a back-up copy of the program on a different device or with a different file name.

The RT-11 utility, SIPP, is easier to use, especially for patching ASCII character strings, such as for FNAME (See section B.4). Instructions for using SIPP will be found in the RT-11 **System Users Guide**.

B.1 Patching the Interface Address (IBASEI)

In the programs CP.SAV or CPF.B.SAV there is a single word, at the memory map location IBASEI, containing the octal address of the D100 bus interface. It is set at the factory (both physically on the card and in the program file) to 177160. If the D100 card is jumpered to a different address, then patch the program file to this address. An error "61" results when the program cannot find the card on the bus. Note that sometimes octal addresses are written with the sixth digit from the right as a "7", other times a "1". Usually these two methods refer to the same address.

To change the interface address in the SAV file, you can use the GET, EXAMINE, DEPOSIT, SAVE procedure described above. However, be sure to consult the link map supplied to get the proper address of IBASEI for your save file. An alternate method of patching the SAV file, takes advantage of the search facility of the RT-11 SIPP utility, so that the link map need not be consulted. For example, the following sequence will change the address in CP.SAV from the factory standard 177160 to 177360:

```
.RUN SIPP
Base?           ;S
Search for?    177160
Start?         <cr>
End?           <cr>
Found at 073232
Base?          73232
Offset?       <cr>

Base           Offset           Old           New
073232        000000        177160       177360
073232        000000        000000       ^Y
*^C
.
(Patch completed)
```

In the program CPT.SAV (TSX+) there is an eight-word array at the memory map address IBASEI. Each location in the array contains the address of cards 1-8 which are installed in the system. If no card is installed for a particular array position, then that location contains zero. As shipped from the factory, the first location of the array contains 177160 and the remaining seven locations contain zero. This is the setup for one card installed in the system at bus address 177160. Remember that the array locations are at word addresses. If IBASEI has a location, for example, of 66446, then the second array entry will be found at 66450, the third at 66452, and so on. Patch this array to contain the interface addresses for all cards installed on the system. If there are two cards with interface addresses 177160 and 177360, then the first two locations of the array should contain these addresses. You could use SIPP to do this as follows:

```
.RUN SIPP
Base?           ;S
Search for?    177160
Start?         <cr>
End?           <cr>
Found at 066446
Base?          66446
Offset?       <cr>

Base           Offset           Old           New
066446        000000        177160       <cr>
066446        000002        000000       177360
066446        000004        000000       ^Y
*^C
.
(Patch completed)
```

B.2 Disk Interleave (INTC)

The word at memory map location INTC is set to 5 at the factory. This is the RT-11 block interleave code for pseudo disks implemented as RT-11 files. There are five legal values for the code: 1, 2, 3, 4, 5. These five codes correspond to interleaves of 1, 2, 4, 8 and 3. Within a pseudo disk file, the logical ordering of blocks does not have to correspond with

the physical ordering in the file. If the code is 5, then the interleave is 3, and the logical ordering in the file will be 0, 3, 6, ... 1, 4, 7 ..., etc. The interleaving is only done within 32-block sections of the file.

The interleave has a substantial effect only on the performance of floppy disk files. The interleave avoids having to wait an entire rotation of the diskette to read the next block. The factory-set interleave of 3 is well-suited for most double-density floppy drives. If you only have a single-density drive, you could experiment with an interleave of 2 (code=2). Performance can be tested by timing the load time for a large program.

In some cases, a non-standard interleave may be incorporated in the formatting of your diskettes. With certain drives, for example those manufactured by Data Systems Design, it is possible to modify the sector addresses put on the floppies when formatted. If your floppies are formatted in this manner, the situation is more complicated and you will have to experiment to find the fastest interleave setting.

B.3 The Default Special Shift Character (CARET)

The default special shift character, which is set at the factory to a caret (the up arrow, or shift 6), is contained at the memory map location CARET. The factory setting is 136, the octal value of the ASCII code for a caret character.

B.4 Floppy Device Name (FNAME)

This is an eight-byte array which specifies the RT-11 device names which will be allowed to be assigned as CP/M compatible floppy disks. In the distribution version this array contains the character string "DX03DY03". Two letters specify the device name (e.g. "DY") and two digits specify the lowest and highest unit numbers allowed. ("03" allows DY0 through DY3.) There is room for two devices in the array (e.g. DX and DY). If you have Peritek drives, which use the names FL4:, FL5: and FL6: for single-density floppy disks, then you should change the array to read "FL46DY03". Only floppy disks in single density should be specified. Using a different device will destroy the directory and probably crash the program. This is a byte array. If you use EXAMINE and DEPOSIT commands to patch the program, you will have to combine bytes into words manually. The low byte of each word is the even-numbered address, and the high byte is the odd-numbered address. The SIPP program will be a more convenient way to make this patch because of its ability to change bytes and display locations in ascii form.

B.5 TSX+ Program Suspension Time (TICKS)

This is a single word at memory map location TICKS in the program CPT.SAV. It is set at the factory to 3. This is the number of ticks, where each tick is 1/60th of a second, that the program will suspend itself when the Z80 is not making any I/O requests. Decreasing this number will improve CP/M performance slightly at the expense of increasing PDP-11 overhead. Increasing the number will degrade CP/M performance, but reduce PDP-11 overhead.

The terminal baud rate affects PDP-11 overhead for programs which are terminal intensive. Reducing the baud rate might be the first thing to try if CP/M cards are overloading the system.

B.6 Avoiding floppy handler special function calls (NSPFN)

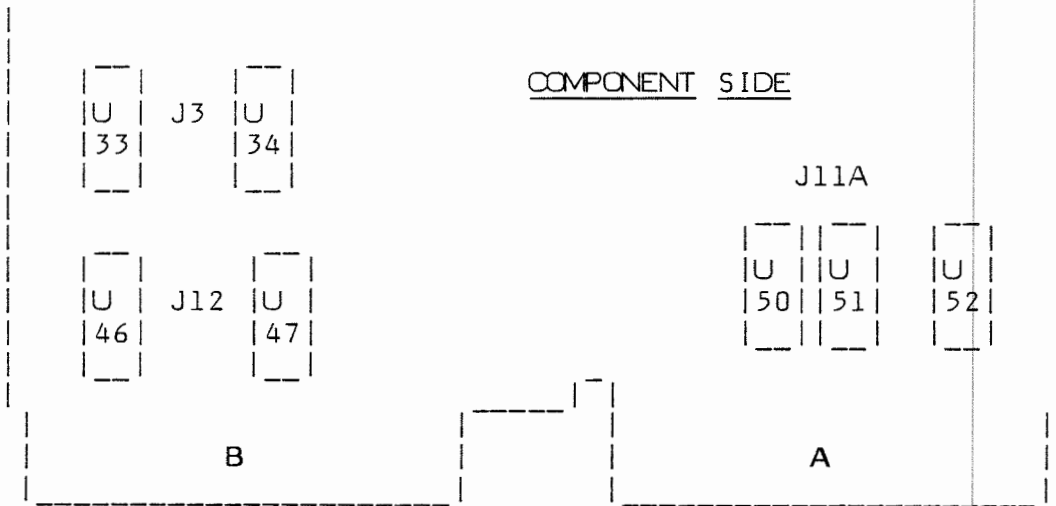
This is a single word at memory map location NSPFN which is set to zero at the factory. A zero indicates that the special function calls of the floppy handler will be used when accessing floppies in standard CP/M format. These special function calls read and write absolute sectors on the floppy and is the most efficient way to read CP/M floppies. The standard DX and DY handlers, and most custom floppy handlers implement these special function calls. However, since RT-11 does not use these calls, some custom floppy handlers do not implement them. In this case, set NSPFN to a 1. This will cause CP, CPFB, and CPT to use only the standard block read and block write functions which must be implemented in all RT-11 floppy handlers. Although this patch allows these custom handlers to read and write standard CP/M floppies, it does not allow them to boot to a standard CP/M floppy since this would require reading track zero. This is because block 0 of an RT-11 floppy starts on track 1, making it impossible to read track 0 with the standard calls. The access of CP/M floppies when NSPFN is set to one is also considerably slower than when the special function calls are used.

When NSPFN is set to "1" you cannot boot from CP/M format diskettes, but you can read and write files on these disks and read disks created on other systems. You should do all your normal work using pseudo disks (which may be on floppies) and use CP/M format only when it is needed for information interchange with other systems or for reading software purchased in CP/M format for the first time.

In order to initially boot your system, use the pseudo disk file named "CPMDSK.CDK" which is distributed on distribution disk #1. Once you have booted you will be able to read all files on CP/M format distribution disks #2 and #3. Transfer them to pseudo disks you create. Note that the program PCOPY.SAV will probably not work either, if your disk drives cannot work properly on track 0. CCOPY.SAV will not work for the same reasons. Use COPY/DEV to copy CP/M format disks, keeping in mind that all files will be copied, but not the CP/M system.

APPENDIX C - BOARD JUMPERS

The Q-bus model (D100Q) and the Unibus model (D100U) are made from the same printed circuit card. The major difference between the two models is the way they are jumpered. There are three jumper blocks can be changed. The location and use of these jumpers are shown below:



PIN NUMBERING FOR JUMPER BLOCKS

J3	J12	J11A
1	9 8	10 8 6 4 2
2	10 7	11 9 7 5 3 1
3	11 6	
4	12 5	
5	13 4	
6	14 3	
	15 2	
	16 1	

JUMPER FUNCTIONS

J12 sets the interface address for the D100Q and D100U.

J3 sets the interrupt vector for the D100Q.

J11A sets the interrupt priority for the D100Q.

J12 is used to select the interface base address for both the D100Q and the D100U. With these jumpers the interface can be selected to be any four words (on a four-word boundary) between 760000 and 777776. The pins of J12 are defined as follows:

	<u>D100Q</u>	<u>D100U</u>
J12-2	MUST TIE TO GROUND	A3
J12-3	A6	A4
J12-4	A5	A9
J12-5	A8	A8
J12-6	A4	A5
J12-7	A7	A6
J12-10	MUST TIE TO GROUND	A13
J12-11	A10	A12
J12-12	A12	A11
J12-13	A9	A10
J12-14	A3	A7
J12-15	A11	A14

J12 pins 1 and 16 are ground and pins 8 and 9 are +5 volts.

In order to install the jumpers for a particular address, write the address in binary, then tie all bit positions with a "0" to +5 volts, and all bit positions with a "1" to ground.

FACTORY CONFIGURED ADDRESS JUMPERS

Model D100Q

Connect: 1, 2, 3, 4, 6, 10, 11, 12, 13, 15 (ground)
 Connect: 5, 7, 8, 14 (+5 volts)

Model D100U

Connect: 1, 3, 4, 6, 7, 10, 11, 12, 13, 15 (ground)
 Connect: 2, 5, 8, 14 (+5 volts)

In the current version of our control program, the interrupts are not utilized, which means that the jumpering of J3 and J11A may be ignored. Future versions however may make use of the interrupt capability on the D100Q. The D100U does not support the use of interrupts, and therefore the jumpering of J3 and J11A is irrelevant for the D100U.

J3 controls the selection of the interrupt vector on the D100Q. It is factory set to select interrupt vector 214. The table on the left of page 9 of the schematic shows how to jumper J3 for the 16 possible choices of interrupt vectors. These choices are:

100,104,110,114,200,204,210,214,300,304,320,314

J11A controls the interrupt priority selection on the D100Q. The table on the right of page 8 of the schematic shows how to connect J11A for the LSI-11/2 and for the four different priority levels (4,5,6,7) used by the LSI-11/23. This is factory configured for the LSI-11/2 which will also work on a LSI-11/23 on a priority level of 4.

Connection of all the board jumpers may be made by wire-wrap, if wire-wrap pins are installed. Otherwise the connections must be made by removing and soldering jumpers.

APPENDIX D - COMMAND SUMMARY

-->HELP (Print a short command summary)

-->A: DY1: (Define CP/M disk A as a CP/M format floppy)

-->B: RK0:FILEB (Define CP/M disk B as a pseudo disk file)

-->C: (Remove the assignments of CP/M disks C thru H)

-->OPEN MYFILE (Create DK:MYFILE.CDK for use as pseudo a disk)

-->LST: LP: (Assign the CP/M LST device to the RT-11 printer)

-->GOCPM (Start CP/M - cold boot to disk A)

A>SEN CPMFIL.ASM (Send an ASCII file to RT-11)

A>SEN CPMFIL.ASM[B] (Send a binary file to RT-11)

A>REC CPMFIL.ASM (Receive an ASCII file from RT-11)

A>REC CPMFIL.ASM[B] (Receive a binary file to RT-11)

A>^C (Exit from CP/M)

-->CONT (Continue CP/M)

-->SHOW (Display disk and device assignments)

-->NOPAGE (Disable XON/XOFF protocol)

-->PAGE (Enable XON/XOFF protocol)

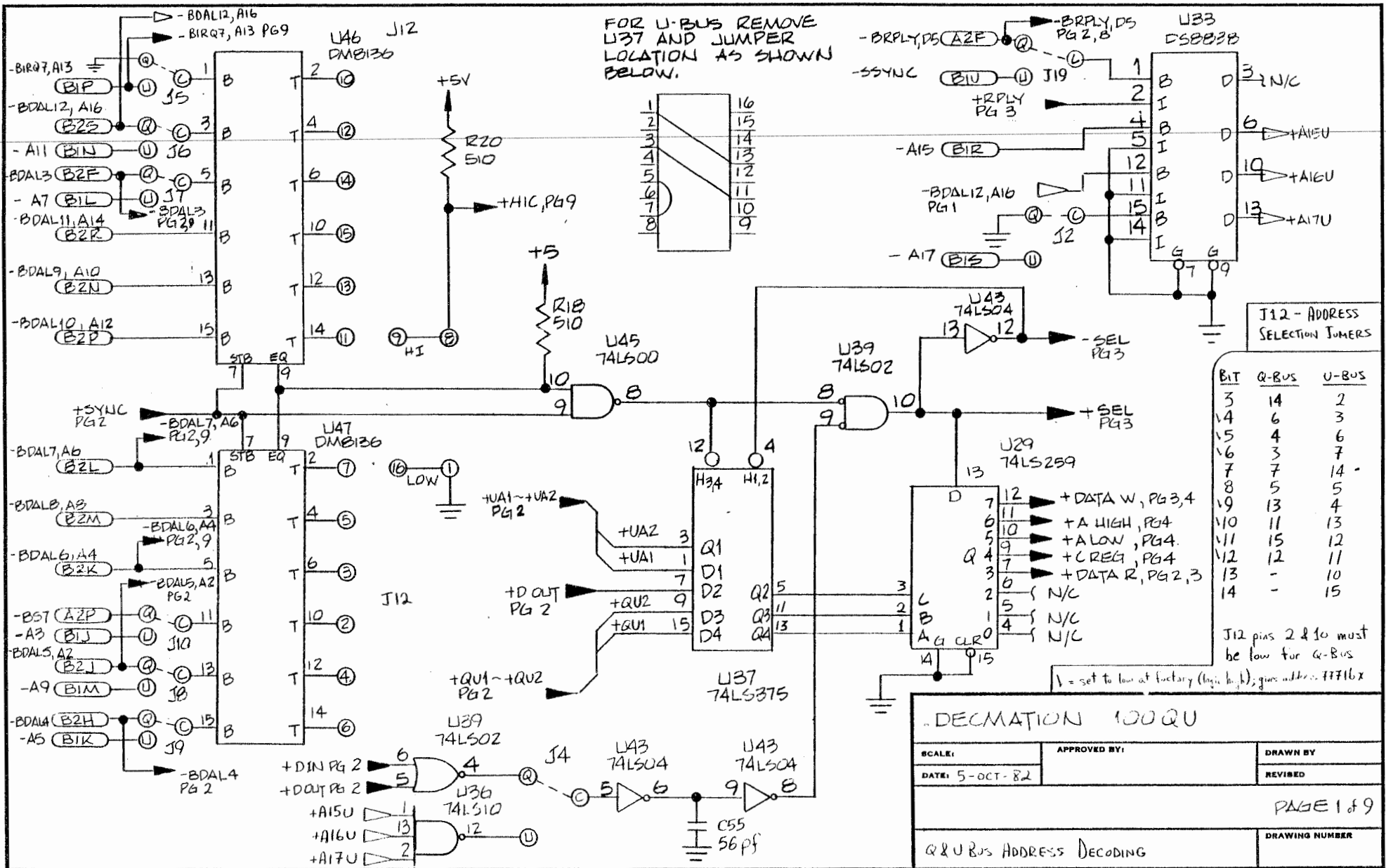
^Z (Dump last printer buffer; close LST device)

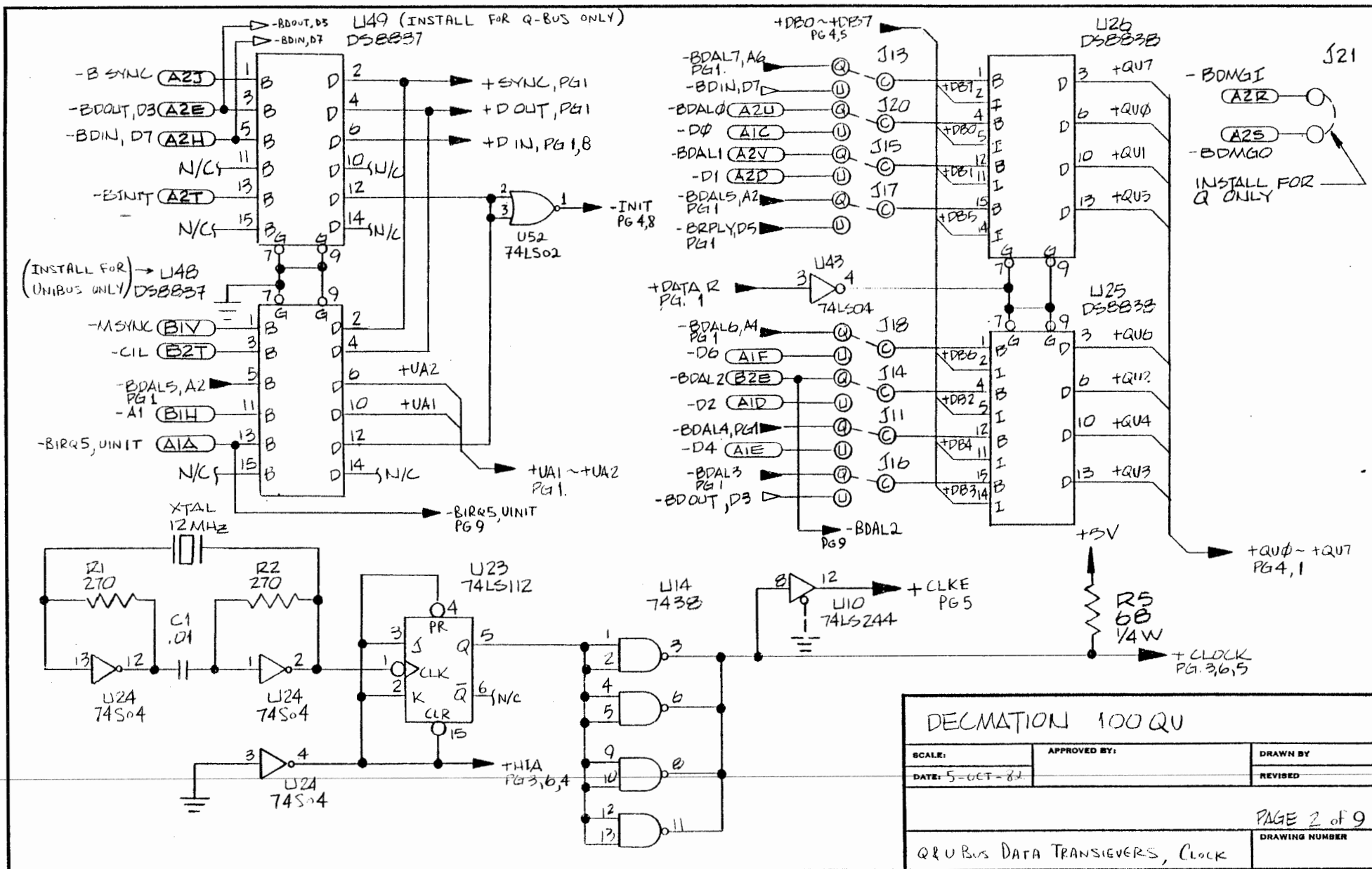
-->SETCARET (Change special shift character from ^ to \)

-->@RTFIL (Get further keyboard input from DK:RTFIL.CMD)

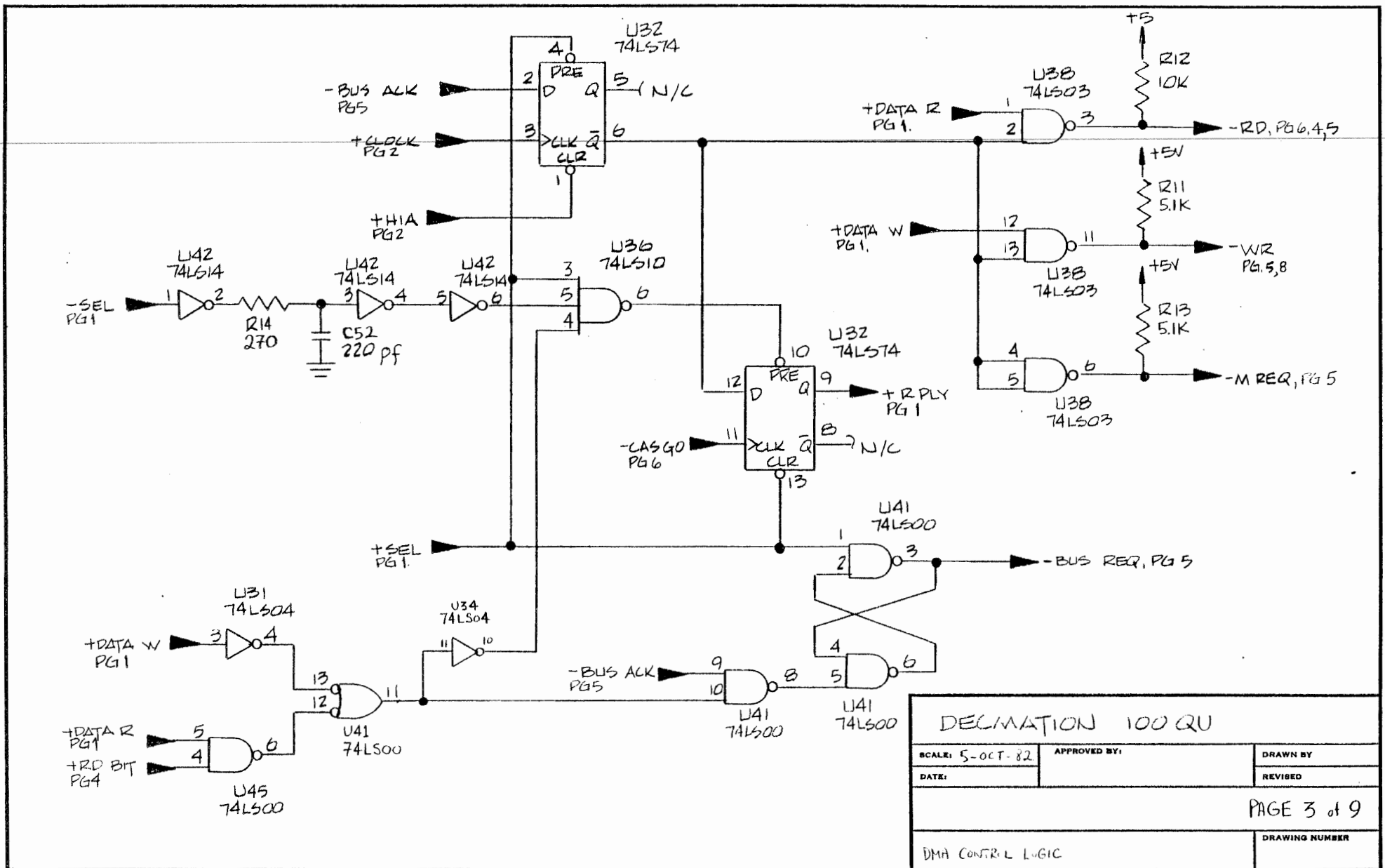
-->BYE (Exit the control program; Return to RT-11)

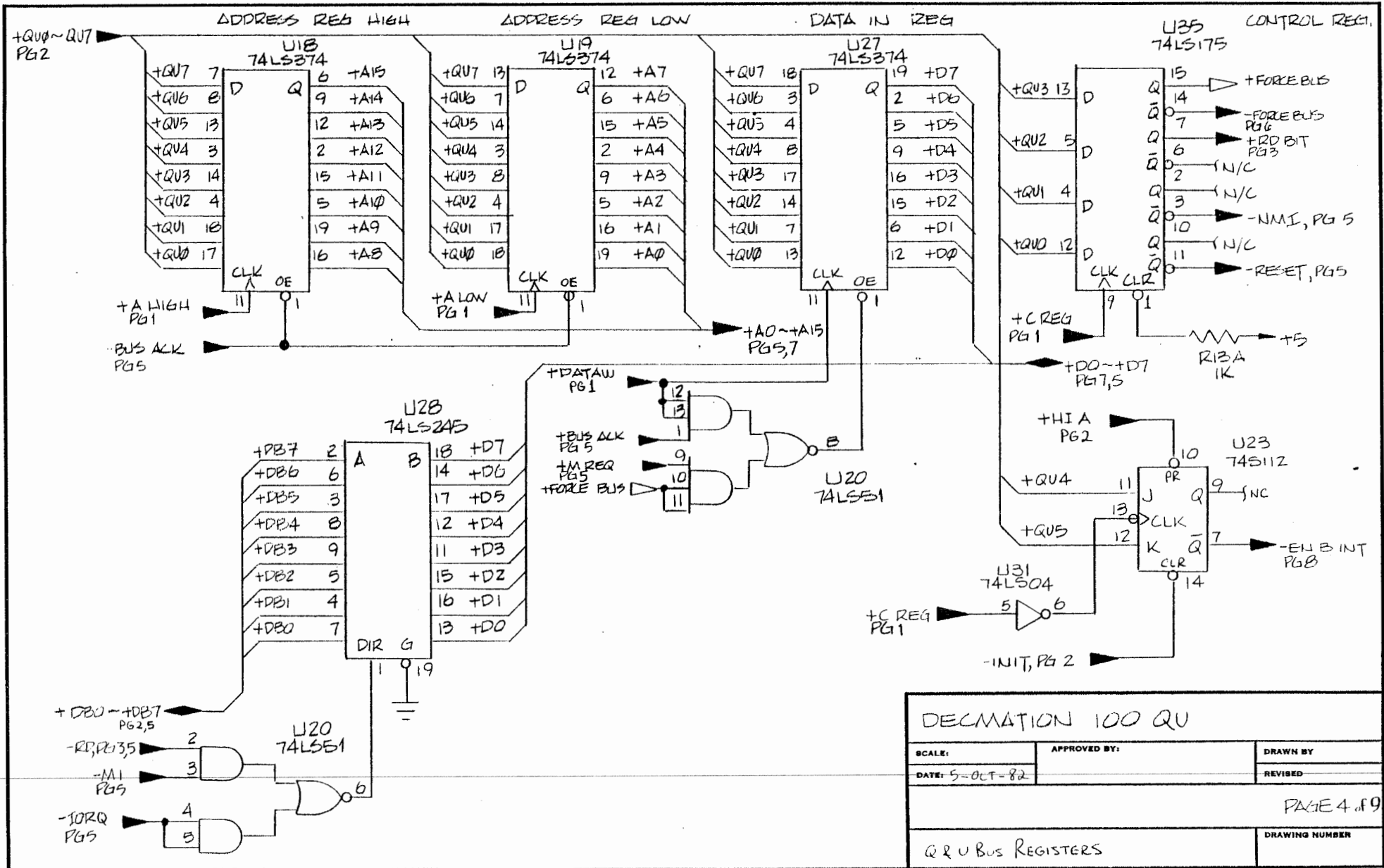
APPENDIX E - ELECTRICAL SCHEMATICS

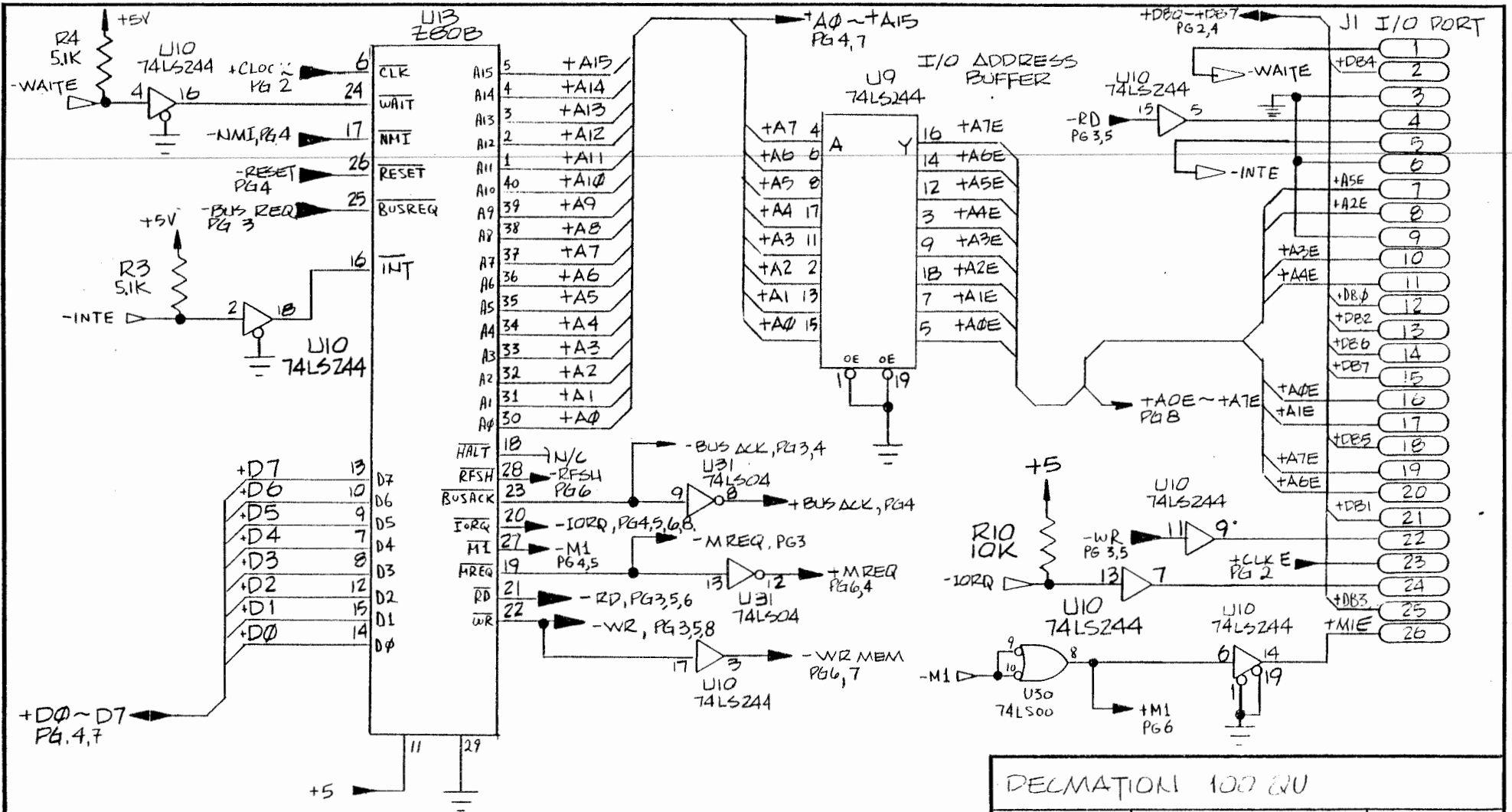




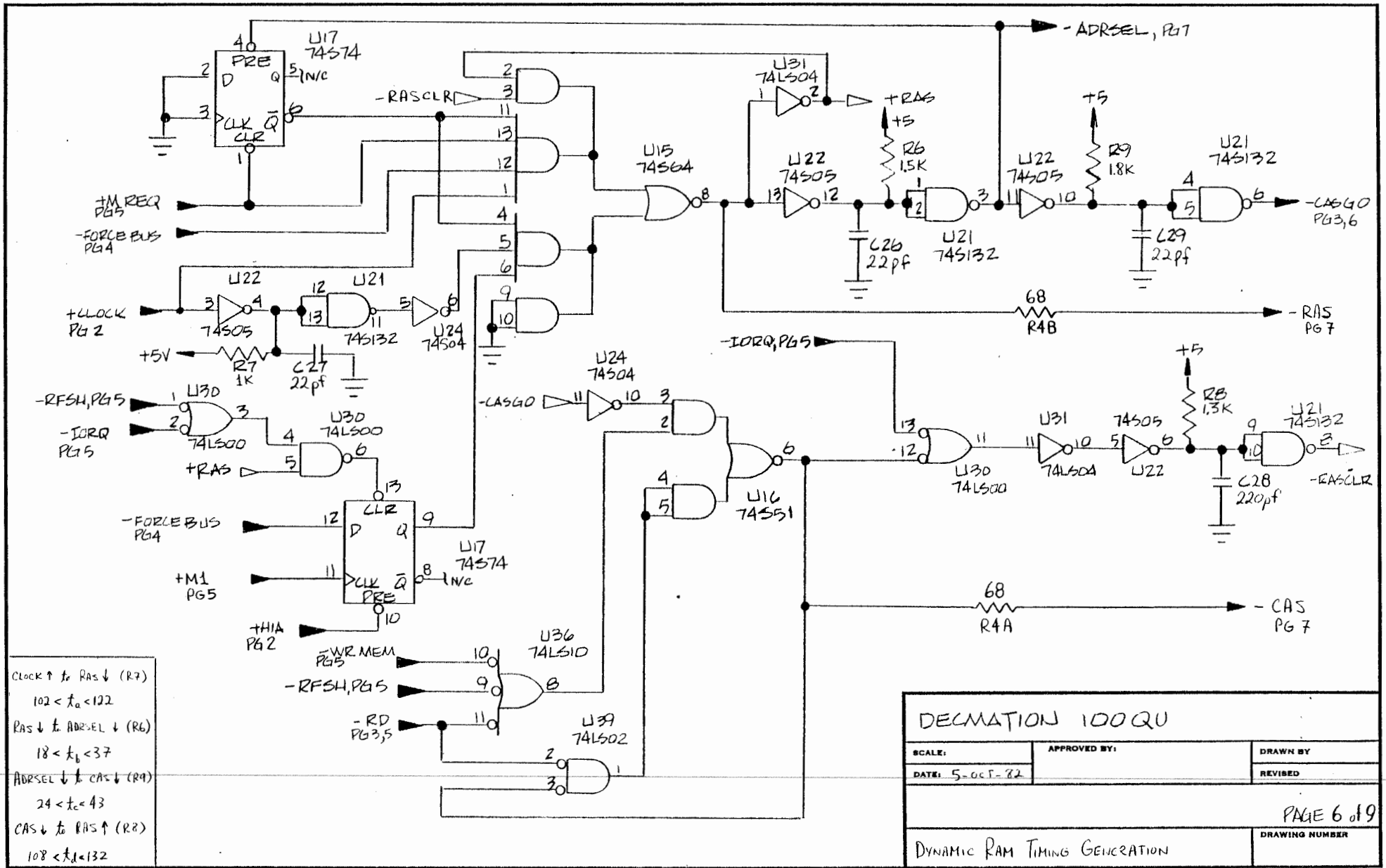
DECLARATION 100 QU		
SCALE:	APPROVED BY:	DRAWN BY
DATE: 5-OCT-82		REVISED
		PAGE 2 of 9
Q-BUS DATA TRANSMITTERS, CLOCK		DRAWING NUMBER





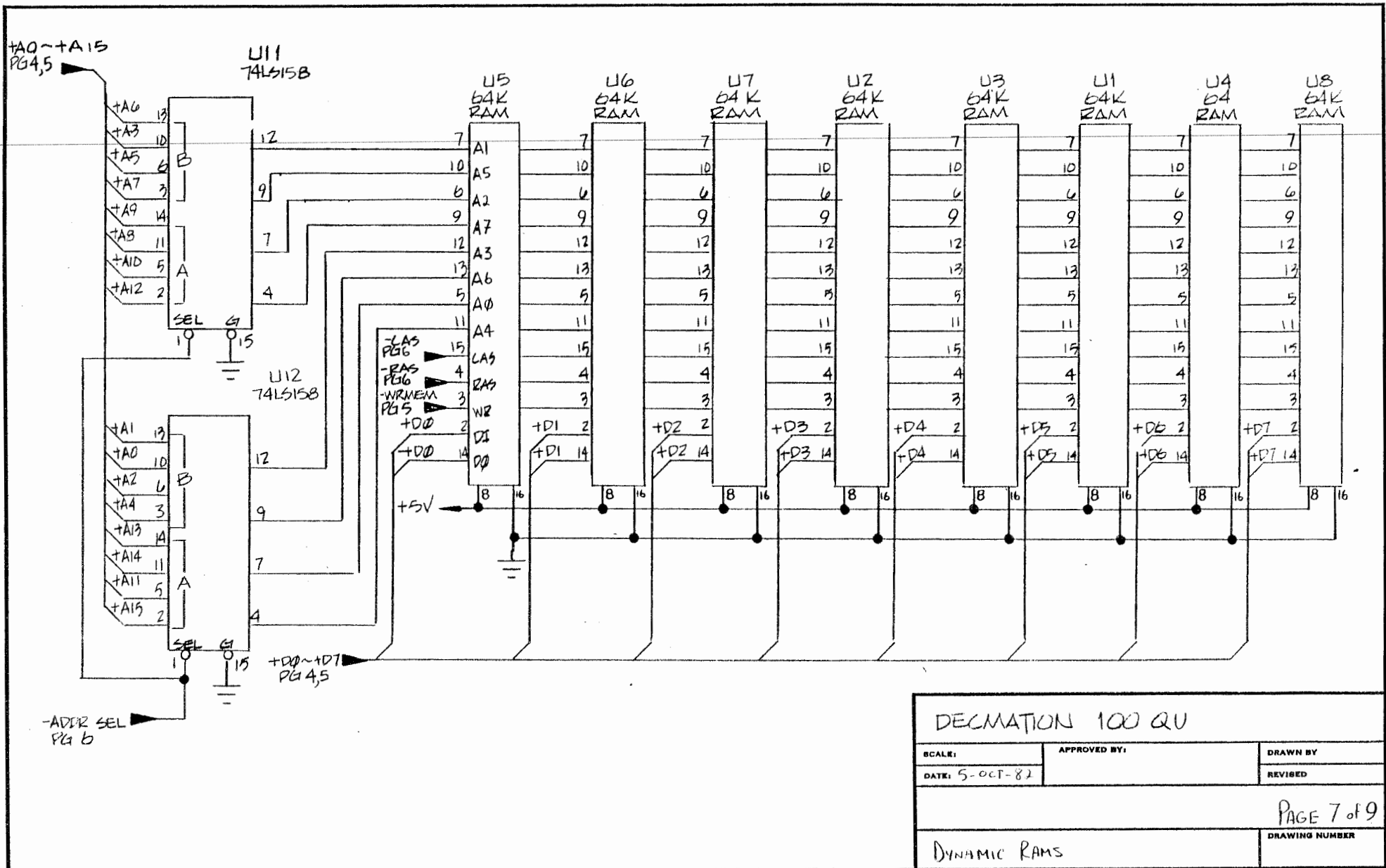


DECLARATION 100 2U		
SCALE:	APPROVED BY:	DRAWN BY
DATE: 5-OCT-82		REVISED
		PAGE 5 of 9
Z80 & I/O PORT		DRAWING NUMBER



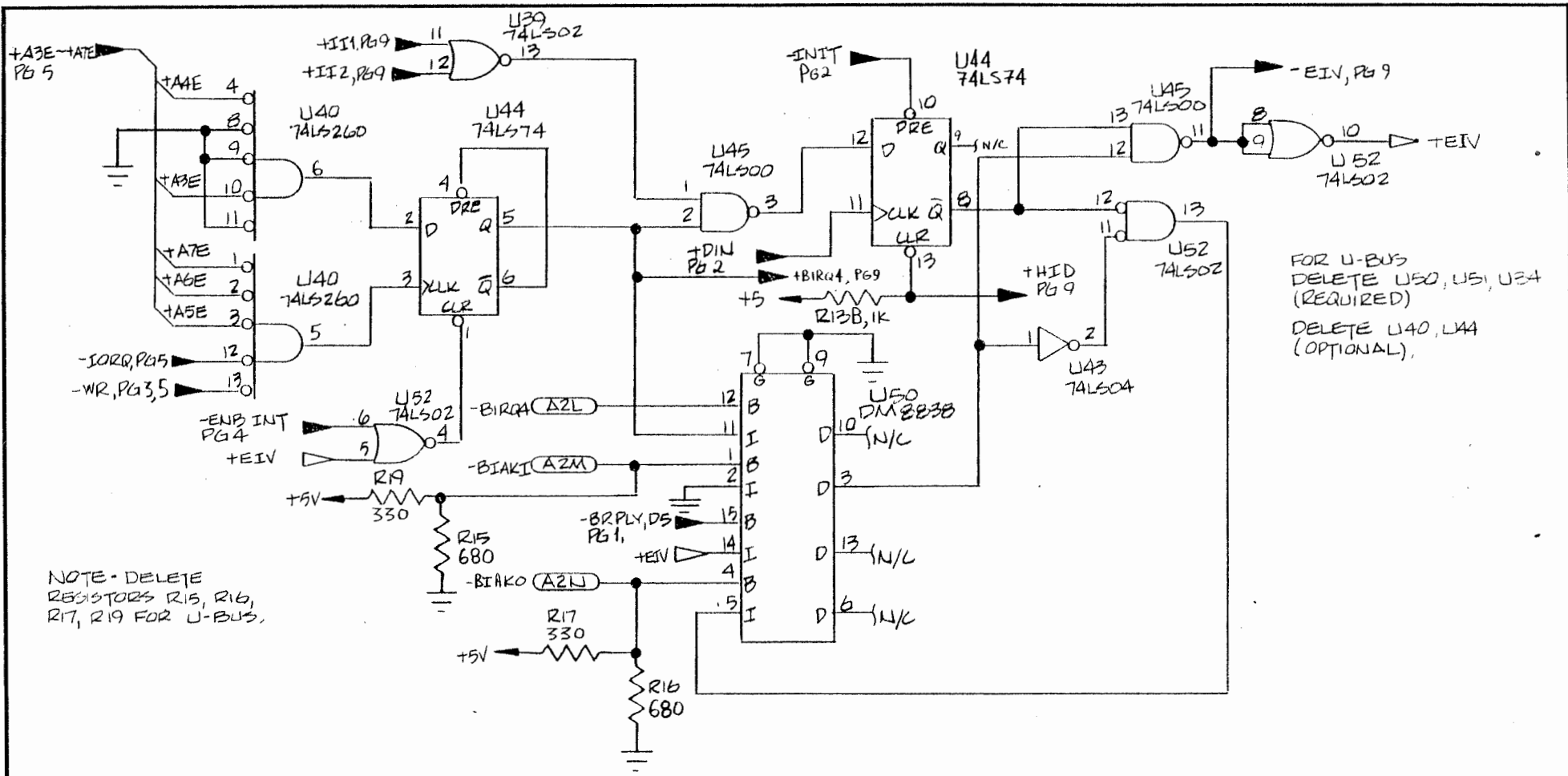
Clock \uparrow to RAS \downarrow (R7)
 $102 < t_a < 122$
 RAS \downarrow to ADRSEL \downarrow (R6)
 $18 < t_b < 37$
 ADRSEL \downarrow to CAS \downarrow (R4)
 $24 < t_c < 43$
 CAS \downarrow to RAS \uparrow (R7)
 $108 < t_d < 132$

DECLARATION 100QU		
SCALE:	APPROVED BY:	DRAWN BY
DATE: 5-06-82		REVISED
		PAGE 6 of 9
DYNAMIC RAM TIMING GENERATION		DRAWING NUMBER



DECLMATION 100 QU

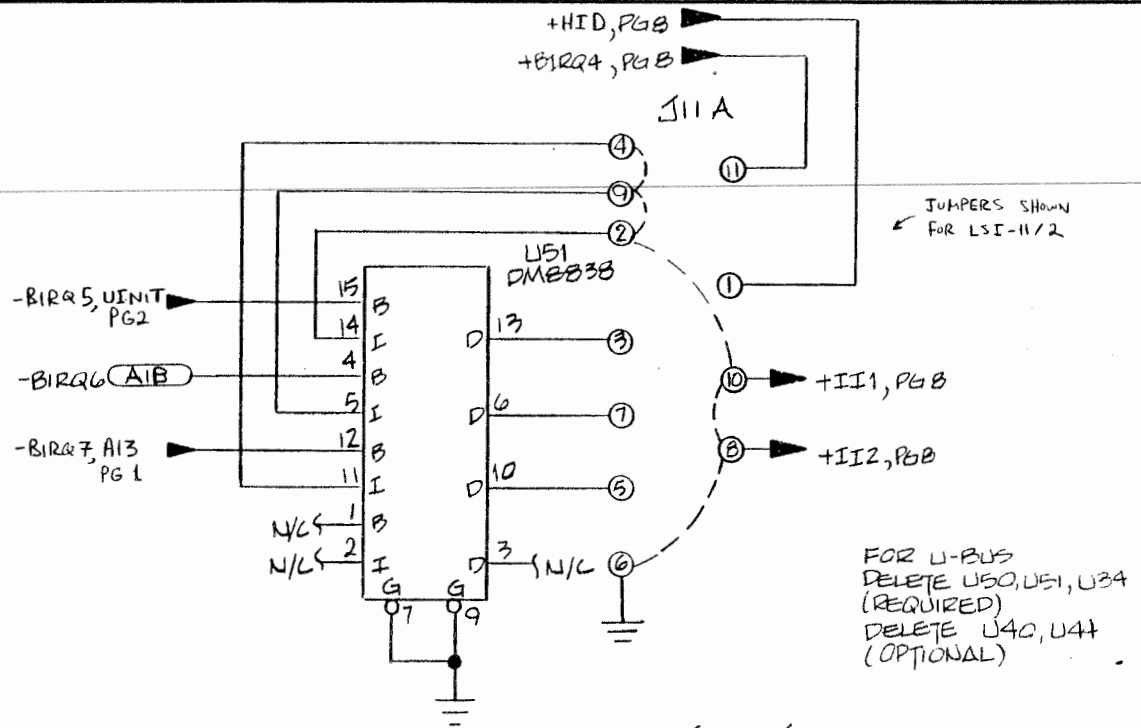
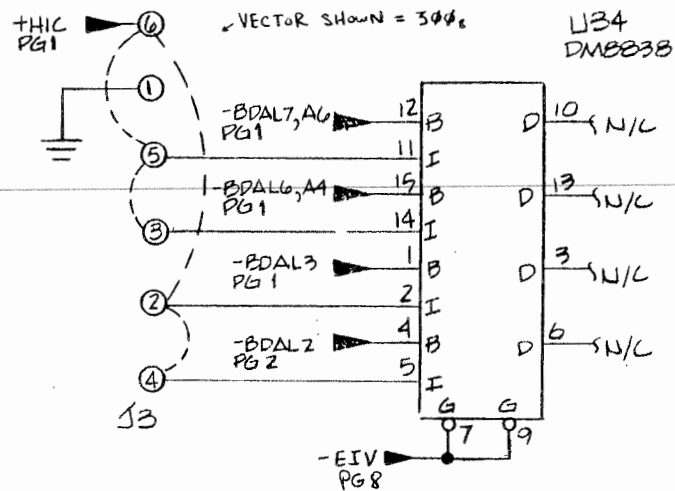
SCALE:	APPROVED BY:	DRAWN BY:
DATE: 5-OCT-82		REVISED:
		PAGE 7 of 9
DYNAMIC RAMS		DRAWING NUMBER



FOR U-BUS
 DELETE U50, U51, U54
 (REQUIRED)
 DELETE U40, U44
 (OPTIONAL).

NOTE - DELETE
 RESISTORS R15, R16,
 R17, R19 FOR U-BUS.

DECLINATION 100 QU		
SCALE:	APPROVED BY:	DRAWN BY:
DATE: 5-OCT-82		REVISED:
		PAGE 8 of 9
Q-BUS INTERRUPT LOGIC		DRAWING NUMBER



INTERRUPT VECTOR (OCTAL)	INTERRUPT VECTOR SELECTION
	J3 JUMPER CHAIN
100	6-3/1-2-4-5
104	6-3-4/1-2-5
110	6-3-2/1-4-5
114	6-3-2-4/1-5
200	6-5/1-2-3-4
204	6-5-4/1-2-3
210	6-5-2/1-3-4
214	6-5-4-2/1-3
300	6-3-5/1-2-4
304	6-3-5-4/1-2
310	6-3-5-2/1-4
314	6-2-3-4-5/1-N/C

J11A JUMPER CHAIN

LSI-11/2	6-2-9-4-10-8 / N.C. 5,7,3,11,1
LSI-11/23 PG	6-2-9-4/3-10/7-8 / N.C. 5,1,11
P5	6-4-9-10/11-2/7-8 / N.C. 3,5,1
P6	6-2-4-10/11-9/5-8 / N.C. 3,7,1
P7	6-2-8-10/11-4-9 / N.C.

INTERRUPT PRIORITY SELECTION.

DECIMATION 100QU

SCALE:	APPROVED BY:	DRAWN BY
DATE: 5-OCT-82		REVISED
		PG 9 of 9
INTERRUPT VECTOR & PRIORITY SELECT		DRAWING NUMBER

CP/M® FOR YOUR PDP-11 OR LSI-11

Enter a New Software World

DECMATION's D100 series products will expand your software world to any of 3,000 low-cost, quality software packages. With our card, you will be able to run CP/M software in addition to the PDP-11 software you can run now.

CP/M is the immensely popular operating system used in millions of personal and small business computers. Whenever you choose to start CP/M, it will seem exactly as if you are sitting at the console of a powerful CP/M computer. If you have a multi-user operating system, such as TSX+ or RSX-11M, CP/M can be started from any of the system's terminals, while users at the other terminals carry on with their normal work.

With our D100 card, you can read and write standard CP/M format floppy disks. This allows you to buy off-the-shelf software from thousands of software outlets and to exchange data and programs with other CP/M microcomputers. You are not limited to using floppy disks under CP/M. You can use large, high-speed disks too.

We include a free copy of the powerful **Palantir®** word processing package from Designer Software with every D100 card. This is one of the finest word processing packages available and very easy to use!

SPECIFICATIONS:

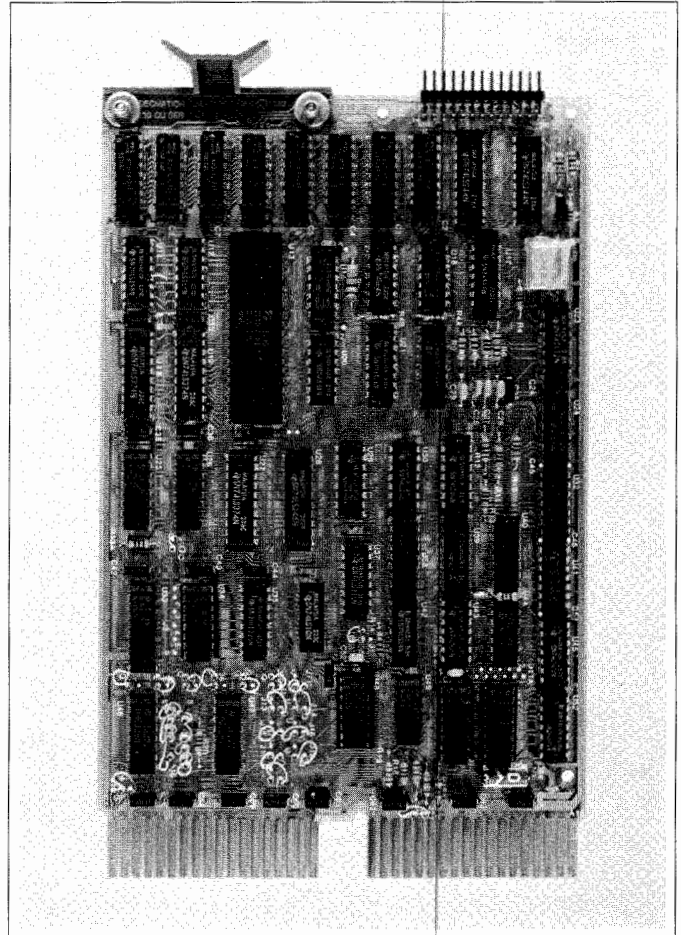
D100Q: A dual height Q-bus module which is compatible with all LSI-11, PDP-11/23 and Micro PDP-11 backplanes. Interface address is jumper selectable with a factory setting of 777160. Compatible with 16-, 18- or 22-bit addressing.

D100U: A dual height unibus module that plugs into any standard unibus or MUD slot. Interface address is jumper selectable with a factory setting of 777160.

Physical: Standard DEC dual module, 21.5 x 13.2 cm.

Processor: Z80B with 6-MHz clock, or optional Z80H with 8-MHz clock. No processor wait states. 64Kb dynamic RAM. Z80 I/O bus on top connector for future expansion.

Software: D100 series available for RT-11, TSX+, RSX-11M and other operating systems as developed. CP/M license and software is included. Palantir word processing



software and license included. Exchange of files between CP/M and PDP-11 operating system is an integral part of the software. Included is a diagnostic program and utility to copy CP/M floppy disks to alternate media.

Power Consumption: +5 volts at 900 mA.

Documentation: Installation and operation guide, circuit schematics, CP/M Handbook, Palantir documentation.

Warranty: Free repair of units failing in normal use for a period of one year.

CP/M® is a registered trademark of Digital Research. Palantir® is a registered trademark of Palantir, Inc. This copy generated using Palantir and a Diablo 630 printer. Prices and specifications subject to change without notice.



DECMATION

3375 Scott Blvd. Suite 422
Santa Clara, Calif. 95051
(408) 980-1688

DECMATION PRICE LIST
Effective 10-May-83

Part Num.	Price	Description
D100Q-RT-11	\$1250	Z80 co-processor for Q-bus and RT-11 operating system.
D100Q-TSX+	\$1350	Z80 co-processor for Q-bus and TSX+ operating system. Includes support for RT-11 operating system.
D100Q-RSX-11M	\$1450	Z80 co-processor for Q-bus and RSX-11M operating system.
D1000Q-X	\$1100	Additional Z80 processor card for systems running TSX+ or RSX-11M.
D100U-RT-11	\$1295	Z80 co-processor for unibus and RT-11 operating system.
D100U-TSX+	\$1395	Z80 co-processor for unibus and TSX+ operating system. Includes support for RT-11 operating system.
D100U-RSX-11M	\$1495	Z80 co-processor for unibus and RSX-11M operating system.
D100U-X	\$1145	Additional Z80 processor card for systems running TSX+ or RSX-11M.

SOFTWARE PACKAGES

D101	\$425	WordStar word processing
D102	\$150	Mailmerge for WordStar
D103	\$ 60	Proofreader spelling checker
D105	\$295	Milestone project planner
D106	\$240	SuperCalc electronic spreadsheet
D107	\$650	dBase II data base manager

NOTES

Q-bus computers are LSI-11, PDP-11/23 and Micro PDP-11. Other PDP-11 models are unibus computers. Additional processor cards (up to eight) may be installed on multi-user systems to allow several users to run CP/M at the same time. Terms cash, or 30-days to rated companies. Shipment typically within 7 days of order. Prices subject to change. Palantir word processing software included with each processor card shipped at no extra cost. CP/M license and software included with each processor card.